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MINERALS YEARBOOK

1963

Volume IV of Four Volumes

AREA REPORTS:

International

Prepared by staff of the
BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR • Stewart L. Udall, Secretary

BUREAU OF MINES • Marling J. Ankeny, Director

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

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.

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FOREWORD

The 1963 MINERALS YEARBOOK marks the 82d year in which this publication or its predecessors have been issued by the Federal Government. It also marks the first issue of a fourth volume reviewing world mineral production, consumption, and trade on a country-by-country basis. This new international review volume represents the Bureau's continuing effort to make the Yearbook as useful as possible to industry, Government and the general public.

Many difficulties had to be surmounted in preparing this new volume. Although it has not been possible in several instances to present international data comparable to those available for the United States, the international review should nevertheless prove a valuable reference.

The general content of this four-volume edition is as follows:

Volume I contains chapters on metal and on nonmetal mineral commodities except mineral fuels. In addition, it includes a chapter reviewing these mineral industries, a statistical summary, and chapters on mining and metallurgical technology, employment and injuries, and technologic trends.

Volume II contains a chapter on each mineral fuel and on such related products as helium, carbon black, peat, coke and coal chemicals, and natural gas liquids. Also included are data on employment and injuries in the fuel industries, and a mineral-fuels review summarizing recent economic and technological developments.

Volume III contains chapters covering each of the 50 States, United States island possessions in the Pacific Ocean, the Commonwealth of Puerto Rico, and island possessions in the Caribbean Sea, including the Canal Zone. Volume III also has a statistical summary chapter, identical with that in Volume I, and a chapter on employment and injuries.

Volume IV contains 124 chapters presenting the latest available mineral statistics for more than 130 foreign countries and areas, and 1 chapter reviewing minerals in the world economy.

To my knowledge, the Minerals Yearbook is the most comprehensive publication of its kind available. The Bureau will continue its efforts in the years to come to increase the Yearbook's value to its many users. Toward that end, the constructive comments and suggestions of readers will be helpful.

MARLING J. ANKENY, *Director.*

ACKNOWLEDGMENTS

The Bureau of Mines acknowledges the assistance in the preparation of this volume of many mineral agencies abroad and the official publications on statistical data and other subjects issued in these countries. Many useful data were obtained from publications of the United Nations and the technical publications originating in the United States and many other countries. Information obtained from dispatches from the Embassies of the Department of State the world over is acknowledged. Particularly useful are routine and special reports received from technical, mineral, and petroleum attaches who usually report on several countries in their respective areas. The attache services comprise:

Burton E. Ashley, Attache, Minerals Reporting Officer, Canberra, Australia.
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John Burgess, Jr., Attache, Technical Minerals Specialist, Lima, Peru.
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Dawson S. Wilson, Second Secretary, Minerals Reporting Officer, Manila, Philippines.

Basic data on production and trade of minerals (metals, nonmetals, and fuels) in foreign countries were in many cases supplied by the International Statistics Staff, supervised by Berenice B. Mitchell, and including Helen L. Hunt, Pearl J. Thompson, Liela S. Price, and Virginia G. Huguley on foreign production; and Corra A. Barry, Bertha M. Duggan, Agnes M. Chaney, and Victoria R. Schreck on foreign trade. Also data on trade in many areas were obtained, correlated and compiled by Agnes J. Doughman, Gertrude N. Greenspoon, and Mary E. Trought.

The individual chapters for this volume were prepared by the staff of the Division of International Activities and were coordinated and reviewed by Louis A. Turnbull, Charles L. Kimbell, and Edgar J. Gealy. The correlation and final checking of material for Volume IV to meet Minerals Yearbook standards were made in the Division of

Minerals and this assistance, particularly that of Paul F. Yopes and Kathleen J. D'Amico, is gratefully acknowledged. The assistance of the Division of Economic Analysis in the interpretation of the economic inferences of the world's mineral industry is sincerely appreciated.

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

VIRGIL L. BARR
Chief, Division of International Activities.

CONTENTS

Minerals in the World Economy

By Stephen C. Brown[1]

THE expansion of the world economy which has been in progress since 1958 continued in 1963 and both production and consumption of minerals rose. Gross national product (GNP) rose sharply in the United Kingdom and Japan, continued to expand in the United States and Canada, and maintained a high though slightly declining rate of growth in the European Economic Community (EEC) despite the appearance of excess capacity in certain lines and inflationary pressures in Italy and France. The steel and motor vehicle industries both increased output in North America, Western Europe, and Japan. The less developed areas benefited substantially from an improvement in their terms of trade, and their export earnings increased some 8 percent in 1963; although estimates of GNP for the majority of them are not yet available, it is probable that this increase was partly reflected in a substantial rise of GNP.[2]

In the United States the expansion was steady and extended through all sectors of the economy producing no distortions likely to disturb its continuing growth; at yearend with unemployment still at about 5.5 percent of the labor force and operating rates of industry estimated at about 87 percent of capacity, there was a substantial margin for further expansion. Though the balance of payments was still in heavy deficit for the year, in the last half it was moving rapidly toward equalibrium as net exports rose and capital outflows declined; prices were relatively stable, inventories increased only slightly and the activity of mineral-consuming industries remained high, steel output rising by 11 percent to highest level since 1957 and the auto industry output equalling the 1955 record.[3]

The economic expansion outside the United States contained some elements of greater uncertainty. The rapid rise of the United King-

[1] Economic consultant, Washington, D.C.

[2] International Monetary Fund. International Financial News Survey, v. 15, No. 49, 1963, pp. 425–432; v. 16, No. 3, 1964, pp. 17–24; v. 16, No. 7, 1964, pp. 49–56; v. 16, No. 8, 1964, pp. 57–68; v. 16, No. 14, 1964, pp. 117–124; v. 16, No. 15, 1964, pp. 125–132; v. 16, No. 16, 1964, pp. 133–140; v. 16, No. 17, 1964, pp. 141–148; v. 16, No. 18, 1964, pp. 149–156; v. 16, No. 19, 1964, pp. 157–164.
International Monetary Fund. International Financial Statistics, v. 17, No. 6, June 1964, 311 pp.
National Institute of Economic and Social Research. Economic Review No. 27, February 1964, 92 pp.
United Kingdom Treasury. Preliminary Estimates of National Income and Balance of Payments 1963. Cmnd. 2328, April 1964, 21 pp.
U.S. Department of Commerce. Survey of Current Business. January 1964. 65 pp.

[3] U.S. Department of Commerce. Survey of Current Business, v. 44, No. 1, 65 pp., and v. 44, No. 3, 60 pp. Economic Report of the President, January 1964, Government Printing Office, Washington, D.C., 304 pp.

dom's output was accompanied by growing pressure on labor supplies, rising wage rates, and a widening trade gap as producers began to restock their inventories of raw materials toward the end of the year. The prospects of a further expansion of demand that might put excessive strain on resources and the balance of payments caused authorities to consider a slight cutback in the growth rate in 1964. In the EEC the overall expansion of the economy by 4 percent in 1963 concealed mounting inflationary pressures, continuing wage rises, and accelerating consumer price increases which led authorities, particularly in Italy and France, to take action to restrict the pressures of demand; the trade deficit with non-EEC countries doubled from US$1,500 million in 1962 to US$3,000 million in 1963 and the balance of payments surplus on trade and factor income was reduced to about US$500 million. A 19 percent increase in fuel imports from non-EEC sources was a major factor in the deterioration of the balance of payments. In Japan, too, the high rate of growth in 1963 had led to a large increase in imports, a widening of the adverse trade balance, and rising inflationary pressures; Japanese authorities (like the British authorities) decided that the rate of growth must be cut back slightly.[4]

The primary producing and less industrialized countries had a better year than in 1962 or for some years past, and benefited from a general rise in the prices of their export products. The volume of their exports continued to increase and import prices changed little. Their terms of trade improved by practically the full amount of the commodity price increases, bringing them back to the level of 1961, and about 10 percent below the high levels of 1950. Export earnings increased and the balances of payments generally improved; although the bulk of the increases in monetary reserves was concentrated in a few countries, the majority of the primary producers recorded somewhat higher reserves. Benefiting from a rise in the volume of petroleum exports, though not from price increases, the oil producers fared somewhat better than most other primary producers.[5]

Much of the improvement in commodity prices and the terms of trade of the less developed countries apparently can be traced to the effects of weather, and caution should therefore be exercised in interpreting it as a continuing trend. The abnormally cold Northern Hemisphere winter of 1962–63 had an adverse effect on crops there, as did the prevalence of drought in some regions; while the cold winter (coupled with a French coal strike early in the year) sharply increased European requirements for fuel imports. Only the improvement in nonferrous metal prices appeared to reflect a changing basic supply

[4] European Economic Community. Monthly Statistics. Foreign Trade, 1964–No. 2. 110 pp.
European Economic Community Commission. The Economic Situation in the Community. Quarterly survey. December 1963. 119 pp. International Monetary Fund. International Financial News Survey, v. 15, No. 49, 1963, pp. 425–432; v. 16, No. 1, 1964, pp. 1–8; v. 16, No. 2, 1964, pp. 9–16; v. 16, No. 3, 1964, pp. 17–24; v. 16, No. 10, 1964, pp. 77–84; v. 16, No. 15, 1964, pp. 125–132; v. 16, No. 16, 1964, pp. 133–140; v. 16, No. 17, 1964, pp. 141–148; v. 16, No. 18, 1964, pp. 149–156.
National Institute of Economic and Social Research. Economic Review No. 27, London, February 1964, 92 pp.: Economic Review No. 28, London, May 1964, 76 pp.
U.S. Embassy, Tokyo, Japan. Airgram A 1064, March 6, 1964, 14 pp.

[5] National Institute of Economic and Social Research. Economic Review No. 27, London, February 1964, 92 pp.; No. 28, London, 1964, 76 pp.
United Nations. World Economic Survey 1963. Part II, Current Economic Developments, 95 pp.
United Nations. Commodity Survey 1963 (Preliminary). UN Conference on Trade and Development, Document E/Conf. 46/115, May 7, 1964.

and demand position, as the continuing high level of world industrial output began to catch up with the excess production capacity created during the 1950's.

The developing pattern of the free world economy in 1963 thus showed a continuing strong expansion in the United States and in Canada, a strong rise in the United Kingdom and Japan which the authorities of both countries believed must be restrained primarily for balance of payments reasons, and a slightly smaller rate of expansion in the EEC than during 1962, a rate whose maintenance may be affected by efforts to restrain internal inflationary pressures. All three of the areas outside North America, more dependent than the United States and Canada on imported raw materials, and all subject in some degree to inflationary pressures in 1963, appeared to be moving towards balance of payments deficits. The U.S. balance appeared finally to be moving towards equilibrium though still in heavy deficit. The convergence of growth rates in the neighborhood of 4 to 5 percent thus appeared to represent different cyclical phases in the growth trend of the free world economy.

Despite the rise of smaller industrial centers in Australia, India, South Africa, Brazil, Mexico, and a few other countries, the United States, Western Europe, and Japan remain the chief motive forces in the free world economy and their requirements are the principal determinants of demand for minerals. Together they account for about two-thirds of the free world's imports of ores, metals, and fuels. The developments of the past 5 years have brought them into a more balanced relationship, and the U.S. economy is no longer the completely decisive factor that it was for a decade after World War II. In the case of minerals, for example, a continuation of the rising trend in the prices and volume of primary producers' exports depends on continuing high demands from all three areas; of these, the EEC is the largest importer and both the United Kingdom and Japan are important markets.

The economies of the Communist countries in Europe and Asia have also expanded at a high rate during the past 5 years but the nature and structure of their economies, as well as their commercial policies, cause them to participate in the world economy on what is essentially a marginal basis. Their domestic economies are completely and centrally planned, the bulk of production is destined for domestic consumption and use, and surpluses have normally been exported primarily to obtain needed supplies of raw materials, equipment or other goods. Even in such cases surpluses are exchanged chiefly among themselves and are exported outside the group usually in exchange for goods not available within it. For this reason their rates of growth do not normally have the same impact on or importance for the world economy as do those of other regions. More recently, however, Communist external transactions have assumed greater importance as these countries have embarked on programs of economic aid to the less developed countries and have begun to export goods to the free world in order to obtain capital equipment. On the supply side of the mineral industries they have played a significant role in a number of commodities such as petroleum, apatite and potash, manganese, chromite, tungsten, antimony, mercury, and the platinum metals; on the demand

side they have been significant importers of copper. Their role may expand if the economic solidarity of the group should dissolve.

The 1963 changes represent for the most part a continuation of trends of previous years. In essence, the trends reflect a period of very rapid growth of the West European and Japanese economies, increasing their overall size and absorbing their domestic resources of raw materials until further growth became dependent on major increases in imports from outside.

The differential growth rates of the three major free world areas have given a new shape and structure to the free world economy. In both Western Europe and Japan powerful investment booms involved a sizable expansion of capacity in major industries, an increasing shift to heavy industry and consumer durables, and a sharply increased consumption of all primary products, especially ores, metals, and fuels. A major development in both areas has been a massive shift from coal to petroleum as a source of energy. The more rapid growth of Western Europe and Japan not only restored them to their prewar positions of eminence in the world economy, but also brought about a redistribution of the world's currency reserves in their favor.[6]

The steady expansion of the world economy since 1958 has also been assisted by the relative stability of commodity prices since the recession of 1957–58, and by the restoration of currency convertibility by the major European countries with the consequent elimination of their exchange controls and quota restrictions. Ample capacity in practically all lines contributed to the stability of prices. This was especially true in minerals, for which investments stimulated by the Korean War actually created surplus capacity. The increasing ease of capital transfers and goods movements stimulated both trade and investment throughout the free world. The net effect was to reintegrate the free world's economies on a scale not seen since 1939.

A rather general measure of the industrial expansion in the past 5 years is given by the United Nations indexes of industrial production.

TABLE 1.—Indexes of world industrial production, by region

(1958=100)

Region	1959	1960	1961	1962	1963 [1]
World [2]	110	118	122	130	137
Northern North America [3]	113	116	117	126	132
Europe [2]	106	116	122	127	133
European Economic Community	106	118	125	132	138
European Free Trade Association	105	113	114	117	121
Japan	124	156	186	201	219
Asia, East and Southeast [4]	109	122	130	141	154
Latin America [5]	106	112	119	123	123
U.S.S.R.	111	122	133	146	158
Industrialized countries	110	117	121	129	136
Less industrialized countries	107	119	130	138	146

[1] Preliminary figures.
[2] Excludes European and Asian Communist countries except Yugoslavia.
[3] United States and Canada.
[4] Excludes Japan, Cambodia, Laos, and Asian Communist countries; includes Iran, Afghanistan, Pakistan, India, Ceylon, Burma, Thailand, Malaysia (except Sabah), South Viet-Nam, Brunei, Indonesia, Philippines, Hong Kong, Taiwan, and Republic of Korea.
[5] Central and South America and the Caribbean Islands.

Sources: United Nations. Monthly Bulletin of Statistics. May 1964; for European Free Trade Association (EFTA), Organization for Economic Cooperation and development (OECD) General Statistics. March 1964, rebased on 1958=100.

[6] Economic Report of the President. January 1963, pp. 91–129.

PRODUCTION

The United Nations index of free world mining production in 1963 rose about 3 percent over 1962 output levels, with the chief increases occurring in iron and steel, aluminum, lead, and the two major fuels. Bureau of Mines data indicate that total world output of steel ingots and castings rose about 7 percent, although iron ore production increased only about 2 percent. Of the minerals associated with the steel industry, output of manganese ore, magnesite, and molybdenite rose, while production of fluorspar, chromite, and ores of vanadium, tungsten, and nickel declined. Among the nonferrous metals, aluminum production continued its growth trend and increased 9 percent though bauxite output declined 2 percent. Total world mine copper output, still under voluntary restrictions and affected by strikes and by political instability in the Republic of the Congo (Leopoldville), rose only about 2 percent. Mine output of lead increased about 1.5 percent and of zinc 2 percent. Mine production of tin increased marginally with small increases in the U.S.S.R., Malaysia, Thailand, Bolivia, and Nigeria offsetting a sharp reduction in Indonesia; the gap between new supply and demand remained, being filled by U.S. stockpile releases and the drawing down of other stocks. Industrial demand pressures also continued on silver, with new production inadequate for requirements and the shortfall being met by U.S. Treasury stocks and other supplies. Gold output rose by 4 percent and silver by 3 percent. Among the nonmetals, total output of sulfur rose by about 2 percent, with a 4 percent increase in output of elemental sulfur more than offsetting a decline in production from pyrites; potash production rose about 11 percent, the main factors being sharp increases in the United States and Canada; while phosphate output rose by about 6 percent, the chief increases occurring in the United States, the U.S.S.R. and Communist Asia, Morocco, and Tunisia. World cement output rose by about 5 percent. Production of coal rose about 4 percent and crude petroleum about 7 percent.[7]

Among free world countries mine output, including petroleum, rose more rapidly during 1963 in the less industrialized countries than in the major industrial areas, reflecting the growing dependence of the latter on ores and minerals from outside their territories; the United Nations index of the volume of mining production for the industrialized countries rose over 1962 levels by 2 percent as compared with a 7 percent rise in the index for less industrialized countries.

In 1963 the output of crude petroleum and natural gas continued to maintain a more rapid rate of growth than coal and metals.

The rates of increase since 1958 in output of the more important minerals, according to United Nations indexes varied substantially.

The United Nations indexes exclude the output of the European and Asian Communist countries and, to that extent, do not reflect accurately the trends of total world production. Data prepared by the Bureau of Mines summarize total world production of 65 major minerals for the years 1959–63, with the averages for the preceding 5 years given for purposes of comparison. The Bureau data include

[7] Engineering and Mining Journal. V. 165, No. 2, February 1964, pp. 90–155, 160. United Nations. Monthly Bulletin of Statistics. May 1964, v. 18, No. 5, 199 pp.

estimates for European and Asian Communist countries and the coverage is therefore more complete.

In table 6 the percentage distribution of 1963 world production of these minerals among the eight major geographical regions is shown, as well as a breakdown between Western Hemisphere and Eastern Hemisphere production.

TABLE 2.—Indexes of free world mining production, by regions

(1958=100)

Region	1959	1960	1961	1962	1963 [1]
Free World [2]	104	111	117	123	127
Northern North America [3]	104	107	108	112	114
Europe [2]	98	100	102	103	104
EEC	98	101	103	103	102
EFTA	98	96	95	97	97
Japan	99	108	116	118	116
Asia, East and Southeast [4]	110	124	132	144	151
Latin America [5]	106	112	114	122	125
Industrialized countries	103	105	107	110	112
Less industrialized countries	108	130	145	161	172

[1] Preliminary figures.
[2] Excludes European and Asian Communist countries except Yugoslavia.
[3] United States and Canada.
[4] Excludes Japan, Cambodia, Laos, and Asian Communist Bloc; includes Iran, Afghanistan, Pakistan, India, Ceylon, Burma, Thailand, Malaysia (except Sabah), South Viet-Nam, Brunei, Indonesia, Philippines, Hong Kong, Taiwan and Republic of Korea.
[5] Central America, South America, and Caribbean Islands.

Source: United Nations, Monthly Bulletin of Statistics, May 1964; for EFTA, OECD General Statistics, March 1964, rebased on 1958=100.

TABLE 3.—Indexes of free world mining production, by type [1]

(1958=100)

Year	Metals	Coal	Crude petroleum and natural gas	Total
1959	104	97	107	104
1960	116	97	118	111
1961	118	96	128	117
1962	121	98	139	123
1963 [2]	123	100	146	127

[1] Excludes European and Asian Communist countries except Yugoslavia.
[2] Preliminary figures.

Source: United Nations. Monthly Bulletin of Statistics. May, 1964.

TABLE 4.—Indexes of world production of major mineral commodities [1 2]

(1958=100)

Commodity	1959	1960	1961	1962	1963
Aluminum [3]	115	129	126	138	152
Copper (smelter) [4]	106	127	128	132	136
Pig iron	109	124	129	133	141
Steel, crude	111	125	130	133	143
Lead [3]	94	100	104	103	108
Tin [5]	94	119	113	119	119
Zinc [3]	103	107	114	119	121
Coal [6]	100	101	102	105	108
Petroleum (crude)	108	116	123	134	143

[1] United Nations. Monthly Bulletin of Statistics. May 1964, Special Table B.
[2] Excludes mainland China.
[3] Excludes U.S.S.R., Eastern Germany, Czechoslovakia, Rumania, and North Korea.
[4] Excludes U.S.S.R., East Germany, Albania, and North Korea.
[5] Excludes U.S.S.R. and Eastern Europe.
[6] Includes coal equivalent of brown coal and lignite.

TABLE 5.—World production of major minerals

Commodity	1954–58 (average)	1959	1960	1961	1962	1963
Metals:						
Aluminum—thousand metric tons	3,250	4,060	4,530	4,725	5,080	5,530
Antimony (content)—do	50	53	53	52	54	56
Arsenic, white (free world) [1]—do	38	43	52	49	49	48
Bauxite—do	19,325	23,000	27,390	29,280	30,940	30,250
Beryl—metric tons	8,900	10,200	11,100	11,700	9,900	6,700
Bismuth—do	2,100	2,300	2,400	2,350	3,000	2,950
Cadmium [2]—do	8,803	10,226	11,462	11,768	12,291	11,931
Chromite—thousand metric tons	[3] 3,910	3,910	4,430	4,235	4,395	4,055
Cobalt (content) (free world) [4] metric tons	13,600	14,800	14,200	13,400	14,400	11,500
Columbium-tantalum (free world) do	3,624	2,737	3,184	3,418	4,178	4,833
Copper, mine (content) [5] thousand metric tons	3,270	3,670	4,220	4,400	4,620	4,740
Copper, smelter—do	3,440	3,840	4,570	4,640	4,860	4,990
Gold—thousand troy ounces	37,800	42,600	45,100	47,200	49,800	51,700
Iron ore—thousand metric tons	381,800	439,044	522,238	502,641	507,364	518,164
Iron, pig (incl. ferroalloys) [6]—do	190,490	224,280	258,810	256,200	264,770	280,320
Lead, mine (content)—do	2,250	2,330	2,390	2,390	2,510	2,550
Lead, smelter—do	2,160	2,190	2,320	2,420	2,410	2,540
Magnesium—do	96	75	93	106	133	141
Manganese ore—do	11,564	12,952	13,574	13,533	14,302	14,600
Mercury—thousand flasks (76 lb.)	213	223	242	240	245	236
Molybdenum (Mo content) [7] metric tons	32,000	32,500	40,400	40,000	34,100	41,600
Nickel (content) thousand metric tons	246	286	326	366	362	347
Platinum-group metals thousand troy ounces	1,075	1,055	1,275	1,355	1,630	1,530
Selenium (free world)—metric tons	804	748	758	950	967	957
Silver [8]—thousand troy ounces	227,600	222,300	241,000	236,900	241,800	249,500
Steel ingots (incl. castings) thousand metric tons	266,330	305,270	346,150	350,860	359,500	386,030
Tellurium (free world)—metric tons	86	116	176	170	180	143
Tin, mine (content)—long tons	187,900	161,500	180,400	184,100	187,000	190,300
Tin, smelter—do	189,500	155,400	189,300	184,000	189,600	191,700
Titanium—ilmenite [9] thousand metric tons	1,473	1,758	2,002	2,092	1,967	2,016
Titanium—rutile [9]—do	94	97	104	117	136	200
Tungsten concentrate—60 percent WO_3—metric tons	66,400	55,500	65,600	70,200	66,500	58,700
Uranium oxide (U_3O_8) (free world) do	([10])	39,340	37,350	32,050	31,320	27,400
Vanadium (V content) (free world) [11] do	3,923	4,827	6,564	7,918	7,517	6,355
Zinc, mine (content) thousand metric tons	3,020	3,120	3,320	3,460	3,530	3,604
Zinc, smelter—do	2,745	2,860	3,040	3,255	3,410	3,475

See footnotes at end of table.

TABLE 5.—World production of major minerals—Continued

Commodity	1954–58 (average)	1959	1960	1961	1962	1963
Nonmetals						
Asbestos [12] thousand metric tons	1,765	2,060	2,210	2,510	2,770	2,900
Barite [2] do	2,655	2,790	2,850	2,860	3,115	2,905
Cement, hydraulic do	231,277	294,412	316,537	333,428	357,841	375,412
Corundum do	9	7	8	7	8	10
Diamond, gem thousand carats	4,742	5,900	6,700	7,000	6,347	6,572
Diamond, industrial do	19,160	20,900	21,000	27,250	27,659	30,089
Diatomite [13] thousand metric tons	1,113	1,345	1,410	1,485	1,480	1,465
Feldspar [14] do	1,230	1,370	1,520	1,550	1,570	1,620
Fluorspar do	1,620	1,720	2,020	2,070	2,190	2,120
Graphite do	280	370	430	410	530	660
Gypsum [15] do	33,260	43,100	42,370	43,300	46,910	48,960
Magnesite do	4,700	5,500	6,250	7,550	7,800	8,200
Mica do	140	160	165	165	180	180
Phosphate rock [16] do	32,700	38,375	41,900	45,475	48,200	51,200
Potash (marketable), K_2O equiv. do	7,500	8,500	9,100	9,700	9,800	10,900
Pumice [17] do	7,680	9,700	10,820	11,840	12,250	13,340
Pyrites (incl. cupreous) [18] do	17,400	18,900	20,100	19,600	20,100	20,000
Salt do	68,000	79,700	84,900	84,700	91,400	95,100
Strontium minerals (free world) [19] metric tons	10,892	9,700	11,800	12,900	7,800	15,200
Sulfur, native thousand metric tons	6,459	7,180	7,810	8,440	8,330	8,250
Sulfur, byproduct elemental do	(10)	2,090	2,710	3,300	3,930	4,475
Talc, soapstone, and pyrophyllite do	1,835	2,345	2,520	2,710	2,705	2,855
Vermiculite (free world) [18] do	228	236	244	253	268	298
Mineral fuels:						
Coal (all grades) thousand metric tons	2,227,090	2,519,027	2,632,860	2,482,217	2,549,271	2,652,310
Anthracite do	145,010	175,700	176,700	174,200	179,800	183,500
Bituminous do	1,521,055	1,725,979	1,817,497	1,645,706	1,684,257	1,746,645
Lignite do	561,025	617,348	638,663	662,311	685,214	722,165
Coke, metallurgical do	246,311	260,456	279,616	272,049	273,126	284,257
Coke, other types [20] do	46,888	45,760	46,090	45,060	45,730	45,470
Fuel briquets do	105,300	104,600	108,300	113,100	118,500	121,700
Peat do	78,150	169,700	162,100	159,600	163,000	163,000
Petroleum, crude thousand 42-gallon barrels	5,962,624	7,144,860	7,689,851	8,183,863	8,882,218	9,535,434

[1] Excludes Argentina, Austria, Finland, and United Kingdom.
[2] Excludes Bulgaria.
[3] Excludes North Viet-Nam.
[4] Excludes, Uganda.
[5] Excludes Czechoslovakia, Hungary, Iran, Kenya, and Malaya.
[6] Excludes a negligible amount produced in the Republic of the Congo.
[7] Excludes a negligible amount produced in Bulgaria, North Korea, Rumania, South-West Africa, and Spain.
[8] Excludes a negligible amount produced in Bulgaria, Mozambique, Panama, and Turkey.
[9] Excludes Brazil and U.S.S.R.
[10] Data not available.
[11] Incomplete total, represents only countries for which data is available.
[12] Excludes a negligible amount produced in Czechoslovakia, Eritrea, North Korea, and Rumania.
[13] Excludes Hungary and Rumania.
[14] Excludes China, Republic of Korea, and Rumania.
[15] Excludes a negligible amount produced in Ecuador and Korea.
[16] Excludes a negligible amount produced in Jamaica, Japan, Sarawak, Somali Republic, and Tanganyika.
[17] Excludes Mexico and U.S.S.R.
[18] Excludes Brazil.
[19] Excludes West Germany.
[20] Excludes a negligible amount produced in Canada.

NOTE.—Statistical tabulations with minor exceptions are based on data available prior to August 1, 1964.

Table 7 groups these distribution data in a different way, to show the proportion of 1963 output of seven major minerals produced in the industrialized countries on the one hand, and the less industrialized countries on the other. In this table the industrialized countries include the United States and Canada, free Europe, Oceania and Japan, South Africa, and the U.S.S.R. and European Communist countries;

the less industrialized countries include the rest of the world. A significant point of the table is the very large proportion of total output of these minerals accounted for by the industrialized countries themselves, despite their growing need for additional supplies from the less industrialized countries.

The rapid growth of mineral output has required large investment in both mineral extraction and mineral processing facilities. Statistical data for mineral investments on a worldwide basis are fragmentary at best, but the available evidence indicates that in recent years free world petroleum investments have averaged about US$10,700 million per year, while investments in the iron and steel industries of the three major industrialized areas (the United States, Western Europe, and Japan) appear to have ranged around US$3,000 million annually in the past 5 years. Data for other mineral investments are too scanty to permit even rough estimates for the major areas. Investment in steel in the United Kingdom and European Coal and Steel Community (ECSC) is now (1964) tapering off. Data for Japan are lacking, but it has been estimated that about US$2,700 million was invested in the Japanese iron and steel industry during 1955–62.[8]

For petroleum, the most complete coverage of investment is contained in the annual estimates prepared by the Petroleum Department of the Chase Manhattan Bank. According to these estimates, expenditures of the free world petroleum industry for expansion, modernization, and replacement of property, plant, and equipment (including the cost of dry holes but excluding exploration expenses) have averaged a little less than US$10,800 million per year for the period 1958–62 inclusive. Of a total of US$11,100 million in 1962, 51 percent was investment in production, about 14 percent in transporation (pipelines and marine), about 13 percent in refineries, about 14 percent in marketing facilities, and about 6 percent in chemical plants.

These estimates may be compared with the United States Department of Commerce figures for petroleum in its estimates of annual U.S. company expenditures for plant and equipment abroad, 1960–64 inclusive. These data exclude investments in petrochemical plants which are classified as a manufacturing industry. Investments in mining and smelting cannot be broken down according to the specific minerals involved because of the problem of revealing individual company data.

As presented in table 11, the financial assistance extended by five international lending agencies for investment in the mineral industries generally covers the mineral industries through the metal stage, and in the case of the steel and aluminum industries through the finished products normally regarded as products of the primary industry; in the chemical industry petrochemicals are excluded. The amounts reported in the table are gross of participations but net of cancellations.

[8] Tokyo Foreign Service. Japan's Iron and Steel Industry. Tokyo, Japan, 1963, p. 132.

TABLE 6.—Approximate percentage distribution of world mineral production by major areas in 1963 [1]

	Western Hemisphere			Eastern Hemisphere							World	
				Europe			Middle East and Asia					
	North and Central America	South America	Total	Free [2]	Eastern [2]	Africa	Free [3]	Mainland China, Mongolia, North Korea, and North Viet-Nam	Oceania	Total	Free	Cuba, Eastern Europe, Mainland China, Mongolia, North Korea, North Viet-Nam
Metals:												
Aluminum:												
Bauxite	31.9	19.3	51.2	16.2	18.8	5.8	5.5	1.3	1.2	48.8	79.9	20.1
Ingot	49.7	.5	50.2	19.6	21.4	1.0	5.2	1.8	.8	49.8	76.8	23.2
Antimony	11.0	14.8	25.8	6.4	14.5	21.4	5.0	26.8	.1	74.2	58.7	41.3
Arsenic, white [4]	(5)	1.3	(5)	(5)	(6)	1.1	2.1	(6)		(5)	100.0	(6)
Beryl	10.2	39.2	49.4	(7)	15.0	33.5			2.1	50.6	85.0	15.0
Bismuth	(5)	(5)	62.8	7.4	3.7	.3	15.6	10.2		37.2	86.1	13.9
Cadmium	47.3	1.5	48.8	16.9	21.9	1.0	8.3		3.1	51.2	78.1	21.9
Chromite	1.3	.4	1.7	2.7	38.0	29.4	27.0	.8	.4	98.3	59.9	40.1
Cobalt [4]	(5)		(5)	(5)	(6)	81.4	(5)	(6)	.2	(5)	100.0	(6)
Columbium-tantalum [4]	25.3	18.5	43.8	4.0	(6)	50.1	1.8	(6)	.3	56.2	100.0	(6)
Copper:												
Mine	33.5	16.6	50.1	3.3	16.2	20.7	5.1	2.1	2.5	49.9	81.6	18.4
Smelter	31.6	14.4	46.0	9.5	15.7	19.0	5.8	2.2	1.8	54.0	82.1	17.9
Gold	11.5	1.8	13.3	.4	25.0	56.8	1.8	.4	2.3	86.7	74.6	25.4
Iron and steel:												
Iron ore	20.2	6.8	27.0	25.4	28.5	4.1	6.3	7.5	1.2	73.0	64.0	36.0
Pig iron (including ferroalloys)	26.1	1.2	27.3	27.5	26.7	1.0	9.8	6.4	1.3	72.7	66.9	33.1
Steel ingots and castings	28.1	1.2	29.3	28.1	27.2	.8	10.0	3.4	1.2	70.7	69.4	30.6
Lead:												
Mine	24.0	8.2	32.2	13.7	20.4	7.4	4.0	5.9	16.4	67.8	73.7	26.3
Smelter	28.6	4.9	33.5	22.8	19.8	2.0	4.6	5.1	12.2	66.5	75.1	24.9
Magnesium	54.5		54.5	20.5	22.7		1.6	.7		45.5	76.6	23.4
Manganese ore	1.8	9.6	11.4	.7	48.4	22.1	10.1	6.9	.4	88.6	44.2	55.8
Mercury	15.7	1.4	17.1	52.4	15.2		4.3	11.0		82.9	73.8	26.2
Molybdenum	72.1	8.7	80.8	.6	13.7	(7)	1.3	3.6		19.2	82.7	17.3
Nickel	65.5	(7)	65.5	.8	24.4	.8	.1		8.4	34.5	70.7	29.3
Platinum-group metals	25.7	1.9	27.6		52.2	20.0	.2		(7)	72.4	47.8	52.2
Selenium [4]	67.2	.9	68.1	13.8	(6)	3.0	14.9	(6)	.2	31.9	100.0	(6)
Silver	45.4	18.4	63.8	6.6	13.8	2.6	5.0	.6	7.6	36.2	85.6	14.4
Tellurium [4]	87.4	8.4	95.8		(6)		4.2	(6)		4.2	100.0	(6)
Tin:												
Mine	(5)	(5)	13.7	1.1	11.0	10.2	47.7	14.7	1.6	86.3	74.3	25.7
Smelter	1.5	2.3	3.8	17.5	10.7	6.3	45.7	14.6	1.4	96.2	74.7	25.3

Titanium:												
Ilmenite [4]	57.1	(7)	57.1	20.9	(6)	2.2	9.7	(6)	10.1	42.9	100.0	(6)
Rutile [4]	5.4	.1	5.5	----	(6)	1.0	.9	(6)	92.6	94.5	100.0	(6)
Tungsten	8.8	6.5	15.3	3.8	18.7	1.0	13.2	45.3	2.7	84.7	36.0	64.0
Uranium oxide (U_3O_8) [4]	74.1	(7)	74.1	6.9	(6)	15.0	(7)	(6)	4.0	25.9	100.0	(6)
Vanadium [4]	55.1	(7)	55.1	8.8	(6)	36.1	----	(6)	----	44.9	100.0	(6)
Zinc:												
Mine	32.7	5.9	38.6	14.8	17.6	6.9	6.3	5.9	9.9	61.4	76.5	23.5
Smelter	32.3	2.2	34.5	24.5	20.7	2.9	7.6	4.5	5.3	65.5	74.8	25.2
Nonmetals:												
Asbestos	41.6	(7)	41.6	3.4	37.7	11.9	1.5	3.4	.5	58.4	58.9	41.1
Barite	39.4	7.0	46.4	30.9	9.7	3.9	3.4	5.5	.2	53.6	84.8	15.2
Cement, hydraulic	19.7	3.7	23.4	31.9	23.6	2.5	14.4	3.2	1.0	76.6	73.1	26.9
Corundum	----	----	----	----	42.5	54.5	3.0	----	----	100.0	57.5	42.5
Diamonds:												
Gem	----	4.2	4.2	----	3.7	92.1	(7)	----	----	95.8	96.3	3.7
Industrial	----	.8	.8	----	9.2	90.0	----	----	----	99.2	90.8	9.2
Diatomite	30.1	.4	30.5	32.7	21.7	.8	13.9	----	.4	69.5	78.3	21.7
Feldspar [5]	35.0	3.8	38.8	39.6	13.6	2.7	4.8	----	.5	61.2	86.4	13.6
Fluorspar	34.1	.4	34.5	31.2	13.9	2.8	4.3	13.3	----	65.5	72.8	27.2
Graphite	(5)	(5)	(5)	(5)	10.1	2.5	47.7	16.5	----	(5)	73.4	26.6
Gypsum	33.9	1.3	35.2	34.2	19.2	1.9	7.1	1.0	1.4	64.8	79.8	20.2
Magnesite	9.2	1.1	10.3	25.0	38.7	1.3	3.1	20.8	.8	89.7	40.5	59.5
Mica, including scrap	55.4	.7	56.1	(7)	16.9	2.2	18.9	5.6	.3	43.9	77.5	22.5
Phosphate rock	39.6	1.6	41.2	.2	21.8	26.2	2.7	3.3	4.6	58.8	74.9	25.1
Potash, K_2O equivalent (marketable)	29.0	.2	29.2	37.6	32.2	----	1.0	----	----	70.8	67.8	32.2
Pumice [4]	17.8	.1	17.9	81.1	(6)	.1	.8	(6)	.1	82.1	100.0	(6)
Pyrites, including cupreous	6.6	(7)	6.6	34.2	21.9	2.7	25.5	8.0	1.1	93.4	69.9	30.1
Salt	34.6	2.5	37.1	24.7	15.4	1.6	8.9	11.7	.6	62.9	72.8	27.2
Strontium minerals [4]	38.5	1.5	40.0	60.0	(6)	----	----	(6)	----	60.0	100.0	(6)
Sulfur:												
Native	78.4	1.2	79.6	.5	15.2	.2	3.0	1.5	----	20.4	83.3	16.7
Byproduct, elemental	47.0	----	47.0	37.7	11.7	.1	.8	2.7	----	53.0	85.6	14.4
Talc and soapstone	27.4	2.2	29.6	21.4	12.3	.5	29.7	6.0	.5	70.4	81.7	18.3
Vermiculite	68.8	.9	69.7	----	(6)	30.1	.2	(6)	----	30.3	100.0	(6)
Mineral fuels:												
Coal, all grades including lignite	16.8	.3	17.1	22.3	40.8	1.7	5.4	10.9	1.8	82.9	48.3	51.7
Coke:												
Metallurgical	19.0	.7	19.7	32.7	31.8	.8	8.3	5.7	1.0	80.3	62.5	37.5
Other types	.5	1.0	1.5	41.8	39.6	.5	13.9	.9	1.8	98.5	59.5	40.5
Fuel briquets	.5	----	.5	31.0	59.2	(7)	7.7	----	1.6	99.5	40.8	59.2
Petroleum, crude	33.3	14.7	48.0	1.4	17.1	4.6	28.3	.6	(7)	52.0	82.3	17.7

[1] Based on production data (including estimates) as presented in world production tables in commodity chapters of Volumes I and II. In some cases, revised figures have been incorporated in individual country chapters of Volume IV, thus percentages given here do not necessarily agree with totals of production based on data in individual country chapters. Regional divisions of total conform to those used in the Table of Contents of Volume IV, except as noted.

[2] As used here, Free Europe includes all countries listed under Europe except: Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and the U.S.S.R.

[3] As used here, includes all Middle East and Asian countries except China (Mainland), Mongolia, North Korea, and North Viet-Nam.

[4] Distribution of free world output only; no estimate of production made for Communist countries except Yugoslavia.

[5] Production data not available but recorded distribution for other areas based on a world total which includes an estimate for this area.

[6] Does not apply; see footnote 4.

[7] Less than 0.1 percent.

[8] Production by China (mainland), Mongolia, North Korea, and North Viet-Nam unknown, no estimate included in world total on which percentage figures are based.

TABLE 7.—Mine production of major mineral commodities in percent of world total, by areas in 1963

Area	Iron ore	Bauxite	Copper	Lead	Zinc	Coal	Crude petroleum
Industrialized areas:							
Canada	5.3	-------	8.8	7.1	12.5	0.4	2.7
United States	14.4	5.1	23.2	9.0	13.3	16.3	28.9
Free Europe	25.4	16.2	3.3	13.7	14.8	22.3	1.4
U.S.S.R.	26.4	14.2	14.8	14.1	11.4	20.0	15.8
European Communist Countries except Yugoslavia [1]	2.1	4.6	1.4	6.3	6.2	20.8	1.3
Japan	.5	-------	2.3	2.1	5.5	2.0	.1
Oceania	1.2	1.2	2.5	16.4	9.9	1.8	(2)
South Africa, Republic of	.9	-------	1.2	(2)	-------	1.6	-------
Total	76.2	41.3	57.5	68.7	73.6	85.2	50.2
Less industrialized areas:							
Latin America [3]	7.3	46.1	18.1	16.1	12.8	0.4	16.4
Free Asia (except Japan)	5.8	5.5	2.8	1.9	.8	3.4	28.2
China (mainland), North Korea, North Viet-Nam	7.5	1.3	2.1	5.9	5.9	10.9	.6
Africa (except Republic of South Africa)	3.2	5.8	19.5	7.4	6.9	.1	4.6
Total	23.8	58.7	42.5	31.3	26.4	14.8	49.8

[1] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, and Rumania.
[2] Less than 0.1 percent.
[3] Includes Mexico, Caribbean, Central America, and South America.

TABLE 8.—Investments of the iron and steel industry in the United States, United Kingdom, and European Coal and Steel Community (ECSC)

(Million U.S. dollars)

Year	United States [1]	United Kingdom [2]	European Coal and Steel Community [3]
1959	1,040	310	590
1960	1,600	470	760
1961	1,130	660	1,120
1962	1,100	550	1,220
1963	1,240	[4] 220	[5] 1,440

[1] Expenditures for new plant and equipment, primary iron and steel industry.
[2] Gross fixed capital formation in iron and steel industry; amounts converted into dollars at rate of £1=$2.80.
[3] Investment expenditures of iron and steel industry.
[4] Estimate of British Iron and Steel Federation.
[5] Estimate.

Sources: U.S. Department of Commerce. Survey of Current Business. July 1963, March 1964; U.K. Central Statistical Office. National Income and Expenditure 1963; ECSC High Authority. Investment in the Community Coalmining and Iron and Steel Industries; British Iron and Steel Federation. Annual Report 1963.

TABLE 9.—Estimated capital expenditures of the free world petroleum industry

(Million U.S. dollars)

Year	United States	Other countries	Total free world	Percent of free world	
				United States	Other countries
1958	5,300	5,400	10,700	49.5	50.5
1959	5,275	5,775	11,050	47.7	52.3
1960	5,175	5,350	10,525	49.2	50.8
1961	5,100	5,325	10,425	48.9	51.1
1962	5,725	5,375	11,100	51.6	48.4

Source: Petroleum Department, Chase Manhattan Bank. Capital Investments by the World Petroleum Industry, November 1962.

TABLE 10.—U.S. direct investments in mineral industries in foreign countries, plant and equipment expenditures only

(Million U.S. dollars)

Area and/or country	1960		1961		1962		1963 [1]		1964 [1]	
	Mining and smelting	Petroleum	Mining and smelting	Petroleum	Mining and smelting	Petroleum	Mining and smelting	Petroleum	Mining and smelting	Petroleum
Canada	290	360	165	315	193	325	155	350	115	315
Latin America:										
South America	44	277	56	246	58	233	65	249	47	249
Other	10	20	8	21	5	24	5	27	5	23
Total	[2] 53	297	64	267	63	257	70	276	52	272
Other Western Hemisphere	24	44	23	39	32	62	30	39	38	38
Europe:										
EEC	([3])	145	([3])	186	([3])	269	([3])	386	([3])	303
Non-EEC:										
United Kingdom	------	100	------	170	------	125	------	110	------	95
Other	2	101	1	82	4	100	4	147	2	88
Total	2	[2] 200	1	252	4	225	4	257	2	183
Total, Europe	2	[2] 345	1	438	4	494	4	643	2	486
Africa:										
Northern Africa	([3])	75	([3])	111	([3])	137	([3])	161	([3])	134
Western Africa	16	23	22	34	43	11	32	9	24	8
Central and southern Africa	28	10	25	17	26	13	18	13	11	24
Total	44	[4] 115	47	[4] 171	69	[4] 176	50	[4] 202	35	[4] 186
Middle East	------	76	------	87	------	72	------	162	------	109
Far East	([3])	101	([3])	108	1	106	1	169	([3])	171
Oceania:										
Australia	12	([5])	12	([5])	9	([5])	11	([5])	16	([5])
Other	------	([5])	------	([5])	------	([5])	------	([5])	------	([5])
Total	12	66	12	64	9	76	11	68	16	45
International shipping	------	65	------	45	------	65	------	41	------	31
Grand total	[2] 426	[2] 1,467	312	1,534	371	1,633	321	1,950	258	1,653

[1] Estimated on basis of company projections.
[2] Detail does not add to total shown due to rounding.
[3] Less than US$500,000.
[4] Includes other Africa as follows: 1960—$7 million, 1961—$9 million, 1962—$15 million, 1963—$19 million, and 1964—$20 million.
[5] Not reported separately, but included in Oceania area total.

Source: U.S. Department of Commerce. Survey of Current Business. September 1962, October 1963

Of the nearly US$755 million of international financing for the iron and steel industry, US$214.5 million was invested in Japan, US$56.6 million in Spain, and US$29.5 million in Mexico. Other large items under this heading were US$66 million for iron ore mining in Mauritania and US$40.5 million for the same purpose in Liberia. The bulk of the US$136.89 million for aluminum consisted of a US$110 million loan for the Volta project in Ghana, equally divided between the Export-Import Bank and Agency for International Development (AID).

TABLE 11.—Financing of mineral investments by selected international lending agencies in 1958–63 [1]

(Million U.S. dollars)

Commodity	International Bank for Reconstruction and Development (IBRD)	International Finance Corporation (IFC)[2]	International Development Bank (IDB)	Agency for International Development (AID)	Export-Import Bank (EXIM)[3]	Total
Iron and steel [4]	226.0	9.36		[5] 156.50	[6] 362.77	754.63
Fertilizer plants		7.58		64.50	83.89	155.97
Aluminum				56.74	[7] 80.15	136.89
Coal and coke	54.5			34.30	6.50	95.30
Petroleum and natural gas	50.0		12.4	2.00		64.40
Cement		6.40	14.5	13.05	24.01	57.96
Copper				4.40	49.23	53.63
Manganese	35.0					35.00
Potash	25.0					25.00
Tin			9.4	[8] 8.50		17.90
Phosphate				1.50	3.50	5.00
Other [9]		2.40	13.0	9.60	9.79	34.79
Total	390.5	25.74	49.3	351.09	619.84	1,436.47

[1] January 1, 1958–December 31, 1963 except for AID, data for which cover July 1, 1957–December 31, 1963 (U.S. fiscal years 1958–64); gross of participations and loans sold but net of cancellations.
[2] Value of financing arrangements in which IFC has participated, and not the amounts of financial assistance it has extended from its own resources.
[3] Excludes loans of less than $100,000.
[4] Includes iron ore mining and finished steel capacity.
[5] Includes US$18.4 million loan for development of railway and port facilities for export of Indian iron ore.
[6] Excludes loans for iron and steel in ECSC countries in order to avoid overlap with data appearing in Table 8.
[7] Excludes US$55 million participation taken over by AID.
[8] Includes supporting assistance loan of US$3.5 million to Bolivia for tin production.
[9] Includes production of ammonia and urea, salt, and soda ash, sodium carbonate, sodium sulfate, carbon black, sulfur, caustic soda-chlorine, refractory bricks, quarry equipment, and US$2 million for a mineral resources survey.

Sources: International Bank for Reconstruction and Development. Statement of Loans, March 31, 1964; International Finance Corporation. Annual Report 1962–1963. Press releases; Agency for International Development. Operations Report Data as of June 30, 1963. Operations Report Data as of December 31, 1963; Export-Import Bank. Report to the Congress for the Twelve Months Ended June 30, 1963. V. II, Report to the Congress for the Six Months Ended December 31, 1963.

U.S. Department of Commerce estimates the value of United States direct investments in mineral industries outside the United States. In 1962 the earnings of the mining and smelting sector were about 11 percent of the book value, and its income about 10 percent of book value; in the case of the petroleum industry, earnings were about 13.6 percent and income about 12.5 percent. The total of mineral investments was 42.7 percent of all United States direct investments abroad in 1962.

Among the principal trends in mineral production shown by the statistical data for the period 1959–63 were the decline of iron ore and nonferrous ore production in Western Europe, the steady rise in output of the same commodities in Eastern Europe, the expansion of the steel industry in practically all regions, the rapid growth of iron ore production in Western Africa, South America, and Canada, and the growth and development of bauxite output in Western Africa, the Caribbean, and Australia. In the nonmetals, the most notable changes were the rapid growth of Canadian output of elemental sulfur (ob-

tained from natural gas) and of potash. In the fuels, the outstanding developments were the continuing rapid growth of petroleum production resulting from expansion of Middle Eastern output and the development of African production in Algeria, Libya, and Nigeria; the growth of natural gas output in Canada; and the discovery of large natural gas deposits in Northern Europe (still in the development stage). Production of uranium oxide declined steadily, affected by cutbacks of demand not yet offset by nuclear power requirements.

TABLE 12.—U.S. direct foreign investment in mineral industries; value, earnings, and income [1] in 1962

(Million U.S. dollars)

Area and country	Mining and smelting			Petroleum		
	Value [2]	Earnings [3]	Income [4]	Value [2]	Earnings [3]	Income [4]
Canada	1,482	91	53	2,834	121	90
Latin American Republics:						
South America:						
Venezuela	(5)	(5)	(5)	2,202	429	420
Other	(5)	(5)	(5)	(5)	(5)	(5)
Total	928	128	125	2,914	472	446
Other	171	19	16	245	18	1
Total Latin American Republics	1,099	147	141	3,159	490	447
Other Western Hemisphere	176	83	79	485	62	42
Europe:						
EEC	9	(5)	(5)	1,083	57	45
Non-EEC:						
United Kingdom	(6)			790	20	24
Other	(5)	(5)	(5)	(5)	(5)	(5)
Total	40	(5)	(5)	1,282	15	21
Total Europe	49	5	7	2,365	72	66
Africa:						
Northern Africa	4	1	(6)	338	−1	−2
Western Africa	170	10	11	99	−23	−24
Central and Southern Africa	133	23	16	135	20	(6)
Eastern Africa	1	(6)	(6)	54	−1	+2
Total	[7] 307	34	[7] 28	[7] 627	[7] −6	[7] −23
Middle East	(5)			1,148	845	846
Far East	29	2	1	612	86	94
Oceania:						
Australia	42	5	4	(5)	(5)	(5)
Other	−1	−1	(6)	(5)	(5)	(5)
Total	41	4	4	462	4	−6
International shipping [8]				968	43	23
Grand total [7]	3,183	[7] 367	[7] 314	[7] 12,661	[7] 1,716	[7] 1,578

[1] Preliminary figure.
[2] Book value.
[3] U.S. share in net earnings of subsidiaries and branch profits.
[4] Sum of dividends, interest, and branch profits.
[5] Not reported separately from other industry in sources, included in area total.
[6] Less than US$500,000.
[7] Detail does not add to total shown due to rounding.
[8] Petroleum investments in shipping.

Source: U.S. Department of Commerce. Survey of Current Business. August 1963

The economic trend of major importance was the growth of mineral import demands in the expanding economies of Western Europe and Japan. A subsidiary trend was the growth in developing less industrialized countries of mineral consuming and fabricating industries, often stimulated by nationalist economic policies, which may foreshadow their increasing share in the consumption of total mineral output. A constant factor throughout the period was the existence of political instability in many mineral producing regions.

The rapid world expansion of the iron and steel industry has had much to do with the development of new mineral production. The industry is undergoing a far reaching technological evolution involving conversion to the oxygen, fuel injection, and other new processes. The industrialized areas are shifting the use of higher grade ores imported from the less industrialized countries. This not only develops new production and increases world mineral trade but also, for cost reasons, creates a tendency toward concentration of new plants in coastal regions accessible to sea transport, and toward a greater degree of beneficiation of ores at the mines, even in the case of the high-grade imported ores, in order to save transport costs. Technological developments tend, for technical reasons connected with the new oxygen processes, to increase the proportion of iron ore in total raw material consumption.

In the fuel sector, the principal technological development has been the rapid rise of petroleum and natural gas-based fertilizer and chemical industries. This has been accompanied by a trend, both for economic reasons and in order to meet nationalistic political pressures, toward market oriented refineries, often requiring design improvements to make smaller units more economical. A second technological development has been the adoption of techniques for transporting natural gas by tanker, making possible the marketing of petroleum derived and other gases produced in regions remote from potential markets. A third technological change has occurred in the field of nuclear power, where the development of very large reactor units (upward of 500 megawatts) and the standardization of designs has brought uranium-fueled nuclear power within competitive range of fossil fuels in some locations.[9]

In the field of the nonmetals, techniques have been devised for the transport of molten sulfur by tanker, a development analogous to the transport of gas by tanker.

Tables 13 through 28 show production of a number of major commodities for the years 1959–63, listing major world producers and total world output. Commodities covered include bauxite, aluminum, copper, iron ore, steel ingots and castings, lead, tin, zinc, cement, phosphate rock, potash, sulfur (two tables, one covering elemental sulfur, the other covering pyrites), coal, and crude oil.

[9] The Economist, Apr. 18, 1964, pp. 289–290. Nucleonics, March 1964, v. 22, No. 3, pp. 17–18.

TABLE 13.—Leading world producers of bauxite[1]

(Thousand metric tons)

Country	1959[2]	1960	1961	1962	1963
Jamaica	5,208	5,837	6,770	7,615	7,014
U.S.S.R.[3 4]	3,000	3,500	4,000	4,200	4,300
Surinam	3,430	3,455	3,405	3,253	3,482
British Guiana	1,701	2,511	2,412	[3] 2,730	[3] 2,247
France	1,757	2,067	2,224	2,158	2,003
United States	1,728	2,030	1,248	1,391	1,549
Guinea, Republic of	301	1,190	1,767	[3] 1,440	[3] 1,500
Hungary	938	1,190	1,366	1,473	1,362
Greece	918	884	1,120	1,321	[3] 1,300
Yugoslavia	815	1,025	1,232	1,332	1,285
Total	19,796	23,689	25,544	26,913	26,042
All other producers[5]	3,204	3,701	3,736	4,027	4,198
World total[3]	23,000	27,390	29,280	30,940	30,240

[1] Data presented conform with that given in world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] The Dominican Republic, with an output of 771,000 tons, ranked 10th ahead of the Republic of Guinea.
[3] Estimate.
[4] Excludes nepheline concentrates and alunite ores.
[5] Derived figure; difference between indicated world total and sum of output of individually listed producers.

TABLE 14.—Leading world producers of aluminum[1]

(Thousand metric tons)

Country	1959	1960	1961	1962	1963
United States	1,773	1,828	1,727	1,921	2,098
U.S.S.R.[2]	625	675	900	910	960
Canada	539	691	602	626	653
France	173	238	279	295	298
Japan	100	133	154	171	224
Norway	146	165	172	206	219
Germany, West	151	169	173	178	209
China (mainland)[2]	70	80	100	100	100
Italy	75	84	83	81	91
Austria	66	68	68	74	76
Total	3,718	4,131	4,258	4,562	4,928
All others[3]	342	399	467	518	602
World total[2]	4,060	4,530	4,725	5,080	5,530

[1] Data presented conform with that given in world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] Estimate.
[3] Derived figure; difference between indicated world total and sum of output of individually listed producers.

TABLE 15.—Leading world mine producers of copper[1]

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

Country	1959[2]	1960	1961	1962	1963
United States[3]	748	980	1,057	1,114	1,101
U.S.S.R.[2 5]	435	500	550	650	700
Chile	546	536	551	593	601
Northern Rhodesia	543	576	574	562	588
Canada[3]	359	398	398	415	416
Congo, Republic of the (Leopoldville)[5]	282	302	295	295	270
Peru	50	182	198	167	177
Australia	96	111	97	112	116
Japan	85	89	96	104	107
China (mainland)[4]	50	70	80	90	90
Total	3,194	3,744	3,896	4,102	4,166
All others[6]	476	476	504	518	574
World total[4]	3,670	4,220	4,400	4,620	4,740

[1] Data presented conform with that given in world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] Mexico, with an output of 58,000 tons, ranked ninth, ahead of Peru and mainland China.
[3] Recoverable.
Estimate.
[5] Smelter output.
[6] Derived figure; difference between indicated world total and sum of output of individually listed producers.

TABLE 16.—Leading world producers of iron ore, iron ore concentrates, and iron ore agglomerates[1]

(Thousand metric tons)

Country	1959[2]	1960[3]	1961[4]	1962[4]	1963
U.S.S.R.[5]	94,015	105,857	117,633	128,102	136,800
United States[6]	61,243	90,209	72,474	72,982	74,780
France	60,938	66,964	66,606	66,301	57,885
China (mainland)[7 8]	45,000	55,000	35,000	30,000	35,000
Canada	22,215	19,550	18,469	24,820	27,338
Sweden	18,351	21,690	23,593	22,023	23,631
United Kingdom	15,109	17,362	16,783	15,522	15,151
India[9]	7,982	10,683	12,270	13,362	14,926
Germany, West	18,063	18,869	18,866	16,643	12,898
Brazil	8,907	9,345	10,220	10,778	[7] 12,000
Venezuela	17,201	19,490	14,565	13,266	11,863
Chile	4,649	6,041	6,989	8,092	8,507
Malaya	3,821	5,731	6,842	6,612	7,381
Luxembourg	6,509	6,977	7,458	6,507	6,990
Liberia	2,689	3,051	3,251	3,607	6,557
Total	386,692	456,819	431,019	438,617	451,707
All others[10]	52,352	65,419	71,622	68,747	70,189
World total[7]	439,044	522,238	502,641	507,364	521,896

[1] Data presented conform with that given in world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] Spain, with 4,609,000 tons and Australia with 4,207,000 tons ranked 14th and 15th, respectively.
[3] Peru with 6,990,000 tons and Goa with 5,856,000 tons ranked 12th and 15th, respectively.
[4] Peru, with 8,737,000 tons in 1961 and 5,949,000 tons in 1962 ranked 12th and 15th in those years, respectively.
[5] Data represents concentrates containing approximately 60 percent iron.
[6] Includes byproduct ores.
[7] Estimate.
[8] Roughly equivalent to ore containing 50 percent iron.
[9] Excludes the output of Goa.
[10] Derived figure; difference between indicated world total and sum of output of individually listed producers.

TABLE 17.—Leading world producers of steel ingots and castings [1]

(Thousand metric tons)

Country	1959 [2]	1960 [2]	1961	1962	1963
United States [3]	84,772	90,066	88,917	89,201	99,119
U.S.S.R.	59,971	65,293	70,751	76,300	80,220
Germany, West (including Saar)	29,435	34,100	33,458	32,563	31,597
Japan	16,629	22,138	28,268	27,546	31,501
United Kingdom	20,511	24,695	22,441	20,820	22,881
France	15,075	17,152	17,428	17,240	17,557
China (mainland)	[4] 13,350	[4] 18,450	9,500	10,000	12,000
Italy	6,762	8,229	9,329	9,757	10,156
Poland	6,160	6,881	7,234	7,684	8,004
Czechoslovakia	6,136	6,768	7,043	7,639	7,598
Total	258,801	293,772	294,369	298,750	320,633
All others [6]	46,469	52,378	56,491	60,750	65,397
World total [5]	305,270	346,150	350,860	359,500	386,030

[1] Data presented conform with that given in world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] Belgium, with a 1959 output of 6,437,000 tons and a 1960 output of 7,188 tons ranked ninth in each of those years.
[3] Data from American Iron and Steel Institute. Excludes production of castings by companies that do not produce steel ingots.
[4] Claime figures. Data appear to be exaggerated by one fifth or more.
[5] Estimate.
[6] Derived figure; difference between indicated world total and sum of output of individually listed producers.

TABLE 18.—Leading world mine producers of lead [1]

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

Country	1959 [2]	1960	1961	1962	1963
Australia	321	313	274	376	416
U.S.S.R. [3]	320	325	360	360	360
United States [4]	232	224	238	215	230
Mexico	191	191	181	193	190
Canada	169	187	166	192	181
Peru	[4] 115	[4] 132	[4] 136	[4] 128	148
Yugoslavia	92	91	97	102	102
China (mainland) [3]	70	80	90	90	100
Bulgaria	80	84	80	94	89
Morocco	92	95	88	90	73
Total	1,682	1,722	1,710	1,840	1,889
All others [5]	648	668	680	670	661
World total [3]	2,330	2,390	2,390	2,510	2,550

[1] Data presented conform with that given in world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] South-West Africa, with an output of 70,353 tons, ranked 10th, ahead of China (mainland).
[3] Estimate.
[4] Recoverable.
[5] Derived figure; difference between indicated world total and sum of output of individually listed countries.

TABLE 19.—Leading world producers of manganese ore[1]

(Thousand metric tons)

Country	Percent Mn[2]	1959[3]	1960[3]	1961[3]	1962[4]	1963
U.S.S.R.	(5)	5,516	5,872	5,972	6,402	6,700
South Africa, Republic of	30+	970	1,194	1,418	1,465	1,308
Brazil	38–50	1,033	999	1,016	1,171	2 1,200
India[6]	35+	1,178	1,199	1,230	1,186	1,075
China (mainland)[2]	30+	1,000	1,200	800	800	1,000
Gabon	50–52				203	637
Ghana (exports dry weight)	48	524	545	391	466	394
Morocco	35–50	471	483	571	469	335
Congo, Republic of the (Leopoldville)	48	386	382	318	299	316
Japan	32–40	348	324	304	309	277
Total		(5)	11,426	12,198	12,020	12,770	13,242
All others[7]		(5)	1,526	1,376	1,513	1,532	1,358
World total[3]		(5)	12,952	13,574	13,533	14,302	14,600

[1] Data presented conform with that given in world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] Estimate.
[3] Rumania, with an output of 197,000 tons in 1959, 175,000 tons in 1960, and 206,000 tons in 1961 ranked 10th.
[4] British Guiana, with an output of 275,000 tons ranked 10th, ahead of Gabon.
[5] Data not available.
[6] Excludes output of Goa.
[7] Derived figure; difference between indicated world total and sum of output of individually listed producers.

TABLE 20.—Leading world mine producers of tin[1]

(Tin content of ore, long tons)

Country	1959	1960[2]	1961[3]	1962[3]	1963
Malaysia	37,525	51,979	56,028	58,603	59,947
China (mainland)[4]	26,000	28,000	30,000	28,000	28,000
Bolivia (exports)	23,811	19,407	20,408	21,492	22,752
U.S.S.R.[4]	15,000	16,000	17,000	17,000	20,000
Thailand	9,684	12,080	13,270	14,679	15,587
Indonesia	21,613	22,596	18,574	17,310	12,947
Nigeria	5,541	7,675	7,779	8,210	8,723
Congo, Republic of the (Leopoldville)	9,194	8,636	6,314	6,875	7,196
Australia	2,351	2,202	2,745	2,714	3,085
South Africa	1,273	1,276	1,430	1,408	1,530
Total	151,992	169,851	173,548	176,291	179,767
All others[6]	9,508	10,549	10,552	10,709	11,233
World total[5]	161,500	180,400	184,100	187,000	191,000

[1] Data presented conform with that given in world production table in commodity chapter, volume 1. In some cases, figures for individual countries have been incorporated in country chapters of volume IV.
[2] Brazilian output, estimated at 1,556 tons exceeded reported output of South Africa, ranking Brazil 10th.
[3] Output of Ruanda-Urundi (1,474 tons in 1961 and an estimated 1,440 tons in 1962) exceeded that of South Africa ranking Ruanda-Urundi 10th.
[4] Estimated smelter output.
[5] Estimate.
[6] Derived figure; difference between indicated world total and sum of output of individually listed producers.

TABLE 21.—Leading world mine producers of zinc[1]

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

Country	1959[2]	1960[3]	1961[4]	1962[4]	1963
United States[5]	386	395	421	459	480
Canada	359	369	402	455	451
U.S.S.R.[6]	335	345	400	410	410
Australia	280	323	316	343	358
Mexico	264	262	269	251	241
Japan	142	157	168	192	198
Peru[5]	143	178	174	162	181
Poland	129	144	140	145	147
Korea, North[6]	85	85	90	90	110
Italy	133	131	134	132	107
Total	2,256	2,389	2,514	2,639	2,683
All others[7]	864	931	946	891	922
World total[6]	3,120	3,320	3,460	3,530	3,605

[1] Data presented conform with that given in the world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] Spain, with an output of 86,000 tons, ranked 10th.
[3] The Republic of the Congo (Leopoldville), with an output of 109,000 tons, ranked 10th.
[4] Mainland China, with an estimated output of 100,000 tons in both 1961 and 1962, ranked 10th.
[5] Recoverable.
[6] Estimate.
[7] Derived figure; differences between indicated world total and sum of output of individually listed producers.

TABLE 22.—Leading world producers of hydraulic cement[1]

(Thousand metric tons)

Country	1959[2]	1960	1961	1962	1963
United States	60,670	56,986	57,753	60,022	62,832
U.S.S.R.	38,784	45,520	51,000	57,300	61,000
Japan	17,268	22,538	24,636	28,787	29,948
Germany, West	23,164	24,905	27,144	28,593	29,217
Italy	14,402	16,014	18,031	20,172	22,088
United Kingdom	12,790	13,497	14,376	14,256	14,000
India	6,936	7,835	8,244	8,586	9,355
China (mainland)	12,270	13,500	8,000	8,000	9,000
Poland	5,317	6,592	7,364	7,544	7,670
Spain	5,729	5,733	6,628	7,294	7,145
Total	197,330	213,120	223,176	240,554	252,255
All others[4]	97,082	103,417	110,252	117,287	123,157
World total[3]	294,412	316,537	333,428	357,841	375,412

[1] Data presented conform with that given in world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] Canada with an output of 5,701,000 metric tons ranked 10th.
[3] Estimate.
[4] Derived figure; difference between indicated world total and sum of output of individually listed producers.

TABLE 23.—Leading world phosphate rock producers [1]

(Thousand metric tons)

Country	1959 [2]	1960 [3]	1961 [4]	1962 [4]	1963
United States	16,124	17,787	18,857	19,692	20,154
U.S.S.R. [5 6]	6,100	7,100	8,800	10,000	11,100
Morocco	7,164	7,472	7,950	8,162	8,548
Tunisia	2,185	2,096	1,982	2,097	2,367
Nauru Island (exports)	1,211	1,373	1,303	1,540	1,572
Viet-Nam, North	311	541	622	712	[5] 800
China (mainland) [5]	500	600	500	600	700
Christmas Island (exports)	502	512	705	529	662
United Arab Republic	629	566	627	602	612
Senegal	95	212	546	638	595
Total	34,821	38,259	41,892	44,572	47,110
All other [7]	3,554	3,641	3,583	3,628	4,090
World total [5]	38,375	41,900	45,475	48,200	51,200

[1] Includes output of all major crude mineral sources of phosphate, including apatite, guano, and similar materials. Data presented conform with that given in world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] Brazil with an output of 1,006,000 tons ranked sixth; Algeria with an output of 572,000 tons ranked eighth.
[3] Brazil with an output of 880,000 tons ranked sixth; Algeria with an output of 563,000 tons ranked ninth.
[4] Brazil with an output of 659,000 tons in 1961 and 566,000 tons in 1962 ranked 7th and 10th respectively, in those years.
[5] Estimate.
[6] Includes a category of material described by the Russians as "sedimentary rock."
[7] Derived figure; difference between indicated world total and sum of output of individually listed producers.

TABLE 24.—Leading world producers of marketable potash [1]

(Thousand metric tons, K_2O equivalent)

Country	1959	1960	1961	1962	1963
United States	2,162	2,394	2,479	2,225	2,600
Germany, West	1,835	1,979	2,044	1,940	1,920
Germany, East	1,600	1,665	1,675	1,752	[2] 1,800
France	1,462	1,532	1,710	1,722	[2] 1,722
U.S.S.R. [2]	1,050	1,100	1,322	1,500	1,700
Total	8,109	8,670	9,230	9,139	9,742
All other [3]	391	430	470	661	1,158
World total [2]	8,500	9,100	9,700	9,800	10,900

[1] Data presented conform with that given in world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] Estimate.
[3] Derived figure; difference between indicated world tota and sum of output of individually listed producers.

TABLE 25.—Leading world pyrite [1] producers

(Gross weight, thousand metric tons)

Country	1959 [2]	1960 [2]	1961 [2]	1962	1963
Japan	3,390	3,692	3,931	4,015	[3] 4,000
U.S.S.R. [3]	2,600	2,800	2,800	3,000	3,200
Spain	2,120	2,253	2,131	2,129	2,005
Italy	1,518	1,546	1,580	1,585	1,399
China (mainland) [3]	850	1,000	1,000	1,100	1,200
Cyprus	884	929	837	822	[3] 900
United States	1,074	1,033	1,003	931	838
Norway	744	833	733	793	711
Portugal	632	655	653	641	605
Finland	263	260	274	475	538
Total	14,075	15,001	14,942	15,491	15,396
All others [4]	4,825	5,099	4,658	4,609	4,604
World total [3]	18,900	20,100	19,600	20,100	20,000

[1] Includes cupreous pyrites. Data presented conform to that given in world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] Canada with an output of 998,000 tons in 1959, 936,000 tons in 1960, and 469,000 tons in 1961 ranked 6th 7th, and 10th, respectively, in those years.
[3] Estimate.
[4] Derived figure; difference between indicated world total and sum of output of individually listed producers.

TABLE 26.—Leading world elemental sulfur producers [1]

(Thousand metric tons)

Country	1959 [2]	1960 [2]	1961	1962	1963
United States	5,412	5,897	6,437	6,020	5,922
Mexico	[3] 1,378	[3] 1,334	1,244	1,447	1,553
France	426	791	1,097	1,347	1,418
U.S.S.R. [3]	780	1,010	1,175	1,320	1,350
Canada (sales)	132	249	358	631	1,054
Poland	11	25	231	342	308
China (mainland) [3]	200	240	240	240	240
Japan	227	256	251	233	233
Germany, East	108	102	117	120	[3] 120
Germany, West	80	84	84	91	[3] 86
Total	8,754	9,988	11,234	11,791	12,284
All others [4]	516	532	506	469	441
World total [3]	9,270	10,520	11,740	12,260	12,725

[1] Includes Frasch-process sulfur, sulfur from sulfur ores, and byproduct sulfur from other ores, natural gas, oil refinery gas, and from oil shale. Data presented conform with that given in world production table in commodity chapter, volume 1. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.
[2] Italy, with a production of 122,000 tons in 1959 and 86,000 tons in 1960 ranked eighth and ninth, respectively, in those years.
[3] Estimate.
[4] Derived figure; difference between indicated world total and sum of output of individually listed producers.

TABLE 27.—Leading world producers of coal (all grades)[1]

(Million metric tons)

Country	1959	1960	1961	1962	1963	Remarks
U.S.S.R.	507	513	511	517	530	26 percent of 1963 total was lignite.
United States	393	394	381	398	433	0.6 percent of 1963 total was lignite.
China (mainland)[2]	348	420	250	250	270	Not reported distributed by grade, but known to include virtually no lignite.
Germany, East	218	228	240	250	257	1.2 percent of 1963 total was lignite.
Germany, West	238	241	243	245	251	42.6 percent of 1963 total was lignite.
United Kingdom	209	197	194	201	199	No lignite.
Poland	108	114	117	121	128	11.9 percent of 1963 total was lignite.
Czechoslavakia	79	85	92	97	102	72.1 percent of 1963 total was lignite.
India	48	53	56	62	67	1.5 percent of 1963 total was lignite.
Japan	49	52	56	56	53	1.7 percent of 1963 total was lignite.
France	60	58	55	55	48	5.1 percent of 1963 total was lignite.
Australia	34	38	41	42	44	43.2 percent of 1963 total was lignite.
South Africa (marketable)	36	38	40	41	42	No lignite.
Hungary	25	27	28	29	30	87.8 percent of 1963 total was lignite.
Yugoslavia	21	24	24	25	27	95.3 percent of 1964 total was lignite.
Belgium	23	22	22	21	21	No lignite.
Total:						
Lignite	574	594	615	633	668	
Bituminous and anthracite (by subtraction)	1,822	1,910	1,735	1,777	1,834	
All grades	2,396	2,504	2,350	2,410	2,502	
All others:[3]						
Lignite	43	45	47	52	54	
Bituminous and anthracite (by subtraction)	80	84	85	87	96	
All grades	123	129	132	139	150	
World total:						
Lignite	617	639	662	685	722	
Bituminous and anthracite (by subtraction)	1,902	1,994	1,820	1,864	1,930	
All grades[2]	2,519	2,633	2,482	2,549	2,652	

[1] Data presented conform with that given in world production table in commodity chapter, volume II. In some cases, revised figures for individual countries have been incorporated in individual country chapters of volume IV.

[2] Estimate.

[3] Derived figures, difference between indicated world total and sum of output of individually listed producers.

TABLE 28.—Leading world crude oil producers [1]

(Million 42-gallon barrels)

Country	1959 [2]	1960 [2]	1961 [3]	1962 [3]	1963
United States	2,575	2,575	2,622	2,676	2,753
U.S.S.R. [4]	946	1,079	1,212	1,360	1,504
Venezuela	1,011	1,042	1,066	1,168	1,186
Kuwait [5]	505	594	600	669	705
Saudi Arabia [5]	400	456	508	555	595
Iran	345	386	432	482	538
Iraq	311	354	366	367	423
Canada	185	190	221	244	258
Algeria	10	67	121	158	183
Libya			7	67	168
Indonesia	139	153	155	168	165
Mexico	96	99	107	112	115
Kuwait-Saudi Arabia Neutral Zone	42	50	65	89	115
Argentina	45	64	84	98	97
Rumania	83	86	86	88	91
Total	6,693	7,195	7,652	8,301	8,896
All others [6]	452	495	532	581	639
World total [4]	7,145	7,690	8,184	8,882	9,535

[1] Data presented conform with that given in world production table in commodity chapter, volume II. In some cases, revised figures for individual countries have been incorporated in country chapters of volume IV.

[2] Qatar, with an output of 61 million barrels in 1959 and 63 million barrels in 1960 ranked 12th and 14th, respectively, and Colombia, with an output of 54 million barrels in 1959 and 56 million barrels in 1960 ranked 13th and 15th, respectively, in the years noted.

[3] Qatar, with an output of 64 million barrels in 1961 and 68 million barrels in 1962 ranked 15th in each year.

[4] Estimate.

[5] Excluding output from Kuwait-Saudi Arabia Neutral Zone, which is listed separately.

[6] Derived figure; difference between indicated world total and sum of output of individually listed producers above.

TRENDS IN METAL CONSUMPTION AND TRADE

The continuing high level of world industrial production resulted in a substantial increase in the use of most mineral products in 1963. Consumption of aluminum rose about 8 percent, of copper about 5.5 percent, of iron ore substantially, that of lead about 4.5 percent, of zinc about 6 percent, of sulfur more than 6 percent, and of petroleum about 6 percent. Tin consumption increased only marginally.[10]

Iron ore consumption in the United States rose about 8 percent above 1962 levels, and steel consumption increased by 7 percent.[11] Increased consumption of both minerals also occurred in Japan and the United Kingdom, while consumption in the EEC remained at about the 1962 level. Estimates of the American Bureau of Metal Statistics, the International Lead and Zinc Study Group, and the International Tin Council for changes in consumption of the five major nonferrous metals indicate that aluminum consumption increased more rapidly during 1961–63 than consumption of any of the other four.

With rising consumption, stocks of major minerals in the hands of producers were drawn down in 1963, inventories of consumers tending to rise. Total copper stocks declined only slightly, a sharp decrease

[10] American Bureau of Metal Statistics. Year Book. (Forty-third Annual Issue for the Year 1963). Pp. 13–118. Engineering and Mining Journal. V. 165, No. 2, February 1964, pp. 90–155, 160.
International Lead and Zinc Study Group. Lead and Zinc Statistics. V. 4, No. 5, May 1964, 28 pp.
International Tin Council. Statistical Bulletin, v. 8, No. 5, May 1964, 44 pp.
World Petroleum. V. 35, No. 1, January 1964, pp. 28–29.

[11] U.S. Department of Commerce. Survey of Current Business. February 1964, pp. S–4; March 1964, p. S–32.

in the United States being almost offset by a substantial rise elsewhere. Producers' stocks of refined lead rose slightly in Europe but were sharply reduced in the United States and elsewhere, while stocks of refined zinc in producers' hands were reduced by about 46 percent, with sharp reductions in both the United States and Europe. Stocks of tin metal (primary and secondary) outside government stockpiles were reduced by 4,500 tons. The buffer stock of the International Tin Council was again exhausted in the autumn of 1963.

In terms of value, readily available data, even for 1962, are incomplete but United Nations analyses covering the major categories of mineral exports give an idea of trends. The evidence indicates that world exports of metalliferous ores, metal scrap, metals, and mineral fuels, as an aggregate, maintained a steady ratio of about 21 to 22 percent of total world exports during 1958–62, keeping pace with the rapid expansion of world trade as a whole. The data do not cover the precious metals or the nonmetallic minerals, and include manufactured metals (for example, steel) but not fabricated metal products.

In the 5-year period this group of mineral exports increased by 22.6 percent in value, with mineral fuels showing a steady rise after 1959 and ores and metals showing a more erratic trend. The sharp rise to higher levels in all three categories beginning in 1960 is noteworthy. The mineral fuels accounted for roughly half the total value and appear to have accounted for approximately 10 percent of total world exports.

TABLE 29.—Estimated world consumption of major nonferrous metals

Commodity	1961	1962	1963
Aluminum [1] thousand metric tons	4,392	4,892	5,286
Copper [2] do	4,596	4,571	4,822
Lead [3] do	2,292	2,376	[4] 2,483
Tin [5] thousand long tons	158	158	161
Zinc [3] thousand metric tons	2,586	2,704	[4] 2,852

[1] American Bureau of Metal Statistics. Year Book (Forty-third Annual Issue for the Year 1963); partial.
[2] American Bureau of Metal Statistics; world total.
[3] International Lead and Zinc Study Group. Lead and Zinc Statistics. V. 4, No. 5, May 1964; excluding European and Asian Communist countries.
[4] Estimate.
[5] International Tin Council. Statistical Bulletin. May 1964; excluding European and Asian Communist countries.

TABLE 30.—Changes in world stocks of nonferrous metals

Metal	End 1962	End 1963	Change
Copper [1] thousand metric tons	432.1	427.4	−4.7
Lead [2] do	280.8	186.4	−94.3
Tin [3] thousand long tons	50.3	45.8	−4.5
Zinc [2] thousand metric tons	262.4	149.7	−112.7

[1] American Bureau of Metal Statistics. Year Book (Forty-third Annual Issue for the Year 1963). Pp. 16–17.
[2] International Lead and Zinc Study Group. Lead and Zinc Statistics. V. 4, No. 5, May 1964; producers' stocks.
[3] International Tin Council. Statistical Bulletin. May 1964; primary and secondary tin; stocks in hands of producers, consumers, dealers at official warehouses, and in transit.

TABLE 31.—World exports of major classes of minerals, by value[1]

(Million U.S. dollars)

Class	1958	1959	1960	1961	1962
Metalliferous ores and metal scrap (SITC Revised, 28)	2,960	3,300	3,870	3,850	3,450
Metals[2] (SITC Revised, 67, 68 less 681)	8,660	9,390	11,430	11,240	11,330
Mineral fuels and related materials (SITC Section 3)	12,260	12,030	12,650	13,480	14,490
Totals	23,880	24,720	27,950	28,570	29,270
Total world exports	107,510	114,940	127,400	133,040	140,580
Percentage of world total	22	22	22	21	21

[1] United Nations Monthly Bulletin of Statistics. April 1964, Special Table B; March 1964, Special Table C.III.C. Categories used are those of the Standard Industrial Trade Classification (SITC).
[2] Excludes precious metals.

About two-thirds of total world exports of these commodities were taken by the three major free world industrialized areas. In 1962 North America took 17 percent of the total, Western Europe 45 percent, and Japan 4.6 percent. A significant trend has been the growing import share of Western Europe in the total; from 1959 to 1962 its import share of exports of metallic ores and scrap rose from 36 percent to 41 percent, of metals from 44 percent to 48 percent, and of mineral fuels from 40 percent to 44 percent. Japan's share similarly rose but at a much lower level. Concurrently there has been, proportionately, a shift of mineral exports from United States to European destinations, particularly marked in the case of Latin America; Western Europe's share of Latin American mineral exports rose from 20.7 percent to 25.3 percent in the period, and Japan's share from 0.3 percent to 2.5 percent.

The European Communist countries' exports of the group of mineral commodities have also grown rapidly, but are concentrated chiefly on destinations within the countries themselves. Its other principal trading partner, Western Europe, took only 19 percent of these mineral exports in 1962 as compared with 20 percent in 1958, and the increase in the value of Eastern Europe's mineral exports to Western Europe amounted to slightly less than US$200 million during the period.

UN data for 1962 trade, in the form of a network or matrix table, bring out the strong influence of transport costs and geographical proximity on trade flows of mineral commodities. They show the existence of a Europe-Africa-Middle East mineral trade area, a Japan-Far East-Pacific trade area, and a hemispheric North America-Latin America trade area. At the same time it shows both Japan and Europe reaching into Latin America for additional supplies, and data for previous years would show this trade increasing.

A high proportion of trade in the industrialized regions consists of intraregional trade; about 39 percent of North America's mineral imports originated in North America, and 49 percent of Western Europe's mineral trade originated in Western Europe. Much of this intraregional trade in the two areas consists of coal and metals, a large part of the latter probably products of the steel industry.

TABLE 32.—World exports of major classes of minerals in 1962, by value and region [1]

(Million U.S. dollars)

Exporters	Destinations										
	North America	Latin America	Western Europe	Middle East [2]	Australia, New Zealand, South Africa	Central Africa [3]	Japan	Other free Asia	Eastern Europe [4]	China (mainland), etc. [5]	Other [6]
North America	1,490	270	1,200	40	80	30	340	270	10	----	20
Latin America	1,550	280	920	(7)	10	20	90	10	10	----	730
Western Europe	570	250	6,380	280	110	170	50	240	570	10	190
Middle East [2]	350	80	2,150	320	230	130	430	330	(7)	(7)	70
Australia, New Zealand, South Africa	160	10	140	(7)	60	20	90	40	(7)	(7)	10
Central Africa [3]	40	10	650	(7)	30	(7)	20	20	10	----	(7)
Japan	160	60	50	20	20	10	----	220	40	10	(7)
Other free Asia	150	10	110	(7)	90	(7)	220	380	20	(7)	10
Eastern Europe [4]	(7)	140	740	60	----	(7)	60	60	2,480	260	10
China (mainland), etc. [5]	----	----	20	(7)	----	----	20	10	130	(8)	----
Other [6]	350	110	710	10	10	50	10	20	(7)	----	80
Total [9]	4,960	1,200	13,190	740	620	440	1,350	1,570	3,290	290	1,110

[1] Includes mineral fuels and related materials (SITC Section 3), metalliferous ores and metal scrap (SITC, Revised 28) and base metals (SITC, Revised, 67, 68, less 681). Data from United Nations. Monthly Bulletin of Statistics. March 1964, Special Table C; April 1964, Special Table B.

[2] Includes Aden, Cyprus, Jordan, Iraq, Israel, Lebanon, Syria, Libya, Ethiopia, Sudan, UAR.

[3] Africa less Morocco, Algeria, Tunisia, Libya, Sudan, Ethiopia, Somalia, French Somaliland, and South Africa.

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

[5] Mainland China, Mongolia, North Korea, and North Viet-Nam.

[6] Includes Morocco, Algeria, and Tunisia.

[7] Less than US$5 million.

[8] Data not available.

[9] Detail does not add to total due to rounding.

No data are available to show the proportion of total world trade by volume accounted for by mineral commodities, but evidence suggests that it is well over half the total tonnage of goods moving in international trade and probably growing as a percentage of the total. According to United Nations data, the tonnage of petroleum and petroleum products alone, which has risen consistently since 1956, in 1962 exceeded half the total of all seaborne international trade; to this of course would have to be added the millions of tons of other mineral commodities moving in international commerce.[12]

As compared with 1961, trade in major minerals in 1962 appears to have increased in volume by about 6 to 6.5 percent. Trade in iron ore was up by 6 percent, in coal and coke by 6 percent, and in crude petroleum by 8 percent. The level of nonferrous metal trade was practically unchanged, increased imports by the United States and Japan offsetting decreased takings by Western Europe.[13]

United Nations quantum indices of major mineral imports by chief industrial areas in 1961 and 1962 are shown in table 33.

TABLE 33.—Imports of major minerals[1] into selected industrialized countries

(Quantum index, preceding year=100)

Commodity	United States[2]		EEC countries[3]		United Kingdom		Japan[4]		Total[5]	
	1961	1962	1961	1962	1961	1962	1961	1962	1961	1962
Iron ore	75	135	99	98	83	86	141	110	102	106
Nonferrous ores and metals	104	114	103	95	91	100	95	128	100	100
Coal and coke	------	------	100	107	146	78	135	123	106	110
Crude petroleum	103	107	118	111	110	108	125	116	114	110

[1] Measured gross, not distinguishing imports later reexported or, in the case of the EEC, imports originating in the Community.
[2] Based in most cases on 11 months' returns.
[3] Based on 8 months' returns.
[4] Based on 9 months' returns.
[5] Estimated on basis of partial returns indicated.

Source: United Nations Commodity Survey 1962.

Data permitting detailed examination of the patterns of international trade in minerals are readily available only for iron ore, steel products, bauxite, solid fuels, crude petroleum, and lead and zinc ores and concentrates. All relate to 1962 trade except those for lead and zinc ores and concentrates, which summarize 1963 trade.

In general, these tables are self-explanatory, but some comment on sources of data may be desirable. The tables for bauxite and iron ore were prepared by the Bureau of Mines. The table for steel products is a rearrangement of the data appearing in the United Nations' Economic Commission for Europe (ECE) study, Statistics of World Trade in Steel 1962, and the definitions, nomenclature, and other qualifications are as given in that document.

The tables of lead and zinc ores and concentrates, based on International Lead and Zinc Study Group data and relating to 1963, should be used with caution. In the cases of both metals they are

[12] United Nations. Monthly Bulletin of Statistics. January 1964, Special Table D–B, p. XVII.
[13] General Agreement on Tariffs and Trade. International Trade 1962. Pp. 57–71.

based on partial data, and the data for Belgium-Luxembourg among the importers are for gross weight of ore rather than metal content, thus distorting the comparability of the figures. Even with these limitations, however, both tables tend to confirm the description of trade patterns given in this chapter.

TABLE 34.—World trade in bauxite in 1962, by areas

(Thousand metric tons)

Exporters	Destination						
	Canada	United States	Western Europe	Eastern Europe [1]	Japan	Other countries	Total
United States	164		54	10		36	264
Caribbean America		7,465					7,465
South America	1,418	3,538	114		53	33	5,156
Western Europe		16	1,691	355		24	2,086
Eastern Europe [1]			65	669			734
Free Asia			105		982	62	1,149
Africa	22		289	1		23	335
Oceania			6				6
Total	1,604	11,019	2,324	1,035	1,035	178	17,195

[1] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.

TABLE 35.—World trade in iron ore concentrates and agglomerates in 1962, by areas

(Thousand metric tons)

Exporters	Destination							
	Canada	United States	South America	Western Europe	Eastern Europe [1]	Japan	Other countries	Total
Canada		17,216		3,208		1,569		21,993
United States	4,857			133		997	5	5,992
South America (including Mexico)	318	15,850	656	9,607	1,024	5,782	319	33,556
Western Europe		29		48,119	1,268		53	49,469
Eastern Europe [1]				901	18,355		293	19,549
China, (mainland), North Korea, North Viet-Nam					100			100
Free Asia				2,733	1,594	12,893	62	17,282
Africa		503		8,729	881	730	35	10,878
Oceania						7	295	302
Total	5,175	33,598	656	73,430	23,222	21,978	1,062	159,121

[1] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.

The tables for solid fuels and crude petroleum are similar to that for steel in that they are rearrangements of data appearing in the United Nations study, World Energy Supplies 1959–62, and are subject to the qualifications of that document; it is important to note, with respect to the petroleum table, that Libya is classified as part of the Middle East and not as part of Africa. In all tables relying on United Nations data the quantities may differ somewhat from data appearing in other sources but the general pattern of trade shown by them will not significantly differ from the picture given by other sources if allowance is made for treatment of Libya, in the petroleum table, as part of the Middle East.

TABLE 36.—Exports of semifinished and finished steel products in 1962 [1]

(Thousand metric tons)

Exporters	Destinations, by regions								
	Oceania	Far East [2]	Middle East [3]	Africa	Latin America	North America	Western Europe	European Communist countries	Total world [4]
EEC:									
Belgium-Luxembourg	8.0	202.0	417.0	246.0	372.0	1,106.0	4,822.0	173.0	7,346.0
Germany, West [5]	4.5	179.5	271.3	140.2	354.0	459.7	5,833.5	835.6	8,078.3
France	10.1	106.9	230.9	615.1	232.4	312.7	3,257.4	210.7	4,976.2
Italy	4.2	15.1	68.6	77.1	145.4	16.7	257.9	327.4	942.2
Netherlands	.4	9.4	24.6	58.7	27.8	19.3	895.2	68.5	1,103.9
EFTA:									
United Kingdom	192.5	360.3	133.6	253.5	301.6	322.4	1,267.2	286.6	3,117.7
Austria	.7	5.2	16.4	1.7	5.6	3.9	901.0	278.2	1,212.7
Sweden	2.5	34.6	6.4	6.2	45.7	57.1	488.3	45.7	686.5
Norway	---	6.9	4.6	2.0	2.5	12.6	136.6	16.6	181.8
Other:									
Japan	101.0	1,494.0	96.0	114.0	375.0	1,024.0	375.0	244.0	3,823.0
United States	13.7	820.0	80.3	71.8	305.2	287.7	239.1	.5	1,818.3
Canada	34.6	21.7	7.5	7.6	145.4	380.2	183.9	---	780.9
Australia [6]	180.2	329.0	.3	13.3	19.3	132.3	11.4	---	692.4
South Africa	2.4	11.9	4.2	120.1	17.6	45.1	134.6	---	335.9
Yugoslavia	---	49.6	16.1	.8	.2	2.2	126.7	54.7	250.3
Hungary	---	18.8	56.1	.2	---	---	173.4	328.8	577.3
U.S.S.R.	---	350.1	82.6	42.5	200.5	---	313.1	2,868.0	3,931.0
Poland	---	76.3	98.1	10.5	14.5	.8	275.8	568.4	1,044.4
Total	554.8	4,091.3	1,614.6	1,781.3	2,564.7	4,182.7	19,692.1	6,306.7	40,898.8

[1] Ingots and semis, railway track material, heavy and light sections, wire rods, strip, plates, sheets, steel tubes and fittings, wire, tinplate, wheels, tires, and axles.
[2] Includes Afghanistan, Burma, Ceylon, mainland China, Taiwan, Malaysia, Hong Kong, India, Indonesia, Japan, Laos, North Korea, North Viet-Nam, Pakistan, Philippines, Republic of Korea, South Viet-Nam and Thailand.
[3] Includes Bahrain, Iran, Iraq, Israel, Kuwait, Lebanon, Saudi Arabia, Syria, and UAR (Egypt).
[4] Includes unallocated exports.
[5] Excludes deliveries to East Germany.
[6] Year ending June 30, 1962.

Source: United Nations, ECE Statistics of World Trade in Steel 1962.

TABLE 37.—Direction of trade in lead ores and concentrates in 1963

(Thousand metric tons of contained metal)

Exporters	Importing regions				
	Western Europe [1]	United Kingdom	United States	Japan	Total
Western Europe	31.6	---	---	---	31.6
Eastern Europe	23.7	---	---	---	23.7
Africa	139.1	---	28.9	---	168.0
North America	30.4	4.8	21.3	---	56.5
Latin America	42.5	---	55.5	10.8	108.8
Asia	1.7	1.2	---	2.1	5.0
Oceania	18.6	12.0	24.0	35.5	90.1
Countries n.e.s.	18.5	7.8	.6	---	26.9
Total	306.1	25.8	130.3	48.4	510.6

[1] Includes Austria, Belgium-Luxembourg, France, West Germany, and Italy. Partial data for Austria (January-September), Belgium-Luxembourg (January-November) and Italy (January-October); gross weight of ore for Belgium-Luxembourg.

Source: International Lead and Zinc Study Group. Lead and Zinc Statistics. V. 4, No. 5, May 1964.

TABLE 38.—Direction of trade in zinc ores and concentrates in 1963

(Thousand metric tons of contained metal)

Exporters	Importing Regions				
	Western Europe [1]	United Kingdom	United States	Japan	Totals
Western Europe	309.9				309.9
Eastern Europe	.2				.2
Africa	150.0		7.5		157.5
North America	35.7	11.7	122.1	10.8	180.3
Latin America	145.1	1.4	204.9	33.1	384.5
Asia	14.6			13.3	27.9
Oceania	27.6	80.7	3.7	20.9	132.9
Countries n.e.s.	56.3	10.9			67.2
Total	739.4	104.7	338.2	78.1	1,260.4

[1] Includes Austria, Belgium-Luxembourg, France, West Germany, Netherlands, and Norway. Partial data for Austria (January-September) and Belgium-Luxembourg (January-November); gross weight of ore for Belgium-Luxembourg.

Source: International Lead and Zinc Study Group. Lead and Zinc Statistics, v. 4, No. 5, May 1964.

TABLE 39.—World movement of solid fuels [1] in 1962

(Thousand metric tons, Standard Coal Equivalent)

Destination	Exporting region						
	North America	Western Europe	Far East	Oceania	Africa	Other countries [2]	Total [3]
North America	11,800	40					11,850
Caribbean America	160					50	210
Other America	1,980	260			60	90	2,400
Western Europe	17,450	44,800			410	19,950	82,700
Middle East	30	40			10	290	370
Far East	6,460	100	1,580	2,890	730	2,200	14,000
Oceania	1	60		60	6		130
Africa		90			930	160	1,170
Other countries [2]	10	540				31,150	31,700
Total	37,891	45,930	1,580	2,950	2,146	53,890	144,530

[1] Data based on general trade system (that is, including re-exports). Lignite, lignite briquets, and coke reduced to coal equivalent. Bunkers excluded.
[2] Includes Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.
[3] Data does not add to right hand column total due to rounding.

Source: United Nations. World Energy Supplies 1959-62.

With respect to the table on steel products, the point of importance is the high proportion of the total imports in most geographic regions accounted for by intraregional trade in steel; in Western Europe 91 percent, in the European Communist countries 60 percent, and in the Far East and Oceania 37 percent and 32 percent, respectively, of total imports of steel was accounted for by intraregional trade in 1962. By contrast, only 16 percent of North American steel trade consisted of intraregional trade.

In crude petroleum the dominance of the less industrialized regions as exporters, and of the industrialized areas as importers, is clear; while in solid fuels the import status of Western Europe and the Far East (that is, Japan) and the diminance of North America (the United States) and Eastern Europe as exporters is plain. In contrast to crude petroleum, however, the solid fuel table shows a high proportion of total imports in the major industrial regions consisting of intraregional trade.

TABLE 40.—World movement of crude petroleum[1] in 1962

(Thousand metric tons)

Destination	Exporting regions								
	North America	Caribbean America	Other America	Western Europe	Middle East[2]	Far East	Africa	Other[3]	Total[4]
North America	12,400	40,800	160	40	23,000	3,290	270	--------	79,900
Caribbean America	--------	49,000	250	35	4,530	--------	130	3,630	57,600
Other America	--------	7,610	370	--------	5,210	--------	--------	160	13,350
Western Europe	60	24,700	230	1,550	155,300	110	24,400	10,400	216,700
Middle East[2]	--------	40	--------	280	23,800	--------	--------	1,180	25,300
Far East	180	280	--------	--------	44,900	10,450	--------	2,140	57,950
Oceania	--------	20	--------	--------	8,480	4,450	--------	--------	12,950
Africa	--------	100	--------	--------	2,020	--------	30	160	2,220
Other countries[3]	--------	--------	--------	500	--------	--------	--------	9,010	9,510
Total	12,640	122,550	1,010	2,405	267,240	18,300	24,830	26,680	475,480

[1] Data based on general trade system (that is, including re-exports).
[2] Includes Libya, Trucial Oman, and United Arab Republic (Egypt).
[3] Includes Czechoslovakia, East Germany, Hungary, Poland, and U.S.S.R.
[4] Data does not add to right hand column total due to rounding.

Source: United Nations. World Energy Supplies 1959–62.

A flow chart, figure 1, adapted from one prepared by the Copper Division, Business and Defense Services Administration, U.S. Department of Commerce, exhibits graphically the major flows of 1962 trade in copper.[14] Statistical data on which the copper trade flow chart is based, converted from short tons as reported in the source, are given in table 41. The data do not cover all exports but only those of the seven major exporting countries, and the import data do not include all imports of the importing countries. The export data for Northern Rhodesia and the Republic of the Congo are partly estimated.

Data for world trade in 1963 are still incomplete but available information suggests that both the value and the volume of trade in minerals increased substantially with respect to that of 1962. According to preliminary United Nations indexes of volume, trade in solid fuels was up about 14 percent, in crude petroleum about 12 percent, and in aluminum about 12 percent. Trade in the nonferrous metals as a group remained at about the 1962 level, increases in aluminum and tin offsetting decreases in copper, lead, and zinc.

Trade in iron ore (another large item) also expanded substantially, with United Kingdom, Japanese, and EEC imports (from outside the Community), rising sharply, while United States imports remained at 1962 levels.

In terms of value as well as of quantity, however, solid fuels and crude petroleum evidently accounted for the bulk of the increase in world mineral trade in 1963.

[14] U.S. Department of Commerce. Business and Defense Services Administration. Copper Industry Report. Summer 1963. V. 9, No. 4, pp. 8–9.

TABLE 41.—Crude and refined copper export shipments of major copper exporting countries in 1962, distributed by destinations

(Thousand metric tons)

Importing country	Exporting country						
	United States	Canada	Mexico	Chile	Northern Rhodesia [1]	Republic of the Congo [1]	Peru
United States		88	19	207			71
Canada	1						
United Kingdom	48	87		55	231	3	31
Germany, West	62	15		59	73	1	30
France	33	13		10	32	18	
Belgium	2	5		2	18	191	15
Italy	49	2		33	41	20	
Netherlands	6			49	1		5
Norway	3	15			1		
Sweden	4	5		29	19		
Switzerland	4			41	9		1
Other Europe	9	8			13	[2]	
Republic of South Africa					15	5	
India	59	3			34	3	
Japan	12	44		15	9	2	9
Other countries	14	4	1	15	41	43	9
Total	306	289	20	515	537	286	171

[1] Partly estimated.
[2] Data not available.

Source: Department of Commerce, Business and Defense Services Administration. Copper Industry Report, Summer 1963. V. 9, No. 4.

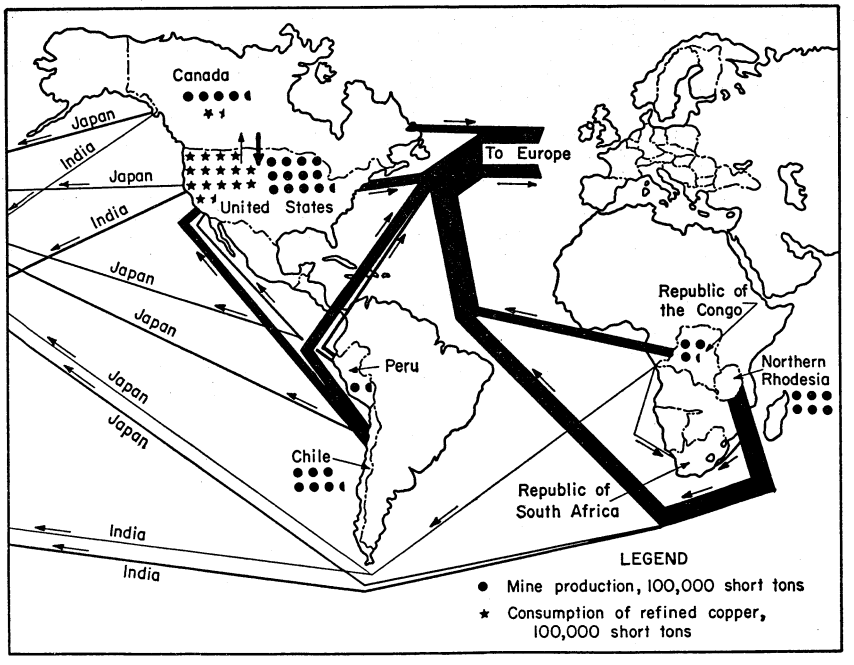

FIGURE 1.—Flow of world trade in copper, 1962. (Courtesy Department of Commerce, Business and Defense Services Administration).

TABLE 42.—World trade volume index

(1960=100)

Commodity	1961	1962	1963 [1]
Aluminum	88	98	110
Copper	103	100	97
Lead	112	116	105
Zinc	100	102	101
Nonferrous metals as group	100	101	101
Solid fuels	103	109	124
Crude petroleum	112	127	142

[1] Preliminary figures.

Source: United Nations, World Economic Survey 1963, Part II, Current Economic Developments.

TRANSPORTATION

Transportation costs are a key factor in the economic structure of the world's mineral industries, and changes in costs and available facilities play a large role in shaping the flow of mineral trade. The two forms of transport which affect the mineral industries significantly are maritime transport and pipelines.

Rapid changes have been occurring in both transport sectors. In the case of maritime transport these involve the sharply increasing sizes of both dry cargo and tanker vessels, the rapidly growing fleet of bulk carriers designed for ore or ore-oil carriage, and the development of specialized tankers for the transport of liquefied gas and molten sulfur. In pipelines, the principal development is the construction of international crude and products pipelines in Europe to serve the growing markets there, and the expansion of crude pipeline facilities from the North African fields. A second development, just beginning, is the construction of international gas pipelines to market the Netherlands and North European natural gas discovered in the last 3 years.

The world's merchant fleet at the end of 1963 comprised over 18,000 vessels with a total deadweight tonnage of 194.3 million tons, an increase of 5 percent over 1962. Of this total, 3,436 with a deadweight tonnage of 74 million tons consisted of tankers (including whaling tankers), and 1,726 with a deadweight tonnage of 23.8 million tons consisted of bulk carriers. In recent years both bulk carriers and tankers have increased their share of the total in terms of tonnage; in 1961 bulk carriers accounted for 9 percent of the total and tankers for 37 percent; in 1962 bulk carriers accounted for 11 percent and tankers for 38 percent; while in 1963 the bulk carrier percentage rose to 12 percent and tankers remained at 38 percent. Bulk carrier tonnage increased by 25 percent in 1962 and by 20 percent in 1963. After a rapid rise in the late fifties, tanker tonnage as a percentage of the total appears to have been relatively stable in the past 3 years.[15]

Moreover, the size of both bulk carriers and tankers has been growing, limited primarily by harbor depths and terminal facilities at ports. In 1962 more than 40 percent by tonnage of the world's dry

[15] U.S. Department of Commerce, Maritime Administration. Merchant Fleets of the World, Seagoing Steam and Motor Ships of 1,000 Gross Tons and Over as of December 31, 1963. Report No. MAR 560–20, May 12, 1964, p. 2.
World Petroleum, v. 34, No. 12. November 1963, pp. 38–41.

cargo fleet was 10,000 gross registered tons (GRT) or over, 16 percent 20,000 GRT or over, and 8 percent 25,000 GRT or over, in the same year 24 percent of the tanker fleet was 40,000 GRT or over, and 83 percent by tonnage of new tankers on order were 45,000 GRT or over. The decreasing per ton cost of transport as size of vessels goes up explains the growing size of vessels.

The seaborne trade in minerals is divided into three fairly separate trades—the ore trade, the petroleum trade, and the coal trade. Typically, the petroleum trade has long been handled by company-owned tankers supplemented by time chartering of other tankers in the market as needed, while in the past both the ore trade and the coal trade were handled primarily by the chartering of vessels (frequently on a voyage basis) in the open market. The ore trade practice is rapidly shifting and a steadily increasing volume of the total is now handled either by industry-owned ore carriers or by other bulk carriers chartered by the industries on long term. United States, British, and Japanese steel companies or industries possess their own fleets, as do some of the U.S. aluminum companies. The coal trade, on the other hand, still relies on chartering in the open market.[16]

Both bulk carriers and tankers can be diverted to the grain trade, the other principal bulk cargo, though the ordinary tramp freighters with which they compete in that trade cannot economically be shifted to the ore and oil trades. This possibility affects the structure of freight rates and causes a tendency for rates in different trades to move together.

In both the tanker and dry cargo trades the increasing size, efficiency, and specialization of new ships tend to make older and smaller vessels uneconomic, and a situation thus arises in which at the same time a statistical surplus of tonnage exists and large new tonnages are coming off the ways, with an inevitable effect on freight rates.

In the summer of 1963 the International Tanker Owners Association, then representing an estimated 54 percent of the tanker tonnage expected to come on the free market by the end of the year, devised a scheme to encourage the laying-up of nonprofitable vessels in order to stabilize rates. Japanese and American owners did not participate. The scheme was to go into effect on September 10, 1963.[17] At mid-1964 it was reported that the scheme had probably had some effect; lead-up tonnage was stabilized at a level somewhat under 1 million tons, though the usual seasonal decline occurred in the winter of 1963–64. All except one of the laid-up tankers were said to be under 25,000 tons, and in the spring of 1964 some 2.5 million tons of smaller tankers were reported to have been shifted to the grain trade.[18]

Requirements for tankers were said also to be affected by the development of North African fields as a source of crude petroleum for European markets, and by the construction of pipelines from the European Mediterranean coast to interior refineries and markets, which are discussed briefly later. The shortening of the tanker hauls resulting from this tends to reduce the demand for sea transport.[19]

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[16] Data in this and the preceding paragraph are chiefly from Organization for Economic Cooperation and Development, Maritime Transport 1962, pp. 21–27, and Statistical Annex thereto.
[17] The Economist. Aug. 24, 1963, p. 688.
[18] The Economist. June 13, 1964, p. 1265.
[19] The Economist. Apr. 11, 1964, p. 180.

Nevertheless, continuing high levels of industrial output and import demand in the main industrialized regions of the world, plus the extraordinary demands for grains and fuels due to crop failures and the adverse winter of 1962–63, pushed most ocean freight rates upward during the year. Table 43 shows UN-published indexes for dry cargo and tanker rates based on Danish, West German, Netherlands, Norwegian, and British indexes.

TABLE 43.—Indexes of ocean freight rates [1]

(1958=100)

Year	Dry cargo (Trip charter)				Tankers (Trip charter)				
	Denmark	West Germany	Netherlands [2]	Norway [3]	United Kingdom [4]	West Germany	Norway [3]		L.T.B.P. [5]
							£ market	$ market	
1959	103	103	--------	102	107	97	101	94	90
1960	111	110	100	105	111	100	96	97	81
1961	111	111	91	108	118	87	89	88	76
1962	108	100	75	99	98	101	101	98	73
1963	114	117	88	109	120	130	135	116	71
1963:									
January	108	106	--------	98	103	150	158	135	----------
February	111	110	[2] 78	102	104	198	200	181	[5] 74
March	111	110	--------	103	108	168	153	126	----------
April	109	113	--------	103	111	106	116	104	----------
May	109	117	[2] 85	106	122	105	107	100	[5] 72
June	112	108	--------	104	117	85	93	77	----------
July	112	108	--------	103	112	68	81	71	----------
August	112	111	[2] 86	108	116	73	99	75	[5] 66
September	114	117	--------	113	122	91	104	87	----------
October	116	137	--------	126	149	159	165	146	----------
November	119	135	[2] 101	126	142	169	165	142	[5] 70
December	120	130	--------	119	141	193	184	150	----------

[1] United Nations. Monthly Bulletin of Statistics. June 1964, Special Table E.
[2] Quarterly; general index, weighted average of quotations for all commodities unloaded in Netherlands ports and carried by ships over 500 gross registered tons (GRT).
[3] Norwegian Shipping News: for tankers, sterling and dollar quotations separately.
[4] United Kingdon Chamber of Shipping, general index; excludes dollar quotations.
[5] London Tanker Brokers Panel; quarterly estimates of weighted average of all known charter rates for two size classes; tankers owned by oil companies included at weighted averages of all charter rates. Index constructed by UN Statistical Office.

Pipeline developments of major importance to the international mineral trade in 1963 included the expansion of Algerian and Libyan pipeline facilities and the completion, at the end of 1962, of one major line (the South European pipeline) from Marseilles to the Strasbourg-Karlsruhe area on the upper Rhine River. Plans exist to extend this to Ingolstadt in southern West Germany. Other lines are under construction or in the planning stage; one from Genoa to Ingolstadt via Ulm, with a possible extension to Munich, and a second from the head of the Adriatic to Vienna, for which at least two separate proposals have been made.[20]

A second petroleum pipeline project of great potential importance is the so-called COMECON or Druzba pipeline from the Soviet Urals-Volga area to the Communist countries of Eastern Europe. Designed to link this region with refineries in Poland, East Germany, Hungary, and Czechoslovakia, the pipeline was also planned to include extensions to the Baltic ports of Klaipeda and Ventspils and possibly to

[20] The Economist. Aug. 24, 1963, p. 690; May 2, 1964, p. 516.
World Petroleum. V. 34, No. 10; September 1963, p. 64; v. 34, No. 12, November 1963, p. 78; v. 35, No. 1, January 1964, pp. 36–37.

Odessa on the Black Sea. According to the (U.S.) National Petroleum Council, the section from Brody (in the western U.S.S.R.) to Uzhgorod on the Hungarian border and Bratislava in Czechoslovakia was completed in late 1961, and work on the main 1,350 kilometer segment from Kuibyshev to Mozyr' was to begin in 1962.[21] According to another report, the entire COMECON pipeline is to be completed by the third quarter of 1964, presumably excluding the Baltic extensions, on which work is said to have been indefinitely suspended at the end of 1960. The same report indicates that in the view of the chairman of the Soviet export agency the line when completed will not be sufficient to meet the expected demands of the countries.[22]

Finally, a significant transport development of somewhat lesser importance was the completion of the canalization of the Moselle River in Germany and France, which opened a channel for barges up to 1,350 tons in size to the Lorraine steel complex in France. This is expected to reduce transport costs for coal and ore, and partially remove the transport handicaps under which that portion of the French steel industry has worked.[23]

PRICES

The United Nations 1963 overall export price indexes for minerals showed little change from 1962 levels, and in the case of metallic ores showed a decline.

The experience of the developed and underdeveloped areas differed, however, as shown in table 45.

Despite the small changes in the yearly averages there were steady upward pressures on the prices of most internationally trade minerals during the course of the year which, in most cases, began to take effect from midyear on. Of the nonferrous metals, prices of aluminum, lead, zinc, and tin rose during the year and copper prices began to rise at the very end of the year. Prices of nickel, bauxite, and petroleum remained at about 1962 levels. Prices of iron ore and the additive minerals, particularly manganese and chrome, were generally lower. Coal prices averaged the highest since 1957.[24]

TABLE 44.—Minerals export price indexes[1]

(1958=100)

Year	Metal ores	Fuels	Total
1959	97	92	94
1960	98	91	93
1961	100	90	92
1962	99	90	92
1963	96	91	92

[1] United Nations, Monthly Bulletin of Statistics. June 1964, Special Table C. II.

[21] National Petroleum Council. Impact of Oil Exports From the Soviet Bloc. V. II, pp. 188–194.
[22] World Petroleum. November 1963, v. 34, No. 12, pp. 42–45.
[23] The Economist. May 23, 1964, p. 826.
[24] American Bureau of Metal Statistics. Year Book (Forty-third Annual Issue for the Year 1963), 143 pp.
Engineering and Mining Journal. V. 165, No. 2, Feb. 1964, 160 pp.
International Lead and Zinc Study Group. Lead and Zinc Statistics, v. 4, No. 5, May 1964, 28 pp.
International Tin Council, Statistical Bulletin, v. 8, No. 5, May 1964, p. 58.
United Nations. World Economic Survey 1963. Part II, Current Economic Developments, 95 pp.

TABLE 45.—Analysis of export price indexes[1]

(1958=100)

Year	Developed areas		Underdeveloped areas	
	Minerals	Nonferrous metals[2]	Minerals	Nonferrous metals[2]
1959	95	108	93	117
1960	96	111	91	120
1961	97	108	90	114
1962	97	106	90	115
1963	99	106	90	116

[1] United Nations, Monthly Bulletin of Statistics. June 1964, Special Table C. III.
[2] Excludes precious metals.

Copper prices in the United States were stable at US$0.306 per pound throughout the year, and were supported at the level of £234 per long ton on the London Metal Exchange in the first half by producers, who in the latter part of the year sold at the same level as demand rose, in order to stabilize the price. In December 1963 the price on that exchange began moving upwards, averaging £235.900 for the month.

Aluminum prices were held steady by producers at US$0.225 per pound in New York and £180 per long ton in London until October, when they were raised to US$0.23 and £184, respectively.

Lead and zinc prices fluctuated more but their rises began earlier, in February and March in London and at midyear in New York. Prices of lead in London rose from an average of £54.3 per long ton in January to an average of £74.4 in December; the corresponding rise for zinc was from £67.7 to £94.9 per long ton. In New York lead prices rose from US$0.103 in January to US$0.125 in December, while zinc rose from US$0.115 to US$0.13.

Tin prices , dominated by the continuing shortfall of new production, U.S. stockpile releases, and International Tin Council efforts to stabilize them within the agreement range, shot upward in the last quarter as the Council's buffer stock was exhausted. From a January average of £852.046 per long ton in London the price rose steadily until May, receded slightly in the summer, and rose to an average of £1,010.950 in December.

Conscious efforts by producers to control traditionally fluctuating nonferrous metal prices were significant in the case of copper, and it was clear that their price policies were dominated by competitive considerations. Copper producers had adopted voluntary output restrictions in 1962, and large African producers had been supporting prices on the London Metal Exchange at £234 per ton; in the latter part of 1963 they appeared as sellers at this price in the face of upward trends and did not permit the price to rise until aluminum producers, their principal competitors for power transmission cable, had raised their prices. Lead and zinc producers made no effort to stabilize price levels but it began to be evident that they were unhappy about the sharp 1963 rises; reporting to shareholders in the spring of 1964, the chairmen of both Rio Tinto-Zinc and New Broken Hill Consolidated expressed fears of consumer substitution of other materials, and the former ex-

pressed the hope that the U.S. Government would consider stockpile releases of both metals, as had been requested by lead-zinc producers and consumers in the United States.[25]

At issue, the question appeared to be the role of the London Metal Exchange in the metal markets of the world. The major metal market outside the United States, it has dominated the formation of nonferrous metal prices for most of the world, and both producers and consumers have relied on its quotations for the pricing of contracts. Moreover, it has been freer in many respects than most other markets, since U.S. metal prices are affected by both tariffs and quotas. The Metal Exchange itself has in the past year attempted to broaden its role by introducing a "Continental" contract and authorizing Rotterdam as a delivery point; and it has also had under consideration the introduction of trading in aluminum. Efforts of producers to stabilize prices appeared to some observers as a possible threat to the future role of the Exchange, and some seemed to believe that a dual-price structure was here to stay, at least in the case of copper.[26]

TABLE 46.—Nonferrous metal prices in the United States in 1963

(Monthly averages, cents per pound) [1]

Month	Aluminum [2]	Copper [3]	Lead [4]	Zinc [5]	Tin [6]
January	22.500	30.600	10.296	11.500	111.131
February	22.500	30.600	10.500	11.500	108.597
March	22.500	30.600	10.500	11.500	109.250
April	22.500	30.600	10.500	11.500	112.940
May	22.500	30.600	10.500	11.500	116.670
June	22.500	30.600	10.713	11.500	117.806
July	22.500	30.600	11.068	12.025	115.426
August	22.500	30.600	11.354	12.500	114.892
September	22.500	30.600	11.628	12.500	116.088
October	22.978	30.600	11.935	12.500	119.902
November	23.000	30.600	12.147	12.500	126.882
December	23.000	30.600	12.500	12.943	130.238

[1] As reported by Engineering and Mining Journal.
[2] Unalloyed ingot, 99.5 percent.
[3] Electrolytic, New York, Domestic refinery.
[4] Refined lead, New York, domestic.
[5] Prime western slab zinc, f.o.b. East St. Louis.
[6] Straits, New York.

Source: American Bureau of Metal Statistics Year Book. (Forty-third Annual Issue for the Year 1963).

[25] The Economist. Apr. 25, 1964, p. 429; May 16, 1964, pp. 768–69.
The Statistician. June 5, 1964, pp. 739–740.
[26] The Economist. Apr. 13, 1963, pp. 160–161; June 8, 1963, pp. 1044–1046.
The Statistician. June 5, 1964, pp. 739–740.

TABLE 47.—Nonferrous metal prices in the United Kingdom in 1963

(Monthly averages, £ per long ton) [1]

Month	Aluminum [2]	Copper [3]	Lead [4]	Zinc [5]	Tin [6]
January	180.000	234.263	54.250	67.583	852.046
February	180.000	234.275	54.683	69.550	852.400
March	180.000	234.250	55.746	71.654	856.404
April	180.000	234.313	57.867	74.183	881.000
May	180.000	234.271	60.604	76.013	905.054
June	180.000	234.304	64,975	75.933	907.896
July	180.000	234.263	65.121	74.342	901.675
August	180.000	234.250	67.058	76.363	905.025
September	180.000	234.250	67.817	76.642	934.954
October	183.870	234.250	69.667	80.138	940.238
November	184.000	234.296	69.038	84.079	975.333
December	184.000	235.900	74.321	91.708	1,010.950

[1] As reported by Engineering and Mining Journal.
[2] Ingot, 99.5 percent.
[3] London Metal Exchange, electrolytic wire bars.
[4] London Metal Exchange, refined pig lead, 99.97 percent.
[5] London Metal Exchange, virgin zinc, 98 percent minimum.
[6] London Metal Exchange, monthly average settlement price.

NOTE.—Official rate of exchange is £1=US$2.80.

Source: American Bureau of Metal Statistics. Year Book (Forty-third Annual Issue for the Year 1963).

GOVERNMENT POLICIES AND PROGRAMS

In this section, only selected aspects of some policies or programs of a multilateral character and U.S. Government policies and programs with effects on international mineral production and trade are reviewed. Readers interested in the mineral policies and programs of specific countries should refer to the appropriate country chapters of this volume (or, for those of the U.S. Government, to volumes 1 and 2 of the Minerals Yearbook) for a discussion of them.

The only international commodity agreement applying to a mineral product is the International Tin Agreement. Twenty-one Governments representing producing and consuming countries (Australia, Austria, Belgium, Bolivia, Canada, Republic of the Congo, Denmark, France, India, Indonesia, Italy, Japan, Republic of Korea, Malaysia, Mexico, Netherlands, Federation of Nigeria, Spain, Thailand, Turkey, and the United Kingdom) are members. The United States is not a member but consults with the Council on matters of common interest. The primary object of the agreement is to stabilize tin prices through the operation of a buffer stock managed by a buffer stock manager under the direction of the International Tin Council, the executive body established by the Agreement. Floor and ceiling prices are established by the Council; at the floor price the buffer stock manager must buy, at the ceiling price he must sell, and in an intermediate range designated the "middle sector" he neither buys nor sells.

During 1963 operating within the limits of floor and ceiling prices (then £790 and £965) the buffer stock manager was compelled to sell out the entire stock in a vain effort to halt price rises, notwithstanding the sale of substantial quantities of tin from U.S. Government stockpile in the same period. Upon exhaustion of the Council's stock at the end of the third quarter the price shot upward as noted earlier.

Throughout the year the Council had constantly under consideration the question of U.S. Government stockpile disposals, which had been going on under Congressional authorization since 1962. At the Council's third meeting of the year in October it decided to ask the U.S. Government to confer in Washington at a mutually convenient early date with a representative mission from the Council in order to obtain an understanding between the Council and the U.S. Government concerning plans for future disposals of tin. This meeting occurred about the end of November.

At its fourth meeting of the year in December the Tin Council revised the price range upward, the floor price becoming £850 and the ceiling price £1,000, with the middle sector becoming £900 to £950 per long ton.[27]

During 1963 U.S. stockpile authorities began developing long-range plans for disposals of a number of commodities in accordance with the recommendations of an interagency committee approved by the President on January 30, 1963. Among these recommendations was one proposing "that the goal of long-term disposals should be the sale of surplus materials in amounts which can be absorbed by regular marketing channels without avoidable loss to the Government and without creating hardships in the domestic or friendly foreign economies, and that plans should be established on an individual commodity basis in amounts and over periods of time which will not unduly interfere with production and employment."[28] It is planned that consultations with appropriate industries, foreign governments, and Government agencies will accompany the development of major disposal plans so that interested groups will have an opportunity to express their views.

U.S. import quotas for lead and zinc were unchanged in 1963. Petroleum import quotas were modified so that quotas for imports of crude oil and products into areas east of the Rocky Mountains are based on a percentage of estimated crude and natural gas liquid production during the quota period instead of on a percentage of past production. This modification does not apply to residual fuels.

One other major policy problem of an international character was not resolved during 1963 but there were significant developments with respect to it. This is the effort of the six countries of the European Economic Community to develop a common energy policy. The question is fully reviewed in the 12th annual report of the European Coal and Steel Community High Authority.[29]

In 1957 the High Authority of the Coal and Steel Community and the executives of the EEC and Euratom had been charged with pursuing long-term energy studies, presenting periodic reports to the High Authority and the Governments, and submitting to the Council of Ministers proposals for energy policy. In 1962 (April 5), the Ministers asked the executives to prepare proposals for a common energy policy. They submitted two memoranda on the subject in that

[27] This summary of the Tin Council's activities is taken from its Statistical Bulletin, May 1964.

[28] Office of Emergency Planning. Stockpile Report to the Congress. January–June, 1963, p. 1.

[29] European Coal and Steel Community High Authority. 12e Rapport General sur l'activité de la Communauté. (1 février 1963–31 janvier 1964, pp. 61–96.) The following account is derived from this.

year, one (June 25, 1962) on energy, policy and one (December 21, 1962) on long-term energy perspectives. The energy policy memorandum proposed the establishment of a common energy policy in two stages: in the first stage reliance would be placed on national measures, and in the second on Community institutions. The Ministers asked the High Authority to study the legal implications of this and to suggest the changes that might be necessary in the basic agreements of the EEC, European Coal and Steel Community, and Euratom.

On April 10, 1963 the High Authority submitted to the Ministers a "draft agreement for creating conditions permitting the realization of a common market in energy." In its annual report the High Authority described this text as "flexible enough to meet any criticism inspired by the same principles as the memorandum"; that is, the energy memorandum of June 1962.

On March 21, 1963 the Council of Ministers discussed the long-term energy study and appointed a working group to study it. On May 2, 1963, it noted submission of the draft agreement, and decided to have the energy memorandum examined by a special energy policy committee whose work would proceed parallel with that of the working group, which was directed to report to it. The special committee was to be composed of high officials designated by member states, and representatives of the High Authority, the European Economic Community Commission, and the Euratom Commission. The draft agreement was referred to it on June 6, 1963. Its report was to be submitted before October 31, 1963.

The High Authority in its annual report described the working group's report as containing "a solid nucleus of common opinions" regarding energy, in general agreeing with the energy study. It notes, however, that before the special committee could consider it, the Council referred to it a proposal of the West German Government for a "transitional protocol" which in effect would authorize subsidies to the coal industry without regard to the provisions of the Coal-Steel Community agreement. The special committee had to consider this and the working group's report together; as a consequence it had to concentrate on economic questions and had no time to consider the juridical aspects. At the end of the special committee's study, the representatives of governments serving on it drafted a resolution which was transmitted to the Council of Ministers on November 22, 1963.

The Council considered this on December 2, 1963, and failed to reach unanimous agreement. Representatives of the High Authority, the EEC Commission, and the Euratom Commission were present. The High Authority's annual report indicates that the three executives considered the resolution "clearly insufficient to realize a common energy policy."

The High Authority enumerated five conditions which it declared must be met for the proposal to obtain its support: First the common energy policy must go into effect beginning January 1, 1970; second the draft resolution constitutes a "first step" toward the application of principles enunciated in the interexecutive memorandum; third the High Authority's conception of a common energy policy is set forth in the memorandum and confirmed by the draft agreement; fourth grants

of subsidies must be subordinated to the prior authorization of the High Authority; and fifth it is important to establish special measures for coke.

Being unable to decide, the Council remanded the draft resolution to the special committee with the other documents, with instructions to report before the March 1964 session of the Council.

The core of the differences between the draft agreement and the draft resolution, of which the texts are printed in the High Authority's report, appears to be mainly in the enunciations of their objects.[30] The draft agreement, in its article 2, enunciates its objects as one to assure consumers a free choice of energy sources, two to promote lower prices, insofar as consistent with stability, three to insure safety and regularity of supplies, four to facilitate development of research in all forms of energy, five to avoid unnecessary protective measures, and six to facilitate the adaptation of industry to the evolution of energy supplies. The draft resolution, on the other hand, would have as its objects the "realization of conditions assuring economically reasonable exploitation of sources of energy by avoiding distortions among producers susceptible of disturbing the common market," and the promotion of the development of energy production within the Community; it also calls for aids and subsidies to coal, promotion of community oil production, and a common inventory or stock policy.

The High Authority in its annual report noted that at the time of writing it was preparing another initiative on the subject.

Finally, another problem of multilateral character is foreshadowed by the discovery of large deposits of natural gas near the North Sea coasts of the Netherlands and Germany, and the subsequent explorations of offshore areas in the North Sea itself for petroleum- and/or gas-bearing strata. All drilling so far has been confined to territorial waters, but late in 1963 the U.K. Government enacted legislation empowering it to claim areas of the continental shelf sea-bottom and license concessions therein, under the terms of the 1958 Geneva Convention regarding the subsurface resources of the continental shelf.[31] No move has yet been made by any government to bring about a parceling out of jurisdictional claims to the North Sea Continental Shelf, but presumably all with territories bordering that sea will eventually put forward claims.

[30] The draft agreement also provides for necessary changes in the three Community agreements, to which the draft resolution does not address itself.
[31] The Economist. Nov. 30, 1963, p. 943; July 18, 1964, p. 273.

The Mineral Industry of Canada

By Lester G. Morrell [1]

AGAIN in 1963, as in nearly every year since 1946, the Canadian mineral industry has established a new national record in value of mineral production. The 1963 estimated total value of $2,976 million is 5 percent higher than the 1962 value of $2,845 million.[2] As in previous years, metals made up more than half the value of total production. For selected years since 1949 the category percentages and total value are as follows:

Year	Metals (percent)	Nonmetals and structural (percent)	Mineral fuels (percent)	Total value (millions)
1950	59.0	21.8	19.2	$1,045
1955	56.1	20.8	23.1	1,795
1960	56.4	20.9	22.7	2,493
1961	53.7	21.0	25.3	2,582
1962	52.6	20.0	27.4	2,845
1963 [1]	50.6	19.7	29.7	2,976

[1] Estimate.

Crude petroleum, Canada's most valuable mineral product, accounted for 21 percent of the total value of minerals in 1963. In descending order came nickel 12 percent, iron ore 10 percent, copper 10 percent, gold 5 percent, and uranium 5 percent. Asbestos accounted for 5 percent, sand and gravel 4 percent, and cement 4 percent. The complete list of Canada's mineral products includes more than 50 basic commodities.

All regional areas showed production increases except the Northwest Territory which declined $3 million, and Ontario which fell $36.7 million below the 1962 output. The greatest gain was $68.5 million in Alberta where an increase of $48.7 million is credited to crude petroleum and $20.4 million to natural gas byproducts. Quebec and Maritime Provinces accounted, collectively, for 25 percent of the 1963 total value of mineral products. Ontario again was the largest with 29 percent; the three prairie provinces (Manitoba, Saskatchewan, and Alberta) totaled 36 percent, and British Columbia and the two territories (Yukon and Northwest) made up 10 percent.

[1] North America-South Pacific specialist, Division of International Activities.

[2] Values are in Canadian dollars. Since May 1962 the Canadian dollar has been held at 92.5 cents in relation to the U.S. dollar.

The role of minerals in the Canadian national economy in 1963 is recorded by the Dominion Bureau of Statistics mine production index of 300, compared with the 1949 base index of 100, and per capita mineral output of $159, compared with $153 in 1962 and $75 in 1950. Of the 1963 officially estimated $32.8 billion net national income (at factor cost), and $43.0 billion gross national product, minerals and primary mineral products contributed, respectively, 9.6 percent and 6.9 percent.

Of the 6.7 million national labor force, approximately 3 to 4 percent are employed in the mineral industry, compared with about 9 percent in agriculture. Of the national total $21.8 billion paid in 1963 in wages and salaries, the mining industry drew $584 million whereas the combined pay of agriculture, fishing, trapping, and forestry employees totaled $553 million. Federal income taxes paid by the mining, quarrying, mineral processing, metallurgical, metals fabricating, and mineral fuels industries accounted for one-fifth of the income tax paid by all of Canada's industries.

On the international scene, the total value of mineral production in 1963 ranks Canada sixth after the United States, the U.S.S.R., Venezuela, China, and West Germany. With continuation of growth virtually assured, Canada's mineral industry will surpass that of West Germany in 1964 or 1965 and thereafter will occupy fifth place. Fuels make up the major portion of mineral products in Venezuela and China. Canada is the third largest producer of metals and with the expected expansion in potash and sulfur Canada's output of industrial minerals will also be the world's third largest. Each of 14 Canadian mineral products furnish more than 10 percent of the world supply of those products. The following mineral products, in percentages (1962 data) are included: Aluminum (smelter) 11; asbestos 40; cobalt [3] 11; columbium-tantalum [3] 12; gypsum 10; nickel 59; platinum metals 38; selenium [3] 24; silver 13; sulfur (elemental) 17; tellurium [3] 15; titanium (ilmenite) [3] 13; uranium oxide [3] 25; and zinc 13. Canada's greatest mineral production potential is in nonferrous metals, total value of which was estimated at US$1,119 million, compared with US$1,300 million for the United States in 1963. Thus, if the recent trend of new discoveries and developments continues and production is not economically curtailed, Canada soon will surpass the United States in value of nonferrous metals production. The Department of Mines and Technical Surveys has predicted [4] that 1964 Canadian mine and smelter output of nonferrous metals will account for, respectively, 12 and 9 percent of world totals.

More exhaustive accounts of 1963 developments in minerals exploration as well as many phases of mining technology and milling and process metallurgy have been summarized in journal articles.[5]

[3] Free world only.

[4] Tooms, R. B. Canadian Minerals in National and International Perspective. Canada Dept. of Mines and Tech. Surveys, Miner. Res. Div., Miner. Inf. Bull. MR 75, 1964, p. 63.

[5] Mamen, Chris. Mining Technology in 1963. Canadian Min. J, v. 85, No. 2, February 1964, pp. 135–151.

Picket, D. E. Technical Advances in Milling and Processs Metallurgy in Canada During 1963. Canadian Min. J., v. 85, No. 2, February 1964, pp. 152–157.

Seigel, H. O. Mineral Exploration Trends and Developments in 1963. Canadian Min. J., v. 85, No. 2, February 1964, pp. 132–134.

GOVERNMENT POLICIES AND PROGRAMS

The year 1963 has recorded steady advance in resource and technological developments by both government and industry. In the field of exploration, copper and zinc prospects in Newfoundland, gold in the Val d'Or and Malartic regions of Quebec, and the copper and molybdenite deposits of British Columbia received major attention. Geophysical methods were extensively applied, with airborne electromagnetic devices and ground surveys using Induced Polarization (IP) as the principal tools for metallic deposits and seismic equipment for petroleum and gas structures. Of particular interest to earth scientists was the completion during 1963 of three holes totaling 10,089 feet drilled in the Muskox Intrusive as part of Canada's contribution to the International Upper Mantle Project in the Northwest Territories.

The broadest economic benefit to Canadian mining in recent years has been the stabilizing in May 1962 of the Canadian dollar at 92.5 cents in relation to the U.S. dollar. This had the effect of increasing the value of virtually all mineral products exported not only to the United States but also to all dollar-trading countries. The higher price thus attained stimulated exploration throughout Canada, particularly in gold areas. Despite curtailments in base-metals production under voluntary quota limitations, three new copper-zinc mines and a new electroyltic zinc refinery came into production in 1963. Other important industrial developments of the year include the start of production of iron ore pellets and asbestos in Newfoundland and the beginning of construction on a zinc smelter in New Brunswick. In western Canada, 1963 marked the first full year of potash production, a noteworthy expansion in output of petroleum as well as in production and international sales of sulfur.

Of particular interest to investors and new operators, was an updated review of Federal taxation and legislation applicable to the mineral industry.[6]

SOURCE MATERIAL

Production and trade statistics presented in this review are from Dominion Bureau of Statistics (DBS) summary reports, compiled in each instance with the appropriate agency such as Department of Mines and Technical Surveys or the Department of Trade and Commerce. The latest year's estimates of mineral production are regularly published early in January as Preliminary Estimate of Canada's Mineral Production, DBS catalog No. 26–202. Trade statistics are based primarily on annual total figures given in the December issues of Trade of Canada—Exports by Commodities and Trade of Canada—Imports by Commodities, DBS catalog Nos. 65–004 and 65–007, respectively.

Text material is derived from numerous sources. Official materials include reports of the Federal Department of Mines and Tech-

[6] Hodgson, E. C., and W. J. Beard. Summary Review of Federal Taxation and Legislation Affecting the Canadian Mineral Industry. Canada Dept. of Mines and Tech. Surveys, Miner. Res. Div., Miner. Inf. Bull. MR 73, February 1964, p. 27.

nical Surveys, Department of Northern Affairs and National Resources, published reports of the counterpart Provincial agencies, and industry journals.

PRODUCTION

Although the total value of Canada's minerals established an alltime record in 1963, the year's output of many individual commodities particularly metals was below the quantity levels of 1962. Voluntary cutbacks by principal producers of nickel, lead, zinc, and copper and the loss of markets for uranium accounted in large measure for the downward trend in metals output. Among the nonmetals, the general uptrend in both quantity and value has continued. Small declines were recorded in barite, feldspar, magnesite, pyrite, and a few others, but these were overshadowed by notable gains in sulfur, gypsum, and potash. In the fuels section, 1963 production of each of the four major categories exceeded the 1962 records in both quantity and value. Greatest gains were in crude petroleum and natural gas and their refined products.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum	538,529	691,282	601,617	626,224	652,616
Antimony [1]	752	749	604	875	692
Arsenic, white	716	782	190	73	85
Bismuth [2]	152	192	217	193	172
Cadmium [3]	980	1,069	616	1,182	1,103
Calcium kilograms	30,585	61,145	32,929	56,024	36,028
Cobalt [4]	1,429	1,618	1,441	1,579	1,277
Columbium concentrate (Cb_2O_5) kilograms	[5] 6,350		28,227	461,083	576,000
Copper:					
Mine (recoverable)	358,580	398,490	398,332	[6] 422,243	415,848
Smelter (refined)	331,453	378,320	368,641	346,998	343,740
Gold thousand troy ounces	4,483	4,629	4,474	4,178	[6] 3,972
Iron and steel:					
Iron ore thousand tons	22,215	19,550	18,469	24,820	27,791
Pig iron and ferroalloys do	3,917	4,024	4,594	4,923	5,496
Steel ingots and castings do	5,354	5,252	5,866	6,508	7,430
Rolled steel do	6,171	6,098	6,427	7,220	8,177
Lead:					
Mine (recoverable) [7]	169,367	186,562	165,612	191,706	180,518
Smelter (refined)	127,804	145,220	156,366	138,565	[6] 140,613
Magnesium	5,536	6,612	6,926	7,998	7,888
Molybdenum	339	348	350	371	454
Nickel [8]	169,239	194,596	211,365	215,042	199,526
Platinum and platinum-group metals troy ounces	328,095	483,604	418,278	470,787	344,736
Selenium kilograms	166,970	236,610	195,321	220,928	219,066
Silver thousand troy ounces	31,924	34,017	31,382	[6] 30,669	[6] 29,840
Tellurium kilograms	5,907	20,267	35,203	26,637	33,993
Tin, mine long tons	334	278	500	291	474
Titanium slag (70–72 percent TiO_2)	245,373	353,427	420,355	273,470	344,115
Uranium (U_3O_8)	14,417	11,565	8,746	7,647	7,385
Zinc:					
Mine (recoverable) [7]	359,251	369,107	401,971	455,347	451,032
Smelter (refined)	231,608	236,745	243,130	254,154	257,077

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Asbestos—thousand tons	953	1,015	1,065	1,103	1,154
Barite	216,786	139,971	173,637	205,567	160,643
Cement [9]—thousand tons	5,701	5,250	5,630	6,240	6,364
Clays and products [10]—value, thousands	$42,515	$38,227	$36,983	$37,817	$37,759
Diatomite	5	40	194	191	292
Feldspar (shipments)	16,287	12,575	9,532	9,066	7,763
Fluorspar [11]	67,000	70,000	72,000	68,000	[6] 72,800
Gypsum and anhydrite—thousand tons	5,428	4,620	4,590	4,838	5,381
Lime—do	1,529	1,388	1,284	[6] 1,292	1,306
Lithium, concentrate (Li_2O content) [12]	1,250	93	243	227	301
Magnesite and brucite [11]	111,000	119,000	111,000	125,000	113,000
Mica (shipments)	369	772	824	546	485
Nepheline syenite	207,492	218,300	218,013	230,803	231,702
Potash (K_2O) [11]—thousand tons	42	8	----------	135	550
Pyrite and pyrrhotite	997,502	936,471	469,246	469,291	446,399
Salt—thousand tons	3,009	3,004	2,997	3,324	3,358
Sand and gravel—do	173,603	171,416	143,605	164,423	168,281
Sodium sulfate	162,871	194,325	227,699	223,776	230,494
Stone:					
Crushed—thousand tons	39,164	37,268	40,131	43,140	49,977
Cut [13]—do	156	182	158	182	[6] 180
Sulfur [14]—do	806	909	841	1,106	[6] 1,700
Talc, soapstone, and pyrophyllite—do	35,540	37,771	43,650	41,876	49,569
Mineral fuels:					
Coal:					
Bituminous—do	7,874	8,020	7,429	7,283	7,894
Lignite—do	1,767	1,969	2,004	2,047	1,700
Coke:					
High temperature—do	3,715	3,513	3,538	3,648	3,883
Low temperature [11]—do	50	40	35	10	
Fuel briquets—do	139	74	61	49	66
Natural gas—million cubic feet	417,335	522,972	657,892	946,909	1,116,217
Peat moss—thousand tons	167	168	203	216	235
Petroleum:					
Crude—thousand 42-gallon barrels	184,778	189,534	220,861	244,132	258,435
Refinery products:					
Gasoline, total—do	98,252	102,724	104,654	111,239	119,608
Kerosine and jet fuels—do	18,121	19,833	22,364	24,433	26,289
Distillate fuel oil—do	74,413	75,511	77,085	82,215	94,325
Residual fuel oil—do	37,354	35,387	37,349	41,071	44,889
Lubricants—do	1,993	2,121	2,164	1,699	1,837
Other products—do	21,128	27,535	35,705	29,942	23,606
Refinery fuel and loss—do	18,563	17,448	18,497	19,532	20,960
Total—do	269,824	280,559	297,818	310,131	331,514

[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-oxide sinter shipped to United Kingdom by International Nickel Co., but includes the cobalt in Falconbridge nickel-copper matte to Norway.
[5] U.S. imports, from production preceding 1955.
[6] Final figure: supersedes figure given in commodity chapter, volume I.
[7] Data for 1961–63 not strictly comparable with earlier years.
[8] Refined nickel and nickel in produced oxide and recoverable nickel in matte exported.
[9] Cement sold or used by producers.
[10] Value of clays including bentonite and value of products from common, stoneware, fire clay and other types of clay.
[11] Estimate.
[12] Spodumene concentrates.
[13] Building, ornamental, paving and similar uses of granite, limestone, marble, slate, and sandstone.
[14] Includes sulfur from natural gas and from pyrite, pyrrhotite, and smelting of sulfide ores.

TRADE

Approximately 15 percent of Canada's gross national product during the 1960–63 period has been accounted for by exports. Minerals and metal exports (including mineral fuels) comprised one-third of the total, whereas the combined value of agriculture, forest, and fishery products made up half; manufactured goods made up the remaining

sixth. In 1963 the value of exported minerals and metals was estimated at $2.0 billion (two-thirds of the total output), compared with $1.9 billion in 1962. The commodity breakdown for exports in 1961, 1962, and 1963 was as follows:

Commodity [1]	Millions			Percent of total (1963)
	1961	1962	1963 [2]	
Iron	$226.7	$220.5	$260.0	13.0
Aluminum	246.1	288.1	307.0	15.3
Copper	193.7	202.6	210.0	10.5
Lead	27.6	25.8	23.0	1.2
Nickel	343.0	323.9	336.0	16.8
Zinc	58.7	60.6	57.0	2.8
Uranium oxide	192.7	166.0	150.0	7.5
Asbestos	131.3	135.6	131.0	6.6
Fuels	204.9	314.2	347.0	17.3
Others	133.2	198.1	179.0	9.0
Total	1,757.9	1,935.4	2,000.0	100.0

[1] Metals include content of ores, concentrates, and primary metal products. Fuels include coal, oil, and gas.
[2] Estimate based on 10-month data.

The destination of Canada's 1963 mineral exports, in percentage of total mineral exports was as follows (1962 data in parentheses): United States 61 (63), United Kingdom 19 (17), European Economic Community 5 (7), European Free Trade Association 4 (4), Japan 5 (4), and others 6 (6).

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963
Metals:				
Aluminum:				
Alumina, Al content	17,124	3,514	2,399	United States 2,354; New Zealand 75.
Scrap	26,701	27,438	39,504	Italy 17,655; United States 12,984.
Pigs, ingots, wire bars, etc	441,828	522,723	576,228	United States 249,017; United Kingdom 152,823.
Bars, rods, sheets, castings	20,837	20,541	11,600	India 2,366; United States 2,035; Mexico 1,781.
Foil	133	420	422	United Kingdom 279; New Zealand 75.
Fabricated materials, n.e.s.[1]	10,557	7,155	12,975	Mexico 3,496; New Zealand 2,498.
Antimony, in antimonial lead	541	718	(2)	(2).
Bismuth	177	173	(2)	(2).
Cadmium	903	1,062	880	United Kingdom 593; United States 266.
Calcium kilograms	50,213	56,291	41,776	United States 11,839; West Germany 8,754.
Cobalt:				
Metal	274	246	335	United States 253; United Kingdom 67.
Oxides and salts, gross weight	690	739	498	United Kingdom 494.
Columbium concentrate kilograms	16,137	684,892	(2)	(2).
Copper:				
Ore and matte, metal content	38,913	86,676	84,304	Japan 52,004; Norway 13,845.
Scrap, slag, sludge	7,334	7,545	8,693	Japan 5,766; Spain 1,591.
Refinery shapes	241,534	202,341	195,032	United Kingdom 89,541; United States 67,220.
Semimanufactures:				
Bars, rods, shapes, etc	19,181	20,105	23,922	Norway 7,047; Switzerland 4,285.
Pipe and tubing	5,960	4,982	6,818	United States 2,209; New Zealand 1,611.
Wire and cable	6,715	415	341	Italy 108; Saudi Arabia 24.

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963
Metals—Continued				
Iron and steel:				
Iron ore.....thousand tons..	15,107	21,993	24,238	United States 18,623; Japan 2,011.
Pig iron.....do....	599	459	437	United States 348; Italy 51.
Ferroalloys:				
Ferrochrome.....	1,490	5,989	2,640	United States 2,494.
Ferromanganese.....	216	123	9	All to Columbia.
Other (type not specified).	45,116	42,254	(2)	(2).
Steel:				
Ingots thousand tons.. and equivalent primary forms.	296	240	341	United States 235; United Kingdom 106.
Semimanufactures..do....	414	439	(2)	(2).
Lead:				
Ore and concentrate, metal content.	64,380	53,973	48,766	United States 24,587; Belgium-Luxembourg 11,758.
Pigs, blocks, and shot.....	106,718	114,125	88,127	United Kingdom 39,988; Japan 8,193.
Alloys, scrap, and metal, n.e.s.[1]	2,678	3,788	4,393	United States 3,791; Italy 484.
Magnesium.....	5,470	5,961	(2)	(2).
Nickel:				
Ore, matte, and speiss, metal content.	84,311	70,225	75,651	United Kingdom 42,475; Norway 30,434.
Oxide, metal content.....	16,349	10,088	13,796	United Kingdom 2,092; United States 8,554.
Ingots and other refined forms.	121,112	110,415	99,024	United States 85,333; United Kingdom 6,782.
Scrap and fabricated.....	3,147	4,064	4,508	United States 4,069; United Kingdom 95.
Platinum-group metals:				
Ore and con- troy ounces.. centrate, metal content.	626,876	542,985	506,782	United Kingdom 479,838; Norway 19,444.
Metals.....do....	4,619	28,262	42,845	Japan 31,499; United States 9,424.
Selenium metal and kilograms.. salts, selenium content.	156,852	147,690	202,168	United States 104,418; United Kingdom 86,138.
Silver:				
Ore and thou. troy ounces.. concentrate, metal content.	10,353	8,801	8,287	United States 6,793; West Germany 530.
Refined metal. thou. troy.. ounces.	10,783	9,445	10,835	United States 10,768; Brazil 61.
Titanium slag, 70 percent TiO_2...	115,323	98,423	(2)	(2).
Uranium, U_3O_8 [3].....	8,741	8,385	6,946	United States 4,893; United Kingdom 2,046.
Zinc:				
Ore and concentrate, metal content.	180,821	219,955	193,272	Belgium-Luxembourg 13,044; Norway 11,825.
Blocks, pigs, slabs.....	188,940	191,167	181,441	United Kingdom 75,166; United States 67,359.
Alloys, scrap, dross, etc.....	3,216	4,982	5,191	United States 2,732; Belgium-Luxembourg 1,937.
Fabricated materials, n.e.s.[1]..	452	424	1,195	United States 505; United Kingdom 457.
Nonmetals:				
Abrasives:				
Fused alumina, crude and grains.	120,946	149,567	138,309	United States 124,259; United Kingdom 14,047.
Silicon carbide, crude and grains.	76,500	56,940	66,138	United States 62,478; United Kingdom 2,688.
Asbestos:				
Crude.....	160	165	177	West Germany 98; Japan 40.
Milled fibre, thousand tons.. all grades.	1,013	1,056	1,094	United States 565; West Germany 75.
Barite, crude.....	155,759	209,471	145,051	United States 127,270; Trinidad 14,225.
Bentonite, earths and clays [3].....	4,085	2,999	2,817	All to United States.
Cement, Portland.....	226,230	198,821	247,481	All to United States.
Clay and value, thousands..... clay products:	$5,778	$7,543	$6,874	(2).
Feldspar.....	2,382	3,355	2,977	All to United States.
Fluorspar.....	1,858	4	2,732	United States 2,728.
Gypsum, crude..thousand tons..	3,465	3,777	4,267	All to United States.
Lime.....	28,301	64,939	88,980	United States 86,808.
Limestone, crude, crushed, and refuse.	(2)	804,850	743,410	United States 743,275.

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963
Nonmetals—Continued				
Nepheline syenite	176,535	175,683	184,398	United States 167,397; United Kingdom 10,464.
Potash materials [3]	(2)	70,786	512,358	United States imports only.
Salt [4]	513,000	724,000	672,000	United States 637,000.
Sand and gravel	353,342	321,244	323,074	United States 323,071.
Silica, quartzite	24,289	141,706	43,034	All to United States.
Sodium sulfate	78,968	67,176	59,283	All to United States.
Stone, cut value, thousands (granite, marble, slate, and others).	$288	$352	$870	(1).
Sulfur, crude and refined	197,644	362,901	744,742	United States 484,669; U.S.S.R. 53,715.
Talc and soapstone [3]	1,709	1,952	1,905	United States imports only.
Mineral fuels:				
Coal, bituminous	852,147	810,945	956,501	Japan 700,769; United States 249,256.
Coke, all types	205,660	143,230	140,009	United States 135,997.
Natural gas—million cubic feet	168,180	319,566	340,953	All to United States.
Petroleum:				
Crude thousand 42-gallon barrels.	65,223	91,590	90,876	All to United States.
Refinery products:				
Gasoline, total—do	570	964	481	United States 477; St. Pierre 4.
Distillate fuel oil—do	314	413	529	United States 181; France 157.
Residual fuel oil—do	730	1,646	1,599	Mainly to United States.
Lubricants—do	2	33	65	Australia 37; United States 25.
Other—do	1,930	2,164	1,882	(2).

[1] Not elsewhere specified (n.e.s.).
[2] Data not available.
[3] Data given are from United States Import Statistics.
[4] Estimate.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963
Metals:				
Aluminum:				
Bauxite and alumina	2,008,089	1,825,766	1,831,959	British Guiana 672,839; Surinam 500,034.
Cryolite	3,660	4,636	4,406	Denmark 3,382; United States 536.
Semimanufactured products. value, thousands	$8,406	$16,019	$23,305	(1).
Fully manufactured products. do	$19,862	$23,872	$21,743	(1).
Antimony:				
Regulus, metal content	377	579	470	Mainland China 393; Yugoslavia 30.
Oxide and salts, metal content.	183	299	306	United Kingdom 232; United States 49.
Bismuth: Metal, residues, and salts (metal content).	15	31	6	United Kingdom 3; Bolivia 2.
Chromium, chromite	64,653	65,289	45,045	Philippines 16,561; Rhodesia and Nyasaland 12,820; United States 12,620.
Cobalt oxides, gross kilograms weight.	12,866	18,568	12,833	United Kingdom 11,927; United States 906.
Columbium metal alloys—do	2	635	(1)	(1).
Copper:				
Scrap	3,591	412	2,952	United States 2,942; British Guiana 10.
Blocks, pigs, ingots	3	133	5,941	United Kingdom 3,517; Belgium-Luxembourg 594.
Bars, rods, sheet, tubing, etc.	2,072	1,242	1,519	United States 1,369; West Germany 75.
Wire	1,777	1,827	20	United States 15; United Kingdom 5.
Oxide and sulfate	441	526	578	United Kingdom 340; United States 233.

See footnote at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963
Metals—Continued				
Iron and steel:				
Iron ore——thousand tons	4,199	4,224	4,909	United States 4,588; Brazil 3,179.
Pig iron	313	9,168	16,133	Finland 15,260; United States 873.
Ferroalloys:				
Ferromanganese	10,996	13,595	20,538	Republic of South Africa 16,952; Japan 2,374.
Silicomanganese	1,971	2,473	2,136	United States 1,418; Japan 370.
Ferromolybdenum	96	60	(1)	(1).
Ferrotungsten	235	130	283	United Kingdom 234; Sweden 34.
Steel:				
Ingots and equivalent primary forms.	5,976	6,506	3,828	United States 3,146; United Kingdom 541.
Semimanufactures	600,601	551,526	(1)	(1).
Lead:				
Pigs, blocks, bars, and sheets	1,074	586	1,668	Mexico 1,045; United States 511.
Litharge	464	700	984	Mexico 452; United States 348.
Manganese ore	68,960	82,304	96,970	Ghana 41,221; Republic of the Congo (Léopoldville) 21,747; Brazil 18,719.
Mercury——76-pound flasks	4,117	3,224	5,889	Spain 3,041; Italy 1,725.
Molybdenum molybdic oxide	121	149	117	All from France.
Nickel, unwrought and semifabricated including alloys.	3,905	3,799	9,954	Norway 8,085; United States 1,830.
Silver——thousand troy ounces	12,278	15,182	7,950	United States 7,348; Mexico 535.
Tantalum metals and alloys.	kilograms 1,074	146	(1)	(1).
Tin, blocks, pigs, long tons and bars.	3,525	2,274	4,193	Malaya 3,044; United Kingdom 550.
Titanium dioxide	24,150	11,449	3,055	United Kingdom 1,719; United States 1,336.
Tungsten, scheelite ore	228	1,295	293	Korea 201; Argentina 91.
Zinc:				
Scrap and dross	115	313	212	All from United States.
Pigs, slabs, blocks, anodes	699	644	580	Do.
Bars, plates, sheets	788	694	715	United States 492; Belgium-Luxembourg 114.
Dust and granules	784	806	1,062	United States 447; Belgium-Luxembourg 380.
Chemicals	3,597	4,042	3,739	United Kingdom 2,217; United States 1,055.
Nonmetals:				
Barite, ground	1,714	2,201	3,474	United States 3,404; West Germany 70.
Bentonite, clay and drilling mud	12,903	13,566	(1)	(1).
Cement, all types	26,505	24,062	28,409	United Kingdom 10,996; Belgium-Luxembourg 5,069.
Clays and value, thousands clay products.	$47,112	$48,264	$49,640	(1).
Diamonds:				
Unset——thousand carats	56	62	63	Belgium-Luxembourg 31; Israel 17.
Bort for drilling——do	1,084	1,130	1,123	United States 894; United Kingdom 149.
Feldspar	1,561	1,725	2,359	All from United States.
Fluorspar	29,727	61,550	60,598	Mexico 44,042; Republic of South Africa 8,694.
Gypsum, crude	59,942	63,455	67,702	Mexico 66,497; United States 1,199.
Lime	34,884	32,762	40,180	United States 40,016.
Limestone, crushed, ground, broken, etc.	717,109	664,055	680,677	All from United States.
Magnesium compounds:				
Magnesia, dead burned	19,907	22,546	14,330	United States 10,384; Yugoslavia 2,000.
Magnesia, calcined	2,573	2,461	2,081	United States 1,988.
Magnesium chemicals	5,136	5,257	14,491	United States 11,663; West Germany 2,554.
Mica, unmanufactured	669	1,046	788	United States 704; India 71.
Phosphate rock——thousand tons	958	1,049	1,177	United States 1,149; Morocco 21.
Phosphate fertilizers, total	180,282	169,498	137,781	All from United States.
Potash products:				
Fertilizers	182,738	161,202	88,664	United States 50,919; France 17,341.
Chemicals and compounds	8,924	8,402	(1)	(1).
Salt	180,860	233,017	301,710	United States 142,923; Mexico 90,049.
Sand and gravel——thousand tons	1,205	761	510	All from United States.
Silica sand	628,857	694,395	714,104	United States 710,871.

See footnote at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963
Nonmetals—Continued				
Sodium sulfate, and Glauber's salt.	30,127	28,824	17,688	United States 11,884; United Kingdom 5,496.
Stone, cut value, thousands (granite, marble, slate, and other).	$3,339	$3,579	$3,299	(1).
Sulfur, elemental	298,967	176,981	136,655	United States 136,602.
Talc	18,330	21,907	24,983	United States 23,894.
Mineral fuels:				
Coal:				
Anthracite—thousand tons	960	829	769	United States 750; United Kingdom 19.
Bituminous—do	10,204	10,614	11,361	United States 11,360.
Coke, all types—do	594	531	548	All from United States.
Natural gas—million of cu. ft.	5,574	5,575	6,877	Do.
Petroleum:				
Crude thousand 42-gal. bbl.	133,249	134,518	147,721	Venezuela 90,085; Near East 54,003.
Refinery products:				
Gasoline, total—do	2,021	1,846	2,882	Netherlands Antilles 794; United States 677.
Kerosine and jet fuel—do	2,764	2,475	2,351	Netherlands Antilles 1,219; Venezuela 732.
Distillate fuel oil—do	9,747	8,354	9,345	Netherlands Antilles 4,645 Venezuela 4,082.
Residual fuel oil—do	10,490	13,513	14,740	Netherlands Antilles 7,632; Venezuela 3,053.
Lubricants—do	1,540	1,119	1,167	Mainly from United States.
Other products—do	3,356	3,074	3,483	(1).

[1] Data not available.

COMMODITY REVIEW

METALS

Aluminum.—Bauxite and alumina from Canadian-owned mines and plants in British Guiana and Jamaica were the principal raw material base for the Canadian aluminum industry's record production of 1963. The bulk of this was produced by the extensive facilities of Aluminum Company of Canada, Ltd.—Alcan. The Canadian British Aluminium Co. smelter at Baie Comeau, Quebec, is supplied with alumina from Reynolds Metals Co. in Texas and the Fria consortium in Guinea. Chryslum, Ltd., an affiliate of the Chrysler Corp., has leased the Alcan Beauharnois plant since 1959 for production of special alloys.

Location and annual capacity of alumina and aluminum facilities at the beginning of 1963 are summarized as follows:

	Metric tons
Alumina plants:	
Alcan:	
Kirkvine, Jamaica	500,000
Ewarton, Jamaica	277,000
Mackenzie, British Guiana	300,000
Arvida, Quebec, Canada	1,152,000
Aluminum reduction plants:	
Alcan:	
Arvida, Quebec	338,000
Shawinigan, Quebec	64,000
Isle Maligne, Quebec	104,000
Kitimat, British Columbia	174,000
CBA, Baie Comeau, Quebec	91,000
Chryslum, Beauharnois, Quebec	34,000

During 1963, the Jamaica and British Guiana alumina plants were operating at full capacity, with the excess above Canadian requirements going to European smelters. The Arvida, Quebec, alumina plant was operated at about 50 percent capacity. Aluminum reduction plants averaged 80 percent of national capacity.

Developments in Canada's aluminum industry in 1963 were confined to expansion of manufacturing facilities. The new cold-rolling mill opened in June will add 23,000 metric tons to bring the total annual capacity of the Kingston, Ontario, Alcan plant to 50,000 tons of sheet and rolled products. The Reynolds companies in Quebec have announced plans to add a cold mill, a foil mill, and an annealing furnace to the Cap de la Madeleine plant and the new 23,000-ton capacity rodmill will be built at Murray Bay.

Copper.—Canada's 1963 mine production and refinery output of copper were both slightly lower than in 1962. Voluntary curtailment by the principal producers (5 percent by Noranda Mines, Ltd.; 5 percent by Gaspé Copper Mines, Ltd.; 13 percent by The International Nickel Co., Inc.; and 17 percent by Falconbridge Nickel Mines) was the principal cause of the decrease. No production was recorded in 1963 from the Territories, following the suspension of mining at the North Rankin Nickel Mines, Ltd., and the Dominion Explorers, Ltd., Kathleen Lake mine. Three new names were added to the already long list of Canadian copper producers. Mattagami Lake Mines, Ltd., New Hosco Mines, Ltd., and Orchan Mines, Ltd., all in the Mattagami Lake area of northwest Quebec, commenced production in 1963. The copper and zinc concentrates produced in the two new mills (3,000 tons of ore per day at Mattagami Lake Mines, Ltd. and 1,900 tons of ore per day, at Orchan Mines, Ltd., which includes 900 tons of ore per day from New Hosco, will be shipped to the Noranda smelter. The Consolidated Mining & Smelting Co. of Canada, Ltd. (Cominco) Wedge mine and the Heath Steele Mines, Ltd., which initiated New Brunswick as a copper producer in 1962, accounted for 7,394 metric tons of copper in concentrates for shipment to Japan in 1963.

In addition to the 39 mine producers of copper listed in 1963 several more are expected to join the ranks of producers in 1964 and 1965.

Exports of copper in 1963 were approximately at the same level as in 1962, the bulk of the raw material exports going to Japan, refined metals to United Kingdom, and manufactured products to more than 50 countries. Domestic consumption of refined copper by Canadian industries in 1963 appears to be a record 154,000 metric tons, compared with 137,460 tons in 1962.

Gold.—Despite the highest price (averaging $37.74 per troy ounce) paid by the Royal Canadian Mint since 1950, the recorded total production of gold in 1963 was the lowest in 15 years. During this period, however, annual output has been relatively steady, fluctuating only between 3.97 and 4.62 million ounces. Two small mines were closed, and a few small gold mines reported production for the first time in 1963. Of the 50 lode gold mines producing in 1963, 42 received assistance under the Emergency Gold Mining Assistance Act. This act, initiated in 1948 and subsequently altered and renewed several times, has again been further extended through 1967. In 1962, the most

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recent year for which data are available, payments under the Assistance Act were about $14.5 million.

Following a long established pattern, approximately 55 percent of the 1963 gold output came from auriferous-quartz mines in Ontario. Eighty-three percent of the national total was from auriferous-quartz mines, and about 15 percent (two-thirds of which came from Quebec) was coproduced with base metals. Slightly less than 2 percent of the Canadian gold was from alluvial deposits of which the majority (6 dredges and 35 small placer operations) were in the Yukon Territory.

Iron Ore, Pig Iron, and Steel.—Production of iron ore in 1963 was a record-high Canadian output—12 percent above the previous peak established in 1962. Each of the four producing provinces also showed an increase in 1963. Newfoundland accounted for 8.5 million metric tons, Quebec for 10.7 million tons, Ontario for 6.7 million tons and British Columbia for 1.9 million tons.

Recent improvement in facilities and expansion of existing mines and ore processing plants not only increased the nation's iron ore production capacity but also provided for better grade products. Total annual production capacity of the 15 companies that comprised the Canadian iron ore mining industry in 1963 exceeded 38 million metric tons. The principal development during 1963 was the addition of pelletizing facilities at three plants. The largest of these, built near Labrador City adjacent to the Iron Ore Co. of Canada concentrator by the Carol Pellet Co. is rated at 5 million tons of pellets per year. Smaller pelletizing plants of 540,000 and 750,000 tons annual capacity respectively were built by Lowphos Ore., Ltd., near Capreol, Ontario, and by the International Nickel Company of Canada, Ltd. (Inco) (to treat roasted pyrrhotite concentrates), near Sudbury, Ontario. These are initial steps in announced plans that will raise the national pelletizing capacity from 1.5 million tons annually in 1962 to over 14.0 million tons in 1965.

Exports of iron ore in 1963 were the highest on record, totaling 24.2 million metric tons. Approximately 77 percent of these exports went to the United States, 10 percent to United Kingdom, and 8 percent, all from British Columbia mines, to Japan. A total of about 5 percent went to European Common Market countries. Consumption of iron ore from domestic sources by the Canadian iron and steel industry was at an alltime high as indicated by the following Dominion Bureau of Statistics summary of Canadian iron ore charged in Canadian blast furnaces:

	Thousand metric tons			
	1960	1961	1962	1963
Crude iron ore:				
From domestic mines	1,364	859	831	697
Imported	1,890	1,886	1,646	1,618
Sinter, pellets, etc.:				
From domestic mines	932	1,230	1,345	1,831
Imported	697	1,621	2,198	2,778
From own processing [1]	1,496	1,561	1,627	1,535
Total	6,379	7,157	7,647	8,459

[1] Domestic and imported materials processed in plants located at iron and steel plants.

Imports of iron ore, over 93 percent of which came from the United States, also were at a record high level of 5.4 million tons in 1963.

The Canadian iron and steel industry is comprised of four integrated companies: The Steel Co. of Canada, Ltd. (STELCO), Hamilton, Ontario; Algoma Steel Corp., Ltd. (ALGOMA), Sault Ste. Marie, Ontario; Dominion Foundries and Steel, Ltd. (DOFASCO), Hamilton, Ontario; and Dominion Steel and Coal Corp., Ltd. (DOSCO), Sydney, Nova Scotia. Three companies make pig iron but do not have steel-making facilities: Quebec Iron & Titanium Corp. (QIT), Sorel, Quebec; Canadian Furnace Division of Algoma Steel Corp., Ltd., Fort Colborne, Ontario; and Consolidated Mining & Smelting Co. of Canada, Ltd. (Cominco), Kimberley, British Columbia. In addition about 35 smaller plants produce steel from scrap in electric furnaces, and 11 plants make ferroalloys. In 1963, 18 rolling mills were in service; 3 in Nova Scotia, 4 in Quebec, 7 in Ontario, and 1 in each of the four western provinces.

Canadian iron and steel making capacity has been increased about 25 percent in the 1960–63 period. As of December 1963, pig iron annual capacity [7] in Canada was rated at 5,266,100 metric tons. Steel furnace capacity at the same time totaled 7,541,750 tons; distributed to open-hearth ingots 4,537,700 tons; electric and oxygen ingots 2,561,900 tons; and castings 442,150 tons. Principal products made in 1962 and 1963 include the following, in thousand metric tons:

	1962	*1963*
Pig iron	4,798	5,366
Ferroalloys	125	130
Steel ingots	6,396	7,316
Steel castings	111	114
Rolled products:		
Carbon steel:		
Hot rolled	5,017	5,725
Cold rolled, and coated	2,048	2,265
Alloy steel	155	187
Total rolled products	7,220	8,177

Lead and Zinc.—While 1963 mine output of both lead and zinc were below the 1962 output, refined zinc production in 1963 was the highest on record. Refined lead production, though slightly greater than in 1963, was below the levels of both 1960 and 1961.

Twenty-seven mines supplied the lead and zinc ores mined in Canada in 1962–63. By far the greatest production was from the Sullivan mine of Cominco in British Columbia. All of Canada's refined lead is produced in the Cominco smelter at Trail, British Columbia. Three companies operate electrolytic zinc refineries to produce refined zinc: Cominco (175,000 metric tons annual capacity), the Hudson Bay Mining & Smelting Co., Ltd. (72,000 tons capacity), at Flin Flon on the Manitoba-Saskatchewan border, and the new 66,000-ton-capacity plant of Canadian Electrolytic Zinc, Ltd., which commenced production of slab zinc in September 1963, at Valleyfield, 30 miles west of Montreal, Quebec.

[7] Sixteen blast furnaces and one electric reduction furnace. Additional capacity of about 300,000 metric tons is also available for electric smelting ilmenite.

Exports of lead and zinc in 1963 were substantially lower than in the previous year. However, the pattern of exports remained the same. The bulk of ore and concentrate exports of both metals were shipped to the United States, and the United Kingdom was the principal destination of refined lead and zinc. Domestic consumption of lead, 71,000 metric tons in 1963, was slightly higher than in 1962. Consumption of refined zinc 71,950 tons in 1963 was 12 percent above the 1962 level.

Under the stimulus of rising metal prices, lead from 10.0 to 12.5 Can. cents and zinc from 10.5 to 13.0 Can. cents between the beginning and end of the year, prospecting, mine development, and other lead-zinc industrial activities in 1963 have been at a relatively high level. Important events of the year included the startup of the Canadian Electrolytic Zinc, Ltd. plant at Valleyfield, Quebec, and the beginning of construction of the new lead-zinc smelter at Balladune Point, New Brunswick. In Quebec's Mattagami Lake area, Orchan Mines, Ltd., and Mattagami Lake Mines, Ltd., began mining zinc-copper ores at respectively 2,700 and 900 tons per day. In November the Kam-Kotia Porcupine Mines, Ltd., near Timmins, Ontario, started by-product zinc shipments from its copper mining operation. Acquisition of the old Britannia copper-zinc mine, north of Vancouver, British Columbia, by the Anaconda Company (Canada), Ltd., was effected early in the year, and on Great Slave Lake, in the Northwest Territories, extensive preparations at Pine Point continued through the year. When completed, probably in 1966, this Cominco operation is expected to ship about 200,000 tons of lead and zinc concentrates to the company's smelter at Trail in southern British Columbia.

Molybdenum.—Production of molybdenum in 1963 was the highest to date. The increase of 22 percent over the previous years' output was in part due to the byproduct recovery of molybdenite at Murdochville, Quebec, by Gaspé Copper Mines, Ltd. The bulk of Canada's 1963 production, as in previous years, was from the Molybdenite Corp. of Canada, Ltd. mine near La Corne, Quebec. In response to the strong demand for molybdenum, particularly in Japan and Western Europe, several new molybdenite prospects were being developed during the year in Quebec and British Columbia. Of these, the Preissac Molybdenite Mines, Ltd., near Cadillac, Quebec, and the Bethlehem Copper Corp., Ltd. near Ashcroft, British Columbia, were expected to commence production early in 1964.

Known deposits of molybdenum in Canada are said to be capable of raising Canadian annual production to over 6,800 metric tons of molybdenum. Domestic consumption however is small, and expansion would be subject to export market conditions.

Nickel.—The Canadian nickel industry is based on 7 companies operating 15 mines, 11 mills with a combined daily milling capacity of 67,000 metric tons of nickel-copper ores, 4 smelters, 2 refineries in Canada, and 1 refinery in Norway. Output, valued at $363 million in 1963 was down slightly from 1962. The decrease to about 93 percent of national capacity was a controlled reduction of output to avoid stock surplus. The two principal Sudbury District producers, Falconbridge Nickel Mines, Ltd., and International Nickel Co., of Canada, Ltd., both effected modest cutbacks in production in October. Sherritt

Gordon Mines, Ltd., mined slightly lower grade ore but maintained capacity tonnage at its Lynn Lake, Manitoba, mine. The several small-scale producers of nickel ores and concentrates were not affected by the cutback. The Gordon Lake, Ontario, mine and 500-ton-per-day mill which commenced operation in 1962 was acquired late in 1963 by Metal Mines Ltd., a subsidiary of Canadian Faraday Corp., Ltd. Concentrates were shipped to the Inco smelter at Copper Cliff. The new mine of Marbridge Mines, Ltd., in northwestern Quebec, which initiated Quebec production of nickel in 1962, operated at near its 400-ton-per-day milling capacity and produced 2,355 tons of nickel in concentrates in 1963. Giant Nickel Mines, Ltd., near Hope, British Columbia, produced concentrates containing 1,677 tons of nickel for export to Japan.

Platinum-Group Metals.—Production of platinum-group metals in 1963 was almost 25 percent less than the annual average of 457,556 troy ounces for the previous 3 years. In 1963, and possibly in earlier years the U.S.S.R. probably replaced Canada as the leading world producer. Platinum normally comprises 46 percent of the platinum-group metals produced in Canada. Palladium, with small amounts of rhodium, ruthenium, and iridium make up the remaining 54 percent. Aside from a few ounces of platinum metals obtained in some past years from placer gravel deposits in the Yukon and British Columbia, the entire Canadian output is recovered as a byproduct of nickel-copper sulfide ores mined in the Sudbury District of Ontario and since 1961 at the Thompson mine in northern Manitoba. On a national basis the original ore is said to carry 0.02 to 0.03 ounce of platinum metals per ton. Recovery is effected only by Inco and Falconbridge. In addition to ores from their own mines, both companies treat a small quantity of purchased ore. The platinum content is not recovered from nickel-copper materials treated at the Fort Saskatchewan refinery of Sherritt-Gordon Mines, Ltd.

Facilities for producing refined platinum or platinum-group metals are not available in Canada. The platinum metals recovered as sludges from the nickel electrolytic tanks by Inco are exported to the precious metals refinery of the Mond Nickel Co., Ltd., at Acton, England. Nickel-copper matte, containing platinum metals is exported by Falconbridge to the company's electrolytic nickel refinery in Norway. The platiniferous residues from the refinery treatment are sent back to the Englehard Industries, Inc., precious metals refinery at Newark, N.J. A portion of the Canadian platinum that is refined in the United Kingdom and the United States is returned and exported from Canada to world markets.

Silver.—Silver production in Canada is all coproduced with or as a byproduct of ores of other metals. Accordingly, the national output of 1963 was a 5-year low, reflecting voluntary cutback in production at several large nickel-copper, copper, and lead-zinc operations. Nevertheless, with exceptionally high world prices for silver, the Canadian price ranged from $1.31 to $1.40 per ounce throughout the year, and the total value of about $41.3 million was an alltime high for Canadian silver. In 1962–63, 28 [8] Canadian producers of silver are listed. Geo-

[8] Exclusive of numerous small producers who ship argentiferous ores or concentrates to customs mills or smelters.

graphically, Ontario accounted for 32 percent, Yukon 20 percent, British Columbia 21 percent, and Quebec 16 percent of the total silver produced in 1963. By sources, according to 1962 analysis, base metal ores yielded nearly 86 percent; the silver-cobalt mines of Ontario produced 12 percent and gold ores, both lode and placer, 2 percent. The great bulk of Canada's silver is exported. In 1963, the United States received nearly 92 percent of Canada's exports. Of the total exports about 43.3 percent was contained in ores and concentrates, and 56.7 percent was as bullion. The refined silver is produced in Canada by Cominco (6,847,606 ounces in 1963), Canadian Copper Refiners, Ltd., Cobalt Refinery, Ltd., The Royal Canadian Mint, Hudson Bay Mining & Smelting Co., Ltd., and the Hollinger Consolidated Gold Mines, Ltd.

Consumption of silver in Canada was primarily for coinage. Approximately 14 million ounces was used for this purpose in 1963, compared with less than 11 million ounces in 1962 and 5 million in 1961. Manufacturers of silverware, photographic materials, and other products absorbed 4.8 million ounces in 1962.

Uranium.—In 1963, production of uranium oxide (U_3O_8) continued the scheduled decline that will adjust Canadian deliveries to about 1,000 metric tons annually by 1970. The 1963 output was obtained from eight mines, two of which were closed by the yearend. Approximately 76 percent of the year's output was from Ontario's four mines at Elliot Lake (Denison, Milliken, Nordic, and Stanrock) and two mines in the Bancroft area (Faraday and Bicroft), and the remaining 24 percent was from the Eldorado Mining and Refining, Ltd., and Gunnar Mining, Ltd., in northern Saskatchewan. Under existing contracts, deliveries for the years 1964–71 to U.S. Atomic Energy Commission (USAEC), United Kingdom Atomic Energy Authority (UKAEA) and the Canadian Government stockpile, are scheduled as follows, in metric tons U_3O_8:

Year	USAEC	UKAEA	Stockpile	Total
1964	1,634	3,894	1,769	7,297
1965	554	2,076	----------	2,630
1966	416	1,489	----------	1,905
1967	----------	1,112	----------	1,112
1968	----------	1,089	----------	1,089
1969	----------	1,089	----------	1,089
1970	----------	1,089	----------	1,089
1971	----------	846	----------	846

Reserve estimates of ores of radioactive materials in Canada were officially revised during 1963. As of December 31, measured, indicated and inferred reserves of uranium ore were estimated to total 236 million metric tons, averaging 0.124 percent U_3O_8. This is equivalent to a recoverable reserve of 222,000 metric tons U_3O_8. In addition, substantial quantities of thoria (ThO_2) are associated with the uranium ores of Elliot Lake and Bancroft areas in Ontario. Free world reserves of recoverable uranium and thorium, as compiled by the Mineral Resources Division, Department of Mines and Technical Surveys, are as follows, in metric tons:

Country	U_3O_8	ThO_2
Australia	7,700	45,400
Brazil	450	34,100
Canada	222,000	145,000
France	22,200	[1] 10,300
India	10,900	181,000
South Africa, Republic of	136,000	13,600
United States	151,500	109,000
Other countries	23,600	42,900
Total free world	574,350	581,300

[1] Malagasy Republic.

NONMETALS

Asbestos.—Over 60 percent of the value of Canada's 1963 nonmetals output was accounted for by the $134.9 million worth of asbestos. The industry embraced 12 companies operating 15 mines with a total mill capacity of about 70,000 metric tons per day. This was a record year, with tonnage up 5 percent and value 4 percent higher than in 1962. As usual, most of the production came from established operations in Quebec (1,050,114 tons), Ontario (30,586 tons), and British Columbia (57,152 tons). A new mine and 4,500-ton-per-day mill operated by Advocate Mines, Ltd., a subsidiary of Canadian Johns-Manville Co., Ltd., at Baie Verte, initiated Newfoundland as an asbestos producer in July, and Newfoundland contributed 16,102 tons to the national total in 1963. The bulk of the new production will be exported to the United States and to Europe for manufacture of absestos cement.

Gypsum.—Canada increased gypsum output by over 500,000 tons in 1963 and undoubtedly retained its position as the world's third largest producer. Larger volume of sales to U.S. consumers, the principal export market, accounted for most of the increase. Canadian production is by 8 companies operating 14 mine-and-mill plants with a total daily capacity of nearly 28,000 tons. The five plants in Nova Scotia accounted for 83 percent of the national total in 1963, Ontario supplied 7 percent, Newfoundland 4 percent. British Columbia, Manitoba, and New Brunswick contributed small amounts.

The gypsum industry's principal development in 1963 involved Western Gypsum Products, Ltd., of Winnipeg commencing a new underground mining project near Silver Plains, Manitoba, and the completion in May 1963 by the same company of a $3.5 million products plant at Clarkson, Ontario.

Potash.—Drilling for oil in the early 1940's revealed enormous resources of potash (sylvite) in Devonian strata at depths ranging from 3,000 to 7,000 feet under a vast area of western Canada. The formation underlies the entire width of Saskatchewan and extends into both Manitoba and Alberta. More than a decade has been necessary to overcome the technical difficulties of sinking shafts through water-bearing formations and in designing extraction methods. While the major developments have been by two companies, Potash Co. of America and International Minerals and Chemical Corp. (Canada), Ltd. (IMC), some 17 companies held potash land rights and 5 had definite

production plans under way in 1963. The sole producer in 1963 was IMC whose mine and refinery at Esterhazy, in eastern Saskatchewan, commenced operation in August 1962. Potash Company of America is expected to resume mine production at Patience Lake near Saskatoon late in 1964. Also late in 1964 Kalium Chemicals, Ltd., is scheduled to initiate solution mining of a sylvite bed more than 5,000 feet deep, near Belle Plaine, 25 miles west of Regina.

Heretofore Canada's requirement of potash fertilizers and chemicals of about 200,000 metric tons annually, has been imported from the United States and Western Europe. Official Canadian trade statistics have not reported exports of potash. However, recorded U.S. imports of potash materials from Canada in 1962 and 1963 probably represent the bulk of Canadian production. By 1970, an annual output capacity of 5 million tons is envisaged; enough to supply half the 1963 world requirement.

Sulfur.—Recovery of sulfur as a byproduct of natural gas has been the primary factor in increasing Canada's annual output of sulfur over fourfold since 1951 and in thus transforming the national status from that of net importer to that of one of the world's principal suppliers. Production of sulfur in pyrites and pyrrhotite has been decreasing since 1957 when these materials totaled 467,000 metric tons of contained sulfur. Recovery of equivalent sulfur from stack gases in the smelting of base metal sulfide ores, most of which is credited to the Cominco smelter in Trail, British Columbia, and the Inco smelters near Sudbury, Ontario, and Thompson, Manitoba, has increased along with base metals production to record levels of 251,000 to 282,000 metric tons per year in the 1960's.

Recovery of elemental sulfur from natural gas was commenced in Alberta in 1951. Each subsequent year has shown an increase as new recovery plants were added. In 1963, 17 plants (15 in Alberta and 1 each in British Columbia and Saskatchewan) produced 1,053,836 metric tons. This represented an increase of nearly 68 percent over the 630,579 tons production reported in 1962. At yearend, Canadian installed capacity for recovering sulfur from natural gas was stated to be 1,935,650 tons per year.

Sulfur produced from pyrites and smelter gas is consumed largely in manufacture of sulfur chemicals, principally sulfuric acid. Canada's annual output of sulfuric acid has averaged 1,516,000 metric tons in the 3 years 1960–62.

Exports of sulfur in 1963 are the largest on record. The United States, as usual, was the principal market—484,669 metric tons. However, new customers in 1963 included the U.S.S.R. 53,715 tons, the Republic of South Africa 29,010 tons, and Japan 16,823 tons.

MINERAL FUELS

Coal.—Whereas the 1963 Canadian production of 9,594,058 metric tons of coal of all types was slightly higher than in 1961 and 1962, the recent level of production has been the lowest in more than 50 years. The decline has resulted from the almost universal trend toward replacement of coal and other solid fuels by petroleum and natural gas for space heating and energy generation. Moreover, the competitive position of Canadian coals has gradually weakened due to rising costs

of production and costs of transportation from mines to consuming centers in Quebec and southern Ontario. For these areas the coal fields of the eastern United States offer economic advantages.

The Canadian coal industry depends heavily on several forms of government aid. The Coal Production Assistance Act makes Federal loan funds available for coal mine development and equipment and for these purposes has in 13 years provided over $12.3 million. Subvention payments on coal transportation totaled $16.8 million in 1963. A total of $1.75 million was paid to compensate operating losses sustained by several mines in Nova Scotia and New Brunswick in 1963. Under the Canadian Coal Equity Act and the Atlantic Provinces Power Development Act, bounty payments are made to consumers of Canadian coal in manufacturing iron and steel and in generating electric power. Payments for these two items in the April 1, 1962 to March 31, 1963, fiscal period totaled $2 million.

A new type of flat-rate subsidy, aimed at assisting the competitive position of coal produced in Nova Scotia and New Brunswick with imported oil, was introduced in 1962. The Nova Scotia producer received 30 cents, and the New Brunswick producer received 10 cents per short ton shipped. The first year's payments totaled $1.2 million.

Coal imports from the United States in 1963 totaled 12,099,000 metric tons (769,000 tons anthracite, 11,112,000 tons bituminous, 213,000 tons coal coke, 5,847 tons briquets). According to estimates by the Dominion Coal Board,[9] consumption of coal in the 1960–63 fiscal periods (April 1 to March 31) is broken down as follows:

	1960–61	*1961–62*	*1962–63*
Total consumption, thousand metric tons	20,672	20,698	21,584
Household—percent	21.7	20.9	16.7
Industrial—do	46.3	47.0	52.8
Railway—do	2.5	1.9	1.4
Coke and gas—do	22.3	23.8	23.2
Bunkers—do	1.3	1.1	1.0
Colliery and waste—do	2.0	.9	1.2
Export—do	3.9	4.4	3.7
Total	100.0	100.0	100.0

Coal exports in recent years have been dominated by shipments of Alberta and British Columbia coal to Japan. New contracts with Japanese steel manufacturers call for a total of 2.2 million metric tons of metallurgical type coal over the 3 years beginning in 1964 from Coleman Collieries, Ltd., Vicary Creek mine near Coleman, Alberta, and Crow's Nest Pass Coal Co., Ltd., Michael Mine in eastern British Columbia.

Optimism regarding the future of the Canadian coal industry is found in anticipated use of coal, both imported and domestic, by new thermal electric plants. Increased production is expected with introduction of improved mining and transportation equipment. A continuous mechanical miner was installed recently in the Dominion Steel & Coal Corp., Ltd., Princess mine, and the Bras d'Or Coal Co., Ltd., plans to add an additional Wilcox mechanical miner. Mechanical mining equipment has been adopted by Canmore Mines, Ltd, Canmore, Alberta, and by Crow's Nest Pass Coal Co., Ltd., at Fernie,

[9] Dominion Coal Board (Ottawa). Fourteenth Annual Report, 1961–62.

British Columbia. The highlight improvement in coal transportation is the success of self-unloading boats used in the shipping of coal from Cape Breton Island to the Great Lakes and the purchase of such a carrier of 25,000-short-ton capacity for delivery in 1964.

Petroleum, Natural Gas, and Helium.—Production of petroleum and natural gas in 1963 continued the growth trend that has been the rule in Canada for more than 40 years. The year's yields of crude petroleum and natural gas represent alltime production records, respectively 6 and 12 percent greater than the previous year.

Although there were relatively few important new oil discoveries in 1963, the year's increase to known reserves was one of the largest on record. Revisions and extensions in established fields, plus pressure maintenance and secondary recovery projects, raised the total national reserve estimate for petroleum and natural gas liquids from 5.2 billion barrels in 1962 to 5.8 billion in 1963. In addition, renewed interest in the oil sands of Alberta has resulted in a revised estimate of 416 billion barrels recoverable reserves which should eventually yield 300 billion barrels of synthetic crude. Canada's natural gas reserves are currently placed at 39,000 billion cubic feet—about 10 percent above the previous year's figures.

Exploration and development drilling in 2,798 wells during 1963 totaled 11.5 million feet. This was about 10 percent more than in 1962. Most of the drilling—1,800 holes totaling nearly 10 million feet—was development drilling in the known Alberta oil and gas fields. At the seasonal peak, 87 geophysical crews, mostly seismic, were working throughout Canada. This approximately equalled the previous year's level of geophysical activity.

Construction of pipelines for oil, natural gas liquids, and liquid products in 1963 amounted to about 1,000 miles, bringing the total oil line mileage to over 11,000. The longest section built in 1963 was Petroleum Transmission Co.'s 577 miles of 6-inch line to carry natural gas liquids from the new plant at Empress, Alberta, to Winnipeg, Manitoba. Interprovincial Pipeline Co. laid 41 miles of oil pipeline in Manitoba and 126 miles in Minnesota. Gas transmission and distribution lines laid in 1963, respectively 700 and 1,300 miles, brought the total of gas pipelines to more than 43,000 miles.

Capacity of Canada's 43 oil refineries was raised from 988,470 barrels of crude oil per day at the beginning of 1963 to 1,020,000 barrels per day at yearend. Nearly 85 percent of the national capacity is controlled by four companies: Imperial Oil Enterprises, Ltd. (33 percent), Canadian Oil Co., Ltd. (18 percent), Texaco Canada, Ltd. (18 percent), and British American Oil Co., Ltd. (16 percent) Refinery receipts of crude petroleum in September 1963, amounted to 929,666 barrels per day and the year's total output of products, up about 7 percent from the previous year, totaled 331.5 million barrels.

With the addition of 5 new processing plants in 1963, the raw gas annual capacity of Canada's 83 plants went to 1,398 billion cubic feet (equivalent to 3,830 million cubic feet per day). The largest of the new facilities were the British American Oil Co. plant at Lookout Butte and the Imperial Oil Enterprises plant for processing casinghead gas from the Swan Hills region of Alberta.

Of particular interest during the year were developments related to the exploration plans for the Athabasca oil sands and the establishment of a helium extraction plant.

The extent and huge potential of the vast deposits of oil sands (also referred to as tar sands and bituminous sands) along the Athabasca River in northeastern Alberta has been known for over a century. However, despite expenditures since 1945 estimated at over $40 million for land acquisition, research, and tests, the problems of economic recovery and marketing have not been solved. Beginning in 1962, industrial interest revived and four companies have recently proposed projects totaling $800 million to produce 245,000 barrels per day by 1970. The Alberta Conservation Board recently approved the application of Great Canadian Oil Sands, Ltd., to undertake a $191 million project to extract 45,000 barrels per day. The board stipulated that the plant must be operating by September 30, 1967. Plans call for an open pit mine operation, and in addition to the oil, the refinery is expected to produce 305 metric tons of sulfur and 2,687 tons of petroleum coke daily. It is expected that following this initial concession one or more of the other project applications by Cities Service Athabasca, Inc., Shell Oil Co. of Canada, Ltd., and Can-Amera Oil Sands Development, Ltd., may eventually be granted.

Following the discovery of commercial occurrences of helium in a deep-test well near Swift Current in 1958 and in the Wood Mountain area in 1960, Canada Helium, Ltd., was formed early in 1963 by British American Oil Co., Ltd., British Oxygen Co., Ltd., and L'Air Liquide of France An extraction plant was built in 1963 near Swift Current in southeastern Saskatchewan. The reservoir which contributes Canada's first helium production (since an experimental operation in 1915–20) contains 1.9 percent helium in a combustible mixture of other gases. The two wells currently in use are estimated to contain 20 years' reserve at the plant's production capacity of 12 million cubic feet of helium per year. Operation commenced late in 1963. In addition to helium, the company also will market liquid nitrogen.

The Mineral Industry of Costa Rica

By Sumner M. Anderson [1]

COSTA RICA constitutes a relatively small market (US$21 million annually) for metals, minerals, and mineral fuels; the country also imports finished manufactures. Completion of a cement plant and a fertilizer plant should make the country self-sufficient or largely so in those products and reduce the total import market by US$4 million to US$5 million.

Mineral production also is nominal, contributing less than 0.5 percent to the gross national product (GNP). Ratios of mineral production value to GNP, in thousand colones,[2] have been as follows:

Year	Value of mineral production (thousand colones)	Share of GNP (percent)	Gross national product (thousand colones)
1961	7,944	0.28	2,852,850
1962	6,767	.22	3,132,150
1963	4,275	.12	3,424,750

Costa Rica has an area of only 19,700 square miles. Its population, estimated in 1963 at 1.3 million, is supported principally by agriculture. Over 95 percent of the people are of Spanish descent; the 88 percent literacy rate is one of the highest in Latin America.

In 1963, Costa Rica was in the early stages of transition from a subsistence coffee-banana export economy to a more diversified, partially industrialized one. The development of mineral resources has been retarded by lack of access into large sectors of the country, inadequate mineral exploration, an obsolete mining code that applies basically to gold mining, and a tradition of speculation on—rather than development of—mine properties. Petroleum exploration has proved disappointing. Bauxite exploration has led to the discovery of large low-grade deposits of commercial potential, and a bill to amend the mining code, reportedly modeled after legislation in force in Jamaica, was submitted for consideration to the legislative assembly on November 7, 1963, for the purpose of facilitating development.

Minerals of construction are abundant, and the recovery of gold has been small in recent years and sporadic since the 16th century; other known resources are limited to minor occurrences or commercially marginal deposits of manganese, iron, copper, lead, zinc,

[1] Chief Latin America specialist, Division of International Activities.
[2] One colón = US$0.15.

mercury, nickel, barite, and sulfur. The Caribbean shoreline, particularly in the Puerto Viejo area of Limón Province, contains about 8 million tons of titaniferous iron sands of potential commercial value.

PRODUCTION

Except for salt, the Costa Rican Government makes no attempt to account precisely for the mineral production of the country. The other figures presented in the production table are rounded estimates.

TABLE 1.—Approximate production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Gold, troy ounces	3,000	3,000	3,000	3,000	3,000
Manganese ore					600
Nonmetals:					
Diatomite	2,200	2,200	650	750	1,900
Lime	3,000	3,800	3,800	3,800	5,000
Limestone	23,000	23,600	24,800	25,600	30,000
Salt, marine	12,504	12,700	11,500	8,950	5,698

TRADE

For many years the total foreign trade balance has been unfavorable. In 1962 the unfavorable trade balance in minerals accounted for US$21 million of the overall deficit of US$26 million. The total trade deficit in 1963 is estimated at US$43 million, but the proportion due to minerals is not available. The trade statistics presented in the accompanying tables are those officially published in Comercio Ex-

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 (quantity)	1962		
		Quantity	Principal destinations	Value (U.S. dollars)
Metals:				
Iron and steel, all forms [1]	16	37	Nicaragua 31	23,510
Nonferrous metals and their alloys, all forms.[1] kilograms	19,465	129	Nicaragua 113	209
Total value, metals				23,719
Nonmetals:				
Industrial stone, including dolomite, chalk, cement raw materials, lithographic stone, and others.		1	All to Nicaragua	72
Dimension stone	128	155	Nicaragua 136; El Salvador 14	4,002
Clay and clay products, including refractory materials.	36	61	Nicaragua 45; El Salvador 16	7,409
Other nonmetallic minerals, crude		7	All to El Salvador	340
Total value, nonmetals				11,823
Total:				
Value of metal and mineral exports				35,542
Value of all exports, f.o.b.				86,910,876
Metals and minerals share in total exports. percent				0.04

[1] Scrap only in 1961; ingots and/or semimanufactures only in 1962.

terior de Costa Rica, Años 1961 y 1962 (Foreign Trade of Costa Rica, 1961 and 1962) by the Direccion General de Estadistico y Censos, Minesterio de Economico y Hacienda, San José (Bureau of Statistics and Census, Ministry of Economy and Finance, San José).

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 (quantity)	1962		
		Quantity	Principal sources	Value (U.S. dollars)
Metals:				
Aluminum and its alloys, all forms.	344	400	United States 196; Belgium-Luxembourg 50; Japan 42.	408, 532
Copper and its alloys, all forms	133	215	Mexico 57; France 35; West Germany 31.	203, 553
Iron and steel:				
Primary forms [1]	81	1,740	West Germany 942; Belgium-Luxembourg 386; France 321.	171, 433
Semimanufactures	35, 821	29, 884	Belgium-Luxembourg 8,085; Japan 6,546; West Germany 5,209; United States 4,549.	5, 816, 528
Lead and its alloys, all forms	61	55	Denmark 24; United States 17; West Germany 8.	34, 824
Nickel and its alloys, kilograms semimanufactures.	5, 415	4, 929	United Kingdom 2,493; West Germany 1,783; United States 461.	19, 265
Tin and its alloys, all forms	13	10	United States 6; West Germany 3	14, 196
Zinc and its alloys, all forms	1	48	West Germany 46	17, 719
Nonferrous metal ore and concentrate, not further subdivided.	6	1	Mainly from United States	371
Nonferrous metal scrap, not further subdivided.	(2)	(2)	All from West Germany	9
Nonferrous metals, not further subdivided, all forms.	1	3	United Kingdom 1; United States 1; West Germany 1.	3, 083
Total value, metals				6, 689, 513
Nonmetals:				
Abrasives, natural	3	9	Italy 6; France 2; United States 1	2, 102
Asbestos, crude, washed or ground.	1	6	All from United States	2, 297
Cement thousand tons	74	82	Colombia 33; West Germany 23; Venezuela 22.	1, 711, 263
Clay and refractory materials:				
Kaolin and similar clays	387	868	United States 577; United Kingdom 291.	70, 976
Refractory rock and earth	163	91	All from United States	8, 548
Dimension stone	190	162	West Germany 77; Italy 75	24, 229
Diatomite	79	14	All from United States	2, 379
Feldspar, fluorspar, cryolite	18	14	do	949
Fertilizers:				
Nitrogenous	13, 632	16, 879	West Germany 13,497; Netherlands 2, 525; Trinidad 608.	1, 210, 750
Phosphatic	21, 840	8, 816	United States 3,437; Netherlands 2,840; Italy 2,330.	726, 544
Potassic	984	3, 048	Netherlands 1,660; West Germany 1,039; Chile 303.	237, 544
Not further described	16, 012	33, 395	West Germany 16,901; United States 6,450; Netherlands 6,394.	2, 588, 136
Graphite	2	1	Mainly from West Germany	432
Gypsum, natural and calcined	117	157	West Germany 130; United States 25; Italy 2.	16, 826
Lime: quicklime, slaked lime, hydraulic lime.	6, 015	109	All from United States	6, 333
Mica	(2)	14	do	1, 899
Pigments, mineral	270	133	West Germany 34; United States 33; United Kingdom 25.	72, 866
Salt	141	96	United States 92	8, 852
Sand, gravel, crushed rock	179	5	United States 4	803
Sulfur	28	10	All from United States	578
Talc	86	84	Italy 62; United States 10; West Germany 9.	11, 983
Miscellaneous nonmetals	2	319	United States 318	20, 220
Total value, nonmetals				6, 726, 509

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961 (quantity)	1962		
		Quantity	Principal sources	Value (U.S. dollars)
Mineral fuels:				
Coal, all grades	28	38	United States 33; United Kingdom 5	2,496
Coal and coke briquets	----	9	All from United States	760
Coke	156	80	West Germany 44; Netherlands 25	5,782
Petroleum products:				
Gasoline thousand 42-gallon barrels.	480	507	Curacao 226; Aruba 144; Venezuela 89.	2,295,976
Kerosine do	87	104	Curacao 44; Aruba 29; Venezuela 14	532,761
Distillate fuel oil do	492	678	Curacao 268; Venezuela 145; Aruba 132.	2,517,763
Residual fuel oil [3] do	181	82	Venezuela 68; Curacao 14	196,572
Lubricants do	34	52	All from United States	1,388,152
Liquified petroleum gas do	14	20	Venezuela 14; Panama 6	223,947
Asphalt do	26	32	Venezuela 31; United States 1	154,151
Other do	12	15	United States 13	292,801
Total, petroleum products do	1,326	1,492	----	7,602,123
Total value, mineral fuels	----	----	----	7,611,161
Total:				
Value of metal and mineral imports.	----	----	----	21,027,183
Value of all imports, c.i.f.	----	----	----	113,346,206
Metals and minerals percent share in total imports.	----	----	----	18.55

[1] Includes pig iron, ferroalloys, ingots, blooms, billets, slabs and sheet bars of steel, and scrap.
[2] Less than 1 ton.
[3] Includes some crude oil and partly refined oil, apparently all for use as boiler fuel.

COMMODITY REVIEW

METALS

Bauxite.—Alcoa de Costa Rica, a local subsidiary of the Aluminum Co. of America, has invested more than US$3 million in exploration for bauxite since 1956 and has found some 150 million tons of material in beds 2 to 2.5 meters (6.5 to 8.2 feet) thick, averaging about 35 percent alumina, in the Valle del General area south of San José. Further development awaits passage of the proposed amendment to the Mining Code and determination of the economic feasibility of treating the low-grade ore in a reduction plant on the west coast of the United States. If these factors prove favorable, a road or railroad must be built from the deposit to a Pacific port.

Gold.—Gold production, estimated by the Banco Central de Costa Rica at 3,000 troy ounces a year, is from individual small-scale placer operations principally on the Osa Peninsula on the southwestern (Pacific) side of the country. Several lode deposits on the west slope of the Cordillera Central were worked in past years but were unable to withstand rising production costs.

Manganese.—In the second quarter of 1963, Metal Surfaces, Inc., a U.S. company working manganese deposits on the Nicoya Peninsula, sent a trial shipment of 600 tons of manganese ore to Japan to deter-

mine whether the deposits are sufficiently rich to justify further mining activities. By yearend, results had not been reported.

NONMETALS

Cement.—Costa Rica has the highest per capita consumption of cement in Central America; imports have risen from 37,000 tons in 1951 to 82,000 tons in 1963, and to a cost exceeding US$1.7 million. To curb this drain on foreign exchange and dependence on foreign suppliers, Industria Nacional de Cemento, S.A., is building the country's first cement plant at Cartago, 20 kilometers (12 miles) southeast of San José The plant is scheduled to be completed and operating in May 1964, with an annual capacity of 112,000 metric tons of portland No. 1 quality cement, marketable at a maximum of US$0.93 (6.20 colones) per 94-pound bag. Local materials required for this scale of operation are estimated to be sufficient for 30 years.

Fertilizers.—In August 1963, Fertilizantes de Centro America, S.A., incorporated in Panama and two-thirds owned by the Esso Corp., completed construction of a US$10.5 million chemical fertilizer plant near the west coast port of Puntarenas. Production was to start in September. Anhydrous ammonia supplied by Esso subsidiaries in Cartagena, Colombia, and Aruba, Netherlands Antilles, will be the principal raw material for producing up to 180,000 metric tons per year of complex fertilizers and ammonium nitrate for sale in Costa Rica and throughout Central America. Local sales should reduce substantially the US$2 million per year in foreign exchange previously required for the importation of fertilizers.

Salt.—Production of marine salt is from Pacific Coast salinas in the Provinces of Puntarenas and Guanacaste.

MINERAL FUELS

Petroleum.—Exploratory drilling and seismic operations by the Gulf Oil Company subsidiary, Cía. Petrolera de Costa Rica, were continued in 1963. Refinadora Costarricense de Petróleo has been organized to establish a small petroleum refining industry in Costa Rica using imported crude. Construction of the refinery is scheduled to start in early 1964 at Moin, 8 kilometers (5 miles) west of the Caribbean port of Puerto Limón.

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The Mineral Industry of El Salvador

By Henry E. Stipp [1]

EL SALVADOR'S 1963 output of minerals and mineral products, all nonmetals, was valued at approximately US$2 million, 22 percent more than in 1962. This figure represented only about 0.3 percent of the country's gross national product.

El Salvador's population of 2.6 million is supported chiefly by agriculture (with coffee and cotton the principal crops) and by trade. It is estimated that only 0.3 percent of the total working force (806,590 in 1961) was employed by the mineral industry. Some light manufacturing is carried out, utilizing domestic raw material (principally agricultural) or imported commodities. The nation's mineral industry was small in 1963, consisting largely of limestone quarrying for manufacture of lime and cement and the production of salt for local consumption. Most of the metals, nonmetals, and mineral fuels consumed were imported. The government of El Salvador advocates geographic diversification of its exports and imports, to reduce heavy reliance upon any one country as either a source of supply or a market. The government is trying to develop the limited mineral resources that exist. A general inventory of physical resources by the Army Map Service, U.S. Corps of Engineers, in cooperation with the Agency for International Development was advanced during the year. The survey is to provide detailed information on mineral resources, soil, vegetation, rocks, and water by December 1964.

SOURCE MATERIAL

The information contained in this chapter was supplied by the U.S. Embassy, San Salvador, El Salvador, through the U.S. Department of State, and supplemented by "Anuario Estadistico (Statistical Annual)," 1961 and 1962 (volume 1), San Salvador, and "Overseas Business Reports," July 1963, published by the Bureau of International Commerce, U.S. Department of Commerce.

PRODUCTION

Production of limestone for use in the manufacture of lime and cement was the principal mining activity carried out in 1963. A single plant produced the country's total output of cement. Salt was recovered from sea water and brine by solar and other evaporation methods, for local consumption.

[1] Physical scientist, Division of International Activities.

Gold and silver were not mined commercially in 1963. Production of gold and silver was last reported in 1960, when output was valued at US$39,000 and US$69,000, respectively.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Gold.....troy ounces..	2,474	[2] 1,121	.....	.....	.....
Silver.....do....	199,080	[2] 76,809	.....	.....	.....
Nonmetals:					
Cement.....	83,144	85,214	73,283	63,834	81,690
Lime.....	[3]	[3]	500	450	[4] 477
Limestone, for cement and lime [4].....	107,700	111,700	96,200	83,800	107,100
Salt.....	12,700	14,000	15,000	18,140	[4] 18,000

[1] In addition to commodities listed, pumice and a slatelike sedimentary rock have been produced, the former for use as an aggregate in cement blocks and for road construction and the latter for construction purposes. Quantity and value of output have not been reported.
[2] One mine produced until May 1960 and has not resumed operations.
[3] Data not available; there was some unrecorded production of limestone for use in the production of lime and in paints.
[4] Estimate.

TRADE

The lack of developed mineral resources has forced El Salvador to rely heavily on imported basic raw materials to supply its small industries. As a result El Salvador has become the leading trader in the Central American Common Market. Total trade established a record high in 1963, with a favorable trade balance.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Copper and copper alloys.....	.....	28	All to United States.
Iron and steel:			
Scrap.....	7	242	Italy 218; United States 16; Honduras 8.
Primary forms and semimanufactures.	68	380	Honduras 264; Guatemala 107; Nicaragua 9.
Nonferrous base metals: Scrap.....	117	91	United States 45; Spain 16; West Germany 14.
Silver.....troy ounces..	32	.....	.....
Nonmetals:			
Asbestos.....	427	1,917	Honduras 892; Costa Rica 858; Nicaragua 166.
Cement.....	2,804	3,723	Honduras 3,696; Guatemala 23; Nicaragua 4.
Fertilizers:			
Sodium nitrate, phosphates, potassium salts.	.....	14	All to Honduras.
Manufactured.....	383	333	Honduras 318; Guatemala 15.
Lime.....	16	62	Honduras 59; Guatemala 3.
Nitrates, acid and anhydride.....	35	24	All to Costa Rica.
Sodium hydroxide, caustic soda.....	1	.....	.....
Salt.....	1,165	1,951	Honduras 1,790; Nicaragua 118; Guatemala 43.
Total:			
Metals value, thousand U.S. dollars.. and minerals.	304	639	
All exports.....do....	120,400	138,100	.....
Metals and minerals share percent.. in total exports.	.25	.46	

Imports for 1963 totaled US$150.8 million, compared with US$130.2 million in 1962. Imports from Central American countries increased 25 percent over those of 1962. The U.S. share of the market remained at 36 percent, despite El Salvador's increased trade with other countries.

Exports in 1963 totaled US$153.6 million, compared with US$138.1 million in 1962. Exports to other Central American countries increased 30 percent over the 1962 figure. The United States, West Germany, Guatemala, and Honduras were El Salvador's principal trading partners in 1963; however, trade with Japan increased.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum or aluminum alloys:			
Unwrought	685	185	Canada 94; United States 91.
Semimanufactures	277	230	United States 77; West Germany 49; Belgium 40.
Copper or copper alloys, all forms	73	92	United States 54; United Kingdom 12; Canada 10.
Iron and steel:			
Scrap	156	418	United States 358; Honduras 60.
Ferroalloys	37	37	Belgium 21; Norway 16.
Ingots and equivalent primary forms.	2,069	48	United Kingdom 46; Switzerland 1; United States 1.
Semimanufactures	22,421	22,999	Belgium 10,786; West Germany 2,880; United States 2,705.
Lead and lead alloys, all forms	108	195	Belgium 106; Guatemala 34; United States 21.
Tin and tin alloys, all forms	18	34	United Kingdom 31; United States 2; Belgium 1.
Zinc or zinc alloys, all forms	10	25	Nicaragua 17; West Germany 5; United States 3.
Nonmetals:			
Abrasives	5	3	Guatemala 1; United Kingdom 1; West Germany 1.
Asbestos, crude, washed or ground	597	413	Canada 412; United States 1.
Clays:			
Refractory and stone	90	46	United States 22; Guatemala 8; Netherlands 8; West Germany 8.
Kaolin and clayey earths	116	242	United States 151; Guatemala 78; Costa Rica 7.
Diatomite	118	238	United States 217; West Germany 21.
Gypsum:			
Crude	1,468	1,405	All from Guatemala.
Calcined, powder	41	35	West Germany 19; United States 14; Guatemala 2.
Graphite	7	2	Italy 1; United Kingdom 1.
Mica	19	7	All from United States.
Salt:			
Not refined	975	1,734	Honduras 1,733; United States 1.
Refined	23	17	All from United States.
Sulfur, unrefined	43	16	West Germany 9; United States 5; Belgium 2.
Talc, natural or powdered	75	67	United States 48; Italy 12; West Germany 4.

See footnote at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Mineral fuels:			
Coal	95	100	West Germany 75; United States 18; Guatemala 7.
Coke	182	209	West Germany 204; United States 5.
Petroleum:			
Crude thousand 42-gallon barrels and partly refined.	562	383	Venezuela 233; Netherland Antilles 143 United States 7.
Refinery products: [1]			
Gasoline do	561	558	All from Netherland Antilles.
Kerosine do	215	132	Do.
Jet fuel do	--------	128	Do.
Diesel oil do	294	419	Do.
Residual fuel oil do	321	351	Venezuela 213; Netherland Antilles 132 United States 6.
Lubricants do	27	28	All from United States.
Liquefied petroleum gas	--------	18	Venezuela 17; Netherland Antilles 1.
Paraffin thousand 42-gal. barrels and petrolatum.	--------	11	All from United States.
Other do	24	13	United States 7; Netherland Antilles 6.
Total:			
Metals value, million U.S. dollars and minerals.	10.0	12.6	
All imports do	153.0	130.2	
Metals and minerals share in percent total imports.	6.5	9.7	

[1] Approximately 31,000 barrels of petroleum products were reexported to Honduras, Guatemala, and Nicaragua in 1961 and 37,170 in 1962.

COMMODITY REVIEW

METALS

Gold and Silver.—An exploration survey was started in October at the dormant San Sebastián mine, Department of La Unión. Money was being solicited to finance reopening the mine, but funds proved difficult to obtain because of the low metal content of the ore. A Canadian firm was considering reopening the Monte-Cristo mine in the Department of Morazán, which was closed in 1960. This could employ 300 miners.

NONMETALS

Cement.—Plans were made to move El Salvador's only cement plant from Acajutla to Metapán because of depletion of raw materials at Acajutla. The plant has an approximate annual capacity of 1.5 million tons. It is owned and operated by Cementos de El Salvádor, S.A. A loan of US$1,200,000 was obtained from the Central American Economic Integration Bank to finance the move.

Limestone.—Deposits of limestone are located in the Departments of Metapán and Sonsonate. The Metapán deposits were expected to last 160 years at current rates of depletion, whereas the Sonsonate calcareous beds near Acajutla were almost exhausted in 1963.

MINERAL FUELS

Petroleum Refinery Products.—El Salvador's first oil refinery, a US$10 million plant near Acajutla, was officially opened in May. The refinery is operated by Refineria Petrolera Acajutla, S.A., which is

owned jointly by Shell (35 percent), Esso (60 percent), and private Salvadoran capital (5 percent). It has a capacity of 14,000 barrels per day of refined products. Crude oil is imported from Venezuela via the Panama Canal. The operating company plans to export products to Guatemala and Honduras. Construction of the refinery has helped the economic development of the country by employing 112 local workers, saving foreign exchange, developing and training skilled labor, and establishing allied industries.

The Mineral Industry of Greenland

By Lester G. Morrell[1]

GREENLAND, the world's largest island (837,000 square miles), formerly a Danish colony, became a fully represented county of the Kingdom of Denmark in 1953. Eighty-five percent of the surface of the island is covered with a mantle of ice 300 to 500 meters thick. The population, estimated in 1963 at 34,000, is mostly Eskimo and is distributed in numerous villages and tiny settlements along the 132,000 square miles of coastal areas that are ice-free for at least part of the year. The country has few known natural resources. The principal occupational activities are fishing and seal hunting. Under a Danish-American agreement for the common defense, several military research projects are maintained by the U.S. Department of Defense.

Mining has been a relatively important element of Greenland's economy for many years. Both coal and cryolite have been produced intermittently since the mid-1800's. Lead and zinc concentrates were produced and exported during 1956–62. Records are vague on several reportedly unsuccessful small-scale attempts to produce copper, graphite, rare-earth minerals, marble, and garnet. Occurrences of other economic minerals have been reported. Iron, molybdenum, and fissionable materials have been prospected in depth, but commercial production of these ores has not been attempted.

The Danish Government is a major participant in all geological investigation projects and mining activities in Greenland. Private companies in partnership with the government are responsible for field activities and technical operations. Legislation relative to concessions and mining is based on the Danish basic law No. 181 of 1950: Law on Exploration and Utilization of Raw Materials in the Subsoil of the Kingdom of Denmark. The most recent Greenland concession under this law in December 1961, when Arctic Mining Co., Ltd., received a 50-year grant of prospecting and extraction rights for molybdenum and certain other minerals in the Mesters Vig area. The Danish Government retains a majority interest in this venture.

SOURCE MATERIAL

Material presented in this chapter is from Danish Government publications, industrial journals, and press, translated and reported by the U.S. Embassy in Copenhagen. Trade data are from the official Department of Statistics publication "Danmarks vareindførsel og-udførsel" (Denmark Products Imported and Exported).

[1] North America-South Pacific specialist, Division of International Activities.

PRODUCTION

Coal was the only mineral reported as being produced in Greenland at yearend 1963. Quantities of indigenous construction materials produced and used within the country are not recorded. The lead-zinc mining and milling operation of the A/S Nordisk Mineselskab (Nordic Mining Co., Inc.), was terminated in 1962, and cryolite production by Øresund Cryolite Co., Inc., was stopped in 1963. Both mines reported depletion of ore reserves.

TABLE 1.—Production of metals and minerals

(Metric tons)

Commodity	1959	1960	1961	1962	1963
Metals:					
Lead:					
Concentrate—gross weight	12,800	8,000	13,000	1,900	----------
Metal content	10,553	6,926	9,166	808	----------
Zinc:					
Concentrate—gross weight	12,000	14,900	12,500	6,200	----------
Metal content	7,600	10,000	8,000	4,000	----------
Nonmetals: Cryolite, crude (exports) [1]	42,041	42,456	41,775	40,943	65,723
Mineral fuels: Coal, bituminous	26,995	28,415	30,139	26,098	40,000

[1] Quantity shown for 1963 is entirely from accumulated stocks.

TRADE

Minerals comprised 15 percent of the value of Greenland's total imports and 31 percent of total exports in 1962. It is anticipated that the importance of minerals will decline in 1963 and succeeding years owing to mine closures; however, shipments from accumulated stocks of crude cryolite will continue for some years. Fuels, foodstuffs, and manufactured products account for most of the imports. Fish and seal products are the principal export items. The bulk of trade is with Denmark.

TABLE 2.—Exports of metals and minerals

(Metric tons)

Commodity	1961	1962	Principal destination, 1962
Metals:			
Lead, concentrate—gross weight	12,769	2,327	All to West Germany.
Zinc, concentrate—do	10,411	10,377	Do.
Nonmetals: Cryolite, crude	41,775	40,943	Denmark 32,355; United States 8,588.
Mineral fuels: Coal, bituminous	8,051	4,215	All to Denmark.

TABLE 3.—Imports of metals and minerals

(Metric tons)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Iron and steel: Semimanufactures [1]	1,628	2,287	All from Denmark.
Nonferrous metals: Semimanufactures.[2]	56	96	Do.
Nonmetals:			
Construction materials:			
Bricks, stone, clay products	5,057	3,695	Do.
Cement	2,222	668	Do.
Expanded clays, etc.	434	499	Do.
Fertilizers, processed	33	100	Do.
Lime (burned)	426	450	Do.
Salt	8,898	7,474	Spain 7,350; Denmark 124.
Other nonmetals, crude	503	364	All from Denmark.
Other nonmetals, processed [3]	969	3,005	Do.
Mineral fuels:			
Coal (includes briquets)	14,732	15,211	United Kingdom 15,190.
Petroleum products:			
Gasoline	3,360	2,870	Netherlands West Indies 1,589; Venezuela 395.
Petroleum turpentine	3,147	2,330	Netherlands West Indies 1,586; Denmark 744.
Kerosine and diesel fuel	40,043	35,808	Netherlands West Indies 24,182; Venezuela 10,839.
Heavy fuel oil	11,361	10,144	Netherlands West Indies 8,379; Venezuela 1,765.
Other petroleum products	565	721	(4).
Natural gas	84	78	All from Denmark.

[1] Bars, rods, plate, sheet, structural shapes, pipe, etc.
[2] Bars, plate, sheet, shapes, etc., of copper, aluminum, lead, zinc, tin, and alloys of these metals.
[3] Exclusive of glass and other ceramic materials.
[4] Data not available.

COMMODITY REVIEW

METALS

Lead-Zinc.—All lead and zinc produced in Greenland has been from the Nordic Mining Co., Inc. mine at Mesters Vig, a small bay off Kong Oscars Fjord on the east coast near the 72d parallel. Shares of the company are held 27.5 percent by Danish Government, 27.5 percent by private Danish investors, and 45 percent by Swedish and Canadian investors. Following exploration and testing during 1950–54, which indicated 500,000 metric tons of sulfide ore averaging 10 to 12 percent lead and 8 percent zinc, a small underground flotation mill was installed and the mine was operated seasonally from 1956 to 1962.

Despite the rigorous climate, the mine was worked (by about 80 employees) 8 to 10 months of each year. The yearly accumulation of concentrates was exported during the brief (approximately August 1 to September 15) season of open water. As anticipated from the beginning, the ore body was mined out and the operation was terminated in 1962. Total recoverable lead and zinc contained in exported concentrates amounted to 48,200 metric tons of lead and 49,850 tons of zinc. These were exported to smelters in Denmark, Belgium-Luxembourg, and The Netherlands.

Molybdenum.—Early in 1962, Nordic Mining Co., Inc., announced that it had joined with American Metals Climax Inc. in a prospecting and exploration venture based on known occurrences of molybdenum near the recently exhausted lead-zinc deposits at Mesters Vig. The newly formed Arktisk Minekompagni (Arctic Mining Co.) will have

an initial capital of 6.5 million kroner (1 krone=US$0.145) but this may be increased, if required, to 100 million kroner or more. A majority of the ownership in Arctic Mining Co. must be Danish. The concession is for 50 years and grants molybdenum and certain other minerals (exclusive of cryolite and radioactive materials) in an area of east Greenland between 71°54′ to 72°05′ north and 24°30′ west. The immediate objective is verifying the reported existence of upwards of 50 million tons of granite averaging 0.0026 percent molybdenite (MoS_2).

NONMETALS

Cryolite.—The Ivigtut mine, which until its closure in 1963 was the world's principal source of natural cryolite, is on the southwest coast of Greenland at 61°17′ north, 48°10′ west. The Danish Government owns 50 percent of the Øresund Cryolite Co., Inc., which holds an exclusive concession to mine the cryolite deposits and operates a cryolite-processing plant at Copenhagen, Denmark. During about a century of operation about 3 million metric tons of crude cryolite was extracted. From 1953 to 1963, annual production from the mine, an open pit operation employing 120 to 150 workers, was presumably 80,000 to 100,000 metric tons. Each year approximately half of this was exported and the remainder was accumulated in a stockpile which contained 700,000 to 800,000 metric tons when operation was suspended in 1963. The stockpile may be used to supply regular customers for 14 to 17 years at the present shipping rate.

About three-fourths of the exported crude cryolite goes to the company's processing plant in Copenhagen, and about one-fourth to the Pennsalt Chemicals Corp. at Natrona, Pa. The Danish plant exports refined cryolite to the consumer market of 20 or more mostly European countries; Pennsalt Corp. is the exclusive distributor in the United States and Latin America and also supplies the Aluminum Company of Canada, Ltd., which has exclusive distribution rights in Canada.

MINERAL FUELS

Coal.—Aside from annual reports on production, information regarding coal mining in Greenland has been very meager. Coal production reported in 1959–63 is presumed to represent the combined output of the commercial-scale operation near Qutdligassat on the island side of Disko Island at latitude 70° north, off the west coast of Greenland, and of several smaller mines elsewhere on Disko Island and nearby on the mainland. The Disko Island coal is described as substandard bituminous, high in ash and sulfur. The seams range from 1 to 2.5 meters in thickness. Until about 1960, when a coal cutter was purchased, no mechanical equipment was used in the mines.

A small tonnage of this coal has been shipped in some years to Denmark. However, Greenland traditionally has imported substantial quantities of coal from the United States, Canada, and the United Kingdom.

The Mineral Industry of Guatemala

By Henry E. Stipp[1]

CEMENT has been the most valuable mineral product of Guatemala. Its production increase in 1963 over that of 1962, and equivalent increases in the materials required for its manufacture, offset general declines in the output of metallic ores and concentrates sufficiently to give a 7-percent increase in value to the total mineral-industry production. The minerals industry, which furnished employment for less than 1 percent of the labor force, accounted for 0.8 percent of the gross national product of US$725 million. The labor force was officially estimated at 1.1 million persons in 1950; an occupational census has not been reported since that year. Lack of adequate transportation also has been a major factor retarding exploration and development of mineral deposits.

GOVERNMENT POLICIES AND PROGRAMS

In 1960, Guatemala signed the General Treaty of Central American Economic Integration. Under the economic integration movement, the Central American Bank for Economic Integration was created to help finance industrial enterprises. Several projects have been planned for installation in Guatemala, using loans from the Bank. Loans have been approved for textile, clothing, and printing establishments. Guatemala passed an industrial development law, which was to encourage development of new industries through tax incentives and import duty exemptions. Several government officials have expressed approval of foreign investment with preferred Guatemalan private-capital participation and the provision that such investment be used to establish industries to aid the economic development of the country.

During the year a draft of a new mining code was prepared and submitted to the Minister of Economy for study by the Council of State.

A law was passed that replaced import duties on refined petroleum products with a consumption tax. This equalized taxes on imported and domestically produced refined petroleum products. The law also increased the tax on diesel fuel to 20 percent of the retail price.

The National Economic Planning Council recommended a program of economic and cadastral studies and mapping for evaluating natural resources to be carried out by the Directorate General of Cartography over a 10-year period.

[1] Physical scientist, Division of International Activities.

SOURCE MATERIAL

The information contained in this chapter was supplied by the U.S. Embassy, Guatemala City, Guatemala, through the U.S. Department of State and supplemented by Anuario De Comercio Exterior, 1961 and 1962, Guatemala, and Overseas Business Reports, December 1962, published by the Bureau of International Commerce, U.S. Department of Commerce.

PRODUCTION

Production of metals and minerals in 1963 was valued at approximately US$6.0 million (1 Quetzal is equivalent to US$1.00); 7 percent greater than the US$5.6 million value of output in 1962. The value of nonmetals was much larger than that of metals, cement alone accounting for 74 percent of total value of metals and minerals.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Antimony, concentrate	----------	----------	----------	60	42
Antimony, metal content	88	108	64	40	28
Cadmium, in zinc concentrate----kilograms	----------	56,012	42,731	40,642	3,357
Chromite	410	181	100	20	----------
Iron ore	[1] 4,000	[1] 4,000	5,000	2,000	[2] 2,000
Lead:					
Concentrate for export	5,789	8,557	8,580	968	748
Smelted for local consumption	----------	181	56	62	47
Total (includes metal in zinc concentrate)	5,789	8,738	8,636	1,030	795
Silver----troy ounces	83,206	663,121	515,905	370,595	64,173
Zinc:					
Concentrate	([3])	18,290	14,425	----------	2,410
Metal content	([3])	10,042	7,926	816	1,169
Nonmetals:					
Cement----thousand tons	116	112	125	117	157
Clays	([3])	([3])	10,650	10,267	15,292
Gypsum	17,754	14,461	12,094	[4] 9,748	14,794
Limestone	580,000	560,000	672,000	581,725	700,665
Quartz	([3])	([3])	8,716	([3])	11,001
Salt----thousand tons	16	15	23	22	([3])
Mineral fuels: Petroleum refinery products thousand 42-gallon barrels	----------	----------	----------	----------	[1] 640

[1] Estimate.
[2] Final figure; supersedes figure given in commodity chapter, volume 1.
[3] Data not available.
[4] Incomplete data.

TRADE

A sharp reduction in the trade deficit was indicated for 1963 by preliminary estimates of the Bank of Guatemala. Exports rose to approximately US$140 million, almost US$26 million higher than the US$114 million in 1962. Imports also increased to about US$140 million, compared with imports of US$137 million in 1962. Were it not for Guatemalan dependence on foreign sources for minerals and mineral products, which in 1961 comprised 18 percent of the imports but only 1.5 percent of the exports, the trade position would have been balanced in that year. During the first three quarters of 1963 the United States, major trading partner of Guatemala, received 41 per-

cent of Guatemalan exports and supplied 48 percent of the total imports. An increase in trade with Central America was apparent during the same period. The bulk of this trade was with El Salvador.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	Principal destinations, 1961
Metals:			
Lead, ore and concentrate	9,044	15,382	United States 10,644; Netherlands 3,812; United Kingdom 926.
Lead and lead alloys, all forms	--------	54	All to El Salvador.
Nonferrous, n.e.s.[1]			
Base metals, all forms	--------	68	United States 63; Netherlands 4; Costa Rica 1.
Ore and concentrate	274	1,307	United States 1,237; Belgium 29; Japan 23.
Silver and gold----troy ounces	289	289	United States 193; Honduras 64; El Salvador 32.
Zinc and zinc alloys:			
Ore and concentrate	15,634	13,653	All to United States.
Semimanufactures	--------	1	Do.
Nonmetals:			
Asbestos	29	10	El Salvador 5; Honduras 3; Panama 2.
Cement	1,637	1,397	All to El Salvador.
Construction materials	8	2,890	El Salvador 2,887; Honduras 3.
Gypsum	1,904	412	All to El Salvador.
Lime	224	238	Do.
Salt	5	--------	
Total value, f.o.b., metals and minerals.---million US$	2.2	1.6	
Share of all exports----percent	2.0	1.5	
Total value, all exports---million US$	112.7	110.2	

[1] Not elsewhere specified.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	Principal sources, 1961
Metals:			
Aluminum and aluminum alloys: Semimanufactures.	306	376	United States 126; Switzerland and Liechtenstein 101; West Germany 44.
Copper and copper alloys:			
Unwrought, electrolytic, powder	8	6	All from United States.
Semimanufactures	137	81	United Kingdom 34; United States 17; Mexico 10.
Sulfate	1,155	414	United States 384; United Kingdom 19; West Germany 9.
Iron and steel:			
Pig and sponge iron, powder	22	23	All from Sweden.
Scrap	1	3	El Salvador 2; United States 1.
Ferroalloys	--------	1	All from United States.
Semimanufactures	37,319	30,584	France 6,036; West Germany 4,487; United States 3,933.
Other	588	1,502	West Germany 631; France 522; United States 292.
Lead and lead alloys:			
Unwrought	40	108	United States 95; Denmark 5; El Salvador 4.
Semimanufactures	4	5	All from United States.
Nonferrous base metals:			
Ores and concentrates	12	52	West Germany 36; United States 15 United Kingdom 1.
Scrap and filings	5	4	All from El Salvador.
Platinum and platinum alloys. troy ounces	--------	32	All from United States.
Silver and silver alloys: All forms---do	163,679	311,444	Mexico 308,486; West Germany, 1,704; Italy and San Marino 1,029.
Zinc and zinc alloys:			
Unwrought	9	2	All from United States.
Semimanufactures	36	41	United States 16; Belgium 12; El Salavador 10.
Tin and tin alloys, all forms	26	18	United Kingdom 6; West Germany 6; United States 5.

See footnote at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1960	1961	Principal sources, 1961
Nonmetals:			
Abrasives, all forms	70	67	West Germany 39; United States 23; Italy and San Marino 2.
Asbestos:			
Crude	225	429	Canada 336; United States 75; South Africa 18.
Semimanufactures	78	75	United States 53; West Germany 10; Canada 5.
Cement	152	155	Belgium 144; United Kingdom 7; El Salvador 4.
Boric acid	7	6	United States 4; Belgium 2.
Carbon black	121	489	United States 478; Japan 11.
Cement	1,281	1,457	Denmark 535; West Germany 519; United States 156.
Clays:			
Kaolin	2,407	1,238	United States 1,235; United Kingdom 3.
Common and refractory	15	51	United States 50.
Diamond, industrial carats	70,000	5,000	All from Denmark.
Diatomaceous earth	79	90	United States 89; Italy and San Marino 1.
Fertilizers:			
Mixed	6,521	13,608	Italy and San Marino 5,434; West Germany 3,300; Netherlands 2,462.
Nitrogenous	13,248	11,046	West Germany 5,454; Netherlands 3,472; United States 2,095.
Phosphate	2,167	549	Canada 201; Netherlands 137; United States 96.
Potash	757	84	Netherlands 57; West Germany 18; United States 9.
Graphite	(1)	1	All from West Germany.
Gypsum, calcined, powder	10	15	United States 11; United Kingdom 2; West Germany 2.
Lime, all forms	14	13	El Salvador 10; United States 3.
Lime, cement and construction materials.	1,481	1,654	Denmark 535; West Germany 519; United States 162.
Mica, uncut, unmanufactured	12	3	All from United States.
Quartz, crude	10	29	Belgium 15; United States 14.
Salt, rock or sea:			
Not refined	198	78	El Salvador 44; United Kingdom 29; United States 5.
Refined	45	39	United States 24; El Salvador 13; United Kingdom 2.
Agricultural	139	133	All from United States.
Salts and compounds:			
Aluminum	143	1,480	United States 1,475; West Germany 5.
Ammonium	37	61	United States 39; Japan 14; West Germany 7.
Calcium	383	426	United States 351; West Germany 22 United Kingdom 16.
Calcium carbide	131	199	Canada 181; United States 17; West Germany 1.
Lead	90	142	United States 92; West Germany 46; Mexico 3.
Magnesium	118	177	United States 143; West Germany 32; Italy and San Marino 1.
Potassium	232	64	West Germany 22; Spain 16; United States 14.
Zinc	68	98	Netherlands 56; West Germany 17; United States 15.
Other	2,626	2,625	Netherlands 1,388; United States 921; West Germany 126.
Sodium compounds:			
Hydroxide	1,865	2,699	United States 2,249; United Kingdom 230; Italy and San Marino 185.
Nitrate	513	1,035	Chile 908; United States 89; Netherlands 33.
Sulfate	41	184	United States 158; West Germany 26.
Sulfur, all forms	75	96	United States 95; West Germany 1.
Talc	73	95	United States 76; France 14; Canada 3.
Mineral fuels:			
Asphalt, natural	8	1	All from United States.
Coal	125	57	United States 47; West Germany 10.
Coke	141	152	United States 139; West Germany 10; Mexico 3.
Crude and partially refined oil and bunker fuel.	thousand 42-gallon barrels 1,411	1,418	Netherlands Antilles 728; Venezuela 690.

See footnote at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Refinery products:			
Asphalt_thousand 42-gallon barrels	95	33	Venezuela 32; United States 1.
Diesel oil_____do____	623	666	Netherlands Antilles 608; Mexico 26; Venezuela 18.
Gasoline_____do____	1,050	1,057	Netherlands Antilles 968; Venezuela 45; Mexico 38.
Kerosine_____do____	257	338	Netherlands Antilles 314; Trinidad and Tobago 17; United States 7.
Liquefied petroleum gas_____do____	44	82	Venezuela 71; United States 9; Netherlands Antilles 2.
Lubricants_____do____	43	42	United States 41; Other 1.
Paraffin and Petrolatum_____do____	47	45	All from United States.
Residual fuel oil_____do____	1,411	1,418	Netherlands Antilles 728; Venezuela 690.
Total value, c.i.f., million US$	25.9	24.0	
metals and minerals.			
Share of all imports_____percent	18.8	18.0	
Total value, all imports_million US$	137.9	133.6	

[1] Less than 0.5 ton.

COMMODITY REVIEW

METALS

Antimony.—Several small operations in the Department of Huehuetenango produced antimony concentrates.

Iron.—Small deposits of iron were mined near San Juan, Sacatepequez, and in the Department of Chiquimula. Ore from San Juan has an iron oxide content of 55 percent, and Chiquimula ore contains about 70 percent iron oxide. The iron was used in manufacturing cement.

Lead and Zinc.—The sharp decrease in output of lead and zinc concentrates that occurred after 1961 was attributable to closing of the Caquipec mine of Minera De Guatemala, S.A., in Alto Verapaz. Production of lead and zinc concentrates in 1962 and 1963 probably resulted from cleanup operations conducted by the new mine owners.

Manganese.—Minas y Productos de Guatemala, S.A., mined a manganese deposit of unreported size in the Department of Huehuetenango. Tests of ore indicated a manganese content of 57 percent. Reportedly, operations were primitive and were carried out with a labor force of about 100. The quantity of ore mined has not been reported in official statistics.

Nickel.—Izabal Exploration and Mining Co., a subsidiary of International Nickel Co. of Canada, Ltd., continued exploration of nickel deposits in the Lake Izabal area, near the cities of Quiriqua and El Estor. Investigations have developed 25 to 30 million tons of low grade lateritic ore (1.5 percent nickel). Plans for mining and processing the ore have been deferred pending passage of a new mining code by the Guatemalan Government and granting of a $40 million loan by the International Bank for Reconstruction and Development.

NONMETALS

Cement.—A plan to construct a US$9 million cement plant in the city of El Progreso, Department of El Progreso, was revived. Ce-

mentos Cruz, S.A., a Guatemalan owned enterprise was to receive a US$6 to $9 million loan from a U.S. investment group. The cement operation was scheduled to exploit a high-purity limestone deposit 5 miles from El Progreso. The limestone was reported to be sufficient to support production of 500 tons of cement per day for 300 years. This would be the second cement operation in Guatemala. Cementos Novella, S.A., mined limestone in 1963 for manufacture of cement from quarries in Guatemala City.

Magnesite.—Deposits of approximately 4 million tons of magnesite were discovered in the Lake Izabal region, northeastern Guatemala, by Refractories, Ltd., of Guatemala City. Plans have been initiated to mine and process between 40,000 and 50,000 tons of magnesite per year for sale in the United States, South America, and Japan.

Silica.—There is no known glass production in Guatemala; however, various firms have made studies of the resource potential for supporting a glass industry. The Central American Institute for Investigation and Industrial Technology has conducted feasibility studies on the subject. Deposits of silica are currently being mined for use in cement producing operations.

Stone.—A rock-crushing plant to produce gravel for highway construction was erected near Amatitlán. The plant was expected to produce 500 cubic meters of crushed stone daily.

MINERAL FUELS

Petroleum.—There was no exploratory drilling in 1963. Standard Oil Co. of New Jersey (ESSO), which has been drilling in the Peten region, terminated its activities in October 1962 with completion of a dry hole. Two other organizations that had planned to drill abandoned these plans after the ninth dry well was drilled in Guatemala.

Refinery Products.—The first petroleum-refining plant in Guatemala, jointly owned by Standard Oil Co. of California and the Shell Oil Co. of Canada, Ltd., began operating near Matiás de Gálvez early in 1963. Construction was started on a second refining plant near Escuintla by the Texaco Co. The plant and a pipeline between the plant site and the port of San José was estimated to cost US$10 million. The plant was scheduled to start operating at the close of 1964.

The Mineral Industry of Honduras

By Henry E. Stipp[1]

THE QUANTITY and value of most metals and minerals produced by Honduras in 1963 increased significantly. Silver output decreased slightly in quantity, but increased in value. Approximately 0.3 percent of the labor force of 579,400 persons (1961 census) was employed by the minerals industry. Minerals resources of the Republic include gold, silver, copper, lead, zinc, cadmium, antimony, mercury, salt and coal; however, transportation difficulties have hindered exploration and exploitation of many prospects.

GOVERNMENT POLICIES AND PROGRAMS

The government of Honduras has recognized and guaranteed the freedom of private enterprise. Laws accord the same rights and privileges to foreign private capital as prescribed for domestic capital. In 1960, Honduras signed the General Treaty of Central American Economic Integration (the Central American Common Market), which provided for free circulation of persons, goods, and capital within member countries. A common tariff on commodities coming from nonmember countries also was provided. A unified customs area was planned for 1965. The government has studied the feasibility of building a network of roads in the Sula Valley Department of Cortes to aid transport of goods to market. The Inter-American Bank for Economic Development authorized a loan of $1.5 million for construction of these roads, which should also enhance the potential for discovery and development of economic mineral deposits.

A hydroelectric plant was being constructed by the government at Lake Yojoa. Power, which will be available in 1964, will benefit many industrial establishments such as the El Mochito mine of the New York & Honduras Rosario Mining Co.

SOURCE MATERIAL

The information contained in this chapter was supplied by the U.S. Embassy, Tegucigalpa, Honduras, through the U.S. Department of State. It was supplemented by Commercio Exterior de Honduras, 1961 and 1962; Tegucigalpa, May 1963.

PRODUCTION

The value of Honduras metal and mineral output in 1963 increased 3 percent over that of 1962. Silver was the only commodity to decrease

[1] Physical scientist, Division of International Activities.

in quantity. One producer reported a decline in the silver content in its ore, which was countered somewhat by increased efficiency of metallurgical recovery processes.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Cadmium, content of ore	----------	4.5	4.6	15.6	[1] 33.2
Copper, content of ore	----------	1	----------	----------	----------
Gold, troy ounces	3,073	2,731	2,274	2,811	3,070
Lead, content of ore	4,177	5,364	6,134	5,917	[1] 8,300
Silver, troy ounces	3,167,376	[2] 2,948,341	3,544,702	[2] 3,179,658	[1] 3,164,000
Zinc, content of ore	3,816	4,486	6,273	6,584	[1] 11,000
Nonmetals:					
Cement	11,296	34,322	41,890	55,913	60,480
Lime, calcined	12,429	10,796	10,433	([3])	([3])
Salt	([3])	[4] 2,881	([3])	([3])	[4] 3,190

[1] Estimate.
[2] Final figure; supersedes figure given in commodity chapter, volume I.
[3] Data not available.
[4] Exports.

TRADE

Honduran imports in 1963 totaled US$95.1 million, compared with US$79.8 million in 1962. Imports from other Central American countries increased 50 percent over those of 1962; those from the United States increased 10 percent. Commodity gains were most significant in manufactured, processed, and semiprocessed materials and food. Exports (including reexports) increased to US$83.5 million from US$77.2 million in 1962. Exports to Central America, consisting principally of agricultural products, increased by 3 percent. Most of the foreign trade was with the United States, Guatemala, and El Salvador. Imports from Nicaragua and Costa Rica were up sharply.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1961	1962	Principal destinations, 1962
Metals:			
Gold, troy ounces	2,310	2,803	All to United States.
Iron and steel	6,962	74	El Salvador 56; United States 11; Japan 5.
Lead, ore and concentrate	7,973	8,573	All to United States.
Silver, all forms, troy ounces	3,327,020	2,905,530	Do.
Zinc, ore and concentrate	12,326	9,785	Do.
Nonmetals:			
Cement	17,000	22,816	El Salvador 17,827; Belgium 4,403; Mexico 574.
Lime	1	17	All to El Salvador.
Salt	954	1,736	Do.
Total value of metal and mineral exports. million US$	5.8	5.7	
Total value of all exports, f.o.b. million US$	72.3	77.2	
Percent of mineral exports to all exports. percent	8.0	7.4	

[1] In addition to commodities listed, Honduras exports its entire cadium output as a constituent of nonferrous ores and concentrates.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum and aluminum alloys, semimanufactures.	90	109	United States 104; West Germany 2.
Arsenic, salts and compounds	----------	5	All from United States.
Bismuth, salts and compounds	----------	1	All from France.
Cadmium, salts and compounds	----------	1	All from United States.
Copper and copper alloys:			
Unwrought	1	1	Do.
Semimanufactures	56	46	United States 34; Mexico 8.
Sulfate	301	45	United States 31; Belgium 14.
Iron and steel: Pig, sponge and powder.	2	16	United States 14; Belgium 2.
Steel:			
Ingots and equivalent primary forms.	115	823	United States 791; West Germany 31; France 1.
Semimanufactures	9,303	14,630	Belgium 4,922; United States 4,562; France 1,853.
Lead and lead alloys:			
Unwrought	4	5	United States 4; West Germany 1.
Semimanufactures	21	9	United Kingdom 3; United States 3; Sweden 1; Hong Kong 1.
Silver and silver alloys: troy ounces. Unworked and partly worked.	386	245,497	Austria 242,508; United States 2,732; Sweden 257.
Tin and tin alloys:			
Unwrought long tons	4	5	United States 4; United Kingdom 1.
Semimanufactures do	2	2	United Kingdom 1; United States 1.
Zinc and zinc alloys:			
Unwrought	20	20	All from Belgium.
Semimanufactures	70	232	United States 231; Japan 1.
Nonmetals:			
Abrasives	25	84	United States 65; El Salvador 8; West Germany 6.
Asbestos	29	37	United States 21; Canada 5; United Kingdom 4.
Barium, salts and compounds	2	3	United Kingdom 2; United States 1.
Boric acid	1	1	All from United States.
Clays:			
Kaolin	48	18	United States 10; Guatemala 3; El Salvador 1.
Refractory and common	21	17	United States 9; El Salvador 5; United Kingdom 3.
Diamond carats	205,000	405,000	All from United States.
Diatomaceous earth	83	96	United States 93; Mexico 3.
Fertilizers:			
Nitrogenous	11,919	12,125	West Germany 8,229; Netherlands 1,152; United States 1,086.
Potassic	90	1,849	United States 1,842; West Germany 5; El Salvador 2.
Phosphatic	138	589	United States 579; West Germany 10.
Other [1]	630	769	United States 499; West Germany 181; El Salvador 78.
Graphite	3	2	All from United States.
Gypsum	59	13	United States 11; Italy 1; Mexico 1.
Lime	74	175	United States 164; El Salvador 5; Guatemala 5.
Quartz	20	8	United States 7; El Salvador 1.
Salt, all forms	984	1,906	El Salvador 1,734; United States 172.
Sodium hydroxide	691	633	United States 320; United Kingdom 232; Italy 77.
Sulfur, all forms	6	5	All from United States.
Talc, natural and ground	18	16	Italy 12; United States 3; United Kingdom 1.
Mineral fuels:			
Coal	153	184	United States 172; West Germany 12.
Coke	10	5	All from West Germany.

See footnote at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Mineral fuel—Continued			
Crude oil, partially refined. thousand 42-gallon barrels	694	543	Netherlands Antilles 405; Trinidad 71; Venezuela 67.
Gasoline do	348	384	Netherlands Antilles 313; United States 44; Trinidad 27.
Kerosine do	84	99	Netherlands Antilles 68; Trinidad 18; United States 11.
Gas and diesel oil do	570	558	Netherlands Antilles 491; Trinidad 48; United States 19.
Lubricants do	45	31	United States 30.
Petrolates do	5	4	All from United States.
Asphalt and coke do	47	17	Netherlands Antilles 11; Venezuela 5; United States 1.
Liquid petroleum gas do	11	11	All from Venezuela.
Total value of metals, nonmetals and mineral fuel imports. million US$	9.7	10.6	
Total value of all imports, c.i.f do	72.0	79.8	
Percent of mineral imports to all imports. percent	13.5	13.3	

[1] Mixed fertilizers, natural sodium nitrate, crude potash salts.

COMMODITY REVIEW

METALS

Two mining companies were active in 1963, producing metal and metal concentrates from sulphide and oxide type ores. Compania Minera Los Angeles, S.A., produced lead and zinc concentrates that also contained silver and cadmium at its mine near the town of Valle de Angeles, Department of Francisco Morazán. The New York & Honduras Rosario Mining Co. produced lead and zinc concentrates and gold and silver bullion at its El Mochito mine near Lake Yojoa, Department of Santa Bárbara. The entire output of these companies was exported to the United States.

Gold.—Four locations were recommended by a nonprofit Honduran organization for exploration of possible commercially workable gold deposits. A cyanide extraction plant was scheduled for construction at one site near Moramulca. Another deposit at El Transito was considered to be too small for mining by a large organization. A thorough sampling of the surface was recommended for a location at Alhambra, Department of El Paraiso. At Clavo Rico, near the town of El Corpus, investigation by two organizations disclosed a small high-grade ore zone of unknown lateral extent.

Iron and Steel.—A semi-integrated steel mill of 50,000 metric tons billet capacity was planned for erection in Honduras. Eight to 10 million tons of high-grade magnetite was estimated to be available probably from beach sands and magnetite deposits in the vicinity of Tegucigalpa. A limited supply of coking-grade coal was indicated. Charcoal could be used instead of coke.

Lead and Zinc.—Compania Minera Los Angeles, S.A., was developing deep underground workings at its Las Animas mine, 35 kilometers east of Tegucigalpa. The main shaft was deepened 500 feet below the

main haulage level and new lateral levels were driven to expose ore veins. A 6,000-foot drainage tunnel also was started to dewater the mine.

Silver.—The New York & Honduras Rosario Mining Co. planned to double its milling capacity at its El Mochito mine by 1966. The company ore reserve was estimated to be 1,019,000 tons.

On December 20, a 5-percent tax was levied on exports of silver concentrates.

NONMETALS

Cementos de Honduras obtained a $1.5 million loan from the Central American Bank for Economic Integration to purchase equipment for increasing production from 150 tons to 300 tons of cement per day. The plant, established near San Pedro Sula in 1959, exported more than US$500,000 worth of cement to other Central American countries in 1963. It was the only cement plant in the country.

MINERAL FUELS

Coal.—Bituminous and sub-bituminous coal beds near Danli, Pataste, and Moroceli, Department of El Paraiso; Yoro, Department of Yoro; and Sabanagrande and Curarén, Department of Francisco Morazán are estimated to contain 5 million tons of coal. None are developed.

Crude Oil.—Pure Oil Co. capped a dry hole in the Mosquitia area near Puerto Lempira, Department of Gracias a Dios, where it had invested more than US$2 million in exploration. The company had no plans to resume drilling.

Petroleum.—Honduran requirements for more than 1 million barrels of petroleum products and half a million barrels of crude and semirefined petroleum annually have been supplied by imports from The Netherlands Antilles, Trinidad, and the United States. Crude and partially refined petroleum was probably used as fuel oil. No new concessions were granted in 1963. The new Petroleum Code was adopted and the Petroleum Law was amended to make it conform with the new code.

The Mineral Industry of Mexico

By Henry E. Stipp [1] and Sumner M. Anderson [2]

MEXICO is one of the leading mineral producing countries of the world. In 1963 it was first in output of silver, as it has been for many years, and produced significant quantities of copper, iron, lead, zinc, sulfur, fluorspar, petroleum, and natural gas. Approximately 24 other metal and mineral commodities were produced in various quantities. A large part of the smelting and refining of metals and the refining of petroleum was carried out within the country. The increase in value of metallic and nonmetallic mineral production from US$614 million in 1962 to about US$650 million in 1963 was in part due to increased prices on the world markets for silver, copper, and lead, although production of silver and copper increased in quantity as well. The mining industry employed an estimated 55,000 persons in 1963, about 0.4 percent of the estimated 13.8 million labor force.

Exports of metals, nonmetals, and mineral fuels were estimated at about US$268 million in 1963 compared with US$233 million in 1962. The United States continued to be the primary market for Mexican metals, nonmetals, and mineral fuels, receiving over US$160 million or about 60 percent of Mexican exports.

Mexican imports of metals, nonmetals, and mineral fuels were insignificant compared with exports.

The mineral industry as a whole accounted for 28 percent of the foreign exchange earnings in 1963, although according to the Mexican Confederation of National Chambers of Commerce the national economy was becoming less dependent on mineral exports.

Of the reported 1963 Mexican gross national product (GNP) equivalent to US$6.7 billion in terms of 1950 dollars, the mining industry provided 1.9 percent, or US$134 million; while petroleum and coke producers supplied 3.3 percent, or US$221 million. Data are not reported separately on the contribution of several sectors of the total mineral industry, including the iron and steel, cement and other construction materials, ceramics, and mineral fertilizer industries; these are grouped with other industries in official statistics. The relationship of the minerals industry to other sectors of the economy, in terms of contribution to GNP in constant (1950) dollars, and rate of growth during 1963 was as follows:

[1] Physical scientist, Division of International Activities.
[2] Chief, Latin America specialist, Division of International Activities.

Industry	Share of 1962 GNP (percent)	Share of 1963 GNP (percent)	Rate of growth (percent increase of value of output in terms of constant 1950 dollars)
Mining	2.0	1.9	3.5
Petroleum and coke	3.3	3.3	6.2
Agriculture	12.6	12.0	1.5
Livestock	6.0	5.7	3.0
Forestry	.3	.3	9.3
Fishing	.2	.2	5.2
Manufactures	23.7	24.3	9.2
Construction	3.3	3.6	15.7
Electrical energy	1.3	1.5	9.6
Transportation and communications	4.6	4.5	4.3
Commerce	26.1	26.1	6.3
Government	2.8	2.8	5.2
Other services	13.8	13.8	6.3
Total and average	100.0	100.0	6.3

GOVERNMENT POLICIES AND PROGRAMS

The policy of the government of Mexico continued to be to foster and promote the development of the nation's economic and social welfare by and for Mexicans. Since the reform constitution of 1917 the policy has effected a more balanced integration of economic and social progress than in any other Latin American republic, but has not provided an environment conducive to the most expeditious development and utilization of mineral resources. Chief among the deterrents has been the heavy burden of multiple taxation imposed on the mineral industry. The petroleum segment and the major part of the coal segment of the industry have been nationalized; iron ore, sulfur, and a growing number of other mineral resources have been placed in the national reserve.

Mexicanization of the mining industry was introduced by the new Mining Law of February 6, 1961, which restricted the issuance of new mining and treatment plant concessions to Mexicans or to companies, the majority of whose capital has been subscribed by Mexicans. Foreign companies were permitted to continue holding and operating the concessions granted to them previously under the terms of their original agreements for an additional 25 years, but were encouraged to "Mexicanize" by being offered a 50-percent reduction in production and export taxes to do so. By 1963 most foreign companies had exercised this option by selling 51 percent of their stock to Mexican nationals, but found the Mexican Government extremely slow in effecting the tax reduction provision. In July 1963 additional legislation was passed to permit Mexicanization by deposit of 51 percent of company shares in trust in the Bank of Mexico for subsequent sale to qualified Mexican investors. (The American Smelting & Refining Co. had been unable to find sufficient Mexican capital offerings for Asarco's majority stock.) An analytical report of the objectives and results of the 1961 Mining Law was published in 1963.[3]

A presidential decree of August 17, 1963, created an exception to the prohibition against export of iron ore from deposits in Baja

[3] Mining World. Mexicanization: It's Impact on the Mining Industry of Mexico. V. 25, No. 3, March 1963, pp. 12–15.

California. The Secretary of Industry and Commerce was given authority to allocate a 10-million-ton quota among persons or companies qualifying as exporters under certain conditions.

Officials reported that the government would develop, directly or indirectly, the Peña Colorada iron ore deposits in the state of Colima.

Compañía Minera Asarco, an affiliate of American Smelting and Refining Co. of the United States, brought suit in Mexican courts to stop enforcement of a presidential decree canceling titles to the company's coal mines near Nueva Rosita, Coahuila, which had been excluded from the original nationalization of coal deposits. The courts ruled that the decree put private mine owners in the same position as the possessors of ordinary mining concessions, antedating the effective date of the 1961 Mining Law. A later presidential decree (August 17, 1963) in effect ratified the finding of the federal court and declared invalid certain sections of the decree (August 30, 1963) that canceled private rights to exploit coal deposits.

The mining law of 1961 was expected to be amended as proposed by the Small Miner's Association and the Mexican Mining Chamber. The amendments probably would remove onerous obligations imposed in the 1961 law and regulations of 1962 on filing and marking of claims and restore some rights to prospectors. The changes reportedly would benefit the entire industry.

The Mexican Government has passed a law whereby a company would be required to share a certain amount of its profits with its labor force.[4] The exact form of the law was being studied by a commission for enforcement purposes. This law could negate recent attempts of the Mexican Government to ease the tax burden on its mining industry.

Extensive mineral rights in the state of Durango were taken into the national mineral reserve program, apparently for exploitation of the iron, chrome, cobalt, copper, nickel, and manganese deposits.[5]

SOURCE MATERIAL

The information contained in this chapter was supplied by the U.S. Embassy, Mexico City, Mexico, through the U.S. Department of State. It was supplemented by Revista de Estadistico May 1962, February 1963, and February 1964, and by Annuario Estadistico del Comercio Exteriór de Los Estados Unidos Mexicanos, 1962. Mexican Government sources are not permitted to release data showing the production of individual mines or companies. Several publications from which supplemental information has been extracted are cited in other sections of the chapter.

PRODUCTION

Mexican mineral statistics, which have never held the finality implied by assembly to the last digital unit, have always been particularly enigmatic in the latest year of availability—in this instance 1963. Measured in value of output as estimated by the Direccion de Minas y Petroleo, Mexico's mineral production in 1963 increased over that of 1962 by 8.6 percent in metals and 7.5 percent in nonmetals. According

[4] Engineering and Mining Journal. Metal and Mineral Markets, Oct. 14, 1963, p. 3.
[5] Mining Annual Review (London). Mexico, June 1964, p. 221.

to values ascribed by the Direccion de Estadistica, however, the value increases were 10.7 percent for metals and 8.1 percent for nonmetals. Adding to both of these the 2.8-percent increase in the dominant petroleum sector of the industry as estimated by the Banco de Mexico, the overall gain in total mineral output value was 5.0 percent, using Direccion de Minas y Petroleo figures, or 5.6 percent, using Direccion de Estadistica figures.

These group discrepancies do not appear to be overwhelming, and examination of individual items shows no appreciable contradictions in the reported increases for tin, cement, sulfur, and coal, or decreases for arsenic, molybdenum, tungsten, fluorspar, and salt. For other items, however, differences vary as follows, and are particularly significant for such high-value commodities as gold and silver, iron ore, lead, and manganese ore. As shown in the following table, the up-and-down trends in gold, manganese, and graphite are reversed by the two agencies.

Commodity	1963 production, as reported by Direccion de Minas y Petroleo			1963 production, as reported by Direccion de Estadistica		
	Quantity (metal content) metric tons	Value (thousand pesos)	Percent change from 1962	Quantity (metal content) metric tons	Value (thousand pesos)	Percent change from 1962
Antimony	4,836	42,456	+5	[1] 4,826	42,359	+3
Bismuth	400	24,800	+12	[1] 427	26,473	+20
Cadmium	868	52,685	+81	724	44,249	+52
Copper	55,098	431,311	+17	[1] 55,861	437,377	+18
Gold	7.103	97,944	−4	[1] 7.401	103,166	+8
Iron ore	1,426,740	370,952	+3	[1] 1,396,882	363,189	+26
Lead	184,334	553,776	+2	[1] 189,987	570,917	+11
Manganese ore	[1] 77,786	129,125	+24	54,341	90,206	−14
Mercury	593	40,492	−11	[1] 562	38,236	−7
Selenium	2	374	+111	[1] 2.874	314	+77
Silver	1,297.241	660,903	+20	[1] 1,330	676,815	+23
Zinc	[1] 241,096	822,330	−2	239,818	817,253	−3
Barite	[1] 256,954	36,898	−17	256,593	35,923	−19
Graphite	18,303	13,930	−37	[1] 29,996	22,797	+3

[1] Data selected tentatively for use in the mineral production table presented in this chapter, but are subject to revision on reconciliation of differences between the two official reporting agencies.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals					
Antimony:					
In untreated ore and concentrate	2,308	2,900	3,018	3,924	3,899
In smelter products	978	1,331	590	842	927
Total	3,286	4,231	3,608	4,766	4,826
Arsenic oxide (metal content)	10,465	12,131	12,281	10,903	9,486
Bismuth—kilograms	239,300	271,900	[1] 292,000	354,000	427,000
Cadium:					
In flue dust (exports)—kilograms	940,693	544,719	1,159,970	[1] 630,000	[2] 539,529
Refined metal—do	60,250	80,996	47,311	[2] 28,788	[2] 7,623
Chromite		3	5		
Copper:					
In ores mined	57,274	60,330	49,314	47,125	55,861
Smeltered and refined	55,434	58,841	47,625	45,520	54,337
Gold—troy ounces	313,663	300,256	268,684	236,758	237,948
Iron ore:					
60 percent Fe equivalent	892,200	868,760	1,145,000	1,818,850	2,328,137
Iron content of ore (as reported)	535,320	521,256	687,000	1,091,310	1,396,882

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals—Continued					
Iron and steel:					
Pig iron	559,227	669,265	757,759	801,324	833,118
Sponge iron	72,635	114,832	173,891	165,647	169,735
Ferroalloys	16,709	16,275	26,156	25,739	25,917
Steel ingots	1,328,142	1,491,778	1,693,076	1,710,662	2,016,883
Steel castings	7,987	10,970	13,706	9,382	11,382
Semifinished and finished steel	(1)	1,307,234	1,329,430	1,278,905	1,379,794
Lead:					
In ore and concentrate	190,680	190,670	181,326	193,298	189,987
In smelter and refinery products	187,002	186,212	176,426	189,100	186,170
Manganese ore 44.8 to 46.1 percent Mn	165,000	155,500	141,400	167,700	171,700
Mercury—76-pound flasks	16,420	20,114	18,101	18,855	17,202
Molybdenum ores:					
Molybdenum sulfide (MoS_2) content—kilograms	44,443	100,452	5,035	97,218	68,755
Molybdenum (Mo) content—kilograms	26,666	60,271	3,021	58,331	41,253
Nickel, in ore	159	30	132		
Selenium—kilograms	4,033	3,150	2,559	3,154	2,874
Silver—troy ounces	44,075,291	44,526,463	40,349,181	41,249,402	42,760,487
Strontium ore (U.S. imports from Mexico)	1,979	2,613	2,397	4,131	5,875
Tin:					
In ores mined—long tons	378	372	530	576	1,056
Refined—do	377	365	559	520	1,056
Titanium, ilmenite					141
Tungsten ore, 60 percent WO_3 equivalent	125	184	175	80	33
Zinc:					
In ore and concentrate	263,935	262,425	268,973	250,683	241,096
In smelter and refinery products	55,667	52,905	51,818	56,908	56,751
Nonmetals:					
Agate—kilograms	2,108	5,300	400	(2)	(2)
Barite	285,703	270,757	248,708	318,136	256,595
Calcite—kilograms	49	107	(2)	(2)	(2)
Cement:					
Gray	2,647,907	3,024,253	2,969,701	3,284,569	(2)
White	60,939	64,875	65,383	67,540	(2)
Total	2,708,846	3,089,128	3,035,084	3,352,109	3,680,072
Clays:					
Kaolin	61,158	73,976	60,700	(2)	46,561
Refractory	33,498	20,453	37,753	(2)	(2)
Common	2,772	5,647	5,797	(2)	(2)
Bentonite	(1)	(2)	(2)	(2)	4,245
Dolomite	65,781	46,743	68,300	(2)	(2)
Feldspar	10,819	9,127	14,833	(2)	(2)
Fluorspar:					
Production	328,815	366,945	398,514	502,256	481,619
United States imports from Mexico:					
Acid grade	141,309	114,472	111,311	177,266	171,503
Metallurgical grade	264,582	287,872	291,034	261,732	301,727
Total	405,891	402,344	402,345	438,998	473,230
Graphite, amorphous	27,836	34,315	18,004	29,023	29,996
Gypsum	827,842	789,789	777,898	794,554	1,097,339
Lime (mortar)	(1)	(2)	(2)	(2)	88,318
Limestone:					
For cement (estimate)—thousand tons	3,520	4,020	3,950	4,360	4,780
Other—do	945	1,163	1,067	(2)	(2)
Total (estimate)—do	4,465	5,183	5,017	(2)	(2)
Perlite	3,311	6,030	7,238	(2)	(2)
Phosphates:					
Rock phosphate	29,768	27,500	29,642	[1] 30,000	[1] 30,000
Calcium superphosphate	(1)	(2)	106,637	109,400	(2)
Guano, beneficiated	(1)	(2)	69	456	(2)
Refractory material, undefined	1,384	985	591	(2)	(2)
Salt—thousand tons	520	994	1,063	1,292	1,225
Sand, silica	98,387	123,808	136,800	[1] 145,000	154,978
Sodium-magnesium sulfate (blödite)	5,014	21,312	7,626	(2)	(2)

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals—Continued					
Sulfur:					
Frasch processed	1,293,181	1,261,574	1,148,494	1,350,375	1,480,026
Mined	[1] 17,700	[1] 17,700	25,116	26,751	29,443
Recovered from natural gas	46,231	46,839	52,849	47,939	44,003
Total	[1] 1,357,100	[1] 1,326,100	1,226,459	1,425,065	1,553,472
Talc	3,683	4,372	4,188	[1] 4,000	[1] 4,000
Mineral fuels:					
Bituminous coal—thousand tons	1,605	1,776	1,818	1,893	2,071
Coal products:					
Coke—do	861	835	781	780	905,905
Coke breeze (finos de coque)					21,265
Coal tar					11,628
Creosote	[3]	[3]	11,145	9,981	10,747
Ammonium sulfate	[3]	[3]	9,733	9,325	8,855
Benzol	[3]	[3]	3,907	4,104	5,190
Naphthaline					273
Synthetic carbon brushes and rings					12
Coal gas—thousand cubic feet					2,971
Natural gas—million cubic feet	348,112	360,691	381,027	392,444	424,371
Petroleum:					
Crude (include distillates and natural gas liquids) thousand 42-gallon barrels	105,755	108,768	116,816	121,559	125,825
Refinery products:[4]					
Gasoline:					
Aviation thousand 42-gallon barrels	376	413	688	640	648
Other (including naphthas)—do	26,517	27,175	31,781	32,487	33,860
Total gasoline—do	26,893	27,588	32,469	33,127	34,508
Jet fuel—do	66	176	494	609	786
Kerosine—do	11,394	10,807	11,601	11,680	11,706
Distillate fuel oil—do	10,997	13,003	13,716	15,658	16,977
Residual fuel oil—do	43,990	42,068	47,432	45,185	42,551
Lubricants, including greases—do	1,042	1,080	1,148	1,141	1,220
Asphalts—do	1,456	1,898	1,778	2,061	2,004
Liquid petroleum gas—do	3,654	3,888	5,064	4,652	5,793
Other—do	2,005	1,714	1,952	1,891	2,261
Total petroleum products—do	101,497	102,222	115,654	116,004	117,806
Refinery losses—do	3,261	4,884	3,115	2,256	1,611
Petrochemicals:					
Light Alkaloids	[3]	2,265	3,651	6,045	5,056
Dodecylbenzene	[3]	10,314	19,600	27,213	20,584
Heavy alkaloids	[3]	1,043	4,332	6,845	3,844
Ammonium sulfate				260	217
Ammonia				57,315	103,393
Carbon dioxide				65,562	125,789

[1] Estimate.
[2] United States general imports.
[3] Data not available.
[4] Figures credited to Petróleos Mexicanos in Revista de Estadistica, February 1964. They differ somewhat from those appearing in Volume II of the Minerals Yearbook and elsewhere, which are also credited to Pemex.

TRADE

Exports of metals, nonmetals, and mineral fuels increased 15 percent in value from US$233 million in 1962 to approximately US$268 million in 1963. Exports of gold decreased by 18 percent in quantity and value in 1963. The metal ranked 10th as an exchange earner. Greater use of gold in the creative arts and coinage was reported to be responsible for the decrease in exports. Silver exports increased 37 percent in quantity and 62 percent in value. A large part of the increased volume of silver exported was reported to come from stocks, inasmuch as production increased only 3.6 percent over that of 1962. Exports and value of copper increased 21 percent over 1962. Lead exports were about the same in quantity, but value increased by 13 percent. The major metallic export was zinc; however, despite favorable prices, the quantity and value decreased, 5 percent and 4 percent respectively from that of 1962. Some U.S. importers were unable to obtain supplies. Exports of antimony, graphite, arsenic, bismuth, and cadmium increased in quantity and value 1 percent, 2 percent, 11 percent, 15 percent, and 20 percent respectively. Exports of other metals that decreased in quantity and value included mercury 6 percent, tin 53 percent, tungsten 53 percent, and molybdenum 30 percent. The decrease in tin reflected increased use of the metal by Mexican processors.

Iron ore exports decreased 98 percent both in volume and value in 1963, reflecting increased domestic demands of the growing steel industry, which also apparently accounted for the 13 percent drop in the volume and value of manganese shipments. Sulfur exports increased 10 percent in volume and 13 percent in value over that of 1962. Exports of crude and residual fuel oil increased 2 percent during 1963. Most of this went to the United States by special agreement. Facilities are not available in Mexico for converting certain types of crude containing heavy fractions, such as coke, to petroleum products.

Mexican imports of metals, nonmetals, and mineral fuels in 1963 were negligible. Small quantities of petroleum products were imported from the United States to supply Baja California, owing to poor Mexican facilities for transporting oil to that region. Authorities were considering importing reconstituted crude from Venezuela or Libya to keep certain refineries operating at full capacity. Petroleum products from this crude would be exported to Europe.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Antimony:			
Ore	9,493	12,062	All to United States.
Mixed bars	89	172	United States 166.
Refined bars	41	103	All to United States.
Arsenic oxide	13,343	8,473	Do.
Bismuth:			
Mixed bars	1,344	300	Do.
Refined bars	93	124	United States 114.
Cadmium:			
Concentrate	----------	45	All to United States.
Refined	47	28	United States 17; France 7.
Dust	1,160	1,054	All to United States.
Copper:			
Ore and concentrate	3,553	7,022	United States 7,002.
Mixed bars	21,079	24,435	United States 22,247; Italy 1,494; West Germany 694.
Refined, ingots, anodes and bars.	3,382	5,009	Brazil 3,972; United States 657; Argentina 380.
Semimanufactured alloys	629	1,269	Colombia 302; Puerto Rico 250; United States 236; Uruguay 177.
Gold troy ounces	42,988	36,435	United States 36,430.
Iron and steel:			
Iron ore	122,768	147,056	All to United States.
Pig iron	46,096	264	United States 260.
Ingots	1	6,978	Venezuela 6,966.
Sheets, plates, and strip	5,770	23,391	United States 19,286; Brazil 3,445.
Bars	4,687	34	United States 28.
Girders and beams	(1)	48	All to Guatemala.
Wire	449	89	United States 83.
Pipes, tubes and accessories	15,523	17,993	United States 16,075; El Salvador 828.
Ferroalloys	2,616	5,083	All to United States.
Lead:			
Ore, concentrate, matte and speiss.	3,959	4,413	Do.
Mixed bars	17,664	10,575	United States 4,390; Netherlands 2,629; Sweden 2,234.
Antimonial bars	1,603	341	Venezuela 120; Sweden 102; United States 91.
Refined bars	150,533	123,507	United States 79,663; Belgium 13,582; Italy 7,632; Netherlands 7,607.
Oxides:			
Litharge	16,875	20,704	United States 15,165; Italy 1,439; Venezuela 810; Netherlands 736.
Red lead	1,567	2,012	West Germany 567; Netherlands 485; United States 360.
Manganese:			
Ore	36,860	37,315	All to United States.
Concentrate	140,297	95,058	United States 95,018.
Mercury 76-pound flasks	19,248	21,734	United States 13,561; Japan 4,341; United Kingdom 1,240.
Molybdenum concentrate	21	113	United States 70; Netherlands 22; France 21.
Silver troy ounces	30,774,529	33,544,541	United States 14,455,488; West Germany 10,519,594; United Kingdom 2,595,114.
Tungsten concentrate	452	61	All to United States.
Zinc:			
Ore, concentrate and other impure forms.	412,593	358,768	United States 351,307.
Refined	27,763	29,411	United States 10,219; Brazil 9,256.
Other metals	12	32	Mainly to United States.
Total value, metals thousand pesos	1,611,924	1,520,224	
Nonmetals:			
Abrasives:			
Industrial diamond carats	40,000	60,000	All to United States.
Pumice	235	1,606	Do.
Barite	126,656	219,741	Do.
Cement	3,616	13,104	Do.
Clays:			
Bentonite	11	1	All to Colombia.
Refractory	168	226	United States 200; Colombia 15.
Flourspar:			
Acid grade	75,825	96,089	United States 93,702.
Ceramic and metallurgical grades.	338,623	372,215	United States 286,067; Canada 86,078.
Fertilizer, phosphate rock	24,344	27,727	All to United States.
Graphite	17,637	30,218	United States 30,172.

See footnote at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Nonmetals—Continued			
Gypsum, crude	711,910	638,858	United States 505,579; Republic of Korea 39,766; Canada 29,936.
Lime	12	773	All to United States.
Magnesite	869	50	Do.
Mica, crude	15	7	Do.
Salt	718,664	1,064,002	Japan 578,849; United States 400,250; Canada 84,886.
Sand and gravel	2,391	1,474	United States 1,457.
Sodium sulfate (blöedite)	2	20	All to United States.
Stone, building	42,603	35,580	United States 35,440.
Stones, semipre- kilograms cious, uncut	1,973	10,105	United States 9,000; France 1,100.
Strontium minerals (celestite)	2,528	4,269	All to United States.
Sulfur	1,154,689	1,330,996	United States 888,459; United Kingdom 90,929; France 72,458; Republic of South Africa 72,038.
Other nonmetallic minerals	5,000	5,111	Mainly to United States.
Total value, thousand pesos nonmetals	600,695	901,105	
Mineral fuels:			
Petroleum:			
Crude thousand 42-gallon barrels	6,486	7,376	United States 7,375.
Gasoline do	357	27	All to Guatemala.
Gas oil and diesel do	92	73	Guatemala 23; United States 13; Denmark 8; Liberia 8.
Residual do	7,925	11,345	United States 11,000; Denmark 110; Liberia 104.
Gas liquids	2	89	All to United States.
Lubricants	147	236	United States 202; Guatemala 31.
Other products	715	1,606	All to United States.
Natural gas, thousand cubic meters.	1,656,416	1,376,905	United States 1,376,773.
Total value, min- thousand pesos eral fuels	430,318	486,102	
Total value, metals and min- do erals.	2,642,937	2,907,431	
Percentage of all exports	26.3	25.8	
Total value, all thousand pesos exports.	10,044,313	11,262,007	

[1] Less than 1 ton.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Ore, bauxite	8,949	7,363	All from United States.
Aluminum oxide	1,958	2,863	United States 1,518; West Germany 1,296.
Ingots and equivalent primary forms.	10,333	15,924	United States 14,335; Canada 789; Austria 788.
Semimanufactures and scrap.	296	1,480	United States 1,072; Canada 301; Switzerland 73.
Cobalt kilograms	6,576	7,717	Belgium 7,700.
Copper:			
In primary forms:			
Unalloyed	11	29	West Germany 24.
Alloyed	8	27	United States 14; West Germany 13.
Semimanufactured alloys and scrap.	316	245	United States 148; West Germany 79.
Gold:			
Wire troy ounces	12	12	All from United States.
Sheets do	3,070	3,412	West Germany 2,872; United States 540.
Powder do	13,354	6,646	United States 6,636.
Iron and steel:			
Iron ore	38	6,019	Venezuela 6,000.
Ferroalloys	1,576	1,535	United States 865; West Germany 310; Belgium 158.
Pig iron	436	(1)	All from United States.
Scrap	368,369	288,675	United States 288,609.
Ingots and castings	1,916	864	United States 663; West Germany 104.
Sheets, plates, and strip	12,698	10,652	United States 7,649; Japan 797; West Germany 611; United Kingdom 498.
Bars	11,852	11,722	United States 5,011; West Germany 2,057; United Kingdom 1,508.
Girders and beams	5,465	2,727	United States 1,885; United Kingdom 553.
Wire	4,117	1,376	United States 516; West Germany 492; Belgium 200.
Pipes, tubes and accessories	16,888	9,930	United States 7,344; West Germany 932; Italy 381; United Kingdom 338.
Magnesium metal	328	363	All from United States.
Mercury 76-pound flasks	23	17	Do.
Molybdenum	4	1	Do.
Nickel:			
Ingots and castings	337	276	Canada 223; United States 53.
Semimanufactures	149	180	United States 158.
Platinum and platinum group metals. troy ounces	39	159	United States 150.
Silver:			
Wire troy ounces	2,500	5,566	West Germany 3,360; United States 2,206.
Sheets do	1	2	All from United States.
Beaten do	990	461	West Germany 269; Belgium 128; United States 64.
Tin:			
Ingots long tons	181	195	United States 142; United Kingdom 50.
Semimanufactures do	85	2	All from United States.
Tungsten, in all forms	5	6	Do.
Uranium, thorium, kilograms plutonium, and other substances.	1,891	1,121	United States 721; United Kingdom 171; Netherlands 114; Canada 103.
Other nonferrous ores and concentrates.	10,330	18,085	Canada 12,106; United States 5,385.
Other nonferrous metals and alloys	890	1,233	Mostly from United States.
Total value, thousand pesos metals.	640,472	596,984	
Nonmetals:			
Abrasives:			
Carborundum and emery	1,143	1,035	United States 620; West Germany 159.
Industrial diamonds:			
Stones carats	189,400	114,555	United States 88,705; Netherlands 16,850; United Kingdom 6,000.
Powder do	19,600	57,850	United States 54,825; Belgium 2,500; Switzerland 525.
Pumice	9	68	All from United States.
Asbestos, crude	15,316	11,786	Canada 9,148; United States 1,947; Republic of South Africa 504.
Barite	360	671	United States 481; Netherlands 154.
Cement	1,556	542	All from United States.
Clays:			
Fuller's earth	3,073	1,858	United States 941; West Germany 916.
Kaolin	7,869	8,432	United States 8,398.
Other refractory	48,332	40,947	United States 40,691.
Other non-refractory	9,002	4,254	United States 4,218.

See footnote at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Nonmetals—Continued			
Cryolite, natural or artificial	65	13	West Germany 10; United States 3.
Feldspar	1,941	1,290	All from United States.
Fertilizers and fertilizer raw materials:			
Nitrogenous:			
Sodium nitrate	8,025	7,922	All from Chile.
Ammonium nitrate	11,594	840	All from United States.
Phosphatic:			
Phosphate rock	66,310	128,211	Do.
Superphosphates	34,744	6,618	United States 6,518.
Potassic: Potassium chloride.	14,157	21,124	United States 21,119.
Graphite	149	84	United States 78.
Gypsum, calcined	365	328	All from United States.
Lime	1,408	771	United States 732.
Magnesite	3,472	8,354	United States 8,349.
Mica:			
Crude	42	91	United States 54; Argentina 31.
Scrap	140	190	United States 184.
Salt	1,380	1,087	United States, 1,078.
Sand and gravel	137,336	107,512	United States 107,308.
Stone, building	3,895	2,019	Italy 1,539; United States 379.
Sulfur, ground and unground	148	148	United States 135.
Talc and pyrophyllite:			
Talc:			
Crude	27,209	23,163	United States 22,757; Italy 406.
Powered	2,062	715	Italy 398; United States 311.
Pyrophyllite	276	93	All from United States.
Vermiculite	717	339	Do.
Witherite (including manufactured barium carbonate).	433	291	West Germany 80; East Germany 76; Belgium 76; Italy 40.
Other nonmetallic minerals	6,616	11,186	Mainly from United States.
Total value, non- thousand pesos metals.	172,790	148,964	
Mineral fuels:			
Coal	50,168	46,787	United States 46,782.
Coke	6,049	9,167	All from United States.
Natural mineral oil or barrels crude petroleum.	183	13	Do.
Petroleum:			
Crude or refined barrels	371,966	66,096	United States 64,505.
Aviation do	57,225	42,873	Netherlands Antilles 33,587.
Kerosene do	5,134	2,688	United States 2,657.
Gas oil and diesel do	245,397	1,804	All from United States.
Residual do	568,236	583,417	Do.
Gas liquids do	2,781,891	3,004,228	United States 3,004,197.
Lubricants do	25,165	17,489	United States 17,478.
Other products do	22,434	20,095	United States 19,979.
Natu- thousand cubic meters ral gas	252,027	272,410	All from United States.
Total value, min- thousand pesos eral fuels.	259,634	223,049	
Total value, metals and do minerals.	1,072,896	968,997	
Percentage of total imports	7.5	6.8	
Total value, all thousand pesos imports.	14,232,912	14,287,501	

[1] Less than 1 ton.

COMMODITY REVIEW

METALS

Aluminum.—Mexico inaugurated its first aluminum smelting plant at Veracruz on July 11. The smelter, built at a cost of about US$17 million by Aluminio, S.A. de C.V., was reported to have a 20,000-ton-per-year capacity. The Aluminum Co. of America (ALCOA), which owns 35 percent of the stock of Aluminio, S.A., is supplying alumina, aluminum fluoride, cryolite, and other material. Mexican nationals

own 51 percent of the stock of Aluminio S.A. American and Foreign Power Co. holds the remaining stock. The Federal Electricity Commission of Mexico supplied electric power for the plant.

Copper.—Compañía Minera de Cananea, S.A. de C.V., a subsidiary of the Anaconda Co., was planning to close down all underground mining operations at Cananea, Sonora. The company expected to continue open-pit mining operations. In order to continue mining on a profitable basis, the company reportedly will have to dismiss 400 miners. The 840 men employed in open-pit mining were not expected to be affected.

Cananea's mine output of copper was sent to Cobre de Mexico, in the Federal District, for refining.

Gold and Silver.—Mexico easily maintained its dominant position among the world's silver producing countries, leading the United States, its closest rival, by approximately 7.7 million troy ounces. The gold-silver mining operations of Minas de San Luis, S.A., at Tayoltita, Durango in the Sierra Madre Occidental were described in midyear; [6] the review covered history, geology, mining methods, crushing facilities, cyanidation mill operations, precipitation and refining methods, and transportation problems.

Iron and Steel.—Iron ore reserves were estimated at 244 million tons.[7] Iron ore deposits in the Las Truchas region of Michoacán were investigated. They were reported to be adequate for establishment of a steel plant.

Extensive deposits of iron ore were discovered on the border between the States of Colima and Michoacán, near the west coast.[8] Iron content of the ore had not been reported; however, it was thought to be the same type as high-grade deposits at Peña Colorada, Colima, and at Las Truchas, Michoacán. The deposit was said to be about 50 million tons.

The government-owned steel producer, Altos Hornos de Mexico estimated that its production would increase 15 percent over that of 1962 Expansion projects currently being carried out will give the company capacity to produce 1.2 million tons of steel ingot by 1964–65 if completed on schedule.

A report entitled "Projections of Demand for Steel in Mexico, 1963–70," was prepared by Surveys and Research Corp. under contract with the Export-Import bank.

Lead and Zinc.—In February, the Mexican Ministry of Industry and Commerce imposed export licensing controls on exports of lead oxides to the United States. Exports of lead pigments to the United States have been increasing for several years causing concern among U.S. producers.

Minera Frisco, S.A., sold 51 percent of its stock to a group of Mexican nationals for a reported US$3,440,000 to comply with the Mexicanization laws. The parent firm, San Francisco Mines of Mexico, Ltd., which holds 49 percent interest in Minera Frisco, announced completion of arrangements for Mexicanization in July 1963.

[6] Mining World. Tayoltita: Mexico's Most Important Silver-Gold Mining Operation, June 1963, pp. 20–24.
Mining World. Tayoltita: Cyanide Mill Has High Recovery Rate, July 1963, pp. 22–25.
[7] Mining Annual Review (London). Mexico, June 1964, p. 221.
[8] Engineering and Mining Journal. Metal and Mineral Markets, v. 35, No. 2, Jan. 13, 1964, p. 3.

The Mexican firm Minerales de Chihuahua stopped shipments of zinc concentrate to the American Zinc Co. of Illinois, failing to comply with terms of a contract between the two companies. Minerales de Chihuahua took this action to comply with a request from a Mexican Government agency to obtain a higher price for its product. Reportedly, Minerales de Chihuahua was to ship 58,000 tons of zinc concentrate to Japan during 1963–65.

A zinc refinery was being constructed at Saltillo, State of Coahuila by Syndicat Belge d'Entreprises à l'Etranger. The plant was scheduled to begin operating late in 1964, using the Overpelt-Lommel refining process.

Molybdenum.—Tidewater Oil Co. obtained 49 percent ownership in Minera Galaviz, S.A., a Mexican corporation with facilities in Sonora, Mexico. An exploration program was started to determine ways to expand mining and milling activities.

Tin.—A tin deposit was discovered by exploration geologists near the mouths of the Bolanos and Santiago Rivers, in the State of Nayarit, south of the Durango tin fields.

Uranium.—Reserves of uranium ore in the State of Chihuahua were reported to be 1.5 million tons.[9] A French company was designing an extraction and refining plant. A pilot plant was said to be producing uranium oxide and metal in Mexico City.

NONMETALS

Fluorspar.—In February, export licensing controls were instituted by the Mexican Ministry of Industry and Commerce on shipments of fluorspar to the United States. This action was taken in an attempt to stabilize export prices for Mexican fluorspar

A drying unit was installed at Minera Frisco, S.A., fluorspar plant, in the Parral district, Chihuahua. Fluorspar concentrates, 99.9 percent dry containing not less than 97 percent calcium fluoride were prepared with aid of the unit.

Sodium Compound.—A plant with an annual capacity of 36,000 tons of sodium sulphate was being constructed for Mexicana de Peñoles, S.A. It will concentrate solutions by vacuum evaporation.

Sulfur.—Stock of sulfur in Mexico (all types) at the end of 1963 totaled 849,552 metric tons. Pan American Sulfur Co. planned to ship liquid sulfur to Europe beginning in 1965.

Compañía Mexicana Metalurgica Peñoles, an affiliate of American Metal Climax of the United States, revealed plans to construct a plant near Torreon, Coahuila, capable of producing 30,000 metric tons of sulfuric acid annually. The plant will use sulfur dioxide gas obtained from the roasting of zinc ore in the nearby smelter of Mexicana de Peñoles. The acid will be sold to a chemical fertilizer plant. Compañía Zincamex, S.A., projected construction of a sulfuric acid plant near Saltillo, Coahuila. The proposed plant will have an annual capacity of 60,000 metric tons, which will be used for the production of phosphoric acid. Celulosa y Derivados, S.A., signed a contract with Simon Carver, Ltd., for construction of a 100-ton-per-day sulfuric acid plant in the Monterrey area. Construction was to begin in early 1964.

[9] Mining Annual Review (London). Mexico, June 1964, p. 221.

MINERAL FUELS

Coal.—Mexican coal deposits were reported to be the richest in Latin America,[10] a claim certain to be disputed by Colombia. Reserves in the State of Coahuila were estimated at 2,000 million tons. Production of coal derivatives from 1950 to 1963 rose by more than 180 percent, according to a report by Nacional Financiera. Output of coal derivatives in 1962 totaled 29,468 tons, 10.9 percent greater than in 1961. The rapid growth in production of coal products was brought about by the great expansion of Mexico's iron and steel industry.

Crude Oil and Natural Gas.—In 1963 Petroleos Mexicanos (Pemex) drilled 554 wells compared with 639 wells drilled in 1962.[11] Of the 554 wells drilled, 99 were exploratory and 455 were development wells; these activities resulted in completion of 290 oil and 52 gas producers. The 99 exploratory wells totaled 815,881 feet of drilling. They included 53 new-field wildcat wells, which resulted in the discovery of 8 new oil and gas fields. These were the Lagarto oilfield in the Veracruz embayment, the Maguey and Santiago oil and gas fields in the Tampico embayment, the Platanal and Tasajero oil and gas fields in the Isthmus of Tehuantepec region, and the Pamorana, Palmito, and Rodeo gasfields in northeastern Mexico.

The discovery of the offshore Isla de Labos field on the extension of the Golden Lane trend, in the Veracruz embayment was hailed as a major discovery. Development of the new field was underway.

Work was started on 10 more compressor stations. Six were for the Ciudad Pemex-Mexico City gas pipeline and four for the gas pipeline connecting the Reynosa fields with Monterrey, Torreón, and Chihuahua. Three crude oil pipelines that totaled 824 kilometers were planned or under construction as of June 1963. One of these lines was scheduled to transport crude oil from the Isthmus of Tehuantepec and central Tabasco-Campeche areas to Salina Cruz on the Pacific Ocean. From there the crude was slated to be shipped by tanker to the refinery being built at Mazatlán. The other pipelines being built will parallel lines operating at present.

Two natural gas pipelines with a combined length of 542 kilometers were under construction or planned in mid-1963. These were to provide connections between the Mexico City-Guanajuato line and San Luis Potosi, and between Guanajuato and Guadalajara. The capacity of both lines was rated at 1,000 cubic feet per day.

Petroleum Refinery Products.—The combined crude distillation capacity of Mexico's six refineries totaled 469,000 barrels per day as of July 1963. A number of additional refinery facilities were under construction or planned in 1963. The crude distillation capacity of the Madero plant at Tampico was being increased by 15,000 barrels per day, and an alkylation unit was under construction. The 40,000-barrel-per-day crude unit being constructed at Salamanca, Guanajuato, will double the refinery's present capacity. A 12,000-barrel-per-day vacuum distillation unit, a 32,000-barrel-per-day catalytic reformer,

[10] Mining Annual Review (London). Mexico, June 1964. p. 221.
[11] Bulletin of American Association of Petroleum Geologists. Petroleum Developments in Mexico in 1963, v. 48, No. 8, August 1964, pp. 1230–1241.

a 17,000-barrel-per-day alkylation unit and a 2,500-barrel-per-day polymerization unit were being erected at the Minatitlán refinery. A 50,000-barrel-per-day refinery was scheduled for construction at Mazatlán, Sinaloa. A coking plant of 18,000-barrel-per-day capacity was planned at the 30,000-barrel-per-day Rosarito refinery, Baja California, which was scheduled for construction in 1963.

Petroleum Products.—There were 17 petrochemical plants in operation at the close of 1963. Petroleos Mexicanos (Pemex) owned eight of these, two were owned by investors associated with Pemex, and seven belonged to private firms.[12] Absorption plant capacity was increased from 250 to 500 million cubic feet per day at both the Reynosa and Ciudad Pemex plants. Total capacity at the La Venta plant was increased to 600 million cubic feet per day. Eleven new petrochemical units were scheduled for construction at Coatzacoalcos, Reynosa, Ciudad Madero, Santa Clara, Chihuahua, and Tlalnepantla. Pemex was granted US$110 million from a US$150 million long-term loan obtained from France, for construction of the plants.

Two private chemical firms received government permission to process basic petrochemicals produced by Petroleos Mexicanos. Adhesivas Pesistal, S.A., was scheduled to produce synthetic tannins from phenol and formaldehyde. The 1,500-metric-ton-per-year plant, which will be located in Mexico City was estimated to cost about US$160,000. Fenoquimia, S.A., was given permission to produce phenol from cyclohexane. The 5,400-metric-ton-per-year plant, to be constructed in Toluca, Mexico was scheduled to cost about US$2 million.

Pipelines were used to transport refinery products and liquefied petroleum gases. A 107-kilometer line paralleling the existing Guanajuato-Morelia connection was the only products line under construction or planned in 1963. The recently completed Pemex City-Mexico City line was scheduled to supply inland areas with refined products. The Minatitlán-Salina Cruz products line was slated to be converted to crude.

[12] Petroles Interamericano, April 1964, pp. 44–45.

The Mineral Industry of Nicaragua

By Henry E. Stipp[1]

NICARAGUA'S mineral industry in 1963 continued to operate at approximately the same economic level as in 1962. Agriculture, the dominant segment of the economy, employs more than half the labor force and contributes 38 percent of the gross national product (GNP). Metals and minerals production in 1963 was equivalent to approximately 4 percent of the GNP. Increases in output of most nonmetallic minerals and in the price of silver balanced decreases in production of the precious metals. In 1962, the total labor force was officially estimated at 510,000 persons. Approximately 0.8 percent of these, or about 4,000 workers, were engaged in the mining industry. Mineral exploration and development was hampered by a restrictive mining law. Before the year ended corrective legislation was being studied by the Nicaraguan Congress.

GOVERNMENT POLICIES AND PROGRAMS

The Government's continued efforts to create conditions favorable to private investment should stimulate mineral exploration and development. Approximately 80 percent of Nicaragua's mining industry was owned and managed by foreign concerns.

The congress ratified four Central American economic integration instruments, including the Uniform Industrial Incentive law. Under this law the Government could grant incentives to new industries and extend benefits to existing industries to help them compete in the Central American Common Market. Mineral industries could benefit from this legislation.

SOURCE MATERIAL

The information contained in this chapter was supplied by the U.S. Embassy, Managua, Nicaragua, through the U.S. Department of State, and supplemented by Memoria De La Recaudación General De Aduanas Por 1961 and 1962, Managua, and Overseas Business Reports, December 1962, published by the Bureau of International Commerce, U.S. Department of Commerce.

PRODUCTION

Nicaragua's production of metals and minerals in 1963 was valued at US$16.5 million, about 1 percent greater than the value of output

[1] Physical scientist, Division of International Activities.

in 1962. Output of precious metals (gold and silver), an important part of the nation's economy with a 5-year annual value of over US$7 million, decreased somewhat. Copper production, which has been increasing steadily since 1959, leveled off in 1963. Nonmetals output except for gypsum increased substantially.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Copper concentrate, metal content	908	4,897	6,277	7,272	[1] 7,283
Gold, troy ounces	218,302	210,200	226,251	221,984	204,769
Silver, do	298,413	326,673	417,253	500,050	405,252
Nonmetals:					
Cement	35,261	32,297	39,019	45,906	53,812
Diatomaceous earth	1,712	2,040	[2] 2,722	1,283	[2] 1,300
Gypsum	([3])	([3])	([3])	3,250	2,500
Lime	24,155	24,823	25,460	26,013	[2] 28,400
Salt	10,829	11,499	[2] 12,474	9,467	16,495

[1] Quantity figure for copper estimated content of concentrate.
[2] Estimate.
[3] Data not available.

TRADE

Nicaragua's total foreign trade was at a high level in 1962 and continued to flourish during 1963. A favorable balance of trade was indicated in 1963, with exports rising to record levels. Nicaragua received 50.4 percent of its imports from the United States in 1962. Trade within the Central American Common Market increased, but was very small compared with total trade.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destination, 1962
Metals:			
Copper and alloys, semimanufactures and pigments.	8,589	10,025	United States 9,823; West Germany 202.
Gold, bars and ingots, troy ounces	210,748	221,326	United States 151,623; Canada 69,703.
Iron and steel:			
Ingots and semimanufactures	15		
Scrap	2,574	40	Spain 11; United States 11; Netherlands 9.
Nonferrous metal, n.e.s.[1]	878	([2])	
Silver and platinum, troy ounces	268,748	288,135	United States 267,784; Canada 20,351.
Silver and/or jewelry, do	40	64	All to United States.
Zinc	([2])	74	Honduras 31; Guatemala 24; El Salvador 19.
Nonmetals: Lime and cement	17	4	All to El Salvador.
Total value (f.o.b.), million U.S. dollars, metal and mineral exports.	11.0	11.7	
Share of all exports, percent	16.1	13	
Total value, all exports million U.S. dollars	68.4	90.2	

[1] Not elsewhere specified.
[2] Data not available.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum and alumium alloys: Semimanufactures.	170	238	United States 140; El Salvador 37; Switzerland 30.
Copper and copper alloys:			
Ingot (refined)	1		
Semimanufactures	78	81	Belgium 32; United States 26; Mexico 7; West Germany 7; United Kingdom 7.
Sulfate	12	12	United States 10; Netherlands 2.
Iron:			
Ore	(1)	(1)	
Scrap	9,162	15,226	All from United States.
Pig iron	1,395	1,053	Do.
Steel:			
Ingots and equivalent primary forms.	1	50	United States 31; United Kingdom 10; El Salvador 6.
Semimanufactures	12,537	24,762	Belgium 12,310; West Germany 4,815; Japan 2,525.
Lead and lead alloys: Unwrought and semimanufactures.	65	92	United States 30; Mexico 25; West Germany 25.
Nonferrous base metals and concentrates, scrap and filings.	5	2	United States 2; West Germany [1].
Silver and silver alloys, all forms	1	(1)	
Tin and tin alloys, all forms	22	18	United Kingdom 14; United States 3; Netherlands and West Germany 1.
Zinc and zinc alloys, all forms	31	277	Belgium 241; United States 29; Honduras 3.
Nonmetals:			
Abrasives	176	203	Costa Rica 152; West Germany 24; United States 22.
Asbestos	24	56	United States 44; United Kingdom 6; West Germany 4.
Cement	6,547	1,559	United States 491; West Germany 311; Denmark 281; Belgium 257.
Clay	172	212	United States 204; United Kingdom 3; West Germany 3.
Fertilizers	14,055	21,920	United States 4,316; West Germany 2,317; Italy 2,115.
Graphite	4	11	United States 8; El Salvador 1; Panama 1; West Germany 1.
Lime, quicklime, slaked lime, hydraulic lime.	615	483	All from United States.
Mica, uncut and manufactured	(1)	1	Mainly from West Germany.
Phosphates and crude potash	3	(1)	All from United States.
Salt	688	691	United States 540; El Salvador 125; Dominican Republic 25.
Sodium compounds:			
Nitrates, natural	102		Chile 101; West Germany 1. (1961).
Carbonate, soda ash or sal soda	167	227	United States 165; United Kingdom 44; West Germany 16.
Hydroxide, caustic soda	1,162	1,481	United States 873; United Kingdom 420; Italy 153.
Sulfur, crude	5,672	8,353	United States 4,464; Mexico 3,888; West Germany 1.
Nonmetallic minerals, crude, n.e.s.[2]	212	402	United States 366; Italy 35; West Germany 1.
Mineral fuels:			
Coal	10	12	All from United States.
Coke and lignite	75	50	West Germany 36; United States 11; El Salvador 3.
Petroleum:			
Crude thousand 42-gallon barrels and partially refined oil.	(3)	128	All from Venezuela.
Refinery products:			
Gasoline do	550	561	Netherlands Antilles 557; United States 4.
Kerosine and jet fuel do	137	143	Netherlands Antilles 141; United States 1.
Distillate and residual fuel oil do	649	765	Netherlands Antilles 392; Venezuela 356; United States 17.
Lubricants do	32	29	United States 28.
Asphalt do	36	13	Venezuela 12.
Miscellaneous do	5	7	United States 6.
Liquefied petroleum gas do	9	9	Mainly from Costa Rica.
Total value (c.i.f.), million U.S. dollars metal and mineral exports.	12.7	13.9	
Share of all imports percent	17.1	14.2	
Total value, all imports million U.S. dollars	74.4	98.2	

[1] Less than 0.5 ton.
[2] Not elsewhere specified.
[3] Less than 500 barrels.

Gold was the principal metal exported and was important in gaining foreign exchange for Nicaragua. Copper and silver exports were also notable. Imports of aluminum and aluminum alloys, iron and steel, lead and lead alloys, zinc and zinc alloys, fertilizers, crude nonmetallic minerals, sodium carbonate, and sulfur increased sharply; imports of cement and lime decreased.

COMMODITY REVIEW

METALS

Antimony.—Deposits have been reported in the Departments of Estelí and Madriz. The National Development Institute worked with the Atlantic Coast Mineral Development Commission to prepare a work program for exploration of these deposits.

Copper.—Mining of copper on a large scale (by Nicaraguan standards) was started in late 1959 by the Canadian-owned Rosita Mines, Ltd., at Siuna, Department of Zelaya, in ore averaging 4.3 percent copper. A mill was erected to produce for export a concentrate containing 72 percent copper, 0.12 ounce per short ton gold, and 22 ounces per short ton silver. The leach-precipitation-flotation process is used to prepare the concentrate. Sulfide minerals are concentrated by flotation and roasted to provide sulfur dioxide gas for producing sulfuric acid. The acid is used to leach the copper oxide minerals forming copper sulfate. Scrap iron is added to the copper sulfate solutions, precipitating cement copper, which is recovered by flotation in the form of a copper concentrate.

Gold and Silver.—These metals are found in several districts of Nicaragua; however, only three companies operated in 1963, averaging 0.23 ounce of gold per short ton of ore. The three firms follow:

Company:	*Mine and location*
Empressa Minera del Setentrion (formerly Empresa Minera de Nicaragua).	El Limon, near Leon.
Neptune Gold Mining Co	Bonanza, Bonanza. La Reina, Matagalpa.
La Luz Mines, Ltd	La Luz, Siuna.

Lead and Zinc.—These metals are present in ores mined for gold and silver but are not recovered at present and are discarded with the waste material.

Molybdenum, Tungsten, and Vanadium.—Occurrences of these metals have been reported at La Soledad, La Cabuya, and El Portillo in the Department of Nuevo Segovia. The deposits have not been exploited; however, the Atlantic Coast Mineral Development Commission was preparing a work program for their exploration.

NONMETALS

Silica.—The Geological Service of Nicaragua discovered two deposits of siliceous sand suitable for the production of glass. The most important deposit, near Puerto Cabezas, contained 98 percent silica, 1 percent aluminum, and practically no iron. The deposit has more than 1 million tons of sand with good granulation characteristics.

The other deposit, near Mosonte, Department of Nuevo Segovia, has 10 million tons of sand containing 86 percent silica, 10 percent aluminum, and 4 percent iron.

MINERAL FUELS

Petroleum Refinery Products.—A refinery built near Managua by an affiliate of Standard Oil Co. of New Jersey was officially opened in mid-April. The plant will use imported crude oil brought in by pipeline from Puerto Somoza. The initial capacity of the new plant, 5,000 barrels per day of fuel oils, diesel oil, automotive gasoline, and kerosine, reportedly is sufficient to supply local demands for these products until 1970. However, requirements for lubricants and aviation gasoline must still be met by imports. A consumer tax placed on the petroleum products sold in the country was designed to replace revenue lost in customs duties formerly collected on imports of these commodities. Demand for refinery products was expected to increase moderately.

The Mineral Industry of Panama

By Sumner M. Anderson [1]

PANAMA'S production of minerals in 1963 was limited to limestone and siltstone for cement in new record tonnages, salt at slightly less than the 1962 level of output, and unrecorded quantities of clay, sand, gravel, and crushed rock used in local brick and tile kilns and for ordinary construction needs. Processing plants using imported metal and crude petroleum included a steel rolling mill in its second year of operation, a few small nail factories, a petroleum refinery in its first full year of operation, and an aluminum extrusion plant which opened in October 1963. The recent awakening of Panama to the potential of a mineral industry in the development of its economy was further emphasized by the adoption on August 22 of Decree Law No. 23, to become operative when published in the Official Gazette, embodying a new and comprehensive Code of Mineral Resources. The code will be applicable to the exploration, extraction, transportation, and processing of "any chemical element or compound occurring naturally as a product of geological and biological process including hydrocarbons occurring in liquid, solid or gaseous state and the artificial deposits, tailings and dumps derived from the foregoing." The objectives of the code as set forth in Article 1 are "to stimulate and regulate the exploration and extraction of minerals, principally through private initiative and investment, in all the territories of the Republic of Panama, and, at the same time, to promote the vigorous development of research, transportation, and processing necessary or convenient to assure the availability of these minerals in a national and international level." The code was based, to a large extent, on studies financed by the International Cooperation Administration and completed in 1958. Copies of the 70-page Official Edition, in either Spanish or English, are available on inquiry to the Director, Department of Mines, Ministry of Agriculture, Commerce and Industries, Panama City, Panama.

The Republic of Panama has had no importance internationally in the primary minerals industries, but has been a small-scale producer in years past of gold and manganese ore. Known minerals, aside from the nonmetals exploited in 1963, include gold, copper, manganese, iron, asbestos, low-grade bauxite, and coal. Exploration for petroleum has been unsuccessful thus far.

[1] Chief Latin America specialist, Division of International Activities.

PRODUCTION

The only official statistics on mineral production compiled by the Government are those for salt. Production data on petroleum refinery products were supplied by industry sources. Actual and estimated production of metal and cement manufactures, limestone, and siltstone and most of the information in the commodity review was collected from industry sources by D. F. McConville, Third Secretary and Vice Consul, U.S. Embassy, Panama City.

The value of mineral production prior to 1962 has not been reported, but may be safely judged as having represented a negligible portion of the gross national product (GNP). With the initiation of the new petroleum refinery in April 1962, the value of petroleum products alone, as estimated on the basis of exports, contributed approximately 4 and 5 percent, respectively, to the GNP in 1962 (US$491 million) and 1963 (US$525 million).

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:[1]					
Aluminum extrusions; pipe, tubing, frames, jalousies, bars, etc					[2] 45
Steel reinforcing rods and small shapes				[3] [4] 4,000	[4] 6,350
Nonmetals:[5]					
Asbestos cement[1]		([6])	([6])	([6])	[3] 545
Cement	96,895	108,941	113,867	122,406	141,713
Limestone and siltstone, for cement	172,161	193,563	202,316	217,748	251,792
Salt	7,846	6,514	7,729	10,499	10,082
Mineral fuels:					
Petroleum refinery products:[1]					
Motor gasoline—thousand 42-gallon barrels				1,192	2,241
Jet fuel—do				30	200
Kerosine—do				628	524
Distillate fuel oil—do				1,381	4,398
Residual fuel oil—do				3,119	6,368
Asphalt—do				39	72
Other—do				268	
Total—do				6,657	13,803
Refinery fuel and losses—do				523	810
Refinery input, crude—do				7,180	14,613

[1] Fabricated or processed from imported raw materials.
[2] Started October 1963.
[3] Estimate.
[4] Fiscal year ending October 31.
[5] In addition, Panama produces annually over 35,000 tons of clay, about 170,000 cubic yards of sand, and unknown quantities of gravel and crushed rock.
[6] Data not available.

TRADE

The latest official figures published for exports and imports were for 1961 in the Comercio Exterior, Contraloría General de la República de Panamá, which does not list countries of origin or destination by commodities. Industry sources have provided data on 1962 petroleum imports which, when compared to 1961 data, reflect the impact of Panamanian refinery production which commenced in 1962.

TABLE 2.—Mineral exports and reexports

(Metric tons unless otherwise specified)

Commodity	1960	1961	
	Quantity	Quantity	Value, c.i.f., U.S. dollars [1]
Exports:			
Nonmetals:			
Cement	355	5	190
Reexports:			
Metals:			
Iron and steel scrap	----	5,067	143,000
Nonferrous metal scrap	996	575	192,607
Mineral fuels:			
Petroleum products:			
Aviation gasoline thousand 42-gallon barrels	126	4	58
Motor gasoline do.	63	----	----
Distillate fuel oil do.	3,233	----	----
Lubricants do.	54	37	783
Other do.	----	120	164
Total do.	3,476	161	1,005
Total: Value of mineral exports and reexports	----	----	336,802
Value of all exports and reexports	----	----	23,535,580
Metals and minerals share in all exports and reexports percent	----	----	1.4

[1] 1 Panamanian balboa equals US$1.00.

NOTE.—Countries of destination not reported, except for 5 tons of cement in 1961 to Nicaragua.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	
	Quantity	Quantity	Value, f.o.b., U.S. dollars [1]
Metals:			
Aluminum, and its alloys:			
Plates, sheets, bars, tubes, etc	254	386	411,494
Salts and compounds	185	202	9,467
Barium salts and compounds	12	8	1,187
Calcium salts and compounds	209	241	35,831
Chromium salts and compounds	10	3	827
Copper:			
Metals, including alloys, semimanufactures	98	168	203,302
Compounds:			
Sulfate	2,482	2,544	495,798
Other	43	[2]	115
Gold ingots, bars, wire, sheets, foil, powder, coins, etc. troy ounces	16,558	5,144	189,427
Iron and steel:			
Sheets, bars, rails, rods, plates, angles, etc	22,422	29,600	5,076,372
Scrap	713	464	14,234
Salts and compounds	3	4	1,217
Nonferrous metal scrap	23	29	2,641
Total value, metals and their compounds	----	----	6,441,912

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1960	1961	
	Quantity	Quantity	Value, f.o.b., U.S. dollars[1]
Nonmetals:			
Boric acid	2	5	869
Cement:			
Portland	1,837	1,573	53,094
White	862	3,583	60,990
Materials of cement, asbestos cement, plaster, etc., for construction	279	352	28,962
Clays:			
Unmanufactured	364	747	29,487
Clays or refractory products for use in construction	331	1,181	112,728
Gem stones, cut or uncut, but not mounted:			
Precious and semiprecious—carats	90,000	475,000	46,646
Common—kilograms	[2]	838	18,287
Graphite, natural	[2]	[2]	6
Gypsum:			
Crude	3,505	6,148	23,247
Calcined	23	17	2,943
Iodine and its compounds	[2]	[2]	581
Lime	4,226	2,698	60,037
Mica, unmanufactured	[2]	1	1,219
Phosphates, natural	3	1	16
Potassium and its compounds	5	4	2,342
Salt	220	268	10,763
Sand, including crushed quartz	840	440	8,806
Sodium compounds	2,283	2,274	219,685
Stone:			
Marble and other stone for construction and monuments	124	378	12,080
Crushed stone		1	88
Stone for industrial use, n.e.s.[4]	142	284	10,153
Sulfur	4	4	437
Talc	175	114	5,570
Other nonmetals, n.e.s.[4]	9	125	4,739
Total value, nonmetals			713,775
Mineral fuels:			
Coal, coke and briquets	234	335	13,485
Petroleum products:			
Aviation gasoline—thousand 42-gallon barrels	374	175	1,080,204
Motor gasoline—do	717	774	3,331,820
Jet fuel—do	45	220	887,500
Kerosine—do	235	264	988,258
Distillate fuel oil—do	358	479	1,696,471
Residual fuel oil—do	875	955	1,938,946
Lubricants, including greases—do	33	12	882,888
Other—do	12	22	167,554
Total—do	2,649	2,901	10,973,641
Gasoline additives—kilograms		953	692
Total value, fuels			10,987,818
Total:			
Value of metals and minerals			18,143,505
Value of all imports			124,413,631
Metals and minerals share in all imports—percent			14.6

[1] US$1.00 equals 1.00 Panamanian balboa.
[2] Less than 0.5 of the unit indicated.
[3] Data not available.
[4] N.e.s.—not elsewhere specified.

TABLE 4.—Imports of petroleum commodities in 1962

(Thousand 42-gallon barrels unless otherwise specified)

Commodity	Quantity	Value, f.o.b., U.S. dollars [1]
Crude oil	7,736	17,119,804
Refinery products:		
Aviation gasoline	137	825,295
Motor gasoline	539	2,260,518
Jet fuel	330	1,377,142
Kerosine	178	733,492
Distillate fuel oil	320	1,238,225
Residual fuel oil	1,100	2,317,071
Lubricants including greases	35	939,909
Other	22	206,476
Total	2,661	9,898,128
Gasoline additives—kilograms	3,401	3,401

[1] US$1.00 equals 1.00 Panamanian balboa.

Exports of minerals and mineral products from Panama are only occasional and very limited, with the recent exception of petroleum products. The U.S. Embassy has been requested to release export statistics for total petroleum products only, because there is only one petroleum refinery in the country. These exports in 1962 and 1963 and the imports of crude petroleum for refinery treatment have been tabulated by destination and origin in table 5.

TABLE 5.—Imports of crude oil and major exports of petroleum refinery products

Origin or destination	1962		1963	
	Quantity (thousand 42-gallon barrels)	Value, f.o.b., U.S. dollars	Quantity (thousand 42-gallon barrels)	Value, f.o.b., U.S. dollars
Imports of crude oil:				
Algeria	532	1,223,241		
Argentina	761	1,484,421	721	1,304,293
Libya	1,157	2,377,402		
Saudi Arabia			338	750,946
Venezuela	5,286	12,034,740	13,645	30,974,790
Total	7,736	17,119,804	14,704	33,030,029
Exports of refinery products:				
Argentina	907	3,145,472	549	1,331,079
Canada	588	2,198,653	997	3,477,473
Dominican Republic	111	222,195		
Jamaica	110	219,362		
Netherlands	134	483,113	1,989	4,021,067
Switzerland			182	364,137
United Kingdom	52	212,732	146	571,441
United States	1,927	5,112,508	3,375	7,317,990
Canal Zone [1]	1,946	6,488,222	4,019	9,079,159
International bunkers [2]	348	1,132,383	914	1,848,928
Total [2]	6,123	19,214,640	12,171	28,011,274

[1] An undetermined quantity of these products was sent to the Canal Zone for storage only and has been, or will be, returned for sale in the domestic market.
[2] Jet fuel sold for consumption at the international bunker at Tocumen Airport is not included.

Unfortunately the usefulness of the petroleum products export figures for both quantity and value is severely restricted by the qualifications listed in the footnotes to table 5. The Panamanian Govern-

ment compiles its trade statistics on the basis of figures submitted by the refinery. The company knows the quantities shipped to the Canal Zone for temporary storage, but has no way of knowing what portion of those quantities sold from storage goes to bunker sales and what portion is brought back into Panama by dealers for domestic sale. Consequently the latter is not recorded as imports, and precise totals for exports, imports, and domestic consumption of petroleum refinery products remain unknown.

COMMODITY REVIEW

METALS

Aluminum.—An aluminum extrusion plant of Panamanian ownership opened in October 1963. During the last few months of the year, imported aluminum billets were used to produce various types of tubing, conduit pipes, frames, jalousies, and bars, operating at about 10 percent of the plant's installed annual capacity of 2,700 metric tons. In addition to completely meeting domestic demand for aluminum extrusions, the firm hopes to export a considerable portion of its production to the other Central American countries.

Iron and Steel.—A few small nail factories of unrecorded output have operated in Panama for some time. A new Panamanian-owned steel rolling mill was inaugurated in 1962, using ingots imported from Venezuela. The mill employs about 30 people. In its production year ending October 31, 1963, the firm reported a total production of about 6,350 metric tons from which one 360-ton shipment was exported to Costa Rica. The remainder, marketed domestically, included reinforcing rods sufficient for complete local requirements plus a limited quantity of small steel shapes. Output in the 1963–64 production year was expected to reach almost 11,000 tons. Long-range plans included the possible installation of electric furnaces for melting scrap metal.

NONMETALS

Cement.—The limestone and siltstone listed in the production table, approximately two-thirds of which was limestone, was extracted from the quarries of Cemento Panamá, S.A., as raw material for that company's (and Panama's) only cement plant, which has been in continuous operation since February 1948. Gypsum, the other essential raw material, is imported. The plant employs the wet process, using rotary kilns, and has an annual capacity of 243,758 metric tons (1,314,000 barrels). The portland cement production has been primarily of type I (general-purpose) cement, with limited quantities of type II (moderate-heat) and type III (high-early-strength) for special projects. The company reported 1963 prices at the plant, per 94-pound bag, as follows: type I, $1.30; type II, $1.40 to $1.60, depending on quality; type III, $2.00. Production, while increasing steadily, has been considerably behind plant capacity but in 1961 was only some 1,570 tons short of domestic requirements. In the absence of import data since that year, the approach to complete self-sufficiency in portland cement is indeterminate. Panama's requirements for white cement are met entirely by imports.

Cemento Panamá also operates an adjoining asbestos-cement plant, inaugurated in December 1960, which has produced annually about 20,000 units of roofing materials including corrugated and flat sheets and ridge rolls. In 1963 approximately 114 metric tons of asbestos was imported for this purpose from Canada. In the first quarter of 1963, Cemento Panamá opened a new $500,000 plant to produce "Fibrolit", a new construction and insulation material comprised of cement pressed with wood shavings from the native guaramo tree.

Clays.—Panama's only major manufacturer of clay products extracts annually from local deposits 98 percent of its own requirements for clay and shale and imports the remaining 2 percent. Native clay consumed by the firm in 1963 was estimated at 33,100 metric tons. Imports normally have been pyrophyllite from Canada, talc and kaolin from the United States, and glazes from both the United States and Mexico. Manufactures include a variety of structural clay products, sanitary ware, glazed wall tile, and ceramic floor tile. An undetermined quantity of clay is also produced by some 15 to 20 very small brick and tile plants scattered throughout Panama. The country's total requirements for refractory products are met by imports.

Salt.—The production, refining, storage, distribution, and sale of salt are controlled by the Panamanian Government through its Institute of Economic Development. Salt production, by solar evaporation of sea water, was officially reported as 222,274 quintals of 100 pounds each in 1963, representing a 4-percent decline from that of 1962. For the needs of the country, production is supplemented by annual imports of iodized salt and rock salt.

MINERAL FUELS

Petroleum.—Until 1962 all of Panama's requirements for petroleum refinery products, which were approaching 3 million barrels annually, were supplied by imports. On April 24 of that year, a new petroleum refinery known as Refinería Panamá, coowned by National Bulk Carriers, Inc., and the Continental Oil Co., was inaugurated at Las Minas Bay near Colon. Built at a cost of $30 million, with $2.5 million in new facilities added in 1963, the refinery represents the largest private industrial investment in Panama. Preliminary reports of values of crude imports versus refined exports indicate a trade gain to the refinery of $2,094,836 for the remainder of 1962, and a trade loss of $5,018,752 in 1963, without consideration of stocks and domestic sales. An unknown portion of the quantities deposited for storage in the Canal Zone was destined for eventual return to the Republic of Panama for domestic sales, making true exports and domestic consumption indeterminate. Nevertheless, refinery officials have estimated domestic consumption of petroleum products in 1963 as follows:

	Thousand barrels
Aviation gasoline	138
Motor gasoline	905
Jet fuel	357
Kerosine	310
Distillate fuel oil	452
Residual fuel oil	1,071
Lubricants, including greases	(1)
Asphalt	52
Liquified petroleum gases	30
Total (excluding lubricants and greases)	3,315

[1] Data not available.

The estimate for jet fuel includes international bunker sales at Tocumen Airport, Republic of Panama.

The Mineral Industry of Cuba

By Sumner M. Anderson [1]

THE ENORMOUS contrast between the mineral economy of Cuba in 1963 and in 1958 was the result of the overall political change to which the total economy of the country was intimately linked. Creation of the Cuban Mining Institute (Instituto Cubano de la Minería) to direct all mining activities in the country was an early act of the new Government after the revolution on January 1, 1959. During the next 2 years, the Government confiscated foreign holdings,[2] including United States investments exceeding $1 billion in value. Foreign mining and metallurgical technicians—predominately from Communist areas—were brought in to reorganize the mineral industries. On January 3, 1961, diplomatic relations between Cuba and the United States were severed, and then on May 2, Cuba announced its full-fledged membership in the so-called Communist Bloc. Fifty-four international treaties assured Cuba of Communist economic support, technical and financial assistance, machinery, raw materials, and manufactures. The Soviet Union agreed to buy some Cuban mineral products, and Czechoslovakia stated that it would buy all mineral production offered for the next 20 years, but in both cases at prices said to be much lower than the world market.

The mineral productivity segment of the mineral economy during and since the period of political metamorphosis, has withstood the political disruption better than has the economy as a whole, but with no direct measure of the magnitude of its cost. The overall economic record is marked with steady deterioration; the annual average per capita income has dropped from $374 in 1957 to $185 in 1963, when Cuba's deficit with the Soviet Union alone reached an admitted $1 billion.

As a mineral producer, Cuba has been of some importance internationally in nickel and chromite and of relatively minor importance in cobalt, manganese ore, and copper. The Cuban output of these items as percentages of total world production and rank among the producing countries of the world, comparing the last year of independence with the first and most recently available years of Communist rule, was as follows:

[1] Chief, Latin America specialist, Division of International Activities.
[2] The legal validity of these seizures was upheld by the United States Supreme Court in its decision of March 23, 1964, in the case of Farr, Whitlock and Co. (New York commodity brokers) versus the Banco Nacional de Cuba.

	Cuba's percentage of world total			Cuba's rank among countries reporting production		
	1958	1959	1963 (est)	1958	1959	1963 (est)
Nickel	8.0	6.3	4.6	3d of 17	4th of 16	6th of 16
Chromite	2.0	1.6	1.2	8th of 20	13th of 22	12th of 21
Cobalt	----------	.6	1.2	----------	5th of 7	6th of 7
Manganese ore	.6	.4	.5	15th of 43	17th of 44	16th of 45
Copper	.4	.3	.1	21st of 46	26th of 47	27th of 48

Cobalt in commercially recoverable form was first produced in 1959–60, prior to confiscation of the Freeport Sulphur Co.'s operation at Moa Bay. Through 1958 and the early months of 1959, most of the production, plus minor quantities of iron ore, lead (last produced in 1958), zinc (produced only during 1954–57), and silver, contributed to the supply requirements of the United States. Since that time (except for lead and zinc) they have been items of barter for food, machinery, petroleum, fertilizers, and manufactures from the Communist countries.

Cuba's resource position in a few of the metallic ores is stronger than indicated by past production. Most abundant are the world's largest reserves of laterites, estimated at over 3 billion tons [3] (regarded as too high by later authorities) averaging about 46 percent iron, 1.75 percent chromic oxide, and 1 percent nickel. (This ore has been nodulized to 54 percent iron, 1.2 percent nickel, 2 percent chromic oxide, 13.8 percent alumina, and 3.4 percent silica.) The metallic reserve position is approximately as follows:

Ore type	Classification of reserve	Quantity (thousand tons)
Exploitable at 1963 prices:		
Laterites, over 1 percent nickel	Indicated	356,000
Nickel content [1]	do	4,646
Cobalt content [1]	do	370
Chromite, refractory grade	Inferred	2,500 to 3,000
Copper	Unmeasured	Largely depleted
Iron ore, hard	Measured	5,000
Lead	Unmeasured	Small
Manganese ore	Measured	1,219
Do	Indicated	2,946 to 3,810
Tungsten ore, 1.36 percent WO_3	Inferred	55
Zinc	Unmeasured	Small
Not exploitable at 1963 prices:		
Laterites, over 1 percent nickel	[2]	[2]
Iron ore, 50 percent Fe basis	Indicated	300,000
Chromite, 48 percent Cr_2O_3 basis	do	24,000
Laterites, under 1 percent nickel	Inferred	1,653,000
Iron ore, 50 percent Fe basis	do	1,393,000
Chromite, 48 percent Cr_2O_3 basis	do	111,438
Nickel, 0.80 percent	do	13,224
Cobalt, 0.07 percent	do	1,157

[1] Calculated on the basis of an average ore grade of 1.3 percent nickel and 0.1 percent cobalt.
[2] Data not available.

In the nonmetallic group of minerals, Cuba has large reserves of barite, a very small portion of which is of high grade. Common clay, for the manufacture of brick and tile, is abundant, but high-tempera-

[3] Rand, C. F. Iron Ore Reserves of Cuba. Eng. and Min. J., v. 96, No. 18, Nov. 1, 1918.

ture clays are lacking. Limestone, widespread throughout the island, is the principal and inexhaustible construction rock and basic raw material for the cement industry, which has never produced as much as 62 percent of its capacity of 1,023,300 metric tons. Marble of excellent quality but unmeasured reserve is quarried at one locality on the Isle of Pines and two in Oriente Province. Gypsum deposits, large and extensive, feed the cement and plaster industries, but in color and content of insoluble matter, are below U.S. import standards. Exposures of magnesite are numerous and small with very little high-grade mineral; most of those tested contain calcium oxide in excess of 10 percent. However, in 1959 the Cuban Magnesite Corp. reported a bed of 50 million tons found by core drilling, with no subsequent information released. Deposits of rock salt in Oriente Province have never been exploited, and Cuba's total salt production has been derived from the sea. Large but unmeasured reserves of pyrite, some of which carry associated values in copper, lead, zinc, gold, and silver, are mined for export as iron-sulfur ores but have never been utilized within Cuba. Plans for their development as a basis for a domestic sulfuric acid industry have been studied. Silica sand, 20- to 200-mesh size, is found along the south coast of Pinar del Rio Province from Cortes to La Coloma and probably beyond. In certain places, the upper 3-foot layer is white and of high purity—over 99 percent silica. The sand is utilized largely for construction purposes and to a minor extent for the manufacture of glass.

The most abundant hydrocarbon material on the island is asphaltite, reserves of which have been estimated at 4,535,000 metric tons, plus 220,000 tons of 5 to 38 percent asphaltic rock. Alteration of the original asphalts has resulted in products varying from glance pitch to grahamite. These asphaltites were mined for use as fuel during the petroleum and coal shortages of World War II, but there has been no production since 1946. Domestically produced crude petroleum and natural naphtha, which has never exceeded the 549,398-barrel peak output of 1956, supplies less than 2 percent of Cuba's requirements for petroleum products. Reserves have not been discovered in signicant volume; they are small but not quantatively definable.

In 1958 the value of Cuban mineral production was estimated at $51.566 million, equal to 2.4 percent of the gross national income. Mineral exports in that year were valued at $49 million, the latest annual total available. Of the production value, 55.8 percent was metallic ores and concentrates (37.7 percent nickel), 37.5 percent nonmetallic minerals and their products (24.6 percent cement), and 1.7 percent crude petroleum and refinery products. Production since that time is estimated to have declined abruptly in 1959 and 1960. Some recovery for nickel and manganese ore began in 1961 and for most other minerals in 1962, with the possible exception of cement and petroleum. In 1963 nickel may have reached over 90 percent of the 1958 level, manganese ore 140 percent, and chromite 75 percent, but qualities and terms of negotiated evaluation are not known, and the national economy as a whole was—and is—supported by Communist subsidy. Most of the recovery has been under the supervision of Soviet technicians and Cuban technicians intensively trained in the U.S.S.R. and

Czechoslovakia. Exploration for petroleum has been resumed, with no evidence of success.

Cuban production of metallic ores and concentrates (including nickel oxides and sulfides) provided an income from export sales valued at $28,107,000 (including pyrite) in 1958 but supports no smelting or refining industry. The nonmetallic and fuel minerals, on the other hand, are almost entirely consumed locally (pyrite excepted) by the construction, agricultural, and chemical industries; petroleum production reduces slightly the import requirement for crude to feed the oil refineries. Cuba is entirely dependent on foreign sources for refined metal, and for all metal products except those fabricated in its own rolling mills, small foundries, and machine shops. It has exported all its barite production while importing its own requirements for barite and barium compounds. It is dependent on foreign suppliers for high-quality tile and high-temperature brick, and partially dependent for cement, glass sand, gypsum, and magnesite, which are produced in quantities insufficient to meet local demands. Cuba is self-sufficient in the production of salt and is a net exporter of marble.

SOURCE MATERIAL

Since the end of 1958 information on all branches of Cuba's economic development—including the mineral industries—has been spotty, often incomplete or biased, and largely unverifiable. However, various articles and news notes appearing in technical journals and both domestic and foreign news media have supplied data which could be evaluated against information in the files of the Bureau of Mines to provide what is believed to be a reasonably accurate estimate of production and trade in the major mineral commodities during the past 5 years.

Principal references used were as follows:

1. The Washington World. V. 4, No. 1, Jan. 13, 1964, pp. 6–7.
2. Hagan, Mary. Cuba Fights To Retain Increased Mine Output. Eng. and Min. J., v. 164, No. 10, October 1963, pp. 80–82.
3. E & MJ Metal and Mineral Markets. Czechs Use Cuban Process to Produce Nickel. Dec. 16, 1963, p. 4.
4. American Metal Market. Problems at Moa Bay Nickel Plant Mount. Oct. 12, 1962, p. 3.
5. Engineering and Mining Journal. Refugees Document Cuban Nickel Shipments to U.S.S.R. V. 163, No. 11, November 1962, p. 91.
6. Engineering and Mining Journal. Russia Attempting To Reopen Moa Nickel Plant. V. 163, No. 4, April 1962, p. 22.
7. Mining Journal (London). Cuba Plans Nickel Boost. Apr. 5, 1963.
8. Mining World. Special Havana Report. V. 24, No. 2, February 1962, pp. 14–15, 49.

PRODUCTION

The figures presented for the last 4 years of the following production table are necessarily speculative. The San Fernando copper mine in Las Villas Province, the only known source of lead, zinc, gold, and

silver, produced no lead since 1958 and is believed to have closed down at the end of 1960. Barite production ceased in early 1959.

The exodus of technical and management talents, the rapid exhaustion of maintenance supplies and replacement parts, and the confusion of organization immediately following the indiscriminate confiscation of private industrial enterprises resulted in a sharp decline in mineral production, which had reached its nadir for manganese ore, nickel, and pyrite in 1960, and for most other minerals in 1961. The immediate remedial action of the U.S.S.R. in supplying engineers and technicians, managers, new and accessory machinery, equipment, and supplies—chiefly from the U.S.S.R., Czechoslovakia, and Poland—arrested the decline and started a recovery, which in 1963 is estimated to have approached the 1959 level of production for nickel and probably to have surpassed it for chromite, manganese ore, cobalt, and pyrite. There is no evidence of a comparable recovery in the production of copper or iron ore, the remaining nonmetallics, or crude petroleum.

TABLE 1.—Estimated production of metals and minerals (except where otherwise noted)

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Chromite, refractory grade	[1] 39,673	[1] 29,732	25,000	35,000	50,600
Cobalt in nickel sulfides—recoverable	90	62		164	170
Copper in concentrate	9,019	[2] 11,842	5,000	5,500	6,000
Gold—troy ounces	[1] 615	[1] 348			
Iron ore	3,000	2,500	2,000	1,000	650
Manganese ore:					
Chemical grade, 81 percent MnO_2	7,048	1,000	1,300	3,000	3,300
Metallurgical grade, 35 to 45 percent Mn	46,300	15,006	68,200	69,000	72,400
Total	[2] 53,348	[1] 16,006	69,500	72,000	75,700
Nickel:					
In oxide with cobalt, recoverable	17,833	[3] 11,382	14,805	14,716	14,700
In sulfide, recoverable	180	1,460		1,887	2,000
Total recoverable	18,013	[3] 12,842	14,805	16,603	16,700
Silver—troy ounces	[1] 215,000	[1] 121,415			
Zinc, in concentrate	[1] 171	[1] 70			
Nonmetals:					
Barite	[1] 1,359				
Cement—thousand tons	626	400	300	300	350
Kaolin	800	500	1,000	3,000	5,800
Feldspar					800
Gypsum	40,800	26,000	19,000	19,000	22,000
Limestone—thousand tons	3,000	2,200	2,000	2,000	2,100
Pyrite, 48 percent sulfur	20,500	18,000	20,000	26,000	33,700
Sulfur content	9,840	8,640	9,600	12,480	16,200
Salt	81,000	59,000	60,000	70,000	80,000
Mineral fuels:					
Petroleum, crude—42-gallon barrels	191,892	108,000	80,000	90,000	72,000
Natural naphtha—do	2,990				
Petroleum refinery products:					
Gasoline, all types—thousand 42-gallon barrels	5,568	6,152	4,780	6,170	6,500
Kerosine (including jet fuel)—thousand 42-gallon barrels	1,045	1,028	1,090	1,280	1,400
Distillate fuels—do	5,493	4,472	3,910	4,790	5,000
Residual oils—do	12,067	10,558	10,440	12,400	13,000
Other—do	1,166	672	870	800	800
Total—do	25,339	22,882	21,090	25,440	26,700

[1] United States imports from Cuba.
[2] Exports.
[3] Exclusive of unknown tonnage produced and stored at Nicaro after Sept. 20, but believed to have been included in 1961 figure.

TRADE

Before 1960 the United States supplied most of Cuba's import requirements for metals and minerals and their derivatives and manufactures, and in return received the bulk of Cuba's exported mineral raw materials except pyrite, which was sold in Europe. Venezuela supplied Cuban refineries with crude petroleum. Beginning in late 1960, foreign trade in practically all mineral commodities shifted to the Communist countries, which Cuba joined early in the following year. Statistics on this trade are very meager, but the accompanying incomplete tables provide examples indicative of the pattern.

TABLE 2.—Exports of nickel oxides and sulfides, gross weight, in 1962

Destination	Metric tons	Destination	Metric tons
U.S.S.R.	10,000	Hungary	130
Czechoslovakia	7,000		
China	5,000	Total	22,730
Rumania	600		

Source: Mining Journal, (London) Apr. 5, 1963.

TABLE 3.—U.S.S.R. mineral exports to Cuba

(Metric tons unless otherwise specified)

Commodity	1961	1962
Metals and alloys:		
Aluminum and duraluminum, rolled	4,000	4,900
Copper, rolled	2,800	2,500
Iron and steel:		
Pig iron	44,700	47,800
Ferroalloys	3,900	4,100
Mill products:		
Pipe	12,300	14,700
Rolled ferrous metals	141,900	159,300
Tinplate	35,200	26,200
Nonmetals:		
Asbestos	3,600	5,200
Cement	30,000	107,000
Potash salts	74,100	65,500
Sulfur	63,800	64,700
Superphosphates	99,100	104,400
Mineral fuels:		
Anthracite	134,000	
Coke	10,000	24,000
Petroleum, crude ---thousand 42-gallon barrels	21,753	26,494
Petroleum refinery products:		
Gasoline ---do	779	1,584
Diesel oil ---do	551	704
Fuel oil ---do	5,565	2,827
Lubricants ---do	313	321
Paraffin ---do	15	12
Total ---do	7,223	5,448

Source: Vneshnyaya Torgovlya S.S.S.R. Za 1962 God. (Foreign Trade of the U.S.S.R. for 1962 Moscow, 1963. 235 pp.

COMMODITY REVIEW

METALS

Chromite.—In its peak year, 1943, Cuba was the world's largest producer of chromite with 321,280 metric tons. In 1963, it probably ranked about 12th, but was still first in the Western Hemisphere. It

is estimated that total production of chromite in Cuba from 1916 to the end of 1963 has been about 3 million metric tons of refractory-grade ore and 200,000 metric tons of metallurgical-grade ore. These tonnages were the product of some 18 mines in Oriente, 13 in Camagüey, and 9 or more in Matanzas, plus numerous small scattered prospects in those provinces. The great bulk of the refractory-grade production was from the Camagüey district, north of the city of Camagüey, which appears to have been virtually worked out; the remainder was largely the production between 1918 and 1926 of the Caledonia metallurgical chromite mine in the Mayarí district of north central Oriente. By 1959 production of metallurgical-grade had ceased, and output of refractory-grade ore, averaging about 36 percent chromic oxide was from two mines. The Cayoguan mine of Cía Minera Moa (Felipe Godoy, Francisco Vidal and Associates), in the Moa-Baracoa district of Oriente is the largest chromite mine in Cuba and the only important producer since World War II; nevertheless, it accounted for only 36 percent of the 1960 output. The Lolita mine of Cía. Minera Basica, S.A. (subsidiary of Basic Refractories, Inc., of Cleveland, Ohio), the largest mine in Camagüey, supplied the remainder (19,000 tons) on a 30,000-ton contract to the Commodity Credit Corporation, but presumably completed the contract and closed down the following year. In 1963, with all mines nationalized, Cayo del Medico was reportedly the only producing mine. This is believed to be a new name given to Cayoguan, where total efforts to reverse the downward production trend have been applied apparently with considerable success. However, increasing the supplies of chromite and manganese ore for sale or barter to the U.S.S.R. and other Communist countries in Europe is unavoidably suggestive of carrying coals to Newcastle: The U.S.S.R. is the world's largest producer of both.

Copper.—The Matahambre mine in the Province of Pinar del Rio was discovered in 1912. Since the closing of El Cobre in 1918, Matahambre has been the major copper producer in the country. It supplied 81 percent of Cuba's copper output in 1958 and 86 percent in 1963, but its production tonnage for those years dropped from 10,344 to approximately 5,300. At the end of 1958, the Cuban owners of Minas de Matahambre, S.A., became optimistic over indications that an ore body discovered in a new section might prove big enough to offset the diminishing reserve and prolong the life expectancy of the mine, but production continued to drop after intervention the following year and a 22 percent increase in the labor force.

The remaining 700 tons in 1963 was the product of four mines: Tete Contino, unidentifiable but possibly a new name for the San Fernando mine of Las Villas Province; Mina Grande, also unidentifiable but a possible new name for the Francisco mine in Pinar del Rio; Dora, in Pinar del Rio, operated until 1958 by the Cía. Minera Mantua, S.A.; and El Cobre, in Oriente. In the late 1950's an attempt was made to rehabilitate El Cobre, 10 kilometers west of Santiago de Cuba, which had been the world's third largest copper mine in the early half of the 19th Century. A concentration plant was installed consisting of a large assortment of crushers, a ball and rod mill, seven flotation cells, four tables, and a large tank for precipitation of cement copper. The plant had not operated by mid-1959, and production was confined to

a few tons of hand-sorted direct shipping ore. When Russian technicians took over, new pumping and precipitation tanks were installed without consideration of the total shortage of scrap iron. In 1961 the pumps broke down and all underground workings were flooded. Production since then, amounting to only about 350 tons in 1963, has been from small pit operations.

Iron and Steel.—The abundant iron ores of Cuba vary widely in quality and are metallurgically complex. With virtually no market demand, production and exports have dwindled to very small quantities.

Cuba has no smelting plant, though one has been promised by the U.S.S.R. Three secondary plants in the Province of Havana have the combined capacity to produce 25,000 tons of pig iron, 170,000 tons of concrete reinforcing rods, and 20,000 tons of cast iron pipe annually, using scrap and imported pig iron, billets, ferrosilicon, and fluorspar. Actual production in 1958 was 3,500 tons of pig iron, 64,000 tons of reinforcing rod, and 4,500 tons of pipe, representing an estimated 100, 39, and 15 percent, respectively, of the apparent consumption of those items, and, collectively, 25 percent of the total consumption of iron and steel products and manufactured items, which amounted to 292,300 tons in that year. About 16,200 tons of imported bars, rods, plates, and sheets (including tinplate) was consumed by hundreds of small foundries, machine shops, and workshops for the manufacture of such items as window frames, doors and door frames, grates, pipe fittings, iron furniture, heaters, ovens, and kitchen utensils. No statistical measure of change in this pattern has been received since the overall nationalization of 1961, but the United States and Western European sources of imports have been displaced by Eastern European Communist countries, and much of the foundry activity is now devoted to the fabrication of machinery parts for broken and worn out factory, plant, and automotive equipment.

Manganese.—Cuba has never had an internal market for manganese ore but has been a producer and exporter of metallurgical grade since 1888 and of chemical grade since 1945. Peak output in both categories was reached at the height of the Korean conflict in 1953 with a 353,218 metric ton export total comprised of 341,699 tons of metallurgical and 11,519 tons of chemical grades. Total production then declined gradually to 234,050 tons in 1956, and abruptly to 134,514 tons in 1957 and 74,339 tons in 1958, under the combined influences of a weak market, increased competition from Brazil, and (since 1956) political instability. Manganese deposits are known in five of the six provinces of Cuba, but except for an insignificant tonnage from Pinar del Rio, Oriente has been the only effective producing province in recent years. The Charco Redondo mine of Cía. Minero Turquino, S.A., a Cuban company (Francisco Cajigas and Associates), has been—and the property still is—the predominant producer, yielding metallurgical-grade ore exclusively. The remaining 10 to 15 percent of the metallurgical grade ore output has been supplied by some 30 to 50 small mines which also yield all of the chemical-grade ore. They were formerly controlled by United States, Canadian, and private Cuban capital. A few of the mines, notably Charco Redondo and Montenegro, have shipped part of their ore direct, without concentra-

tion. The great majority, however, requires total concentration, in some cases by log washer, screen or classifier, but generally by jigs. The ore may be so treated at the mine where it is produced or sent to a centrally located plant treating ore from several mines. All the ore was sold in the United States, which favored Cuba and the Philippines by permitting manganese imports from those countries to enter duty free. The last United States imports from Cuba were in 1960. Shipments since have been to the Communist countries.

In January 1959 Charco Redondo was the first mine property in Cuba to be confiscated and placed under the operation of an "interventor." Later it was renamed Harlem. By the end of 1960, all other properties had similarly entered the domain of the state. Production dropped abruptly but quickly recovered, and in 1963 surpassed that of 1958. Production in 1963 of ore upgraded for shipment has been estimated in metric tons as follows, based on the mid-year rate:

Mine or mine group	Metallurgical-grade ore		Chemical-grade ore (81 percent MnO_2) (metric tons)	Total (metric tons)
	Quantity (metric tons)	Manganese content (percent)		
Harlem (ex-Cía. Minero Turquino, S.A.)	[1] 63,636	48		[1] 63,636
El Cristo (ex.Holston Trading Corp.)	4,517	41	80	4,597
Bueycito (ex.-Holston Trading Corp.)	377	44	1,669	2,046
Margarita de Cambute (ex-Inter-American Industries, Inc.)	71	44	1,307	1,378
Ponupo (ex-Cía. Firmeza, S.A.-Felipe Godoy)	3,815	39	208	4,023
Total shipping ore	[1] 72,416	39 to 48	3,264	[1] 75,680

[1] Includes 1,557 tons of direct shipping ore, metallurgical grade, 40 percent manganese.

Much of the upgrading apparently was done at the reactivated nodulizing plant at the port formerly known as Felton and now renamed Porfirio Hechavarria Santos. This plant, previously owned by Bethlehem Mines Iron Co. for nodulizing lateritic iron ore, had been unsuccessful and in disuse for some time. It was converted in 1960 to treat low-grade manganese ores hauled by truck at prohibitive cost from the Harlem (Charco Redondo) mine. Output dropped from 67,000 tons in 1961 to 55,148 tons in 1962 when concentration equipment was installed at Harlem and possibly reactivated elsewhere. A large new concentrating and sintering plant of 1,000-ton daily capacity at Santiago de Cuba was scheduled to start operating in 1962, by which time a stockpile of more than 50,000 tons of sub-grade ore had accumulated there. The three-unit sintering plant was badly damaged by foundation failure shortly after its inauguration on July 26, 1960, and whether any of its units have resumed operation is not known.

Nickel and Cobalt.—Nickel production, the largest mineral industry in Cuba, was developed in Oriente Province by two United States enterprises before 1958.

The oldest and only operation which attained important output was the U.S. Government project at Levisa Bay, operated on a fee basis between December 1943 and March 1947, by the Nicaro Nickel Co., a subsidiary of Freeport Sulphur Co., and from January 1952 to

October 24, 1960, by the Nickel Processing Corp., owned 60 percent by the National Lead Co. and 40 percent by Formento de Minerales Cubanos, S.A., a Cuban company. From more than 15 million tons of laterite ore treated during those two periods, the project produced nearly 198,000 tons of oxide containing 158,386 metric tons of nickel, including a minor content of cobalt. The cobalt could not be separated and was counted commercially as the equivalent of nickel until 1958, when the demand for nickel of higher purity reacted adversely on marketability of the Cuban product. Production from September 20, 1960, when an unsuccessful attempt was made to suspend operations, to October 24 when the properties were confiscated—and for the remainder of the year—has not been reported, but is supposed to have been included with the production tonnage reported for 1961. At the time of confiscation, the physical plant, including all properties, equipment, inventories, cash, and stocks, was valued at US$100 million. The detailed history of the operation as a U.S. Government project, from its inception, has been published.[4] The Cubans renamed the Nicaro plant Comandante Rene Ramos Latour. On November 29, 1960, a team of Russian technicians arrived to help the Cubans run the plant, and the U.S.S.R. has supported the project technologically, materially, and financially ever since. In 1963 operations reportedly were under the direction of 16 Soviet, 4 Czech, and 4 Latin engineers. A process for producing electrolytic nickel from Cuban oxide has been adopted by Czechoslovakia's Sered works, the only nickel producer in Central Europe.

The Moa Bay Mining Co., a subsidiary of the Freeport Sulphur Co., started development of a nickel-cobalt project in a mining area some 50 or 60 miles east of Nicaro in 1954. Two ultramodern plants were built to perform a special leaching process developed by Freeport. One was a facility to produce 1,300 tons per day of 98 percent sulfuric acid from liquid sulfur brought in special vessels from Louisiana. The other was a plant to utilize the acid in the production of 125 tons per day of sulfide concentrate in the form of slurry to be piped into the sulfur-carrying vessels for delivery on their return trip to a refinery in Louisiana for final treatment. These plants were placed in operation in December 1959, and between then and mid-1960 made five shipments of slurry containing 3,496 metric tons of solids. Nickel content of the solids was 50 to 55 percent, and the approximate nickel-to-cobalt ratio was 11:1. The Louisiana plant recovered from the slurry, in the form of refined metals, approximately 3,450,000 pounds of nickel and 304,840 pounds of cobalt, representing the total production of the Moa Bay project under private ownership, and the total return on Freeport's $61.5 million investment in Cuba. On August 18, 1960, the Cuban Government took over all company properties and operations in Cuba by "intervention"—a term adopted for confiscation or seizure. The leaching plant and the Louisiana refinery were designed as interdependent units of the total processing procedure, and the Cubans were unable to overcome the technical difficulties governing utilization of the plant until 1962. This was then at least partially accomplished with the aid of Russian, Czech, Polish

[4] Closedown and current status of U.S. Government nickel plant at Nicaro, Cuba. Hearing before a Subcommittee of the Committee on Government Operations, House of Representatives, Eighty-Seventh Congress, First Session, Aug. 29–30, 1961.

and other foreign engineers, Cubans trained in the U.S.S.R., and material and financial support from the U.S.S.R. and other European Communist nations. In 1963, at Moa Bay, renamed Bahia Minera Comandante Pedro Soto Alba, the engineering staff reportedly included two from the U.S.S.R., two from Chile, one from Argentina, one from Spain via the U.S.S.R., and four Cubans recently returned from training in the U.S.S.R.. Production in 1963 was only 14 percent of the annual output planned by Freeport, but officials claim that operations have been largely experimental and that production should exceed that of Rene Ramos Latour (Nicaro) in 1965.

Plans for the future are said to include immediate construction of a small ammonia plant to relieve the U.S.S.R. of its supply burden, ultimate substitution of either an ammonium carbonate or an electrolytic process to eliminate the sulfur precipitation plant at Pedro Sota Alba (Moa), and a new Czech-supplied cobalt plant and $100 million nickel plant at Rene Ramos Latour to produce refined metal. Whether the nickel and cobalt are now being separated from Cuban concentrates and separately refined in Europe is not known.

NONMETALS

Pyrite.—The 1963 output of pyrite was primarily the 32,544-ton production of a property operated by or named for one Julio A. Mella. This probably is the Mono mine, but could be any one of the following three:

Mono, 3 kilometers northeast of Matahambre in the Province of Pinar del Rio, was drilled by Cía. Minera Inspiracion Occidental, a subsidiary of Minas de Matahambre. A reserve conservatively estimated at 1 million tons of hard, massive, fine-grained pyrite was developed, containing 43 percent sulfur, 2.4 percent lead, 5.2 percent zinc, 0.17 percent copper, 0.19 ounces of gold per ton, and 2.2 ounces of silver per ton. To utilize this ore a US$10 million plant was completed at Santa Lucia in 1960, designed to produce 300 tons of sulfuric acid per day and to recover from the calcine copper, lead, gold, and silver values by means of a chloridizing roast and acid leaching.

Antonio, 16 kilometers northeast of Fomento, Province of Las Villas, produced 63,053 tons of pyrite containing 944 tons of copper in 1956–57. Sales were to Europe. Indicated reserves at the time it was closed down were at least 50,000 tons.

Carlota, 9 kilometers southeast of Cumanayagua, which is east of Cienfuegos, Province of Las Villas, last produced in 1921 and was last examined in 1951–52 by the Freeport Sulphur Co. Reserves are large but low in copper.

The remaining 1,167 tons of 1963 pyrite production is credited to the Buenavista mine, 12 kilometers east of Bahía Honda, Province of Pinar del Rio. This is a copper mine traditionally producing chalcopyrite in a massive pyrite containing 4 to 5 percent copper, but with no copper production mentioned in 1963. It may be that the mine has ceased to operate, and that pyrite production was from tailings dumps only.

The Margot mine in the Province of Matanzas produced and shipped to Europe 350,000 tons of pyrite containing 944 tons of copper in 1952–57, but then closed down when reserves were exhausted.

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MINERAL FUELS

Half of the total energy requirements of Cuba for 1955–59 was supplied by domestic bagasse and fuel wood, and half by petroleum, of which 97.6 percent of the crude and 43.2 percent of the refinery products were imported. Yearly averages for the period were—

	Quantity (thousand barrels)
Runs to stills:	
Domestic crude (including natural naphtha)	369
Imported crude	14,957
Total crude refined in Cuba	15,326
Refined products:	
From refineries in Cuba	14,022
Imported	10,651
Total refined products available	24,673
Exported (est.)	4,700
Approximate refined products consumed	20,000

Activities in the industry during the period had none of the uniformity suggested by the averages. Domestic production of crude rose from 369,000 barrels in 1955 to 543,000 barrels in 1956, and declined steadily to 192,000 barrels in 1959. Crude imports rose abruptly from 3.6 million and 3.9 million barrels, respectively, in 1955 and 1956, to 25.8 million and 26.4 million barrels, respectively, in 1958 and 1959. Domestic refinery output and imports of refinery products followed a parallel and reverse pattern, respectively, but the decline in imports was more moderate. Requirements for refinery products as measured by approximate consumption rose steadily from about 15 million to 28 million barrels. Domestic refinery production declined in 1960 and 1961, but recovered to the 1959 level by 1963. If exports have stopped, which appears likely, Cuban consumption in 1963 should have been in the order of 30 million barrels.

Domestic production of crude in 1958 and 1959 was from three old fields pumping or bailing from accumulations in shattered pockets in serpentine, and from new fields yielding oil from sedimentary rock reservoirs, as follows:

Field	Province	First production	Petroleum type	Production, barrels	
				1958	1959
From serpentine:					
Bucuranao-Cruz Verde	Havana	1914 to 1956	Paraffin	53,329	22,085
Motembo	Las Villas	1934	Naphtha	3,435	2,995
Jarahueca	Las Villas	1943	Paraffin	23,997	9,475
From sedimentaries:					
Jatibenico	Camagüey	1954	Asphalt	211,453	136,254
Santa María del Mar	Havana	1956	Paraffin and asphalt.	10,863	9,095
Catalina	Camagüey	1956	Paraffin	4,552	
Guanabo	Havana	1956	Asphalt	35,903	14,943
Total				343,532	194,847

Following drastic revisions of the petroleum law in 1959, all private exploration activity came to a halt and the Cuban Gulf Oil Co., Atlantic Refining Co., and Cuba California Oil Co. closed their offices. A dozen years of disappointing exploration had cost them more than US$30 million. Since then exploration has been renewed by Soviet technicians with no discoveries reported.

There were eight refineries in Cuba, listed according to ownership, location, and daily distillation capacities exclusive of other processing units, as of the beginning of 1959:

		Barrels
Esso Standard Oil Co., S.A.	Belot, Havana	36,500
Cía. Petrolera Shell de Cuba, S.A.	Havana, Havana	27,000
The Texas Co. (West Indies) Ltd.	Santiago de Cuba, Oriente	20,000
Refineria Cabaiguán	Cabaiguán, Las Villas	2,500
Corporacion General de Petroleo	Jatibanico, Camagüey	1,000
Santa Maria Oil Refining Co	Cotorro, Havana	600
Bucuranao Refining Co	Bucuranao, Havana	300
Petrolera Jarahueca, S.A.	Jarahueca, Las Villas	200
Total daily crude distillation capacity, barrels		88,100

On June 29 and July 1, 1960, the foreign-owned refineries of Esso Standard, Shell, and the Texas Co., representing 94.8 percent of the refining capacity of the country, were seized by the Government after refusing to process Soviet crude in displacement of crudes customarily imported from Venezuela. The Cabaiguán refinery had been confiscated earlier in 1959 because its operators were not in sympathy with the Communist regime. The remaining refineries were later brought under national control of the Cuban Petroleum Institute, and the Soviets are said to have agreed to expand refining facilities.

The Mineral Industry of the Dominican Republic

By Sumner M. Anderson [1]

IN 1963 the Dominican Republic produced 2.6 percent of the world's production of bauxite and 4.9 percent of that produced in the Western Hemisphere. It ranked fourth among the six bauxite producing countries in the Latin American area, and one of three that registered a production increase over 1962.

Agriculture normally yields over 80 percent of the country's foreign exchange earnings and 41 percent of the gross national product (GNP) as measured in 1958. Trade in that year accounted for 17 percent of the GNP; manufacturing 15 percent; government 7 percent; and other activities 20 percent, of which about 2 percent was supplied by the mineral industry.

The nonarable Cordillera Central, the highest mountain range in the Antilles, extends in a southeasterly direction through the center of the country. There are no inland waterways of any importance. The capital and principal port of Santo Domingo on the Caribbean Sea (south coast), handles about 90 percent of the imports and 40 percent of the exports. Transportation is mainly by highways of varying adequacy which connect most of the important towns, but there is a shortage of feeder roads.

The industrial census for 1961 showed that mining and manufacturing of mineral and metal products employed 3,859 persons, distributed as follows:

[1] Chief, Latin America specialist, Division of International Activities.

Branches of industry	Number of establishments	Persons employed
Raw material production:		
Bauxite	1	371
Gypsum and salt	2	834
Marble quarrying and cutting	1	85
Total	4	1,290
Semi- and primary-manufacturing:		
Foundries	9	1,099
Cement	1	364
Quick lime (mortar)	1	25
Brick kilns	9	62
Potteries	1	10
Glass works	1	202
Paving asphalt	1	60
Total	23	1,822
Fabricators:		
Metal products	63	268
Cement products	2	5
Asbestos cement products	1	122
Gypsum products	1	1
Mosaic and block tile	49	318
Glass products	8	25
Articles of amber	1	8
Total	125	747
Grand total	152	3,859

SOURCE MATERIAL

Production statistics for 1959–61 are from Estadistica Industrial de la República Dominicana, No. 12, 1961, published in 1963 by the Dirección General de Estadistica y Censos, Santo Domingo. Production data for 1962 and 1963 and much of the description of individual segments of the industry were supplied by the U.S. Embassy, Santo Domingo, from industrial sources and the following Dominican Government sources: Dirección General de Minería, Ministerio de Industria y Comercio; Banco Central de la República Dominicana (bauxite); and Corporación de Fomento, the Government agency which administers Sal y Yeso Dominicano (mined salt and gypsum) and Fabrica Dominicana de Cemento (cement).

Trade statistics are from Comercio Exterior de la República Dominicana, v. IX, 1961, and v. XI, 1962, Dirección General de Estadistica y Censos. General economic data were abstracted principally from "Summary of Basic Data" releases prepared by the Agency for International Development.

Supplemental information on the bauxite and iron ore deposits was derived from the following publications: Goldich, S. S., and Berquist, H. R., Aluminous lateritic soil of the Sierra de Bahoruco area, Dominican Republic, W.I., United States Geological Survey Bulletin 953–C, 1947, pp. 53–84; and Kochman, A. H., and Gordon, Mackenzie, Jr., Geology and mineral resources of the Maimón-Hatillo district, Dominican Republic, United States Geological Survey Bulletin 964–D, 1950, pp. 307–357.

PRODUCTION

Bauxite production in 1963 was the highest since the start of operations in 1959. Other reported extractive segments of the industry were sharply depressed. In 1961, the latest year for which value figures are available, the value of total mineral production was estimated as US$17,825,000, representing 2.7 percent of that year's GNP of US$660,400,000.

The Dominican Republic is self-sufficient in its requirements for salt, gypsum, limestone, gray cement, lime, granite, and sand, and virtually so for clay.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum ore (bauxite, dry)	771,475	688,621	750,514	717,110	773,008
Gold, troy ounces	513	[1] 308	[2]	[2]	[2]
Iron ore, 60-65 percent Fe	[3] 51,233	122,745			
Nonmetals:					
Amber, kilograms	73		[3] 98	[3] 61	[2]
Cement, gray	189,513	169,664	237,567	257,100	228,170
Clays [4]	22,890	15,133	13,213	[2]	[2]
Gravel and crushed rock [4], cubic meters	97,047	50,121	36,246	[2]	[2]
Gypsum	158,502	324,700	408,765	[5] 300,000	35,318
Lime	16,121	7,539	[6] 6,475	[5] 6,000	[2]
Limestone [4]	255,872	216,596	317,723	[2]	[2]
Salt:					
Marine	20,149	19,518	20,099	[2]	[2]
Mined	63,826	66,306	75,702	[2]	22,754
Total	83,975	85,824	95,801	[5] [6] 33,500	[2]
Sand [4]	92,907	53,006	58,983	[2]	[2]
Stone, dimension:					
Granite [4]	617	261	137	[2]	[2]
Marble, cubic meters	317	186	88	[2]	
Travertine, do	242	121		[2]	[2]

[1] United States imports from the Dominican Republic.
[2] Data not available.
[3] Exports.
[4] Domestic consumption of national product.
[5] Estimate.
[6] Revised figure; supersedes that given in commodity chapter, volume I.

TRADE

The Dominican Republic has no facilities for processing bauxite beyond crushing and drying and exports all it produces. It exports quantities of domestically produced gypsum, salt, gray cement, dimension stone, amber, aluminum manufactures, and ceramic products that are beyond its own requirements. The Republic is dependent on imports for all of its required metals and alloys, white cement, and mineral fuels, most of its metallic semimanufactures and finished goods, and some glass and ceramic specialties.

Metal and mineral manufactures, which have not been included in other country chapters, have been included in the foreign trade statistics for the Dominican Republic for reasons of comparability, inasmuch as they are not statistically separable from some of the metal groupings reported.

The dollar values shown in the trade tables are equivalent to Dominican Republic peso (RD$) values, which are pegged to the United States dollar at an exchange rate of 1 : 1.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962		
	Quantity	Quantity	Principal destinations	Value (U.S. dollars)
Metals:				
Aluminum ore, bauxite	869,290	869,193	All to United States	8,717,694
Aluminum manufactures (doors and window frames).	16	6	All to Netherlands Antilles	17,254
Iron ore	13			
Iron and steel scrap	8,780	806	United States 397; Norway 214; Netherlands 128.	150,144
Nonferrous ores and metals	93			
Total value, metals				8,885,092
Nonmetals:				
Amber—kilograms	98	61	All to United States	400
Cement	141,624	68,646	United States 45,240; U.S. Virgin Islands 9,322; Puerto Rico 4,052.	780,312
Clay products:				
Brick	61	12	All to Puerto Rico	272
Roofing tile	116	21	do	540
Mosiac tile, glazed	40	204	U.S. Virgin Islands 166; Puerto Rico 26; United States 7.	10,837
Pottery	120	59	U.S. Virgin Islands 41; Puerto Rico 18.	2,298
Total	337	296		13,947
Glass products	5	(1)	Puerto Rico 98 kilograms; United States 7 kilograms.	108
Gypsum	380,817	394,564	United States 306,345; Puerto Rico 76,132; Panama, 4,500.	1,062,796
Salt	58,517	26,582	United States 26,536; Panama 45	89,255
Sand	4			
Stone, dimension:				
Granite	61	9	All to Puerto Rico	250
Marble	29	3	do	1,503
Travertine		49	United States 46; U.S. Virgin Islands 3.	2,911
Other, not specified	51	7	All to United States	361
Total	141	68		5,025
Total value, nonmetals				1,951,843
Total:				
Value of metal and mineral exports.				10,836,935
Value of all exports				172,434,165
Metals and minerals share in total exports—percent				6.28

[1] Less than 0.5 ton.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962		
	Quantity	Quantity	Principal sources	Value (U.S. dollars)
Metals:				
Copper and its alloys and manufactures.	846	833	United States 314; France 160; Canada 153.	1,004,010
Gold, silver, platinum, and their manufactures.	kilograms 854	925	United States 462; Italy 214; West Germany 166.	284,950
Iron and steel products:				
Semimanufactures:				
Construction materials: [1]				
Large pieces	2,252	3,215	United States 1,859; Belgium 545; West Germany 281.	1,144,401
Galvanized sheet	2,263	7,595	Belgium 3,894; Japan 1,240; Luxembourg 898.	1,292,447
Other, not specified	7,236	13,104	Belgium 6,367; United States 1,785; France 1,735.	1,556,529
Rails and railway materials.	2,125	1,993	Belgium 986; West Germany 883; United States 125.	291,522
Pipes and fittings:				
Cast iron	45	187	United States 151; West Germany 26; United Kingdom 10.	29,839
Other	2,081	3,391	West Germany 1,482; United Kingdom 1,108; United States 405.	792,516
Wire, smooth	3,496	4,624	Belgium 1,567; France 1,518; West Germany 620.	673,551
Manufactures [2]	5,583	12,522	United States 5,863; Belgium 1,560; West Germany 821.	6,146,492
Total iron and steel products.	25,081	46,631		11,927,297
Tin, lead, zinc, and other metals and metal manufactures.	666	1,008	United States 363; Canada 181; Puerto Rico 75.	1,121,580
Total value, metals and metal manufactures.				14,337,837
Nonmetals:				
Cement	1,112	1,307	United Kingdom 760; West Germany 253; Japan 245.	38,989
Ceramic products	3,098	2,949	Japan 1,493; United States 658; Spain 360.	685,594
Gem stones, unmounted carats	160,000	375,000	United States 155,000; West Germany 125,000; Austria 65,000.	4,226
Glassware and glass manufactures.	1,363	7,478	United States 4,545; West Germany 850; Japan 601.	1,581,167
Stone, earth, and their manufactures.	1,432	1,763	United States 577; Canada 535; West Germany 482.	318,758
Total value, nonmetals and manufactures.				2,628,734
Mineral fuels:				
Coal, coke, briquets	661	513	United States 266; Netherlands 172; West Germany 75.	20,308
Petroleum products:				
Gasoline thousand 42-gallon barrels	640	854	Netherlands Antilles 784; Italy 70	3,338,728
Kerosine do	118	152	Mainly to Netherlands Antilles	602,411
Fuel oil do	1,283	1,702	Venezuela 657; Netherlands Antilles 636; Netherlands 154.	3,897,698
Lubricating oil do	45	46	United States 39; Netherlands 3; Netherlands Antilles 2.	1,038,850
Other do	70	89	Venezuela 57; United States 21; Netherlands 5.	600,661
Total do	2,156	2,843		9,478,348
Total value, mineral fuels				9,498,656
Total:				
Value of metal and mineral imports.				26,465,227
Value of all imports				129,083,718
Metals and minerals percent share in total imports.				20.5

[1] As reported, no further description other than the three listed subclasses is available; may include some items normally classified as manufactures.

[2] May include some items normally classified as semimanufactures.

COMMODITY REVIEW

METALS

Bauxite.—Bauxite is the most important mineral product of the Dominican Republic, representing in dollar value 80.4 percent of mineral exports, 5.1 percent of total exports, and 1.1 percent of the GNP in 1962. Alcoa Exploration Company, a subsidiary of the Aluminum Company of America and the sole producer, started shipments in early 1959 following 7 years of exploration and the investment of $14 million in mine development and equipment and the construction of port facilities. An appreciable portion of this investment went into construction of a pier 2,100 feet long and 440 feet wide at Cabo Rojo on the south coast adjoining Haiti, where no national harbor exists; the pier has been subjected twice (1955 and 1956) to severe hurricane damage.

The bauxite zone is about 32 kilometers in from the coast and contains a series of valley or basin type deposits on the southwestern slope of the Sierra da Bahoruco in the southwestern Provinces of Barahona and Pedernales. Within its concession of 8,783 hectares, Alcoa has been operating the Aceitillar mine, 4,300 feet above the level of the sea in Pedernales Province. The bauxite contains, as shipped, close to 50 percent alumina, 3 percent silica, and 18 percent moisture, which is more or less typical of that found elsewhere in the bauxite belt extending westward through southern Haiti and Jamaica. It is mined by power shovel and trucked in 28- to 32-ton loads about 34 kilometers to a 60,000-ton storage area at the Cabo Rojo wharf, from which it can be belt-loaded into vessels at a rate of 1,250 tons per hour for shipment to Alcoa's alumina plant at Point Comfort, Tex., via the port of Aransas Pass. The company's facilities in the Dominican Republic are large enough to mine and ship 1 million tons of ore per year.

Gold.—Dominican gold has been the product of hand panning by thousands of men, many of whom are only part-time miners. Mountain streams in five provinces have yielded gold, but all production in 1960 and possibly since has been from the Provinces of Seibo and Santiago Rodriguez only, principally from concessions granted in 1960 to Cardox Dominicana, C. por A. Coarse flake gold placers discovered in 1958 on the Mao and Bulla Rivers near the village of Bulla in Santiago Rodriguez were reportedly large enough to justify the adaption of mechanized recovery methods, but there is no evidence that this has been done. Production since 1960 has not been officially reported. Activity in Seibo for many years has been in and around the north coast port of Miches, near the eastern end of the island.

Iron Ore.—Relatively small but high grade pockets of magnetite and lateritic hematite occur in the Maimón-Hatillo iron ore district, an area roughly 25 kilometers long and 17 kilometers wide near the center of the country in Sanchez Ramirez and La Vega Provinces. These deposits yielded a total of 869,812 metric tons of ore from 1952 through 1960. Production apparently ceased in 1960, as none has been reported since that time; 13 tons of iron ore exported in 1961 is believed to have been mined in 1960.

A 30-year mining concession for the area was granted to Explotación Minera Hatillo, C. por A., on July 6, 1949, and was extended

for an additional period of 10 years in 1952. This Government-controlled company did some exploratory mining and installed a small pilot mill before negotiating a series of operating concessions with three private companies. Cía. Minera Dominicana, C. por A., worked the deposits from early 1952 to April 1953, and Cía Minera Panamericana, C. por A., worked them from April 1953 to September 1954; these two companies produced a total of 217,366 metric tons of ore. Cía. Dominicana de Minerales, C. por A., a subsidiary of Phoenix Iron and Steel Co. (operating arm of Barium Steel Co.), produced 529,701 metric tons of ore between January 1, 1955, and May 31, 1959. Explotación Minera Hatillo, C. por A., then undertook mining on its own account late in 1959 and produced 122,745 tons of ore by late 1960. The company apparently did not complete a contract to supply 25,000 tons of ore per month for 3 years to Ferrostaal Import-Export Corp. of Essen, West Germany, and it may be assumed that known reserves of commercial ore were exhausted.

Most of the ore mined was high-grade (66–68 percent iron) lump of open-hearth quality. The deposits were covered by only a few feet of overburden, and the ore was extracted with power shovels. After being washed, it was trucked 105 kilometers to the Rio Haina docks near Santo Domingo (then called Ciudad Trujillo) for export, mainly to the United States.

Iron and Steel.—The National Armory at San Cristobal, about 26 kilometers west of Santo Domingo, is the largest and most important element of the small Dominican iron and steel industry, which also includes four smaller foundries in the Federal District, two in San Pedro de Macoris Province, and one each in Barahona and San Cristobal Provinces.

Servicos Technologico, a branch of the Department of State for Armed Forces, manufactures arms and military equipment at the Armory, utilizing domestic scrap and imported pig iron and coke. In 1953 or 1954, the plant began to use part of its productive capacity to manufacture commercial and industrial products, and became the only producer of cast iron pressure pipe and fittings in the Dominican Republic.

Quantity of pipe production has not been reported since 1956 when the output was estimated as 540 metric tons of 4-meter lengths of 4-, 5-, 6-, and 8-inch diameter pipe and accessory fittings. Principal customers for this pipe are the contractors who install secondary lines on Government-owned water distribution systems and the sugar and oil companies; a small market also exists in private housing. Degree of self-sufficiency cannot be calculated because official import statistics do not separate pressure pipe from the larger category which includes all cast iron pipe, fittings, and such accessories as valves, drains, and plugs.

NONMETALS

Gypsum and Salt.—The great gypsum and salt deposits about 40 kilometers west of the port of Barahona, lie parallel to each other in the same geologic sequence, forming a range of hills about 11 kilometers long. Reserves reportedly include at least 1,000 million tons of gypsum and 250 million tons of readily accessible salt. In 1956, the Gov-

ernment Agricultural and Industrial Credit Bank, sold the gypsum and salt concession to Sal y Yeso Dominicanos, C. por A. After the 1961 political upheaval, the properties were confiscated by the new Dominican Government. They were operated again by the Agricultural Bank and, since March 1963, by the Industrial Development Corporation (Corporación de Fomento) at two open-pit mines. The salt mine is at Las Salinas, 6.4 kilometers west of the gypsum mine.

Both mine products, after grinding and screening, are hauled by narrow-gage railway to the dock area in Barahona, from where they are exported, except for the gypsum requirements of the Government-owned cement plant in Santo Domingo and a small quantity of salt refined in Santo Domingo for table use. The Industrial Development Corporation also recovers salt from sea water in solar evaporation salinas at Puerto Hermosa, Las Calderas Bay, on the south coast between Barahona and Santo Domingo.

Gypsum and salt, respectively, are the third and fourth most valuable mineral products of the Dominican Republic, following bauxite and cement, but production has declined sharply since the 1961 transfer of operations to the Government.

MINERAL FUELS

Petroleum.—Petrolera Dominicana, C. por A., which had U.S. capital, suspended petroleum exploration in the first half of 1961, and there has been none since. On March 26, 1963, a contract signed the previous August between the Dominican Government and Esso Standard Oil Co. providing for the construction of a petroleum refinery in the Dominican Republic was rescinded by mutual agreement. The Government showed continued interest in establishing a refinery, but by the end of the year nothing further had developed beyond discussions. All of the Republic's mineral fuel needs are imported.

The Mineral Industry of Haiti

By Sumner M. Anderson [1]

HAITI is significant in the world mineral economy only as a relatively minor producer of bauxite and copper. These items however, provide an important share of the domestic economy, supplying collectively about 23 percent of the gross national product (GNP) of a country whose GNP per capita (US$71 in 1961) is the lowest in Latin America. Haiti is essentially self-sufficient in the production of limestone, lime, cement, and salt; the relatively small quantities of all other commercial metals and minerals, mineral products, and mineral fuels required for the economy are imported. The mineral industries are financed by investment capital from the United States in bauxite, from the United States and Canada in copper, and from France, Haiti, and Venezuela in cement. Local individuals and small groups engage in the production of lime, limestone other than for cement manufacture, and salt. Mineral exploration is in process, but small known deposits of antimony, gold and silver, iron, nickel, tin, gypsum, sulfur, and coal are undeveloped. Petroleum exploration has not been successful.

The 4,431,000 (1963) French- and Creole-speaking inhabitants of Haiti are crowded into the 10,700 square miles that comprise the western third of the island of Hispaniola, giving Haiti the highest population density in Latin America, with 414 per square mile; annual population growth is 2.1 percent. The economy is based primarily on agriculture, which engages 83 percent of the labor force. Five percent are employed in manufacturing (including cement) and construction, and 12 percent are employed in other activities including mining and government service.

PRODUCTION

The Haitian Government does not provide definitive statistics on mineral production. The data on production of bauxite, copper, and cement were provided by the various companies. Those for lime, limestone, and salt were provided by the U.S. Embassy in Port-au-Prince as representing the best available estimates.

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TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum ore: Bauxite, dry equivalent	259,000	272,000	266,800	376,300	332,500
Copper concentrates		2,722	10,658	18,140	16,181
Grade: Percent copper		[1] 33	32.61	33.70	36.74
Copper content		[1] 900	3,476	6,113	5,945
Nonmetals:					
Cement	38,423	48,051	44,435	51,352	45,798
Lime [2]	180,000	180,000	180,000	180,000	180,000
Limestone [2]	390,000	390,000	390,000	390,000	390,000
Salt, marine [2]	10,400	10,400	10,400	10,400	10,400

[1] Estimate.
[2] Estimated annual average.

TRADE

The statistics on metal and mineral trade are those officially published on a fiscal-year basis in Importations et Exportations, Années Fiscales 1960–61, 1961–62, by the Administration Générale des Douanes, Port-au-Prince.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960–61 [1] (quantity)	1961–62 [1]		
		Quantity	Principal destinations	Value (gourdes) [2]
Metals:				
Aluminum ore, bauxite	352,930	451,329	All to United States	18,343,185
Copper concentrate	7,505	18,398	Japan 15,286; Portugal 3,112	16,190,101
Total:				
Value of metal exports				[3] 34,533,286
Value of all exports				[4] 204,162,446
Metals share in total exports percent				16.9

[1] Fiscal year, ending Sept. 30.
[2] 1 gourde = US$0.20.
[3] US$6,906,687.
[4] US$40,832,489.

TABLE 3.—Imports of metals and minerals in 1960–61 [1]

(Metric tons unless otherwise specified)

Commodity	Quantity	Principal sources	Value (gourdes) [2]
Metals:			
Aluminum alloys, unmanufactured.	28	Switzerland 15; United States 4; Austria 4.	156,518
Copper and copper alloys, unmanufactured.	103	United States 44; Belgium 19; United Kingdom 18.	666,111
Iron and steel:			
Cast iron pipes, tubes, fittings	436	France 98; West Germany 89; United Kingdom 60.	582,227
Steel:			
Bars, rounds, etc	2,380	Belgium 858; France 694; Luxembourg 327.	1,577,974
Plates, sheets, strips and bands, uncoated.	309	Belgium 168; United States 74; Luxembourg 40.	281,045

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals in 1960–61 [1]—Continued

(Metric tons unless otherwise specified)

Commodity	Quantity	Principal sources	Value (gourdes) [2]
Metals—Continued			
Iron and steel—Continued			
Steel—Continued			
Tinplate	1,848	Belgium 1,649; United States 185; West Germany 8.	2,091,511
Pipes, tubes, fittings	30	Mexico 17; United States 9; Netherlands 2.	96,163
Wire rods and wire	192	Belgium 127; United States 27; Netherlands 18.	242,279
Rails and track access	32	Netherlands 13; United States 10; West Germany 4.	97,605
Total iron and steel products.	5,227		4,968,804
Lead and lead alloys, unmanufactured.	1	All from Netherlands	6,864
Nickel alloy bars and rods	4	All from Austria	18,417
Silver bullion—troy ounces	19,966	United States 18,455; Japan 1,157; France 193.	139,171
Tin solder and other alloys	126	United States 80; Netherlands 19; West Germany 11.	440,394
Zinc alloys, wrought	[3]	Belgium	403
Nonferrous ores and concentrate, n.e.s.[4]	[3]	United States	1,337
Total value, metals			6,398,019
Nonmetals:			
Asbestos cement	237	Belgium 191; Italy 30; France 10	192,943
Cement	413	United Kingdom 191; Denmark 106; France 77.	122,841
Clay, refractory	68	West Germany 38; United States 28	43,184
Gem stones—kilograms	21	West Germany 10; Italy 7; United States 2.	3,526
Potassium salts (natural fertilizers).	81	United States 35; West Germany 32; France 14.	35,427
Salt, common	56	United States 56	35,125
Stone, cut and uncut; gypsum; chalk.	48	United States 38; United Kingdom 3; West Germany 3.	25,853
Other nonmetallic minerals, n.e.s.[4]	[3] 38	United States 27; France 11	41,865
Total value, nonmetals			500,764
Mineral fuels:			
Petroleum refinery products:			
Aviation gasoline—thousand 42-gallon barrels	26	[5]	[5]
Motor gasoline—do	255	[5]	[5]
Jet fuel—do	4	[5]	[5]
Kerosine—do	7	[5]	[5]
Distillate fuel oil—do	264	[5]	[5]
Residual fuel oil—do	175	[5]	[5]
Lubricants, including greases—thousand 42-gallon barrels	20	[5]	[5]
Other—do	5	[5]	[5]
Total (distribution by source estimated).	756	Curacao [6] 395; Trinidad [6] 278; United States [6] 77.	12,620,905
Total:			
Value of metal and mineral imports.			[7] 19,519,688
Value of all imports			[8] 185,853,208
Metals and minerals share in total imports—percent			10.5

[1] Fiscal year ending Sept. 30.
[2] 1 gourde = US$0.20.
[3] Insignificant quantity.
[4] Not elsewhere specified.
[5] Data not available.
[6] Estimate.
[7] US$3,903,938; metals comprised US$1,279,604, nonmetals US$100,153 and fuels US$2,524,181.
[8] US$37,170,642.

COMMODITY REVIEW

METALS

Bauxite.—Deposits of bauxite are in the southern peninsula, in the east-west bauxite belt which includes similar deposits in Jamaica and southwestern Dominican Republic. Deposits near Beaumont and Savane Zombi (and near Gonaïves in the northern part of the country) are too thin and low in grade to be commercially valuable. The largest operational deposit is in the Rochelois Plateau at an elevation of 956 meters (3,100 feet) at Sainte Croix and is up to 30 feet thick. From March 1957 to the end of 1963, Reynolds Haitian Mines, Inc. (the corporate name under which Reynolds Metals Co. of Richmond, Va., operates in Haiti), mined approximately 2,059,000 metric tons of bauxite (calculated to a moisture-free basis) from this deposit. At least 8 million tons of recoverable ore remained in reserve. The ore is crushed and dried at the mine site and hauled approximately 19 kilometers (12 miles) in 30-ton trucks to the port of Miragoâne, where a loading pier has been constructed. Shipments reported in "long dry tons" carried an average 13.4 percent moisture. The ore has been shipped to the company's refining plant at Corpus Christi, Tex., which is specially designed to process Jamaican and Haitian ores. Damage to the port facilities at Miragoâne by Hurricane Flora on October 3, 1963, may have contributed slightly to that year's production drop but shipping was not seriously interrupted. The company continued to provide free electricity to the port of Mirogoâne and to maintain a private hospital. Relationships with the Haitian people reportedly are excellent.

Copper.—An area of 25,000 hectares (96.5 square miles) in the Terre Neuve district, Department of L'Artibonite, 24 kilometers (15 miles) north of Gonaïves, was explored intensively in 1956–58 by SEDREN S.A. (Société d'Exploitation et de Développement Economique et Naturel d'Haiti), a subsidiary of the United States-Canadian financed Consolidated Halliwell Ltd. of Toronto. Tunneling and more than 70,000 feet of diamond drilling developed an estimated 5,200,000 tons of 1.7 percent copper ore, including 1,800,000 tons of 2.5 percent copper in the Meme ore body. The ore is in metamorphic deposits along a contact of Upper Eocene limestone with intrusive quartz diorite, with veins in quartz diorites, basalts, and andesites. Chalcopyrite is the principal copper mineral and is associated with bornite in the enriched veins. The company then installed mining equipment; sank shafts; drove adits; built a concentrating mill with a capacity of 1,500 tons per day, a 25-million-gallon reservoir to insure a water supply, roads, and dock facilities at the port of Gonaïves; and undertook the training of Haitian labor. Total plant operations began in October 1960, and from then to the end of 1963, production was 47,700 metric tons of concentrate containing 16,400 tons of copper. The concentrate was shipped to Minerals and Chemicals Philipp Corp. in the United States, but at a rate far short of the ultimate goal of 32,650 metric tons annually. As of the end of 1960, the company was employing about 500 Haitians. SEDREN has a 25-year exclusive concession from the Haitian Government granted in April 1955.

NONMETALS

Cement.—Le Ciment d'Haiti, a company capitalized at US$1,250,000 by the French owners of Compagnie des Grands Travaux de Marseilles, the Haitian Bank for Industrial and Agricultural Credit, and private Haitian and Venezuelan investors, has manufactured cement since mid-1954. The wet-process plant, using a single diesel-fired kiln with a capacity of 150 metric tons per day, is on the coast at Source Matelas, about 24 kilometers (15 miles) north of Port-au-Prince and adjacent to large deposits of marl. The company also constructed a wharf at the port for ocean shipments, but has been unable to produce for export a surplus over the domestic requirements of the building and construction trades. Cement imports, however, which formerly supplied the total needs of the country, have been reduced to a few hundred tons per year. In addition to manufacturing cement, the plant casts concrete blocks and other forms for construction, and crushes limestone for sale in uncalcined form.

No information is available on lime, except that it has been produced in small, old-fashioned, and generally handmade kilns which are numerous and widely scattered.

Salt.—No accurate figures on salt production can be obtained because of the diversity of the producing areas and their small size. Individual peasants and small groups flood rectangular lowland areas with sea water, which is left to dry in the sun; the remaining salts are then harvested and marketed throughout the country. Analyses of the product made in 1948 showed only 87 percent sodium chloride, 10 percent salts of calcium, magnesium, and potassium, and nearly 3 percent dirt. It is not known if the quality of the product has improved since that time. In any event, it serves the predominant needs of the nation; less than 100 tons of refined salt have been imported annually.

MINERAL FUELS

Petroleum.—Haiti is not a petroleum-producing country, and sizable capital invested in petroleum exploration yielded negative results. Petroleum refinery products imported for Haitian consumption are distributed through marketing outlets maintained by the Esso, Texaco, Sinclair, and Shell companies or their affiliates.

On February 14, 1963, the Haitian Government published the constitutive act and statutes of the Haitian Petroleum and Refining Co. and announced official approval of that company's Valentine refinery project. The company was capitalized at $100,000, of which more than half was paid in at that time. The president and most of the principal officers are residents of the United States. Surveys were started in the Port-au-Prince area for a refinery site, but at year end there was no evidence that the project had progressed beyond that point.

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The Mineral Industry of Jamaica

By Garn A. Rynearson [1]

ALTHOUGH Jamaica's mineral industry is limited to the production of only a few mineral commodities; this small Caribbean island of only 4,411 square miles is the world's foremost producer of bauxite and a significant producer of alumina. Jamaican bauxite output surpassed that of Surinam in 1957 and has led that of all countries ever since. Output in 1963 was slightly more than 23 percent of the world total. Approximately three-fourths of the bauxite mined in Jamaica is exported to the United States, where it constitutes more than half of the annual supply, and one-fourth is converted to alumina for export. Jamaican output of limestone, gypsum, clay, and other construction materials is of significance mainly to the domestic economy. Appreciable quantities of gypsum are exported to the United States, and large reserves of high-grade material may enable Jamaica to become a more important exporter of this commodity in the future.

Jamaica's mineral industry, dominated by the production and export of bauxite and alumina, accounts for approximately 10 percent of the country's gross domestic product, which amounted to US$728 million [2] in 1962. National account estimates are not available for 1962 or 1963, but in 1961 mining contributed 8.9 percent of the total compared with 13.4 percent by manufacturing, 13.0 percent by agriculture, forestry, and fishing, and 11.5 percent by construction and installation; cement manufactured contributed about 1 percent. The total market value of Jamaica's mineral products, including cement and lime, probably is in the order of US$90 million annually.

The importance of the mineral industry to the national economy is measured largely by the income derived from the bauxite-alumina operations. Taxes and royalties collected from the bauxite companies constitute the largest single source of Government revenue and represented 15.6 and 10.9 percent of the total revenue for 1962 and 1963, respectively. As the amount of revenue collected is based on a formula that takes into account the price of aluminum pig on the New York market, the low price that prevailed during most of 1963 resulted in considerably less revenue than that collected in 1961 when less bauxite was exported. During 1962 and 1963 the bauxite-alumina industry employed an average of 5,600 persons and had an annual wage bill

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[2] Jamaica's monetary unit is the Jamaican pound (J£), equated by law to the pound sterling, and is equivalent to US$2.80 (US$1.00=J£0.357).

that exceeded US$11 million. Other disbursements in the country (that is, capital expenditure, materials and supplies, and services) averaged US$15 million.

SOURCE MATERIAL

This report is based mainly on official publications by several agencies of the Government of Jamaica and unclassified despatches from the U.S. Embassy at Kingston. Supplemental information pertaining to specific commodities was derived from other published sources. Among these were a series of articles by Mike Eigo, published in the January, March and May 1964 issues of Engineering and Mining Journal, which describe in detail the bauxite and alumina industry of Jamaica as of the latter part of 1963. Information on iron was derived, in part, from an article by V. G. Hill on investigations made by the Scientific Research Council of Jamaica, published by the United Nations (E/Conf. 39/A384, November 1962, 8 pp.), and part of the information on petroleum refining was derived from an article by W. B. Hudson in the February 1964 issue of World Petroleum.

PRODUCTION

Overall output of Jamaica's mineral industry during 1963 remained at about the same level as in 1962. A substantial decrease in bauxite production for export, reflecting the general decline in world demand, was partly offset by a record output of alumina. Gypsum output rose slightly despite the large stocks (291,088 metric tons) carried over from 1962. Cement output also increased slightly but was considerably lower than in 1960 and 1961. The lag in both public and private construction activities during 1962 and the first half of 1963 has been attributed largely to an attitude of caution that prevailed while the Government of the newly independent nation was becoming established. This attitude apparently has changed to one of optimism; a marked increase in construction was noted in the latter part of 1963. It is expected, therefore, that during 1964 production of cement and other construction materials will return to normal levels.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite mined, dried equivalent	[2] 5,208,047	5,836,994	6,770,063	7,615,419	7,013,910
Alumina (exports)	405,617	676,040	714,774	637,719	737,193
Nonmetals:					
Cement, common portland	195,617	212,175	215,710	200,162	200,721
Glass sand	[3]	[3]	[3]	6,648	[3]
Gypsum	475,668	249,778	226,625	228,923	231,968
Limestone	[3]	[3]	[3]	[4] 1,708,000	[3]
Phosphates	35	65	63	57	14

[1] In addition to commodities tabulated, Jamaica produces china and pottery clays, lime, marble, and clay, sand, and gravel for construction purposes, but data on quantities are not available.
[2] Revised figure, supersedes that given in commodity chapter, volume 1.
[3] Data not available.
[4] Based on officially estimated production of registered quarries.

TRADE

Three commodities—bauxite, alumina, and sugar—comprise 75 percent of Jamaica's total exports. The combined export value of bauxite and alumina, measured as a portion of total domestic export value, declined from 51.0 percent in 1961 to 48.4 percent in 1962 and to 41.8 percent in 1963. Despite the net decline in bauxite-alumina exports during 1963, Jamaica's traditionally adverse balance in visible trade was reduced to US$22.7 million, the lowest deficit since 1954, because of a sharp increase in the value of sugar exports, which accounted for 33.5 percent of the total for the year.

The island's limited natural resources and its relatively small manufacturing capacity cannot provide many of the needs of a domestic market consisting of 1,706,000 Jamaicans and numerous tourist visitors. Almost all capital goods, most durable consumer goods, and a substantial amount of foodstuffs (about 20 percent of all imports) are imported. Although exports of mineral commodities far exceed imports in this category, Jamaica has to import virtually all its metal and mineral fuel requirements and such essential nonmetals as salt, sulfur, and fertilizer materials. The level of these imports has remained fairly stable in recent years. Preliminary data for 1963 indicate that increased imports of metals and fertilizers were partly offset by a decrease in imports of petroleum products, and the net rise was less than 1 percent.

The United States, which displaced the United Kingdom as Jamaica's principal overall trading partner in 1962, generally receives about half of the island's metal and mineral exports but supplies only about 15 percent of its imports in this category, chiefly in the form of fuel and lubricating oils and metal semimanufactures. The U.S. statistical share of such imports is expected to become even smaller because Jamaica has begun to produce petroleum products in its new refinery and a steel mill is planned for the near future.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962		
	Quantity	Quantity	Principal destinations	Value (Jamaican pounds) [1]
Metals:				
Domestic products:				
Aluminum:				
Bauxite	5,054,648	6,082,764	All to United States	[2] 15,715,031
Alumina	714,774	637,719	Canada 386,042; Norway 184,420; Brazil 30,416.	[2] 14,422,654
Aluminum and aluminum alloys, wrought.	6	19	Mainly to British Honduras	6,663
Copper ore and concentrate, gross weight.	70			
Iron and steel:				
Scrap	9,761	1,070	Netherlands 1,064; United Kingdom 4; West Germany 2.	11,660
Semimanufactures		6	All to Trinidad and Tobago	500
Nonferrous metal scrap	417	1,030	Italy 244; United Kingdom 210; West Germany 166.	59,175
Total value of metals				30,215,683
Reexports, total value [3]				20,596
Nonmetals:				
Domestic products:				
Cement, common portland	12,107	21,878	Bahamas 7,332; Antigua 4,560; British Honduras 2,077.	178,723
Clays		2	Canada 1; United Kingdom 1	10
Gypsum	84,216	260,907	All to United States	386,206
Sand, gravel, crushed rock	(4)	6,096	All to Cuba	5,257
Stone, dimension, not worked.	40	47	Mainly to United States	787
Other nonmetals, not specified.	7	10	Trinidad and Tobago 9; Barbados 1.	74
Total value of nonmetals				571,057
Reexports, total value [5]				1,154
Mineral fuels:				
Reexports, including bunkers:				
Coal	4	2	All to Turks and Caicos Islands	87
Coke	(4)			
Gases, liquified [6] 42-gallon barrels.	1,385	61	Cayman Islands 54; bunkers 7	644
Petroleum refinery products: [7]				
Gasoline:				
Aviation ---do---	87,018	121,540	Bunkers 116,979; Netherlands Antilles 4,429; Turks and Caicos Islands 122.	336,999
Other ---do---	4,816	2,797	Cayman Islands 1,541; Turks and Caicos Islands 1,204; bunkers 52.	11,089
Kerosine ---do---	162,210	282,664	Bunkers 280,044; Turks and Caicos Islands 1,845; Cayman Islands 774.	580,471
Distillate fuel oil [8] ---do---	462,804	283,954	Bunkers 281,127; Turks and Caicos Islands 1,516; Cayman Islands 1,311.	345,018
Residual fuel oil [8] ---do---	1,059,559	601,183	Bunkers 601,041; Haiti 101; Cayman Islands 41.	488,082
Lubricants [8] ---do---	2,346	1,427	Bunkers 1,159; Cayman Islands 112; Turks and Caicos Islands 85.	15,807
Paraffin and vaseline [8] ---do---	43	2	All to Turks and Caicos Islands	29
Asphalt	13	22	Mainly to Cayman Islands	530
Total value of mineral fuels.				1,778,756

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962		
	Quantity	Quantity	Principal destinations	Value (Jamaican pounds) [1]
Total:				
Value of metal and mineral exports [9]				30,786,740
Value of all exports, f.o.b. [9]				62,234,602
Metals and minerals share percent in total exports [9]				49.47

[1] The Jamaican pound (J£) is equivalent to US$2.80 (US$1.00=J£0.357).
[2] Arbitrary value fixed by agreement between the Government and producer-exporters.
[3] Reexports of wrought and unwrought metals in relatively small quantities. Value in 1961, J£31,530.
[4] Less than 1 ton.
[5] Largely reexports of salt, dimension stone, and fertilizer materials. Value in 1961, J£1,102.
[6] Includes natural gas and gases derived from coal and petroleum.
[7] Excludes liquified petroleum gas (LP gas).
[8] Source reports quantities in gravimetric units. Conversion to volumetric units is based on conversion factors in use by U.S. Bureau of Mines.
[9] Excludes reexports.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962		
	Quantity	Quantity	Principal sources	Value (Jamaican pounds) [1]
Metals:				
Aluminum:				
Alumina	14	10	Mainly from United Kingdom	271
Metal, including alloys:				
Unwrought	34	7	Mainly from United States	4,353
Semimanufactures	1,415	1,133	United Kingdom 546; United States 450; Puerto Rico 43.	471,203
Copper, including alloys:				
Unwrought	8	10	United Kingdom 6; Canada 2; United States 2.	6,404
Semimanufactures	250	158	United Kingdom 96; Canada 30; United States 30.	76,891
Gold, nonmonetary	(2)	(2)	Not available	24,053
Iron and steel:				
Scrap iron and steel	49			
Pig and sponge iron	114	77	United Kingdom 47; United States 25; Canada 5.	3,886
Ferroalloys	44			
Steel ingots and equivalent primary forms.	266	468	United Kingdom 276; Belgium-Luxembourg 151; United States 41.	25,069
Semimanufactures, including unworked castings.	42,500	45,073	United Kingdom 17,714 Belgium-Luxembourg 9,141; United States 5,860.	2,888,541
Lead, including alloys:				
Unwrought	122	113	United Kingdom 86; Mexico 20; Netherlands 5.	10,180
Semimanufactures	89	69	United Kingdom 65; Denmark 2; United States 1.	7,888
Nickel, including alloys:				
Unwrought	2	1	United Kingdom, United States, and Canada 1.	1,491
Semimanufactures	(3)	9	Mainly from United States	10,123
Platinum and platinum-group metals, unworked and partly worked.	(2)	(2)	United Kingdom J£503; United States J£101; West Germany J£26.	630
Silver, unworked and partly worked.	(2)	(2)	All from United Kingdom	558
Tin, including alloys and solder:				
Unwrought—long tons	31	36	Mainly from United Kingdom	17,030
Sheets [4]—do	39	623	United Kingdom 418; United States 131; Italy 47.	58,053
Other wrought tin—do	945	430	West Germany 350; United Kingdom 40; United States 36.	38,000

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962		
	Quantity	Quantity	Principal sources	Value (Jamaican pounds)[1]
Metals—Continued				
Zinc and zinc alloy semimanufactures.	46	41	United Kingdom 19; Japan 13; United States 8.	7,326
Miscellaneous base metal ores and concentrates.	7	(5)	Mainly from United States	3,660
Nonferrous base metals and alloys, not specified:				
Scrap	2			
Unwrought	1	3	Mainly from United Kingdom	1,332
Semimanufactures	2	6	do	1,633
Total value of metals				3,658,575
Nonmetals:				
Abrasives, natural, including industrial diamond.	6	10	Italy 3; United States 3; United Kingdom 2.	1,107
Asbestos	29	21	All from United Kingdom	1,178
Cement:				
White portland	1,949	1,087	United Kingdom 553; Denmark 484; Japan 50.	21,476
Refractory	140	129	United Kingdom 111; Canada 18	5,504
Other	27	25	United Kingdom 14; United States 9; Colombia 1.	1,716
Clays	105	1,352	United Kingdom 1,163; United States 189.	14,332
Gem stones, cut but unset	(2)	(2)	British Guiana J£649; West Germany J£401; Canada J£397.	1,496
Graphite	1	1	Mainly from United Kingdom	295
Fertilizers, mineral and chemical:				
Nitrogenous:				
Natural sodium nitrate	2	58	Chile 56; United Kingdom 2	1,576
Ammonium sulfate	24,524	22,883	Trinidad and Tobago 17,564; West Germany 2,845; Belgium-Luxembourg 2,439.	333,340
Other, manufactured	2,648	1,059	Trinidad and Tobago 331; Italy 307; United States 269.	29,363
Phosphatic:				
Natural phosphates	50	6	Mainly from United States	432
Superphosphates, Thomas slag, other manufactured phosphatic fertilizers.	774	1,587	Netherlands 1,207; West Germany 162; United States 110.	40,373
Potassic:				
Crude potash salts		787	Mainly from Netherlands	21,123
Other potassic fertilizers	5,524	3,660	France 1,992; West Germany 1,383; United States 181.	74,409
Mixed and other nonspecified fertilizers.	22,029	21,151	Netherlands 8,057; Italy 5,857; Belgium-Luxembourg 4,572.	464,536
Lime	278	2	All from United States	68
Magnesite	4	6	All from United Kingdom	622
Mica	54	85	Brazil 30; Norway 25; United Kingdom 15.	14,626
Salt	11,666	11,115	Turks and Caicos Islands 3,725; United Kingdom 3,148; West Germany 2,027.	113,069
Stone, dimension:				
Unworked	578	384	Italy 299; United States 59; Japan 15	9,770
Worked	65	48	Italy 35, United Kingdom 10; Canada 1.	9,046
Sulfur	4	16	United States 13; United Kingdom 3	582
Other nonmetals, not elsewhere specified.	536	1,538	United Kingdom 1,225; Belgium-Luxembourg 311; United States 233.	54,801
Total value of nonmetals				1,214,840
Mineral fuels:				
Coal	217	211	United Kingdom 206; United States 5	5,089
Coal briquets		10	United Kingdom 8; United States 2	272
Coal coke	534	514	United Kingdom 509; West Germany 5	10,627
Gases, liquefied[6] thousand 42-gallon barrels.	50	53	Venezuela 27; United States 18; Netherlands Antilles 5.	206,406

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962		
	Quantity	Quantity	Principal sources	Value (Jamaican pounds)[1]
Mineral fuels—Continued				
Petroleum refinery products: [7]				
Gasoline:				
Aviation.....do....	113	113	Trinidad and Tobago 73; Netherlands Antilles 40.	311,189
Other.....do....	687	743	Mainly from Trinidad and Tobago...	1,074,914
Kerosine.....do....	479	581	Trinidad and Tobago 403; Netherlands Antilles 177.	874,951
Distillate fuel oil [8].....do....	1,094	1,084	Netherlands Antilles 610; Trinidad and Tobago 343; United States 121.	1,423,896
Residual fuel oil [8].....do....	4,051	3,370	Netherlands Antilles 2,182; United States 472; Colombia 315; Venezuela 306.	2,813,585
Lubricants [8].....do....	42	44	United States 29; Netherlands Antilles 7; United Kingdom 7.	478,996
Paraffin and vaseline [8].do....	2,204	2,174	United States 831; Netherlands 797; West Germany 439.	28,253
Lighter fuel.....do....	41	79	United Kingdom 42; United States 37.	5,579
Asphalt [9].....	13,104	9,254	Netherlands Antilles 4,894; Trinidad and Tobago 3,163; Barbados 421.	133,414
Natural asphalt.....	1,841	2,386	All from Trinidad and Tobago.....	39,434
Mineral tar and crude chemicals from coal, petroleum, and natural gas.	75	113	United States 93; United Kingdom 20.	6,521
Total value of mineral fuels.	.....	.....	.....	7,413,126
Total:				
Value of metal and mineral imports.	.....	.....	.....	12,286,541
Value of all imports, c.i.f.	.....	.....	.....	79,601,200
Metals and minerals share percent in total imports.	.....	.....	.....	15.44

[1] Jamaican pound is equivalent to US$2.80 (US$1.00=J£0.357).
[2] Data not available.
[3] Less than 1 ton.
[4] Quantities shown probably include paperbacked foils and therefore do not represent actual amount of metal involved.
[5] Total quantity not available. Includes 10 tons of unspecified material and less than 1 ton each of several specified materials.
[6] Includes natural gas and gases derived from coal and petroleum.
[7] Excludes liquefied petroleum gas (LP gas).
[8] Source reports quantities in gravimetric units. Conversion to volumetric units is based on conversion factors in use by U.S. Bureau of Mines.
[9] May include relatively small amounts of other petroleum or coal byproducts.

COMMODITY REVIEW

METALS

Aluminum.—Total production of bauxite in 1963 declined almost 8 percent from the record output of 1962, despite a marked increase in production for consumption in the island's two alumina plants. The net decline is attributed to curtailment of exports by Kaiser Bauxite Co. and Reynolds Jamaica Mines, Ltd., because of reduced demand in their U.S. markets and lower quotas for the barter of Jamaican bauxite in fiscal 1964. Exports of bauxite were 5,244,391 dry metric tons, almost 14 percent less than exports in 1962. However, alumina exports by Alcan Jamaica, Ltd., increased 15.6 percent to 737,302 metric tons. Barring adverse economic conditions, production and export of

bauxite should recover in 1964 as the new facilities of Alcoa Minerals of Jamaica, Inc., come into year-round operation.

In June 1963 Alcoa began sending ore from the Woodside mine in Clarendon Parish to its drying plant and port installations at Rocky Point. Shipments to Point Comfort, Tex. commenced in November. Initial production is to be 250,000 to 300,000 tons per year, increasing to 500,000 or 600,00 tons when full-scale operation is attained. Alcoa's facilities feature 85-ton aluminum-body cars for the 18.5-mile rail haul and an aluminium-domed storage structure 300 feet in diameter with a capacity of 67,000 tons of bauxite.

Kaiser Bauxite Co., the largest producer in Jamaica, embarked on a US$30 million, 5-year expansion program to develop a second mining and port installation. The first phase of the program involves an 18-month dredging project to breach the reef at Discovery Bay on the north coast in order to permit entry of 37,600-ton ore ships and other large vessels. The port terminal to be built will include a deepwater pier and drying, screening, storage, and loading facilities with an initial annual capacity of 1.5 million tons, but will be designed for easy and rapid future expansion. Preliminary work was begun on roadbed construction for 10 miles of railway to connect the port with bauxite deposits in St. Ann's and Trelawny Parishes. Location of the rail terminal and initial mining areas was not announced. A possible site in St. Ann requires a longer haul than one in Trelawny, but the latter requires construction of a 1,200-foot bridge over a river gorge 420 feet deep.

Kaiser continued to improve its main operations in St. Elizabeth Parish on the south side of the island. With a fourth kiln in operation at Port Kaiser, the company's annual capacity has been increased by 2 million tons to a total of 6.3 million tons. The company has started to lay heavier rails on its 17-mile railroad and began replacing the old 75-ton steel cars with 84-ton aluminum cars to increase transport capacity.

Alcan Jamaica Ltd. proceeded with modifications at the Kirkvine alumina plant in Manchester Parish and predicted these changes would permit increased output in 1964. This plant and the Ewarton works in St. Catherine Parish provided Alcan with a total rated capacity of about 750,000 tons of alumina in 1963.

Harvey Aluminum of America has been granted a special mining lease on bauxite deposits in St. Catherine Parish, but no mining was done in 1963. Prospecting by the company has indicated the deposits to be high in silica, and their exploitation in the near future appeared uncertain.

Jamaica has no facilities as yet for reducing its bauxite to metal, but plans for such facilities have been tentatively discussed. Unless and until petroleum is found on the island, development of the power required by such a plant would depend entirely on imported fuels; domestic power sources are extremely inadequate.

Iron and Steel.—Jamaica's first steel mill was scheduled for construction by the Caribbean Steel Co., Ltd., during 1964 and should be in operation in 1965. The US$2.5 million mill will have an annual ingot capacity of 30,000 tons and will use scrap, part of which will be obtained locally and part of which will be imported duty free. A

rolling mill with a one-shift capacity of 18,000 tons will process ingots into reinforcing bars. Imports of iron and steel bars averaged about 13,000 metric tons annually during 1959–63, and domestic output of these items is expected to save approximately US$1.4 million on foreign exchange per year.

The new steel mill may give some impetus to establishment of a small, integrated iron and steel industry based on scrap iron, local magnetite and hematite ores, and red mud tailings from the alumina plants. The tailings were being stored in case this industry should materialize.

Small replacement bodies of high-grade magnetite and hematite occur in the metamorphic rocks of the Port Royal Mountains and the Blue Mountain Range in Portland, St. Andrew, and St. Catherine Parishes. The deposits are widely scattered and some are too inaccessible to be of economic interest. The only iron-mining lease in effect in 1963 was registered in the name of Mavis Bank Iron Ore, Ltd., which reportedly has been acquired by the Jamaican firm of International Metals, Ltd. The lease includes the Glade-Orchard deposits in the Mavis Bank area of St. Andrew Parish, where trenching and drilling have proved reserves of about 200,000 tons of minable ore. Other investigations have indicated that three black sand deposits on the south coast might yield about 1 million tons of titaniferous magnetite. A blend of black sand concentrate, Mavis Bank ore, and red mud tailings might overcome the problem of a high titanium dioxide content in the black sand and certain handling problems of the tailings, and thus make a mixture suitable for furnace reduction.

Other Metals.—Small deposits of copper, lead, zinc, cobalt, and manganese ores occur at widely scattered localities in Jamaica. Some of these were worked on a small scale during the 19th century but activities in recent years have been restricted to intermittent prospecting. In 1963, 4 companies held 11 prospecting licenses for copper. A geochemical survey of some of the more promising copper-bearing areas was made in 1961 and some diamond drilling and underground exploration have been accomplished since, but the only production appears to have been the small quantity of high-grade ore or concentrates exported in 1961.

Relatively recent explorations at the old Hope mine near Papine in St. Andrew Parish have indicated reserves of some 65,000 tons of proved and 85,000 tons of probable ore averaging 1.7 percent lead and 3.8 percent zinc with 0.21 ounce of silver and 0.06 ounce of gold per ton. No production of ore or concentrates has been reported.

NONMETALS

Cement.—The Caribbean Cement Co., which operates under a monopoly franchise, supplied virtually all of the country's portland cement requirements from its plant at Rockfort in St. Thomas Parish. This company also exported cement to many of the other Caribbean islands. Small quantities of white portland cement and refractory, colored, and other types of cement not produced in Jamaica continued to be imported.

Expansion of the Rockfort plant was nearly completed during 1963 with this installation of a third rotary kiln which will double rated

capacity from 200,000 to 400,000 tons. The additional capacity should enable the company to meet the increased demand caused by a rising level of construction activity. The plant utilizes the wet process. Limestone is obtained from two nearby quarries on Long Mountain, clay from the bottom of Hunt's Bay west of Kingston, and gypsum from a local supplier.

Kaiser Bauxite Co. announced an agreement concluded with Bahama Cement Co. to supply low-grade bauxite for use in the cement to be made at a new plant at Freeport, Grand Bahama. Kaiser is to deliver between 70,000 and 250,000 tons of cement-grade bauxite over 10 years, and thus will help to compensate for a probable loss of part of Jamaica's cement export markets to Bahama's new plant.

Gypsum.—Large deposits of high-grade gypsum occurring in the eastern part of St. Andrew Parish constitute one of Jamaica's more important mineral resources. Total reserves of these deposits have been estimated as at least 84 million tons. Jamaica Gypsum, Ltd., a subsidiary of United States Gypsum Co., remained the only significant gypsum producer in 1963; the bulk of its output has been exported to the United States. The local cement industry has regularly consumed about half of the 14,000 tons of gypsum sold each year in the country, and most of the remainder has been used in the local manufacture of plaster for gypsum board and other building materials. Small quantities of alabaster have been cut into ornamental objects.

Jamaica Gypsum's quarries and crushing plant are just north of Bull Bay, and its pier and stockpiling facilities are at Harbour Head. The company has maintained a fairly uniform rate of production since the abnormally high levels of 1958 and 1959. Local sales also have been relatively constant, but exports were far below normal in 1961 and 1963, with the result that unusually large stocks have accumulated. Exports in 1963 totaled only 136,651 metric tons, and local sales decreased about 6 percent to 12,823 metric tons. Stocks at year-end amounted to 373,582 tons.

Limestone and Marble.—Limestone has been utilized extensively in Jamaica for road construction, fill and ballast material, aggregate for concrete and concrete blocks, and raw material for cement and lime. Thick limestone beds cover more than 60 percent of the island, so a virtually inexhaustible supply of this rock is readily available. Other hard rocks are relatively scarce and, for the most part, occur in the more inaccessible areas. Dolomite suitable for refractory and metallurgical purposes occurs on the island, but local demand for this stone has been insignificant. A wide variety of colored marbles suitable for facing stone and other ornamental purposes are found in St. Thomas Parish. Serge Island Jamaica Marble, Ltd., has recently started a quarrying, cutting, and polishing operation near Morant Bay and has begun to produce polished marble slabs for local use and for export. Banded travertine has been used locally as a building stone.

Except for the limestone equivalent of the cement produced, statistical data on production and consumption of limestone and marble are not reported regularly. The official estimate for total production by registered quarries in 1962 was 1,506,540 cubic yards, or approximately 1.7 million metric tons. The cement industry consumed

about 270,200 metric tons in 1962. Limekilns, notably those at Alcoa's Kirkvine alumina works and at Bamboo in St. Ann's Parish, probably consumed 100,000 metric tons or more. Most of the limestone output is used for roadbuilding.

Phosphates.—Much attention has been given to deposits of bat guano and associated phosphatic marl found in some of the numerous limestone caves on the island. This material has been collected and used by farmers as fertilizer, and some has been produced on a commercial scale and processed for sale as a dairy feed supplement and as fertilizer. Some caves worked have contained several thousand tons of phosphates, but most have yielded only a few hundred tons. Intensive prospecting probably would locate numerous caves with recoverable phosphates, but the relatively small average size of the deposits and the wide dispersion and difficult accessibility of the caves have discouraged any serious attempt to enlarge commercial recovery operations. Annual reported output in recent years has been less than a hundred tons of dried phosphates.

MINERAL FUELS

Petroleum.—As of 1963, all of Jamaica's requirements for mineral fuels and lubricants had to be imported, as the country has no known oil resources and only a few small uneconomic deposits of low-grade lignite. Oil exploration on the island by several companies has been unsuccessful thus far, and offshore drilling seems to offer the best remaining possibility of finding commercial quantities of oil. Jamaica Time Petroleum, Inc., still holds 23 oil prospecting licenses, but no field activity by the company has been reported for 1963. Fuel imports cost Jamaica an average of nearly US$20 million annually during 1959–63. This heavy outflow of foreign exchange will be reduced somewhat by the new 26,500-barrel-per-day Esso West Indies oil refinery and marine terminal at Kingston, which was completed in December. To go on stream early in 1964, this refinery will process imported crude oil into gasolines, kerosine, jet fuel, distillate and residual fuel oils, liquefied petroleum gas, and asphalt. The finished products will provide most of Jamaica's internal and bunkering requirements, with a surplus of about 30 percent for export to the Bahamas, Bermuda, and British Honduras. The new refinery's processing units include a crude oil pipestill; an asphalt vacuum pipestill; hydrofiners for naphtha, kerosine, and gas oils; a Powerformer catalytic reformer; and facilities for fractionating light ends. Esso also plans early installation of facilities for blending lubricating oils.

The Mineral Industry of the Netherlands Antilles

By Eugene R. Slatick[1]

PETROLEUM refining continued to be the most important industry in the Netherlands Antilles during 1963. It supported all other segments of the economy directly or indirectly and employed about 30 percent of a labor force of about 29,000. In both volume and value, petroleum was the most important trade commodity. Feedstock requirements for the two refineries (one on Aruba and one on Curaçao) continued to be met by imports, mostly from Venezuela.

Phosphate rock mining remained the second principal mineral industry, but its importance decreased. Of lesser importance were salt production from salt pans on Bonaire and Curaçao and limestone aggregate produced as a byproduct of phosphate operations. Sulfur was recovered as a byproduct of refining operations, but most of it was used by the refineries. Among the new mineral industries established in 1963, the most significant was the nitrogenous fertilizer complex on Aruba.

The Netherlands Antilles comprise two groups of three islands each, about 880 kilometers apart. The large group (Aruba, Curaçao, and Bonaire) covers an area of 921 square kilometers; the smaller group (St. Martin, St. Eustatius, and Saba), an area of 68 square kilometers. The principal cities are the capital, Willemstad on Aruba and Oranjestad on Curaçao. These are the sites of the two refineries on the islands. Together, the islands supported a population of 188,914 in 1960.

Since December 1954, the Netherlands Antilles have been fully autonomous in their internal affairs and constitutionally equal with the Netherlands and with Surinam. The sovereign of the Kingdom of the Netherlands is the titular head of government and is represented by a governor. The governor and his Council of Ministers form the internal government of the islands but are responsible to a unicameral legislature (Staten).

SOURCE MATERIAL

Data on production of refined petroleum products was obtained from Standard Oil Co. (New Jersey) reports and from the British Ministry

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of Power. Sulfur production was estimated from reported sulfur-plant capacities.[2] Other production data and all trade information were obtained from official statistics. Information on the new chemical complex was obtained from U.S. State Department Airgrams and commercial publication.[3] Data on additions to the Curaçao refinery came from Petroleum Management.[4] Information on other development was obtained mainly from U.S. State Department Airgrams and Dispatches.

PRODUCTION

Output of refined petroleum products in 1963 was about the same as in 1962. Limestone production was estimated to have decreased slightly and phosphate-rock production continued the downward trend that began in 1962. Production of marine salt was more than twice that of 1962. The increase was due to resumption of production on Curaçao, which accounted for about 38 percent of the total. Sulfur production was estimated to be same as in previous years.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Limestone.....cubic meters	[1] 28,653	[1] 16,085	[1] 11,703	21,389	[2] 20,000
Nitrogenous fertilizers					[3]
Phosphate rock	98,161	114,912	151,997	131,552	128,280
Salt, marine	283	114	134	121	281
Sulfur, recovered [2]	40,000	40,000	40,000	40,000	40,000
Mineral fuels: Petroleum, refinery products:					
Aviation and motor gasoline thousand 42-gallon barrels	36,311	39,353	44,240	46,804	43,462
Kerosine and jet fuel.....do	25,384	20,587	24,455	19,624	18,683
Distillate fuel oil.....do	40,862	40,291	46,548	48,908	52,027
Residual fuel oil.....do	132,513	145,605	145,894	157,534	153,442
Lubricants.....do	2,324	2,367	2,592	2,811	2,774
Other [4].....do	20,666	14,890	18,120	14,154	19,215

[1] Production on Curaçao only.
[2] Estimate.
[3] Data not available.
[4] Includes asphalt, liquefied petroleum gas, waxes, and unfinished oils.

TRADE

In 1962, as in the past, petroleum comprised the bulk of imports. There was a slight decline in crude-oil imports, the largest import item, but total petroleum imports rose by about 3 percent. Most of the increase was due to a rise in imports of residual fuel oil. Almost all petroleum-product imports, except specialty products not produced in the Netherlands Antilles, were either for additional refining or for reexport. Crude oil imports in 1962 were valued at Ant. f958.9 million,[5] compared with Ant. f184.7 million for refined products.

Nonmetal imports rose by about 45 percent in 1962 largely because of increased cement imports. Most of the 34 percent increase in metal imports was pipes and tubes. Nonmetal imports were valued at Ant. f1.4 million; metal imports, at Ant. f7.2 million.

[2] Sulphur. No. 43, December 1962, p. 19.
[3] Commercial Fertilizer. V. 108, No. 1, January 1964, p. 38.
Nitrogen, No. 27, January 1964, p. 9.
[4] Petroleum Management. V. 36, No. 6, June 1964, p. 92.
[5] One Netherlands Antilles guilder or florin (Ant. f) equals US$0.535.

In 1962, Venezuela supplied almost all the crude oil, most of the refined products, and almost half of the nonmetal imports. The Netherlands and the United States were the two largest suppliers of metals.

The volume of mineral exports rose by about 10 percent during 1962. Most of the increase was in petroleum product exports, which comprised about 99 percent of the total. The largest increase, almost 25 million barrels, was accounted for by residual fuel oil. Crude-oil reexports also increased. Metal exports, however, dropped about 26 percent, mostly because of a reduction in iron and steel scrap exports. Nonmetal exports were down about 12 percent largely because of a decline in phosphate exports.

Refined products continued to be the most valuable export item. They were valued at Ant. f1,262.1 million, compared with Ant. f12.3 million for crude-oil reexports, Ant. f6.8 million for nonmetals, and Ant. f1.3 million for metals.

As in the past, the United States remained the most important market for petroleum and phosphate exports. Italy was the largest market for metal exports.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Copper	1	1	All to Venezuela.
Iron and steel	238	1,008	Dominican Republic 650; Puerto Rico 346.
Iron and steel scrap	17,229	11,722	Italy 8,133; Netherlands 2,724.
Metalliferous ores, n.e.s.[1]		111	All to Iran.
Nonferrous metal scrap	1,241	922	Netherlands 527; United States 186; Italy 161.
Other nonferrous metals and alloys, n.e.s.[1]		7	United Kingdom 6; Netherlands 1.
Nonmetals:			
Phosphate rock	151,997	131,552	United States 109,602; Belgium 18,750; Canada 3,200.
Salt	30	12	All to Trinidad.
Other nonmetallics, n.e.s.[1]	265	2,642	All to Surinam.
Mineral fuels:			
Crude oil thousand 42-gallon barrels	2,286	2,657	United States 1,727; Brazil 874.
Refined products:			
Aviation gasoline do	13,154	14,480	Brazil 1,949; France 872; United Kingdom 828; Italy 819; Netherlands 810.
Other gasolines do	22,281	21,457	United States 5,287; United Kingdom 1,757; Colombia 1,394; Denmark 1,088.
Kerosine do	8,347	6,533	Canada 1,511; Argentina 1,046; United Kingdom 767.
Jet fuel do	17,520	18,400	United States 6,576; Japan 1,032; Portugal 904; Brazil 840.
Distillate fuel oil do	37,606	46,383	Netherlands 7,460; Canada 5,550; bunkers 3,331; Argentina 3,163.
Residual fuel oil do	133,313	158,122	United States 93,293; bunkers 17,583; Canada 7,013; Italy 4,609.
Lubricants do	2,415	2,674	United Kingdom 1,134; Brazil 252; Republic of South Africa 210.
Asphalt do	5,871	5,360	United States 3,530.
Other[2] do	11,019	10,589	(3).
Total:			
Value of metal and mineral exports million Ant. f[4]		1,282	
Value of all exports do		1,297	
Metals and mineral share in total exports percent		99	

[1] Not elsewhere specified.
[2] Includes liquefied petroleum gas and waxes.
[3] Data not available.
[4] The Netherlands Antilles guilder or florin is equivalent to US$0.535 (US$1.00=Ant. f1.87).

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum and aluminum alloys, all forms.	104	127	United Kingdom 43; United States 22; Netherlands 21; West Germany 20.
Copper and copper alloys, all forms	204	226	United Kingdom 106; Netherlands 60; United States 32.
Iron and steel, semimanufactures:			
Shapes and sections	2,653	3,689	Belgium 1,805; Netherlands 1,144; United States 413.
Strip	2	11	Netherlands 7; United States 4.
Plates	3,820	1,991	Netherlands 1,090; Belgium 203; West Germany 195; United States 189; Venezuela 168.
Wire	88	114	Netherlands 67; West Germany 20; Belgium 15.
Pipes and tubes	4,227	9,240	United States 2,926; Netherlands 2,748; United Kindgom 1,612.
Castings and forgings	104	105	Netherlands 80; United Kingdom 20; United States 5.
Other, n.e.s.[1]	574	77	Mainly from Netherlands.
Lead and lead alloys, all forms	60	50	Netherlands 29; United Kingdom 13.
Nickel and nickel alloys, all forms	2	3	United States 2; United Kingdom 1.
Tin and tin alloys, all forms	4	5	Netherlands 2; United States 2; United Kingdom 1.
Zinc and zinc alloys, all forms	60	90	Belgium 45; Netherlands 27; West Germany 17.
Metalliferous ores, n.e.s.[1]	12	307	All from Surinam.
Nonferrous metal scrap	55	4	Colombia 3; Venezuela 1.
Other nonferrous metals and alloys, n.e.s.[1].	5	4	Netherlands 3; United Kingdom 1.
Nonmetals:			
Cement	26,844	45,431	Venezuela 31,164; Belgium 8,102; West Germany 4,259.
Clays	2,173	2,012	Mainly from United States.
Lime	1,316	958	Mainly from United Kingdom.
Salt	531	629	Mainly from United States.
Sand	14,277	17,489	Netherlands 12,652; Surinam 4,805.
Stone, dimension	92	55	Italy 26; Netherlands 24.
Other nonmetals, n.e.s.[1]	4,046	10,916	Netherlands 8,386; United Kingdom 1,466; United States 724.
Sulfur	4,066	----------	
Mineral fuels: Petroleum:			
Crude oil thousand 42-gallon barrels	273,488	271,279	Venezuela 269,405; Brazil 1,009; Colombia 865.
Refinery products:			
Gasoline [2] do	4,183	3,871	United States 2,038; Venezuela 1,807.
Kerosine do	791	310	Venezuela 302; Dominican Republic 8.
Jet fuel do	248	341	Venezuela 312.
Distillate fuel oil do	2,529	2,171	Venezuela 2,148.
Residual fuel oil do	2,171	11,089	Venezuela 10,290; Colombia 533; United Kingdom 220.
Liquefied petroleum gas do	522	742	All from Venezuela.
Other [3] do	15,366	19,832	Venezuela 16,739; United Kingdom 990; Argentina 476.
Total:			
Value of metal and mineral imports million Ant. f [4]	----------	1,152	
Value of all imports	----------	1,358	
Metals and minerals million Ant. f [4] percent share in total exports	----------	85	

[1] Not elsewhere specified.
[2] Includes components for blending in refineries.
[3] Mostly unfinished oils.
[4] The Netherlands Antilles guilder or florin is equivalent to US$0.535 (US$1.00=Ant. f1.87).

COMMODITY REVIEW

NONMETALS

Cement.—No developments were reported in 1963 on the proposed construction of a cement plant on Aruba. The plant, which was proposed in 1962, was to cost Ant. f18.7 million, employ 100 persons, and produce 188,000 metric tons of cement annually. Most of the output was to be exported.

Limestone.—In 1963 limestone aggregate was produced mainly as a byproduct of phosphate mining on Curaçao. Some limestone aggregate was also produced on Bonaire. Most of the production was consumed by the local market. A small quantity, however, was reported to have been exported, principally to Surinam.

Nitrogeneous Fertilizers.—The four plants—ammonia, nitric acid, urea, and fertilizer—of the chemical complex at Barcadera, Aruba, began producing fertilizer materials and fertilizer during 1963. Production began at the Ant. f16.8 million ammonia plant in May 1963. It is operated by Antilles Chemical Co., a subsidiary of Standard Oil Co. (New Jersey). The plant, which is among the largest of its type in the world, has an annual production capacity of 110,000 tons. Base stock for the plant is refinery gas from the Aruba petroleum refinery. About two-thirds of the plant output will be used by the nitric acid and urea plants. The remainder will be shipped by special refrigerated tankers to other countries in Latin America.

The other plants of the complex went into operation in November 1963. They are operated by Aruba Chemical Industries, which is jointly owned by Standard Oil Co. (New Jersey) and International Development & Investment Co. (C. & I. Girdler Investment, Ltd., and Phoenix Overseas, Ltd.). The Ant. f2.4 million nitric acid plant has an annual production capacity of 50,000 tons, the Ant. f9.3 million urea plant an annual capacity of 75,000 tons; and the Ant. f3.7 million fertilizer plant, an annual capacity of 132,000 tons. The entire output of nitric acid will be used by the fertilizer plant. Most of the urea and fertilizers produced will be exported to other countries in Latin America. New export markets are expected to be opened when the Netherlands Antilles candidacy for associate membership in the European Economic Community (commonly referred to as the Common Market) receives final approval.

Phosphate Rock.—Phosphate rock remained the only important mineral produced in the Netherlands Antilles. Deposits of this mineral occur on both Curaçao and Aruba, but only those on Curaçao were being mined. Almost all the phosphate rock produced was exported to the United States, where its low fluorine content commanded a premium price.

During 1963 the Curaçao Mining Co. continued to be the sole producer of phosphate rock. Although mechanization has been useful in working lower grades of ore, small pockets of highly concentrated ore must be sorted by hand. Employment at the mine dropped to 480, compared with 524 in 1962 and 633 in 1961.

The Aruba Exploration & Mining Co., which was founded in 1960, had not begun production from deposits on the southeastern end of Aruba. The deposits, which are of too low a grade to be exported, are expected to be used to make phosphoric acid for the new fertilizer industry.

Pumice.—The Antillian Aggregate Corp. retained the option to mine pumice deposits on St. Eustatius, but operations continued to be delayed by lack of capital to build facilities needed to take the ore off the island. The pumice deposits, estimated at 400 to 500 million tons, outcrop in the cliffs along the southwest coast of the island.

Salt, Marine.—Salt production continued to be mainly from salt pans on Bonaire, although salt was also produced on Curaçao. A Panamanian subsidiary of the International Salt Co. investigated the feasibility of constructing salt pans in a 3,500-hectare area on Bonaire. Annual production of this installation would be about 450,000 tons.

Sulfur, Recovered.—In 1963 sulfur recovered from petroleum refining was estimated to be the same as in previous years. Most of it was used in manufacturing sulfuric acid for refining purposes.

MINERAL FUELS

During 1963, petroleum refineries, which ranked among the largest in the world, continued to be the mainstay of the Antillian economy. Employment at the refineries, however, continued to drop because of continued automation of refinery operations. Employment was 8,712, compared with 9,657 in 1962 and 10,515 in 1961.

In 1963, as in previous years, oil processing installations were modernized or replaced by new units. An 85,000 barrel-per-day thermal cracking unit and a 20,000 barrel-per-day thermal reforming unit were added to the Curaçao refinery in 1963. No information was available for improvements at the Aruba refinery. The Curaçao refinery was operated by Shell Curaçao, N.V., a member of the Royal Dutch/Shell Group. The Aruba refinery was operated by Lago Oil & Transport Co., Ltd., a subsidiary of Standard Oil Co. (New Jersey).

Throughput increased slightly during 1963 and was about 29 percent more than designed capacity. Crude oil throughput decreased by about 1 percent, but throughput of partially refined oils rose by about 10 percent. As in the past, total throughput greatly exceeded the combined designed distillation capacity (Aruba refinery, 440,000 barrels per day; Curaçao refinery, 210,000 barrels per day). During 1963 there was a continuation of the informal agreement between the refining companies and Venezuela to limit crude oil throughput so that more Venezuelan crude oil could be refined domestically. This limitation, however, was partly offset by the trend to run more partially refined oil. Throughput has been as follows:

Type of feed stock:

	Quantity (thousand barrels)				
	1959	*1960*	*1961*	*1962*	*1963*
Crude oil	257, 603	259, 608	267, 474	271, 234	268, 820
Partially refined oils	14, 407	19, 645	31, 801	34, 596	37, 960
Total	272, 010	279, 253	299, 275	305, 830	306, 780

In 1963, the Netherlands Antilles candidacy for associate membership in the European Economic Community was still being discussed. There was no change in the agreement to limit the duty-free entry of Antillian petroleum products to the Common Market to 17 million barrels a year. Nor was there any change in the right of the European Commission to suspend entry of Antillian products into the Common Market if the market was in serious difficulties. Member countries also continued to have the right to temporarily suspend imports into their territories if their full quotas would have adverse effects. All these arrangements, however, were subject to review because the future common tariff for petroleum products still remained to be fixed and a number of related problems had to be settled.

The Mineral Industry of Trinidad and Tobago

By Gordon W. Koelling [1]

THE PETROLEUM industry continued to occupy a dominant position in the economy of Trinidad and Tobago during 1963 and was the source of 40 percent of ordinary government revenue. It also accounted for approximately 12 percent of the 119,790 workers employed at the end of the year in nonagricultural undertakings (but including sugar estates) employing 10 or more. Crude oil production accounted for only 3 percent of that from all of Latin America, but refinery output was about 10 percent of total for the same area. Imports provided approximately 60 percent of the feedstock for the two Trinidad and Tobago refineries, one of which was among the world's 10 largest. Production of other minerals was limited principally to construction materials (including natural asphalt and pitch sand), although the output of nitrogenous fertilizers was also significant. Small quantities of sulfur recovered as a byproduct of refinery operations were consumed at the refineries.

The mineral industry of Trinidad and Tobago accounted for approximately one-third of the total 1963 gross national product of around BWI$1,000 million.[2] Of this total, Trinidad was responsible for the greatest amount. The contribution of Tobago could be regarded as inconsequential. Exports and reexports of minerals during the same year comprised approximately 77 percent of the country total, valued at BWI$638 million. An estimated 62 percent of total imports, valued at BWI$641 million, was metals and minerals.

Trinidad and Tobago became an independent state of the British Commonwealth, having its own constitution and bicameral legislature, on August 31, 1962. Geologically, the islands, which together have an area of 5,128 square kilometers (Trinidad, 4,828 square kilometers; Tobago, 300 square kilometers), are an extension of the Venezuelan portion of the South American continent. Together the islands supported a population of 827,957 in 1961.

No significant mining or petroleum legislation was enacted during 1963 and Government policy was unchanged in favoring development of petroleum and other mineral industries by private enterprise. The country's second 5-year development plan (1964–68) was approved during the latter part of 1963. This plan, although acknowledging that the petroleum industry will continue to form the basis of economic

[1] Geographer, Division of International Activities.
[2] One British West Indies dollar (BWI$) equals US$0.59.

viability and political stability, has as its major goal the expansion of agriculture and manufacturing.

SOURCE MATERIAL

Most production and trade statistics were obtained from publications of the Central Statistical Office of Trinidad and Tobago. Some statistical information was also obtained from official U.S. sources. Considerable data on recent developments was provided by various issues of Petroleo Interamericano and Petroleum Press Service.

PRODUCTION

Crude oil production, which had been increasing steadily, declined slightly during 1963. However, output of refinery products processed from imported and indigenous crudes increased 13 percent. Production of limestone and sand and gravel rose 12 and 24 percent, respectively, but output of clay, which dropped 20 percent from 1962, continued its downward trend. No other production changes of major significance occurred during the year.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Cement	180,000	178,000	98,000	166,000	155,000
Clays	157,594	134,220	108,578	97,228	78,221
Diorite	8,478	7,247	5,951	7,798	13,152
Gypsum	4,928	6,571	2,849	3,645	5,233
Limestone	1,041,491	958,792	751,125	725,090	810,790
Nitrogenous fertilizers	----------	[1] 40,000	[1] 97,800	[1] 84,500	[1] 80,000
Porcellanite	100,445	43,447	48,890	68,046	60,109
Sand and gravel	500,625	881,888	774,533	606,136	748,809
Sulfur [1]	2,000	2,200	2,500	3,000	5,000
Mineral fuels:					
Petroleum:					
Crude petroleum [2] thousand 42-gallon barrels	41,137	42,560	46,166	49,070	48,849
Refinery products:					
Aviation gasoline do	3,893	4,150	3,826	3,833	3,668
Motor gasoline do	11,094	10,391	12,671	12,955	15,647
Kerosine and jet fuel do	2,921	6,957	10,406	10,601	14,080
Distillate fuel oil do	12,950	13,315	16,472	17,502	20,064
Residual fuel oil do	35,231	44,487	56,346	60,457	66,343
Asphalt do	256	185	216	239	228
Unfinished oils do	194	89	319	231	----------
Liquefied petroleum gases do	35	42	48	71	109
Other [3] do	1,507	5,416	7,228	483	300
Natural gas million cubic feet	91,963	97,651	106,602	99,948	99,385
Natural asphalt	148,516	156,687	178,140	165,223	171,540
Pitch sand	90,522	28,656	23,264	18,072	15,155

[1] Estimate.
[2] Includes natural gasoline and condensate.
[3] Includes lubricating oils and greases, petrolatum, and paraffin.

TRADE

Exports of crude oil, refined petroleum, and natural asphalt had a combined value of BWI$492 million in 1963. The value of metals and nonmetals exports was about BWI$5 million. Shipments of metals and minerals were generally destined for the United States, countries of Western Europe, and nearby areas in Latin America, with no significant break in the customary trade pattern.

TABLE 2.—Exports and reexports of metals and minerals
(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Metal and alloys	31	40	Barbados 16; British Guiana 8; Curacao 4.
Scrap	3	24	Australia 10; United Kingdom 9; Netherlands 5.
Copper:			
Metals and alloys	132	69	British Guiana 43; Netherlands 23.
Scrap	449	431	Netherlands 278; West Germany 118; Spain 35.
Iron and steel:			
Scrap	8,250	20	All to British Guiana.
Pig iron, sponge and ferroalloys	7	2	British Guiana 1; Venezuela 1.
Steel ingot and equivalent primary forms.	7	1	All to United States.
Semimanufactures:			
Pipes and tubes	224	79	United Kingdom 21; Antigua 15; United States 14.
Other	198	263	Barbados 143; Grenada 41; St. Vincent 21.
Lead:			
Metal and alloys, unwrought and semimanufactures.	(1)	6	Venezuela 4; United Kingdom 2.
Scrap	242	138	United Kingdom 63; Italy 36; Netherlands 25; Denmark 14.
Nickel and nickel alloys	1	3	Mainly to Venezuela.
Platinum: Semi- and troy ounces wrought.	2	3	All to United Kindgom.
Silver: Unwrought and semi ....do	12	52	All to Virgin Islands.
Tin and tin alloys	(1)	2	British Guiana 2.
Zinc, zinc alloys and scrap	13	8	Mainly scrap to United Kingdom.
Nonferrous metals, scrap and ores thereof.	441	[2] 764	Puerto Rico 454; Netherlands 187; Japan 91.
Nonmetals:			
Barite	4	-------	
Cement	1	6	All to Grenada.
Clays	1	(1)	All to St. Kitts.
Graphite, natural	(1)	-------	
Gravel and crushed rock	19,719	13,829	Surinam 13,036; West Germany 663.
Lime	5,049	1,057	Barbados 643; St. Kitts 316.
Nitrogenous fertilizers	89,049	75,333	British Guiana 20,285; Jamaica 18,556; Guadeloupe 6,519; Barbados 5,195.
Salt	54	15	Mainly to stores and bunkers.
Sand	950	64	British Guiana 41; St. Lucia 14; stores and bunkers 10.
Stone	26	16	British Guiana 15; St. Vincent 1.
Other nonmetals	597	894	Stores and bunkers 816; Venezuela 73.
Mineral fuels:			
Coal, coke and briquets	938	751	Barbados 533; British Guiana 121.
Petroleum:			
Crude thousand 42-gallon barrels petroleum.	4,338	4,047	All to Canada.
Refinery products:			
Aviation gasoline ....do	11,560	12,099	Spain 2,629; United Kingdom 2,436; United States 2,226; France 1,684.
Motor gasoline ....do	10,619	9,122	United Kingdom 4,064; France 937; Sweden 872; Jamaica 718.
Kerosine ....do	2,753	2,005	United States 363; Jamaica 312; United Kingdom 304; stores and bunkers 257; Brazil 236.
Distillate fuel oil ....do	15,937	17,064	Netherlands 4,269; United Kingdom 2,965; Sweden 2,653; stores and bunkers 2,060; Canada 428.
Residual fuel oil ....do	55,884	59,230	United States 27,431; stores and bunkers 10,316; United Kingdom 8,520; Netherlands 4,286; Chile 1,121.
Asphalt ....do	282,959	351,441	Netherlands 88,786; Republic of South Africa 74,481; Chile 33,396; Guadeloupe 28,843; Jamaica 26,359.
Other [3] ....do	27,556	14,719	British Guiana 3,950; British Honduras 3,548; Barbados 2,795.
Natural asphalt	58,910	66,393	United Kingdom 50,794; West Germany 5,781; United States 3,699; Belgium-Luxembourg 3,114.
Total:			
Value of metal and mineral exports.	million BWI$	507	
Value of all exports ....do	.....	592	
Metals and minerals share in total exports.	percent	86	

[1] Less than 0.5 metric ton.
[2] Nonferrous scrap only.
[3] Includes lubricating oils and greases, petrolatum, paraffin, and other byproducts.

Trinidad and Tobago 1963 petroleum imports were valued at BWI$301 million and consisted almost entirely of crude oil destined for processing locally. During 1962, the latest year for which a breakdown for imports of metals and minerals was available, receipts of these items were valued at BWI$370 million. Metals accounted for 8 percent of this total; nonmetals, 1 percent; coal, coke, and lignite, 15 percent; and petroleum, 76 percent.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum and aluminum alloys, all forms.	1,212	987	United Kingdom 611; United States 187; Canada 88.
Copper and copper alloys, all forms	532	226	United Kingdom 148; Canada 67.
Iron and steel:			
Scrap	137	1,302	Mainly from United States.
Pig iron, sponge iron, and ferroalloys	34	11	All from United Kingdom.
Steel ingots and equivalent primary forms.	99	746	United Kingdom 376; United States 304.
Semimanufactures:			
Pipe and tubes	36,551	45,174	United Kingdom 38,048; France 4,547; United States 1,649.
Other	27,850	30,573	United Kingdom 14,573; Belgium-Luxembourg 5,276; Australia 3,283.
Lead and lead alloys, all forms	54	77	Mainly from United Kingdom.
Nickel and nickel alloys, all forms	2	5	Do.
Platinum, including troy ounces wrought.	44	367	United Kingdom 343; West Germany 24.
Silver: Unwrought and semi- do manufactures.	10,421	15,833	Mainly from United Kingdom.
Tin and tin alloys, all forms	289	566	Do.
Zinc and zinc alloys, all forms	64	50	United Kingdom 44; West Germany 6.
Nonferrous metals, scrap, and ores	7	335	Mainly from United Kingdom.
Nonmetals:			
Barite	30,716	42,784	Brazil 29,417; Canada 13,005.
Cement	26,442	14,368	Venezuela 8,772; United Kingdom 3,423; Netherlands 731.
Clays	179	1,067	United States 465; United Kingdom 376; French Africa 226.
Feldspar	78	768	All from United Kingdom.
Gravel and crushed rock	432	403	Mainly from Italy.
Lime	559	995	Barbados 502; United Kingdom 493.
Magnesite	50	40	All from Netherlands.
Mica	-------	1	All from United Kingdom.
Nitrogenous fertilizers	2,105	1,028	West Germany 473; Belgium-Luxembourg 406.
Phosphate rock	18	54	All from United States.
Potash	7	-------	
Natural abrasives	4	10	Italy 6; West Germany 2; United Kingdom 1.
Salt	6,319	6,252	United Kingdom 3,708; West Germany 837; Netherlands 793.
Sand	55	53	Mainly from United States.
Stone, dimension	1,067	2,406	Dominican Republic 1,676; Barbados 629.
Sulfur	27,715	9,910	Mainly from United States.
Other nonmetals	6,537	404	Mainly from United Kingdom.
Mineral fuels:			
Coal, coke and lignite	533	1,507	Mainly from United States.
Petroleum:			
Crude thousand 42-gallon barrels petroleum.	62,847	64,588	Saudi Arabia 32,115; Venezuela 27,937; Colombia 4,359.
Refinery products:			
Distillate fuel oil do	282	140	All from Aruba.
Residual fuel oil do	(1)	(1)	Mainly from United States.
Asphalt [2] do	158	195	Mainly from United Kingdom.
Unfinished thousand 42-gallon oils. barrels	-------	4	All from Venezuela.
Blending agents do	27	15	Mainly from United Kingdom.
Liquefied petroleum gases do	295	460	United States 236; Venezuela 165; West Germany 47.
Other [3] do	55,664	56,032	United States 33,731; United Kingdom 18,267.
Natural asphalt	(4)	-------	

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Total:			
Value of metal and mineral imports. million BWI$	--------	370	
Value of all imports do	--------	604	
Metals and minerals share in total imports. percent	--------	61	

[1] Less than 1,000 barrels.
[2] Includes small quantity of petroleum coke in 1961.
[3] Includes lubricating oils and greases, petrolatum, paraffin, lignite and mineral waxes.
[4] Less than 0.5 metric ton.

COMMODITY REVIEW

METALS

All requirements for metals were met by imports. The small iron ore deposits located in northern Trinidad were not being exploited. Bauxite, mined in Surinam, was brought to Trinidad in shallow draft vessels for transshipment to large freighters, without entry in the customs records.

NONMETALS

Most nonmetals requirements were supplied wholly or in large part from local production. Major exceptions were sulfur, salt, and barite.

The largest single-line ammonia plant in the world was completed at Point Lisas in late 1963. This 235,000-ton-per-year plant is an extension of a smaller plant built in 1960 and is owned by Federation Chemicals, Ltd., a subsidiary of W. R. Grace and Co. of New York. Included in this expansion program was the construction of facilities for the shipment of liquefied ammonia in specially designed, low-temperature tankers. Previously, ammonia from Point Lisas was used primarily for domestic production of solid-state nitrogenous fertilizers.

MINERAL FUELS

Petroleum.—The number of wells drilled declined for the third successive year in 1963. Of 234 wells drilled during the year, 203 were producers. This was a lower success ratio than in the preceding year when 255 wells out of a total 280 drilled were productive. Total footage drilled also declined from 1,506,000 in 1962 to 1,246,000 in 1963. An 8-week strike against BP (Trinidad), Ltd., during 1963 was probably responsible in part for the decrease in drilling activity.

Two new offshore discoveries were made by Dominion Oil, Ltd., (subsidiary of Standard Oil Co. of California) during 1963. One of these wells is located in the Gulf of Paria 12.5 miles west of Couva, the other is east of Point Galeote. At yearend, testing and further drilling were underway to determine the significance of these discoveries. Total proved crude reserves in Trinidad and Tobago were reported at 500 billion barrels as of mid-1963.

Despite declining productivity of most onshore fields and the strike against BP, output of crude petroleum was only 0.45 percent less than

in 1962. Decreases in onshore production were largely offset by a rise in output from the Soldado offshore field. This field, owned by Trinmer, Ltd., (Texaco, Shell, and BP), accounted for 27 percent of total production during 1963. The share of output accounted for by other companies, which produced from a total of 16 fields, was as follows: Texaco Trinidad, Inc., 39 percent; BP (Trinidad), Ltd., 20 percent; Shell Trinidad, Ltd., 11 percent; Trinidad Canadian Oils, Ltd., 2 percent; Premier Consolidated Oil Fields, 1 percent; and Dominion Oil, Ltd., less than 0.5 percent. Crude oil gravities varied considerably with those of most crudes produced ranging from 15° to 35° API.

Early in 1963, Trinmer announced initiation of a major development program in the Soldado field—involving additional development drilling, expansion of the gathering system, and installation of gas injection facilities. Plans also called for drilling seven stepout wells.

The country's two refineries, the 275,000-barrel-per-day Texaco plant at Pointe-a-Pierre and the 62,00-barrel-per-day Shell plant at Point Fortin, had a combined average throughput of 327,900 barrels per day in 1963. This was nearly 10 percent greater than the average throughput during 1962. Most of the Texaco refinery's crude feedstock was imported, primarily from Venezuela and the Middle East. The Shell refinery processed indigenous crude only.

During 1963, a cyclohexane unit with an annual capacity of approximately 240,000 barrels was placed on stream at the Texaco refinery. This unit produces benzene, toluene, and extra pure cyclohexane. Production of the latter is by a process involving the catalytic hydrogenation of benzene.

Nearing completion at the same refinery at yearend was a 2,700-barrel-per-day lubricating oil plant. Major units in this plant will include vacuum distillation and furfural solvent facilities. When placed on stream, this will be Texaco's largest foreign lubricating oil installation.

Work was also in progress to expand secondary processing facilities at the Shell refinery. Here, a 6,700-barrel-per-day platformer was placed on stream during 1963 and an 18,000-barrel-per-day hydrotreater was under construction at the end of the year.

Natural Gas.—The output of natural gas, almost all dissolved in or associated with crude oil, has declined recently; in 1963 it was 7 percent lower than in the peak year of 1961. Proved reserves as of December 1963 were reported at 1 trillion cubic feet. Two new gas pipelines were under construction at yearend. One of these, a 16-inch diameter, 42-mile line, was being constructed by Shell to link the Penal-Barrackpore field with Port-of-Spain. The other, a 17-mile line, was being built by Texaco between the Forest Reserve field and its refinery at Pointe-a-Pierre. This 16-mile pipeline will replace an existing 12-inch line that will be converted to transport crude oil.

Natural Asphalt and Pitch Sand.—Natural asphalt is cut from the surface of Trinidad's large asphalt lake, and pitch sand is dug from the shores of this same lake. There were no major developments during the year under review with respect to these commodities.

The Mineral Industry of Argentina

By Sumner M. Anderson [1]

ALTHOUGH scattered signs of increased activity in the mining industry accompanied an incipient improvement in the overall economic situation during the latter months of 1963, production levels for the year as a whole responded to the general 1962–63 business recession with a 4.2 percent decline. The petroleum industry, active since 1907, did not become a dynamic force in the economy until exploration and drilling contracts were concluded with private companies in 1958 and 1959; on November 15, 1963, having virtually achieved self-sufficiency in petroleum in the preceding year, those contracts were unilaterally annulled. In the field of metallics, the only approach to internal sufficiency—aside from the iron and steel industry that has depended heavily on the importing of basic raw materials—has been in mining, smelting, and refining lead and zinc; although iron ore, silver, beryllium, tantalite, and tungsten have been mine production items of economic significance. Reserves of lead, zinc, silver, bismuth, vanadium, and low-grade and metallurgically difficult iron ore—as well as those of beryllium, tantalite, and tungsten which are produced primarily for export—appear to be fairly abundant. The exploration of deposits of copper, cobalt, tin, lithium, gold, manganese, and uranium has been undertaken on a relatively small scale, and little precise information is available on the extent of reserves. Argentina is dependent on foreign sources for part of its required iron and steel and, except for lead and zinc, most of its nonferrous metals. Nonmetallics and solid fuels present an exceptionally varied array of production items among which cement had the second largest 1963 output in South America. Borates, bentonite, common clay, diatomite, fluorite, granite, lime, limestone, obsidian, onyx, rhodochrosite, salt, and spodumene ordinarily are produced for export either exclusively or in excess of domestic consumption requirements. Barite, cement, chalk, gypsum, marble, and mica are both exported and imported. Argentina depends entirely or partly on imports for coal and coke, certain special types of clay, mineral abrasives, graphite, magnesite, mineral fertilizers, sulfur, talc, and minerals for construction, the last group being chiefly attributable to convenience of river transport from Uruguay.

Despite this diversity of activity, Argentinian mineral importance internationally in 1963 was confined to production of 13 percent of the world output of beryl and only about 1 percent each of its lead,

[1] Chief Latin America Specialist, Division of International Activities.

zinc, and crude petroleum. Domestically, the total value of mine production in 1963 has been estimated at slightly more than 1 percent of the gross national product of 1,395 billion Argentine pesos. (The monetary exchange rate has been unstable; the average for 1963 was 139.2 Argentine pesos for US$1.00.) Adding the petroleum, iron and steel, and cement industries would probably more than double the percentage figure, which would still be low for the second largest country in South America, facing a need for industrial expansion. Deterrants to mineral development have included (1) resources that are poor in quality, small in size, isolated from transportation facilities in mountainous areas, or inadequately explored; (2) lack of skilled labor and technicians; (3) shortage of investment capital; (4) mining laws devoid of provisions for depletion allowances and of a time limit for development of a property; and (5) a nationalist policy discouraging to foreign investment capital.

To overcome the first of these deterrents, perhaps the most significant development of 1963 was a US$3 million program of aerial mapping and geological studies initiated with the cooperation of the United Nations to survey the western Provinces of Mendoza, Neuquén, and some areas of San Juan. The studies will take 3 years and may reveal previously unknown or unrecognized resources. The Dirección Nacional de Economía Minera was planning a similar program in the Provinces of Salta, Jujuy, Tucamán Catamarca, and La Rioja scheduled to begin in July 1964. The Departamento Minería of San Juan began reconnaissance and geological surveys in regions of that Province, and similar surveys elsewhere were scheduled by the Dirección Nacional de Geología y Minería.

More than 75 percent of the population is urban; about one-fourth live in greater Buenos Aires, and seven other cities have 100,000 or more inhabitants. Distribution of the labor force shows 26 percent engaged in industry, 19 percent in agriculture, 12 percent in transport and communications, and less than one-half percent in mining. The recent attention to mineral exploration is recognition of the imbalance between industry and the production of mineral raw materials to feed it.

SOURCE MATERIAL

Material was obtained from annual reviews of the minerals, iron and steel, and petroleum segments of the industry by the U.S. Embassy, Buenos Aires, and from a preliminary manuscript chapter on the mineral industries from a forthcoming book on Argentina by Merwin L. Bohan, consulting economist and ex-United States Ambassador to the Organization of American States. Contributions from published sources included:

Engineering and Mining Journal, Progress in Latin America, April 1964, pp. 115–116, McGraw Hill Publishing Co., New York.

Stoll, W. C., Metallogenic belts, centers, and epochs in Argentina and Chile, Econ. Geol., v. 59, 1964, pp. 126–135.

Mining Journal (London), Mining Annual Review 1964, June 1964, p. 231.

Direccion Nacional de Economia Minera, Buenos Aires, Boletin Informativo, Año III, No. 36, Deciembre 1962.

Direccion Nacional de Energia y Combustibles, Combustibles, 1962, Buenos Aires.

PRODUCTION

Production statistics are compiled by the Dirección Nacional de Economía Mineral (National Office of Mineral Economics); they are published in part in their monthly Boletin Informativo and are supplied in greater detail through the U.S. Embassy in Buenos Aires. They are based primarily on mine and plant shipments, although for a few items they have been rejected in favor of export figures. Details of the iron and steel, cement, and petroleum industries have been supplied, also through the U.S. Embassy, by the Centro Industriales Siderúrgica, the Camara Laminadores Industriales Metalúrgicos Argentina, the Asociación de Fabricantes de Cemento Portland, the State oil agency (YPF), and private companies.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Antimony	4				
Beryl, 11 percent BeO[1]	3,026	1,050	1,350	1,325	907
Bismuth, content of concentrates kilograms	[2] 18,000	[2] 6,750	[2] 3,900	3,220	3.450
Columbite-tantalite:					
Columbite do	[3] 1,629		[1] 921		
Tantalite[3] do	731		2,016	1,650	2,050
Copper, content of concentrates	182	516	551	405	[2] 300
Gold troy ounces	1,231	3,504	2,270	766	482
Iron ore thousand tons	110	160	139	121	[4] 94
Iron and steel:					
Pig iron	37,700	180,100	398,500	396,500	424,200
Crude steel:					
Ingots	187,000	234,000	[2] 406,487	628,347	893,800
Castings and forgings	27,000	43,000	[2] 35,000	29,153	18,900
Total	214,000	277,000	441,487	657,500	912,700
Semifinished steel:					
Billets	(5)	(5)	250,053	374,500	432,800
Blooms	(5)	(5)		46,000	108.200
Slabs	(5)	(5)	2,438	33,300	110,400
Total	[2] 150,000	[2] 190,000	252,491	453,800	651.400
Finished steel:					
Reinforcing bars	176,144	163,982	208,246	175,318	129,281
Wire rods	197,032	175.336	214,589	171.759	217,639
Flats	92,825	81,660	89,223	72,819	48,737
Hot strip	84,429	77,318	101,636	78,128	66,364
Angles, T, I, and U bars, moldings	86,994	82,351	108.973	90,454	57,956
Pipe	59.215	95,631	99,720	89,352	62,211
Round, squares, hexagonals	65,490	71.152	67,074	47,712	35,840
Sheets	9,643	13,137	13,671	34,732	133,009
Railroad ties	3,828	7,059	5,575	2,832	8,204
Fishplates, forgings, and other	409	783	513		
Total	776,009	768,409	909,220	763.106	759,241
Cold-rolled strip	17,293	25,755	27,256	(5)	(5)
Lead:					
In ores or concentrates	30.300	26,700	28,400	29.580	26,660
Metal	31,026	25,673	28,123	24,494	24,000
Manganese:					
Ore, 30–40 percent Mn	19,376	[2] 22,000	17,893	[4] 12,629	[2] 15,000
Ore, less than 30 percent Mn		[2] 26,453	22,011	16,616	[2] 23,558
Total, all grades	19,376	48,453	39,904	29.245	38,558
Silver troy ounces	1,549,600	1,671,838	1,430,675	2,086,101	1,935,860
Tantalite[6]					

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals—Continued					
Tin, in concentrates—long tons	225	238	515	[4] 231	[4] 220
Tungsten concentrates, 60 percent WO_3 equivalent	750	810	809	576	144
Uranium:					
Ores	3,638	1,792	3,136	2,500	7,513
Oxide, U_3O_8, content	[2] 12	[2] 6	[2] 5	4	[2] 11
Vanadium, in concentrates	4		[2] 10	8	10
Zinc:					
In concentrates	40,800	35,400	32,207	31,467	28,750
Metal	13,100	16,000	14,400	16,771	19,700
Nonmetals:					
Asbestos	290				200
Barite	18,000	24,482	28,555	12,536	14,114
Basalt, and related rocks	95,062	132,796	117,940	103,497	141,977
Borates, tincal and ulexite	9,900	4,551	6,836	18,551	24,214
Cement—thousand tons	2,368	2,641	2,903	2,921	2,495
Clays:					
Bentonite	28,705	27,923	31,857	29,055	24,064
Foundry mold earth	1,245	1,058	2,395	561	1,249
Fuller's earth	4,019	3,402	3,643	3,980	4,614
Kaolin	28,297	41,031	36,415	47,560	31,102
Refractory clay	50,310	62,176	123,553	93,146	58,000
Miscellaneous	217,582	308,199	227,904	268,516	210,064
Diatomite	4,381	[2] 4,400	1,167	[1] 3,850	3,445
Dolomite	27,231	30,630	37,123	60,694	74,786
Feldspar	5,001	8,553	11,658	4,931	3,000
Fluorspar	16,319	12,472	10,074	9,050	8,810
Garnet, almandite	253				
Granite, and related rocks	1,355,600	1,542,934	1,809,837	2,024,713	1,983,705
Graphite	503	488	778	425	208
Gypsum	115,202	144,981	180,004	214,989	[4] 141,570
Limestone	5,699,800	5,464,779	7,137,225	6,934,584	6,200,000
Lime	[2] 1,000,000	[2] 1,000,000	[2] 1,000,000	(5)	(5)
Lithium minerals	170	139	402	450	1,160
Marble:					
Crystalline dolomite	27,631	30,630	37,123	60,694	74,786
Crystalline limestone	1,376	9,979	14,553	8,702	7,678
Onyx	980	1,181	954	896	348
Travertine	6,249	3,241	3,238	2,794	3,129
Marble rubble	134,614	18,503	25,822	29,364	15,807
Mica	[1] 183	[1] 180	[1] 336	[1] 295	[2] 300
Mineral water	13,858	13,347	12,418	12,870	11,022
Ocher	2,030	202	92	129	70
Phosphates: Guano	181	356	161	182	175
Rhodochrosite, ornamental	165	176	172		
Rubble, coarse	737,860	806,635	1,350,873	1,397,020	710,000
Sand, black, iron-titanium	680				
Salt:					
Rock salt	400	1,056	1,900	1,625	1,460
Other	518,600	569,999	415,581	492,899	167,916
Total	519,000	571,055	417,481	494,524	[7] 169,376
Serpentine	351	4,887	7,298	6,816	6,324
Silica:					
Quartz	23,510	34,853	59,199	26,063	16,857
Quartzite	442,722	654,761	773,874	865,203	775,498
Sandstone	2,801	3,020	29,394	38,575	22,301
Sand for construction	3,165,684	[2] 3,170,000	3,177,441	3,053,488	3,001,216
High purity silica sand	89,484	102,067	121,457	100,849	80,013
Strontium minerals, celestite	88				
Sulfur, elemental	25,611	39,895	22,539	22,661	22,497
Sulfates, hydrous:					
Aluminum, alum	4,006	7,385	8,513	7,822	8,919
Iron, melanterite	49	730	452		
Magnesium, epsomite	2,186	2,503	1,541	1,942	1,390
Sodium, mirabilite	15,283	10,686	11,199	11,249	3,571
Talc	27,159	19,041	18,711	14,853	14,913
Vermiculite	[2] 800	317	491	2,687	1,390
Volcanic materials: Ash, pumice, and pozzolana	22,581	15,035	29,321	11,417	7,063
Zeolites		410			

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Mineral fuels:					
Asphaltites:					
Raphaelite	1,441	2,620	1,076	1,972	2,497
Other	13,773	6,159	3,671	1,066	2,875
Total	15,214	8,779	4,747	3,038	5,372
Carbon black				(4)	5,815
Coal, bituminous thousand tons	316	280	344	286	[4] 207
Coke: Oven and beehive [2]		250	400	500	600
Coke, low-temperature [2] thousand tons	55	60	60	60	60
Peat do	3	[2] 3	[2] 3	[2] 3	[2] 3
Petroleum and natural gas:					
Natural gas, marketed million cubic feet	32,119	51,607	88,673	111,852	110,313
Natural gasoline thousand 42-gallon barrels	83	93	75	86	102
Petroleum, crude do	44,613	64,132	84,418	98,154	97,221
Petroleum refinery throughput do	79,033	85,703	92,112	105,539	103,181
Petroleum refinery products:					
Aviation gasoline do	423	481	412	400	322
Motor gasoline do	13,734	16,588	19,046	23,563	22,048
Jet fuel do			221	492	609
Kerosine do	9,286	7,947	7,735	9,236	7,572
Distillate fuel oil do	12,003	11,672	12,378	14,973	19,368
Residual fuel oil do	31,167	35,884	38,834	39,429	36,804
Lubricants, including greases do	863	1,004	1,096	1,062	860
Other do	6,136	6,105	4,376	8,020	8,086
Total do	73,612	79,681	84,098	97,175	95,669
Refinery fuel and losses do	5,421	6,022	8,084	8,364	7,512

[1] Exports.
[2] Estimate.
[3] United States imports from Argentina.
[4] Final figure; supersedes that given in commodity chapter, volume 1 and/or 2.
[5] Data not available.
[6] Included under Columbite-tantalite.
[7] As reported by Direccion Nacional de Economia Minera—appears to be incomplete.

TRADE

Comercio Exterior, volumes 1 and 2 for both 1961 and 1962, as published by the Argentine National Bureau of Statistics and Census, is the official source of the mineral export and import tables, with the few exceptions noted. The same government agency supplied the preliminary figures for 1963 cited in the commodity review section. Export values are f.o.b.; import values are reported as including cost and freight (C. y F.) without mention of insurance, which presumably is excluded.

The initial par value of the Argentine peso was established on January 9, 1957, as 18 pesos per U.S. dollar. However, since January 1959 no market transactions based on the par value have taken place but have been conducted without restrictions in a free-exchange market. Exchange rates, as measured by those in effect at the end of quarter year, have fluctuated as follows, in terms of pesos per U.S. dollar:

Year:	*High*	*Low*	*Yearend*
1961	M$N83. 04	M$N 82. 71	M$N83. 02
1962	135. 00	82. 95	134. 10
1963	149. 80	132. 50	132. 50

In 1962 the values of Argentine exports and imports of minerals and mineral products, exclusive of advanced manufactures, represented approximately 0.2 and 2.7 percent, respectively, of a gross national product that was estimated at M$N1,115 billion.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962		
	Quantity	Quantity	Principal destinations	Value, f.o.b. (thousand pesos)
Metals:				
Aluminum ingots, bars, plates, sheets, and other forms.	1,143	12	Mainly to Uruguay	1,576
Beryl	1,350	905	United States 855; Japan 50	32,151
Columbite kilograms	921			
Copper and copper alloys:				
Copper concentrates	1,615	1,708	Mainly to Japan	21,109
Copper-silver concentrate	166	2	All to Belgium	882
Copper matte	212	209	Japan 195; United Kingdom 14	4,578
Copper ingots, bars, plates, sheets, and other forms.	3	12	Mainly to Uruguay	1,643
Bronze slags and dross		1,067	United Kingdom 416; France 262; West Germany 155.	57,093
Bronze, unworked	767	5,132	West Germany 2,508; Netherlands 1,512; United Kingdom 740.	295,266
Bronze scrap		867	West Germany 834; Netherlands 33.	14,711
Iron and steel:				
Bars, plates, and sheets	3,140	1,534	Uruguay 1,411; Paraguay 120; Bolivia 3.	22,370
Structural shapes	915	113	Mainly to Paraguay	1,932
Galvanized plates	272	79	All to Paraguay	1,046
Rods	513	412	Paraguay 232; Uruguay 173; Boliva 7.	5,897
Wire	4,229	2,646	Brazil 1,711; Paraguay 926; Bolivia 7.	59,314
Pipes and fittings	297	404	Paraguay 163; Bolivia 106; United States 93.	11,193
Forms not elsewhere specified.	80	4	All to Paraguay	178
Scrap	28	75	All to Japan	818
Lead ingots, bars, plates, sheets, and other forms.		3	Mainly to Paraguay	135
Silver:				
Silver, gold, kilograms and platinum powders, residues, and dross.	40,172	31,242	All to United Kingdom	1,930
Silver ingots, troy ounces bars, grains, and other forms.	69,960	785,989	United Kingdom 461,395; Brazil 192,840; United States 128,767.	96,648
Tantalite kilograms	1,096	1,650	All to United States	766
Tin:				
Tin concentrate long tons	182	137	Mainly to United Kingdom	5,288
Tin-silver concentrate do	1,160	1,374	All to United Kingdom	34,327
Tin and tin-silver dross and residues do		164	do	3,760
Tungsten concentrate	15	2,100	Canada 1,100; United States 550; West Germany 350.	111,848
Zinc concentrate	50,946	19,682	Belgium 16,072; Poland 3,610	100,960
Other types not elsewhere specified:				
Ores		205	United Kingdom 130; West Germany 54; United States 15.	636
Drosses, skimmings, residues, powder.	36	234	West Germany 107; Japan 66; France 21.	12,348
Metals and alloys	70	79	Mainly to Belgium	5,009
Total value, metals				905,412

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962		
	Quantity	Quantity	Principal destinations	Value, f.o.b. (thousand pesos)
Nonmetals:				
Barite	840	636	All to Bolivia	2,552
Borates	2,274	3,573	Brazil 2,990; India 204; Uruguay 150.	35,105
Cement	352	293	Paraguay 240; Bolivia 53	1,404
Chalk	52	61	(1)	239
Clays:				
Bentonite	4,668	6,888	Bolivia 3,559; Brazil 1,848; Chile 1,477.	26,018
Common	168	351	Brazil 180; Denmark 171	1,934
Diatomite		4	(1)	39
Dolomite	150	150	(1)	281
Fluorite	839	578	All to Chile	3,689
Granite	1,154	1,729	All to Italy	9,012
Gypsum	960	3,961	Uruguay 3,005; Paraguay 956	6,381
Lime	685	844	Bolivia 824; Paraguay 20	2,575
Limestone	5	30	(1)	81
Lithium minerals, spodumene	2	161	(1)	1,363
Marble	66	122	West Germany 43; United States 35; Belgium 33.	4,020
Mica	330	295	United States 159; Italy 90; Mexico 41.	14,984
Onyx	83	5	Italy 4; United Kingdom 1	76
Quartz		5	(1)	53
Rhodochrosite	27	24	(1)	1,001
Salt, common	23,977	37,795	Paraguay 22,146; Uruguay 15,582	56,392
Sulfur		2	All to Paraguay	25
Volcanic glass, obsidian		10	All to France	20
Other nonmetals, not elsewhere specified.	397	3,441	Mainly to Paraguay and Chile	22,609
Total value, nonmetals				189,853
Mineral fuels:				
Asphaltite, raphaelite	1,170	724	Brazil 398; United Kingdom 212; West Germany 30; United States 30.	38
Natural gas liquids thousand 42-gallon barrels.	(2)	932	Mainly to Brazil	460,533
Petroleum, crude do	224	1,779	Panama 750; Uruguay 666; Bolivia 363.	446,893
Petroleum products:				
Gasoline do		168	Uruguay 164; Paraguay 4	72,248
Kerosine do	16	195	All to Brazil	110,544
Distillate fuel oil, including bunkers. do	331	461	All to bunkers	1,196
Residual fuel oil, including bunkers. do	1,191	4,323	Canada 1,301; Netherlands 1,118; bunkers 1,020.	463,304
Lubricants, including greases. do	1			
Asphalt do	7	1,279	Mainly to Brazil	9,167
Other do	38			
Total petroleum products. do	1,584	6,426	Bunkers 1,481; Brazil 1,446; Canada 1,301; Netherlands 1,118.	656,459
Total value, mineral fuels				1,563,923
Total:				
Value of metal and mineral exports.				2,659,188
Value of all exports, f.o.b				137,100,680
Metals and minerals share in total exports. percent				1.94

[1] Boletin Informativo, Direccion Nacional de Economia Minera, Buenos Aires. Countries of destination not given. Values deducted from "Other, n.e.s." category in Comercio Exterior.
[2] Less than half the indicated unit.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962		
	Quantity	Quantity	Principal sources	Value (thousand pesos)
Metals:				
Aluminum:				
Bauxite	40,165	26,469	Surinam, 20,319; British Guiana, 5,150.	62,754
Ingots and bars	29,237	15,497	United States, 5,457; Canada 4,965; France 4,264.	786,445
Plates, sheets, and powder	37	33	Norway 16; United States 13; West Germany 3.	3,425
Antimony:				
Ore and concentrate	621	562	Bolivia, 491; Peru, 71	20,761
Regulus	(1)	(1)	All from United States	2
Arsenic, white	732	793	United States, 301; Belgium, 295; Sweden, 126.	8,377
Bismuth, metal and compounds.	5	5	West Germany, 3; Japan, 1	9,584
Cadmium and its salts	5	2	United Kingdom, 1; United States 1.	1,416
Chromium and compounds	2	2	Mainly from United Kingdom	538
Cobalt:				
Metal		15	Mainly from Belgium	6,263
Forms, not elsewhere specified.	37	7	do	789
Copper, electrolytic	29,786	17,453	Rhodesia, 5,032; United States, 4,440; Chile, 3,153.	1,271,901
Gold foil, troy ounces	257	3,440	Italy, 3,022; West Germany, 225; France, 193.	269
Iron and steel:				
Iron ore	137,402	515,046	Peru, 226,559; Brazil, 161,410; Chile, 127,028.	974,644
Pig iron, including silicon pig iron.	66,110	12,946	U.S.S.R., 5,979; West Germany, 3,450; Brazil, 2,620.	102,044
Iron and steel scrap	3,280	71	All from United States	306
Ferromanganese	459	1,176	Belgium, 201; France, 173; United States, 69.	9,279
Steel billets, blooms, and slabs.	732,115	275,173	West Germany, 133,097; Belgium, 45,911; Sweden, 26,117.	2,256,100
Finished steel:				
Bars, plates, and sheets, uncoated.	678,119	450,020	Japan 118,221; West Germany 82,355; Italy, 58,544; United States, 51,074.	7,411,861
Galvanized plates and sheets.	2	268	United States, 165; United Kingdom, 61; Netherlands, 25.	7,360
Tinplate	87,289	88,136	United Kindgom, 37,866; United States, 17,080; France, 13,673.	2,110,981
Hoops and strips	1,874	3,068	United States, 841; West Germany, 566; France, 542.	113,587
Sections	17,104	14,580	West Germany, 7,133; United Kindgom, 3,371; Belgium, 1,500.	209,250
Rods	9,575	8,310	United Kingdom, 3,303; West Germany, 1,528; United States, 1,362.	101,133
Wire	222	352	United States, 137; West Germany, 86; Belgium, 60.	21,651
Pipes and tubes	24,211	67,296	Italy, 51,093; West Germany, 9,098; United States, 2,128.	2,296,249
Rails and railway track material	6,765	4,864	France 2,323; Belgium 1,142; West Germany 432.	110,041
Other, not elsewhere specified.	2,202	1,128	United Kingdom 523; West Germany 226; Italy 159.	50,097
Total, finished steel	827,363	638,022		12,432,210
Lead:				
Ingots and bars		821	Mexico 400; Peru 320	15,389
Other semimanufactures	1	2	France 1; West Germany 1	297
Mercury, 76-pound flasks	178	320	Mainly from Mexico	8,408
Nickel:				
Ingots, etc	70	63	Canada 43; United States 19	14,194
Other, not elsewhere specified.	292	138	Canada 53; United States 48; United Kingdom 36.	31,802
Platinum metals, troy ounces, all forms		(2)	All from United States	16
Selenium	3	6	Canada 2; Sweden 2; Japan 1	7,783
Silver foil, troy ounces	32			
Tin, bars and ingots, long tons	1,958	954	Malaya 897; Netherlands 52	281,396

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962		
	Quantity	Quantity	Principal sources	Value (thousand pesos)
Metals—Continued				
Zinc:				
Ingots and bars	318	85	Belgium 60; Congo 25	2,856
Sheets and plates	237	143	Belgium 92; West Germany 28; United States 23.	7,801
Metals containing copper, nickel, and other metals.	237	568	Mainly from West Germany	95,447
Other base metals ores, except lead, not elsewhere specified.	492	812	Australia 379; United States 143; Republic of South Africa 124.	17,864
Other metals, not elsewhere specified.	113	137	United States 41; Norway 33; United Kingdom 30.	26,520
Total value, metals				18,456,880
Nonmetals:				
Barite	206	195	Mainly from West Germany	2,033
Cement	550	4,739	Denmark 2,596; Uruguay 1,084	14,986
Chalk	11	27	United States 17; Belgium 10	241
Clays:				
Foundry-mold earth	2,393	2,602	Austria 930; Italy 508; France 245	30,618
Kaolin	6,211	5,416	United States 3,474; United Kingdom 1,863.	38,495
Other earths	76	51	United States 30; West Germany 20.	1,050
Emery	2,397	1,470	West Germany 586; Brazil 306; France 234.	52,455
Graphite	126	121	United States 65; United Kingdom 26; Norway 21.	4,822
Gypsum	148	23	West Germany 14; United States 5; United Kingdom 3.	341
Industrial diamonds:				
Stones—carats	3,185	17,895	United States 11,235; West Germany 4,400; Belgium 1,335.	7,673
Powder—do	5	10	West Germany 5; United Kingdom 5.	85
Lithium and its compounds	10	25	Mainly from Brazil	5,099
Magnesite	2,590	2,762	Austria 1,728; Yugoslavia 405; Czechoslovakia 315.	32,193
Marble—square meters	952	4,422	All from Italy	2,668
Marble—cubic meters	246	8,997	Mainly from Italy	3,897
Mica	5	18	United States 10; United Kingdom 7.	3,511
Potassium nitrate	69	2	All from Spain	48
Pumice	9	1	All from Italy	41
Salt	8	2	All from United Kingdom	42
Sand	398	521	All from Uruguay	50,476
Sodium nitrate	16,604	14,011	All from Chile	84,480
Stone for construction—cubic meters	1	5,098	All from Sweden	47
Stone for construction	65,338	105,435	Mainly from Uruguay	42,681
Other stone	10	11	Mainly from United Kingdom	336
Sulfur	20,617	24,311	United States 23,809; Norway 498	84,328
Talc	130	75	France 25; Brazil 16; Switzerland 12.	833
Nonmetals, not elsewhere specified.	4,159	7,270	Mainly from Brazil	30,927
Total value, nonmetals				494,406
Mineral fuels:				
Coal	1,215,532	611,787	United States 402,362; Poland 84,388; Republic of South Africa 71,058.	1,160,417
Coke	45,247	22,616	United Kingdom 14,442; West Germany 8,174.	57,714
Petroleum and petroleum products:				
Crude 1,000 42-gal. bbl—petroleum.	13,220	7,917	Venezuela 6,645; Bolivia 580; Peru 165; Ecuador 89.	2,763,870

See footnotes at end of table.

TABLE 3.—Imports of metals and mienrals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962		
	Quantity	Quantity	Principal sources	Value (thousand pesos)
Mineral fuels—Continued				
Petroleum, and petroleum products—Continued				
Refined products:				
Lique- 1,000 42-gal bbl.. fied petroleum gas.	971	599	Chile 159; United States 132; Venezuela 120; Uruguay 100.	500,749
Gasoline.....do....	578	437	Netherlands Antilles 411; Venezuela 26.	281,588
Kerosine.....do....	4,108	2,582	Venezuela 1,304; Netherlands Antilles 1,057; Panama 221.	1,413,049
Distillate fuel oil..do....	6,532	7,169	Venezuela 3,562; Netherlands Antilles 3,079; Panama 473.	3,385,715
Residual fuel oil..do....	1,115	316	Venezuela 243; Netherlands Antilles 73.	
Lu- 1,000 bbl., 42-gal... bricants, including greases.	334	782	Venezuela 580; Netherlands Antilles 113; United States 84.	1,190,008
Asphalt.....do....	1	1	All from United States.	2,035
To- 1,000 42-gal bbl.,.. tal refined products.	13,639	11,886	Venezuela 5,835; Netherlands Antilles 4,733; Panama 694.	6,773,144
Total value, mineral fuels.	----------	----------	----------	10,755,145
Total:				
Value of metal and mineral imports.[3]	----------	----------	----------	29,706,431
Value of all imports[3].....	----------	----------	----------	153,642,454
Metals and minerals percent.. share in total imports.	----------	----------	----------	19.3

[1] Less than 0.5 metric tons.
[2] Less than 1 troy ounce.
[3] Recorded import values include cost and freight charges, but apparently do not include insurance.

COMMODITY REVIEW

METALS

Aluminum.—In 1961 the Argentine Government authorized the Kaiser Aluminum and Chemical Corp. to build a 22,000-ton aluminum plant at Puerto Madryn in the Patagonian Territory of Chubut. Kaiser immediately formed the Argentine company Fabrica Argentina de Alumina, S.A., for that purpose. The plant had not been completed by the end of 1963.

In 1961 Industrias Siderurgicas Grassi, S.A., announced plans to build alumina and aluminum plants in southern Mendoza Province; the aluminum plant was to have a capacity of 10,000 tons a year. In 1962 Reynolds International, Inc., was authorized to build a 22,700-ton aluminum plant near either Puerto Madryn or Comodoro Rivadavia, which is also in the Territory of Chubut.

Argentina has no bauxite deposits of its own. Final utilization of bauxite imports listed for 1961 and 1962, plus 4,292 tons imported in 1963, has not been reported.

Beryl.—Argentina in 1963 was third largest producer of beryl in the world, following Brazil and the U.S.S.R. Since the Argentine Government freed producers in 1961 from exclusive sale to COCOMINE (Comité de Comercialización de Minerales), the Government mineral

sales committee output has depended largely on the international price factor. It was not adversely affected until September 1962, when prices on ore imported into the United States, the predominant market, began to decline. Argentine production declined in 1963, but toward the end of the year some producers who had shut down reinitiated operations. Production of high-quality mineral, containing as much as 10, 12, and more percent BeO, has been from an extensive pegmatite zone in the Pampean Ranges—mined primarily in the Provinces of Catamarca, La Rioja, Córdoba, San Luis, and occasionally San Juan. Some beryl-bearing pegmatites are situated farther south in Rio Negro.

All Argentine-produced beryl has been sold abroad except an estimated 24 tons consumed annually by Cía. Argentina Berilo y Aleaciones which, when last reported in 1960, was producing beryllium-copper alloy, beryllium oxide, and beryllium hydroxide for unrecorded disposal.

Columbite and Tantalite.—The ore minerals are coproducts of beryl from mining pegmatites. They have found a steady market abroad, principally in the United States.

Copper.—Since 1851 Argentina has been a persistent but an ineffective producer of copper, despite its proximity to the great Chilean copper belt. Peak production was attained in 1908 with about 2,500 tons of copper in ores and concentrates. The average through 1950 was between 250 and 350 tons, and the peak since then was about 750 tons produced in 1957. Production from small rich veins in generally remote areas of the high Andes has been an insignificant fraction of the approximate 30,000-ton annual industrial requirement of the country, which customarily is supplied by imports from Rhodesia, the United States, and Chile.

Iron Ore.—Domestic resources of iron ore are inadequate for the expanding steel industry. Production in 1963 dropped 22 percent from that of 1962 and was 41 percent below that of 1960. Nearly all of the ore production has been from the Zapla deposit in the Province of Jujuy, which feeds the state-owned charcoal furnaces of the Establecimiento Alto Hornos de Zapla. The ore contains only 35 to 45 percent iron and is high in phosphorus and silica. The proved reserve is 110 million tons; possible reserves have been estimated to total 400 million tons.

In the Province of Rio Negro, about 19 kilometers from the Atlantic Coast, the undeveloped Sierra Grande deposit has 48.5 million tons of measured ore, containing an average of about 55 percent iron but also a high phosphorus content. Unmeasured reserves may be an additional 200 million tons. A survey of the deposit by the international consortium MISIPA (Minera y Siderúrgica Patagónia—Sierra Grande, S.A.) continued in 1963 and was expected to extend for 3 more years to embrace detailed studies of mine and smelter production methods, market outlets, transportation and power supplies, and other facets of industrial integration. Early in 1961 the Argentine Government approved a US$150 million contract with MISIPA to develop the deposit. Studies underway at yearend were being financed by a 1963 technical assistance loan of US$400,000 from the Inter-American Development Bank plus US$250,000 provided by MISIPA.

The project can become a major operation, but it will be some time before commercial mining will begin, assuming the fruition of forecasts. Plans call for initial shipment of ore to the San Nicolás steel plant of SOMISA where, because of the high phosphorus content, it can be used to make up only 10 percent of the blast-furnace charge. Later MISIPA expects, if the ore reserve is adequate, to establish an industrial complex at a site yet to be determined but probably at Pureto Madryn to draw power from the projected Chocan hydroelectric installation and utilize coal from Rio Turbio. The planned complex includes plants with annual capacities to produce 1 million metric tons of iron pellets suitable for blast furnace charge, 330,000 tons of sponge iron, and 296,000 tons of steel.

Less important deposits of iron ore have been found in the provinces of Mendoza, Salta, Cordoba, and Buenos Aires; some may have been exploited on a very small scale locally.

The metallic raw material needs of the iron and steel plants, beyond the iron ore contribution of the Zapla mine and some suspected domestic production of ferromanganese, have been supplied by imports of iron ore from Peru, Brazil, and Chile; pig iron from the U.S.S.R., West Germany and Brazil; billets, blooms, and slabs chiefly from West Germany, Belgium, and Sweden; and ferromanganese from Belguim, France, and the United States.

Iron and Steel.—The business recession that began early in 1962 and continued into 1963 struck the Argentine metals industry with particular force. Output of finished steel products was considerably less than capacity and 16 percent less than the 1961 production record. In contrast, and as a process of import substitution, major increases were made in the production of pig iron, crude steel, and semifinished steel. Producers sought and obtained export outlets for their manufactures amounting to 117,000 tons, a record high. Steel is not a traditional export product, and overseas sales were expected to diminish sharply in 1964. Argentine apparent consumption of finished steel in 1963 has been calculated as 1,460,900 metric tons, but reduction of stocks already in the country may have made actual consumption 100,000 to 200,000 tons higher. Iron and steel producing capacities at the end of 1963 were:

	Capacity, metric tons per year			
Plant:				
Government owned:	*Pig iron*	*Crude steel*	*Semifinished steel*	*Finished steel*
SOMISA [1]	630, 000	900, 000	800, 000	1, 000, 000
Zapla [2]	160, 000	150, 000	135, 000	120, 000
Private [3]	10, 000	500, 000	350, 000	1, 400, 000
Total	800, 000	1, 550, 000	1, 285, 000	2, 520, 000

[1] Sociedad Mixta Siderúrgica Argentina plant at San Nicolas, Buenos Aires Province, produced 385,500 tons of pig iron and 510,700 tons of crude steel in 1963; it was the sole producer of slabs.
[2] Establecimiento Altos Hornos de Zapla, a property of Fabricaciones Militares at Zapla, Province of Jujuy, produced 37,200 tons of pig iron in 1963.
[3] Altos Hornos Guemes, which started in 1963 in Santa Fe Province, and other plants and foundries including Acindar, Dalmine, Gurmendi, Santa Rosa, Siderca, A.B.K. Electrometalúrgica, La Cantábrica, and San Martin.

Capacities of SOMISA for pig iron and crude steel are out of balance. Long-range plans include addition of at least one more blast

furnace, a basic oxygen steel furnace and oxygen plant, additional blooming facilities, and more equipment for the finished steel lines to complete an integrated mill with 2 million tons of crude steel capacity. Expansion progress in 1963 included installation of a fifth open-hearth furnace, a cold sheet line, a hot sheet mill, and a tinplate line.

Zapla confined itself to small-scale pig iron production until the late 1962 completion of an integrated steel plant consisting of two new blast furnaces, three Thomas converters, and a rolling mill for structural shapes. The plant was expected to serve the regional market of northwestern Argentina, but the new facilities were not put to work in 1963, except part use of one of the blast furnaces.

Acindar, Industria Argentina de Aceros, S.A., operating in the Province of Santa Fe, is the largest of the private steel companies. It completed in 1963 the installation of a merchant Morgan rolling mill in its Villa Constitución plant, raising its finished steel capacity to about 420,000 tons. At the same time, crude steel capacity of its Rosario plant was increased 25,000 tons to 95,000 tons. The company possesses no facilities for producing pig iron, but plans for an integrated plant call for an eventual blast furnace capacity of 500,000 tons, an open hearth capacity of 650,000 tons, and a 100,000-ton expansion of semifinished steel output.

Gurmendi was adding 180,000 tons of finished steel capacity to its previous 60,000 tons and planning installation of crude steelmaking facilities and later blast furnaces for pig iron.

The expansion program of Establicimientos Metalurgicos Santa Rosa, S.A., scheduled for completion in 1964, involved installation of a 25-ton electric furnace at its Tablad plant in Buenos Aires Province to raise crude-steel capacity from 60,000 to 90,000 tons, and amplification of its finished steel lines to raise capacity from 90,000 to 130,000 tons.

Propulsora Siderúrgica, not yet in production, was engaged in a big project for construction of a plant near La Plata, Buenos Aires Province, capable of producing annually 1.4 million tons of pig iron, 1.3 million tons of crude steel, and 1.1 million tons of semifinished steel, at an estimated cost of slightly more than US$200 million. The Italian-capital Techint company, that controls Siderca and Dalmine, was sponsoring the project but facing a problem of financing.

Other projects were underway or being planned during 1963. Some were comparatively small and others, including a few of major proportions, showed uncertain prospects of fulfillment.

Lead and Zinc.—Mine output of lead and zinc, the two most important indigenous metals produced in Argentina, accompanied the general business recession of 1962–63 with declines of 9.9 and 8.7 percent, respectively. Lead production from mines and smelters was adequate or nearly so to meet the needs of the country, but there was not enough surplus to permit sales abroad until 1963, when 270 tons of lead concentrates were exported. Production costs are high, and the industry requires and receives tariff protection of 150 percent surcharge on lead-ingot imports. The price of lead produced and sold in Argentina has been roughly double the world price and has created considerable consumer demand for reduction of the surcharge on imports.

Production of zinc is determined by that of lead, with which it is associated in the ores. In recent years, the ratio of zinc to lead in ore mined has increased. National consumption since 1960 has been satisfied by the domestic-smelting capacity without need for imports of slab zinc. Part of a regular and inevitable oversupply of zinc concentrate found export markets principally in Europe, but appreciable tonnages have contributed to an ever-growing accumulation of stocks that probably exceeded 140,000 tons at the end of 1962. Stocks were reduced a little in 1963 when increased world demand and prices provided an export outlet for 47,372 tons of concentrate and 3,179 tons of slab zinc, compared with 19,682 tons of concentrate and no refined metal exported in 1962.

Cía. Minera Aguilar, a subsidiary of the St. Joseph Lead Co., was the only major producer of lead-zinc ores and concentrates in Argentina. In its 28 years of mining and milling, from early 1936 through 1963, it produced 644,926 tons of exceptionally high-grade lead concentrates and 983,503 tons of zinc concentrates from its Aguilar group of mines situated about 4,420 meters above sea level in the Department of Humahuaca, Province of Jujuy, in the extreme northwestern part of the country. With outstanding application of operational efficiency, the company in 1963 succeeded in holding production costs to a slight increase, despite increases of 21.4 percent in basic wages and 50 percent in cost of supplies. The lead concentrates are smelted by several Argentine smelters and fabricators. The zinc concentrates, other than those exported and stocked, move by rail to Borghi, a port on the Parana River north of Rosario, for treatment by Sulfacid, S.A., which is owned jointly by Aguilar and Bunge & Born, international dealers in agricultural products. Sulfacid facilities include roasters, a sintering plant, an acid plant, and—since late 1962—a modern electrolytic zinc plant with a capacity of 6,000 tons per year of Special High-Grade zinc, that produced only about 4,000 tons in 1963. Sulfacid sinter is shipped to the sintering and electrothermic zinc smelting plant of Cía. Metalurgica Austral-Argentine S.A.C.I.G. (43.3 percent owned by Aguilar) at Comodoro Rivadavia in Patagonia, which has a capacity to produce 12,000 tons of prime western zinc per year.

Cía. Minera Castaño Viejo, a subsidiary of the National Lead Co., was the second largest lead-zinc producer from its Castaño Viejo mine in San Juan Province near the Chilean border, but gradual depletion of ore reserves of that mine contributed to the decline of total lead-zinc production for Argentina in 1963, and the company embarked on an extensive exploration program. Castaño Viejo lead concentrates, and most of those from Aguilar, have been treated at Puerto Villelas plant of the National Lead Co. at Barrangueras, Chaco Province.

Small lead-zinc mines and smelters productive in 1963 have not been identified. Those active in the recent past include the following:

Facility:	*Department or City*[1]	*Province*
Lead-zinc mines:		
Sol de Mayo	Yavi Department	Jujuy.
Alejandro	----do----	Do.
Bella Blenda	Valle Fertil Department.	San Juan.
Cristal Blenda	----do----	Do.
Viscachani	Santa Victoria Department.	Salta.
Helvecia	La Valle Department.	La Rioja.
Carreri	Picunches Department.	Neuquén.
Achalay	----do----	Do.
Minor prospects	Las Heres Department.	Mendoza.
Lead smelters:		
Elaboración General del Plomo	Mercedes	Buenos Aires.
Compañía Sudamericana de Industria y Commercia.	San Justo	Buenos Aires.
Piterman	Isidro Casanova	Buenos Aires.
Daniel Nogiera	Avellaneda	Do.
Partenopea Argentina S.R.L.	Buenos Aires	Federal Capital.
Calles, Fraga y Chernitzky, S.R.L.	Buenos Aires	Do.
Industries Rab, S.A.	Barazetequi	Buenos Aires.
Martin Munster y Cía	Villa Adelina	Do.
Zinc smelters:		
Meteor Establecimiento Metalúrgico, S.A.	Zarate	Buenos Aires.
Fábrica Militar de Zinc Electrólitico.	Rio Tercero	Córdoba.

[1] City except where otherwise noted.

Manganese.—Deposits of manganese ore are small, scattered, and of too low grade (ranging from 15 to 40 percent contained metal) to be competitive in the world market. Production, mainly from the Provinces of Santiago de Estero and Cordoba, has been protected by a 100-percent tariff on imports. No imports have appeared in the officially released statistics, but the recent decline in the production of 30 to 40 percent grades has been attributed to imports of high-grade Brazilian ore under reduced charges granted to LAFTA (Latin American Free Trade Area) member countries. The ore is consumed largely by the steel industry as an additive either to pig iron furnaces or directly to the steel in open-hearth furnaces, although a plant reportedly inaugurated in 1957 in Mendoza may be supplying part of the open-hearth feed in the form of ferromanganese. Minor quantities of ore are used in the glass and chemical industries and for electrodes.

The Farellon Negro manganese deposit in the Agua de Dionisio district of Catamarca Province has been under investigation since 1958 by the Government-created YMAD (Yacimientos Mineros de Agua de Dionisio). The deposit reportedly contains 200,000 tons of very low-grade (9 to 20 percent manganese) ore with 10 to 12 troy ounces of gold and 200 ounces of silver per ton which, if true, should warrant its development as a precious metal mine. The validity of the precious metals content is questionable, and tentative plans are for initiation of a manganese-ore-production operation in 1966.

Precious Metals.—Since known depletion of ore in the vein mines of Cía. Minera Los Marayes in San Juan Province and Empresa Minera del Huaracó in Neuguén Province appears to have forced their closure towards the end of 1961, gold production has been limited to that contained as a byproduct in the ores of other metals and possibly recovered from small placer operations. (See manganese.)

The only metallic silver presently refined in Argentina is recovered in the process of smelting lead, and virtually all of it can be traced to the lead ores mined by Cía. Minera Aguilar in the Province of Jujuy.

Tin.—Internationally, Argentine production of tin is insignificant. The economically exploitable tin-silver vein and placer ores in the high mountains at Pirquitas, Province of Jujuy, were reported to be exhausted and the mines and mills closed in late 1958, leaving unexplained the origin of the continued small but steady production and exports of tin and tin-silver concentrates.

The only tin smelter to operate in Argentina since the close of World War II was closed in 1957, dismantled, and scrapped.

Tungsten.—During World War II tungsten was the most valuable mineral product in Argentina; average annual output in the years 1939–45 was 1,580 tons of concentrates of 60 percent WO_3 equivalent. Production fell nearly to the vanishing point in 1950 and then slowly rose to 600 tons by 1953; the annual average for that 7-year period was only 250 tons. In mid-1954 a 5-year, fixed-price purchase contract with the U.S. Government boosted the 1954–58 annual average to 1,079 tons. Thereafter through 1961 COCOMINE (Comité de Comercialización de Minerales), the Government mineral sales committee, became the mandatory sole purchaser of tungsten ore and supported mining activity at a reduced level, averaging 790 tons a year, by paying a subsidy price of M$N180 per kilogram for ore that was then sold to export markets for M$N50 to M$N60 per kilogram. At the end of 1961 legislation freeing tungsten and beryllium from Government control came into effect, permitting producers to sell their ore either in the open market or to COCOMINE, but early in 1963 COCOMINE—having depleted its funds—announced that as of April it would no longer purchase tungsten ore. When April arrived, all important tungsten mines had been shut down, and continued operation by small mines only on an irregular basis accounted for the 144 tons produced in 1963, a 75 percent reduction in output from the 576 tons in 1962. Recovery will have to await substantial improvement in international demand and prices.

Various mines in San Luis Province, most important of which was the Los Condores mine and mill of SOMISA (Sociedad Minera Argentina, S.A.), have yielded more than half of the country's past production of both wolframite and scheelite. Second largest producing area was the Province of Córdoba, having 29 known deposits. Occurrences that have been worked from time to time are widely scattered in at least six other provinces: Rio Negro, La Rioja, San Juan, Catamarca, Jujuy, and Mendoza. Except for Rio Negro and Jujuy, all these provinces encompass the Pampean Range where tungsten minerals occur as disseminations in granite, in tungsten-bearing pegmatites and aplites, as wolframite or scheelite or both in quartz veins, and as replacement deposits of scheelite in crystalline limestone

and granulite. All of the bismuth produced in years past was by-product of these ores.

Uranium.—Argentina does not have a known resource potential for more than modest production of uranium. Under a special appendix of 1956 to the Mining Code, all radioactive minerals are owned by the Argentine Government, and authority for their exploration and exploitation rests with the Comisión de Energia Atomica acting in cooperation with the individual provincial governments. Deposits have been found in the Provinces of Mendoza, La Rioja, Chubut, and possibly elsewhere, and plants for ore treatment and production of yellow cake concentrates have been erected. Sales abroad are restricted to such exports as the Comisión de Energia Atomica deems to be in the public interest. Production in 1963 was the highest since 1959.

NONMETALS

Barite.—Barite produced principally in the Provinces of San Juan and Neuquén supplies most of the well-drilling needs of the domestic petroleum producers and part of the similar requirements of Bolivia. Production has fluctuated with the slight variation in demand.

Borates.—Annual domestic requirements for borax are roughly 10,000 tons, and excess production of the source minerals tincal and ulexite, amounting to 5,410 tons in 1963, is exported. Reserves are extensive in five major deposits in Jujuy and six in Salta. Cía. Productora de Boratos and one other firm are the leading producers. Borate minerals are utilized in Argentina in manufacturing enamels, varnishes, glass, pottery, soap, toilet articles, tubes for conveying illuminating gas, straw hats, and textiles.

Cement.—An abundance of limestone, clay, and gypsum, as well as a usually adequate supply of fuel, permitted the establishment in 1913, and expansion, of a cement industry at rates generally commensurate with the steady growth of domestic demand. By 1963, 7 companies and the Argentine Government were operating 14 plants well distributed at or near 10 cities in 8 provinces. The plants had a total of 7,344 employees. Foreign trade has been relatively light and well balanced between exports and imports.

The most important producer was S. A. Loma Negra, which shipped 997,500 metric tons from its Barker, Loma Negra, and Frías plants. Others, in descending order of 1963 output, were Corporación Cementera Argentina, S.A., which shipped 385,696 tons from its Papinas, Kilómetro 7, and Capdeville plants; Compañí Sudamericana de Cemento Pórtland (Juan Minetti & Sons) with 327,659 tons from its Dumesnil, Panqueua, and Campo Santo plants; Compañía Argentina de Cemento Pórtland (a subsidiary of International Cement Corp., which also owns the Lone Star Cement Co.) with 541,346 tons from its Sierras Bayas and Paraná plants; S. A. Calera Avellaneda with 177,806 tons from its single V. C. von Bernard plant at Olivarría; the Argentine Government with 50,137 tons from its plant at Comodoro Rivadavia; and Yalu, S.A., with 30,869 tons from its newly established plant at San Juan.

TABLE 4.—Cement production and installed capacities distributed by provinces and plants

(Metric tons)

Province	Plant	Production [1]		Installed capacity	
		1962	1963	1961–62	1963
Buenos Aires	Barker	518,114	448,512	1,174,000	1,174,000
Do.	Loma Negra	579,792	467,846	600,000	1,000,000
Do.	Sierras Bayas	483,594	409,520	585,000	585,000
Do.	V. C. von Bernard	212,734	177,806	225,000	235,000
Do.	Pipinas	120,885	117,747	157,000	168,000
Total		1,915,119	1,621,431	2,741,000	3,162,000
Córdoba	Dumesnil	160,141	150,310	202,000	202,000
Do.	Kilómetro 7	145,426	156,676	165,000	165,000
Total		305,567	306,986	367,000	367,000
Mendoza	Panqueua	148,002	123,915	193,000	193,000
Do.	Capdeville	145,625	111,273	175,000	175,000
Total		293,627	235,188	368,000	368,000
Chubut	Comodoro Rividavia [2]	66,358	50,137	120,000	120,000
Entre Ríos	Paraná	127,854	131,826	146,000	146,000
Salta	Campo Santo	73,559	53,434	91,000	91,000
San Juan	San Juan [3]		30,869		125,000
Santiago del Estero	Frías	117,390	81,142	144,000	144,000
Total Argentina		2,899,474	2,511,013	3,977,000	4,523,000

[1] Plant shipments.
[2] Government owned.
[3] Plant started operating Mar. 28, 1963.

Pegmatite Minerals.—Mines of the pegmatite zone, described under beryl, yield as coproducts Argentine's total output of feldspar, lithium minerals, mica, quartz, and some of the fluorspar. Most of the fluorspar is found in veins with phyllite in Córdoba and San Luis—leading producing provinces—Catamarca, La Rioja, Mendoza, Rio Negro, and San Juan.

Salt.—Argentina is self-sufficient in its production of salt and normally has had a modest excess available for export. Reported production in 1963 was far below the preliminary estimate of 600,000 tons and is suspected of being incomplete.

Production is of three types: (1) Derived from solar evaporation of landlocked lakes fed by intermittent streams, chiefly in the Provinces of La Pampa, San Luis, Buenos Aires, and Córdoba; (2) mined as rock salt in the Provinces of Salta and Neuquén; and (3) derived from brine wells tapping subsurface saline deposits in the vicinity of El Tembo, Province of Tucumán. The three types are listed in the order of importance, with the first representing the bulk of production. Recovery of salt by the solar evaporation of sea water, a standard method elsewhere, is not practiced in Argentina.

Sulfur.—With the closing of the most important small producer in 1961, the production of sulfur in Argentina fell almost entirely in the control of Fabricaciones Militares, the Government military factories establishment, which refines the sulfur produced from its Azufre del Norte mine in the Province of Salta. Fairly uniform production at higher than world prices has satisfied less than half the normal de-

mand, the remainder having been made up by imports and production by Sulfacid, S.A., of sulfuric acid from zinc sulfide concentrates.

In addition to the exploited resources in the high mountains of Salta and Mendoza, relatively untouched deposits of sulfur occur in Jujuy and San Juan. Major domestic consumers of sulfur, largely as sulfuric acid, have been the petroleum refineries, tanneries, munition factories, plastic and rayon plants, sugar refineries, and miscellaneous chemical industries. Crude sulfur is consumed in the rubber, insecticide, and other industries.

MINERAL FUELS

Coal.—The increased usage of natural gas and fuel oil for industrial purposes reduced Argentine consumption of bituminous coal from the 1-million-ton level of 1960–61 to approximately 830,000 and 970,000 tons, respectively, in 1962 and 1963. Imports in 1963 (768,940 tons) were 157,000 tons greater than in 1962 but 447,000 tons, or 37 percent, less than in 1961. In the same 3-year period, mine production declined 40 percent. The ratio of imports to mine production was 3 : 5 in 1961, 2 : 2 in 1962, and 3 : 7 in 1963.

Argentina has a few small coal deposits in La Rioja, Neuquén, San Juan, and Rio Negro, but its most important resource and production area is in the foothills of the Andes at Rio Turbio, in the extreme southwestern corner of Santa Cruz. All the mines are operated by the Government agency YCF (Yacimientos Carboníferos Fiscales). Reserves in the Rio Turbio area have been estimated between 300 and 400 million tons of low-calory, high-ash coal. Shortages of labor, electric power, and machinery, and the difficult problem of transportation by rail to the port of Rio Gallegos, by boat to northern ports, and in some cases again by rail to consumption centers have raised delivery cost higher than that of imported coal, and an operating deficit of M$N2 billion in the 1962–63 fiscal year. The principal consuming outlets have been the Government-owned electric power companies, national railways, and SOMISA steel mill.

Petroleum.—Appraisal of developments of any single year in Argentine exploitation of its petroleum resources is difficult without a framework of the historical background, which was outlined by Edward V. Lindburg, Economic Officer, U.S. Embassy, Buenos Aires, in a State Department Airgram of May 23, 1963, as follows:

BACKGROUND OF PETROLEUM INDUSTRY

While searching for water to supply the needs of the small town of Comodoro Rivadavia, a Government well drilling team discovered oil on December 13, 1907. From 1907 to 1935 the Government, through YPF (Yacimientos Petrolíferos Fiscales) and its predecessor agencies, competed freely with private companies (principally Esso and Shell) which were granted oil concessions in the 1920's. From 1935 to 1958, because of political and nationalistic considerations, the development of the Argentine petroleum industry was the exclusive domain of the Government. During this period no new concessions were granted, neither to Argentine nor to foreign companies, although the private companies were allowed to develop the concessions obtained in the 1920's.

The exploration and development of new petroleum areas was reserved by law entirely to YPF. However, during this period Argentina's petroleum needs were growing far faster than they could be met through YPF's exploration and development efforts, because of technical and financial inadequacies in YPF.

Constantly increasing imports of crude petroleum and petroleum products were necessary to satisfy the energy needs of Argentina's developing economy. These imports were an increasing burden on the balance of payments. The cost of petroleum imports, both crude and products, reached its maximum in 1958—about $250 million.

It was against this background that the newly-elected President Frondizi formulated a politically acceptable solution in July 1958. He started his "Battle of Petroleum" program by inviting foreign and domestic petroleum companies to bid, not on concessions, but on exploration and development contracts with YPF under which the companies bear the risks and expenses in prospecting in their allotted areas throughout Argentina and deliver any crude oil that may be found to YPF at contractual prices, averaging $11 per cubic meter. Since 1958 only three companies have delivered to YPF significant amounts of crude petroleum—Pan American Argentina Oil Company, a subsidiary of Standard Oil Company (Indiana); Argentina-Cities Service Development Company, which took over the Carl M. Loeb, Rhodes & Co. contract; and Tennessee Argentina S.A., a subsidiary of Tennessee Gas Transmission Company, Houston, Texas. These three companies today produce approximately 30 percent of Argentine crude petroleum, while YPF and its contract drillers produce about 70 percent. ASTRA, an Argentine company, Shell (Royal Dutch, Shell subsidiary) and four U.S. firms, including Esso, have yet to find significant quantities of petroleum under their contracts. Since 1958 these companies have invested about $200 million under their contracts.

DEBATE OVER OIL CONTRACTS

There are three types of contracts under which the foreign (mostly U.S.) oil companies work with YPF—exploration and development contracts, well drilling contracts, and oil well service contracts. There is no controversy over the service contracts under which several companies (Petro-Tech, Halliburton, Delta, Schlumberger, and Atlas) perform technical well services such as logging, perforating, coring, etc. Some criticism has been leveled at the drilling contracts—especially that the cost of $20 per meter is too high, and that YPF is contracting for too many wells at one time. Under these contracts the drilling companies (Southeastern, Kerr-McGee, SAIPEM) drill wells when and where directed by YPF.

The major volume of criticism has been directed at both the legal validity and the desirability of the exploration and development contracts. The contracts were attacked by the National Committee of the UCRP (Unión Cívica Radical del Peublo) and defended by the UCRI (Unión Cívica Radical Intransigente—Frondizi's party) and the Secretary of Energy and Fuels. Openly opposing the Government's petroleum policy, the President and several directors of YPF debated the validity of the contracts at YPF Board meetings during 1962, and the Board eventually decided to request the legal opinion of the Attorney General of the National Treasury. This request was refused by the Government and the debate came to a head on December 13, 1962 (Petroleum Day) when YPF President Fitte, in a nationally broadcast speech, attacked the Government's petroleum policy and described the contracts as "unjust and burdensome for YPF and for the nation". His resignation and those of three YPF directors who supported his position were accepted by the Government on December 28 (Fitte has been replaced as YPF President by José L. J. Mazzaferri). Although the debate on the contracts ceased within YPF, it will be continued during election year 1963 both by sincere opponents of the contracts, as well as by those with political, personal or ideological axes to grind.

Frequently overlooked is the fact that under the contracts YPF always retains title to the oil—whether below or above ground. Undoubtedly the attacks on the contracts will strengthen YPF's hand when it decides to renegotiate them. Several of the foreign oil companies have expressed publicly their willingness to engage in reasonable and responsible negotiations with a view to modification of some clauses of their contracts.

* * * * * * *

Perhaps the major problem in the current development of Argentina's petroleum industry is financial, i.e., how a country in an economic depression, with large budgetary deficits and a growing balance of payments problem, can pay for

the work which must be done by private companies, either foreign or domestic, to enable Argentina's underground petroleum resources to be developed so as to satisfy the enery needs of the nation. The development and utilization of Argentina's petroleum resources is comparatively expensive because of the heavy qualities of Argentine crude, the low yield per well-year, and the distance from production to consumption centers.

At the close of 1963 the contracts of the service companies and of the Pan American Argentina Oil Co. and the Shell Production Co. of Argentina apparently were still operative, but Decrees No. 744 and 745 of November 15 annulled the drilling, exploitation, and pipeline contracts signed in the years 1958 through 1961 with the following companies: Argentina Cities Service Development Co. (ex-C. M. Loeb Rhoades & Co.); Astra, Compañí Argentina de Petróleo S.A.; CADIPSA—Compañía Argentina para el Desorrollo de la Industria del Petróleo y Minerales; Continental Oil Co. of Argentina; ESSO S.A.P.A., Esso Argentina, Inc.; SNAM (ex-Saipem (E.N.I.)); Southeastern Drilling Co. of Argentina, S.A.; Tennessee Argentina, S.A.; Transworld Drilling Co. (ex-Kerr McGee Industries, Inc.); and Union Oil Co. of California (operating agent: Cabeen Exploration Co.).

Decree 744 authorized YPF, the state oilfields entity, to take such steps as it might deem appropriate for the normal supply of fuel for the country.

Crude petroleum production in 1963 was 97,221,000 barrels; 64,917,000 (66.8 percent) was obtained by YPF, 29,595,000 (30.4 percent) from fields formerly operated by the contractors but recovered by YPF in November, and 2,709,000 (2.8 percent) from the four old concession areas operated by Shell, Petroquímica, Astra, and El Sosneado. Drilling completed during the year was as follows:

Wells:	*Drilled by YPF*	*Drilled by contractors*	*Total*
Field	86	504	590
Exploration	59	39	98
Outpost	109	--------	109
Total	254	543	797

Whether YPF is equipped to maintain a statisfactory balance between exports and imports with an expanding domestic demand for petroleum products remains to be tested.

The distribution of crude petroleum production by provinces in 1962 and 1963 has been reported as follows, in thousands of barrels:

Province:	*1962*	*1963*
Chubut	22,919	21,649
Santa Cruz	37,104	40,017
Neuquén	6,044	5,163
Rio Negro	34	23
Mendoza	17,694	18,013
Salta	8,458	6,537
Tierra del Fuego	5,952	5,766
Total	98,205	97,168

Crude is processed at the La Plata, San Lorenzo, Luján de Cayo, and Dock Sur-Avellaneda plants of YPF; the Compana, Bahía Blanca, Manuel Elordi, and Dadin plants of Esso Refinadora de Petróleo; the Dock Sur-Avellaneda plant of Diadema Argentina S.A. de Petróleo;

the Comodoro Rivadavia plant of Petroquímica; the Salta plant of Chachapoyas; the Bahía Blanca plant of La Isaura, S.A.; the Neuquén plant of Plaza Huincul; the Lomas de Zamora plant of Condor S.A. Petrolera Argentina; the Dock Sur-Avellaneda plant of Lottero y Papini Cía.; and the Quilmes plant of Ragor Cía., S.A. (Ramón Gerleri).

The Mineral Industry of Bolivia

By Frank E. Noe [1] and Sumner M. Anderson [2]

IN 1963 the gross value of mineral exports, indicative of approximate value of production (before deduction of realization and other costs) was placed at US$82,825,924 by the Bolivian Ministry of Mines and Petroleum. This was equivalent to 96 percent of the value of all 1963 exports (US$86,400,000) and represented roughly a 16 percent increase in value of 1962 mineral exports. Tin was by far the most valuable export commodity in 1963 accounting for US$57,369,314 or 66 percent of the value of all exports.

Bolivia has a significant position in the world production of three minerals—tin, antimony, and bismuth. In 1963 Bolivia was third in production of antimony and tin-in-concentrates, and fourth in bismuth; its share in the global production of these metals was 13.5 percent, 12.0 percent, and 7.8 percent, respectively. Bolivia also ranked fifth in production of tungsten, having 3.9 percent of the world output. It is in the Western Hemisphere, however, that Bolivia achieves its principal importance as a source of mineral supplies. It ranked first in production of tin and antimony, second in tungsten, third in bismuth, fourth in gold, fifth in silver and sulfur, sixth in lead, and seventh in zinc. Bolivia is handicapped in its competition for foreign markets by location of its mines at altitudes above 12,000 feet and corresponding transportation problems. As a land-locked nation it also bears heavy transportation costs through neighboring countries to reach ocean ports.

The mining industry has been historically, and is at present, the most important element of the Bolivian economy. The country is highly dependent commercially and financially on its mineral exports. Mineral production has contributed more than 90 percent of the foreign-exchange income, and the mining industry in the past has accounted, directly and indirectly, for more than half of the gross national product (GNP). In 1956 the industry directly accounted for about 47 percent of the GNP. From that time its contribution declined sharply to 16.2 percent by 1963, a figure exceeded, however, only by agriculture.

Although the mining industry dominates the economy of the country, only a small portion of its total output is consumed domestically. Domestic production of iron and steel products is extremely limited, and almost all consumption requirements are supplied by imports. Nonmetallic minerals are of little importance because the domestic

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consumption of these commodities is small, and the high production and transportation costs preclude any sizable output of low-unit-price commodities for export. Bolivia is thus an exporter of mineral raw materials and an importer of semifinished and finished metal products, machinery, and equipment.

In addition to its important contribution of foreign exchange to the economy, the mining industry was the largest employer of salaried workers, even though about two-thirds of the population are engaged in agriculture. The mining industry (excluding petroleum) in 1963 employed about 45,000 people permanently and 30,000 more part-time.

Mines in the industry have been traditionally classified arbitrarily by volume of production as large, medium, and small. The only large mines are those of the former Patiño, Hochschild, and Aramayo enterprises which were nationalized in 1952. Since that time they have been managed and operated for the Bolivian Government by the Bolivian Mining Corp. (COMIBOL), which was established especially for that purpose. In 1963 COMIBOL contributed 61 percent of the gross mineral export value, including 68.6 percent of the total tin exports, 97 percent of bismuth, 86 percent of silver, and 81 percent of zinc. At the end of 1963 the COMIBOL work force in 20 operating mines numbered 25,524.

Medium-size mines are those that have a monthly output of not less than 5,500 kilograms of fine tin, 7,000 kilograms of tungsten, 20,000 kilograms of antimony, 20,000 kilograms of copper, or 15,000 kilograms of lead. Mines which do not meet the normal monthly minimum-production schedules are classified as small. In 1963 the small and medium mines, comprising the private sector of the industry, numbered about 2,100. These operations employed about 19,000 people or approximately 42 percent of the total permanent workers in the mining industry. The value of exported mineral products of these medium and small mines for 1963 was approximately US$31,352,000, which represented 38.9 percent of the total value of the output of the mining industry, excluding petroleum. During 1963 the private mining sector produced 99.9 percent of the gold, 98.4 percent of the antimony, 85 percent of the tungsten, 56 percent of the lead, 51 percent of the copper, 31 percent of the tin, and important quantities of zinc and silver.

Indicators of the general economy of Bolivia are presented as follows:

	1959	*1960*	*1961*	*1962*	*1963*
GNP in current prices million U.S. dollars	336	390	431	475	500
Population thousands	3,705	3,790	3,877	3,966	4,057
GNP per capita	91	103	111	120	123
Cost of living index, La Paz, 1958=100	120	134	144	152	151
Exports, gross million U.S. dollars	78	68	77	76	86
Mineral exports, gross million U.S. dollars [1]	69	60	69	70	81
Imports, gross million U.S. dollars	65	72	78	98	104
Gross mineral production, percentage of GNP [1]	20.5	15.4	16.0	14.7	16.2

[1] Excluding petroleum.

GOVERNMENT POLICIES AND PROGRAMS

In 1936 the Bolivian Mining Bank was created to promote the mining industry by granting credit; maintaining stores of supplies, tools, and machinery; and providing technical personnel to assist the medium and small mining companies. In June 1952 this organization was authorized as the sole purchaser and exporter of mineral products. The same decree also directed that the small and medium mining companies purchase all machinery and equipment from the bank. This decree, in effect, nationalized the mining industry. A few months later, in October 1952, purchase of the production of large mines was passed from the mining bank to the Bolivian Mining Corp. (COMIBOL) by a decree which established COMIBOL for operating and managing the expropriated properties of Patiño, Hochschild, and Aramayo.

Finally in an attempt to control runaway inflation, the Government in December 1956 made important changes in its policy toward the private mining industry. It decreed that:

1. Production of the medium mines could be sold to the highest bidder, whether Mining Bank or private ore buyers.
2. Production of the small mines would continue to be purchased and marketed exclusively by the bank.
3. Private miners could purchase their machinery and supplies from any source, rather than exclusively from the Mining Bank.

At the same time the Government decreed that the net proceeds from all mineral sales, after deduction of realization costs and royalty, would revert to the possession of the miners and that the miners were to pay the Government a royalty on production in lieu of all other taxes. This policy exists today and has resisted all attempts by the associations of small and medium miners to lessen the control of the Government and the Mining Bank over the private sector.

In 1963 the U.S. Agency for International Development financed two technical groups to assist the private mining sector. One of these technical groups is cooperating with the National Department of Geology, which is primarily engaged in mapping mineralized zones in Bolivia and in offering technical geologic assistance to the small miners. The other group was assigned to the Mining Bank and to recommend changes in the structure of the bank and to assist in reorganization of that entity.

Although the Government expressed interest in a reorganization of the Mining Bank, internal political pressures nullified efforts to accomplish the basic changes required to aid the growth of the private sector of the mining industry. Throughout 1963, the bank continued to operate with the complex structure and ineffective organizational framework that had been devised at its inception. Overhiring and the financial support of uneconomic ventures brought the bank to a precarious financial position that completely paralyzed its ability to render effective financial and technical aid to the small mines.

Bolivian and American experts discussed and proposed modifications of the Mining Code with a view to making it more attractive to private capital. The high-mineral export taxes also were studied, and recommendations for changes were prepared for submission to the Government.

The Government, through the National Department of Geology, continued a joint geological exploration program with United Nations technicians. Another joint project between Bolivia and the United Nations calls for creating a national Institute of Mining and Metallurgical Investigations for increasing mine production, improving beneficiation practices, and investigating methods of refining. The location of the new Institute and the form of the Bolivian contribution to it had not been definitely determined by the end of the year.

The COMIBOL mineral production record reveals a sharp drop in tin output following nationalization of the mines. In 1952, COMIBOL produced 27,347 metric tons of fine tin. The following 10 years, production gradually declined. In 1961, the overall output of COMIBOL amounted to 14,830 tons of fine tin, a reduction of 48 percent. Since COMIBOL produces more than 61 percent of Bolivian mineral exports, which in 1963 amounted to 96 percent of the value of all Bolivian exports, the decline in COMIBOL production has been a matter of serious concern to the Bolivian Government.

The chief causes in the decline of production were:

1. Management inability to cope with the political power of the labor unions. Labor had power to veto management decisions and operations and at times even interfered in administration.
2. Decapitalization of COMIBOL, which resulted from rampant monetary inflation from 1952 to 1957 and the official exchange policy of the Bolivian Government. While the unofficial exchange rate rose from 190 Bolivianos (Bs) per dollar to Bs12,000 per dollar during that period the official exchange rate remained at Bs190 per dollar. Labor and other costs rose with the unofficial exchange rate, but the COMIBOL gross income did not, since it was obligated to sell all tin produced through the Central Bank at the official exchange rate of Bs190 per dollar. In this manner it is estimated that COMIBOL from 1952 to 1956 lost $120,500,000 and, in the process, totally decapitalized itself.
3. Lack of reinvestment in machinery and in exploration. Because of decapitalization, COMIBOL had no capital to do either.
4. Inadequate management to meet the technical, operational, financial and accounting requirements of a very large and complex mining operation. With the withdrawal of the former owners following nationalization, COMIBOL lost most of its experienced managers and technicians.

Seeking to correct the problems involved, a "Memorandum of Understanding" was negotiated on June 9, 1961, between the U.S. Agency for International Development, the Inter-American Development Bank, and the Federal Republic of Germany. Under this agreement a three-phase rehabilitation plan known as Operation Triangular was undertaken. An overall investment of US$37.75 million to be disbursed during a 3-year period was envisaged. This did not include funds for working capital, the need for which was recognized but not included in the estimate. Nevertheless, funds required for working capital have been furnished exclusively by the U.S. Agency for International Development.

Delay in the administration and coordination of the international operation and consequently in the disbursement of funds, as well as

the late arrival of the necessary equipment and supplies at the mines, forced a change in the original concept of the rehabilitation plan. The original 3 years became three phases, each lasting 18 months, with the second phase scheduled to end on or about April 1964. The first and second phases of the Triangular Operation were largely devoted to reorganization and restocking of spare parts and equipment. Owing to the time lag between ordering equipment and its arrival at the mine sites, there were still about $2 million worth in transit at the end of 1963. However, most direct mining and milling equipment had been renewed, and the warehouses had nearly enough spare parts and materials for 2 years.

During the first two phases loan funds were received as follows:

(In millions of dollars)

Triangular Operation basic agreement		US$37.75
First phase	US$14.75	
Second phase	US$12.38	
Total phases		US$27.13
Total available		US$10.62

In addition to funds which were normally financed under the Triangular Operation the following loans were negotiated in order to finance the funds required for working capital:

(In millions of dollars)

U.S. Agency for International Development	US$16.68
Banco Central de Bolivia	0.50
Smelters	1.43
Total	US$18.61

The funds received during the first two stages of the Triangular operation have enabled COMIBOL to increase production and to improve its economic structure. In 1963, if there had been no strikes or other disorders to interrupt COMIBOL mining activities, the total production of COMIBOL mines would have reached 16,500 metric tons of tin or about 10 percent more than the average of the 3 previous consecutive years. This production was not reached, however, because of Communist-led strikes during July and August. In all previous strikes since nationalization, whether justified or not, labor had been paid for strike time. The refusal of COMIBOL to pay for the strikes in 1963, combined with the strong stand taken by the Government in the hostage incident in December, have definitely discouraged strike abuses in the mines. Public opinion and the daily newspapers opposed the general strikes and were hostile to union strike leaders. The Government made progress in diminishing the power of extremists and has been strengthened in this by the important financial help given under Operation Triangular. However, the administrators of COMIBOL did not regain the right to manage operations to the extent that is considered necessary. Although considerable progress was made in management-labor relations, it was still not possible to implement in full the measures needed to achieve technical and eco-

nomic rehabilitation of COMIBOL operating units. However, a very important step was taken in August when, despite strong objections by the unions, the Government suspended the right of labor to veto the decisions of management.

The mines have been equipped to produce more ore but there is still much to be done in improving tin recovery by the present concentrating plants. To improve recovery COMIBOL and the Triangular Operation, during 1963, sponsored metallurgical research in the United States, Canada, England, West Germany, and Holland. At the same time substantial additions of equipment were made to COMIBOL metallurgical laboratories in Oruro, and a diversified research program has been conducted in this laboratory.

Costs involved in producing 1 pound of tin have been lowered from $1.37 in 1962 to $1.29 in 1963. Cost reductions were attributable to the increased quantity of tin that could be produced because of the additional equipment and spare parts provided in the first and second phases of the Triangular Operation and to the mining of slightly higher grade ores owing to better geologic control, instituted by technicians brought to COMIBOL by the rehabilitation plan. These costs may be reduced further by good management to the level of costs in the private medium mine sector, which were $1.01 in 1963. The average price received by COMIBOL from selling tin concentrate in 1963 was US$1.124 per pound of contained tin, indicating a loss of US$0.216 per pound in its tin operations. The future outlook indicates that there are favorable possibilities of COMIBOL increasing its mineral production and reducing its overall operating costs.

SOURCE MATERIAL

Mineral production statistics for the whole mining industry are not available. COMIBOL issues relatively accurate figures for production, metallurgical results, and exports. The small and medium mines, constituting the private sector of the industry, do not report production. However, the total exports of the Mining Bank, which buys all production of the small mines, and of the medium mines, which sell to the highest bidder, may be regarded as being representative of the production of the private sector. For most minerals there is no domestic consumption and, because the small and medium mining entities are usually short of capital, there is no significant inventory buildup of unsold minerals. Only in production of gold and silver is there a substantial difference between production and export because of domestic consumption and holding of inventories.

Preliminary export figures are prepared by the General Directorate of Mines (Direccion General de Minas) of the Ministry of Mines and Petroleum and usually are available approximately 3 months after the end of the reporting period. Official statistics of exports and imports are prepared by the Ministry of Finance and Statistics (Ministerio de Hacienda y Estadistica). The official export figures for any given year are usually available within 6 months following the end of the year. The final official import statistics are published in the annual Import Statistics (Importaciones) by the General Directorate of Statistics and Census of the Ministry of Finance (Direc-

cion General de Estadistica y Censos, Ministerio de Hacienda). However, this volume is not available until 2 or 3 years after the period in question. The most recent detailed import statistics available from this source are for the year 1961. However, the system of commodity classification was changed during that year, and the imports for the second half of the year are detailed in an entirely different manner from those of the first half of the year. Therefore, import data shown in this report for 1961 should be considered as approximate only, having possible duplications or omissions within the commodity classifications. Petroleum statistics have been supplied by the American Embassy in La Paz, with production for 1962 and 1963 adjusted to data published in the Bulletin of the American Association of Petroleum Geologists, August 1964. This combination of sources tends to give Bolivia an unreliable record of statistical accuracy. General economic data were obtained from the Economic Data Book for Latin America prepared by the U.S. Agency for International Development. Basic information has been obtained from field observations and conversations of the U.S. Bureau of Mines mining engineer in Bolivia with representatives of COMIBOL and the Inter-American Development Banks Advisory Group to COMIBOL. Reports prepared by COMIBOL for the Inter-American Development Bank have also contributed much information.

PRODUCTION

Production statistics presented in the following table represent actual COMIBOL production plus exports by the small and medium mines and the smelters. In addition to the nonmetallic minerals reported, salt and sodium carbonate are produced but statistics on these industries are not collected.

TABLE 1.—Approximate production of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Antimony, content of:					
Ore and concentrate	5,509	5,333	6,733	6,665	7,549
Metal [2]	3	10	2		
Beryl [2]			60	79	
Bismuth, content of ores and concentrates kilograms	202,763	186,636	227,716	303,904	254,748
Copper, content of ore and concentrate	2,174	2,208	2,232	2,408	3,001
Gold troy ounces	35,176	38,677	80,191	35,034	153,019
Iron ore [2]				63	
Lead, content of:					
Ore and concentrate	21,580	21,301	18,937	18,484	19,041
Refined metal and solder	266	108	4	125	(3)
Manganese, content of ore (grade not specified) [2]			48	264	
Mercury [2] 76-pound flasks	11			11	105
Nickel, content of ore [2]	2				
Silver, content of concentrate troy ounces	4,234,255	4,703,656	3,649,111	3,883,812	4,443,235
Tin, content of:					
Concentrate long tons	20,476	20,251	20,399	21,271	22,209
Refined metal, solder, dross [4] do	1,040	1,468	2,015	2,023	2,463
Tungsten concentrate, 60 percent WO_3 equivalent	2,275	2,244	2,887	2,482	2,194
Zinc, content of concentrate	2,771	4,292	4,885	3,634	4,229
Nonmetals:					
Asbestos [2]	152	60	52	52	9
Cement thousand tons	29	38	45	49	56
Mica [2]				7	
Sulfur [2]	1	1,194	4,975	7,363	9,950
Mineral fuels:					
Petroleum, crude thousand 42-gallon barrels	3,170	3,574	2,989	2,917	3,401
Refinery products:					
Motor gasoline do	860	904	920	1,028	1,010
Kerosine do	348	400	399	431	404
Distillate fuel oil do	331	383	356	439	424
Residual fuel oil do	626	542	503	633	594
Naphtha do				65	156
Total refinery products do	2,165	2,229	2,178	2,596	2,588
Refinery fuels and losses do	46	32	32	39	91
Total refinery throughput do	2,211	2,261	2,210	2,635	2,679

[1] COMIBOL production data plus exports by small and medium mines and smelters. Figures differ slightly from those in volume I which uses total exports as indicative of approximate production.
[2] Exported by small and medium mines.
[3] Data not available.
[4] Contains unspecified amount of tin reported also in tin-in-concentrate production. Total mine production is tin-in-concentrates plus an unknown portion of the tin in refined metal, solder, and drosses

TRADE

Bolivia has had an unfavorable trade balance for many years, primarily because of heavy imports of food and declining mineral exports. In 1963, however, with mineral exports at a 7-year high, imports were also inflated by the arrival of large quantities of spare parts and replacements for worn out and obsolete equipment in COMIBOL mines and mills. The normal purchase of 68 percent of Bolivian tin makes the United Kingdom the principal buyer of Bolivian mineral raw material exports. Other important consumers of Bolivian minerals are the United States, West Germany, and the Netherlands. The United States is the primary source of Bolivian imports and in 1963 supplied approximately 48 percent of the total. West Germany, Japan, the United Kingdom, and Argentina also supplied important quantities of food and manufactured goods. Normally, detailed import data are not available in published form for several years follow-

ing the end of the period; however, in 1963 a new and modern mechanized system of tabulating custom data was installed, and it is anticipated that detailed foreign trade statistics will become available with less time lag.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963		
	Quantity	Quantity	Quantity	Principal destinations	Value, c.i.f. (U.S. dollars)
Metals:					
Antimony, content of ore and concentrate.	6,740	6,651	7,563	United States 7,422; Argentina 122.	2,537,243
Beryl, gross weight	60	79			
Bismuth, content of ore and concentrate.	211	296	280	United States 243; West Germany 22.	833,257
Copper, content of ore and concentrate.	2,081	2,400	2,994	United States 1,912; Japan 1,082.	1,848,028
Gold—troy ounces	80,183	35,052	153,034	Switzerland 85,591; France 35,054; United Kingdom 32,052.	5,356,224
Iron ore		63			
Lead, content of ore and concentrate.	20,301	18,601	20,163	United States 12,796; Japan 3,529; Netherlands 1,763.	4,233,328
Manganese, content of ore	48	264			
Mercury—76-pound flasks			105	All to United States	19,425
Silver con- thousand troy ounces tent of ore and concentrate.	3,900	3,760	4,869	United States 4,051; Netherlands 354.	5,897,036
Tin, content of:					
Concentrate—long tons	18,393	19,469	20,306	(1)	(1)
Refined bars, solder, —do and dross.	2,015	2,023	2,463	(1)	(1)
Total—do	20,408	21,492	22,769	United Kingdom 15,501; United States 4,304.	57,369,314
Tungsten content of ore and concentrate, 60 percent WO_3 equivalent.	2,816	2,539	2,281	United States 2,198	1,162,321
Zinc content of concentrate	5,332	3,648	4,648	United States 3,999; Japan 509.	1,189,131
Total value, metals					80,445,307
Nonmetals:					
Asbestos	52	52	9	Italy 5; Chile 2; Argentina 2	105
Mica		7			
Sulfur	4,975	7,363	9,950	All to Chile	124,572
Total value, nonmetals					124,677
Mineral fuels:					
Pe- thousand 42-gallon barrels troleum, crude.	743	506	747	All to Argentina	2,255,940
Petroleum refinery products:					
Gasoline, motor—do	64	8	(1)	(1)	(1)
Fuel oils—do	6	(1)	(1)	(1)	(1)
Total:					
Value of metal and mineral exports					82,825,924
Value of all exports, c.i.f.					86,400,000
Metals and minerals share percent in total exports.					96.0

[1] Data not reported.

TABLE 3.—Imports of metals and minerals in 1961

(Metric tons)

Commodity	Quantity	Principal sources	Value, c.i.f. (U.S. dollars)
Metals:			
Aluminum:			
Bars, sheets, tubes, wire	166	Belgium 50; England 47; Switzerland 37.	151,318
Powder	1	All from United States	1,373
Copper:			
Bars, rods, ingots	56	Italy 47; West Germany 4	65,793
Slabs and sheets	5	West Germany 2; Belgium 2	4,830
Pipe and tubing	11	West Germany 6; Italy 3	17,409
Wire, cable, screen	10	Belgium 3; Chile 3; West Germany 3	10,200
Iron ore, pyrite sinter	31	Japan 21; Belgium 10	7,306
Iron oxide pigments	2	West Germany 1; United States 1	768
Iron and steel mill products:			
Pig iron	67	France 60; United States 4	16,065
Bars, beams, plates, strip, sheet	7,694	Belgium 2,976; West Germany 2,353; United States 1,055; Japan 1,053.	1,364,152
Galvanized sheet, strip and wire	2,107	Belgium 994; Japan 804	468,029
Tinplate	300	United States 287; England 13	74,213
Pipe	6,625	United States 3,047; Japan 1,326; West Germany 1,186.	2,212,241
Wire and cable	1,113	West Germany 393; Belgium 318; United States 162.	329,776
Rails and ties	767	Netherlands 441; West Germany 154; England 104.	139,924
Lead pipe	38	All from United States	14,161
Nickel alloys	2	Japan 1; West Germany 1	5,806
Tin alloys, babbitt—long tons	1	All from England	1,737
Zinc sheet, strip, powder, flakes	79	Japan 42; West Germany 20; France 10.	18,889
Nonferrous metals [1]	4	United States 3; Japan 1	9,577
Total value, metals			4,913,567
Nonmetals:			
Abrasives, natural	6	England 2; Norway 2; United States 1	5,181
Asbestos	3	West Germany 1; United States 1	2,884
Barium minerals:			
Barite	50	All from Argentina	1,918
Witherite, barium carbonate	243	United States 164; France 45; West Germany 34.	72,303
Cement:			
Portland	1,074	Brazil 477; United States 345; Argentina 126.	60,790
White	98	United States 35; Denmark 21; West Germany 21.	7,557
Chalk	5	All from West Germany	215
Clays, kaolin, bentonite	1,785	Argentina 1,630; United States 155	72,644
Diatomaceous earth	6	All from West Germany	2,037
Gypsum, anhydrite	46	All from United States	2,996
Lime	200	All from Argentina	8,535
Mineral fertilizers:			
Nitrogenous	11	West Germany 10	2,518
Phosphates	127	United States 114; West Germany 13	13,383
Potassic	40	Netherlands 25; Italy 15	3,921
Refractory brick	485	Peru 254; United States 200; Australia 31.	57,805
Salt:			
Crude	155	Brazil 152; United States 2	9,809
Refined	10	Brazil 9; England 1	824
Sands, silica, and other	199	United States 171; Peru 20	32,005
Stone, ornamental marble, slates	11	United States 5; England 2; West Germany 2.	10,019
Sulfur, all forms	58	Chile 56; West Germany 2	5,233
Other mineral materials [1]	1,347	Argentina 1,142; United States 167	66,344
Total value, nonmetals			438,921

See footnote at end of table.

TABLE 3.—Imports of metals and minerals in 1961—Continued

(Metric tons)

Commodity	Quantity	Principal sources	Value, c.i.f. (U.S. dollars)
Mineral fuels:			
Solid fuels	1,820	Peru 956; Chile 751; West Germany 88	53,535
Petroleum, crude and partially refined	340	United States 275; Brazil 33; Argentina 25.	56,399
Petroleum refinery products:			
Aviation gasoline	9,428	Chile 8,855; Peru 295; Venezuela 189	878,627
Motor gasoline	33	All from Brazil	4,807
Kerosine	93	Brazil 91; United States 2	11,078
Diesel oil	470	Argentina 393; United States 59	43,177
Fuel oil	14,185	Colombia 5,653; Venezuela 4,566; Chile 3,781.	377,222
Lubricants, including greases	966	United States 880; Argentina 49	249,368
Paraffin	1,671	United States 1,670	267,647
Other	586	United States 551; Peru 20; Spain 10	35,042
Total value, mineral fuels			1,976,902
Total:			
Value of metal and mineral imports			7,329,390
Value of all imports, c.i.f.			77,686,352
Metals and minerals share in percent total imports.			9.4

[1] Not elsewhere specified.

COMMODITY REVIEW

METALS

Antimony.—Antimony is produced and exported as handpicked lumpy ore and gravity concentrates. A small quantity of concentrates also is produced by flotation. The largest operator is the Empresa Minera Unificada, S.A. (EMUSA), which regularly produces between 42 and 47 percent of the total production. In 1962, EMUSA produced 2,836 metric tons of antimony in concentrates. In August 1962 COMIBOL initiated treatment of frankeite, a lead-antimony-tin-silver sulfide in a new 100-ton-per-day flotation mill at the San José mine in Oruro. Production was on a reduced scale until September of 1963, when the plant began operation at full capacity. The frankeite mill produced all COMIBOL antimony output in 1963—amounting to 107 metric tons obtained from ore averaging 250 grams per ton of silver, 2.9 percent lead, 0.8 percent antimony, and 0.5 percent tin. Complex concentrate containing 4,500 grams per ton of silver, 47 percent lead, 16 percent antimony, and 3.4 percent tin is exported to Europe. In 1963 a survey of Bolivian antimony resources was conducted under the sponsorship of the U.S. Agency for International Development. The survey reported an estimated antimony reserve of 1,530,213 tons of ore, having a metal content of 134,097 tons of antimony metal and an average grade of 8.78 percent antimony. This tonnage is distributed between dumps and mine ore in the following proportion: Mine ore 925,150 tons, containing 10.98 percent antimony, and dump ore 605,063 tons containing 5.38 percent antimony. The mine reserves are inferred and only the dump ores are measured reserves.

Bismuth.—The Tasna mine of COMIBOL was the principal producer of bismuth, accounting for 238 tons or 93 percent of the domestic production in 1963.

Copper.—The Corocoro mine of COMIBOL was the largest copper producer, and production was mainly as metallic copper. In 1963, Corocoro mine produced 1,360 tons. The only other production of copper by COMIBOL was recorded at the Tasna mine, where 104 tons of copper was separated from bismuth by flotation methods. The Japanese firm, Nitto Mining Co., was the second largest producer of copper, having a 1963 output of 1,105 metric tons from the Chacarilla mine.

Gold.—Gold production recorded an appreciable increase from 35,034 ounces in 1962 to 153,019 ounces in 1963. The increase was principally in output of the gold cooperatives on the Tipuani River, from 1,536 kilograms to 2,494 kilograms. A decrease in production of the South American Placers, Inc., from 1,077 kilograms to 997 kilograms was due to breakdowns of its dredge. At the end of the year the Tidewater Oil Co. was negotiating with the Bolivian Government for placer ground formerly held by the Bolinca Co.

Lead.—The largest individual lead producer was the Animas mine of COMIBOL, accounting for approximately 25 percent of total Bolivian production. In 1963 it produced 4,788 metric tons. The Tatasi mine produced 1,650 tons; the San José mine, 1,258. Breakdown of production by individual small and medium mines is not known.

Mercury.—Mercury is recovered sporadically from old patio-process areas. Production for 1963 was probably an accumulated total for several years.

Silver.—Silver, the second most valuable mineral export, is produced in association with lead, zinc, and tin. The Animas mine of COMIBOL was the primary source of Bolivian silver in 1963 producing concentrates containing 86.9 metric tons of silver. The San José mine and the Tatasi mine also produced important amounts during 1963, 17.9 and 10.6 metric tons, respectively.

Tin.—The 1963 COMIBOL tin production of 15,150 long tons was only slightly higher than the 15,020 long tons produced in 1962. COMIBOL exports, however, increased from 14,721 long tons in 1962 to 15,693 long tons in 1963. It is noteworthy that about 67 percent of COMIBOL 1963 production was mined and milled through COMIBOL facilities; the remainder was mined by cooperative groups and contractors who work in or near COMIBOL mines and sell their production to COMIBOL. Tin exports by the private sector increased about 2.5 percent, including an 18 percent increase in exports from medium miners and a 5 percent decline by small miners.

TABLE 4.—Exports of tin by groups

(Long tons of contained tin)

Group	1956–60 (average)	1961	1962	1963
Corporation Minera de Bolivia	17,726	12,622	13,218	13,934
Medium mines	[1] 4,639	2,475	2,731	3,239
Banco Minero, small mines		3,297	3,521	3,133
Smelter, tin metal and solder	752	2,015	2,022	2,463
Total	23,117	20,409	21,492	22,769

[1] Exports of small mines included.

The average mining and realization cost for COMIBOL, excluding export taxes, decreased from $1.37 in 1962 to $1.34 in 1963. The comparison of the 1963 monthly averages for the five major COMIBOL mines and COMIBOL as an entity is shown in table 5. The same cost in private mining amounted to $1.01 per pound of tin in 1963. The high-production costs in the nationalized mines have been attributed to ineffective management and to low labor productivity stemming from a lack of discipline and excess personnel.

The Fundicion de Estaño Oruro (Bolivia), S.A., more commonly known as the Peró smelter, added three Schmitz and Apelt remote-controlled rotary furnaces during the year. The smelter theoretical capacity was raised to 5,000 tons of tin per year, based on consumption of concentrates containing a minimum of 50 percent tin. The feed to the smelter is primarily concentrates from the Colquiri mine of COMIBOL.

TABLE 5.—1963 monthly average tin production data for major COMIBOL mines

Mines	Ore grade, percent tin	Production, long tons fine tin	Cost per pound [1]		Mill recovery, percent	Percentage of COMIBOL output
			Mining	Total		
Catavi	0.55	291	1.46	1.62	49.6	23
Huanuni	.89	217	1.02	1.18	62.9	17
Colquiri	.83	180	1.31	1.54	50.5	14
Unificada	1.29	130	.87	1.27	51.0	10
Caracoles	1.74	84	.69	.87	74.5	7
COMIBOL average	.76	1,283	1.02	1.34	51.5	100

[1] Mining costs include mining, milling, and depreciation. Total costs include mining, milling, depreciation, transportation, handling, insurance, and smelting. Export taxes are not included. These ranged in 1963 from 5 to 18 cents per pound of tin.

Tungsten.—Tungsten producers continued to be plagued by decreased demand and low prices during 1963. Output declined to the lowest point in the last decade.

Zinc.—Production by the small and medium mines, responding to favorable increases in the market price of zinc during the year, was 866 tons, an increase of 367 percent over their 1962 production. The production of COMIBOL, however, declined slightly from 3,398 to 3,363 tons. The Overseas Mineral Resources Development Co., a Japanese firm, announced at the end of the year that it hoped to sign an agreement with the Bolivian Government for the joint development of the Matilde zinc mine. If agreement is reached a new firm for development of the mine would be established by the Japanese firm and COMIBOL.

NONMETALS

Cement.—About 98 percent of Bolivian requirements for cement was supplied by a plant at Viacha, privately owned by the Sociedad Boliviana de Cemento, and a plant at Sucre, owned by the Government and operated by the Corporacion Boliviana de Fomento. The Viacha plant was established in 1926 and the Sucre plant (whose principal customer is COMIBOL) in 1961. Production has been divided as follows:

	Quantity, metric tons	
	1962	1963
Viacha plant	27,320	31,754
Sucre plant	22,109	24,490
Total	49,429	56,244

Sulfur.—Export of 9,950 tons of sulfur marked a new high for this mineral element. The previous peak of 9,246 metric tons was reached in 1951. Sulfur was mined from volcanic deposits near the town of San Pablo de Napa, Department of Potosi, and was exported to Chile.

MINERAL FUELS

Natural Gas.—Production of natural gas was reported at 5,110 million cubic feet in 1962 and 5,948 million cubic feet in 1963, with nothing to indicate whether these figures represented gross or commercial production.

Petroleum.—Yacimientos Petrolifera Fiscales Bolivianos (YPFB), a Government entity, was created in December 1936 to undertake the exploration and possible development of vast areas of eastern Bolivia, considered to have oil bearing possibilities. The only actual petroleum assets then existent were the proven Camiri, Sanandita, and Bermejo fields and two small refineries that were acquired for YPFB by Government seizure from the Standard Oil Co. of Bolivia in March 1937, the first of such seizures in Latin America. Between that time and the end of 1963, YPFB expanded the development of these fields and of later discovered productive structures in the Guairuy, Toro, Camantindi, and Los Monos fields. Production expanded, but earnings were insufficient to finance an adequate exploration and exploitation program, and by the mid-50's the door had again been opened to exploration and development by private companies. The Bolivian Gulf Oil Co., which began operating in Bolivia in 1956, loaned YPFB US$5 million in 1957 to build a branch extension of its Cochabamba-La Paz pipeline from Sicasica to Arica, Chile, to facilitate petroleum exports from the Pacific port. Crude production reached a peak of 3,575,000 barrels in the same year, and the pipeline has received no appreciable use. Current production is maintained by using various techniques to increase recovery from wells that are approaching exhaustion, including gas injection, gas lift, and hydraulic fracture. By these methods, production by YPFB is expected to meet the anticipated 5-percent yearly increase in domestic demand for gasoline through 1967, after which production will drop sharply unless new fields are discovered. Of the many interests that have invested millions of dollars in exploration, six private companies and company partnerships still held concessions at the end of 1963; others were relinquished in that year. Only two had found commercially exploitable oil and remained active.

The Bolivian Oil Co. was the first and larger producer, but its reserves in the Madrajones field adjoining the Argentine border appear to be approaching exhaustion. The gas-to-oil ratio has been relatively high, and in October 1962 the company began piping gas to Argentina. These exports amounted to 319 million cubic feet in the last quarter of 1962 and 1,957 million cubic feet in 1963. All of the

crude petroleum produced in 1962 was sold to YPFB. In 1963 YPFB purchased 64 percent (83,462 barrels) of the Madrajones production, and the remaining 36 percent (46,082 barrels) was exported to Argentina.

The Bolivian Gulf Oil Co., with little production so far, has had the best success in exploration and holds the brightest potential for the future, with 46 shut-in wells capable of producing oil or gas but awaiting pipeline outlets for disposal of both products. Delineation and evaluation of its three fields continued, following the discovery of oil at Caranda (1960), oil and gas-condensate at Colpa (1961), and gas-condensate at Rio Grande (1962). Small quantities of oil have been sold to the YPFB topping plant at Santa Cruz. Developed reserves of both oil and gas are said to be very large. The company has been negotiating with the Government relative to construction of a pipeline from the Caranda field to join the State-owned pipeline from Sicasica to Arica.

On June 6, 1962, a Presidential supreme decree transferred all potentially attractive petroleum areas not then under concession (including 1960 concession areas subsequently renounced by private industry) to the fiscal reserve.

TABLE 6.—Crude petroleum production distributed by company and field

(42-gallon barrels)

Company and field	1959	1960	1961	1962	1963
Yacimientos Petrolifera Fiscales Bolivianos:					
Camiri-Guairuy	2,657,345	2,640,823	2,249,464	2,043,209	2,678,531
Bermejo-Toro	481,409	449,566	438,955	498,954	401,741
Sanandita-Camatindi	31,374	20,056	17,906	44,320	74,419
Los Monos				16,271	401
Total	3,170,128	3,110,445	2,706,325	2,602,754	3,155,092
Bolivian Oil Co.: Madrajones		463,678	282,442	188,408	129,505
Bolivian Gulf Oil Co.: Caranda				125,938	[1] 116,318
Total	3,170,128	3,574,123	2,988,767	2,917,100	3,400,915

[1] Production through May, wells capped during last 7 months.

All the unexported crude was treated in the YPFB seven petroleum-processing facilities. Pipelines delivered crude from the producing fields to their installations, and distributed finished products for domestic use to Tarija, Santa Cruz, Potosi, Oruro, and La Paz and for export to Argentina. Total domestic consumption was 2,702,229 barrels of crude and 2,409,522 barrels of refinery products in 1962 and 2,695,164 barrels of crude and 2,513,970 barrels of refinery products in 1963.

TABLE 7.—Petroleum refining facilities in 1963

Location	Year constructed	1963 capacities, barrels per day	1963 throughput, barrels
Camiri	1931	1,450	418,335
Sanandita	1931	410	90,535
Cochabamba	1950	5,850	1,845,404
Sucre	1949	3,530	257,420
Sucre, auxilliary	1951	1,100	
Bermejo	1954	300	34,815
Santa Cruz, topping plant		200	19,423
Other small topping plants	(1)	(1)	13,347
Total		(2) 12,840	2,679,279

[1] Data not available.
[2] Total of listed figures.

The Mineral Industry of Brazil

By Garn A. Rynearson [1]

BRAZIL makes significant contributions regularly to the world supply of several mineral commodities. In 1963, Brazil ranked first in world production of quartz crystal and beryl; second in sheet mica; third in manganese ore, monazite, and columbium and tantalum concentrates (including pyrochlore); fourth in zirconium minerals; and about tenth among listed world producers of iron ore, lithium minerals, tungsten mineral concentrates, and feldspar. All of these items except feldspar were produced in excess of domestic needs and exported in crude or processed forms to help fulfill the requirements of other industrial countries. Output of quartz crystal, beryl, sheet mica, and manganese ores each represented more than 5 percent of the world totals. In addition, Brazil produced a large share of the world supply of several semiprecious gemstones.

The total value of mineral products mined in Brazil is estimated at approximately 61.7 billion cruzeiros for 1961 and 83.1 billion for 1962, representing about 1.75 and 1.5 percent of the gross domestic product for those years. These estimates include the manufacture of cement and lime (about 45 percent of the total) and crude oil production (about 25 percent) but exclude sand, gravel, and common clay because quantity and value of their output are unavailable. Refining of petroleum and reduction of metallic ores and concentrates to metals, except gold and silver, also are excluded. Crude oil output was assigned a value based on average export value during the year. Value added by reduction of ore to primary metal form and by the export of mineral commodities (f.o.b. value) amounted to approximately 36.6 billion cruzeiros in 1961. Basic data available for 1962 are incomplete, but value added by production of metal and export of minerals for that year was roughly 49 billion, if the ratio of increase was about the same as in 1961. Petroleum refining is not included in these estimates as available data are not strictly comparable with data on other products. In terms of U.S. dollars, estimated total cruzeiro value for the entire industry as qualified above equates roughly to 686 million for 1961 and 618 million for 1962.

Mineral raw materials are of prime importance to the country, as its economy has shifted rapidly from a predominantly agricultural base to one in which the industrial sector now contributes a share of the national income almost equal to that of agriculture. With a territorial area ranking it as the fifth largest country in the world, Brazil is favored with a huge but underdeveloped potential of mineral resources and, as the eighth most populous nation, its represents a large

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consumer market that is growing faster than the capacity to develop the resources. Brazil is deficient in known resources of some basic mineral raw materials, notably sulfur, potash, copper, silver, coking coal, and petroleum, which must now be imported in relatively large quantities to nurture industry and to sustain its expansion. Domestic production essentially satisfies current demand for salt, construction materials, most ceramic and refractory materials, and a few other industrial minerals, but the country still lacks adequate capacity to process sufficient quantities of domestic minerals to meet all its requirements of most ferrous and nonferrous metals, of mineral fertilizers, and of many mineral-based chemicals.

The mineral industry remained remarkably stable in 1963 despite political, economic, and social problems that beset the country during most of the year, but in general, it failed to attain predicted levels of productivity. An unchecked inflationary spiral caused the exchange rate of the free market cruzeiro to fall from Cr$795=US$1.00 in January to Cr$1,230=US$1.00 at yearend and the cost of living soared 80.6 percent. Under these circumstances, labor and distribution costs continued to rise and many domestic mineral producers found it difficult to compete with importers of foreign products. Some probably continued to operate only by virtue of the protection offered by government subsidies and strict import controls. Furthermore, a combination of leftist and nationalistic trends helped to create a climate that not only made new foreign investment unattractive but discouraged investment of private Brazilian risk capital as well, thus retarding much-needed expansion of the minerals and other industries.

SOURCE MATERIAL

Statistical data pertaining to the metal and mineral industries of Brazil are by no means complete or accurate for many commodities and simply are not available for others. Trade data compiled by the Serviço de Estatística Econômica e Financeira of the Ministry of Finance and data on the petroleum industry, compiled by the Conselho Nacional de Petróleo, are considered unusually reliable; but the latter are incomplete in that value of output is not included.

The Serviço de Estatística da Producão of the Ministry of Agriculture and the Conselho Nacional de Estatística (IBGE) collect official data on the production and consumption of ores, minerals, and metals. Theoretically, the system used should provide excellent statistical coverage, but some producers do not report, and some do not report completely the information required. Furthermore, production data compiled and reported by these agencies are intended primarily to record mine extraction of crude ores and reduction of major metals. They do not include the amounts of marketable mineral products that have been beneficiated by other than rudimentary methods such as hand sorting. For example, apatite ore and asbestos-bearing rocks are reported, but apatite concentrate and asbestos fiber are not, and in such cases, it is reasonably certain that data on ores and concentrates reported for different mines have been added together indiscriminately or unintentionally to obtain erroneous totals. Excluded also are data on metal content or other measurement of the

grade of ores. Some official data, therefore, are not representative of output as normally recognized in trade circles and merely present unknown portions of unknown totals without so indicating.

In compiling the table on production, an attempt was made to evaluate source data on each commodity shown. In most cases the official sources were judged more nearly complete and more consistent than unofficial sources. In a few cases other sources were used, such as the special studies made by the Banco Nacional do Desenvolvimento Econômico (BNDE) on lead and fertilizer materials and surveys made by the American Embassy and trade organizations. Production data on some commodities produced primarily for export are incomplete and less representative than export figures. Informed estimates based on various sources have been made to indicate order of magnitude of production for some commodities, but information available for others known to be produced is too meager or too unreliable to provide a basis for a meaningful estimate.

Inasmuch as official production data for 1963 were not available in time to be included in the table, figures shown for the year of review were drawn from other sources and are subject to revision.

PRODUCTION

Production of most major metals and mineral commodities, with the important exception of phosphate rock, was somewhat greater in 1963 than in 1962. However, the internal demand for crude oil, some refinery products, coking coal, fertilizer materials, sulfur, copper, zinc, and a few lesser commodities increased at a greater rate than domestic production, and larger quantities of these materials had to be imported.

TABLE 1.—Production of metals and minerals [1]
(Metric tons, unless otherwise specified)

Commodity [2]	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite	96,998	120,763	111,394	190,708	[3] 128,000
Alumina	28,670	31,342	36,139	38,792	(4)
Refined metal, unwrought	18,098	18,175	20,029	20,141	[3] [5] 25,000
Semimanufactures	4,487	6,638	7,170	(4)	(4)
Arsenic, white	333	211	58	149	282
Beryl, exports	2,655	3,472	3,178	3,011	1,968
Bismuth, exports—kilograms		2,000	1,000		
Chromite	6,224	5,666	15,456	24,839	[6] 17,053
Columbium and tantalum:					
Pyrochlore concentrate			1,600		25
Columbite—tantalite concentrates:					
Columbite [7]—kilograms	18,000	20,000	14,000	14,000	[3] 19,399
Tantalite [7]—do	111,000	193,000	94,000	125,000	[3] 104,781
Total—do	129,000	213,000	108,000	139,000	124,180
Copper:					
Ore:					
Gross tonnage, unknown grade	71,818	70,241	68,773	65,802	(4)
Copper content [3]	1,100	1,100	1,700	1,600	1,500
Refined	1,800	1,212	1,659	1,800	[3] 1,800

See footnotes at end of table.

TABLE 1.—Production of metals and minerals [1]—Continued

(Metric tons, unless otherwise specified)

Commodity [2]	1959	1960	1961	1962	1963
Metals—Continued					
Gold bullion [9]—troy ounces	112,335	118,894	118,636	127,092	(4)
Iron and steel:					
Iron ore—thousand tons	8,908	9,345	10,220	10,778	[3] 12,000
Pig iron—do	1,560	1,750	1,826	1,832	2,375
Cast iron	125,232	139,620	151,220	125,824	[3] 232,000
Ferroalloys	28,200	33,548	34,162	39,576	[3] 45,000
Ingot steel—thousand tons	1,866	2,279	2,485	[3] 2,579	2,812
Cast steel	13,608	16,846	15,235	[3] 20,000	[3] 21,000
Rolled steel [3]—thousand tons	1,546	1,648	1,888	2,043	2,145
Lead:					
Ore:					
Gross tonnage	99,100	140,903	173,422	204,193	(4)
Lead content [3]	6,100	11,100	13,900	15,900	15,600
Metal, primary, smelter	5,526	9,976	12,527	14,295	[3] 14,000
Manganese ore	1,032,966	999,163	1,016,353	1,170,688	[3] 1,200,000
Nickel:					
Ore, garnierite	5,292	5,005	4,431	15,852	(4)
Nickel content of ferronickel	73	95	100	105	[3] [5] 1,000
Rare-earths and their derivatives:					
Monazite	1,109	1,046	840	3,500	[10] 1,700
Unspecified metal, exports, kilograms		1,250	2,000		
Rare earth compounds, exports [11]	1,126	2,409	6,160	1,063	865
Silver bullion—troy ounces	225,152	252,930	231,936	219,558	[3] 220,000
Tin:					
Concentrates:					
Cassiterite concentrates	621	2,635	985	1,239	[3] 1,700
Tin content [3]—long tons	367	1,556	582	732	1,000
Metal, smelter—do	1,227	1,311	1,525	2,317	[3] [5] 2,500
Titanium ore, rutile	210	216	[5] 383	[5] 352	(4)
Tungsten:					
Scheelite concentrates:					
Gross weight	1,740	1,412	1,029	1,034	[3] 1,000
60-percent WO_3 equivalent [3]	2,088	1,694	1,235	1,241	1,200
Zirconium:					
Zircon	154	130	459	648	970
Baddeleyite-caldasite [12]	9,685	5,638	6,613	2,320	(4)
Nonmetals:					
Agate, rough, exports—kilograms	162,087	259,996	240,244	276,187	219,006
Asbestos minerals [13]	3,400	3,500	3,100	4,400	[6] 1,306
Barite	50,811	40,337	62,445	54,650	[6] 54,076
Cement:					
Portland, common—thousand tons	3,810	4,443	4,680	4,938	5,154
Portland, high resistance—do	9	6	1		
Portland, white—do	22	26	30	32	30
Corundum and emery, exports	4	4	4	7	1
Diamonds:					
Gem [3]—carats	180,000	175,000	175,000	175,000	175,000
Industrial [3]—do	170,000	175,000	175,000	175,000	175,000
Diatomite [3]	2,600	2,800	3,000	3,200	3,200
Dolomite	155,359	226,146	313,053	418,978	(4)
Feldspar [3]	35,000	40,000	40,000	40,000	40,000
Fluorspar [14]	(4)	1,032	365	(4)	(4)
Gemstones, exports [15]—kilograms	178,238	250,346	243,007	397,389	417,799
Graphite	1,210	1,300	1,451	1,510	[3] 1,500
Gypsum	183,028	103,101	156,035	108,079	(4)
Lime	1,110,739	1,069,299	1,279,576	1,186,211	(4)
Lithium ores and compounds:					
Amblygonite, exports	535	50			
Spodumene, exports	425			150	25
Lithium carbonate, exports	44	126	71	19	
Magnesite	48,424	63,315	76,702	93,756	(4)
Marble, dimension stone	56,093	49,533	48,911	59,393	(4)
Mica, muscovite	1,158	2,014	4,128	1,762	[3] 1,252
Mineral water—thousand liters	98,944	98,293	108,685	98,870	(4)
Nitrogen fertilizers, manufactured:					
Ammonium calcium nitrate	48,530	69,564	59,638	57,045	56,266
Ammonium sulfate	5,050	7,371	6,802	8,282	9,570
Phosphate fertilizers, natural:					
Ores, as reported:					
Apatite	132,946	203,184	243,908	310,117	(4)
Phosphate rock	873,433	676,447	415,513	255,440	(4)
Total	1,006,379	879,631	659,421	565,557	
Marketable concentrates [16]	212,991	241,743	225,309	192,442	146,754

See footnotes at end of table.

TABLE 1.—Production of metals and minerals [1]—Continued

(Metric tons, unless otherwise specified)

Commodity [2]	1959	1960	1961	1962	1963
Nonmetals—Continued					
Quartz crystal, exports	816	1,392	2,105	1,587	1,246
Salt—thousand tons	854	923	889	1,240	1,259
Sulfur, elemental			2,605	4,561	5,750
Talc, soapstone, pyrophyllite	21,200	19,918	23,776	38,300	[4]
Mineral fuels:					
Coal, mine-run [17]—thousand tons	2,330	2,330	2,390	2,508	[3] 2,655
Coal derivatives:					
Coke, high temperature—do	521	704	699	720	[5] 858
Coke, gas-house—do	[3] 225	[3] 250	285	[3] 285	[3] 285
Manufactured gas—million cubic feet	[4]	[4]	13,106	[4]	[4]
Coal tar products	87	83	[4]	[4]	[4]
Natural gas—million cubic feet	15,952	19,962	19,660	19,082	18,801
Petroleum, crude—thousand 42-gallon barrels	23,590	29,613	34,807	33,401	35,710
Crude petroleum processed—do	54,369	65,483	79,980	103,888	111,298
Petroleum refinery products:					
Gasoline—do	19,172	21,372	23,688	30,782	32,799
Kerosine—do	2,312	4,031	3,945	4,364	4,053
Distillate fuel oil—do	7,286	9,910	15,071	19,625	23,573
Fuel oil—do	20,534	23,575	28,896	38,762	41,094
Lubricants—do	15	24	13	19	52
Asphalt—do	1,113	1,254	1,271	1,428	1,596
Solvents—do	748	723	817	803	748
Liquefied gases—do	2,648	3,007	3,161	3,421	4,113
Other—do	490	612	563	697	692
Total refinery products—do	54,318	64,508	77,425	99,901	108,720
Carbon black	11,500	16,000	16,995	19,700	[4]

[1] Includes export data on some commodities for which production data are not available and on commodities for which export data are more representative than incomplete data on production.
[2] In addition to commodities tabulated, Brazil produces bentonite, china and refractory clays, glass sand, ilmenite, kyanite, limestone, pyrite, ocher, thorium oxide and nitrate, tungsten metal, uranium oxide, and vermiculite, as well as clay, sand, gravel, and stone for construction purposes, but data on quantities are not available.
[3] Estimate.
[4] Data not available.
[5] Revised figure supersedes that given in commodity chapter, volume I.
[6] Preliminary figure for State of Bahia only.
[7] Production of columbite and tantalite are not separately reported; total production allocated on basis of export ratio.
[8] Exports.
[9] Reported production for Minas Gerais and Paraná. Perhaps as much as 20 percent of total gold recovered in Brazil is not reported statistically.
[10] Excludes production by Comissão Nacional de Energia Nuclear (CNEN).
[11] Represents roughly equivalent quantities of Brazilian monazite, export of which is prohibited.
[12] Most of production shown is presumed to be held as stocks as exports are restricted.
[13] Includes anthophyllite, chrysotile, and tremolite fiber. Data shown are estimates, as ore rather than fiber is reported as production for some mines.
[14] Data for one mine only. Total annual production probably is less than 1,500 tons.
[15] Includes rough and cut (but unset) stones except diamonds and rough agate.
[16] Production of marketable apatite and phosphate rock is not reported separately; however, relative quantities produced are indicated by concentrates sold under Government subsidy, as follows: Apatite: 1959—45,297 tons, 1960—68,674 tons, 1961—95,002 tons, 1962—100,264 tons. Phosphate rock: 1959—170,566 tons, 1960—171,063 tons, 1961—116,753 tons, 1962—83,980 tons.
[17] Total merchantable coal averages approximately 60 percent of total mine-run product.

TRADE

Foreign trade in metal and mineral commodities is an important aspect of the Brazilian economy, accounting for 27.8 percent of all imports and 9.4 percent of all exports in 1962. A rapid rate of industrial expansion in recent years has been sustained by importation of large quantities of fuels and lubricants, metals, machinery, and other manufactured items without a commensurate increase in production of exportable goods. As a result, the balance of trade has been unfavorable each year since 1956. Were it not for dependence on for-

eign sources for petroleum and some of its derivatives, the trade deficit in the other items would be more than offset by the favorable balances in agricultural products and in ores and minerals. Another facet of the trade deficit is the insignificant market that exists for Brazilian goods in Venezuela, Saudi Arabia, and Kuwait, the principal sources of petroleum imports.

Iron and manganese ores are by far the principal nonagricultural commodities exported, and their sales abroad constitute an important source of foreign exchange. Paradoxically, oil-deficient Brazil presently cannot utilize all the high-paraffin crude it produces, and the surplus is exported. Exports of other ores and minerals are relatively minor compared to the three major commodities, but include such scarce materials as beryl, columbium-tantalum ores, mica, and quartz crystal.

Iron ore exports increased 7.4 percent to 8,217,155 tons in 1963, but the income derived increased only about 1.2 percent because average value of the ore sold was somewhat lower than in 1962. Brazil hopes to sell about 15 million tons of iron ores abroad in 1965 and to double this target by 1970. Manganese ore exports amounted to 840,709 tons in 1963, making a notable recovery from the 1962 slump but still below the record attained in 1961.

Metal and mineral imports during 1963 increased over 1962 levels for all major commodities, including fuels, lubricants, steel semimanufactures, aluminum, copper, and fertilizer materials.

The United States is the principal trading partner of Brazil. Exports to the United States represented 42.7 percent of the total value of goods exported during the period 1958–62 and included about half of the mineral sales. Imports from the United States during the same period accounted for 33.1 percent of the total value of goods imported and included a little less than 20 percent of all metal and mineral purchases. In comparison, western European countries as a group received 36.4 percent of exports and supplied 32.6 percent of imports, with West Germany leading in both categories.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal destinations	Value (U.S. dollars)
Metals:				
Aluminum:				
Bauxite	1,700	2,000	Uruguay 1,500; Argentian 500	68,225
Semimanufactures		28	Uruguay 20; Paraguay 8	36,757
Beryl	3,178	3,011	All to United States	1,103,040
Bismuth kilograms	1,000			
Columbite do	17,453	17,311	All to United States	64,329
Ilmenite	20			
Iron and steel:				
Iron ores thousand tons	6,282	7,650	West Germany 2,896; United States 1,241; Italy 642.	69,493,707
Scrap	82	51	Mainly to United States	4,776
Pig iron	38,469	50	All to Uruguay	2,450
Ferromanganese	50	5,016	All to United States	614,000
Ingot steel		3,880	Italy 3,500; Argentina 320; Uruguay 60.	175,700
Steel semimanufactures	8,181	1,616	Argentina 1,164; Bolivia 205; Uruguay 122.	419,414
Manganese ore	868,501	759,915	United States 718,104; France 19,136; Belgium 10,969.	27,480,801
Rare-earth metals:				
Cerium chloride	1,390	921	Austria 600; Italy 124; West Germany 100.	347,665
Cerium carbonate	(1)	112	United States 111; West Germany 1.	43,801
Unspecified compounds	4,770	31	Largely to United States	58,051
Unspecified metal. kilograms	2,000			
Tantalite do	119,985	146,423	United States 138,483; United Kingdom 5,000; Netherlands 2,940.	1,121,028
Tungsten:				
Scheelite concentrate, gross weight.[2]	875	625	Netherlands 300; France 160; United States 100.	659,522
Metal kilograms		501	Sweden 500; Uruguay 1	6,604
Zinc scrap	599	130	All to Belgium	4,683
Zirconium:				
Zirconium silicate, zircon. kilograms	3,300	3,300	All to Argentina	1,011
Zirconium ore, type not specified.	54			
Other [3]	(4)	(4)	(4)	45,688
Total value, metals				101,751,252
Nonmetals:				
Abrasives, natural [5]	4	10	Argentina 7; Bolivia 3	4,417
Agate, rough kilograms	240,244	276,187	West Germany 171,109; United States 55,055; Japan 42,000.	137,715
Asbestos		20	All to Bolivia	1,130
Barite	42,393	51,002	Trinidad 39,449; United States 11,553.	417,080
Cement, portland, common	2,202	2,257	Bolivia 1,168; Paraguay 1,089	48,982
China clay	337	100	All to Uruguay	2,300
Diamonds:				
Industrial carats	132,865	75,855	United States 75,330; Argentina 450; Canada 75.	725,834
Gem, uncut do	8,515			
Gem, cut do	395			
Gem stones: [6]				
Rough or uncut kilograms	242,799	86,872	United States 31,352; Japan 26,766; West Germany 14,039.	502,362
Cut do	208	55	Netherlands 23; United States 12; Austria 7.	53,584
Other [7] do		310,462	United States 104,741; West Germany 100,276; Japan 75,299.	207,512
Granite, dimension stone	3,220	2,326	Italy 1,023; United States 826; West Germany 134.	108,303

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961 Quantity	1962 Quantity	1962 Principal destinations	1962 Value (U.S. dollars)
Nonmetals—Continued				
Lithium:				
Spodumene		150	All to United Kingdom	8,108
Lithium carbonate	71	19	United States 11; Argentina 8	27,901
Magnesite	3,760	4,873	Hungary 3,500; Spain 500; Belgium 400.	216,514
Marble, dimension stone	3	13	All to Argentina	454
Mica, muscovite sheet	893	882	United States 734; Japan 111; West Germany 30.	878,736
Quartz crystal:				
Electronic and optical grades.	251	174	United States 132; United Kingdom 15; West Germany 9.	956,982
Lasca or fusing grade	1,854	1,413	West Germany 432; Belgium 380; United Kingdom 247.	608,795
Salt	30			
Talc, industrial	3	20	Argentina 15; Bolivia 3; Chile 2	1,575
Other [3]	(4)	(4)	(4)	7,681
Total value, nonmetals				4,915,965
Mineral fuels:				
Petroleum, thousand tons crude.	1,052	298	United States 159; Netherlands Antilles 139.	6,344,399
Petroleum products:				
Fuel oil do	75	77	Mainly to United States	1,084,607
Other	12	7	Bolivia 4; Paraguay 3	2,717
Total value, mineral fuels				7,431,723
Total:				
Value of metal and mineral exports.				114,098,940
Value of all exports, f.o.b				1,214,185,488
Metals and minerals percent share in total exports.				9.40

[1] Not reported. May be included in unspecified compounds.
[2] Estimated equivalent on a 60-percent WO_3 basis: 1961, 1050 metric tons; 1962, 750 tons.
[3] Includes material not identified by commodity in foreign trade publications and commodities not listed separately in this table.
[4] Data not available.
[5] Includes emery and pumice. Excludes industrial diamonds.
[6] Includes rough and cut (but unset) stones except diamonds and rough agate.
[7] Probably represents rejected material suitable for tumbling and mineral suites.

TABLE 3.—Imports of metals and minerals

(Metric tons, unless otherwise specified)

Commodity	1961 quantity	1962 Quantity	1962 Principal sources	1962 Value (U.S. dollars)
Metals:				
Aluminum:				
Unwrought	18,342	19,507	Canada 13,421; United States 3,400; Norway 1,776.	10,010,068
Semimanufactures	134	283	United States 149; West Germany 86; Switzerland 25.	582,071
Antimony:				
Ores	380	54	All from Bolivia	17,729
Crude metal	109	641	Mainland China 360; Peru 113; Czechoslavakia 85.	308,436
Arsenic:				
Metallic arsenic	12	3	All from Sweden	2,896
White arsenic	686	797	Sweden 381; France 304; East Germany 71.	125,072

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons, unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (U.S. dollars)
Metals—Continued				
Bismuth, crude-metal kilograms	4,781	7,393	Peru 4,747; Canada 1,498; United Kingdom 454; United States 393.	40,358
Cadmium do	38,428	34,485	Belgium 8,817; Peru 7,300; Japan 6,825; Canada 6,293.	128,102
Calcium, metallic do	1	1,000	All from Japan	552
Chromium:				
Chromite	1,747	4,215	All from Union of South Africa.	88,408
Metal, all forms kilograms	385	2,693	United States 1,431; West Germany 1,262.	8,936
Cobalt oxides	30	43	United Kingdom 30; Belgium 13.	106,258
Copper:				
Scrap	31	10	All from United States	4,594
Refined, unalloyed	36,025	42,012	Chile 13,979; Peru 8,154; United States 5,307; Rhodesia and Nyasaland 5,069; West Germany 4,278.	29,132,691
Copper alloys, unwrought	144	100	Argentina 98; United States 2	77,508
Semimanufactures, including alloys.	317	380	West Germany 190; United States 147; Netherlands 18.	657,044
Gold:				
Bullion troy ounces	183	468	All from United Kingdom	16,863
Plates and sheets do	7			
Manufactures [1] do	298	138	All from West Germany	1,055
Iron and steel:				
Scrap	123	9,726	United States 9,725; Paraguay 1.	574,084
Sponge, powder, and granules	220	508	United States 361; Sweden 117; France 21.	150,957
Ferroalloys	1,427	1,427	Japan 617; United States 197; West Germany 116.	1,183,215
Semimanufactures	241,295	180,013	United States 49,049; West Germany 37,468; Japan 35,984.	49,259,265
Lead	13,524	8,082	Peru 4,901; Mexico 2,252; Denmark 469.	1,600,961
Magnesium	93	617	United States 596; Canada 12; Denmark 6.	391,607
Magnetite, pigment grade	250	255	All from France	17,204
Mercury 76-pound flasks	2,527	1,330	Mexico 925; Chile 180; Spain 162.	241,059
Molybdenum kilograms	75	7,591	United States 3,106; Netherlands 2,778; West Germany 949.	168,316
Nickel:				
Scrap	5	22	All from United States	41,859
Refined	753	880	United States 492; Canada 349; West Germany 39.	1,657,731
Semimanufactures	195	312	United States 156; West Germany 47; France 42.	883,069
Platinum group metals:				
Platinum, unwrought troy ounces	540	7,268	Hungary 3,075; France 2,911; United States 624.	514,954
Platinum, semimanufactures do		369	West Germany 321; United States 48.	35,221
Platinum, manufactures [1] do	183	484	West Germany 470; Sweden 11; United States 3.	56,658
Other, unwrought do	901	1,125	France 836; United States 261; United Kingdom 28.	26,832
Other, semimanufactures do		239	All from United States	3,841
Other, manufactures [1] do	50			
Selenium, metallic kilograms	4,450	4,318	Canada 2,200; Sweden 840; United States 607.	55,223
Silicon, metal	320	168	Italy 87; France 77; Japan 2; West Germany 2.	59,040
Silver:				
Bullion troy ounces	1,006,625	1,075,714	Mexico 523,708; Peru 225,926; Argentina 123,811.	1,150,883
Semimanufactures do		40,342	West Germany 18,381; United States 16,461; Switzerland 5,499.	39,804
Manufactures [1] do	8			

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons, unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (U.S. dollars)
Metals—Continued				
Sodium, metallic.....kilograms..	1,220	7,084	France 7,000; West Germany 80; Italy 3.	3,989
Tantalum.....do....	----------	34	United States 31; Austria 1; Netherlands 1.	6,418
Tellurium.....do....	14	----------	----------	----------
Tin:				
Cassiterite concentrates. long tons..	2,143	1,843	Thailand 1,701; Bolivia 140; Argentina 1.	4,109,278
Refined tin.....do....	15	1	All from Netherlands.....	2,807
Powder.....do....	9	10	Largely from United States...	35,170
Tungsten.....kilograms..	6,724	6,239	West Germany 3,453; Netherlands 912; United States 832.	127,971
Zinc:				
Scrap.....	2	1	All from United Kingdom.....	2,068
Refined.....	31,533	42,234	Peru 13,698; Mexico 10,855; Belgium 3,685.	10,433,163
Semimanufactures.....	1,343	554	Belgium 303; West Germany 180; United Kingdom 56.	178,758
Other metals, not specified.....	112	84	(2).....	272,130
Total value of metals.....	----------	----------	----------	114,592,176
Nonmetals:				
Abrasives, natural [3].....	103	78	Italy 62; United States 10; United Kingdom 6.	22,194
Asbestos.....	15,509	18,686	Canada 17,381; Union of South Africa 819; United States 181.	3,917,781
Barite.....	33	28	All from United States.....	6,154
Borax, crude.....	1,094	1,100	..... do.....	157,008
Cement:				
Portland, common.....	----------	1,169	All from Uruguay.....	32,905
Magnesium.....	16	52	Austria 41; West Germany 11.	6,637
Type not specified.....	446	515	West Germany 326; France 130; United States 24.	64,727
Chalk, natural crude.....	2,976	2,313	Denmark 1,154; France 825; Sweden 285.	106,532
Clays:				
Bentonite.....	3,661	7,205	United States 5,360; Argentina 1,839; Italy 6.	484,239
China clay.....	405	198	United States 191; United Kingdom 6.	21,538
Refractory clays.....	1,365	77	United States 72; West Germany 5	16,935
Type not specified.....	1,105	358	Argentina 180; United States 144; France 33.	47,025
Cryolite:				
Natural.....	1,034	600	Denmark 596; United States 4.	155,665
Synthetic.....	576	620	All from Italy.....	138,173
Diatomite and infusorial earth....	1,747	1,121	United States 1,006; West Germany 114; United Kingdom 1.	171,374
Earth pigments.....kilograms..	6,410	3,393	France 3,000; United States 393.	1,897
Fertilizers, mineral and chemical:				
Nitrogenous materials:				
Chilean nitrates.....	57,021	44,736	All from Chile.....	2,612,069
Other compounds.....	153,468	137,806	West Germany 76,764; Belgium 22,919; United States 12,326.	6,440,153
Phosphatic materials:				
Phosphate rock, crude...	57,541	95,880	United States 76,806; Morocco 18,573; Togo 500.	1,840,384
Superphosphate.....	20,864	14,237	United States 10,196; Yugoslavia 3,186; Netherlands 854.	508,807
Triple superphosphate...	52,200	44,200	United States 36,905; Netherlands 5,317; Italy 1,024.	3,064,751

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons, unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (U.S. dollars)
Nonmetals—Continued				
Fertilizers, mineral and chemical—Continued				
Phosphatic materials—Con.				
Thomas slag	4,379	2,298	Belgium 1,488; West Germany 810.	69,650
Other phosphates	5,606	5,004	Belgium 2,925; Japan 2,079	319,807
Potash fertilizers	119,380	115,193	United States 33,263; West Germany 28,518; France 23,144.	5,857,848
Mixed and nonspecified fertilizers.	550	525	West Germany 512; United States 13.	51,962
Fluorspar	650	552	United Kingdom 551; West Germany 1.	42,533
Graphite, natural	200	192	Mainly from United States	54,963
Gypsum	23	32	West Germany 28; United Kingdom 4.	2,986
Marble, dimension stone	54	65	All from Italy	2,860
Mica—kilograms		1,018	All from United States	342
Salt, pure sodium chloride	26	38	United Kingdom 24; West Germany 12; United States 2.	7,250
Silex or flintstone, crude	699	654	Denmark 498; France 148; Belgium 8.	47,712
Sulfur:				
Crude	130,072	152,764	United States 136,320; Mexico 14,920; France 1,524.	4,123,510
Refined	175	198	United States 168; United Kingdom 28; West Germany 2.	97,912
Other, not specified or not elsewhere specified.	(2)	(2)	(2)	3,505
Total value of nonmetals				30,499,788
Mineral fuels:				
Coals and coal products:				
Anthracite—thousand metric tons	5	17	All from United States	344,651
Bituminous coals—do	853	875	United States 852; Czechoslovakia 20; Poland 2.	13,627,270
Coal briquets	196			
Coal coke	43,852	27,495	West Germany 19,344; United States 7,614; Belgium 537.	999,615
Coal tar	109	1	All from United States	115
Petroleum:				
Crude—thousand tons	7,549	9,961	Venezuela 5,101; Saudi Arabia 3,017; Kuwait 1,436.	174,195,051
Refinery products:				
Gasolines—do	809	419	Netherlands Antilles 266; Trinidad 44; Venezuela 39.	19,985,282
Kerosine—do	139	86	Netherlands Antilles 42; Argentina 25; Venezuela 19.	3,063,914
Jet fuel—do		152	Netherlands Antilles 88; Venezuela 33; Trinidad 31.	5,572,146
Gas/diesel oil—do	599	38	Rumania 23; Netherlands Antilles 10; Trinidad 3.	1,170,118
Fuel oil—do	1,290	124	Netherlands Antilles 67; France 29; Venezuela 27.	2,082,269
Lubricants—do	184	242	United States 179; Netherlands Antilles 41; Venezuela 22.	19,548,250
Liquefied petroleum gas—do	136	249	Venezuela 143; Argentina 98; France 7.	17,408,324
Paraffin and vaseline—do	15	22	United States 13; Japan 3; East Germany 2; Rumania 2.	3,472,248
Petroleum coke—do	11	8	All from United States	308,779

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons, unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (U.S. dollar)
Mineral fuels—Continued				
Petroleum—Continued				
Refinery products—Cont.				
Asphalt and asphalt mixtures.	4,560	3,534	Netherlands Antilles 2,328; Venezuela 400; Argentina 345.	195,429
Other refinery products	5,691	3,282	Netherlands Antilles 1,608; United States 1,497; Netherlands 141.	483,125
Carbon black	6,821	6,538	United States 5,650; West Germany 479; Canada 281.	1,703,953
Mineral waxes	354	664	United States 593; Union of South Africa 28; East Germany 20.	210,003
Total value of mineral fuels				264,370,542
Total:				
Value of metal and mineral imports				409,462,506
Value of all imports, c.i.f.				1,475,046,568
Metals and minerals share percent in total imports.				27.76

[1] Excludes jewelry and other ornamental items.
[2] Data not available.
[3] Includes emery, pumice, and diamond and other gem-stone dust. Excludes millstones.

The U.S. share of the Brazilian market for metals and minerals is gradually being reduced by stiffer competition from other countries and by increasing use of barter arrangements by Brazil to expand its export markets with other countries. The recently organized Latin American Free Trade Area (LAFTA) also is beginning to influence trade patterns. For example, imports of copper ingot, pig, and cake from LAFTA countries have increased markedly, mainly at the expense of U.S. exporters. The share of imports from LAFTA countries jumped from 5.3 percent in 1961 to 58.5 percent in 1962, whereas the U.S. share dropped from 53.6 percent to 12.6 percent. Also, LAFTA country shares of other crude metal imports rose from 17.4 to 88.5 percent for lead, from 10.7 to 58.8 for zinc, and from 20.9 to 81.2 for silver at the expense of both United States and European exporters. The changed trade pattern for these metals, and perhaps for other commodities as well, apparently has resulted from the more attractive cruzeiro transactions offered by importers in the LAFTA countries, who do not have to meet the compulsory prior deposit requirements or to pay the tariffs (on copper and lead) imposed on imports of non-LAFTA origin.

COMMODITY REVIEW

METALS

Aluminum.—The combined output of the two aluminum reduction plants in Brazil provides only about half of the relatively modest requirements for primary aluminum. Official figures for aluminum-ingot output shown in the production table apparently include ingot derived from both primary and secondary sources; however, an

aluminum-market study released by the National Economic Development Bank (BNDE) in 1963 indicates production from primary sources was 15,187 tons in 1959; 16,573 tons in 1960; 18,467 tons in 1961; and an estimated 21,700 tons in 1962. The difference between BNDE and official figures for 1959–61 suggests that scrap metal was the source for about 10 percent of the ingot output.

Growth in production has not lowered import tonnages, because consumption increases have averaged more than 10 percent annually. Despite the need to import crude and processed metal to balance out industrial requirements, the domestic industry continued to enjoy high-protective tariffs on aluminum—50 percent ad valorem on crude and semifabricated metal, 50 to 80 percent on fabricated products, and 100 percent on household articles. However, consumers of crude metal pay only 10 percent ad valorem on imports, providing 30 percent or more of their requirements have been obtained from domestic producers. This exemption applies also if domestic sources cannot provide the 30 percent.

Brazil has ample reserves of bauxite in the States of Minas Gerais and São Paulo but a shortage of electric power continued to inhibit expansion of existing aluminum reduction facilities and has delayed plans to construct new plants. The large Furnas and Três Marias hydroelectric projects in Minas Gerais should make more power available for aluminum reduction in the near future. Anticipating this probability, state entities proposed the erection of a new 25,000-ton plant at Santa Luzia which would utilize power supplied by the state-controlled power company, CEMIG, and bauxite from recently discovered deposits near Serro; reserve estimates for these deposits range from 10 to 100 million tons. Until this or some other new plant can be implemented, the country must rely on increased production at the two operating plants to contain the volume of aluminum imports as consumption increases.

Cia. Brasileira de Alumínio nearly completed an expansion program at its completely integrated plant near Sorocaba, São Paulo. The new facilities should be operative early in 1964, and will increase the alumina capacity of the plant from 25,000 to 45,000 tons and the ingot capacity from 11,000 to 21,000 tons. A new 35,000 kilowatt company-owned hydroelectric plant will supplement the power now being supplied by a 30,000-kilowatt plant. Bauxite for the alumina plant is shipped by rail from company deposits at Poços de Caldas, Minas Gerais. Reserves of these and other deposits in the area total more than 40 million tons.

The other primary aluminum plant in Brazil is at Saramenha, near Ouro Preto, Minas Gerais and is operated by Alumínio Minas Gerais, S.A., a subsidiary of Alumínio do Brasil, S.A., which in turn is affiliated with Aluminium, Ltd., of Canada. Ingot produced at Saramenha is shipped to São Paulo for fabrication at the plant of the parent company. Installed capacity in 1963 was for 28,000 tons of alumia and 14,000 of ingot. Alumina capacity is to be increased to 40,000 tons and ingot capacity to 20,000 tons, but the additional facilities may not be fully operative until 1966. The company generates part of its power supply at five small hydroelectric plants with a total installed capacity of 29,500 kilowatts and purchases the remainder

of about 12,000 kilowatts from CEMIG. Bauxite is mined from nearby company deposits which have reserves of about 1.4 million tons.

Columbium.—Distribuidora e Exportadora de Mineiros e Adubos, S.A., (DEMA) finally obtained approval from the Comissão Nacional de Energia Nuclear (CNEN) to export pyrochlore concentrate produced from the large deposit at Araxá, Minas Gerais. An export license was issued at midyear under an agreement whereby the radioactive equivalent of thorium contained in the concentrate would be returned to Brazil in the form of South African yellowcake, enabling DEMA to export 765 tons of concentrate (53 percent Cb_2O_5) from its 1,600-ton stockpile to the United States late in the year. The modern mining and milling facilities installed by DEMA at Araxá represent an investment of US$2 to 3 million, and the company suspended commercial production until the stockpile could be disposed of. During most of 1962 and 1963, operations were limited mainly to research and development. The company experimented with a thermite process for making thorium-free ferrocolumbium and succeeded in producing about 2.5 tons of the alloy in 1963. The stock of concentrates was rerun through the mill and a new leaching unit to reduce the amounts of contained silica and sulfur. In addition, the mill produced about 25 tons of new concentrate.

Copper.—The supply position in primary copper has been very unfavorable for Brazil, and this situation will become more acute each year as consumption increases. Less than 5 percent of the copper requirements have been derived from domestic ores, making it necessary to expend about US$30 million annually on imports of the refined metal.

Reserves of known deposits containing more than 1 percent copper are rather small, and as yet none of the known lower grade deposits have proved large enough to warrant large-scale recovery operations. The Caraíba deposit in northern Bahia has been drilled to depths of from 100 to 200 meters and is estimated to have a reserve of about 40 million tons of disseminated ore (chalcopyrite) averaging about 0.9 percent copper. Geochemical prospecting in the general area is being conducted jointly by the Departamento Nacional da Producão Mineral, AID, and the University of Bahia. An anomaly was found near Santa Rosa in 1963 that is similar to the one observed at Caraíba. A preliminary appraisal indicates the possible existence of about 30 million tons of ore, but the area will have to be drilled to determine size and grade of the ore body. Explorations are to be continued in the hope of finding enough ore in the region to permit large-scale mining and smelting operations.

Virtually all the primary copper output of the country is mined, smelted, and refined by enterprises controlled by the Pignatari interests of São Paulo. Two small sulfide deposits in Rio Grande do Sul contribute the bulk of the ore and concentrate produced. The concentrate is trucked more than 1,300 kilometers to the Pignatari smelter at Itapeva, São Paulo, where it is reduced with charcoal to black copper. This smelter also treats some oxide ore from the nearby Santa Blandina property and, in recent years, has also treated small quantities of hand-picked (11 to 14 percent copper) Caraíba ore. The smelter product is refined by Laminacão Nacional de Metais at a plant in

Utinga, São Paulo, which has both electrolytic and fire refining facilities and also produces copper and copper alloy products and metal powders.

Iron and Steel.—The iron and steel industry, largest in Latin America, continued its rapid expansion during 1963 as new facilities for producing and finishing steel became operational, and other expansion projects neared the completion stage. Actual production, however, was insufficient to satisfy the increasing demand for steel in the country, and imports of basic steel products increased markedly during the year. The Government created the Executive Commission for Importation of Steel Products (CEPLA) to supervise and regulate imports of essential steel products. Cia. Siderúrgica Nacional (CSN), the government-owned company that produces about one-third of the national steel output and sets the pace for the industry, was permitted to raise its prices by an average 40 percent. Commensurate price increases by other companies helped to avoid a financial crisis that was facing the industry in general.

Estimated output of ingot steel during 1963 was 2.812 million tons, of which CSN produced 1.268 million tons. CSN hopes to increase its ingot capacity to 1.5 million tons by 1965. The National Economic Development Bank (BNDE) estimates that national steel capacity will be about 4.68 million tons of ingots and 3.73 million tons of finished products in 1965 but predicts that demand will then exceed production by about 720,000 tons of ingots and 470,000 tons of rolled products. Imports of steel semimanufactures will have to be increased considerably in order to balance the expected shortfall.

Most major and several smaller steel companies were involved in significant expansion activities during 1963. Cia. Siderúrgica Belgo Mineira, the second largest steel producer, neared completion of a program to raise ingot capacity to 500,000 tons per year. The company also has moved its wire and tube mills from the Monlevade works to new sites near Belo Horizonte and Santa Luzia in Minas Gerais.

Usinas Siderúrgica Minas Gerais (USIMINAS), which fired its first blast furnace and initiated pig iron and ingot steel production in October 1962, inaugurated the first units of a rolling mill in June 1963. The mill is designed to produce plates up to 108 inches wide and 75-inch-hot and 61-inch-cold-rolled sheets to supply the naval construction and automobile industries. The steelmaking capacity of the company reportedly will be 600,000 tons per year when the second blast furnace and other facilities begin operation in 1964. Production in 1963 included 217,790 tons of pig iron and 73,417 tons of steel ingots. The USIMINAS plant is near Ipatinga, Minas Gerais, and represents a joint venture in which Brazilian interests, principally BNDE and the State of Minas Gerais, have a share of 60 percent, and Japanese interests have the remaining 40 percent.

Cia. Siderúrgica Mannesmann inaugurated a new blast furnace at its steel works near Belo Horizonte in March. Other new units put into operation include a coke oven, gasometer, a third electric furnace, two LD converters, and an oxygen generator. The additional facilities have increased annual ingot capacity from 146,000 to 350,000 tons.

Mannesmann specialize in seamless pipes and tubes made under patents held by its West German parent company.

Cia. Ferro e Aço de Vitoria inaugurated its new rolling mill at Vitoria, Espirito Santo, in October. The mill will produce medium and light finished structural steel at an initial rate of 130,000 tons per year from ingots supplied by USIMINAS until the plant becomes integrated. Additional facilities to permit the annual production of 380,000 tons of ingots and 310,000 tons of structural steel are scheduled for completion in 1967, and further expansion to 2,000,000 tons of ingots and 1,600,000 tons of finished products is projected for 1971–72. BNDE holds a 95 percent interest in this steelworks, and the remainder is divided among private Brazilian and West German investors.

Cia. Siderúrgica Paulista (COSIPA) formally inaugurated its new steel rolling mill at Piaçaguera, São Paulo, in December, thus surmounting at least some of the technical, financial, and administrative difficulties that have delayed the project. The mill began producing hot-rolled sheets and coils from ingots supplied by USIMINAS, and plans called for adding cold-rolled sheets to the line during 1964. Trade sources estimate probable output for 1964 at between 250,000 and 400,000 tons. When completed, the COSIPA works will be fully integrated with an annual capacity of 500,000 tons of ingots and 400,000 tons of rolled sheet products. Shares in COSIPA are distributed as follows: 58.2 percent with BNDE, 23.3 percent with the State of São Paulo, 2.7 percent with state-controlled entities, 6.7 percent with the National Treasury, and 9.1 percent with private investors.

Iron Ore.—Iron ore was the principal mineral commodity produced in Brazil and by far the most important mineral exported. Annual output has more than doubled since 1958, and exceeded 10 million tons in the last 3 years. About one-fourth of the ore produced is consumed by the domestic iron and steel industry, and the remainder is exported. The bulk of iron ore output comes from extensive hematite deposits in the Quadrilátero Ferrífero of Minas Gerais, although deposits in Paraná, Mato Grosso, Bahia, and São Paulo supply relatively small quantities that amount to only about 1 percent or less of the total. The total iron ore reserve in the country has been estimated as approximately 42 billion tons, but a large fraction of this figure represents material that has little economic significance at present because of its low grade, physical nature, or remote location. Nonetheless, the indicated and inferred reserves of deposits of high-grade hematite ores (plus 66 percent iron) in Minas Gerais alone, which total more than 3,300 million tons, are among the largest in the world and are more than ample to supply the foreseeable market for Brazilian ores.

Iron ore production is dominated by two government-controlled companies, Cia. Vale do Rio Doce, S.A. (CVRD), and Cia. Siderúrgica Nacional (CSN). CSN mines ore from its own deposits in the Congonhas District of Minas Gerais and purchases some ore from other producers to feed its steel mill at Volta Redonda, Rio de Janeiro. CVRD produces iron ore for export from five major mines it owns or leases in the Itabira District of Minas Gerais. This company also owns and operates the only railroad connecting this district with the port facilities at Vitoria, Espirito Santo. In 1962, CVRD accounted

for 52 percent of total iron ore output and 80 percent of its exports, whereas CSN produced 12 percent of the output.

CVRD is engaged in an extensive program of improving its mine, railroad, and port facilities to service its own export commitments and also to provide transport services for other companies that must export from Vitoria. The company is constructing a new ore terminal 10 kilometers from Vitoria with facilities to permit the export of about 15 million tons of ore per year. When completed in 1966, this port will accommodate ships of 100,000 deadweight-tons. The installation has been designed to car-dump cuts of 50 cars, without uncoupling, into a conveyor system that will stockpile, reclaim, and shipload ore at a rate of 6,000 tons per hour. A screening plant is included in the system to classify the ore according to size specifications of the customer. The new port will also include facilities to tranship coal destined for steel mills in the Rio Doce Valley.

As of 1963, the export commitments of CVRD included short- and long-term contracts for the delivery of approximately 100 million tons of ore to customers in 13 countries, principally Japan and West Germany. To assure fulfillment of these commitments, the company also has negotiated with S.A. Mineracão da Trinidade (a subsidiary of Cia. Belgo Mineira), Mineracão de Ferro e Carvão, and Mineracão Serro da Moeda to supply export ores from their mines under an agreement whereby these companies will be able to utilize CVRD transport facilities to export equal amounts of ore for their own account, providing the profits are reinvested in the iron and steel industry.

Construction of another new port for iron-ore export presumably was started in 1963 by Cia. Siderúrgica da Guanabara (COSIGUA) at Santa Cruz, Guanabara. This port will have a capacity of 10 million tons per year and will provide an export outlet for some of the ores produced in the western part of the Quadrilátero Ferrífero. A steel mill also is to be built at Santa Cruz by COSIGUA.

Manganese.—Manganese ore is one of the most important mineral resources in Brazil and the second largest mineral export commodity. Reserves of known deposits may total from 100 to 150 million tons; about two-thirds occur in deposits in the Urucum District of Mata Grosso and most of the remainder in deposits in the Territory of Amapá and the states of Minas Gerais and Bahia. The bulk of the ore produced in the country since 1956, as well as the bulk of exports, has come from the Serra do Navio deposits in Amapá, which are mined by Indústria e Comércio de Minério, S.A. (ICOMI), under a 50-year concession from the Territory. The ICOMI operation, in which the Bethlehem Steel Co. has a 49 percent interest, is one of the best planned and executed large mining enterprises in Brazil. In addition to the modern mining, crushing, washing, and auxiliary facilities, the company operates a 193-kilometer, standard-gauge railroad from the mine to Porto Santana, where it has docking and loading facilities for oceangoing vessels. According to a company official, 827,200 tons of washed ore (plus 48 percent manganese) was produced from 1,083,000 of crude ore in 1963, and shipments from the port totalled 816,500 tons for the year. Most, if not all, of the ore shipped was destined for the United States.

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Minas Gerais is the second largest manganese-producing state. Most of its output is sold to domestic consumers as exports have been curtailed in recent years to guarantee an adequate, low-cost supply for the local market. Data on 1963 production are not available, but output for 1961 and 1962 was 181,491 and 164,618 tons, respectively. The largest manganese producer in the state has been the United States Steel Corp. subsidiary, Cia. Meridional de Mineracão (MERIDIONAL), which operates the Morro da Mina mine near Conselheiro Lafaiete, but the large manganese deposits discovered relatively recently by Cia. Belgo Mineira near Alegria promise to figure prominently in future output.

The manganese ores mined in Mato Grosso and Bahia are destined primarily for export. Sociedade Brasileira de Mineracão, Ltda. (SOBRAMIL), owned by the Chamma brothers, is the sole producer in Mato Grosso. This firm receives financial and technical assistance from MERIDIONAL in return for credit on ore purchases for export markets previously supplied by Morro da Mina ore. Ore containing 45 to 46 percent manganese is barged down the Paraguay River to Nueva Palmyra, Uruguay, where it is transferred to oceangoing vessels and shipped to Santos or Rio de Janeiro for export. Shipments in 1963 totaled 62,658 tons, as compared with 21,825 and 23,216 tons in 1961 and 1962 when low water precluded normal barging operations. Exports by three producers in Bahia decreased from 28,735 tons in 1962 to 10,500 tons in 1963.

Nickel.—National consumption of nickel was reported as approximately 1,800 metric tons for 1962, more than double the average of the 5 previous years; however, consumption may have decreased slightly during 1963. Brazil has large reserves of garnierite ores, but it lacked adequate reduction facilities prior to 1963, and from 90 to 95 percent of the annual nickel requirements of the country were imported as metal, semimanufactures and chemicals—valued at almost US$2.71 million in 1962. Inauguration of a second ferronickel plant in the latter part of 1962 provided Brazil with the capacity to produce more than enough ferronickel to supply internal demand for nickel in that form and a part of the surplus was exported in 1963.

In 1963, Morro do Níquel, S.A., produced 937.6 metric tons of nickel in the form of ferronickel at its new plant near Passos, Minas Gerais. The company is planning to install facilities to further reduce some of its alloy output to pure metal and to nickel salts. Cia. Níquel do Brasil has announced plans to triple production of ferronickel at its plant at Liberdade, Minas Gerais, and also is considering production of nickel and nickel-chrome steels. Annual alloy output by this firm averaged 318 metric tons for the period 1958–62.

Pressures by the State of Goiás to activate mining of the large deposits of garnierite near Niquelândria appeared to gain ground in 1963 when the principal concessionaire, Cia. Níquel Toncantins, agreed to form a mining corporation in which its parent company, Grupo Votorantim, S.A., will retain a 60 percent interest, and the remaining 40 percent will be held by state-controlled Metais Goiás, S.A. (METACO). The new corporation, Nibrasa-Niqueis do Brasil, S.A., proposes eventual production of 5,000 tons of ferronickel and the possible recovery of several hundred tons of cobalt as well as some copper.

Tin.—Rich alluvial tin deposits in the Territory of Rondônia, adjacent to Bolivia, have been worked at gradually increasing rates since 1959 leading to widespread speculation on the possibility of Brazil becoming a major low cost tin producer. The occurrence of tin in the district was first reported by a geologist, Dr. Donald F. Campbell, in 1950, but the potential of the area still is obscure, and it may be several years before the known deposits can be properly evaluated. Available information, which is somewhat meager, indicates that several large areas of relatively rich placer ground have been discovered, and at least eight small-scale recovery operations were active in 1963; three of these employed partially mechanized sluicing methods. Transportation to the coast is costly, and actual production thus far has been relatively small.

The tin occurs as fine to very coarse (up to 30 centimeters in diameter) fragments and crystals of cassiterite in the alluvial material overlying basement rocks which are mainly Precambrian grantic rocks. The known deposits apparently are rather rich as ground containing less than 5 kilograms of cassiterite per cubic meter is being bypassed or discarded, and pay streaks on the bedrock reportedly yield as much as 80 kilograms per cubic meter although the average probably is only 10 to 30 kilograms. Zircon and topaz are reported to be abundant in some of the sands and may become valuable byproducts when large-scale mining methods become operative. Ilmenite and columbite-tantalite also have been reported. Insofar as is known, the primary source of the cassiterite has not been found in any of the areas, but tin-bearing cobbles in the alluvium indicate a derivation from greisen-type deposits formed by pneumatolytic mineralization of the granites or gneisses.

Elsewhere Brazilian tin is produced from widely scattered localities in Minas Gerais, Goiás, Amapá, Paraíba, and Rio Grande do Sul. The steadiest production in recent years has been from the São João del Rei district in Minas Gerais. The modern, well-equipped tin smelter of Cia. Estanífera do Brasil at Volta Redonda produces refined tin from Brazilian and imported ores. There are several other small tin smelters in operation.

NONMETALS

Cement.—Brazil is by far the leading cement producer in Latin America and in 1963 ranked 15th among all cement-producing nations with an output amounting to 1.4 percent of the world supply. Virtually all the cement requirements of the country have been supplied by domestic production since 1956. The small quantities imported from Uruguay in 1962 and 1963 to alleviate a shortage in the State of Rio Grande do Sul were more than balanced by exports to Bolivia and Paraguay.

In 1963 the progressive and well-organized cement industry comprised 29 operating plants with a total installed annual capacity of 6,155,000 tons. All the plants have rotary kilns of foreign manufacture, and all but five use the wet process. The industry is controlled and financed largely by nationals. However, one U.S. firm, the Lone Star Cement Corp., controls two plants representing about 11 per-

cent of total capacity, and five other countries have minor investments in cement.

The average level of operation during the year attained only 84 percent of capacity, and output rose only 4 percent as compared with gains of 5.5 percent in 1962 and 22.7 percent in 1961. A part of the increase represents partial recovery of output lost by the Perus plant during a 102-day strike in 1962. The Votorantim plant at Sorocaba, São Paulo, the largest in Brazil, increased output considerably due to expansion completed in 1962; however, this plant and some other plants probably curtailed planned production because of a general slowdown in the construction industry.

Most expansion plans of the industry were deferred in 1963, but the Caué plant at Pedro Leopoldo, Minas Gerais, put a second Allis-Chalmers kiln into operation in midyear, increasing capacity from 110,000 to 243,000 tons per year. Also, Itabira Agro-Industrial, S.A., was reported to be remodeling the old Barbará plant in Espirito Santo and expects to become the second producer in the country of white and special cements, having a capacity of 50,000 tons. Known expansion plans include the construction of 7 new plants with a total capacity of 723,000 tons and capacity expansion of existing plants by about 200,000 tons. However, these projects will not increase total capacity enough to provide the cement requirements predicted for 1965, and imports may be necessary to supply the deficit.

Phosphate Rock.—Output of phosphate rock in Pernambuco declined again in 1963 as the 250,000-ton beneficiation plant of Fosforita Olinda, S.A., near Recife operated at less than one-fifth capacity. The company produced only about 35,000 tons from January through September as compared to the peak output of 160,471 tons in 1960. The principal market for Pernambuco phosphate is in the south-central part of the country, but maritime freight rates to southern ports have become so prohibitive that Fosforita Olinda cannot compete with the imported product even though it receives the subsidy paid for domestically produced fertilizers. According to Banas Informa, the cost of shipping fertilizer from Recife to Santos almost doubled between January 1962 and the end of 1963. The company also is faced with depletion of reserves of ore amenable to open-pit, dragline-mining methods, and recovery of other ores probably will be more costly.

MINERAL FUELS

Petroleum.—The trend toward a completely state-dominated petroleum industry was further implemented by two measures adopted in December 1963. The National Petroleum Council Resolution No. 8-63, published December 17 in Diário Oficial, authorized Petróleo Brasileiro, S.A. (PETROBRÁS), the national petroleum entity, to distribute petroleum products throughout the country. PETROBRÁS previously had distributed such products in areas surrounding its refineries and had supplied government agencies but did not compete generally with private distributing firms. Presumably, additional distributing activities will be conducted through its subsidiary, DISBRAS, which was created in 1959. Decree No. 53,337 published

December 24, gave PETROBRÁS the exclusive right to import crude-oil and petroleum derivates, and private refineries now must import their crude-oil requirements through PETROBRÁS. Control of imports is expected to facilitate negotiations for exchanging iron ore and other export products for crude oil and to permit greater use of the Brazilian tanker fleet to transport goods. It is further anticipated that bulk-buying should result in a saving of foreign exchange. Import control also might facilitate eventual displacement of private distributing enterprises. At yearend it appeared almost inevitable, if not iminent, that PETROBRÁS would be authorized to take over control of all private refineries and thus make its petroleum monopoly virtually complete.

The oil industry registered modest gains in output of crude oil and refinery products during 1963, despite continued troubles involving the administrative, financial, and political activities of PETROBRÁS. Crude-oil production, all from fields in Bahia, attained a new peak that was 6.9 percent higher than the previous year but only 2.6 percent more than that of 1961. The increase is attributed partly to additional producing wells and partly to use of water injection in secondary recovery operations. PETROBRÁS drilled 146 development and 76 exploratory wells during the year, and in October, its Director confirmed a new discovery by a 100-barrel-per-day well at Carmópolis, Sergipe. Also announced were plans to supplement its 61 drilling rigs by purchase of from 9 to 14 new rigs from Rumania.

Two of the three PETROBRÁS refineries and most of the six private refineries operated at near or above nominal capacity during the year, and total throughput averaged almost 305 million barrels daily, about 7 percent greater than in 1962. Imported crude oils constituted about 71 percent of total refinery feedstock. Output of refinery products increased 7.7 percent from the previous year, largely due to increases in production of diesel and fuel oils. Output of liquefied gases and asphalt also increased notably, and that of lubricating oils almost quadrupled as the Landulfo Alves refinery began producing lubricants. Output of kerosine declined, however, and it was announced that the Duque de Caxias refinery would cut back production of diesel oil in order to increase that of kerosine and gasoline.

PETROBRÁS let a contract to a consortium of Italy's Ente Nazionali Idrocarbui (ENI) and the Brazilian firm of Engebras for the construction of the Gabriel Passos refinery at Belo Horizonte, Minas Gerais, and the Alberto Pasqualini refinery at Canoas, Rio Grande do Sul. Capacity of each installation is to be 45,000 barrels per day, and completion is scheduled for 1966. Work is underway on a 362-kilometer, 18-inch pipeline from the Almirante Tamandaré terminal in Guanabara Bay to the Gabriel Passos refinery site, and completion is programmed for 1964. Until the new refinery is completed, this pipeline is to be used to supply the Belo Horizonte area with petroleum products from the Duque de Caxias refinery. A 116-kilometer pipeline will connect the Canoas refinery with an ocean terminal at Tramandaí.

The Mineral Industry of British Guiana

By Garn A. Rynearson[1]

THE NOTABLY progressive growth of the mineral industry in recent years was sharply arrested in 1963 by intensified political and racial disturbances. The most serious of these was a 79-day general strike during the second quarter of the year which severely disrupted operations in the largest industry in the country, mining and processing bauxite. Largely because of this strike, output of bauxite in 1963 decreased almost 14 percent from the record production level attained in 1962. Although the total quantity of dried bauxite produced for export (metallurgical and chemical grades) by the two bauxite companies was 35 percent less than in 1962, the Demerara Bauxite Co. was able to minimize the effect of the strike on its operations by concentrating on the production of higher value calcined bauxite (abrasive and refractory grades) and alumina. It even managed to increase its alumina output by a little more than 1 percent. Reynolds Metals Co., which produces only dried bauxite, was affected more seriously, as its ore transport system could not compensate for time lost, and output was only 63 percent of that of the previous year. As a result, one of the major customers of the company had to obtain a part of its supply for the year from Surinam.

Bauxite and alumina are by far the most important mineral commodities produced in British Guiana. The combined export value of these products generally represents between 75 and 85 percent of the value of all reported mineral production and between 25 and 30 percent of the value of all exported goods. Bauxite output was a little less than 8 percent of the world total in 1963 and nearly 9 percent in 1962. British Guiana was the leading world producer of bauxite in 1940 and 1946, held second place from 1947 to 1954, and has ranked fourth since 1959. Total output from 1917 through 1963 amounted to 45 million metric tons, representing 11.6 percent of the world supply during that period. Only Surinam and Jamaica have produced more than that amount. All of the bauxite produced has been destined for export either as raw or as calcined bauxite or, since 1960, as alumina. The country has no facilities for making aluminum metal or aluminum chemicals other than alumina.

British Guiana is a significant producer of manganese ore and diamonds, ranking either second or third among Western Hemisphere nations in the output of each of these commodities in recent years. The only other minerals regularly produced are gold and sand, gravel, and crushed stone for construction; however, the amounts produced are relatively modest. Manganese ore and both gem and industrial

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diamonds are produced for export, but the amount of gold recovered in recent years has barely sufficed the local jewelry industry. British Guiana is a potential producer of sands suitable for glass, of kaolin, and perhaps of petroleum and gas (from possible offshore deposits). Shell accumulations on the beaches are the only known domestic source of lime and some probably have been worked on a small scale. A variety of other minerals has been found in the country but deposits of commercial significance were not known as of 1963. Much of the country is nearly inaccessible and is difficult to prospect. It is hoped, however, that UN-sponsored aeromagnetic surveys, begun in 1962, may lead to discovery of new mineral deposits of economic importance.

The colony includes an area of 83,000 square miles that can be divided roughly into three main regions: (1) A low-lying coastal region varying in width up to 30 miles that constitutes the agricultural area; (2) a higher inland region about 100 miles wide that is almost entirely forested and within which most of the important mineral deposits occur; and (3) a generally high plateau and mountain region with extensive savannahs that borders Brazil and Venezuela. About 90 percent of an estimated population of 630,000 people live in the coastal region. Agriculture employs about 35 percent and mining about 6 percent of the colony's labor force, which was estimated to number about 195,800 in 1962. Approximately half of 12,000 persons engaged in mining activities in 1961 were individual prospectors or porknockers searching for diamonds; about 5,000 were employed by the bauxite companies; and 650 were employed by a manganese mining company.

British Guiana is a crown colony with a constitution that provides for full home rule except that Great Britain appoints the Governor and retains control over matters of defense and external affairs other than trade. It is generally expected that independence within the British Commonwealth of Nations will be granted within a few years. The country has a Lands and Mines Department in the Ministry of Natural Resources and a Geological Survey Department in the Ministry of Trade and Industry.

British Guiana economy is based largely on production and export of agricultural and mineral products. Estimated distribution of the gross national product indicated that agriculture, forestry, and fishing contribute 26 percent; mining, 13 percent; and manufacturing, 14 percent. The latter category may include manufacture of alumina as other manufacturing in the colony is rather limited. Sugar is most important in the economy in that its production provides a livelihood for the largest segment of the population, and its export accounts for about 40 percent of foreign exchange earnings. Although production of mineral products supports a relatively small number of people, the total export value of such products normally accounts for about one-third the value of all exports. The mineral industry also provides an appreciable source of Government revenue through taxes and other income such as leases, licenses, and royalties. In 1961, for example, nontax revenue from mining and quarrying amounted to about BWI$840,000.

SOURCE MATERIAL

General background material and information pertaining specifically to the mineral industry are based largely on despatches from the U.S. Consulate General in Georgetown and on official publications of several agencies of the Government of British Guiana. The latter sources include the following:

1. Annual report—British Guiana, published by the Government for the years 1959 to 1961.
2. Annual reports of the Lands and Mines Department, 1959 to 1961.
3. Annual reports of the Geological Survey Department, 1959 to 1961.
4. Monthly and annual publications of the Department of Customs and Excises, 1960 to 1962.

Additional information on specific mineral commodities was derived from:

1. Stockley, G. M. The Geology of British Guiana and the Development of Its Mineral Resources, British Guiana Geological Survey Department Bulletin 25, 1955.
2. Bishopp, D. W. The Bauxite Resources of British Guiana and Their Development, British Guiana Geological Survey Department Bulletin 26, 1954.
3. Bracewell, Smith. Bauxite, Alumina, and Aluminium, Overseas Geological Surveys, 1960, pp. 104–110.

Statistical data on mineral production are those reported by the Consulate General and include figures obtained from both official and company sources.

The compilation and publication of official trade data is behind schedule due to the general strike during 1963, and 1961 is the latest year for which complete data have been published; incomplete data have been published for January through November of 1962. Therefore, trade data given for 1962 and 1963 are preliminary estimates and are subject to revision.

The unit of currency in British Guiana is the British West Indies dollar (BWI$). Values given in U.S. dollars have been converted at the rate of BWI$1.00=US$0.58.

PRODUCTION

The total value of mineral commodities produced in British Guiana during 1963 amounted to approximately US$33.2 million, compared with US$37.9 million in 1962 and US$29.9 million in 1961. These figures exclude clay, sand, and natural gravel utilized in roads and dikes and other construction projects. Total value given for 1961 was derived from f.o.b. export values of bauxite, alumina, and manganese ore; the values reported by the Commissioner of Lands and Mines for diamonds and gold; and an estimated value for quarried stone. Total values given for 1962 and 1963 are estimates, based on average export values for 11 months in 1962 except for gold and stone whose values were estimated more or less arbitrarily. Decreased bauxite production in 1963 was a result of the long general strike but the drastic reduction in manganese ore output, which amounted to little more than half

that of 1962, stemmed more from difficulties encountered in marketing the relatively low grade ore (42 percent Mn) than from adverse effects of the strike.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite	1,701,290	2,510,853	2,411,712	[2] 2,762,637	2,379,883
Alumina, exports			122,090	[3] 211,286	[3] 225,708
Gold—troy ounces	3,448	2,364	1,702	1,903	2,847
Manganese ore and concentrate		[4] 124,696	196,136	275,454	142,728
Nonmetals:					
Diamonds [5]—carats	62,328	101,004	112,680	100,145	99,748
Total number of stones	430,446	710,671	1,024,033	728,150	766,034
Stone, granite, crushed or broken	68,370	86,912	57,664	35,507	11,892

[1] In addition to commodities tabulated, British Guiana produces clay, sand, gravel, and crushed or broken stone (other than granite) for construction purposes, but data on quantities are not available.
[2] Data from Statistical Summary of the Mineral Industry, 1957–62. Overseas Geological Surveys.
[3] Reported as sales for export.
[4] Revised figure supersedes that given in commodity chapter, volume 1.
[5] Includes both gem and industrial diamonds. Approximately 60 percent of production is estimated to be of gem quality.

TRADE

In 1961, the latest year for which complete trade data were available, the total value of all goods exported from British Guiana was BWI$148 million, and the value of imports was BWI$146.5 million. Preliminary unpublished data from official sources indicated that exports increased substantially in 1962 to BWI$164.5 million. An official estimate was not available for 1963 but the U.S. Consulate General at Georgetown estimated that exports during the year amounted to roughly BWI$166 million, the increase being attributed to higher sugar prices, which more than offset the decrease in bauxite exports. Preliminary unpublished import data indicated an increase in imports to BWI$156.4 million in 1962 and then a sharp decline to BWI$108.4 million in 1963. The decline was attributed to reduced imports of consumer goods, as a result of the general strike, and of capital goods, as a result of lack of investor confidence, as well as failure of the Government to obtain sufficient foreign aid funds to maintain momentum in its development program.

Sugar and sugar products constitute the most valuable export commodity group—followed by bauxite and alumina, rice, manganese ore, and diamond. As a percentage of 1961 exports, sugar represented 40.6 percent, bauxite and alumina 27.6 percent, rice 15.4 percent, and manganese ore and diamonds about 3.5 percent each. These proportions apply roughly to exports for 1962 and 1963, the variation for a given commodity being no more than 5 or 10 percent.

Principal customers during 1961 and 1962 were Canada (bauxite, alumina, sugar), United Kingdom (sugar, diamonds), United States (sugar, bauxite, manganese ore, diamonds), and Trinidad (rice) in the order listed.

Based as it is on agriculture and mining, British Guianan economy depends largely on imports to provide its needs for most capital goods and many types of consumer goods. Virtually all requirements for

metals and fuels as well as many of the raw materials needed for use in agriculture and construction are imported. Mineral fuels and lubricants represent about half of all imports of metals and minerals. Fertilizer materials, iron and steel semimanufactures, and cement also are imported in relatively large amounts.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960 quantity	1961		
		Quantity	Principal destinations	Value (BWI dollars)[1]
Metals:				
Domestic products:				
Aluminum:				
Bauxite:				
Dried	1,816,660	1,255,387	Canada 785,061; United States 421,818; Trinidad 13,408.	14,197,888
Calcined	311,883	376,712	Canada 104,249; United States 92,288; United Kingdom 32,857.	14,277,089
Alumina		122,090	Canada 108,884; Norway 13,246	12,083,588
Gold:				
Unrefined, troy ounces		1	All to United States	53
Semimanufactures do		7	All to United Kingdom	300
Iron and steel scrap	3,063	1,629	All to Japan	5,088
Manganese ore and concentrate.	77,997	190,390	United States 138,173; Norway 52,217.	5,373,790
Nonferrous metal scrap	204	226	Netherlands 93; United Kingdom 91; West Germany 38.	100,143
Total value, domestic metals.				46,088,939
Reexports [2]				8,589
Nonmetals:				
Domestic products:				
Clays		102	All to Japan	1,000
Diamonds:				
Uncut [3] carats	92,223	121,221	United Kingdom 69,609; United States 28,589; Netherlands 14,675.	5,100,873
Cut but unset. do	60	115	Trinidad 102; Canada 11; United States 2.	33,369
Sand, gravel and crushed rock.	1,363	955	Surinam 953; stores 2	8,477
Other nonmetals, not specified.	25	25	All to stores	90
Total value, domestic nonmetals.				5,143,809
Reexports [4]				216
Mineral fuels:				
Reexports, including bunkers:				
Coal		8	All to stores	50
Gases, liquefied, manufactured.	(5)	(5)	United States BWI$964; Surinam BWI$857; Trinidad BWI$230.	2,051
Petroleum refinery products: [6]				
Gasoline:				
Aviation 42-gallon barrels	6,416	12,954	Bunkers 12,880; French Guiana 65	287,335
Other, including blending agents do	1,169	2,080	All to bunkers	49,227
Kerosine do	789	8,314	do	165,841
Distillate fuel oil do	7,088	3,580	do	25,886
Residual fuel oil do	781	276	do	1,218
Lubricants do	227	524	Trinidad 279; bunkers 152; French Guiana 83.	25,023
Mineral tar and crude chemicals from coal, petroleum and natural gas kilograms	454	729	French Guiana 504; Trinidad 200; stores 25.	735
Total value, mineral fuels, reexports and bunkers.				557,366

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons, unless otherwise specified)

Commodity	1960 quantity	1961		
		Quantity	Principal destinations	Value (BWI dollars)[1]
Total:				
Value of metal and mineral exports.[7]				51,232,748
Value of all exports, f.o.b.[7]				146,545,155
Metals and minerals percent share in total exports [7].				34.96

[1] The British West Indies dollar (BWI$) is equivalent to US$0.58 (US$1.00=BWI$1.71).
[2] Rexports of miscellaneous metal semimanufactures. Value in 1960, BWI$3,850.
[3] Includes gem and industrial stones.
[4] Largely reexports of cement, fertilizers, and salt. Value in 1960, BWI$1,302.
[5] Data not available.
[6] Excludes LP gas.
[7] Excludes reexports.

Principal sources of imports during 1961 and 1962 were United Kingdom (foodstuffs, manufactured goods), United States (machinery, foodstuffs, chemicals, manufactured goods), Trinidad (petroleum products), and Canada (foodstuffs, manufactured goods).

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960 quantity	1961		
		Quantity	Principal sources	Value (BWI dollars) [1]
Metals:				
Aluminum, semimanufactures	499	268	United Kingdom 204; Belgium 47; Switzerland 7.	439,410
Copper, including alloys:				
Unwrought	4	1	All from United Kingdom	4,464
Semimanufactures	79	42	United Kingdom 30; West Germany 6; United States 2.	82,088
Gold:				
Unrefined—troy ounces		30	All from United Kingdom	[2] 1,882
Semimanufactures	([3] [4])	([3])	United Kingdom BWI$365,535; Canada BWI$437; United States BWI$156.	[2] 366,128
Iron and steel:				
Scrap iron and steel		104	All from United Kingdom	13,315
Pig iron and sponge iron	295		do	
Ingots or equivalent primary forms.	740	779	do	91,662
Semimanufactures	17,364	18,348	United Kingdom 12,013; Belgium 4,199; West Germany 1,134.	4,730,467
Lead, including alloys:				
Unwrought	([5])			
Type metal	4	3	United Kingdom 2; United States 1.	2,270
Semimanufactures	22	29	United Kingdom 28; Canada 1	18,769
Platinum, unwrought and partly wrought.	133	43	All from United Kingdom	1,575
Silver, unwrought—do	12,519	3,739	United Kingdom 3,723; United States 16.	4,866
Tin, including alloys:				
Unwrought, including tin solder.	15	13	Mainly from United Kingdom	22,417
Semimanufactures	8	9	United Kingdom 6; United States 3.	5,468

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1960 quantity	1961		
		Quantity	Principal sources	Value (BWI dollars) [1]
Metals—Continued				
Zinc, including alloys:				
Unwrought	26	(5)	All from United Kingdom	128
Semimanufactures	6	8	Mainly from United Kingdom	9,934
Base metal semimanufactures, not elsewhere specified.	9	9	do	21,317
Total value, metals				5,448,150
Nonmetals:				
Abrasives, natural, kilograms, including industrial diamonds.	308	(5)	All from United Kingdom	897
Barite, ground for pigment	5	22	West Germany 15; United Kingdom 7.	2,096
Cement	34,699	35,822	Venezuela 14,373; United Kingdom 11,239; Trinidad 210.	1,563,544
Clay	99	35	United States 30; United Kingdom 5.	5,980
Fertilizer materials:				
Nitrogenous:				
Ammonium sulfate	18,215	20,174	Trinidad 15,893; West Germany 4,166; United Kingdom 115.	1,479,831
Ammonium nitrate	(5)	620	Trinidad 417; West Germany 203	44,616
Other nitrates	(5)	823	Trinidad 813; West Germany 10	59,603
Other, not specified	145	414	Trinidad 340; Netherlands 37; West Germany 31.	67,922
Phosphatic:				
Natural phosphates	2,642	(5)	Mainly from United Kingdom	143
Superphosphates	2,862	1,738	Netherlands 1,432; West Germany 255; Trinidad 51.	230,303
Thomas slag	227	1,156	Netherlands 1,153; Belgium 3	62,402
Other, not specified	1,157	3,220	France 1,900; Netherlands 1,269; Trinidad 51.	164,237
Potassic:				
Potassium chloride	2,360	3,623	West Germany 1,877; France 1,321; East Germany 425.	295,418
Other potassic fertilizers.	33	60	France 57; United Kingdom 2; West Germany 1.	7,897
Mixed and other nonspecified fertilizers.	11	26	Netherlands 15; West Germany 10; United Kingdom 1.	6,450
Gem stones, including synthetic stones:				
Uncut	(3)	(3)	Brazil BWI$594; United Kingdom BWI$540.	1,134
Cut but unset	(3)	(3)	United Kingdom BWI$972; Canada BWI$35; West Germany BWI$14.	1,021
Gypsum, including plasters [6]	28	204	Trinidad 152; United States 46; United Kingdom 6.	5,872
Lime	4,647	2,821	United Kingdom 2,816; Trinidad 5.	167,499
Limestone, ground for agricultrual purposes.	16,209	15,762	Barbados 12,103; Trinidad 3,646; West Germany 13.	355,875
Salt	2,721	2,728	United Kingdom 2,722; Canada 6	155,399
Sand, gravel, crushed rock	491	339	Barbados 177; Trinidad 154; West Germany 5.	6,557
Stone, dimension:				
Not worked	24	7	Trinidad 4; Italy 3.	1,965
Worked	7	8	Italy 7; United Kingdom 1	4,822
Other nonmetals, not elsewhere specified [7].	38	168	United States 128; United Kingdom 26; Netherlands 10.	13,326
Total value, nonmetals				4,704,809

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1960 quantity	1961		
		Quantity	Principal sources	Value (BWI dollars) [1]
Mineral fuels:				
Coal	248	268	United States 235; Netherlands 18; Belgium 15.	18,387
Coke	43	104	All from United Kingdom	9,916
Fuel briquets	20	44	do	3,837
Gases, liquefied, manufactured	(3)	(3)	Trinidad BWI$91,365; United Kingdom BWI$11,256; United States BWI$8,407.	118,352
Petroleum refinery products: [8]				
Gasoline:				
Aviation thousand 42-gallon barrels	37	58	All from Trinidad	745,608
Other, including blending agents. do	170	193	Mainly from Trinidad	1,705,777
Kerosine do	133	144	do	1,360,066
Distillate fuel oil do	331	362	All from Trinidad	2,893,706
Residual fuel oil do	825	976	do	4,336,092
Lubricants do	30	22	United Kingdom 14; United States 7; Netherlands Antilles 1.	1,120,858
Paraffin 42-gallon barrels and vaseline.	825	743	Netherlands 424; West Germany 158; United States 158.	34,351
Road oil do	8,422	8,452	Mainly from Trinidad	126,061
Other, not specified	736	239	Trinidad 100; United Kingdom 83; United States 56.	50,431
Asphalt:				
Natural	1,082	893	Mainly from Trinidad	68,531
Refinery	443	2,896	Trinidad 2,276; United Kingdom 440; Netherlands Antilles 171.	312,412
Mineral wax, except paraffin. kilograms	98	2,043	All from United Kingdom	1,263
Mineral tar and crude chemicals from coal, petroleum, and natural gas.	245	442	United Kingdom 420; Surinam 21; West Germany 1.	44,307
Total value, mineral fuels				12,949,955
Total:				
Value of metal and mineral imports.				23,102,914
Value of all imports, c.i.f.				147,000,928
Metals and minerals percent share in total imports.				15.72

[1] The British West Indies dollar (BWI$) is equivalent to US$0.58 (US$1.00=BWI$1.71).
[2] Value not included in totals.
[3] Data not available.
[4] Value in 1960, BWI$271,572.
[5] Less than ½ of unit measure.
[6] May include small quantities of industrial limestone.
[7] Not specified except for small quantities of graphite and sulfur
[8] Excludes LP gas.

COMMODITY REVIEW

METALS

Aluminum.—The most important bauxite deposits occur within a zone about 10 miles wide and 110 miles long, which extends south-southeast from an area northwest of Bartica on the lower Essequibo River to an area between the Berbice and Courantyne Rivers about 25 miles from the border with Surinam. This zone coincides roughly with a line demarking the eastern outcrop limit of the crystalline basement rocks. Bauxite also has been found along the northwestern ex-

tension of this zone to the Venezuela border but none of the known deposits in this region are large enough to be of commercial significance. Laterites and ferruginous bauxite cover hills and ridges of igneous rocks west and southwest of the zone of commercial deposits and also cover large areas in the Pakaraima Mountains on the central-west edge of the colony; however, none of these deposits are of economic importance at present.

The commercially important bauxite deposits are grouped in four main areas roughly 10 miles in diameter and separated by from 15 to 30 miles of comparatively barren territory. The northernmost group, along and near the Essequibo River in the vicinity of Bartica, has not been exploited. The most important group comprises the numerous large and small deposits on both sides of the Demerara River in the vicinity of Mackenzie which is about 60 miles south of the capital city of Georgetown. These and a smaller group of deposits near Ituni about 35 miles south are worked by the Demerara Bauxite Co., Ltd. (DEMBA). The Reynolds Metals Co. works a fourth group in the vicinity of Kwakwani on the east side of the Berbice River.

DEMBA, a subsidiary of the Aluminum Company of Canada, Ltd., made the first shipments of British Guiana bauxite in 1917 and has since been the principal producer. The Plantation Bauxite Co. worked deposits near Christianburg in the Mackenzie area from 1953 to 1957 when it sold its mining rights to DEMBA, and the Berbice Co., Ltd., worked the Kwakwani deposits from 1943 to 1953 when Reynolds took over operations in that area. Other companies have explored for bauxite but none has reached the production stage. Notable activities in recent years have been the intermittent exploration of the Bartica and other areas by Harvey Aluminum of America and an investigation of laterites in the central part of the colony by Petromina (British Guiana), Ltd. Harvey gave legal notice of its withdrawal from British Guiana in 1963.

The DEMBA ore processing and shipping facilities are at Mackenzie, on the Demerara River near the upper limit of navigation for small seagoing vessels. Ore ships can load only about 8,000 tons at Mackenzie, and the larger carriers complete their cargo at a transfer station at Chaguaramas in Trinidad. Ores from deposits on the east side of the river are moved to the processing plant over a system of company railroads. Ores from deposits near Christianburg on the other side of the river have been barged across in the past but the company has announced it will construct a combined rail and highway bridge across the river to make resumption of mining in that area economical.

In general, the ore bodies in the Mackenzie and Ituni areas are dome-shaped lenses from 10 to 40 feet thick and sloping away steeply at their margins. They are underlain by kaolinic clays that have been developed, or perhaps deposited, on the irregular surface of weathered basement rocks. A sequence of sands and clays known as the White Sands series overlies most of the bauxite. The thickness of overburden varies widely, partly because of the east to northeast dip of the bauxitic zone and a thickening of the White Sands series in those directions and partly because of variations in the topography. Mostly, the overburden is less than 50 feet thick but some important ore bodies are overlain in places by more than 150 feet of sands and

clays, and their removal constitutes a major mining problem. Waste stripping is accomplished with such equipment as hydraulic monitors, power shovels, and both small and large draglines, including one with a 10-cubic-yard bucket and a 235-foot boom. To cope with the increased overburden, the company acquired a bucket wheel excavator capable of removing 600 cubic yards per hour and excavating to a depth of 122 feet. This machine has been in operation since early 1962.

At Mackenzie the bauxite is crushed, washed, and screened to remove some of the sand and clay impurities and then is dried or calcined. Part of the dried bauxite has been converted to alumina in the 220,000-ton alumina plant of the company since March 1961, and the remainder has been exported. A relatively small part of that exported was chemical grade. Annual output of calcined bauxite averaged approximately 370,000 tons from 1961 to 1963, roughly 50 to 60 percent was dead burned to a product destined for refractory uses, and the remainder was partly calcined to abrasive grade.

For some years DEMBA has been experimenting with a special process for making synthetic mullite. A few hundred tons of this material has been made in a small pilot plant and has been distributed abroad for market research purposes. A favorable response to the product has encouraged the company to proceed with plans to construct a full-scale plant with a maximum capacity of 50,000 tons per year. Completion of the new plant is scheduled for the latter part of 1964.

The bauxite deposits in the Kwakwani area are similar to those worked by DEMBA, but the scope of the Reynolds operation is much smaller, largely because of natural limitations which tend to restrict the quantity of ore that can be moved from the mines to the coast. The only practical way of transporting the ore is via the Berbice River, which is not navigable to seagoing vessels. The mined ore is trucked to Kwakwani, where it is crushed and washed and loaded onto pontoon barges, each with a capacity of only 400 tons. Shallow-draught tugs move a train of several loaded barges through a ¾-mile canal to the river, down a 12-mile channel dredged in the river, and thence to the drying plant and shipping terminal at Everton near the river mouth. The 120-mile river journey takes about 24 hours. A bar across the Berbice Estuary limits overseas shipping to the use of very small freighters. A test cut was dredged through the bar during 1963, and preliminary determinations of the silting rate indicated a channel could be maintained by dredging every 2 or 3 years. The channel in the upper reaches of the river is maintained by an 8-inch hydraulic dredge.

In addition to shipping problems, Reynolds was handicapped by the general strike and other labor disputes during 1963, and its total output of dried bauxite amounted to only 300,695 metric tons, compared with a record output of 479,169 tons in 1962. The 1963 output included 269,717 tons of metallurgical-grade and 30,978 tons of chemical-grade bauxite. About 95 percent of the ore came from the Mombaka mine. Most of the remainder came from the Wong Lease, and a little came from the Bissaruni mine.

Gold.—Although the total quantity of gold recovered in 1963 was about 50 percent greater than in 1962, gold mining in British Guiana continued to be of minor importance, compared to the more productive period before 1959. From 1884 through 1963 British Guiana produced almost 3.4 million ounces of gold or an average of more than 48,500 ounces per year. However, annual output has been only a fraction of this average since 1958, when all dredging operations ceased. Although dredging has been an important production method, it has accounted for no more than 15 percent of the total gold output, whereas from 80 to 85 percent has been recovered by hand methods from thousands of small workings; some gold also has been won by milling ores from a number of small lode deposits and some by large-scale hydraulicking methods.

The last gold dredges to operate in the colony were those of British Consolidated Goldfields, Ltd., which were working gravels on the Potaro and Konawaruk Rivers when the company was forced into receivership in 1958. This company produced 10,578 of the 16,491 ounces of gold produced in the colony in 1957. The demise of the venture resulted from attempts to maintain too large an operation for the yield attainable. Attempts to persuade other companies to purchase the equipment and to resume dredging operations apparently have been unsuccessful, and at last report the two dredges and the hydroelectric facilities installed at Tumatamari Falls still were on a care and maintenance basis.

Most, if not all, the gold recovered since 1958 has resulted from the efforts of individual prospectors. Their combined output has been abnormally low in recent years for the reason that many prospectors previously engaged in the search for gold have been lured to the newly discovered diamond fields.

Manganese.—Northwest Guiana Mining Co., Ltd., partly owned by Union Carbide Corp., produces manganese ore from deposits at Matthews Ridge about 15 miles southwest of Arakaka in the Northwest District. About 250 tons of ore was exported to the United States in 1956, but large-scale production was not begun until 1960. Output increased from nearly 125,000 metric tons in 1960 to more than 275,000 tons in 1962 but had to be cut back sharply to less than 143,000 tons in 1963 because of low prices that prevailed for lower grade manganese ores in that year; production costs in British Guiana were reported to exceed the sales value of the 42 percent ore the company produces.

Development of this large-scale mining operation in an almost uninhabited jungle region reportedly involved an investment of about US$12 million; a large part was spent on constructing a transportation system to move the ore from the interior to the coast for export. A 33-mile railroad was built from Matthews Ridge northward to a transshipment point called Port Kaituma on the Kaituma River. Dredging a turning basin and 2.5 miles of canal, as well as extensive dredging along the Kaituma River, was necessary to provide a suitable waterway for the vessels of about 3,000-ton capacity used to transport the ore via the Kaituma and Barima Rivers to a transfer station in Trinidad. The company also built Pakera Village near the mine and washing plant to provide housing and other facilities for em-

ployees and noncompany personnel engaged in local governmental activities.

The ore bodies at Matthews Ridge are similar to those in Amapá and Minas Gerais in Brazil in that they resulted from the supergene enrichment of manganiferous horizons in Precambrian sedimentary rocks. A reasonably accurate estimate of ore reserves is not available; however, one source has indicated a magnitude of 6 million tons. Similar deposits of manganese oxides are known to occur at Pipiani, Tassawinni, Saxacalli, and other localities in the northern part of the colony. Some of these occurrences have been explored superficially, but thus far no other deposits have been found that compare in size and grade to those at Matthews Ridge.

NONMETALS

Diamonds.—Diamond miners recovered nearly 100,000 carats of gem and industrial diamonds during 1963, thus maintaining their high level of productivity for the 4th successive year. The Mazaruni District continued to be the most productive, increasing its contribution to 78 percent of the total carats and 77 percent of the total number of stones produced during the year. However, output decreased in the Potaro and Cuyuni Districts, fell markedly in the Rupununi District, and no stones at all were reported from the Northwest and Berbice Districts.

The revival in diamond mining in the colony began in 1958 with discovery of diamonds in the gravels of the Kurupung River above the escarpment of the Pakaraima Plateau. Previously most diamond recovery in the Mazaruni District was restricted to the lower areas. As a result of this new find, diamond output almost doubled in 1959 to the highest level since 1930. Another plateau discovery was made in 1960 on the Ekereku River in the Cuyuni District, and several subsequent finds have been made in adjoining areas in both districts. Access to these areas has been facilitated by trails cut by the Geological Survey and by the establishment of landing facilities for small aircraft.

Diamond recovery in British Guiana is largely the realm of individual prospectors although a few more or less organized groups also participate. Diving equipment is used by some miners to gather gravels in deep water. The water-dogging technique usually is employed in shallow water; one miner reportedly recovered 2,000 carats of stones during 3 months of work on the upper Ekereku River. Some attempts have been made to work diamondiferous gravels by dredging but results have been poor thus far, mainly because the equipment used was not suitable. Several groups are planning to introduce more advanced types of suction dredges into the diamond areas. If successful, they may increase production substantially.

Total diamond production from 1901 through 1963 amounted to 3,199,484 carats. Peak output was in 1923, when 214,474 carats was recovered. Most of the stones found in the colony were small, averaging 7 or 8 stones to a carat. Many very small stones probably are missed by the miners or are ignored because of their slight value. The largest stone found was a crystal of bort weighing 97 carats, whereas the largest stone of gem quality weighed 56.75 carats. The Lands and Mines Department has estimated that about 60 percent of

the stones recovered in recent years were of gem quality. Apparently, gem diamonds are predominant in some areas, whereas industrial stones are more common in others.

Construction Materials.—Cement and lime must be imported but sand, stone, and clay are available locally for use in concrete, for road metal, and for construction of dikes and seawalls. Various types of stone have been quarried intermittently in the general vicinities of Bartica and Mackenzie and along the road from Bartica to Potaro. The gabbro quarry at Monkey Jump on the Essequibo River south of Bartica is considered one of the better sources of stone for the Georgetown area. The Public Works Department operates a crushing plant in Georgetown and sells graded products for aggregate.

Relatively small amounts of clay are produced for making brick and pottery; however, burnt clay has been widely used as a dressing for the main roads. Some marl imported from Barbados also has been used to surface roads, and bauxite has been used as a binder for some roads in the Mackenzie area. Approximately 100 miles of public roads have been surfaced with imported asphalt and road oils.

MINERAL FUELS

Oil companies have made geophysical surveys in the coastal and offshore areas of British Guiana and a few exploratory wells have been drilled on the mainland. The explorations made thus far have failed to indicate the presence of commercial amounts of oil or gas, although the possibility of finding offshore deposits is not entirely discounted. The latest exploration was an unencouraging marine seismic survey made by the California Oil Company (British Guiana), Ltd., in 1958. This company abandoned its concession in 1960, and no license to explore for oil has been issued since that time; although Gulf States Land and Industries, Inc. has attempted to negotiate such rights for off shore areas adjoining those it is exploring off Surinam.

Petroleum imported from Trinidad is the principal source of energy as the colony has no known fuel resources other than wood. There is a considerable hydroelectric energy potential that is virtually undeveloped; one small hydroelectric plant has been built in a remote mining area but has not been utilized since 1958.

Incomplete data indicate a marked increase in imports of fuel oils during 1962. Fuel oil imports, distillate and residual, are estimated at 2,194,000 barrels for 1962, compared with 1,338,000 barrels imported in 1961. Conversely, gasoline imports decreased from 252,000 to about 200,000 barrels. Kerosine imports increased slightly from 144,000 to about 147,000 barrels.

The Mineral Industry of Chile

By Lester R. Brown, Jr.,[1] and Sumner M. Anderson[2]

GAINS were made in 1962–63 in all major elements of the mineral-production industry except iodine and coal (which declined 8.2 and 7.3 percent respectively), and in at least 7 of the 16 minor elements. In the field of metals, production declined only in lead, mercury, and zinc, which have never been important quantitatively. Among the nonmetallic minerals, production advanced for the important nitrate and phosphate fertilizers, cement and relatively incidental sodium sulfate, kaolin, feldspar, quartz, and lapis lazuli; it declined 22 percent for borates and in proportions ranging from 9 to 2 percent for gypsum, sulfur, salt, barite, and limestone.

Metal, mineral, and mineral fuel production and processing dominate the economy of Chile, and copper dominates its foreign trade and contributes vitally to the federal budget and to politics. The industry accounted for 82.6 percent (an estimated US$297 million) of total export earnings in 1963. The importance of the mineral industry relative to total South American and world production in 1963 is shown in the following table:

Commodity:	*Share of South American total production, percent*	*World total production, percent*
Copper:		
Mine production, third in world rank	76.7	12.7
Smelter production, third in world rank, first in exports	77.7	11.2
Nitrogen compounds:		
Natural nitrates	100.0	100.0
All types, including natural nitrates	[1] 82.0	[1] 1.0
Iodine	100.0	[1] 60+
Iron ore	21.7	1.7
Molybdenum, third in world rank	83.5	7.3
Bituminous coal	24.8	(2)

[1] Estimate.
[2] Negligible.

The mineral industry of Chile, exclusive of the mineral fuels, is the largest in South America. Domestically the monetary importance of mining follows that of manufacturing, agriculture, and transportation and communications. Normally mining, which employed approximately 67,000 people in 1963, accounts for 11.5 percent of the national income and 9.7 percent of the gross national product (GNP), but values have not been made available to show what portion of manufacturing is represented by copper and iron and steel production, cement and other mineral processing and manufacturing, and petroleum

[1] Latin America specialist, Division of International Activities.
[2] Chief Latin America specialist, Division of International Activities.

refining, all important sectors of the mineral industry. Detailed value figures for 1963 have not been received; according to the International Monetary Fund, the value of total exports in 1962 was US$530 million, of which US$471.6 million [3] or 89 percent was mineral exports. Of the mineral exports, 77 percent was copper, 12 percent iron ore, 6.5 percent nitrates, 2.1 percent molybdenum, and 0.8 percent iodine—all shipped by the large mining companies; 9 other mineral items comprised the remaining 1.6 percent.

The dominance of copper has made its price and international demand of prime importance to the Chilean Government, which has exercised increasing control over marketing policy and production rates of the industry. The Chile Exploration Co. and Andes Copper Mining Co. (subsidiaries of The Anaconda Company) and the Braden Copper Co. (subsidiary of Kennecott Copper Corp.) comprise the copper segment of the large mining category ("gran minería"). They pay direct taxes amounting to roughly one-fifth of the total tax receipts of the country and supply approximately 68 percent of the foreign exchange needs. Miners in the medium and small categories are subject to separate and lower tax rates. Additional millions enter the economy through purchase by these companies of nearly half their operating requirements in the domestic market (US$32.5 million in 1961) and from special levies for road construction, irrigation, housing, education, social services, provincial and municipal improvements, the armed forces, and assistance to the economic and industrial development program of the Government.

The 5-year period 1959–63 showed a 141 percent rise in the GNP from Esc4,077 million to Esc9,827 million and a 9.7 percent increase in estimated population from 7,411,000 to 8,133,000, giving an increase of 51.9 percent in GNP per capita from Esc545 to Esc828. The net foreign balance (inflow minus outflow) quadrupled from Esc86 to plus Esc342 million. These suggestions of progress have been offset by (1) inflation, as seen in the 51 percent devaluation of the escudo from an official market exchange rate of Esc1.053 to Esc2.146 per US$1 and a 97.1 percent rise in the Santiago cost-of-living index from 139 to 274 (based on 1958=100); (2) an increasingly unfavorable trade balance; and (3) a declining balance of payments (minus US$48 to minus US$190 million on goods and services).

To improve the economy, Chile has adopted a 10-year plan, 1961–70, for raising the gross domestic product (GDP) by 5.5 percent a year or the per capita GDP by 3 percent a year. The total planned investment is Esc9,500 million; the investment scheduled for mining is Esc1,726 million. Copper mining is expected to absorb Esc523 million; iron-ore mining, Esc85 million; and nitrate mining, Esc20 million, with the hope of increasing production of those products by 54, 124, and 8 percent, respectively. The plan provides for investment of Esc405.9 million in expansion of the petroleum industry and Esc33.3 million in the merged Lota and Schwager coal mines. Progress toward financing the plan was made in 1963 when The Anaconda Company and Kennecott Copper Corp. agreed to invest about US$250 million in new electrolytic refinery installations, contingent on a tax freeze and lifting

[3] 533,131,427 Escudos (Esc), converted at a calculated average official market exchange rate of Esc1.1325=US$1.

special additional taxes of 5 and 8 percent on income imposed in 1960 and 1961. The Canadian Foreign Ore Development Corp. agreed to put US$30 million into developing the Cía. Minera de Santa Fe iron mines and another US$5 million for opening its Santo Domingo copper mine near Antofagasta. In December 1963, an agreement was signed between Chile and the Alliance for Progress in Washington authorizing the Agency for International Development to provide for U.S. citizens and firms investing in Chile insurance against risks of expropriation, war, revolution, and insurrection.

SOURCE MATERIAL

Mineral production statistics have been mainly supplied by the Chilean Ministry of Mines publication, "Anuario de la Mineria de Chile." This was supplemented by export statistics from Comercio Exterior, Dirección de Estadistica y Censos, Santiago, 1961. Annual minerals and iron and steel reports, as well as mineral production questionnaires submitted by the U.S. Embassy, Santiago, furnished most of the information on industrial development. Other sources included: World Oil; Mining Annual Review, 1964, Mining Journal (London), June 1964; and E&MJ Metal and Mineral Markets, February 18, 1963.

PRODUCTION

Chilean official statistics on production of metals and metallic ores and concentrates are reported generally in terms of metal content. Exceptions are iron ore and manganese ore, which are given in gross weights and grades.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Copper:					
In ores and concentrates	28,590	31,630	26,458	35,723	44,079
In smelter production	517,634	504,816	524,415	557,225	556,991
Total	546,224	536,446	550,873	592,948	601,070
Gold, troy ounces	58,547	54,367	56,489	65,009	77,290
Iron ore, 61.2 to 63.4 percent iron, thousand tons	4,649	6,041	6,989	8,092	8,507
Iron and steel:					
Pig iron, thousand tons	290.3	266.0	285.3	383.0	418.4
Steel ingots, do	414.8	421.6	362.9	494.7	488.9
Semifinished products, do	365.4	369.0	301.6	413.4	441.5
Finished products, do	282.0	279.6	266.7	346.3	365.5
Lead:					
In ore and concentrate	2,322	2,444	2,043	1,454	[1] 974
Smelter products	810	600	480	254	220
Manganese ore, 43.2 to 46.2 percent manganese	40,874	45,928	34,966	43,162	46,480
Mercury, 76-pound flasks	2,007	2,876	1,509	791	613
Molybdenum, in concentrates	2,297	1,852	1,831	2,384	3,046
Silver, troy ounces	[1] 1,949,750	[1] 1,679,105	2,156,768	[1] 2,279,887	2,768,372
Zinc, in ore mined	1,013	1,051	162	496	486

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Barite	[1] [2] 1,000	1,306	1,407	[1] 1,049	1,019
Borates, ulexite, 33 percent B_2O_3	5,756	2,919	160	3,814	2,981
Cement	836,036	828,020	869,976	1,147,119	1,166,272
Clays:					
Kaolin	[1] 6,800	7,800	14,151	30,464	36,899
Refractory	(3)	(3)	(3)	(3)	10,019
Feldspar	1,500	1,113	2,317	1,156	[1] 1,200
Gypsum:					
Crude, for calcining	[2] 78,900	[2] 40,800	[2] 80,000	115,212	105,000
Calcined	[2] 36,327	[2] 32,165	34,811	[2] 54,150	49,500
Iodine	1,108	1,776	1,843	2,348	2,156
Lapis lazuli	(3)	(3)	(3)	[2] 3	4
Limestone	1,348,294	1,462,662	1,493,191	1,839,625	1,808,929
Nitrates:					
Sodium	1,175,788	1,087,100	849,415	1,013,012	992,908
Potassium	87,166	103,658	83,333	106,800	142,973
Total	1,262,954	1,190,758	932,748	1,119,812	1,135,881
Phosphates:					
Apatite	19,408	17,537	13,924	12,591	13,909
Guano	21,417	18,221	19,724	16,046	22,195
Total	40,825	35,758	33,648	28,637	36,104
Quartz	(3)	(3)	(3)	[2] 57,900	75,269
Salt, common	34,589	42,672	46,112	51,013	47,812
Sodium sulfate	5,777	8,536	4,629	[2] 12,970	32,421
Sulfur	22,020	31,397	44,700	[1] 64,242	58,789
Talc	(3)	(3)	(3)	(3)	3,555
Mineral fuels:					
Coal, bituminous, and lignite thousand tons	1,892	1,424	1,764	1,855	1,719
Coke:					
Oven and beehive do	237	234	[2] 249	[2] 249	249
Gashouse do	85	[2] 86	[2] 86	[2] 86	99
Natural gas million cubic feet	67,746	81,873	95,120	132,844	192,402
Liquefied petroleum gas from natural gas plants. 1,000 42-gal bbls	581	415	619	304	1,445
Petroleum:					
Crude do	6,428	7,231	9,263	11,689	13,206
Crude runs to stills do	8,677	10,864	12,230	15,116	16,112
Petroleum refinery products:					
Aviation gasoline do	3,942	238	319	441	369
Motor gasoline do		4,533	4,776	5,804	5,679
Kerosine do	720	1,106	1,187	1,592	1,837
Distillate fuel oil do	1,764	1,904	2,055	2,407	2,643
Residual fuel oil do	1,673	2,142	2,712	3,643	3,858
Other [4] do	271	319	416	473	541
Total salable refinery products. do	8,370	10,242	11,465	14,360	14,927
Refinery fuel and losses do	307	622	765	756	1,185

[1] Revised, superseding figure in world production table of commodity chapter, vol. 1.
[2] Estimate.
[3] Data not reported.
[4] Excludes liquid petroleum gas from natural gas plants.

TRADE

Trade data from Comercio Exterior showing country distribution and values in 1961 were the latest available. Partial data on 1962 exports from Embassy sources have been listed separately. Values are given in dollars only when so reported from Chile. Values reported in Comercio Exterior are in gold pesos, an artificial unit used in foreign trade statistics only, to which the Chilean Government assigned an arbitrary value equivalent to US$0.20597 for the year 1961.

TABLE 2.—Exports of selected commodities in 1962

(Metric tons unless otherwise specified)

Commodity	Quantity	Value (thousand U.S. dollars)
Metals:		
Copper:		
Ore and concentrate	94,252	40,653
Blister copper	491,659	318,718
Gold, crude, troy ounces	31,688	4,079
Iron ore, thousand tons	7,246	64,226
Lead ore and concentrate	2,163	174
Manganese ore	9,879	262
Mercury, 76-pound flasks	37	149
Molybdenum concentrate	5,129	9,904
Zinc dross	259	4
Others, not specified	17,996	2,987
Nonmetals:		
Borates	100	4
Iodine	2,588	3,624
Nitrates	912,498	30,350
Sulfur	641	31
Others, not specified		6
Mineral fuels:		
Coal	1,118	32
Petroleum, crude	14	1

TABLE 3.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960 quantity	1961		
		Quantity	Principal destinations	Value (thousand gold pesos) [1]
Metals:				
Copper:				
Ore and concentrate	37,604	32,989	Japan 23,425; West Germany 7,479; Sweden 1,108.	21,455
Precipitates	3,978	3,747	Japan 2,621; West Germany 1,126.	6,620
Cement copper	4,037	4,337	Largely to Japan	9,353
Blister, in ingots	90,099	97,577	United States 51,255; United Kingdom 25,046; West Germany 16,897.	284,112
Blister, in bars	182,940	206,291	United States 157,677; United Kingdom 23,266; West Germany 23,171.	653,569
Electrolytic	140,996	145,718	Netherlands 62,501; United Kingdom 21,744; Sweden 20,316.	469,443
Refined	75,656	74,981	United Kingdom 31,533; West Germany 15,722; Italy 11,143.	209,411
Semimanufactures	1,340	647	Argentina 498; Peru 63; Colombia 40.	2,138
Gold ore	96			
Iron and steel:				
Iron ore, thousand tons	5,200	6,197	United States 2,894; Japan 2,021; Panama 550; West Germany 520.	215,644
Steel ingots	300			
Ferroalloys	4,226	4,636	United States 3,677; Venezuela 528; Peru 431.	3,567
Bars	31,406	4,488	Argentina 2,904; Uruguay 863; Ecuador 298.	2,249
Plates and sheets	62,259	52,431	Argentina 52,006; Brazil 399	45,812
Galvanized sheets	10	53	All to Brazil	37
Lead:				
Ore and concentrate	2,688	2,896	West Germany 2,282; Belgium 590	1,334
Slag		267	All to Belgium	101
Manganese, ore and concentrate	21,068	9,460	United States 8,241; West Germany 1,219.	1,163
Mercury, 76-pound flasks	2,727	2,408	Japan 1,653; Brazil 667; Argentina 87.	1,709
Molybdenum concentrate	4,066	3,981	West Germany 1,917; United Kingdom 1,067; Netherlands 514.	28,816

See footnotes at end of table.

TABLE 3.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1960 quantity	1961		
		Quantity	Principal destinations	Value (thousand gold pesos)
Metals—Continued				
Base metal ores and concentrates with gold and silver.	59,074	40,233	West Germany 18,345; Japan 13,585; Poland 4,619.	26,960
Other concentrates, not elsewhere specified.	18	2	All to West Germany	9
Total value, metals				1,983,502
Nonmetals:				
Asbestos		3	All to Peru	12
Cement	58	317	Cuba 309; Peru 8	188
Clays:				
Refractory	2	56	Argentina 50; Peru 6	10
China clay	12	(2)	All to Peru	(2)
Diatomite		5	All to Uruguay	2
Iodine	1,724	2,278	United States 789; United Kingdom 617; West Germany 463; Netherlands 238.	17,520
Marble	1			
Potassium salts	64,405	68,381	United States 30,665; Brazil 19,510; Netherlands 8,400.	14,097
Quartz	1	10	All to United Kingdom	13
Sand	25			
Sodium nitrate	724,636	1,028,321	United States 490,920; Spain 98,651; France 80,626; Netherlands 56,961.	162,386
Sulfur ore		10	All to Peru	3
Sulfur	813	715	Peru 680; Bolivia 35	141
Total value, nonmetals				194,372
Mineral fuels:				
Coal and coke	110	787	All to Bolivia	127
Petroleum and petroleum products:				
Bitumens	110	97	All to Argentina	48
Gasoline, 42-gallon barrels	7,174	5,714	Argentina 5,032; Bolivia 682	379
Diesel oil	924	859	All to Argentina	308
Lubricating oils	883	69	West Germany 67; Bolivia 1	30
Total value, mineral fuels.				892
Total value, metals and minerals.				2,178,766
Total value, all exports				2,466,818
Metals and minerals share in total exports—Percent				88.3

[1] Gold peso ($ oro) is an artificial unit used by Chilean Government in foreign trade statistics; arbitrary value in years shown was US$0.20597.
[2] Less than 0.5 metric ton.
[3] Less than 500$oro.

TABLE 4.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960 quantity	1961		
		Quantity	Principal sources	Value (thousand gold pesos) [1]
Metals:				
Aluminum:				
Bauxite	21	---	---	---
Alumina	4	7	Largely from United States	20
Ingots	1,790	1,408	United States 781; Canada 500	3,597
Semimanufactures	228	382	United Kingdom 133; United States 126; West Germany 47.	2,243
Antimony, metal	100	39	Largely from United Kingdom	103
Arsenic, metal	---	1	Largely from Sweden	3
Bismuth, metal	1	2	All from West Germany	58
Cadmium, metal	1	(a)	All from United States	8
Chromium, metal	55	42	Norway 29; West Germany 5; France 4.	75
Copper, semimanufactures	43	61	Italy 33; United States 15; United Kingdom 9.	339
Gold, semiwrought troy ounces and wrought.	531	---	---	---
Iron and steel:				
Powder	1	14	Largely from West Germany	25
Ingots	115	---	---	---
Ferroalloys	174	741	United States 665; West Germany 50.	625
Bars and billets	8,321	8,666	United States 3,962; Belgium 2,133; West Germany 1,756.	8,906
Shapes and sections	11,128	10,238	United States 4,544; Belgium 2,337; West Germany 2,315.	12,390
Plates and sheets	4,145	7,330	United States 3,664; West Germany 2,065; Belgium 1,041.	8,402
Tinplate	1,673	4,509	United States 2,675; France 1,135	5,146
Hoops and strips	249	502	West Germany 203; United Kingdom 128; Belgium 120.	852
Railway track material	48	88	Largely from West Germany	135
Alloy steel	848	1,192	West Germany, 730; United States 169.	3,309
Expanded metal	180	44	Largely from United States	74
Lead:				
Ore and concentrate	---	(2)	All from West Germany	1
Ingots	698	301	United States 141; Peru 65; United Kingdom 60.	318
Wrought	54	21	Largely from Peru	27
Magnesium, metal	(2)	1	West Germany; United States	3
Mercury	(2)	(2)	Largely from United Kingdom	11
Molybdenum, metal	---	9	do	145
Nickel:				
Ore	---	30	All from United States	14
Ingots	21	6	Canada, 2; Norway, 2; United States 2.	41
Electrolytic	21	32	Canada, 20; United States, 12	273
Wrought	12	29	Largely from United States	270
Platinum-group troy ounces metals, unwrought and wrought.	3,586	232	Largely from West Germany	37
Silver do	96,452	32,238	do	201
Tin:				
Ore and concentrate	10	---	---	---
Ingots	380	870	Largely from United Kingdom	9,893
Tin and tin alloys	(2)	(2)	Largely from Denmark	2
Zinc:				
Ingots	2,821	4,225	United States, 2,981; Peru 768; Mexico 341.	5,480
Wrought	213	194	Belgium 107; West Germany 42; United States, 40.	580
Other ores and concentrates, not elsewhere specified.	209	4,180	Largely from United States	300
Other metals, not elsewhere specified.	4	7	Largely from Sweden	43
Total value, metals	---	---	---	63,949

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1960 quantity	1961		
		Quantity	Principal sources	Value (thousand gold pesos) [1]
Nonmetals:				
Abrasives:				
Emery	63	123	West Germany 65; France 22; United States 22.	150
Pumice	1	1	Largely from United States	1
Other	51	106	do	115
Cement	8,597	17,375	Japan 4,393; West Germany 3,424; United Kingdom 32.	2,063
Chalk	(2)	2	France 1; West Germany 1	1
Clays:				
Refractory	584	2,686	Largely from United States	1,348
China clay	64	115	do	42
Other not elsewhere specified.	991	3,095	United States 1,989; Peru 468; West Germany 417.	1,854
Diatomite	76	353	Largely from United States	238
Dolomite	5,459	119,522	do	7,209
Feldspar	3			
Fertilizers:				
Guano		2,026	All from Peru	1,081
Phosphate	6,966	1,559	Largely from United States	220
Fuller's earth	256	1,313	Argentina 732; United States 546	359
Graphite	1	130	United States 76; West Germany 27; United Kingdom 26.	98
Gypsum	6	37	United States 28; Peru 6	7
Lime	67	3,704	Largely from United States	1,184
Magnesite:				
Raw	52	55	Largely from United Kingdom	77
Calcined	2,670	2,345	United States 1,734; Austria 336	670
Mica	5	30	United Kingdom 17; United States 7.	215
Quartz	(2)	4	All from West Germany	2
Salt		18	Largely from United States	30
Sand	12	13	Largely from United Kimgdom	14
Slag		9	Largely from West Germany	15
Stone, dimension	2	8	Largely from Italy	7
Talc	34	68	United States 37; Italy 31	44
Other nonmetals, not elsewhere specified.	313	1,296	Argentina 566; United States 247; Peru 229.	405
Total value, nonmetals				17,449
Mineral fuels:				
Coal, coke and briquets	267,648	886,259	Peru 499,301; United States 384,804.	37,640
Petroleum and petroleum products:				
Asphalt and bitumens	18,770	8,660	United States 8,481; Curacao 135	2,677
Crude petroleum thousand 42-gallon barrels.	12,412	8,551	Venezuela 4,099; Curacao 2,121; Trinidad 1,006.	82,894
Gasoline do	250	239	Peru 137; Curacao 78	6,713
Kerosine do	803	294	Curacao 155; Peru 116	6,867
Diesel oil	108,778	156,028	Peru 88,138; Curacao 49,757; United States 12,267.	20,808
Fuel oil		3,253	All from Venezuela	250
Lubricating oils	20,423	19,053	Largely from United States	19,963
Paraffin	6,600	8,870	United States 3,012; Indonesia 1,550; United Kingdom 1,262.	6,629
Other mineral waxes	73	160	Largely from United States	333
Total value, mineral fuels				184,774
Total value, metals and minerals.				266,172
Total value, all imports				2,866,574
Metals and minerals share in total imports. percent				9.3

[1] Gold peso ($ oro) is an artificial unit used by Chilean Government in foreign trade statistics; arbitrary value in years shown was US$0.20597.

[2] Less than 0.5 metric ton.

COMMODITY REVIEW

METALS

Copper.—The 1963 production of recoverable copper in ore was nearly 1.4 percent greater than that of 1962. More than 84 percent of the 1963 output was from the mines of the three U.S.-owned companies which comprise the copper segment of the Gran Minería, a grouping of large mining enterprises that also includes certain iron ore and nitrate producers. The Gran Minería share of Chilean copper output declined nearly 7 percent in the 1959–63 period.

The largest copper producer of the Gran Minería group has been the Chuquicamata mine, owned and operated by the Chile Exploration Co., a subsidiary of The Anaconda Company. The mine is in Tarapacá Province northeast of Antofagasta.

Large-scale open-pit mining methods continued in use in 1963 but underground mining is expected to begin around 1970. A drainage tunnel 5,700 meters long reached a point 150 meters below the pit bottom in 1961.

TABLE 5.—Copper production distributed by type and producing group
(Metric tons)

Year	Gran Minería					Total	Total Chilean production	Gran Minería percentage of total
	The Anaconda Company			Kennecott Copper Corp., Braden Copper Co., El Teniente mine				
	Chile Exploration Co., Chuquicamata mine		Andes Copper Mining Co., Potrerillos and El Salvador mines					
	Electrolytic	Blister	Blister	Fire refined	Blister			
1959	177,010	100,940	54,800	82,631	81,734	497,115	546,224	91.00
1960	146,997	83,131	78,797	78,565	91,288	478,778	536,446	89.25
1961	153,492	96,158	72,564	62,289	96,629	481,132	550,873	87.34
1962	180,106	95,705	82,465	66,369	98,111	522,756	592,948	88.16
1963	178,947	95,889	88,216	61,800	78,737	503,589	601,070	83.78

The upper oxide ores are treated by a leaching process and the deeper sulfides by flotation concentration. Products of both concentrator plants are smelted and refined at Chuquicamata. Reserves are not officially reported but estimates range from 600 million to 1,000 million tons of ore containing 1.6 percent copper.

The second largest Chilean producer is the underground El Teniente mine, owned and operated by the Braden Copper Co., a subsidiary of the Kennecott Copper Corp. It is at Sewell in the Province of O'Higgins, northeast of the city of Rancagua. All ore extraction is by block caving; the reserve is unofficially estimated at more than 350 million tons of ore containing 1.9 percent copper.

The Braden smelter is at Caletones, about 6 kilometers from the mine, and ore is moved by aerial tramway to the smelter.

The third of the Gran Minería, the El Salvador mine, is in the Province of Atacama and east of the port of Chañaral. It is owned and operated by the Andes Copper Mining Co., another Anaconda

subsidiary. The mine was opened in 1959 to replace the worked-out Potrerillos mine. Reserves are estimated to total 375 million tons of ore, with an average copper content of 1.6 percent.

Each of the Gran Minería operations has its own copper smelting facilities. In addition, four other domestic metallurgical facilities processed copper ores in 1963, and a fifth was under construction. In 1963, Chilean smelter output was equal to more than 93 percent of the mine output. All ore produced by the Gran Minería group is smelted in Chile, together with an appreciable amount of that produced by the smaller mines.

TABLE 6.—Copper smelters other than those of the Gran Minería

Plant	Owner and/or operator and location	Remarks
Paipote smelter	Chilean Government, near Copiapo	In 1961, treated 155,335 metric tons of ores and concentrates from medium and small mines.
Chagres smelter	Cía. Minera Disputada de Los Condes, S.A. (Compagnie Miniere du M. Zaita of France); Province of Valparaiso at Llaillay.	Reactivated in 1960 to exclusively treat products of affiliated mines.
Montos Blancos chemical plant and smelter.	Empresa Minera de Montos Blancos (Mauricio Hochschild y Cía., Ltd.); 50 kilometers from Antofagasta.	Initiated in 1961 to exclusively treat products of affiliated mines.
Small matte furnace	Privately owned and operated, treating ores from the Chivas mine, on Lake Buenos Aires.	Remote, isolated location.
Ventanas smelter	Empresa Nacional de Minera, Chilean Government, near Valparaiso. (Scheduled completion, April 1964.)	Plans are underway for additional government projects plus electrolytic refining facilities.

The major mining companies of Chile are required by law to furnish the refined copper needed by the local industry and fabricators. The three Chilean fabricators are: (1) Fabricas y Maestronzas del Ejercito (FAMAE); (2) Manufacturos de Cobre, S.A. (MADECO); and (3) Cobre Cerrillos, S.A. (COCESA). These fabricators reportedly have an annual capacity of 60,000 tons, but production has never reached this figure, apparently because Chilean fabricating costs are high, and operation at capacity would not yield products which would be competitive with imports.

Gold.—Most recent gold production has been obtained as a byproduct of copper refining. Most of the remainder has been from small placer operations in the Provinces of Atacama, Coquimbo, and Antofagasta.

TABLE 7.—Gold production in 1961 by provinces and mine size groups

(Troy ounces)

Province	Major mines	Medium mines	Small mines	Total
Atacama	13,946	2,153	12,789	28,888
Coquimbo		6,008	6,716	12,724
Antofagasta	6,105		1,124	7,229
O'Higgins	4,467	1,381		5,848
Others		1,446	354	1,800
Total	24,518	10,988	20,983	56,489

Iron Ore.—In 1963, iron ore continued to be second only to copper among Chilean mineral commodities in value of production and of

exports. In 1962, it accounted for 11.4 percent of the value of production and 12.05 percent of the value of exports.

Most of the high-grade iron ore deposits are in southern Atacama and northern Coquimbo Provinces, in a well defined belt, inland from the Pacific Coast, and extending 580 kilometers from Taltal to Ovalle.

More than 85 percent of 1963 iron ore production came from three companies: Cía. de Acero del Pacífico, S.A. (CAP), Bethlehem-Chile Iron Mines Co., and Cía. Minera Santa Fe.

Expansion of the Huachipato steel plant together with apparent continuing growth in export markets suggests that output should continue to increase; growth in output to date has not been accompanied by any decline in grade.

TABLE 8.—Major iron ore producers in 1963

Company	Cía. de Acero del Pacífico, SA. (CAP)	Bethlehem-Chile Iron Mines Co.	Cía. Minera Santa Fe
Ownership	The Anaconda Company, Kennecott Copper Corp., W. R. Grace & Co, Koppers Co., and 7,200 shareholders.	Subsidiary of the Bethlehem Steel Corp. (United States).	Minerals and Chemicals Philipp Corp., Canadian Foreign Oil Development Corp., and others.
Main mine	Algarrobo	El Romeral, started in 1955. El Tofo, principal producer until 1957.	Carmen.
Location	Province of Atacama, at Guacolda, near Huasco, in Northern Chile.	Province of Coquimbo, 25 kilometers from La Serena.	Province of Atacama, 50 kilometers from Chañaral.
Reserves	70 million measured tons. (Largest of any Chilean property).	16 million tons measured	Between 8 and 10 million tons.
Production	1962 production was 1,622,000 tons. 1961 was the first year of exploitation (open pit). CAP is primarily a steel producing facility, exporting its Algarrobo production and ore purchased by ENAMI. It does not supply the Huachipato plant with feed, buying it all from Bethlehem at cost. The Algarrobo deposit is proving larger than expected.	1962 production was more than 2 million tons. Both El Romeral and El Tofo are open-pit operations. Romeral provides all the requirements of the Huachipato steel plant, which amounted to almost 700,000 tons in 1962.	Equipped to produce 1 million tons per year (open pit). Carmen has a series of endless belts to move the ore from mine to railroad station at Hermantita. Santa Fe also operated several other small mines and purchased ore from other companies. Combined reserves of Carmen and other mines are estimated at 40 million tons.

Iron and Steel.—More than 90 percent of iron and steel output was from Cía. de Acero del Pacífico, S.A. (CAP). This firm is a highly integrated steel company, possessing or controlling virtually all steelmaking elements either by direct ownership or long-term contracts. Steel-ingot-production capacity was rapidly approaching the target of more than 600,000 tons outlined in the 1962–65 productivity improvement program. In 1962 the Huachipato steelworks of the company, in Concepción Province, had one blast furnace, four open hearths, and several rolling mills. The company also had its own coke plant and pipe mills at another site.

In a joint venture with the Ecuadorans, CAP was forming a new steel company in Ecuador. CAP is investing $400,000 (40 percent of the capital), and will supply the new company with semifinished steel from Chile.

Other Chilean steel producers include Armco (Chile) S.A.I. (a subsidiary of Armco International Corp.), near Huachipato, which

has a new and modern plant with an output capacity of 30,000 tons of grinding balls; and Metalurgicos Indac, S.A., in Santiago, which is equipped with one electric furnace for scrap remelting as well as various rolling mills, and can produce 12,000 tons of crude steel and 18,000 tons of merchant mill products.

Lead.—Lead production in Chile in 1963 was limited to two companies; the Sucesión Federico Blanc, in Coquimbo Province, and Empresa Minera Aisén in Aisén Province.

Exports of raw ores and concentrates in 1963 were mostly to West Germany; a smaller amount was to Belgium.

The lead smelter of Empresa Minera Aisén has not operated since 1959. Metal production since that year has been from the Dos Rios smelter of Sucesión Federico Blanc in Coquimbo Province.

Manganese.—Output of manganese ore in Chile increased 7.7 percent from that of 1962; the country continued to rank third among South American producers, its output being equivalent to about one-third that of British Guiana and virtually inconsequential in comparison with that of first-ranked Brazil. Two companies, Cía. Manganesos de Atacama and Cía. Manganesos de Chile (Santa Fe), provided almost all of the 1963 output in about equal shares, as they have in each year since 1960; various small mines in Coquimbo and Antofagasta accounted for the small remainder. Indicated average ore grade in 1963 was 45.5 percent manganese.

The largest part of Chilean ore output was processed in Chile for the production of ferromanganese and silicomanganese, most of which has been exported to the United States. The production increase in 1963, in part at least, was attributable to a barter arrangement whereby Chile received surplus agricultural products in exchange for ferromanganese.

Mercury.—The downward trend in mercury production continued in 1963, as a result of depletion of high-grade ores. Mercury deposits lie mainly within a narrow strip extending from Copiapo in the north to Illopel in the south. The only active mercury producer in 1963 was the Los Mantos de Punitaqui gold and copper mine in Ovalle, in the Province of Coquimbo.

Molybdenum.—Molybdenite was recovered as a byproduct in the flotation plants of each of the large copper-mining companies. It generally occurs disseminated in the ores in concentrations of 0.03 percent to 0.12 percent MoS_2, but some small vein deposits have been reported. Production in 1963, in metric tons, was as follows, by company: Chile Exploration Co., 1,361; Andes Copper Mining Co., 891; Braden Copper Co., 794.

In 1962, with an export value of more than Escl1 million, molybdenum ranked fourth in value among mineral export commodities. Exports in 1963 went largely to West Germany, the United Kingdom, the Netherlands, and Sweden.

Silver.—Most silver production is a byproduct of the large copper producers, and a minor amount is recovered from refining lead ores.

In the years 1959–63, Chile ranked third behind Peru and Bolivia in South American silver production, but output amounted to only about 5 percent of the total production of the continent.

Zinc.—Since 1950, the largest lead-zinc mine, the Puerto-Cristal property in Aisén Province, has produced more than 80 percent of the lead and zinc.

Empresa Minera Aisén, a subsidiary of CORFO since July 1963, was the only 1963 zinc producer. Output was sent to the Netherlands and West Germany for refining and then returned to Chile.

NONMETALS

Barite.—Production in 1962 and 1963 was distributed among the producers as follows:

Province and producer:	Mine	Production metric tons 1962	1963
Atacama: Sociedad Minera Godoy, Schwenger y Cía.	Copiapo	735	797
Valparaiso:			
Minas y Plantas Pompilio Raggio	Quebrada lo Choapa	180	125
Industria Minera Vassali	Las Mazas	134	97
Total Chilean production		1,049	1,019

Consumers included Empresa Nacional de Petróleo (for drilling mud) and Industrias Bellavista, S.A. (for use in pigments).

The only recorded reserves are about 3 million tons near Caracales, in Antofagasta Province, but no output has been reported from this area in recent years.

Borax.—Fifty years ago, Chile produced 50,000 metric tons of boron minerals per year or about one-half of the world total; however, since 1930, annual production tonnages have been erratic and generally considerably smaller. In 1963 there was only one active producer of borax ore in Chile, the El Loa mine of Borax Consolidated, Ltd., at Ascotán, in Antofagasta Province.

Chilean reserves in known deposits, averaging approximately 30 percent B_2O_3, are estimated to total 10 million tons. They are ulexite-type salina deposits mainly in the provinces of Tarapaca, Antofagasta, and Atacama. Borax is also found in the caliche nitrate deposits where there is an additional reserve of about 19 million tons. The Ascotán reserve is estimated to be 250,000 tons of 27 to 36 percent B_2O_3. This salina, 30 kilometers long and from 3 to 18 kilometers wide, lies in a basin surrounded by inactive volcanos at an elevation of 3,700 meters on the Chilean-Bolivian border. This property has supplied 90 percent of the ulexite mined in Chile.

Cement.—Chile was the fifth largest producer of cement in South America, following Brazil, Argentina, Colombia, and Venezuela. In 1963, output was 8.5 percent of total continental production. The cement plant at Calera, Valparaiso Province, is owned by El Melón Cement Manufacturing Co. and, with a rated capacity of 760,000 metric tons per year, was the largest cement plant in South America. It produced portland, rapid hardening, and white cement. The plant has 8 rotary kilns, and fed with limestone from the underground El Navió mine, 12 kilometers north of the plant.

Cemento Cerro Blanco de Polpaico, S.A., has a plant at Polpaico, about 33 kilometers northwest of Santiago, with an annual capacity

of about 430,000 tons. The plant, has three rotary kilns, used for producing portland and white cement.

Cemento Bio-Bio, S.A., had the smallest but newest of Chilean cement plants. The operation, having a capacity of approximately 132,000 tons per year, is in Huachipato in the Concepción metropolitan area. Portland and iron portland cement was produced from its two rotary kilns.

Clays.—Of the 1963 kaolin output, 18,165 tons was produced by Cemento Cerro Blanco de Polpaico, S.A., 9,677 tons by Cía. Jesus de Irararte y Bernaola of Santa Cruz in Calchogua Province, and the remainder for several smaller producers. Customers for this product in Chile included Cía. Acero del Pacífico, S.A. (CAP), and Refractarios Lota Green, S.A.

Gypsum.—High-grade (90-percent-purity) gypsum, estimated at 300 million tons, occurs in the northern provinces of the country. Reserves of anhydrite are considerably greater; the Salar de Llamara deposit alone is estimated at 825 million tons.

Approxiately 90 percent of the gypsum produced in 1963 went to the construction industry; the remaining 10 percent, to fertilizer producers. Of the quantity consumed by the construction industry, about 30 percent has been used in cement and 70 percent has been calcined for plaster—about half of which was used for wallboard. The two major producers were Cía. Industrial, "El Volcán," at Puerto Alto, and Cía. Industrias de Yeso Romeral.

Iodine.—In 1963, Chile remained the leading producer of iodine, accounting for more than 60 percent of world production, even though output dropped 8.2 percent from 1962. Chile is the only country that recovers iodine as a byproduct of nitrate production.

The Anglo-Lautaro Nitrate Corp. produced 1,992 tons of the 1963 total; independent companies provided the small remainder.

Iodine occurs in the nitrate-bearing caliche beds in concentrations ranging from 0.03 to 0.12 percent. Crude iodine reserves are estimated at 1.3 million tons.

TABLE 9.—Iodine supply position

(Metric tons)

Year [1]	Production	Exports	Apparent consumption and changes in stocks
1958/59	1,108	1,359	−251
1959/60	1,776	1,330	446
1960/61	1,843	1,724	119
1961/62	2,348	2,278	70

[1] Year ended June 30.

Lapis Lazuli.—Cía. Minera Carén in Coquimbo Province operated the only active lapis lazuli mine in Chile. The mine is at an elevation of 4,500 meters, near the Argentine border and only accessible 3 months of the year. The growing hobby of cutting and polishing semiprecious stones in the United States has offered an expanding market for this material.

Limestone.—Most limestone production has come from operations of the two large cement manufacturers, Empresas Industriales El Melón, S.A., in Santiago Province (742,945 tons in 1963), and Cemento Cerro Blanco de Polpaico, in Valparaiso Province (764,472 tons in 1963). A third producer was Cía. Acero del Pacifíco, S.A. (CAP), much of whose output (196,819 tons in 1963) has gone to its steel plant in Huachipato for furnace flux.

No exact data are available on the number of limestone kilns in Chile or on the volume of caustic lime produced. Cerro Blanco operates the biggest kiln with a 35,000-ton yearly capacity.

Limestone reserves in northern and central Chile, total about 300 million tons containing 75 to 80 percent $CaCO_3$, while between Puerto Montt and Cape Horn, there are deposits containing thousands of millions of tons.

Nitrates.—Exploitation of nitrates began in the middle of the 19th century, and for some time thereafter Chile was the principal world source of nitrogen. This continued until the process was developed to make synthetic compounds, using nitrogen from the air.

In 1962, the value of Chilean production of nitrates placed this commodity in third position among mineral products after copper and iron ore, providing 6.31 percent of the total output value. In the same year, exports of nitrates provided 6.5 percent of the value of total exports, again ranking them third after copper and iron ore.

The deposits are in an area 16 to 80 kilometers wide and 700 kilometers long in the northern desert part of the country in the Provinces of Tarapaca and Antofagasta. They are not uniform and range from a few centimeters to several meters in thickness. Reserves of recoverable nitrates have been estimated as high as several hundred million tons.

In 1963, the Anglo-Lautaro, Pedro Perfetti, Iquique, and Victoria nitrate companies were the main producers, the first being by far the largest.

Domestic consumption of nitrates reached almost 20 percent of total production in 1963, compared with only 2.3 percent in 1961.

Phosphates.—*Apatite.*—Commercial deposits of apatite are found in Chile in a belt approximately 240 kilometers by 20 kilometers from Vallenar (on the border of Atacama and Antofagasta Provinces) to just south of Coquimbo.

The sole Chilean producer of apatite is Cía. Salitrera de Tarapaca y Antofagasta, which has operations in Atacama and Coquimbo Provinces. Output of apatite and guano phosphates has not been sufficient to meet domestic requirements for phosphate-fertilizer raw materials, and the quantity of rock phosphate imported is usually greater than domestic production. In 1963, output increased by 10.5 percent from 1962 but was still below tonnages recorded in previous years. Grade averaged 26.5 percent P_2O_5.

Chilean apatite reserves are estimated at 2.5 million tons of 25 to 28 percent P_2O_5 and 3.0 million tons of 10 to 12 percent P_2O_5.

Guano.—All guano production is now limited by law to the activities of the Soc. Chilena de Fertilizantes, Ltda., a government-controlled corporation, organized by Production Development Corp., (CORFO) and the Agricultural Commerce Co.

Annual production increased 38 percent in 1963 to the highest level recorded since 1958. Of the total, 18,248 metric tons consisted of the fossil red type, and the remainder was the white or recent type. Most of this came from the Arica and Iquique zone with a minor amount from the Antofagasta area near Mejillones.

Lazulite.—Records do not indicate any lazulite production for the past few years. The only known Chilean deposit is in the Sierra del Combo, 10 kilometers southwest of Copiapo in the Province of Atacama. It is quite extensive, covering an area of 700 by 1,200 meters, containing an estimated 800 tons of ore, averaging 18 percent P_2O_5, and approximately 300,000 tons, averaging 6 percent P_2O_5.

Quartz.—There were six active quartz producers in Chile in 1963, of which the largest was the Soc. Productora de Cuarzo Tilama at Illapel, in the Province of Coquimbo, which produced 38,376 tons, or 51 percent of the Chilean total.

Salt.—Sodium chloride is abundant and widespread in Chile, occurring in virtually all the solars and nitrate deposits.

Production is apparently governed by domestic needs; no exports are recorded. The largest producer, Punta de Lobos Salt Mining Co., operates several mines in the Solar Grande area, south of Iquique. Another is Fistonic Kinast y Cía., Ltd., whose mines in the Solar de Pintadas produce some 6,000 to 8,000 tons annually.

Chilean resources of salt are considered to be 10,000 million tons.

Sodium Sulfate.—Chile remained a small producer of natural sodium sulfate, having reached a peak in 1947 with a production of 114,142 tons. Even though Chile has produced only for domestic consumption, the years of 1959 through 1963 showed considerable overall gain. Major Chilean consumers include the glass industry, fertilizer producers, and the chemical and paper-products industries.

There are two types of sodium sulfate deposits in Chile: (1) Salinas, containing as much as 80 percent Na_2SO_4, and (2) caliche-nitrate deposits, containing 8 to 10 percent sodium sulfate. All the known deposits occur in the Provinces of Tarapaca and Antofagasta. Reserves are estimated at 300 million tons in the caliche-nitrate beds and 3.5 million tons in the salinas.

There were three producers of sodium sulfate in Chile in 1963. The largest, C. A. Minera Canchones, Ldta., near Iquique, produced 20,210 tons of an unknown grade. The Aguas Blancos Mine, near Antofagasta, produced 6,991 tons with a grade of 88 percent Na_2SO_4; Fistonic, Kinast y Cía. of Iquique produced 5,220 tons.

Sulfur.—Chile was the leading South American producer of native sulfur; its production, which has exceeded 55,000 tons annually, constituted less than 1 percent of world production.

The principal producer of sulfur in Chile in 1963 was Soc. Azufrera Aucanquilcha, S.A., in Antofagasta Province. In 1962, this firm, holding reserves of 5.5 million tons of 48 percent sulfur ore, accounted for 51 percent of total Chilean output. The second-ranked producer, Cía. Azufrera Agricola y Commercial Tacora, S.A., produced an estimated 15,000 tons of sulfur from its deposits in Tarapaca Province in 1962. Reserves in the company mines, all on the flanks of Tacora Volcano, are estimated at 2 million tons of 50 percent sulfur ore. The third-ranked producer in the nation, Soc. Azufrera Borlando y Cía.,

Antofagasta Province, produced 7,680 tons of sulfur from its 2-million-ton reserve of 50-percent sulfur ore on Chutinza Mountain on the Bolivian border.

The Chilean Ministry of Mines lists more than 100 sulfur mines and deposits, with estimated total reserves of 41 million tons having an average sulfur content of 51 percent. The ore bodies consist of native sulfur in bedded deposits with volcanic ash, tuff, pumice, clay, and gypsum.

TABLE 10.—Elemental sulfur supply position

(Metric tons)

Year	Production	Imports	Exports	Apparent consumption
1959	22,020	1,154	961	22,213
1960	31,397	2,198	813	32,782
1961	44,700	6,180	726	50,154
1962	64,242	(1)	641	[2] 60,000
1963	58,789	(1)	(1)	(1)

[1] Data not available.
[2] Estimate.

Talc.—In 1963, there were two active talc operations in Chile; one operated by O. B. Wolf at Corral in Valdivia Province and the other owned and operated by E. Martín. These properties produced 2,488 and 1,067 metric tons, respectively, in 1963.

MINERAL FUELS

Coal and Coke.—Coal showings, mostly bituminous, occur in Chile from Santiago to Magellanes Provinces, but commercial mining in 1963 was limited to the Provinces of Concepción, Arauco, Valdivia, and Magellanes. Of the total output, Concepción produced 1,267,952 tons (bituminous); Arauco, 315,871 tons (bituminous); and Magellanes and Valdivia together, 134,792 tons (lignite).

The last decade has seen a steady decline in Chilean coal production; however, declining opportunity for replacement by other fuels, coupled with increased mechanization and consolidation of properties, should slow this trend. Decrease in output for the last 10 years was about 25 percent.

The 1963 merger of Cía. Carbonífera y Industrial de Lota and Cía. Carbonífera y de Fundición Schwager, S.A., was a major step to put Chile into a more competitive position. These firms together produced about 74 percent of the domestic total.

Coal exports have been insignificant; 1963 imports, all from the United States, totaled 163,024 tons and were used by the Huachipato steel plant for coking purposes.

Metallurgical-grade coke for use in the Huachipato steel plant is produced from Chilean coal blended with higher grade, low-volatile coal imported from the United States. The ratio of imported coal to domestically produced coal is 2 to 3.

Natural Gas.—Natural gas production increased significantly during the years 1959 through 1963. Output in 1963 was 45 percent higher than that of 1962 and 184 percent greater than in 1959. Gas output is expected to continue to rise to meet anticipated increases in demand.

Two refrigerated tank ships are being built to transport liquefied methane, which at the present time is being reinjected due to lack of handling and transporting facilities.

Petroleum.—Active oil exploration in Chile began in the early 1900's. Results of these early studies were not considered sufficiently promising by American and British companies then interested, and activity remained dormant until 1938. The Chilean oil industry was nationalized in that year and placed under the control of the Corporación de Fomento of Chile (CORFO) which initiated an active study program in the Magallanes area that led to discovery of oil at Spring Hill on the main island of Tierra del Fuego.

In 1950, the Government of Chile saw a growing need to consolidate all Chilean exploration and production, and the Empresa Nacional de Petróleo (ENAP) was established as a separate governmental entity. By 1963, technical personnel within ENAP reportedly felt that the rate of discovery of new producing areas had reached a dangerously low point and that the 10-year reserve level could not be maintained. Efforts to improve this situation included exploration drilling near Lebu, 100 kilometers south of Concepción, and testing of sand horizons other than the Spring Hill in the Magallanes area.

The industry has shown production gains during the years 1959 through 1962, despite this low rate of discovery, but output still amounts to less than 1 percent of total South American production. Chile ranked sixth in 1962 after Venezuela, Argentina, Colombia, Brazil and Peru.

All phases of the domestic petroleum industry with the exception of distribution were controlled by ENAP.

A major portion of the crude production has come from the main island of Tierra del Fuego. Data on output by area have been:

	Crude oil production, thousand barrels	
	1961	*1962*
Area:		
Mainland Chile	2,722	5,316
Tierra del Fuego	6,541	6,373
Total	9,263	11,689

The reserves of crude oil of ENAP in the Magallanes area are reportedly 65 million barrels.

The ENAP refinery now under construction at San Vicente Bay, near Concepción, will cover domestic requirements for refinery products when it comes on stream in 1965. It is being built at a cost of approximately US$30 million and is designed to process approximately 35,800 barrels per day.

The mainstay of Chilean refinery production has been the Concon Refinery, in the Province of Valparaiso. Built in 1954, it had a capacity of 44,000 barrels per day in 1963.

ENAP operates a 1,200-barrel-per-day topping plant at the Manantiales field to supply gasoline, kerosine, and diesel fuel to the Magallanes Province. The field also has a compressional absorption plant, which treats approximately 63,450,000 cubic feet of gas per day.

The Cullen gas plant, at the Cullen field, on the island of Tierra del Fuego went on stream to process natural gas in March 1962. It can treat about 98 million cubic feet of gas daily, and also produce

propane, butane, and natural gasoline. It is being used for stabilization of crude and repressuring of the field.

Chilean refineries have operated primarily on domestic crude, but substantial imports have proved necessary, as shown in the following distribution by origin of refinery runs to stills:

	Runs to stills, thousand barrels		
Source of crude:	*1960*	*1961*	*1962*
Domestic fields	6, 856	8, 321	11, 366
Imports	3, 585	3, 434	4, 239
Total	10, 441	11, 755	15, 605

The Mineral Industry of Colombia

By Walter C. Woodmansee [1]

MINERAL production was characterized by a large and growing petroleum sector, small but diversified output of industrial minerals, and limited coal and metals output. Oil and gas production has expanded steadily in recent years as newly productive fields have been developed. About 60 percent of the crude oil produced has been refined in Colombia; the remainder has been exported chiefly to the United States and western Europe. Petroleum refinery capacity continued to expand, and further growth has been scheduled. Exploration and development drilling continued to enlarge domestic petroleum resources.

Colombia remained the only important source of gem emeralds, producing about 95 percent of the world total. The only other commodity in which Colombia has been a significant world producer is platinum, output of which ranked the country fourth, after the Republic of South Africa, Canada, and U.S.S.R.

The 1962 mine production, excluding petroleum and natural gas, was valued at more than Col$715 million (US$81 million).[2] Crude oil, natural gas, and petroleum refinery products probably accounted for an additional Col$2,000 million in value of mineral extraction. The extractive industries contributed an estimated 3.5 percent of the gross national product.

Mineral development in Colombia has been hindered by poor access to large parts of the country and a lack of incentives for mineral exploration, mainly due to available supply of most commodities on world markets. Nearly all mineral investigations have been confined to the west and northwest parts of the country—comprising the Andean mountain ranges, intermontane valleys, and coastal lowlands, which constitute about 45 percent of the total land area. The plains and remote tropical jungles of the east and southeast, relatively unimportant economically at present, have not been investigated for mineral deposits to any great degree.

Nearly all the population, transportation facilities, mineral exploration and extraction, and manufacturing are restricted to the west and northwest portion of the country. Exploration has not been extensive in large parts of this region, which is considered favorable for mineral investigations and potential economic deposits. High-grade as well as marginal ore deposits have been discovered in the

[1] Foreign mineral specialist, Division of International Activities.
[2] Based on average free rate of Col$8.83 (pesos) per US$1 (dollar) for that year.

mountainous areas, but the cost of access, exploration, and development have discouraged investment.

TABLE 1.—Value of mineral production in 1962

Commodity [1]	Value 1,000 Col$ [2]	Commodity [1]	Value 1,000 Col$ [2]
Metals:		Gypsum	9,130
Gold	124,983	Lime	7,650
Iron ore	37,400	Limestone	16,000
Lead concentrate	1,010	Magnesite	10
Platinum	6,776	Marble	650
Silver	847	Quartz, quartzite, and industrial sand	1,875
Zinc ore	387	Salt	29,367
Total	171,403	Sulfur	4,082
Nonmetals:		Talc	195
Barite	1,940	Total	328,332
Cement	215,745	Mineral fuels:	
Clays:		Coal	165,000
Kaolin	4,200	Coke	50,400
Other industrial clay	33,750	Total	215,400
Diatomite	45	Grand total	715,135
Dolomite	322		
Emeralds	1,821		
Feldspar	1,550		

[1] Does not include petroleum and petroleum products.
[2] The Colombian peso (Col$) is equivalent to US$0.113 (US$1.00=Col$8.83).

GOVERNMENT POLICIES AND PROGRAMS

The Mining Code, adopted in 1887, has been modified and implemented by numerous subsequent amendments and decrees. A new code, better suited to serve the mining industry and the Government, has been proposed and was under consideration in 1963. According to existing laws, any individual qualified under the Mining Code to acquire dominion or ownership of a mine had full rights for mineral prospecting and development, with certain restrictions regarding proximity to dwellings, cutivated areas, and types of mines. The State maintained exclusive ownership of salt mines, sea salt, and a national reserve—including alluvial mines along navigable rivers for 1 kilometer on each side. Mining on these and other State lands has been permitted by concession or by other contract. Other lands may be claimed and exploited subject to terms of the Mining Code and its supplements and amendments. Emeralds, also excluded from the general provisions governing mining claims and concessions, may be worked under permit with governmental inspection. The Banco de la República had authority over the salt mines and some of the emerald mines. During 1962, 162 mineral contracts and 45 permits were in force.

The National Government recently adopted a new mineral policy designed to encourage mineral resource development. This new policy included the following proposals: (1) Increased investigations for mineral deposits, including exploration, development, and marketing; (2) greater governmental financial and technical assistance and foreign technical assistance, credit, and capital; and (3) revision of existing mining laws to simplify and expedite the issuance of mining permits and concessions and to stimulate mineral development.

Ministerio de Minas y Petroleos collaborated more effectively with the departmental governments and with private operators in 1963. In addition, foreign technical assistance programs were initiated. The French Government assigned a phosphate specialist to Colombia for 6 months during 1963 to study phosphate deposits and recommend procedures for further studies and development of deposits. The French also planned an aerial photo and ground survey of a 50,000-square-kilometer area considered favorable for mineral deposits.

Technical assistance from West Germany was expected during 1964. As planned during 1963, the German Mission, including a geologist, mining engineer, and test-hole driller, would initially study coal deposits in the Departments of Magdalena, Norte de Santander, and Guajira and, during a second stage, determine coal reserves and commence mine development.

Through an agreement between the U.S. Agency for International Development (AID) and the Colombian Ministry of Mines and Petroleum, a US$4.5 million, 4-year mineral survey was started during the year. Approximately 70,000 square kilometers are to be mapped and studied in the northern, central, and western parts of the country, including the Santa Marta area (Department of Magdalena), central Antióquia, northern Caldas, and parts of Santander, Norte de Santander, Boyacá, and Cundinamarca Departments. AID was to finance US$2 million on a low-interest, 40-year loan. Near yearend, the Ministry issued bid specifications for the mineralogical-geological survey to 11 selected American geological-engineering firms. A geologist from the U.S. Geological Survey was to be assigned as project manager, and a Colombian Technical Advisory Committee was to be appointed by the Ministry to advise the project manager and to review the progress of the program.

The Ministry also has proposed to the Congress the establishment of a Corporación Minera Nacional to encourage and coordinate capital investments in the mining industry. This agency would permit the organization of mixed domestic and foreign capitalized companies for mineral development, exploitation, processing, transportation, and marketing.

A revised bill concerning the newly proposed Mining Code was submitted late in the year and was expected to receive committed study in 1964. Several laws, decrees, and resolutions covering mines and mining activities have been passed since 1960. Some are of a temporary nature. Law 10, a petroleum law passed by the Congress in March 1961, established new royalties and depletion allowances for certain areas, permitted other foreign oil companies to enter the industry of the country, and modified the size of contract areas, exploration periods, rental and work obligations, and duration of concessions. Decree 197 of June 1961, established significant tax exemptions on the mining, chemical, and iron and steel industries as an aid in general economic development.

The National Government had the responsibility for granting concessions to private companies for petroleum exploration and exploitation. It also was involved more directly in the petroleum industry as the largest producer of crude oil and refined products, through the

State-owned petroleum company, Ecopetrol (Empresa Colombiana de Petroleos). Petroleum exploration has been permitted free on State lands, but for private lands, notice must be given to the landowner, who is compensated for damages. Under the Petroleum Code adopted in 1960, surface fees and royalties were increased. Oil operators were granted certain tax exemptions and depletion and amortization allowances. Helium or other rare gases discovered became a national reserve. The Ministry may decree any expropriation necessary for the development and welfare of the industry.

SOURCE MATERIAL

All statistical data were derived from official publications of the Departmento Administrativo, Nacional de Estadistica; the Ministerio de Minas y Petroleos; Banco de la República; and the Ministerio de Fomento. U.S. Embassy dispatches from Bogotá also provided useful information.

PRODUCTION

The mining and processing of metallic and nonmetallic minerals has been limited to relatively few commodities, despite the wide diversity of mineral occurrences in the country. The principal metals produced were gold and iron and steel. The Aceriás Paz del Rio, the only fully integrated iron and steel plant in the country, continued to dominate the iron and steel industry. Other iron and steel companies have small-capacity furnaces or mills, and serve local areas. Gold, platinum, and silver were produced by South American Gold and Platinum Co. (New York) and by numerous small placer operations.

A few base metals were produced in small quantities. Juval, Ltda., Bogotá (Department of Cundinamarca) made castings and finished products of zinc, copper, tin, aluminum, and their alloys from imported nonferrous ingots and semimanufactures. Several aluminum mills produced rolled and extruded products. Some of the iron and steel firms also made specialized nonferrous products. Most of the metal supply has been imported, but small quantities of domestic scrap have been generated in smelting and milling operations.

Production of most nonmetallic mineral commodities remained on a par with 1962 or showed some improvement. Output of cement, by far the most important industrial mineral commodity in terms of value of product, continued to expand during the year. The salt industry showed little change from 1962, but expansion appeared necessary to provide salt for a growing chemical industry. Mining of emeralds, another important commodity, has encountered difficulties in recent years, but output increased in 1963—owing to improved mining techniques.

Available data indicate that production of most mineral fuels expanded further during the year, principally crude oil and processed natural gas. Preliminary figures for petroleum refinery products, showing a decline during the year, may be incomplete. The refineries apparently operated at full capacity, and plans were made for needed additional capacity.

TABLE 2.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Antimony concentrate	40	60	--	--	30
Chromite	50	70	185	140	110
Gold, thousand troy ounces	398	434	401	397	325
Iron and steel:					
Iron ore, thousand tons	405	655	676	680	695
Pig iron and ferroalloys, do.	145	185	190	[2] 200	202
Steel ingots and castings, do.	109	157	176	137	199
Lead concentrate	967	1,070	1,290	670	500
Mercury, 76-pound flasks	95	149	191	--	3
Platinum:					
Placer, thousand troy ounces	18	21	20	14	23
Refined, do.	--	--	17	12	19
Silver, refined, do.	103	134	128	132	106
Zinc:					
Concentrate	1,200	2,300	2,200	431	600
Slab	--	540	1,250	194	--
Nonmetals:					
Barite	10,000	7,300	10,226	8,000	10,500
Cement:					
Portland, thousand tons	1,356	1,447	1,572	1,725	1,810
White, do.	18	19	20	21	25
Total, do.	1,374	1,466	1,592	1,746	1,835
Clay:					
Kaolin, do.	15	20	50	70	75
Construction, do.	--	--	320	350	[3] 360
Other, do.	--	--	90	105	[3] 100
Diatomite	300	400	300	150	2,200
Dolomite	1,400	2,000	2,000	2,680	5,100
Emeralds:					
Gem, thousand carats	61	39	38	51	51
Morralla, do.	119	53	89	294	2,004
Feldspar, thousand tons	15	15	15	16	13
Gypsum, do.	70	70	75	83	10
Lime, do.	75	80	82	85	97
Limestone, do.	2,550	2,700	2,950	3,200	3,400
Magnesite	--	--	100	100	250
Marble, cubic yards	--	196	262	850	[3] 800
Quartz, quartzite, industrial sand, thousand tons	--	--	118	125	[3] 130
Salt:					
Terrestrial, do.	213	235	267	266	263
Marine, do.	57	68	70	39	34
Total, do.	270	303	337	305	297
Sulfur, do.	9	9	10	10	13
Talc	--	350	550	650	650
Mineral fuels:					
Coal:					
Bituminous, thousand tons	2,500	2,600	2,800	3,000	3,200
Coke, do.	344	330	325	360	400
Gas, natural, gross production, million cubic feet	83,720	82,562	78,775	78,424	[2] 67,000
Gas liquid, natural, thousand 42-gallon barrels	909	699	649	360	359
Petroleum:					
Crude, do.	53,574	55,770	53,247	51,908	60,343
Refinery products:					
Gasoline, aviation, do.	458	521	537	601	721
Gasoline, motor, do.	8,173	9,280	11,009	10,938	10,380
Jet fuel, do.	24	44	121	174	[3] 170
Kerosine, do.	1,628	1,623	1,596	1,856	1,810
Distillate fuel oil, do.	3,255	3,327	3,767	4,040	4,019
Residual fuel oil, do.	9,386	9,567	8,892	10,478	9,176
Lubricants, do.	99	94	118	137	133
Liquefied petroleum gas, do.	225	250	279	322	[3] 350
Bitumens, do.	310	336	314	424	338
Other, do.	687	726	1,052	989	[4]
Total, do.	24,245	25,768	27,685	29,959	[4]
Fuel gas, do.	[4]	626	610	591	[3] 600
Petroleum coke, do.	[4]	543	540	514	[3] 520

[1] In addition to commodities listed, the following also have been produced: Calcite (774 tons in 1963), mica (10 tons in 1963), and nitrogenous fertilizer ingredients. Certain 1963 figures are preliminary and subject to change.

[2] Final figure, supersedes that given in commodity chapter, volume 1.

[3] Estimate.

[4] Data not available.

TRADE

Total exports of metals and minerals exceeded imports by Col$32.1 million in 1962. Crude petroleum was responsible for this favorable trade balance, accounting for nearly 90 percent of value received from metal and mineral exports.

Colombia continued to import a wide variety of metals and minerals, most in small quantities for limited domestic requirements. Imports of iron and steel mill products accounted for half the total value for all metals and minerals. Receipts of motor and aviation gasoline and lubricants, the only petroleum products imported in large quantities, continued high.

TABLE 3.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal destination	Value (1,000 Col$) [1]
Metals:				
Mercury---76-pound flasks	121			
Platinum, ingots, troy ounces	20,232	14,100	All to United States	6,777
bars, powder and scrap.				
Uranium and other radioactive minerals.	3			
Other ores and minerals	8	(2)	Italy	
Other metals including scrap	21	94	United States 70	105
Total value of metals				6,882
Nonmetals:				
Cement---thousand tons	205	169	Puerto Rico 83; Costa Rico 36; United States 37.	13,866
Other minerals	66	14	All to Venezuela	4
Total value of nonmetals				13,870
Mineral fuels:				
Coal	48	246	All to Venezuela	26
Coke	102	178	---do	17
Petroleum:				
Crude thousand 42-gallon barrels.	27,530	24,311	United States 9,001; Netherlands 5,244; Trinidad and Tobago 4,898; United Kingdom 3,386.	422,401
Refinery products:				
Gasoline, motor---do	247			
Gasoline, aviation barrels	1,131			
Distillate fuel oil thousand 42-gallon barrels.	2,623	3,894	Peru 1,918; Netherlands Antilles 512; Jamaica 422; United States 356; Panama 199.	50,213
Residual fuel oil barrels		20,113	All to United Kingdom	500
Lubricants---do		1	All to United States	2
Total value of mineral fuels.				473,159
Total:				
Value of metal and mineral exports.				493,911
Value of all exports				3,094,675
Metals and minerals share in total exports. percent				16.0

[1] The Colombian peso (Col$) is equivalent to US$0.113 (US$1.00=Col$8.83) at 1962 average free exchange rate.

[2] Less than 1 ton.

TABLE 4.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (1,000 Col$) [1]
Metals:				
Aluminum:				
Bauxite	4,524	6,082	British Guiana 6,015	1,530
Alumina	461	345	United States 293	635
Ingots and castings	3,511	4,808	United States 2,729; Canada 1,940	17,147
Semimanufactures	766	737	United States 535; West Germany 113.	6,831
Antimony, alloys, crude	26	40	China 16; United States 15	178
Copper:				
Ingots, anodes, and bars	61	164	United States 49; Mexico 32; Chile 30 United Kingdom 26.	805
Semimanufactures	2,851	2,940	United States 1,894; Mexico 224; Belgium-Luxembourg 218.	17,120
Alloys:				
Ingots and castings	50	20	United States 9; United Kingdom 6.	204
Semimanufactures	1,534	1,266	Canada 307; United States 279; Finland 161.	9,040
Gold, ingots, bars, troy ounces powder, and scrap.	8,879	----------	----------	----------
Iron and steel:	----------	133	All from Norway	56
Iron ore	----------	9	All from United Kingdom	7
Pig iron	15	4,955	Largely from Sweden	3,193
Ingots, blooms, billets, and slabs.	2,141	1,884	Republic of South Africa 800; Canada 382; United States 270.	2,468
Ferroalloys	(2)	370	United States 270; Netherlands Antilles 100.	162
Scrap				
Semimanufactures	thousand tons 157	165	Japan 35; United States 35; West Germany 33; France 18; Belgium-Luxembourg 16.	230,545
Lead:				
Ingots and bars	1,223	233	Netherlands 81; Denmark 53; United States 38.	719
Semimanufactures	98	10	Netherlands 9	22
Magnesium metal and alloys, crude.	(2)	7	Canada 5	51
Mercury	76-pound flasks 28	89	United States 57; Mexico 20; United Kingdom 7.	145
Nickel:				
Ingots and anodes	30	34	United States 26; Canada 5	567
Castings and forgings	150	45	All from West Germany	561
Semimanufactures	51	65	West Germany 29; United States 20; Canada 12.	1,279
Platinum, ingots, troy ounces bars, powder and scraps.	1,297	950	All from United States	158
Silver:				
Ingots, bars, powder and scrap.	do 36,041	25,238	do	140
Semiworked	do 18,808	14,275	United States 13,632; West Germany 643.	38
Tin:				
Ingots, including alloys.	long tons 201	187	United States 44; West Germany 39; United Kingdom 36.	3,030
Semimanufactures	do 2	5	United Kingdom 2; West Germany 2.	82
Zinc:				
Slab, plates and pellets	732	1,243	United States 520; Canada 465; Belgium-Luxembourg 100; Netherlands 100.	2,223
Castings and forgings	54	46	United States 32; India 12	320
Scrap	29	----------	----------	----------
Semimanufactures	487	363	United States 199; Spain 100	1,308
Other ores and minerals	1,044	3,231	West Germany 2,253; United Kingdom 870.	2,416
Other metals and alloys	57	10	United States 6; Sweden 2	135
Total value of metals	----------	----------	----------	303,165

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal destination	Value (1,000 Col$) [1]
Nonmetals:				
Abrasives	116	169	United States 74; West Germany 65.	246
Asbestos, crude	10,262	11,084	Canada 9,778; Republic of South Africa 952.	18,380
Barite and witherite	9	10	Mainly from West Germany	9
Borax, refined	387	626	United States 618	595
Cement	253	4,037	Venezuela 3,694; West Germany 237.	917
Clays:				
Bentonite	2,338	2,375	United States 2,351	1,239
Kaolin	2,240	3,127	United States 2,684; United Kingdom 408.	1,741
Other refractory	633	890	United States 845	565
Cryolite	4	9	Denmark 3; Norway 3	20
Dolomite, calcined	4,681	2,647	France 2,002; Belgium-Luxembourg 600.	1,198
Feldspar and fluorspar	247	302	United States 230; West Germany 63.	180
Fertilizers and fertilizer raw materials:				
Nitrogenous:				
Sodium nitrate	30	390	Chile 380	195
Ammonium nitrate	1,016	833	Italy 394; United States 328; Belgium-Luxembourg 99.	567
Phosphatic:				
Phosphate rock	3,401	8,322	All from United States	2,395
Superphosphates	4,421	4,207	United States 8,948; Netherlands 5,259.	6,417
Potassic:				
Potash, crude	145			
Potassium chloride	14,907	15,943	West Germany 6,773; United States 5,072; France 3,999.	5,818
Potassium sulfate	3,770	1,799	West Germany 849; France 550; East Germany 400.	816
Graphite, crude, including artificial.	77	40	United States 37	106
Gypsum:				
Crude	2,531	3,523	Dominican Republic 3,500	179
Calcined	512	596	United States 595	424
Infusorial earth	1,051	1,440	United States 1,434	1,318
Lime	48	22	All from United States	10
Magnesite	49	19	United States 8; Austria 5; West Germany 5.	28
Mica, crude	178	193	United States 185	239
Mineral pigments	149	45	Spain 27; United States 18	68
Sand:				
Silica and ground quartz	231	455	United States 450	142
Other	724	319	All from United States	102
Slate	239	151	Portugal 133	162
Stone, building and monumental	711	869	Italy 405; France 260; Belgium-Luxembourg 196.	486
Sulfur:				
Crude		4,372	United States 2,491; Mexico 1,881	987
Refined	97	477	United States 470	395
Talc and steatite	992	1,128	United States 684; Italy 370	834
Other minerals	831	1,122	United States 1,048	1,121
Total value of nonmetals				47,899

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal destination	Value (1,000 Col$) [1]
Mineral fuels:				
Coal, anthracite	18			
Coke	50	23	All from United States	38
Asphalt, natural	9	7	---do	15
Petroleum:				
Crude and 42-gallon barrels partially refined.	7,510	9,539	United States 8,234; Netherlands 684.	2,089
Refinery products:				
Gasoline, thousand 42-gallon barrels motor.	974	1,462	Netherlands Antilles 1,448	28,601
Gasoline, aviation do	155	117	Netherlands Antilles 117	5,399
Kerosine and jet fuel do	48	3	Mainly from Venezuela	106
Distillate fuel oil do	229	9	do	185
Residual 42-gallon barrels fuel oil.	1,538	(4)	All from United States	
Lubricants thousand 42-gallon barrels	240	245	United States 222; Netherlands Antilles 16.	50,100
Other [5]	29	24	United States 14; East Germany 5	24,802
Total value of mineral fuels.				111,335
Total:				
Value of metal and mineral imports.				462,399
Value of all imports				3,683,632
Metals and minerals share in total exports. percent				12.5

[1] The Colombian peso (Col$) is equivalent to US$0.113 (US$1.00=Col$8.83) at 1962 average free exchange rate.
[2] Data not available.
[3] Less than 1 ton.
[4] Less than 1 barrel.
[5] In tons as reported.

COMMODITY REVIEW

METALS

Aluminum.—Imports continued to be the sole source of aluminum supply. Receipts of bauxite and ingot aluminum increased appreciably during 1962. Bauxite, together with alumina, apparently was utilized for nonmetals industry applications, whereas the ingot and semimanufactures were processed by several rolling and extrusion mills and numerous small shops.

Antimony.—Small mine output of stibnite has been reported intermittently during recent years. Small but growing industrial demand for antimony compounds and alloys has been met largely by imports. Mineral occurrences are known in the Departments of Antióquia, Caldas, Tolima, Cauca, Nariño, Huila and Boyacá, but high local production and transportation costs and relatively low world prices have offered little incentive for development.

Chromite.—The limited production of chromite has been from a single small mine near Medellín in Department of Antióquia. Most has been absorbed in ferroalloys or has entered the export market.

TABLE 5.—Aluminum rolling and extrusion mills, 1963

Company	Location	Products	Remarks
Aluminio Alcan de Colombia.	Cali (Valle)	Sheet, extruded	Alcan affiliate. Rolling-mill production in 1963 after 2 years in construction; capacity 2,200 tons sheet annually. Extrusion section production in 1961; capacity 700 tons. Ingots received from parent company.
Aluminio de Colombia Reynolds, Santo Domingo, S.A.	Barranquilla (Atlantico).	Sheet, foil, tubes	Reynolds Aluminum Co. affiliate. Capacity 2,500 tons. Largest importer of ingot; sells to most other local plants. Both hot and cold rolling.
Industrias Consolidada	do	Extruded	Alcoa affiliate. Capacity 1,800 tons.
Matrini y Caridi, Ltda.	do	Extruded, tubes	Plant constructed 1961.
PERFALCO—Perfiles de Aluminio y Cobre, Ltda.	Cali (Valle)	Extruded	Other light metals also milled.
Vernig	Bogotá (Cundinamarca).	do	None.

Copper.—Colombian copper supply has been provided by imports of the crude and semimanufactured metal and alloys, which during 1962 were increased for the metal and lowered for the alloys. There are copper deposits in several areas, notably the Departments of Magdalena and Guajira, but there has been no reported mining activity. CAMAGRA, a U.S. firm formed by W. R. Grace & Bunker Hill Mining Co., investigated these deposits in 1961 but apparently did not find minable ore.

Copper wire and cables were produced from imported rods by FACOMEC (Fábrica Colombiana de Materiales Eléctricas), a company partly owned by the Phelps Dodge Corp. and Cables Colombiana, Ltda.

Gold.—Gold output, which has been declining since 1960, fell 18 percent during 1963, and values decreased from US$14.2 million in 1962 to US$11.4 million in 1963. Although this output is only about 1 percent of the total world production for the year, Colombia remained the largest gold producer in South America, having an output almost double that of second ranked Brazil.

Production totals are only rough estimates; considerable quantities of gold as well as silver and platinum are contrabanded, leaving the country by means other than through the Bank of the Republic to avoid a 15-percent export tax. South American Gold & Platinum Co. (New York) produced about 60 percent of the total reported output, principally through four subsidiary and affiliated companies—Pato, Frontino, Chocó and Nariño. The Frontino deposit in northeast Antióquia is the only vein type; the others are dredging operations.

In February 1961, the Banco de la República, the sole official buyer of domestic gold, had anounced new purchasing provisions by which an increase in pesos was paid to large producers. Payment was made 25 percent in dollars and 75 percent in pesos. In 1963 the Bank permitted a free market on gold, with no restrictions, from placers in Antióquia, Caldas, Cauca, Chocó and Nariño. The general price was US$35 per troy ounce, but much gold moved clandestinely.

Iron and Steel.—All phases of production showed continued improvement during the year of review. Output of crude steel was 45 percent

higher after the 1962 cutback. Imports of most types, especially finished steel, also increased with growing domestic demand.

TABLE 6.—Production of gold and silver by company, 1962
(Troy ounces)

Company	Gold	Silver
Pato Consolidated Gold Dredging	100, 524	10, 109
Frontino Gold Mines, Ltd	82, 373	73, 753
Nóvita Mines Corp	27, 168	4, 146
Minera de Nariño	17, 156	2, 250
Chocó Pacífico	15, 330	1, 854
Medium and small mining operations	154, 276	39, 487
Total	396, 827	131, 599

The industry remained centered around the largest iron ore deposits in the country at Belencito in Department of Boyacá, where Aceriás Paz del Rio, S.A., produced about 90 percent of the crude steel in 1962. Commencing in that year, the iron and steel industry has been emphasized in plans for economic growth. In the General Plan for Economic and Social Development, crude steel production of 270,000 tons and domestic consumption of 420,000 tons were envisioned by 1964. A program submitted to IBRD (International Bank for Reconstruction and Development) in 1962 had called for an increase in crude steel capacity at Paz del Rio from the existing 120,000 tons to 550,000 tons by 1968.

A press report during 1963 announced plans for a new natural gas-fired sheet-rolling mill at Barranquilla (Atlantico) and a new company, Siderúrgica del Caribe, established by a group of Colombian industrialists. This project was approved by the Consejo Nacional de Política Económica y Planeación. Initial scheduled production was 76,000 tons of finished steel per year, mostly plate and tinplate. Investment of US$45 million was anticipated, with the Export-Import Bank providing a loan of US$30 million.

The Council also approved the IBRD-financed expansion program for Aceriás Paz del Rio, S.A., although complete details were not made public during the year. The program was to be implemented in three stages, the first two starting in 1963 if approved by IBRD, at an initial cost equivalent to US$25 million in both local currency and foreign funds. As part of the first stage, ingot capacity was scheduled for increase from 140,000 to 220,000 tons, a 300-ton-per-day, hot-rolling mill was to be constructed, blast furnace capacity was to be expanded to 1,000 tons per day, and a second blast furnace was planned.

Lead.—Much of the limited production of lead concentrates has been a byproduct of Frontino gold-mining operations in the Department of Antióquia. All or most of these concentrates have been exported. In 1961 Frontino sent 313 tons of concentrate to the American Smelting & Refining Co., at Selby, Calif., for smelting, refining and reexport to Colombia.

Small galena deposits scattered throughout the country also have yielded small quantities of lead. Although pig-lead production has not been reported, a few hundred tons appear to have been produced annually by four or five small smelters.

TABLE 7.—Iron and steel plants, 1962

Company	Location	Remarks
Acerías Paz del Rio, S.A.	Belencito (Boyacá)	Only integrated plant in country. 850-ton-per-day blast furnace; three 20-ton basic Bessemer converters; one 15-ton electric furnace; roughing mill; structural mill; other mills; wire plant. New plate and sheet mill, 1962; capacity, 50,000 tons. 43 coke ovens. Products: merchant bars, structural steel, shapes and sections, rails and wire. Produced 127,800 tons ingot steel, exceeding theoretical plant capacity of 120,000 tons. Ore is Tertiary oolitic hematite, 2 to 6½ meters thick, average 48 percent Fe, 1 percent P_2O_5. Reserves adequate for many years; one estimate, 50 million tons proved and probable, similar tonnage in possible category.
Empresa Siderúrgica de Medellín.	Medellín (Antióquia)	Mill producing reinforcing rods, tubes, and rail wheels. Receives ingots from Paz del Rio. Some secondary production.
Siderúrgica del Muña	Soacha (Cundinamarca)	Subsidiary of Medellín. Uses scrap and Rio products, makes structural shapes, angles, tube joints; planned galvanizing plant for tubes. Also iron and special steel products.
Siderúrgica Corradine	Pacho (Cundinamarca)	Two 15-ton-per-day blast furnaces for reducing local iron ore; scrap furnace; few finished products. Ore and limestone from Guayogue; coking coal from La Vieja mine near Pacho.
Siderúrgica de Tibirita	Tibirita (Cundinamarca).	One 20-ton-per-day blast furnace, 6 to 10 tons of gray iron daily. Uses nearby raw materials.

Magnesium.—Magnesium has been extracted from dolomite (12 percent Mg) near Amalfi in the Department of Antióquia. Discovery of other deposits has been reported from time to time, but, insofar as known, no development has been done. Domestic consumption has been very small, a few tons of the imported crude metal and alloys apparently satisfying annual requirements.

Mercury.—Reported production of mercury, appreciable through 1961, was principally from the area of Aranzazu (Caldas). Pato Consolidated Gold Dredging Co. reportedly worked these deposits but withdrew because the operation was unprofitable.

Numerous occurrences of cinnabar have been reported, mostly in the central range of the Colombian Andes.

Nickel.—The Hanna Mining Co. (United States) reportedly conducted a geologic study of nickel-bearing laterites in northern Colombia during 1962, but results of the investigation are not known. The limited demand in the country continued to be met by imports of the crude metal and semimanufactures.

Platinum.—Output of platinum has been from the gold placers of the Department of Chocó, operated by Compañía Minera Chocó Pacífico. This company annually recovers about 15,000 to 20,000 troy ounces, and it had five dredges working during the year. The United States apparently has been the sole market for platinum leaving the country via the Banco de la República.

Silver.—Silver production also is a byproduct of gold placer mining, primarily in the Department of Antióquia, which accounted for about 85 percent of the 1963 output. This production was valued at US$76,030, compared with US$95,700 in 1962.

Uranium.—No production of uranium minerals and other radioactive minerals has been reported, but about 2,000 tons of uranium ores was mined in the region of California, Department of Santander,

in 1961, and a few tons of concentrate have been exported in recent years. Mine operator was Compañía Minera de Uranio (MINURANIO). Exploitation terminated in 1962 because of marketing difficulties in the Western Hemisphere. Uranium deposits are also known in other parts of the Department of Santander, as well as in the Cauca Valley (Department of Cauca).

All uranium and thorium deposits in the country have been considered as part of the national reserve, exploitable only by the Government or under contract with the Government. All industrial activity from mine development to distribution has been a public utility. The Instituto Colombiano de Asuntos Nucleares, created in 1955, later became the Comisión de Energía Atómica de Colombia.

Zinc.—There was no output of slab zinc in 1963, because ore and scrap supply was exhausted. The 1960–62 production was at the plant of Metales y Productos Afines, S.A., Bogotá—first electrolytic smelter in Colombia. Total annual capacity was 2,500 tons of slab zinc and several thousand tons of zinc oxide. The ore was produced at Junin, 48 kilometers east of Bogotá. Other possible sources of zinc are the Frontino Gold Mines in Antióquia, where zinc occurs in the tailings, and the Caluranio uranium concession at California (Santander), where considerable zinc is associated with the uranium ore.

NONMETALS

Asbestos.—Production of asbestos has not been reported in Colombia in recent years, although four exploration and mining concessions were granted during 1960. Deposits of chrysotile exist in the Department of Antióquia. Others have been reported in the Departments of Nariño and Caldas and at scattered localtities in the central Cordillera.

Barite.—Production of barite, averaging about 10,000 tons annually, appears sufficient for domestic consumption, which is primarily in oil-well drilling. Deposits of commercial value have been reported in the Departments of Santander, Norte de Santander, Magdalena, Tolima, Huila, Cundinamarca, Cauca, Boyacá and Nariño. The centers of production have been the Los Santos (Santander), where reserves in 1962 were reported to total 300,000 tons, and Abrego (Norte de Santander), where the reserve was about 600,000 tons.

Clays.—Clay production has steadily increased in recent years, especially for use in the cement industry, which has expanded rapidly. Tile, brick, and other construction clays are found throughtout the country. Despite of kaolin have been mined in the Department of Antióquia and the savannah of Bogotá. Numerous other kaolin deposits have been located in the central and eastern mountainous regions.

Cement.—About 10 percent of the cement output has been exported in recent years. This exportable surplus may decrease, however, with the high rate of growth of domestic demand in the construction industry. The annual growth rate of production was 5 to 10 percent during 1959–63.

A shortage of supply developed in 1963 and cement companies made plans to invest US$15 million in expansion. This growth has been underway since 1958, when total annual capacity of nine operating plants and two under construction was about 1.8 million tons. By 1960 capacity had increased to 2 million tons, chiefly due to the Cementos Boyacá plant near the Paz del Rio steelworks at Belencito, where 400 to 800 tons of cement were produced daily using a blast furnace slag mixture. In 1962 Cementos del Caribe, S.A., and Cementos Nare, both large producers in the country, announced plans to build a new plant (capacity 100 to 150 tons per day) at Cartagena, where bulk cement could be exported. During 1963 Cementos Boyacá planned expansion to 1,000 tons per day, with new equipment ordered from Denmark. Also, Corporación Financiera Colombiana de Desarrolla Industrial announced plans to finance a new 750-ton-per-day plant at Toluviejo in Department of Bolívar, with production scheduled for 1966; and later in the year plans were revealed for a Cemento del Norte, S.A., plant at Cúcuta in Department of Norte de Santander, which would provide 150 tons per day to the local area.

Diatomite.—The marked increase in output of diatomite was attributed to greater activity at a deposit on the Bogotá plateau, a few miles north of Bogotá (Cundinamarca), where a small processing plant was established. Largest known deposits of diatomite are in the Department of Valle, where a reserve of 50 million cubic meters has been estimated.

Dolomite.—Dolomite output nearly doubled during 1963, owing to mining near Amalfi in Department of Antióquia. Dolomite also has been found at the Muzo emerald mines, north of Bogotá. Production at Amalfi has been hindered by poor transportation facilities; however, roads have been improved to provide better access.

Emeralds.—Reported production of gem-quality emeralds has been shrinking in recent years. The principal reasons for this decline have been the lack of a definite Government policy relating to the mining and sale of these gems in the domestic and international markets, increasing contraband both on local markets and in foreign countries, and limited exploration and discovery of new deposits.

Practically all emeralds in Colombia have been found in an 80-kilometer-wide, northwest-trending belt extending for approximately 330 kilometers from the Vasquez Territory (130 air kilometers north of Bogotá) through Almeida in southwest Boyacá Department. Production continued centered around Muzo and Cosquez in Department of Boyacá, where operations have been under control of Empresa Colombiana de Esmeraldes since 1960, and Chivor in Department of Boyacá, operated by Emeral Mines, Inc., a U.S. firm having a concession in perpetuity from the Colombian Government. The Empresa was organized with Government, private Colombian, and foreign capital, its purpose being to encourage private interest in emerald-mine development. By Decree 1988 of August 1961, a new public corporation, Esmeraldes de Colombia, S.A., was organized to exploit the Muzo and Cosquez deposits on a commercial basis but, as of the end of 1963, this corporation had not been established by law.

The Chivor operation encountered financial difficulties for several years. Administration of the mine was recently reorganized and

placed under supervision of seven controllers, all company members. New mining equipment and open-pit methods were introduced in 1962.

Feldspar.—Deposits of feldspar in pegmatites occur in numerous mountain locations throughout the country. The mineral has been mined by crude methods in the Departments of Antióquia, Norte de Santander, and Tolima. Feldspar also has been imported from the United States for use in the glass industry.

Fertilizers.—Increasing quantities of fertilizers, raw materials, and chemicals for use in manufacturing fertilizers have been imported in recent years. Two large factories have been constructed since 1960 to provide for increased domestic consumption: ICF (Industria Colombiana de Fertilizantes, S.A.) at Barrancabermeja (Department of Santander) and ABOCOL (Abonos Colombianos, S.A.) near Cartagena (Department of Bolívar). The ICF plant, situated in a large oil and gas field, has annual capacity for 15,000 tons of nitrogenous and mixed fertilizers, utilizing ingredients from natural gas. The ABOCOL plant, having daily capacity of 650 tons, has produced nitrogenous fertilizers, utilizing materials from a nearby Intercol Petroleum Co. ammonia and nitric acid plant.

An older plant, that of the Paz del Rio steelworks at Belencito in Department of Boyacá, has annually produced 40,000 tons of ammonia, nitric acid, ammonium nitrate, and urea for agricultural and industrial uses, as well as similar quantities of phosphatic slag, containing 18 percent P_2O_5.

By Decree 987 of April 1962, the Government transferred tariff positions on imported fertilizer materials, removing them from the free list. This apparently was done to protect the growing domestic fertilizer industry.

Gypsum.—Output of gypsum has steadily grown, increasing 23 percent during the year, due mainly to greater demand from cement producers. Domestic deposits, although numerous, are commonly of rather poor quality. They occur between Giradot and Bogotá in southwest Cundinamarca Department; Ibaqué and Rovira, Department of Tolima; Gachalá and Macanal, Department of Boyacá; and on the Guajira Peninsula near the Atlantic coast.

Limestone.—Limestone production has increased at an annual rate of 200,000 metric tons in recent years, largely because of the greater cement output. The Paz del Rio steelworks has mined 400,000 to 500,000 tons annually for fluxing and for other uses. This limestone is not of particularly good quality for steelmaking because of high content of silica, aluminum, and sulfur. There are many deposits throughout the mountainous regions of the country, and reserves appear virtually inexhaustible.

Magnesite.—Until recently, magnesite was imported from West Germany and the United States. Since development of deposits in the Department of Antióquia, however, the country has not relied on imports, and during 1963 it appeared to be in a position to offer limited quantities for export.

Salt.—Production of terrestrial salt continued approximately at the 1961–62 rate at Zipaquirá and Nemocón, both in the Department of Cundinamarca, about 30 miles north of Bogotá. Total salt output,

including marine salt, was valued at US$43.4 million in 1963. Domestic consumption was 224,000 tons in 1962 and 231,000 tons in 1963.

Rock salt at Zipaquirá and Nemocón has been mined by room-and-pillar methods. The salt is processed at Planta Colombiana de Soda, 6 kilometers from the mine, where it is delivered as brine by pipeline and truck. Plant capacity in 1962 was 1,500 cubic meters of brine daily. The rock salt and brine also have been delivered to many small private refineries.

Output of marine-salt evaporite, produced by hand methods along the Caribbean coast of Guajira Peninsula, decreased by 50 percent during 1961–63, mainly because fewer people have been engaged in this activity. A small quantity also was produced at other salinas between Barranquilla in Department of Atlantico and Cartagena in Department of Bolívar.

All rock salt mines, marine salinas, and other salt deposits are the property of the National Government and have been exploited by the Banco de la República, Concesion de Salinas, under agreement with the Government.

In recent years production of salt has exceeded demand for human and industrial consumption in the country. A new chemical plant under construction at Cartagena in Department of Bolívar, which is scheduled for operation in 1966, is expected to use 500 to 600 tons of salt daily, which would necessitate a production increase of about 50 percent during 1964–66.

Sulfur.—Compañia Industrias Puracé has produced all Colombian sulfur in recent years from a deposit at the base of the extinct volcano Puracé, near the city of Popayán, Department of Cauca. The sulfur occurs as impregnations and fracture fillings in porous Pliocene andesite and dacite tuffs. Drilling in 1961–62 revealed four mineralized zones, and reserves were estimated at 6 million tons containing 30 percent sulfur. As of 1963, 10 autoclaves had been installed, and plans were made for expansion of annual production to 18,000 tons.

Imports of crude sulfur were prohibited by the Government to protect domestic industry. Consumption was about 15,000 tons in 1963, largely in sulfuric acid, or 2,000 tons more than was produced. Because of rising demand, the Government licensed imports of refined sulfur with a tariff of Col$200 per ton and a surcharge of 20 percent ad valorem c.i.f., which raised the price of imported refined sulfur to Col$525, approximately that charged by Puracé.

MINERAL FUELS

Coal.—Coal has been one of the chief mineral commodities exploited for domestic consumption in Colombia. Coals range in rank from subbituminous to bituminous and are widely distributed throughout the country. Reserves and potential resources are enormous. Estimates have placed Colombian reserve from 20 to 40 billion metric tons, perhaps greater than the combined total of other South American countries.

Production has gradually expanded with general industrial growth. About 70 percent of the coal output has originated in the Departments of Cundinamarca and Boyacá in recent years. The Paz del Rio

steelworks produced an estimated 600,000 to 800,000 tons of coking coals in 1963 from captive mines. These coals contain excessive ash, and washing has been necessary in preparation of coals for the coke ovens.

Efforts have been made in recent years to interest foreign investment in coal development. Improved inland transportation facilities, port facilities for bulk loading, and mine mechanization would be necessary for any large-scale planned development.

The Instituto de Fomento Industrial investigated the El Cerrejon and Palmarito coal deposits on Guajira Peninsula, near the Venezuelan border, during 1960–61. A report placed proved and probable reserves at 250 million tons of high-volatile bituminous coal, which would require blending with low-volatile coals for coking. Japanese industry has expressed interest in these deposits, but the low-coking qualities may hinder development in the near future.

Coals in the Cauca Valley (Department of Cauca) will be surveyed by AUTECO, a Belgian company acting on a technical mission. The project is sponsored by the United Nations Special Fund and the Colombian Government.

Crude Oil.—Output of crude oil recovered considerably from the decline of 1960–62, mainly due to the new Payoa and Provincia fields in the Department of Santander and the Cúcuta field in the Department of Norte de Santander. Exports continued high during 1962, the latest year for which data are available, although lower by 3 million barrels. Of 98 new wells started, 83 were completed, 10 were abandoned, and 27 were productive in 1962. Nearly 708,000 feet were drilled.

Concession activity remained at a relatively low level in 1962, compared with 1960 when 93 exploration and exploitation agreements were in effect. The main reason for this reduction in activity was the passage of new oil legislation in 1961 and a resulting "wait and see" attitude of foreign oil companies.

TABLE 8.—Operating petroleum companies and their concessions, in 1962

Company	Number in exploration status	Number in exploitation status
Intercol—International Petroleum (Colombia) Ltd.	11	3
Ecopetrol—Empresa Colombiana Petróleos	4	1
Texas Petroleum Co.	14	4
Shell-Condor, S.A.	5	5
Colpet—Colombian Petroleum Co.	1	3
Richmond Petroleum Co. of Colombia	4	----
Magdalena Oil Co.	1	----
Other	2	1
Total	42	17

Late in 1962, two new crude pipelines were brought into operation, both serving the Payoa field. Ecopetrol-Colombian Cities Service completed a 10-inch line, 60 kilometers long, carrying 42,000 barrels per day to the Ecopetrol Barrancabermeja (Santander) refinery. Intercol-Sinclair-British Petroleum completed an 8-inch, 53-kilometer line, having a capacity of 30,000 barrels per day, in Department of

Santander from Provincia to the Andean Pipeline Co. line at Yariri on the Rio Magdalena.

TABLE 9.—Petroleum pipelines in operation in 1962

From	To	Length (kilometers)	Owner
Crude oil lines:			
El Centro	Mamonal	592	Andian National Corp. (Intercol).
Petrolea	Coveñas	409	South American Gulf Oil Co. (Colpet).
Retiro	do	109	Do.
El Difícil	Plato	85	Shell-Condor, S.A.
Casabe	Galán	10	Do.
Cantagallo	Puerto Wilches	3	Do.
Puerto Niño	Galán	180	Texas Petroleum Co.
Do	La Dorado	77	Do.
Anisales	Guamo	34	Do.
Palagua	Velasquez	8	Do.
Aquachica	Puerto Mosquito	18	Intercol.
Totumal	do	19	Do.
Cicuco	El Retiro	16	Colpet.
Violo	Cicuco	16	Do.
Llanitos	Galán	13	Ecopetrol.
Refined products line:			
Galán	Cantimplora	98	Ecopetrol.
Cantimplora	Puerto Berrío	5	Do.
Do	Puerto Salgar	148	Do.
Puerto Salgar	Bogotá	143	Do.
Puerto Berrío	Medellín	182	Ferrocarril de Antióquia.
Buenaventura	Cali	98	Oleoducto del Pacífico.
Natural gas lines: Cicuco	Barranquilla	249	Gas Natural Colombiano, S.A. (Mobil, Texas, Colpet, others).

During 1963 Standard Oil Co. of California awarded a contract to Williams Bros., Tulsa, Okla., for construction of a 10-inch, 480-kilometer crude oil line from its Rio Zulia (Department of Norte de Santander) field to Santa Marta (Department of Magdalena) on the north coast. Work was scheduled to begin late in the year. The Rio Zulia discovery well was completed in 1962; by the end of 1963, 14 wells had been completed, and a productive area of 2,000 acres had been delineated.

Exploration during 1962 was concentrated in the El Roble and El Conchal (Intercol-Sinclair-BP) and the Payoa (Ecopetrol-Cities Service) concessions, all in the middle Magdalena valley, Department of Santander. These operations confirmed extensive deposits discovered in 1960. Colpet discovered a new field in its Cicuco (Bolívar) concession, and Richmond Petroleum Co., after 40 years in Colombia, struck oil in 1961 at its concession near Cúcuta, Department of Norte de Santander. During 1962 Intercol continued development drilling in its fields in the Departments of Cordoba and Bolívar.

Oil was discovered in the Department of Putumayo in southwest Colombia in 1963, and development drilling continued at yearend. The operation was a joint venture of Texas Petroleum Co. and Gulf Oil Corp. Texas held 2.5 million acres of concession in Putumayo. The first wildcat hole on an extensive anticline 48 miles southeast of Pasto, Department of Nariño, was drilled to 6,440 feet and encountered several pay sands. Initial yield was 2,000 barrels per day, but final tests had not been carried out because of a lack of tankage. A second well was spudded, and two additional drill rigs were to be placed in operation. Earlier drilling by Texas Petroleum Co. in the adjacent Department of Caqueta had been unsuccessful.

Refined Products.—Refinery output of most petroleum products was reduced from the 1962 peak, although consumption continued an upward climb. Daily refinery capacity was nearly 84,000 barrels from five refineries in 1962. Refinery throughput was 30.5 million barrels, compared with nearly 28.3 million barrels in 1961, while output was nearly 30 million barrels, 2.3 million barrels more than in 1962.

TABLE 10.—Salient statistics of the petroleum industry

	1960	1961	1962
Crude oil:			
Exploration drilling—feet	318,749	422,183	217,065
Development drilling—do	702,023	325,075	490,848
Fed to pipeline—thousand 42-gallon barrels	56,802	53,812	51,699
Refinery throughput—do	26,549	28,252	30,465
Export value—thousand U.S. dollars	79,998	68,239	60,585
Petroleum products:			
Refinery output—thousand 42-gallon barrels	25,768	27,685	29,959
Refinery fuel and loss—do	626	610	591
Consumption—do	20,117	21,652	23,125
Export value—thousand U.S. dollars	8,292	5,155	8,237
Natural gas:			
Well production—million cubic feet	82,562	78,775	78,424
Treated at processing plants [1]—do	28,725	27,666	31,107
Disposal:			
Used in secondary recovery operations—do	5,864	4,901	4,352
Used by industry for fuel and power—do	10,225	10,900	13,282
Flared—do	62,439	59,164	53,162
Processed to other products—do	4,034	3,810	4,041
Employment:			
Concessions—number of persons	11,028	9,590	9,535
Pipelines—do	1,361	1,160	1,130

[1] Includes losses and processed gas flared; therefore total treated plus flared is greater than well production.

Late in 1962 a Mobil International Co. and Shell-Condor, S.A., partnership filed notice with the Ministry of Mines and Petroleum of intent to build a US$35 million, 16,000-barrel-per-day refinery in 1963. At approximately the same time, Ecopetrol, the Government-owned company, also filed with the Ministry for either a new refinery or a major expansion of its Barrancabermeja installation to 75,000 barrels per day. Both proposals have been under consideration by the Ministry. The final decision awarding the contract for this needed additional capacity either to the national company or the private company would no doubt affect the flow of new investment in the oil industry.

Natural Gas.—Well production of natural gas appears to have decreased considerably during 1963, although definite data are not available. Marketed production was 12 billion cubic feet, as compared to 13.8 billion cubic feet in 1962. The two major processors, Ecopetrol and Colpet, produced liquefied petroleum gas, natural gasoline, and butane at their El Centro (Department of Santander) and Tibú (Department of Norte de Santander) plants, respectively. Intercol at Cartagena in Department of Bolívar and Ecopetrol at Barrancabermeja also produced liquefied petroleum gas. A Colpet gas refinery at Cicuco in Department of Bolívar went into production in April 1962. This refinery has daily throughput capacity of 35 million cubic feet and output capacity of 25,000 gallons of liquefied petroleum gas and 13,000 gallons of natural gasoline. The latter has been used chiefly for mixing with crude oil for export, but Colpet reportedly has been experimenting with its use in making motor gasoline. Shell-Condor,

S.A., and Antex Oil and Gas, Inc., continued negotiations for a gas refinery, capacity 30 million cubic feet daily, at the Shell El Difícil field in Department of Magdalena in 1962. Such a plant would increase output of processed natural gas by about 50 percent.

TABLE 11.—Principal petroleum companies

Company	Production of crude oil in 1962 (thousand barrels)	Refinery location	Crude oil throughput in 1962 (thousand barrels)	Daily capacity (barrels)	Remarks
Ecopetrol—Empresa Colombiana de Petróleos.	12,675	Barrancabermeja	13,190	41,500	Wholly Government-owned. Crude oil mainly from El Centro field, 24 kilometers from refinery; 1,170 productive wells; average daily production 30,000 barrels. Also received crude from Shell-Condor and Cities Service at Payoa.
Intercol—International Petroleum (Colombiana), Ltd.	1,389	Cartagena	11,530	33,000	Crude oil from Sinclair-B. P. Exploration, Inc., field, and Texas Puerto Niño field.
		La Dorada	1,412	5,000	
Colpet—Columbian Petroleum Co.	14,160	Tibú	611	2,500	Largest domestic crude oil producer; crude largely exported; small quantity went to Tibú refinery; 296 productive wells. Company also has small refinery at Cicuco which produces liquefied petroleum gas; 17,000 barrels annual capacity. Cicuco oilfield had 12 wells; produced 15,000 barrels per day. Subsidiary South American Gulf Oil Co. is export agency. About 32,000 barrels per day exported.
Texas Petroleum Co.	11,711	Guamo	758	1,800	Oilfield at Puerto Niño; output 33,000 barrels per day; 269 productive wells. Crude went largely to Intercol Cartagena refinery.
Shell-Condor, S.A.					Oilfield at Casabe; 15,000 barrels per day crude produced; 385 wells; largely exported; some went to Ecopetrol refinery.

The Mineral Industry of Ecuador

By Sumner M. Anderson[1] and Lester R. Brown, Jr.[2]

ECUADOR increased the production of most of its metals and minerals in 1963. The only significant exceptions were quantitative declines of 4.2 percent in the output of petroleum and 4.9 percent in the output of silver, but these were not enough to prevent an overall increase of 15.1 percent in the total value of all its mineral products, estimated at 161,133,000 sucres (US$8,952,000) in 1962 and 180,302,000 sucres (US$10,302,000) in 1963. Cement was by far the most valuable product, representing 58.7 percent of the total and two-and-a-half times the combined value of crude petroleum and natural gasoline.

Ecuador makes no appreciable contribution to the world supply of any mineral, and its mineral industry domestically contributes only 1.1 percent to a gross national product (sucres 16,560 million, or US$911 million in 1963) sustained 37 percent by agriculture, forestry, and fishing; 28 percent by commerce, transportation, and construction; and 26.5 percent by services and other activities.

It cannot be stated positively that Ecuador is devoid of major natural mineral resources but only that nothing of outstanding present commercial importance has been revealed by the intensive application of modern exploratory techniques to relatively limited portions of the country's area. The geologic position of the country between the mineral-rich regions of Peru and Colombia continues to offer encouragement to ultimate discoveries of importance, but exploration is extremely difficult in extensive areas, potentially mineral bearing, that are covered with dense forests or marked by Quaternary volcanic or sedimentary deposits. A comprehensive summary of presently known deposits of actual or potential economic interest was published in 1962.[3] Exploitation of deposits that might otherwise be economic is greatly hampered by inadequacy or total absence of transportation facilities and available sources of power.

GOVERNMENT POLICIES AND PROGRAMS

The per capita GNP increased at a slightly faster rate than population in the years 1959–62. The Ecuadoran Government endeavored to improve this progress by issuing the Emergency Decree of August 17, 1962, offering special inducements for expanding industrial transformation of raw and semimanufactured materials to finished products

[1] Chief Latin America specialist, Division of International Activities.
[2] Latin America specialist, Division of International Activities.
[3] Stoll, W. C. Notes on the Mineral Resources of Ecuador. Economic Geology, v. 57, 1962, pp. 799–808.

for both domestic use and export, and for the adoption of assembly line production methods in industrial plants.

SOURCE MATERIAL

In addition to the references cited elsewhere in the chapter, economic and background data were obtained from: Focus (American Geographical Society, New York, v. 9, No. 6, February 1959, pp. 1–6; and from Basic Data on the Economy of Ecuador (Overseas Business Reports 64–74, U.S. Department of Commerce, June 1964, pp. 1–10).

PRODUCTION

Data on production have been supplied by industrial and Ecuadoran Government sources through the collecting facilities of the U.S. Embassy at Quito.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Cadmium, in zinc concentrates—kilograms				931	2,008
Copper, in concentrates	135	100	101	158	[1] 284
Gold:					
In concentrates—troy ounces	18,450	15,159	15,210	20,591	21,041
From placers—do	118	50	(1)	(1)	(1)
Total—do	18,568	15,209	(1)	(1)	(1)
Lead, in concentrates	107	108	111	124	164
Silver—troy ounces	162,608	126,419	101,190	127,739	121,784
Zinc, in concentrates			112	164	358
Nonmetals:					
Cement	156,927	200,812	219,165	[2] 214,220	[2] 258,394
Clay, kaolin	721	317	546	377	352
Gypsum	(1)	83	81	32	(2)
Ocher	9	4	2	2	1
Salt	21,778	29,670	31,500	[3] 32,000	[3] 35,000
Sulfur	195	107	112	(1)	203
Mineral fuels:					
Lignite	217	396	250	99	65
Natural gasoline—42-gallon barrels	107,939				
Petroleum, crude—do	2,633,376	2,729,674	2,926,263	2,573,087	2,465,430
Petroleum refinery products:					
Gasoline—thousand 42-gallon barrels	886	1,730	1,399	1,467	1,811
Kerosine and jet fuel—do	253	300	319	321	437
Distillate fuel oil—do	641	693	748	698	813
Residual fuel oil—do	748	1,206	1,490	1,218	1,167
Other—do	272	202	219	201	67
Total—do	2,800	4,131	4,175	3,905	4,295
Refinery fuel and losses—do	34	113	41	29	83

[1] Data not available.
[2] Estimate.
[3] Revised figure; supersedes that given in commodity chapter, volume 1.

TRADE

Mineral exports, 1961–62, and imports for 1962 were compiled from Anuario de Comercio Exterior, Dirección de Estudios Economicas y Fiscales, Años V (1961) and VI (1962), Quito.

Values have been reported in Ecuadoran sucres. Exchange rates in terms of sucres per U.S. dollar at the end of the year have varied as follows:[4]

	1959	1960	1961	1962	1963
Official selling rate	15.15	15.15	18.18	18.18	18.18
Free rate	16.96	17.50	21.70	22.10	18.53

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal destinations	Value, sucres
Metals:				
Copper:				
Crude, matte, residue, scrap	3	3	All to West Germany	26,775
Bars, shapes, wire	1	2	All to Colombia	(1)
Gold and its alloys, troy ounces crude and in dust.	15,210	20,591	West Germany 19,829; United States 762.	14,164,216
Iron and steel scrap	950	875	Japan 850; United States 25	579,600
Lead concentrates	403	508	All to West Germany	2,453,418
Zinc concentrates	----------	372	All to France	384,871
Nonmetals:				
Salt	----------	25	All to Dominican Republic	34,937
Other (clays, abrasives, and asbestos)	6	----------	----------	----------
Mineral fuels:				
Petroleum, crude thousand 42-gallon barrels.	----------	175	All to Argentina	2,935,113
Total:				
Value of metal and mineral exports.	----------	----------	----------	20,578,930
Value of all exports	----------	----------	----------	2,113,728,737
Metals and minerals share percent in total exports.	----------	----------	----------	1.0

[1] Value not recorded.

[4] International Financial Statistics. International Monetary Fund, Washington, D.C., v. 17, No. 6, June 1964, pp. 102–103.

TABLE 3.—Imports of metals and minerals, 1962

(Metric tons unless otherwise specified)

Commodity	Quantity	Principal sources	Value, sucres
Metals:			
Aluminum bars, sheets, foil, pipes, tubes, and wire.	278	Austria 114; West Germany 86; United States 73.	5,939,439
Copper bars, slabs, forgings, sheets, foil, wire, pipe, tubes, and solder.	242	Mexico 82; West Germany 57; Chile 36.	4,207,990
Gold, crude, sheets, troy ounces and powder.	289	Canada 129; West Germany 128; Austria 32.	101,537
Iron and steel, crude and semimanufactured:			
Pigs, ingots, billets, bars, castings.	101	(1)	349,857
Forged and drawn	14,745	(1)	35,114,065
Rails	485	(1)	927,940
Sheets and plates, plain	4,264	(1)	16,395,643
Sheets, galvanized and enameled.	541	(1)	1,956,566
Tinplate	2,208	(1)	9,142,156
Hoops or straps	115	(1)	659,015
Wire	4,449	(1)	13,387,156
Pipe	5,793	(1)	28,100,851
Ferroalloys	2	(1)	9,797
Total, crude and mill products.	32,703	Belgium 18,405; West Germany 4,833; United States 3,990.	106,043,046
Lead pieces, bars, plates, sheets, foil, pipes, tubes, fittings, etc.	209	Peru 60; Belgium 49; United Kingdom 29.	1,289,883
Tin bars, pipes, tubes, foil, containers, and solder.	25	United Kingdom 19; United States 4; West Germany 1.	763,736
Zinc slabs, bars, plates, sheets, pipes, tubes, wire, and foil.	22	United States 10; West Germany 5; Belgium 5.	305,699
Total value, metals			118,651,330
Nonmetals:			
Abrasives, natural	18	West Germany 16; United States 2	115,618
Asbestos, crude, washed, or ground	390	Canada 349; South Africa 23; United States 18.	1,417,196
Cement:			
Aluminous	63	All from United States	179,173
White	1,182	West Germany 456; Denmark 331; United Kingdom 179.	1,200,897
Other	33	Denmark 25; United Kingdom 7; United tates'	81,691
Clays:			
Bentonite	119	United States 118; United Kingdom 1	158,256
Kaolin	29	All from United States	39,033
Other	23	United Kingdom 20; United States 3	42,320
Diatomite and infusorial earth	152	West Germany 86; United States 66	401,882
Graphite	2	United Kingdom 1; United States 1	20,119
Gypsum	52	United States 36; West Germany 14; Italy 2.	165,285
Magnesite, crude or calcined	5	All from West Germany	17,631
Marble, alabaster, and "other forms".	121	All from Italy	345,918
Mica, all forms	11	All from United States	44,642
Salt, common (NaCl)	70	do	117,357
Salts, other mineral	136	do	190,407
Sand, including ground quartz	410	do	529,832
Sulfur	22	United States 16; West Germany 6	58,307
Talc or steatite	87	Italy 29; Canada 25; United States 20	144,383
Other nonmetallic minerals, n.e.s.	112	United States 46; Mexico 45; West Germany 15.	359,848
Total value, nonmetals			5,629,795

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals, 1962—Continued

(Metric tons unless otherwise specified)

Commodity	Quantity	Principal sources	Value, sucres
Mineral fuels:			
Coal	220	All from West Germany	318,467
Coal and other tars and pitches	134	United Kingdom 131; West Germany 3.	223,482
Coke	161	United States 52; West Germany 50; Portugal 40.	245,963
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels.	90	(1)	(1)
Kerosine do	1,438	(1)	(1)
Distillate fuel oil do	5	(1)	(1)
Residual fuel oil do		(1)	(1)
Lubricants, including greases. do	52	(1)	(1)
Other do	105	(1)	(1)
Total do	1,690	(2)	39,348,970
Total value, mineral fuels			40,136,882
Total:			
Value of metal and mineral imports			164,418,007
Value of all imports			1,748,656,374
Metals and minerals share in total imports. percent			9.4

[1] Data not available.
[2] Distribution of products not reported on a volumetric basis; of the total of 12,541 metric tons imported, the United States supplied 9,224 tons and the Netherlands Antilles 1,791 tons.

COMMODITY REVIEW

METALS

The greater part of all the metals and metallic ores ond concentrates that have been produced in Ecuador have come from two rather widely separated mining areas— the Macuchi mine near the foot of the western Andean slope in the Province of Cotopaxi, and the Portovelo mines at Zaruma in the southern Province of El Oro. The Macuchi mine yielded 24,250 metric tons of copper and from 95,000 to 130,000 ounces of gold while worked by the Cotopaxi Exploration Co. (a subsidiary of the South American Development Co.) between 1941 and 1950 from 472,156 tons of ore. Ore from the main mine level averaged 5 percent copper, 0.27 ounces-per-ton gold, and 0.30 ounces-per-ton silver. The commercial ore was exhausted in 1950, and the mine was shut down, leaving an estimated 139,000 tons of mineralized but submarginal material. The South American Development Co. operated the Portovelo mines continuously from 1892 until 1950 when ore values less than 0.4 ounce of gold per ton ceased to be economic and the mine was closed. The remaining material contained approximately 0.22 ounce of gold and 1.86 ounces of silver per ton, 0.24 percent copper, 0.32 percent lead, and 0.4 percent zinc with traces of cadmium.

Closure of the mines presented a serious economic and social problem to the local mining communities. The Ecuadoran Government purchased the company's equipment and sponsored the organization in January 1952 of CIMA (Compañía Industrial Minera Asociada, S.A.) with 35 percent of the shares purchased by the municipality of Zaruma, 35 percent by a management group of private individuals, and 30 percent donated by the government to ex-employees of the

South American Development Co. with 10 years or more of service. Except for insignificant amounts of placer gold, all the gold, silver, and concentrates of copper, lead, and zinc (with associated recoverable cadmium) produced since 1951 apparently have been by CIMA from the properties abandoned by the South American Development Co. at Portovelo; there is no positive evidence of a comparable revival of Macuchi. The Portovelo gold occurs in quartz veins associated with galena, sphalerite, pyrite, and chalcopyrite.[5] Milling facilities at the mine include a cyaniding plant.

NONMETALS

Cement and Lime.—The cement industry has grown rapidly in recent years, and Ecuador has attained self-sufficiency in the production of portland cement but still depends on imports to fulfill its very minor requirements for other types of cement. Production has been from two plants.

A very small cement plant erected in 1922 at San Eduardo near Guayaquil, Guayas Province, was acquired by the Ecuadorian Corporation, Ltd., of New York in 1934, which organized Cemento Nacional C.A. as an operating company. The old plant was replaced by second-hand equipment from the United States, that had a 36,000-ton annual capacity, which has since been gradually replaced and expanded to the present modern dry-process plant of 285,000 tons (6 million 94-pound bags) annual capacity. This plant currently is supplying 80 percent of total Ecuadoran cement production. The company has its own nearby source of limestone, and gypsum and iron sand are available within 100 miles of the plant. The cement is marketed under the brand name "Rocafuerte" at a wholesale price of 17.50 sucres (US$0.97) per bag. The company employs about 200 laborers and 66 office employees.

In 1956 the National Development Bank (Banco Nacional de Fomento), a government institution, opened the Chimborazo cement plant northwest of Riobamba in Chimborazo Province. Production, probably close to the designed capacity of 45,000 tons per year, serves a highland area that has poor transportation facilities to the coast. Extensive limestone and clay deposits are available locally for raw material. Both this plant and that of Cemento Nacional are fueled with domestic fuel oil.

A privately owned 10,000-ton plant called Guapan, near Azogues, Cañar Province, was constructed in 1963 and expected to be in operation in 1964, producing portland and some white cement from local deposits of limestone and travertine. The plant is to be fueled by lignite.

Lime is burned in many small kilns throughout the country, the largest of which is the plant of Fábrica de Cementos Cerro Azul, C.A., near Guayaquil, which has a daily capacity of 10 tons.

Gypsum.—The small amount that is produced in Ecuador goes for making cement. It is handpicked from lacustrine clays near the Cemento Chimborazo plant and from certain marine beds near the Rocafuerte plant.

[5] Billingsley, Paul. Geology of the Zaruma gold district in Ecuador. Trans. AIME, v. 74, 1926, pp. 255–275.

Salt.—Salt is the most important nonmetallic mineral produced in Ecuador. Producers of salt by the solar evaporation process are known in the following localities:

Locality:	*Province*
Charapoto	Manabí.
Salina (largest)	Guayas.
Punta Arena	Do.
Payana	El Oro.
El Morro and San Miquel	Guayas.

In addition rock salt deposits found on the Galapagos Islands, are presently under exploitation by Industrial Salinera Inversionista Dariegas C.A., which invested US$500,000 in the purchase of equipment for mining, refining, and iodizing.

On August 13, 1963, the government salt monopoly was abolished, releasing producers and buyers to operate in a free market throughout Ecuador. At least temporarily, producers obtained a price of from S/10 to S/15 per hundred pounds of crude salt, while the price of refined salt in Guyaquil dropped from S/5 to S/3 for a 5-pound bag.

Stone.—Many small localities in the Provinces of Loja, Azuay, Pichincha, Cotopaxi, and Napo-Pastaza yield onyx, travertine, diabase, and fossiliferous limestone for use as building stone.

Sulfur.—Small tonnages of high-cost sulfur have been produced more or less regularly to meet the domestic need of sugar refineries and Panama hat-makers. Production in recent years has been last reported from two volcanic deposits near the towns of Maldonado and Tufiño in Carchi Province.

MINERAL FUELS

Lignite.—The Azogue-Biblian lignite basin in Cañar Province is the most important in Ecuador and one that has been mined, albeit on a very small scale, entirely by hand methods. Production was expected to be increased in 1964 to supply fuel for the new Guapan cement plant. The reserves of Tertiary lignite have been estimated as 22.8 million tons in 5 minable seams of 0.6 to 1.1 meters thickness, ranging to depths of 250 to 500 meters below outcrops. The best bed is the Cañari, traceable for 14 kilometers along the strike. The beds include brilliant "black lignite"—possibly better classified as subbituminous coal—with calorific values from 3,600 to 4,600 kilogram-calories as mined and from 5,000 to 6,500 kilogram-calories when dried.

Two Tertiary lignite basins, Malacatos and Loja, are in the Province of Loja. The Malacatos basin has reserves of at least 3.3 million tons in two possibly workable seams. The Loja basin has considerable reserves in 5 seams regarded as workable and has supplied some brilliant lignite to local brick plants and rice mills.

The Nabón basin in Azuay Province has brilliant Miocene lignite in its Nabón and Palmira fields and Pleistocene lignite in its San Antonio field. Most of the beds are steeply tilted and not minable, and the lignite is high in sulfur. However, sink and float tests on some of the San Antonio coals gave a product suitable for thermal powerplants and for cement, lime, and brick kilns, and construction of coal washeries has been considered.

Petroleum.—The production of crude petroleum and natural gasoline has been declining steadily in Ecuador since the peak of 3,599,000 barrels was reached in 1955. Recently active producers in the Santa Elena Peninsula, west of Guayaquil, have been the Anglo-Ecuadorian Oilfields, Ltd., and its several subsidiaries, and Tennessee de Ecuador, S.A. (the Tennessee Gas Transmission Co.).[6] Past explorations in the Oriente region east of the Andes by the Shell Oil Co. (1939 to 1950) and of the Pacific coastal belt by International Petroleum Co. and the Standard Oil Co. of New Jersey were unproductive and abandoned.

Santa Elena crude, most of which comes from the Ancon field, is treated at three refineries. These include Anglo-Ecuadorian's La Libertad refinery which has a 12,200-barrel-per-day distilling capacity and a 6,000-barrel-per-day thermal cracking capacity; Anglo-Ecuadorian's new 6,600-barrel-per-day refinery; and Tennessee's Cautivo topping plant at its Tigre field which has a capacity of 2,500 barrels daily. Ecuador's requirements for refinery products are no longer met by domestic production, which has to be supplemented by imports.

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[6] On January 1, 1964, Tennessee de Ecuador, S.A., officially became Cautivo Empresa Petrolera Ecuatoriana, C.A. owned 100 percent by Ecuadoran nationals.

The Mineral Industry of Paraguay

By Sumner M. Anderson [1]

PARAGUAY'S only active mineral industry in 1963 consisted of a cement plant and some limekilns with their supporting quarries, a rock-crushing plant, and the quantitatively unreported activities of three small glass plants manufacturing bottles and jugs and a few scattered brick and pottery kilns. Interest in the mineral industries was not dead, however. The rock-crushing plant is new and modern; cement production, which has been growing steadily, was seeking further expansion; petroleum exploration was resumed; construction was started on Paraguay's first petroleum refinery; and iron and manganese ore concessions were sought and granted.

Landlocked Paraguay is bisected by the Paraguay River which joins the Paraná and La Plata to give the country a 600 to 700 mile river route to the ocean. An international bridge over the Paraná River, unfinished in 1963, will link Paraguay with Brazil. The economy of the country depends almost entirely on products of the soil—agriculture, grazing, and forestry—and associated fields of manufacturing, commerce, communications, and services. In the 5-year period 1959–63, the gross national product (GNP) rose 36 percent to US$259 million (Guaranies 32,634 million, at 126.0 guaranies per U.S. dollar), population increased 9 percent to 1,857,000, and the GNP per capita in current prices increased 24 percent from US$112 to US$139.

Paraguay is poorly endowed in mineral resources and has not fully utilized what it has, although its plan for national development includes exploration of mineral industry expansion. An excellent basis for such studies, including a geological map, has been prepared by the U.S. Geological Survey, in cooperation with the Paraguayan Department of Geology [2], describing in some detail both the known limitations and many previously unrecognized potentials of Paraguay's mineral resources.

Paraguay does not export minerals. Imports, which have not been tabulated here, include all the country's requirement for minerals, metal and mineral manufactures (excepting the domestically produced cement, lime, and stone), and petroleum products (1,068 thousand barrels in 1962).

Data on production and recent mineral developments have been supplied by the U.S. Embassy, Asunción.

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[1] Chief Latin America specialist, Division of International Activities.

[2] Eckel, E. B. Geology and Mineral Resources of Paraguay—a Reconnaissance. U.S. Geol. Survey Prof. paper 327, U.S. Government Printing Office, Washington, D.C., 1959, 110 pp., 2 maps.

TABLE 1.—Production of minerals

(Metric tons)

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Cement	13,477	14,000	15,737	16,900	18,500
Lime	9,794	13,400	14,045	14,800	12,500
Limestone:					
For cement (approximate)	23,000	26,000	28,500	32,000	33,600
For lime (approximate)	14,000	20,000	21,000	22,000	19,000

COMMODITY REVIEW

METALS

Iron.—During the latter half of 1963, a geological investigation of the feasibility of mining iron ore was started, reportedly under the sponsorship of the Economic Commission for Latin America and at the request of the Paraguayan Ministry of Defense. Particular attention was to be given to the surface-rich hematite-magnetite deposits of the Paso Pindó area about 8.5 kilometers north-northeast of Villa Florida. Small iron mines and foundries were last operated in 1870.

Manganese.—Three concessions for the exploitation of manganese ore were granted during the year to two Paraguayan nationals and one Argentine citizen. The concessions are in the Valle Yo'a area, Ita District, Department Central; the Yaguaron area, Department of Paraguarí; and the Colmena District, also in the Department of Paraguarí. No plans have been announced for working the deposits, and their commercial value has not been established.

NONMETALS

Cement.—The 18,500 metric tons of cement produced in 1963 was an alltime record high for Paraguay and the first close approach toward meeting the consumption needs of the country. Imports, which in the years 1958–61 averaged more than 3,500 tons annually, declined to less than 1,000 tons in 1962, and in 1963 were an estimated 500 tons.

Vallemí, S.A., a government-owned company, has operated the country's only cement plant located on the Paraguay River 536 kilometers north of Asunción, at Puerto Vallemí near Concepción, since 1952. The plant, employing the wet-grind, rotary-kiln process, was imported secondhand from Belgium and reconstructed by native labor under the training and supervision of a skilled German cement specialist. It is old and in need of modernization financing for which purpose a loan was being sought at the end of 1963 by the Ministry of Public Works and Communications.

Limestone and shale, abundant along this part of the Rio Paraguay, are quarried near the plant. Gypsum, the only other essential cement raw material, is imported from Argentina. Cement bags, grinding balls, and refractory brick also are imported. For fuel the plant uses pulverized charcoal, burned from timber cut in the company's 300 square kilometers of forest land. This charcoal doubtless represents

a substantial portion of the 12,000 tons reported as average annual production of the entire country.

Lime.—Some lime is imported from Argentina, but most of Paraguay's needs for the past century have been supplied by lime of rather poor quality from charcoal-fired kilns fed from small limestone quarries at Puerto Fonciere, Itapucumí, and several other places.

Stone.—The limestone used for the manufacture of cement and lime probably represents all that is produced in the country, although reserves are enormous and the acid soils of much of the farmland could be greatly improved by utilization of crushed limestone fertilizer.

Paraguay regularly produces unreported quantities of white and colored sandstone for walks, walls, and the exterior facing of buildings, and broken stone—mostly dark, fine-grained igneous rock—for street paving, rough wall construction, and foundations.

In March 1963, the Argentine firm of Petrominera, S.A., began operating its new US$1.1 million rock-crushing plant at San Antonio just south of Asunción on the east bank of the Paraguay River. The plant is equipped with United States machinery and has a capacity of 220 tons of crushed rock per hour. The firm contracted to supply 1.2 million tons of crushed rock over a period of a year and a half for construction of a highway (Route 11) to parallel the Paraguay River between Resistencia and Clorina.

No quarried stone in Paraguay is cut, polished, or elaborately dressed, but much is admirably suited for such treatment, including many fine marbles and granites.

MINERAL FUELS

Petroleum.—On February 4, 1963, a new contract was signed between the Paraguayan Ministry of Public Works and Communications and Petróleo Guaraní, S.A. (PEGASA), a subsidiary of the Brazilian firm of Fiduciaria Fluminense, S.A., to continue the "prospecting, exploration, and exploitation of hydrocarbons." Previous explorations under a similar contract signed in 1958 had produced no positive results. The period of activity specified under the new contract was 17 months from the date of the signing, and the area of exploration covered approximately 11,220 square kilometers in the southern part of the Chaco. If oil or gas is discovered, the area of exploitation is not to exceed 5,000 square kilometers. The Chaco region was explored for oil unsuccessfully by the Union Oil Co. in the 1940's and the Pure Oil Co. in the 1950's.

Refinería Paraguay, S.A., signed an agreement with the Paraguayan Government in July 1962 for construction of Paraguay's first oil refinery and a crude oil pipeline from Bolivia to Asunción. In September 1963, the Asunción press announced that the Fish engineering firm of Houston, Tex., had obtained the contract for the engineering plans for the refinery, to have a 10,000-barrel-per-day capacity to produce gasoline, kerosine, jet fuels, and diesel oil, and to be built on the Paraguay River 20 kilometers (12 miles) downstream from Asunción. Refinería Paraguay, S.A., is financed by Interfinancial Corp., of New York.

The Mineral Industry of Peru

By John Burgess,[1] Sumner M. Anderson,[2] and Lester R. Brown, Jr.[3]

MEASURED internationally on the basis of available world production data and estimates, Peru in 1963 supplied more than 1 percent of the total world production of 11 metal and mineral commodities as follows, in percent: Bismuth 19.1, silver 14.6, tellurium 8.4, lead mined 5.8 (primary lead smelted 3.3), zinc mined 5.3 (primary zinc smelted 1.6), barite 4.3, copper mined 3.7 (primary copper smelted 3.2), cadmium 1.5, antimony 1.3, iron ore 1.2, and mercury 1.1. Relative to the countries of the South American continent, Peru was the only producer of cadmium, selenium, and tellurium; the leading producer of white arsenic, bismuth, lead, zinc, mercury, silver, and barite; the second leading producer of antimony, copper, and gold; and the third leading producer of iron ore.

The Andean range in Peru is richly mineralized; it has been mined since earliest colonial days and before that by the Indians. The diversified mineral industries provide a livelihood for 14 percent of the population, surpassed only by the agriculture-and-fishing segment of the economy. Most of the metal mining, except for the Marcona iron ore operation, is conducted at altitudes ranging from 10,500 to 15,500 feet above sea level.

Indicators of the general economic progress of Peru are presented as follows:

	1959	1960	1961	1962	1963
Gross national product (millions of U.S. dollars)	1,602	1,896	2,062	2,411	2,706
Population (millions)	10.8	11.1	11.4	11.6	11.9
GNP per capita (dollars)	148	171	181	208	227
Cost of living index, Lima (1958=100)	113	122	131	139	148
Commodity trade:					
Exports, f.o.b. (millions of U.S. dollars)	312	430	494	540	540
Imports, c.i.f. do.	293	373	468	537	556
Trade balance do.	19	57	26	3	−16
Net foreign balance, inflow minus outflow do.	39	−22	−7	29	60
Total mineral production do.	242	294	320	349	387
Mineral production as percentage of GNP	15.1	15.5	15.5	14.5	14.3

The steady increase in mineral production, although impressive, has not kept pace with the growth in the GNP to which it has contributed on a scale that is high by any standard. Its ratio to the GNP is exceeded within Latin America only by those of Venezuela and Bolivia.

[1] Minerals Attaché, United States Embassy, Lima, Peru.
[2] Chief Latin America specialist, Division of International Activities.
[3] Latin America specialist, Division of International Activities.

The distribution of principal values within the mineral industries in 1963 was as follows:

Commodity	Value, thousands of U.S. dollars	Percent of total mineral value	Percent of GNP
Metals:			
Copper	106,097	27.44	3.92
Silver	43,478	11.24	1.61
Iron ore	39,419	10.20	1.46
Lead	22,403	5.79	.83
Zinc	21,445	5.55	.79
Gold	3,195	.83	.12
Antimony	2,867	.74	.10
Bismuth	2,521	.65	.09
Molybdenum	1,436	.37	.05
Other	18,099	4.68	.67
Total	260,960	67.49	9.64
Nonmetals:			
Cement	15,926	4.12	0.59
Guano	5,727	1.48	.21
Salt	1,382	.36	.05
Sand and gravel	1,096	.28	.04
Other	4,398	1.14	.16
Total	28,529	7.38	1.05
Fuels:			
Petroleum and its products	95,000	24.57	3.51
Metallurgical coke	1,249	.32	.05
Coal	928	.24	.03
Total	97,177	25.13	3.59
Grand total	386,666	100.00	14.28

Most of the two score metals, minerals, and mineral fuels which comprise the materials of the industry are produced in excess of domestic consumption needs. In 1962 metal and mineral sales abroad accounted for 9.6 percent of the GNP and 40 percent of the earnings from total export sales. Peru was a net importer, however, of petroleum and its derivatives; in 1963 production of crude petroleum and natural gas liquids totaled 22,545,629 barrels against consumption by refineries and end-product users of 23,464,028 barrels.

The mineral industries and the Peruvian economy as a whole achieved substantial gains in 1963 despite the political uncertainties of an election year. Development capital continued to flow into the country in response to the exceptionally favorable investment environment presented by commercial and industrial laws successfully designed to stimulate economic progress.

SOURCE MATERIAL

Mineral production statistics are supplied by the Department of Mines, Division of Statistics and Economics, in its annual publication on the mineral industry (Anuario de la Industria Minera del Peru); the Mining Bank of Peru; and individual operating companies. The two latter sources also provide preliminary statistics on mineral exports, but the final official trade statistics, usually released a year later, are published in the annual Statistics of Foreign Trade (Estadistica

del Comercio Exterior) by the Superintendency of Customs, Ministry of Treasury and Commerce. These sources combine to give Peru the most comprehensive, detailed, and reliable statistical coverage of mineral activities of any country in Latin America. This basic information has been supplemented by general economic data from the Mining Bank of Peru, the Economic Data Book for Latin America prepared by the U.S. Agency for International Development, and the January 6, 1964, issue of International Commerce, U.S. Department of Commerce. Textual details have been gleaned from continuous field observations and conversations by the Minerals Attache and from articles and notes appearing in such trade and news media as the Engineering and Mining Journal, Mining and Metallurgy, The Mining World, The Mining Journal (London), Skilling's Mining Review, World Oil, The Peruvian Times, The New York Times, and Peruvian Report, by A. S. Lipsett (Brownsville, Tex.), 1963.

PRODUCTION

The metal production statistics presented in the accompanying production table may be regarded essentially as representing recoverable content in all forms. The Department of Mines, in reporting production, deducts from the fine metal content of ores and concentrates 5 percent for copper and lead; 10 percent for zinc, iron, manganese, molybdenum, and tungsten; 35 percent for arsenic, bismuth, cadmium, tin, etc., calculated in accordance with average recoverability experience.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Antimony, content of:					
Refined bars	293	324	400	242	352
Antimonial lead bars	19	52	27	42	29
Lead-tin-antimony bars	6	----	2	----	----
Total smelter products	318	376	429	284	381
Ore and concentrate for export	401	441	360	237	359
Total	719	817	789	521	740
Arsenic oxide (white arsenic)	475	393	352	519	620
Bismuth content of:					
Refined metal kilograms	226,230	380,587	387,950	436,811	475,730
Bismuth-lead bars do	103,151	27,110	78,785	51,512	84,161
Total smelter products do	329,381	407,697	466,735	488,323	559,891
Lead concentrate for export do	5,200	4,368	1,284	3,479	3,962
Total do	334,581	412,065	468,019	491,802	563,853
Cadmium content of:					
Refined bars do	63,923	83,696	105,240	106,507	173,359
Zinc concentrate exported do	13,101	25,499	25,708	21,244	21,420
Total do	77,024	109,195	130,948	127,751	194,779

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals—Continued					
Copper content of:					
Refined bars	27,919	29,938	33,798	34,419	36,913
Blister	5,540	133,552	146,712	113,414	118,295
Matte	1,036	1,300	1,561	1,778	2,154
Zinc-copper-aluminum bars	----------	----------	----------	2	8
Total smelter products	34,495	164,790	182,071	149,613	157,370
Copper sulfate	267	298	397	365	468
Ore and concentrate for export	15,055	15,755	14,722	15,939	19,536
Cement copper for export	869	878	862	873	(1)
Total recoverable copper mined	50,686	181,721	198,052	166,790	177,374
Gold content of:					
Refined bars, troy ounces	45,139	42,322	50,820	46,749	41,507
Silver bars, do	10,901	34,234	22,344	18,983	7,913
Copper bars, do	5,193	4,544	4,125	1,253	1,391
Lead bars, do	27	----------	----------	----------	----------
Other unrefined bars, do	19,551	----------	----------	----------	----------
Total smelter products, do	80,811	81,100	77,289	66,985	50,811
Placer gold (estimate), do	3,215	3,215	3,215	3,215	3,215
Ores and concentrates for export, troy ounces	66,273	56,686	56,914	52,785	40,343
Total, do	150,299	141,001	137,418	122,985	94,369
Iron ore and concentrate, thousand metric tons	3,575	6,990	8,737	5,949	6,161
Steel ingots and castings, do	51	60	75	75	73
Lead content of:					
Refined bars	56,482	73,767	76,147	67,922	82,723
Antimonial bars	154	356	216	406	298
Bismuth-lead bars	69	18	53	34	56
Silver-lead bars	41	----------	----------	----------	----------
Lead-tin-antimony bars	61	----------	17	----------	----------
Total smelter products	56,807	74,141	76,433	68,362	83,077
Ore and concentrate for export	58,408	57,489	59,965	59,814	65,219
Total	115,215	131,630	136,398	128,176	148,296
Manganese ore, 45 percent manganese equivalent	2,543	1,501	3,519	6,716	988
Mercury, 76-pound flasks	2,526	3,034	3,001	3,483	3,086
Molybdenum sulfide content of concentrate	----------	----------	----------	8	889
Selenium, refined, kilograms	3,699	4,845	7,396	8,338	8,977
Silver content of:					
Refined bars, troy ounces	10,282,386	13,518,873	15,955,385	16,228,376	19,081,176
Sterling bars, do	817,368	688,830	797,467	617,551	615,012
Gold-silver bars, do	428,698	475,092	520,070	447,731	488,016
Copper-silver bars, do	1,034,804	1,532,754	1,522,434	784,896	887,135
Lead-silver bars, do	11,960	----------	----------	----------	----------
Matte, do	443,745	459,370	471,008	454,419	466,314
Total smelter products, do	13,018,961	16,674,919	19,266,364	18,532,973	21,537,653
Ore and concentrate for export, troy ounces	14,206,255	14,080,577	14,895,343	14,397,810	15,375,771
Total, do	27,225,216	30,755,496	34,161,707	32,930,783	36,913,424
Tellurium, refined, kilograms	28,395	26,918	34,600	22,894	12,081
Tin content of:					
Lead-tin-antimony bars, long tons	15	----------	7	----------	----------
Ore and concentrate for export, long tons	27	6	7	11	29
Total, do	42	6	14	11	29
Tungsten ore, 60 percent WO_3 equivalent	492	488	388	395	463
Vanadium concentrate	----------	----------	----------	2 360	----------

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals—Continued					
Zinc content of:					
Refined metal	26,848	32,397	31,757	32,753	54,714
Zinc-copper-aluminum bars				186	
Total smelter products	26,848	32,397	31,757	32,939	54,714
Sulfates	123	176	117	137	[3] 150
Concentrate for export	116,128	145,549	141,995	129,164	126,750
Total	143,099	178,122	173,869	162,240	[3] 181,600
Nonmetals:					
Barite	95,759	109,600	111,165	114,551	124,800
Bentonite	120	250	401	265	[3]
Cement	582,027	599,690	593,500	700,568	754,089
Clay:					
Common	218,620	238,241	241,624	248,630	250,000
Refractory	2,106	2,769	3,308	6,216	5,250
Kaolin	123	601	466	350	294
Diatomite	230	1,022	1,858	1,473	2,197
Dolomite	885	707	884	978	[3]
Feldspar	[3]	240	1,008	292	314
Gypsum, crude:					
For cement (estimated)	20,301	20,968	22,818	23,027	30,000
For calcining	30,047	33,511	34,249	36,942	[3] 35,000
For other uses (estimated)	5,011	8,023	6,633	1,231	2,000
Total crude gypsum	55,359	62,502	63,700	61,200	[3] 67,000
Gypsum, calcined	28,329	28,290	28,713	31,247	28,000
Lime	67,000	76,800	69,500	79,923	85,000
Limestone, crude:					
For cement manufacture	974,743	848,147	753,677	888,836	982,000
For lime manufacture	97,003	104,777	98,954	99,578	[3] 143,000
For metallurgical fluxing	34,461	15,852	39,439	22,130	[3] 30,000
Total	1,106,207	968,776	892,070	1,010,544	[3] 1,155,000
Marble, dimension stone	2,860	1,279	1,300	1,708	1,500
Mineral water—liters	8,797,716	7,785,723	8,136,938	6,006,437	6,150,000
Mineral pigments, ocher	23				
Phosphate, guano:					
Rich	108,919	127,495	142,937	[4]	181,671
Poor	18,389	30,369	16,261	[4]	10,170
Total	127,308	157,864	159,198	206,061	191,841
Estimated tricalcium phosphate content	30,500	40,650	40,650	[4]	[4]
Pyrophyllite (see talc)					
Sand and gravel	769,831	762,803	814,000	1,041,207	980,000
Salt:					
Marine	87,167	85,618	70,707	76,700	63,500
From saline springs	8,703	10,856	7,572	6,092	10,000
Mined rock salt	8,785	9,577	9,065	10,849	13,900
Total	104,655	106,051	87,344	93,641	87,400
Stone, crushed:					
Pegmatite		829	800		
Quartz and marble	7,757	7,500	6,650	11,300	11,000
Silica	6,697	17,101	18,200	11,155	[4]
Total	14,454	25,430	25,650	22,455	[4]
Talc and pyrophyllite:					
Talc	247	244	334	286	192
Pyrophyllite	1,290	1,327	2,602	1,434	3,092
Total	1,537	1,571	2,936	1,720	3,284

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Mineral fuels:					
Anthracite	59,152	31,200	20,922	22,469	21,170
Bituminous coal	114,005	131,029	146,186	140,379	118,001
Coke	32,159	30,475	35,989	39,500	39,000
Fuel briquets	4	5			
Natural gas—million cubic feet	34,171	(4)	(4)	42,320	40,150
Natural gas liquids—thousand 42-gallon barrels	1,070	997	1,053	1,081	1,078
Petroleum, crude—do	17,733	19,255	19,371	21,134	21,468
Petroleum runs to stills—do	15,664	16,748	16,789	18,196	20,556
Petroleum refinery products:					
Aviation gasoline—do	203	98	54	63	48
Motor gasoline—do	4,688	4,854	4,992	5,368	5,443
Jet fuel—do	64	249	329	493	486
Kerosine—do	3,206	3,647	3,060	3,000	2,989
Distillate fuel oil—do	4,903	5,062	5,478	5,989	5,791
Residual fuel oil—do	2,314	2,454	2,410	2,770	4,531
Lubricants—do	65	48	83	75	60
Asphalt—do	105	52	87	130	93
Coke—do	1	2	2		1
Other—do	1	2	4	4	3
Total refinery products—do	15,550	16,468	16,499	17,892	19,445
Refinery fuel and losses—do	114	280	290	304	1,111

[1] Included with ores and concentrates.
[2] Exports.
[3] Estimate.
[4] Data not available.

Sources: Anuario de la Industria Minera del Peru, 1959–62. Instituto Nacional de Investigacion y Fomento Mineros, Lima. Annual minerals production questionnaire, 1963 (Preliminary data). United States Embassy, Lima, May 11, 1964.

TRADE

The declining trade balance, which reached an unfavorable position in 1963, has been primarily the result of increased imports of automobiles and heavy machinery and equipment, rather than any decline of exports. The United States is the principal buyer of Peruvian metal and mineral supplies. Other important customers include Belgium, The Netherlands, Sweden, France, Canada, Argentina, Brazil, Chile, Venezuela, India, and Israel. Peru is best known in international markets as a supplier of lead, zinc, copper, silver, iron ore, and bismuth, and a customer for iron and steel products, petroleum and its products, gold, and aluminum, in addition to manufactured goods. Complete details of 1963 trade are not expected before 1965; available details of mineral trade are tabulated herewith.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962 Quantity	1962 Principal destinations	1962 Value (U.S. dollars) [1]
Metals:				
Antimony:				
Gross weights:				
Ores	711	525	France 187; Japan 98; India 90.	(2)
Refined bars	526	591	United States 475; Brazil 116.	(2)
Antimony content of ore, mixed bars and refined bars.	915	878	(2)	451,395
Bismuth:				
Gross weight of mixed bars, with lead and silver and refined bars.	385	793	United States 621; United Kingdom 146; West Germany 20.	(2)
Bismuth content:				
Mixed bars	81	76	(2)	225,362
Refined bars	250	667	(2)	2,966,375
Total	[3] 331	743	(2)	3,191,737
Cadmium, refined bars	94	118	United States 108; Brazil 10.	384,377
Copper:				
Ore and concentrate:				
Gross weight	37,925	49,174	Japan 27,695; United States 18,990; Sweden 1,315.	(2)
Copper content	15,559	14,813	(2)	7,881,610
Cement (precipitates):				
Gross weight	1,245	1,145	United States 771; Japan 373.	
Copper content	821	679	(2)	343,857
Matte:				
Gross weight	3,215	3,601	All to Japan.	
Copper content	1,310	1,436	(2)	1,086,340
Blister:				
Gross weight	153,313	119,176	United States 64,114; West Germany 21,029; United Kingdom 18,190.	
Copper content	149,440	118,130	(2)	65,809,731
Mixed bars, with gold and silver:				
Gross weight	----	9	All to West Germany.	
Copper content	----	8	(2)	4,605
Refined bars	4,757	6,462	Brazil 5,840; Argentina 596; Japan 25.	3,555,095
Electrolytic sheets	26,878	30,342	United Kingdom 12,333; Netherlands 8,608; Belgium 4,571.	16,686,351
Bare wire	188	----	----	----
Total, copper content	198,953	171,870	----	95,367,589
Brass scrap	244	139	Japan 110; Netherlands 29.	46,584
Gold, content of:				
Ores troy ounces	5,301	3,731	(2)	107,122
Concentrates do	49,115	55,171	(2)	1,604,787
Mixed bars do	10,763	7,567	(2)	241,441
Blister bars do	4,126	4,882	(2)	46,702
Refined bars do	4,058	----	----	----
Sweepings do	----	48	All to West Germany	1,668
Total do	73,363	71,399	(2)	2,001,720
Iron ore	5,572,580	5,149,202	Japan 2,445,153; Canal Zone 2,207,643; Argentina 313,739.	32,681,153
Iron and steel:				
Ingots and castings	16	----	----	----
Bars, plates, and sheets	1	52	Chile 44; Bolivia 1; Ecuador 7.	22,069
Wire	----	2	All to Chile	663
Scrap	1	72	All to United States	2,611
Total	18	126	----	25,343

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal destinations	Value (U.S. dollars)[1]
Metals—Continued				
Lead:				
Ore and concentrate:				
Gross weight	127,807	120,174	United States 68,605; Japan 25,378; West Germany 13,424.	
Lead content	65,516	62,405	(2)	6,475,292
Mixed bars: [4]				
Gross weight	192	204	Brazil 169; Netherlands 33; United States 2.	
Lead content [4]	225	221	(2)	96,921
Refined bars	76,721	72,526	United States 22,986; Netherlands 15,464; Italy 12,664.	9,690,194
Total lead content	142,462	135,152		16,262,407
Manganese ore	928	6,968	All to United States	108,249
Mercury:				
Sludge concentrates		168	All to Japan	127,858
Refined 76-pound flasks metal.	3,220	3,510	Japan 1,856; United States 1,595; United Kingdom 29.	441,293
Total	3,220	3,678		569,151
Molybdenum:				
Sulfide concentrates. [5] kilograms		9,147	West Germany 4,731; United Kingdom 4,416.	5,491
Sulfide (Mo_2S) content of concentrates. do		7,865	(2)	(2)
Molybdenum (Mo) content of concentrate. do		4,714	(2)	(2)
Selenium, refined do	6,800	4,833	Netherlands 2,240; West Germany 1,120; United States 463.	48,447
Silver content of:				
Ore troy ounces	677,928	445,391	(2)	364,789
Concentrates do	14,721,663	13,942,193	(2)	12,141,403
Matte do	437,971	380,721	(2)	350,695
Blister bars do	1,505,465	829,029	(2)	835,175
Mixed bars do	493,087	487,697	All to Belgium	483,529
Refined bars do	15,447,651	18,304,082	All to United States	18,845,142
Total do	33,283,765	34,389,113	(2)	33,020,733
Tellurium, refined kilograms	35,390	11,545	Japan 7,354; West Germany 3,362; United Kingdom 454.	111,212
Tin content of concentrate. [6] long tons	16	23	All to United Kingdom	49,367
Tungsten:				
Ore:				
As shipped	305	329	United States 159; Japan 110; Canada 60.	268,571
WO_3 content [6]	189	238	(2)	(2)
Ore, 60 percent WO_3 equivalent.	316	397	(2)	(2)
Vanadium concentrate		360	All to United States	7,870
Zinc:				
Concentrate:				
Gross weight	320,731	261,966	United States 98,776; Belgium 47,781; Japan 34,529.	
Zinc content	176,206	144,368	(2)	8,666,063
Refined bars and slabs	30,338	37,299	Brazil 17,103; United States 8,342; Netherlands 3,426.	7,757,629
Total zinc content	206,544	181,667		16,423,692
Total value, metals				201,025,088

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal destinations	Value (U.S. dollars) [1]
Nonmetals:				
Abrasives, natural, kilograms—crude.	1,200			
Barite, crude	101,940	84,678	United States 83,487; Chile 1,099; Ecuador 91.	842,590
Cement, Portland	1,314	71	All to Chile	2,760
Clays, refractory—kilograms	500	1,020	All to Bolivia	145
Gypsum, calcined	6	2	All to Ecuador	36
Salt	479	1,027	All to Ecuador	24,468
Stone: Ornamental porphyry, onyx, marble.	411	77	United States 53; Italy 24	3,656
Total value, nonmetals				873,655
Mineral fuels:				
Coal, anthracite	2,000	10,624	Japan 9,250; Chile 1,201; Bolivia 173.	113,211
Peat	275	85	All to Chile	373
Petroleum, crude [7] thousand 42-gallon barrels.	2,520	2,758	United Kingdom 1,312; Brazil 621; Argentina 509.	6,813,962
Liquid petroleum gas—do	[8]	1	Ecuador; Chile	7,034
Petroleum refinery products [7]	349,056	254,823	Chile 97,993; New Zealand 74,117; bunkers 25,476.	6,346,364
Petroleum refinery products: [7]				
Aviation gasoline. thousand 42-gallon barrels.	38	15	[2]	[2].
Motor gasoline—do	51	3	[2]	
Jet fuel—do	8		[2]	
Kerosine—do	271	5	[2]	
Distillate fuel oil—do	1,976	1,536	[2 9]	
Residual fuel oil—do	225	212	All to bunkers	
Lubricants, including greases. do	2	8	[2]	
Other—do	2	4	[2]	
Total—do	2,573	1,783	Chile; New Zealand; bunkers.	
Total value, fuels				13,280,944
Total:				
Value of metal and mineral exports.				215,179,687
Value of all exports				540,039,326
Metals and minerals percent share in total exports.				39.8

[1] Converted from Peruvian soles at $/26.81/US$1.00.
[2] Data not available.
[3] Exclusive of 11,777 tons of bismuth ores to Japan, United States, and United Kingdom, valued at US$1,219,692, believed to have been intransit shipments from Bolivia.
[4] As officially reported. The obvious discrepancy between gross weight and lead content has not been explained or rectified.
[5] In addition 29 long tons of refined tin metal imported from Bolivia in 1961 and 7 long tons in 1962 were shipped to the United States. Peru has no tin refining facilities.
[6] Officially reported as tungsten content; however believed to be 60 percent WO_3 equivalent.
[7] Includes reexports.
[8] Less than 500 barrels.
[9] 97 thousand barrels in 1961 and 80 thousand barrels in 1962 to bunkers.

Sources: Estadistica del Comercio Exterior, 1961, 1962. Ministerio de Hacienda y Comercio, Superintendencia General de Aduanas, Lima. State Department Foreign Service Dispatches (petroleum refinery products).

TABLE 3.—Exports of selected metals and minerals in 1963 (preliminary)

(Metric tons unless otherwise specified)

Commodity	Quantity	Principal destinations	Value (U.S. dollars) [1]
Metals (metal content, unless otherwise specified):			
Antimony	885	United States 156; Belgium 37; Brazil 30.	285,870
Bismuth [2]	482	United States 236; Norway 137; United Kingdom 101.	2,145,325
Cadmium	149	United States 62; Netherlands 28; Sweden 14.	564,598
Copper	162,684	United States 82,421; West Germany 22,850; Belgium 17,382.	88,743,017
Gold—troy ounces	42,715	United States 18,975; West Germany 13,623; Japan 5,795.	1,372,472
Iron ore (gross weight)	5,737,393	Japan 2,903,167; Netherlands 568,148; Italy 413,363.	36,235,446
Lead	119,578	United States 57,195; West Germany 17,911; Netherlands 8,254.	16,502,924
Manganese	361	All to United States	16,751
Mercury—76-pound flasks	2,574	United States 1,764; Netherlands 810	412,000
Molybdenum sulfide (MoS_2)	852	France 397; United Kingdom 340; West Germany 78.	604,349
Selenium—kilograms	9,201	United States 3,828; Netherlands 3,099; Italy 1,113.	92,795
Silver—troy ounces	31,298,844	United States 14,531,042; West Germany 6,615,433; United Kingdom 2,957,482.	36,535,375
Tellurium—kilograms	962	Belgium 399; West Germany 398; United States 165.	12,391
Tin—long tons	34	All to United Kingdom	85,564
Tungsten ore: 60 percent WO_3 equivalent	368	Japan 284; United Kingdom 67; West Germany 17.	----------
Tungsten content [3]—short-ton units	19,305	Japan 14,890; United Kingdom 3,525; West Germany 890.	157,065
Zinc	185,083	United States 57,577; Belgium 37,348; Japan 21,593.	17,094,345
Total value	----------	----------	200,860,287
Nonmetals:			
Barite, crude	90,146	United States 89,828; Chile 227; Ecuador 91.	825,516
Bentonite	6	All to Ecuador	840
Marble	48	All to United States	1,515
Other	213	All to Ecuador	38,922
Total value	----------	----------	866,793
Mineral fuels: Anthracite	7,000	All to Japan	69,250

[1] Converted from Peruvian soles at $26.82/US$1.00.
[2] In addition 20 tons of bismuth imported from Bolivia were shipped to England and Norway.
[3] As reported.

Source: Banco Minero del Perú, Lima. Figures are based on paid up customhouse permits, and will not correspond to figures released by the companies.

TABLE 4.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (U.S. dollars) [1]
Metals:				
Aluminum:				
Ingots	566	572	Canada 441; United States 131	461,330
Bars, plates, sheets, and bands.	1,795	1,638	United Kingdom 482; West Germany 378; Austria 233.	1,439,492
Pipes	186	8	United Kingdom 4; United States 3; West Germany 1.	12,211
Powder	73	45	West Germany 38; Sweden 3; United States 3.	47,352
Cadmium metal—kilograms	155	522	United Kingdom 245 kg; Italy 155 kg; United States 122 kg.	1,253
Copper:				
Refined bars, rods, sheets, bands, and powder.	657	591	United States 82; United Kingdom 77; Italy 65.	609,917
Pipe	191	264	United States 72; Chile 71; West Germany 43.	359,296
Wire	38	85	Chile 36; United States 19; West Germany 10.	94,467
Alloys: Muntz metal, and others.	48	218	Netherlands 59; Austria 56; West Germany 27.	176,999
Gold:				
Bars—troy ounces	27,204	73,062	Canada 56,992; Switzerland 16,065; West Germany 5.	3,199,976
Sheets, beaten, etc—do	661	763	West Germany 416; United States 229; Austria 116.	15,348
Paste, or powder—do	965			
Iron oxide pigments, crude	139			
Iron and steel mill products:				
Cast iron	140	303	West Germany 168; United Kingdom 133; Norway 3.	21,297
Blocks, structural beams	12,288	16,515	Belgium 11,689; Luxembourg 1,677; United States 1,067.	2,282,028
Bars, plates, rods, and wire	64,404	70,268	Belgium 26,057; West Germany 20,015; Japan 6,819.	11,371,116
Rails and fittings	7,839	5,619	Japan 2,796; United Kingdom 1,579; West Germany 616.	1,189,350
Galvanized sheets	9,846	11,138	Japan 6,015; Belgium 3,166; United States 1,545.	4,182,534
Tinplate	17,227	17,266	United States 9,121; Canada 2,973; France 2,103.	4,211,485
Pipe	18,586	25,068	France 8,964; Japan 3,999; Switzerland, 2,699.	7,290,825
Ferroalloys, chrome, manganese.	1,059	377	France 172; Chile 68; United States 55.	84,073
Metals for ferroalloying: Mo, V, W.	119	58	South Africa 31; United States 19; United Kingdom 6.	5,196
Lead:				
Ingots, bars—kilograms	92			
Sheets, wires	8	5	All from United States	2,178
Pipes	45	3	All from United States	1,041
Granular, powdered	3	7	United Kingdom 3; United States 2; West Germany 2.	7,424
Antimonial lead (type)	48	35	Denmark 27; West Germany 6; United States 2.	14,556
Magnesium metal—kilograms	1,642	5,886	United States 5,279; Italy 607	7,429
Nickel:				
Refined metal	4	2	All from United States	4,095
Sheets, plates	1	1	All from United States	3,088
Nickel alloy: Monel metal, bars, pipes, etc.	28	21	United States 12; West Germany 6; Switzerland 1.	91,822
Platinum group metals:				
Iridium—troy ounces	48	66	All from West Germany	1,878
Sheets, unspecified—do	41	361	West Germany 359; United States 2.	18,050
Silver ingots, dust, sheets, do—etc.	5,948	5,208	United Kingdom 2,829; United States 1,865; West Germany 161.	4,869
Tin:				
Refined metal	80	63	Malaya 37; United Kingdom 20; United States 1.	194,514
Babbitt	18	14	United States 10; United Kingdom 3; Canada 1.	33,522
Other alloys	79	120	United Kingdom 60; United States 37; Netherlands 11.	147,389

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (U.S. dollars) [1]
Metals—Continued				
Zinc:				
Refined ingots, bars	1	5	West Germany 4; Norway 1	3,690
Plates, lithographic; bands, rods, strips.	179	178	West Germany 117; Belgium 43; United States 11.	114,393
Granular	33	38	United States 21; Belgium 10; United Kingdom 7.	17,597
Nonferrous ores, scorias, n.e.s.	22	26	All from Bolivia	32,407
Total value, metals				37,755,487
Nonmetals:				
Abrasives, natural	904	976	United States 900; West Germany 31; Netherlands 17.	116,865
Asbestos, crude	2,412	2,415	Canada 1,687; Union of South Africa 365; Southern Rhodesia 272.	474,681
Cement:				
Portland	18,161	21,809	Venezuela 14,799; West Germany 3,990; Colombia 1,908.	333,828
White (for stucco)	1,659	1,671	Denmark 719; West Germany 340; France 280.	76,745
Clays:				
Kaolin, refractory	1,509	2,316	Belgium 800; United States 767; France 414.	140,535
Fuller's earth, crude	1,811	1,995	West Germany 1,327; United Kingdom 292; United States 233.	215,243
Graphite, crude	60	50	United States 32; United Kingdom 12; Norway 4.	8,818
Mica:				
Book or sheet—kilograms	132	174	United Kingdom 63; United States 60; West Germany 51.	1,489
Scrap—do	95,383	93,256	United States 88,219; Norway 4,975; West Germany 62.	11,995
Salt, crude	93	2,459	Bahama Islands 2,336; United States 77; United Kingdom 32.	20,793
Sands, silica and other	1,966	942	United States 931; West Germany 6; Netherlands 3.	44,722
Stone:				
Ornamental marbles, slates	176	148	All from Italy	16,683
Crude limestone, magnesite, gypsum.	997	1,235	United States 1,198; West Germany 23; Netherlands 6.	107,716
Sulfur, all forms	9,983	15,764	United States 15,212; Chile 530; Belgium 20.	500,887
Witherite, crude (barium carbonate).	22	(2)	West Germany [2]; Mexico [2]	45
Other nonmetallics: cryolite, feldspar, talc, lime, calcined gypsum, etc.	846	1,898	British Guiana 1,000; Italy 302; United States 136.	129,740
Total value, nonmetals				2,200,785
Mineral fuels:				
Solid fuels	(2)	(2)	United States; West Germany	1,274
Natural gas thousand barrels	(2)	(2)	All from United States	59
Petroleum, crude and partially refined. do	94	668	All from Venezuela	1,285,304
Petroleum refinery products:				
Aviation gasoline. thousand barrels	403	223	(3)	(3)
Motor gasoline. do	48	62	(3)	(3)
Kerosine. do	19			
Distillate fuel oil. do	201	51	(3)	(3)
Residual fuel oil. do	3,009	3,155	(3)	(3)
Lubricants, including greases. do	119	169	(3)	(3)
Other. do	50	56	(3)	(3)
Total refinery products. do	3,849	3,716	Netherlands Antilles; United States; United Kingdom.[4]	17,147,576
Total value, mineral fuels.				18,434,213

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (U.S. dollars) [1]
Total:				
Value of metal and mineral imports.				58,390,485
Value of all imports				536,931,459
Metals and minerals percent share in total imports.				10.8

[1] Converted from Peruvian soles at $/26.81/US$1.00.
[2] Less than 0.5 of the unit indicated.
[3] Countries of origin and values not reported.
[4] Not reported volumetrically; distribution in metric tons was: Netherlands Antilles 43,093; United States 20,356; United Kingdom 5,688. (Total was 79,997 metric tons compared to 90,908 metric tons in 1961.)

Sources: Estadistica del Comercio Exterior, 1961, 1962. Ministerio de Hacienda y Comercio, Superintenencia General de Aduandas, Lima. State Department Foreign Service Dispatches (petroleum refinery products).

COMMODITY REVIEW

METALS

Antimony.—The largest single producer of antimony in Peru is the Cerro de Pasco Corp. at La Oroya which treats complex company-mined and custom ores primarily for their copper, lead, zinc, and silver values and recovers antimony as a principal byproduct. The La Oroya plant accounts for Peru's total production of antimony in the form of refined and mixed-metal bars. Other antimony districts producing ore or concentrates, partly for custom treatment at La Oroya and partly for Peru's export of antimony in those forms, include the Canta and Yauli districts in the Department of Lima, Huallanca in the Department of Ancash, Quiruvilca in the Department of Libertad, and Azángaro in the Department of Puno.

Arsenic Oxide.—White arsenic is an unavoidable rather than a willful byproduct of the La Oroya nonferrous metals refining complex. However, Cerro de Pasco has succeeded in transforming at least a substantial part of it from a liability to an asset by combining it with lime to produce a calcium arsenate insecticide. This product is particularly effective against the boll weevil and finds a good market with the Peruvian cotton growers; it is not an item of export. Production fluctuates principally in accordance with the amounts of enargite ($Cu_3As_5S_4$) in the copper ores smelted.

Copper.—In 1963 the Southern Peru Copper Corp., which at the start of operations in 1960 more than tripled Peru's mine output and quadrupled smelter production, extracted 118,295 tons of blister copper anodes at its Ilo smelter from 9,973,975 tons of 1.37 percent copper porphyry ore mined from the Toquepala open pits. The mine and concentrating plant are 87 kilometers northeast of the smelting center and port of Ilo, to which they are connected by a 167-kilometer standard gage railroad.

The Cerro de Pasco Corp. is Peru's second largest producer of copper and the largest integrated nonferrous metal producer. The

La Oroya metallurgical plant, 200 kilometers northeast of Lima, produced 36,913 tons of electrolytic copper, of which 63 percent was derived from complex ores supplied by its own five mines (Cerro de Pasco, Morococha, Casapalca, San Cristóbal, and Yauricocha) in the central Andean range and 37 percent from purchased ores and concentrates. Copper exports amounted to 34,231 tons valued at US$21 million, and local sales amounted to 1,325 tons valued at US$820,000.

In the last few years, the company has developed the McCune open pit at its Cerro de Pasco mine, stockpiling the low-grade copper ore for future treatment by heap leaching. In december 1963, an ore body of high direct-smelting grade was discovered in the pit. Rail shipment of this ore to La Oroya for smelting should raise the total metal production in 1964. The Yauricocha mine yields the company's only other direct smelting ore. The Cerro de Pasco, Morococha, and Casapalca mines have their own concentrating plants, and ores from the San Cristóbal mine are upgraded at the Mahr concentration mill. The Cerro de Pasco Corp. also owns bituminous coal mines at Goyllarisquizga and Jatunhuasi, and affiliated interests in Peru amounting to 60 percent of Minas de Cobriza, S.A. (copper mining), 60 percent of the Cía. Minera Raura, S.A. (lead-zinc-copper-gold-silver mining and milling), 46 percent of Industrias de Cobre, S.A. (electric wire and cable), 42 percent of Refractorios Peruanos, S.A. (refractory brick), 33.3 percent of Cía. de Minas Buenaventura, S.A. (lead-zinc-copper-silver mining and milling), 32.32 percent of Explosivos, S.A. (explosives), 28.54 percent of Metalurgía Peruana, S.A. (steel castings), and 22.25 percent of Southern Peru Copper Corp. Development of a 3 million ton vein-type deposit containing 3.5 percent copper continued at the Cobriza property 185 kilometers southeast of La Oroya in the Big Bend of the Mantaro River.

The Northern Peru Mining Co., a subsidiary of the American Smelting and Refining Company and the third largest copper producer in Peru, operated a mine, concentrating plant, and precipitation unit at Quiruvilca, 113 kilometers east of Trujillo. The company's 1963 production amounted to 5,719 tons of copper in concentrates and 712 tons in cement copper precipitated from acid mine waters. The parent American Smelting and Refining Company started an extensive drilling program on Peru's (and South America's) northernmost porphyry copper body at Michiquillay, 32 kilometers east of the city of Cajamarca. The contractors, Boyles Brothers of Salt Lake City, completed nearly 18,300 meters of diamond drilling in 1963 and are expected to continued throughout 1964.

The three leading companies accounted for 83.3 percent of Peru's mine production of copper in 1963, and 98.6 percent of the smelter products.

The French company Cie. des Minas de Huaron produced 12,156 tons of concentrates containing 3,386 tons of copper from its copper-lead-zinc mine 48 kilometers north of Cerro de Pasco.

The English-controlled Lampa Mining Co., produced matte containing 2,154 tons of copper from four small reverbatory furnaces near the Santa Lucia station on the Southern Peru Railway, 48 kilometers west of Lake Titicaca. The furnaces treated direct-smelting ore from the Berenguela mine and copper concentrates from the ore mined and

milled at the San Rafael mine. The company planned to close its smelter operation (the only British owned smelter in South America) and intensify its production of concentrates for shipment from San Rafael because of rising costs and declining ore grade at Berenguela. Experiments with a pilot segregation plant continued with varying degrees of success.

Peruvian companies producing copper concentrates included Minas de Cobre de Chapi, S.A.; Cía. Minera Pativilca, S.A.; Cobre Acarí, S.A.; Cía. Minera Algamarca, S.A.; and Cía. Minera Condor, S.A.

A Japanese company, Cía. Minera Condestable, S.A., resumed construction work on a 300-ton-per-day flotation mill at its mine near Mala, following settlement of difficulties in obtaining water rights. The mill was scheduled to go on stream in July 1964.

Gold and Silver.—The figures for total gold in the production table are those recorded in the official Anuario de la Industria Minera del Peru, and include an estimate of 100 kilograms (3,215 troy ounces) of fine gold produced annually by approximately 2,000 miners engaged in intermittent placer mining from streams on the eastern slope of the Andes. This product is not controlled by the Peruvian Government, and the actual yield is not known, but informed observers resident in Peru believe a more realistic figure is on the order of 700 kilograms. If such is the case, the official total figures may be short of reality by a well-rounded 19,000 to 20,000 ounces annually. In 1963 this unorganized placer production was augmented by a firm 4,609 ounces of gold dredged intermittently by the Natomas Company of Peru, formed by the Natomas Company of California and operating by agreement with the Sociedad Aurífera San Antonio de Poto, about 50 kilometers north of Lake Titicaca.

The only lode mine reporting production of gold exclusively in 1963 was that of the Andaray Gold Mines Co. in the Department of Arequipa which yielded 5,534 troy ounces. Cía. Aurifera Buldibuyo in La Libertad and the San Luis Gold Mines Co. in Ayacucho exhausted their commercial ores in 1962 and were shut down in 1962. The exclusively precious metal lode mines include Cía. Explotadora Millotingo (a major silver producer), Department of Lima, and Cía. de Minas del Peru, Department of Arequipa, which produce both gold and silver. All other gold and silver production was from a few precious metal mines with base metal byproducts and many base metal mines with precious metal byproducts or coproducts. Principally, but not entirely, the gold is associated with copper ores and the silver with lead and lead-zinc ores. Cerro de Pasco produced 39,459 ounces of refined gold (46 percent from purchased ores and concentrates) and 19,696,000 ounces of silver (58 percent from purchased ores and concentrates). The 118,295 tons of blister copper anodes produced by the Southern Peru Copper Corp. contained 1,268 ounces of gold and 80,860 ounces of silver. About mid-year the Consorcio Minero del Peru closed its Calpa and Otoca gold-silver-copper properties which ceased to be profitable, and merged with Cía. Minera San Juan de Lucanas in which it held 50 percent interest; the Consorcio was dissolved. The old San Juan de Lucanas mine was Peru's second largest silver producer, deriving 2,400,000 ounces from 155,000 tons of ore containing 17.8 ounces of silver and 0.032 ounce (1.01 grams) of gold

per ton and 1.05 percent lead. Other major silver producers were Castrovirreyna Metal Mines and Cía. de Minas Buenaventura.

Three new flotation mills for beneficiating silver ores were completed during the year: A 120-ton-per-day plant at the Machicala mine of Cía. Minera Acre, 40 kilometers (25 miles) east of Trujillo; a 50-ton-per-day plant at the Kiowa mine of Cía. Minera Yarabamba, south of Arequipa; and a 50-ton-per-day plant of the old Arcata mine of Cía. Minera Arcata, owned by Mauricio Hochschild and Peruvian associates, near Juli in the Department of Puno.

Iron Ore.—In addition to the 6,161,157 metric tons of iron ore reported as 1963 production, 1,340,820 tons was added to Marcona's crusher stockpile. Export earnings increased 13.2 percent over those of 1962, and Marcona supplied 25,930 tons of ore to the Chimbote steel plant.

The Marcona Mining Co. is the largest iron ore company on the west coast of South America, having a known ore reserve of over 400 million tons in a deposit on the coastal plateau about 336 kilometers (210 miles) south of Lima. The deposit is owned by the Santa Corporation, a semiautonomous Government agency which in 1952 entered into a leasing agreement for 20 years with the Utah Construction Co. and Cyprus Mines Co., who then formed the Marcona Mining Co. The lease was later extended for an additional 10 years. In the first 10-year period, Marcona maintained a uniform 60 to 61 percent shipping grade of iron ore by very selective open pit mining, concentration, and careful blending; the ore was shipped through its port facilities at San Juan Bay. In February 1960, a new agreement was concluded with the Santa Corp. which served as a basis for private ownership and construction of a beneficiation plant and port facilities at San Nicolas Bay, just north of San Juan Bay, at an estimated cost of US$55 million. The plant was designed to treat the primary magnetite ore which averages 58 percent iron with sulfur content up to 2.5 percent. This ore is ground, screened, and upgraded by magnetic separation, and a proportion of the product made into pellets containing 68 to 69 percent iron. The Lurgi pelletizing unit of the plant started operating in July 1963, and when two additional grinding and magnetic separation units are operating continuously, the plant will have a yearly capacity of 1 million tons of pellets.

The only other producer in the country was the Peruvian company Panamerican Commodities, S.A., which operates the Acarí iron ore mine 56 kilometers by paved road southeast of the port of San Juan. All mining was underground by sublevel stoping methods. In 1962 a dry magnetic separation unit was installed to upgrade the fines rejected by the crushing and sceening plant. The ore for export moves by truck to the company's port facilities just north of those of Marcona at San Juan Bay. Acarí production in 1963 amounted to 934,800 tons of ore averaging 64 percent iron. The ore reserve was reported to be sufficient for 2 to 3 years. Because of financial difficulties encountered in 1962, the Banco Minero was designated by the Government to oversee the operation until the Government's guarantee to the American Overseas Finance Corporation is repaid.

Iron and Steel.—The Chimbote plant of the Santa Corp. continued steel production at an uneconomic rate. The plant was in process of enlargement by the Santa Corp. which is heavily in debt.

Lead and Zinc.—In 1963 the metallurgical center of the Cerro de Pasco Corp. at La Oroya continued to be the largest producer of lead with 80,775 metric tons of 99.99 percent electrolytic lead, of which approximately 46 percent came from ores and concentrates purchased in the Central District. The center was the only Peruvian producer of refined zinc; the entire 53,905 metric tans of electrolytic slabs (99.99 percent zinc) came from Cerro's operating mines, in addition to which the company exported 90,000 tons of zinc concentrates averaging 56 percent zinc. The company's increase in production over that of 1962 can be attributed to (1) expansion of the lead refinery capacity from 168 to 200 million pounds per year; (2) expansion of the zinc refinery capacity from 110 to 126 million pounds per year; (3) increases in the market prices of lead, zinc, and silver; and (4) a year of compatible labor relations uninterrupted by strikes. By the end of the year, two new drainage tunnels being driven at Cerro de Pasco's Casapalca lead-zinc-silver-copper mine were open for 2 miles of the 7 miles needed to tap the veins below the lowest development workings at the 3,900-foot level. The volume of water encountered to the 2-mile point was 100,000 gallons per minute. Completion of the tunnel, which should greatly extend the life of the mine, lies several years in the future.

Other major producers of lead and zinc concentrates included Cía. Minera Atacocha, S.A. (the country's largest producer of lead from a single mine); Cía. Minerales Santander (a St. Joseph Lead Co. subsidiary and, next to the Cerro de Pasco Corp., the country's largest producer of zinc); the French Cie. des Mines de Huaron; Cía. Minera Milpo, S.A.; Sociedad Minera "El Brocal"; Northern Peru Mining Co. (American Smelting and Refining Company); Volcan Mines Co.; Sindicato Minera Rio Pallanga; Cía. Minera Santo Toribio, S.A.; and Sociedad Minera Yauli. Except as otherwise noted, these are Peruvian companies.

Since its creation in 1940, the Mining Bank of Peru (Banco Minero del Peru) has aided the development of the Peruvian mining industry by making loans to the small miners and sometimes to the larger Peruvian companies, selling equipment, tools, and explosives, purchasing ores and concentrates, and operating an assay office in Callao, seven branch offices, and five custom mills. The declining activities of the small miners are reflected in the custom mills, which treated 132,312 tons of ore in 1961, 94,243 tons in 1962, and 91,533 tons in 1963. As reported in terms of metal content, the ores milled in 1963 yielded 3,417 metric tons of lead concentrates, 3,373 tons of zinc concentrates, and 385 tons of copper concentrates. A local group, with a loan from the Mining Bank, was planning in 1963 to exploit the Chavin mine which Victor Kravchenko (author of "I Chose Freedom") sold to Ventures, Ltd., of Canada. The mine, 121 kilometers (75 miles) northeast of Chincha Alta, has an estimated 350,000 tons of high-grade lead-zinc ore.

For several years the Mining Bank has been trying to promote a lead smelter and zinc refinery to be located on the coast at Ancón, north of Callao, but recently decided that the lack of locally available coking coal would make operation of a lead smelter uneconomic. A revised proposal to construct a 100-tons-per-day electrolytic zinc plant

and an auxiliary 175-tons-per-day sulfuric acid plant has encountered little private support from the zinc mining companies.

Manganese.—Modest production of manganese ore has been entirely from the Gran Bretana mine in the Central District.

Mercury.—The Santa Barbara mine of Sociedad Minera El Brocal, S.A. (formerly operated by Fernandini, Clotel y Hermanos), near Huancavalica was the only producer of mercury in Peru in 1963. Its 3,086 flasks of liquid metal required the treatment of 65,160 metric tons of ore containing 3.6 pounds of mercury per metric ton.

Molybdenum.—A flotation circuit was installed in 1962 in the Toquepala concentrator of the Southern Peru Copper Corp. to recover the fractional percentage of molybdenum contained in the copper ores. This was Peru's only commercial source of molybdenum.

Tin.—A minute amount of tin in ores is recovered in lead-tin-antimony bars produced from lead drosses in the byproducts plant of the Cerro de Pasco Corp. at La Oroya. The only producer of tin concentrates, all of which is exported, was the Lampa Mining Co. which has added a tin concentrating unit to its copper concentrator at San Rafael.

Tungsten.—The low demand for tungsten has forced closure of all Peruvian producers except the Pasto Bueno mine of F. Malaga Santalla. Continued operation of this property at a reduced scale has been sustained only by the Peruvian Government suspension of the 4 percent export tax on tungsten ore. Cerro de Pasco plans to install a magnetic separator for the byproduct recovery of wolframite from ores at its Morococha mine.

Vanadium.—The Vanadium Corporation of America, which shipped a small cleanup tonnage of vanadium ore in 1962, closed down exploration in 1963 and disposed of all supplies and portable machinery. The corporation will maintain its old mining concession in the Mina Ragra District.

Byproducts.—In addition to its copper, lead, and zinc smelters and refineries, Cerro de Pasco conducts a complicated assembly of metallurgical operations at La Oroya to obtain the highest possible commercial yield from the complex ores it treats. These byproducts include the antimony, arsenic oxide, silver, and tin previously mentioned, plus bismuth, selenium, tellurium, copper sulfate, zinc sulfate, and much of the gold listed in the production table. Other items regularly produced but not reported quantitatively include sulfuric acid, calcium carbide, oxygen, hydrofluosilicic acid, silica brick, fire clay brick, magnesite brick, slag brick, and coke. Indium and thallium, now going to the dumps, can be recovered if and when justified by market demands.

NONMETALS

Barite.—This was the only nonmetallic mineral produced in Peru principally for export. The chief producers, Barmine Co. and Cía. Perfordora de Pozos para Irrigación, S.A., operated mines in the upper Rimac Valley, northeast of Lima. The barite was consigned to oil companies operating in the North American Gulf Coast, Chile, and Ecuador, for use in drilling muds.

Cement.—The cement manufacturers of Peru and their rated annual capacities are as follows:

Company:

	Capacity (metric tons)
Cía. Peruana de Cemento Portland	612, 000
Cía. Cemento Chilca	204, 000
Cemento Chiclayo, S.A.	68, 000
Cemento Pacasmayo	106, 000
Cía. de Cemento Andino, S.A.	85, 000
Total capacity	1, 075, 000

Production rose in 1963 to about 70 percent of rated capacity and may have met the requirements of the country, which previously has been a net importer of cement. To produce 754,089 tons of cement, the industry used 982,000 tons of limestone and 30,000 tons of gypsum.

Clays.—Most of the clay industry is small and well dispersed throughout the country. Refractarios Peruanos, S.A., continued to be the largest manufacturer of refractory brick, and the two largest copper companies are its best customers.

Lime.—Distribution of burnt lime produced in 1963 showed 45,000 tons consumed in construction, 22,000 tons for agricultural uses, 13,000 tons by mineral concentration plants, and 5,000 tons by chemical and industrial plants.

Phosphates and Potash.—Guano containing 14 percent nitrogen was the only phosphate fertilizer produced in 1963, as it has been for many years. In June 1963, the Cía. Administradora del Guano was absorbed by the Corporación Nacional de Fertilizantes (National Fertilizer Corp.), organized to increase the production and distribution of fertilizers.

The great phosphate rock reserves in the Sechura Desert, extensively explored since 1959 by Midespa Industries, Ltd., of Montreal, Canada, through its Minerales Industriales del Peru, S.A., remained unexploited throughout 1963. Minera Bayovar, S.A., was organized to mine the phosphate deposit with which potash and salt are associated. By special law the Congress granted Minera Bayovar exception to the monopoly control of salt production held by Estanco de la Sal, and also granted special consideration of a 7 cents-per-ton export tax and permission to export phosphate, potash, and salt on ships other than Peruvian registry. At the end of 1963 a contract between the government and Minera Bayovar awaited approval by the Ministry of Public Works and Finance.

Salt.—Production of salt fell short of domestic consumption by 16,254 tons in 1962 and 22,657 tons in 1963. Marine salt was produced by evaporation at the great Salera de Huacho, 25 kilometers south of the port of Huacho and about 5 meters below mean sea level. Solar evaporation also was used to crystallize salt from waters which leach the saline lands near the Hacienda Cantato, 7 kilometers from the port of Pisco, and from saline springs in both the coastal and sierra regions. Rock salt was mined from the 6-million-ton deposit at the Solera de Atacocha, 45 kilometers north of Ayacucho. All operations have been controlled by Estanco de la Sal.

The Morton Salt Co. and Rayon Peruana, S.A., have joined in founding a new company, Industrias Químicas del Peru, which in 1963

was engaged in the construction of a new electrochemical plant near Lima's satellite city of Ventanilla at a cost of about US$3.5 million. The plant was scheduled for operation in April 1964. Salt will be utilized to manufacture caustic soda and other chlorine derivatives at an initial rate (later to be increased) of 15 tons per day. This should greatly reduce the imports of caustic soda, which in 1963 amounted to 12,606 tons valued at US$797,000.

MINERAL FUELS

Coal and Coke.—Cía. Carbonera Pallasca, S.A., produced 13,370 tons of washed and sized anthracite in 1963 from its mine near the Santa River approximately 100 kilometers east of Chimbote. Paid up customhouse permits were issued for the export of 13,557 tons of anthracite from this mine to Japan. The Northern Peru Mining Co. produced 7,800 tons of anthracite from its Cuyacullo mine for heat and fuel in its camps. The only other anthracite production during the year was unreported quantities from small seams in various areas of the country for domestic use.

Cerro de Pasco mined 118,000 tons of bituminous coal from its Goyllarisquizga mine in the Department of Pasco, and produced 39,500 tons of metallurgical coke, all of which was used in the La Oroya smelter. The company also imported 500 tons of metallurgical coke from England and planned to import a similar tonnage in 1964.

Petroleum.—Peru's petroleum industry is long established but production has been relatively small, being outranked in South America by that of Venezuela, Argentina, Colombia, and Brazil. Nevertheless, in recent years it has accounted for over 4 percent of the gross national product and employed more than 9,000 people with an annual payroll of about US$25 million. The relationship between the characteristics of Peruvian petroleum and the pattern of domestic demands is such that Peru (judged by data available for 1961 and 1962) is a net importer of crude and a net exporter of petroleum refinery products. Domestic consumption of 23,464,000 barrels of petroleum products in 1963 exceeded total production by only 918,000 barrels. The 19.2 percent increase in production of crude over 1959–62 was exactly the same as that of the South American Continent, and 8.7 percent greater than that of the world as a whole. During the same period, Peru's production of refinery products increased 15.0 percent.

In 1963 nearly 90 percent of the domestic petroleum products were produced at the Talara refinery of the International Petroleum Co., the major portion being consumed within the country. The Empresa Petrolera Fiscal topping plant near Iquitos and the small batch refinery of Cía. de Petroleo Ganso Azul, Ltda. at Pucallpa supplied the needs of the Peruvian Amazon basin for gasoline, kerosine, and diesel oil. The new Conchan topping plant, constructed in 1961 on the Pan-American Highway 29 kilometers south of Lima, went on stream February 15, 1963. It is owned jointly by the Banco Popular (65 percent) and the Standard Oil Co. of California (35 percent). Technicians of the latter company manage the refinery, and marketing is handled by Petrolera Conchan, S.A., which is owned by Mariano I.

TABLE 5.—Distribution of crude petroleum production by zone and company

(42-gallon barrels)

Zone and company	Production		
	1961	1962	1963
Northwestern coastal and Continental Shelf zones:			
International Petroleum Company, Lobitos	8,813,827	9,488,800	8,893,016
International Petroleum Company (I.P.C.)	7,831,095	8,110,111	8,603,843
Empresa Petrolera Fiscal	968,596	1,381,313	2,048,192
Belco Petroleum Corporation	623,248	598,936	568,692
Peruvian Pacific Petroleum Company	91,690	176,631	74,152
Petrolera Amotape	42,104	25,970	20,215
Douglas Oil Company	7,862		
Total	18,378,422	19,781,761	20,208,110
Eastern zone:			
Cía. Petrolera Ganso Azul	687,306	787,944	754,553
Cía. Pedro "El Oriente", S.A.	305,146	563,749	505,337
Total	992,452	1,351,693	1,259,890
Total Peru	19,370,874	21,133,454	21,468,000

Prado of the Banco Popular. Refinery feed during the remainder of the year was 1,530,000 barrels of crude obtained from Venezuela (Boscan) and the State owned Empresa Petrolera Fiscal in northwestern Peru. Products consisted of gasoline, kerosine, diesel, and fuel oil marketed in the Lima area. It is possible that initial difficulties of operation were responsible for the sharp rise in refinery losses noted on the production table.

An organic law promulgated in May 1963 authorized Empersa Petrolera Fiscal (EPF) to solicit international bids for construction of a refinery of 12,500-barrel-per-day-output capacity. After receiving these bids, the EPF board of directors in September declared them null and void because of technicalities and announced that new bids would be requested shortly. This had not materialized by the close of the year.

The prolonged legal dispute between the International Petroleum Co. (Standard Oil Co. of New Jersey affiliate) and the Government of Peru, still unresolved at the end of 1963, has an unusual and complex history. In 1826 ownership of the La Brea property and its pitch deposits near Talara on the north coast was transferred by the government of the new Republic to one Sr. Quintana in payment of a debt of 4,964 pesos incurred for supplies used in the war of independence from Spain, won by Peru at the Battle of Ayacucho on December 9, 1824. Subsequently the property and its mining rights passed through several private hands and was extended to encompass the Mancana estate, also on the pitch deposits, and the contiguous Pariña estate. In February 1888, Sr. Genero Helquero, who had acquired the property 10 years earlier, sold it to Herb Tweddle, an English oil promoter, who leased it to the London and Pacific Petroleum Co. Meanwhile, a law had been enacted requiring the filing of claims of 40 hectares each for petroleum and coal. In 1911 the Peruvian Government, by resolution of President Leguia, ordered exact measurement of the 41,614 claims comprising the property and payment of their surface taxes, but the British company claimed exemption. In 1918 the Peruvian Con-

gress, responding to diplomatic protests by the British minister to Peru, authorized the government to submit the tax claim to the International Court of Arbitration. Then in January 1922, they enacted Petroleum Law No. 4452 which declared all petroleum deposits to be property of the nation and assigned to the government the right to grant petroleum concessions against a 10 percent royalty plus certain surface rentals. In April 1922, the Court of Arbitration, meeting in Paris, ruled that the owners and lessees should pay US$1 million as settlement of all taxes claimed to have accrued before December 21, 1921, and should be exempt from further taxation until 1972, when the property should become subject to all taxes then valid. On the basis of this decision, the International Petroleum Co., in February 1924, purchased the property. The settlement was paid, but the extended exemption and ruling that the subsoil of the La Brea-Pariñas property belong to a private and foreign company rather than the nation was regarded by many Peruvians as interference in the national sovereignty, and the matter became a political issue. On October 31, 1963, the Peruvian Congress unanimously voted to invalidate the 1922 arbitration award signed by the British and Peruvian Governments, in a bill stating that the agreement violated pertinent legal requisites and therefore does not obligate Peru. The bill also cancelled previous congressional authorizations to submit the question to arbitration by international negotiations. At the same time, a bill was submitted to the senate by the executive which offered two alternatives: A new contract with the International Petroleum Co. under a modified tax status (which I.P.C. claimed would be 102 percent of profits, equivalent to "economic confiscation"), or transfer of I.P.C.'s properties and operations to Empresa Petrolera Fiscal, the Government-owned petroleum agency. In the senate it was recommended to refer the question back to the executive for either selection of one of the two alternatives or re-entry into negotiations with I.P.C. in an effort to reach an acceptable formula for settlement. Interest in the controversy has been based on both its importance to the petroleum industry and the repercussions which any settlement may have on the general investment climate. I.P.C.'s gross investment in Peru is estimated at US$193 million.

The Mineral Industry of Surinam

By Garn A. Rynearson [1]

BAUXITE mining, processing, and export continued to dominate Surinam's mineral industry during 1963, accounting for 99 percent of the value of all reported mineral production and 77 percent of the value of all exported commodities. Output of bauxite increased about 7 percent from that of 1962 to an alltime high of 3,482,142 metric tons, exceeding the previous record production reported for 1960 by some 27,000 tons but nearly 153,000 tons lower than the export record set in that year. The gain over 1962 output was largely a result of an industry strike in British Guiana which gave Surinam an opportunity to supply a larger than usual share of the Canadian market.

Surinam, formerly known as Netherlands Guiana or Dutch Guiana, has produced more bauxite than any other country in the world. The country has no facilities for converting its bauxite into alumina, metal, or aluminum chemicals, and all its output has been exported, either in a raw or a calcined form. Total output from 1922 through 1963 amounted to 60.5 million metric tons, representing nearly 16 percent of the world supply during that period. Surinam was the leading bauxite producer in 1941 and from 1947 until 1956, when its annual output was surpassed by that of Jamaica. Surinam then ranked second for 4 years and has ranked third behind the U.S.S.R. since 1959.

As bauxite output increased in other parts of the world, Surinam's share of the world market dwindled from a high of 27.9 percent in 1947 to 11.5 percent in 1963. The United States has received 93 percent of Surinam's bauxite exports, and a large part of the remainder has gone to Canada.

Aside from its eminence in bauxite, the country's mineral industry is extremely limited, even for a small underdeveloped nation. Relatively modest amounts of sand, gravel, and clay and small quantities of gold and several pegmatite minerals are produced more or less regularly. The country does not produce portland cement or lime, for calcareous rocks apparently do not occur or are very scarce in the readily accessible regions. Furthermore, no mineral fuels are produced, but the possibility of finding and developing offshore deposits of oil and gas appears promising. Chromite, iron, manganese, and tungsten ores, as well as platinum, diamonds, beryl, mica, and kyanite are known to occur in the country. Apparently none of these known occurrences were worthy of exploitation on a commercial scale under conditions existing in 1963.

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Efforts to broaden the base of the mineral industry have been hampered by the geographic character of the country. Surinam has large areas of swamp in the lowland coastal region and most of the interior highlands are covered by dense forest. Access to the latter region is extremely difficult, and large areas have not been prospected or even surficially explored. In 1959, the Geological and Mining Service began an ambitious long-range geological exploration program, known as Operation Grasshopper, involving the use of aerial photogrammetric and geophysical surveys and photogeologic studies to delineate the most promising areas for investigation by ground survey crews based at seven airfields established at remote localities in the interior. As of 1963, the project was still in its early stages but had already disclosed large bauxite deposits and a new and possibly important occurrence of chromite.

Surinam offers a number of advantages that may be attractive to foreign investors, including political stability, encouragement of private enterprise, generous tax credits and certain exemptions from customs duties for new industries, low wage rates, and a relatively high level of education and literacy. These advantages are tempered by inadequate and costly transportation facilities and general inexperience of the labor force.

Surinam is an equal partner with the Netherlands and the Netherlands Antilles in the Kingdom of the Netherlands and is an associate member of the European Economic Community. The country is autonomous except for matters of defense and foreign affairs, which are under the jurisdiction of the kingdom. The local government is headed by a governor who is the appointed representative of the Dutch Sovereign. He is advised by an advisory council of five appointed by him. He also appoints a Council of Ministers with a minister-president, but its members are responsible to the popularly elected Legislative Council (Staten) of 21 members. The country is divided into eight administrative districts—the urban capital district of Paramaribo and the districts of Commewijne, Marowijne, Surinam, Saramacca, Coronie, Nickerie, and Brokopondo—supervised by civil commissioners responsible to the Minister of Internal Affairs. The Geological and Mining Service is a part of the Ministry of Development.

The population of the country is estimated to number about 320,000; more than one-third of the populace live in the capital city of Paramaribo. About half of the working force is engaged in agriculture and about 5 percent in mining and associated activities. Dutch is the official language but English is widely spoken, especially in Paramaribo. The currency used in Surinam is the Surinam florin (or guilder); the rate of exchange is Sur.f1.00=US$0.535.

Mining, agriculture, and forestry are the principal productive sectors of the Surinam economy. Mining contributes roughly one-third of the gross national product, whereas agriculture and forestry together account for about one-sixth. A considerable part of the government's revenue is derived from taxes, royalties, and fees levied on producers of bauxite and payment for services and other fees by firms that ship the bauxite.

SOURCE MATERIAL

Statistical data on mineral production are those reported by the U.S. Consulate General at Paramaribo and include figures obtained from both official and company sources. Foreign trade data are from monthly and annual publications of the General Bureau for Statistics of Surinam. Background material and information pertaining to the mineral industry are based in part on consular dispatches and in part on the following published sources:

1. Lubig, M. R. Bauxite in Surinam. U.S. Department of Commerce, World Trade in Commodities, v. 8, pt. 23, No. 5, April 1950, pp. 1–7.

2. Engineering and Mining Journal. Surinam's Ten-Year Development Program, v. 161, No. 6, June 1960, pp. 104–106.

3. Engineering and Mining Journal. Operations Grasshopper Opens Up Surinam's Untapped Mineral Frontier, v. 161, No. 6, June 1960, pp. 107–113.

4. Cazort, J. G., Jr. Stripping Overburden With a Dredge. Mining Engineering, v. 12, No. 10, October 1960, pp. 1083–1089.

5. Cazort, J. G., Jr., and De Witte, J. J. Suralco's Bauxite Handling System. Mining Engineering, v. 12, No. 11, November 1960, pp. 1166–1169.

6. Bracewell, Smith. Bauxite, Alumina, and Aluminium. Overseas Geological Surveys, 1960, pp. 191–194.

7. van Eijk, H. T. L. Preliminary Abstract Concerning Pegmatite Investigations in Northeastern Surinam. Geologisch Mijnbouwkundige Dienst van Suriname Jaarboek, 1956–58. 1961, pp. 87–90.

8. Janssen, J. J. Bauxite in the Adampada—Kabalebo Area, Surinam. Presented at the Sixth Inter-Guiana Geological Conference, Macapá and Belém, Brazil, October 1–8, 1963.

PRODUCTION

The total value of mineral commodities produced in Surinam during 1963 amounted to approximately US$35.7 million, compared with US$33.2 million in 1962. Bauxite represented slightly more than 99 percent of these totals, and the contribution of all other minerals amounted to only US$252,000 in 1962 and US$292,000 in 1963. The quantity of bauxite produced in 1963 increased 7 percent over that of 1962, but its value increased only 4.5 percent because the total output included a larger proportion of the lower value metallurgical-grade bauxite. About 15 tons of cassiterite and columbite-tantalite concentrates were produced during 1962 or 1963 for export to the Netherlands. An estimate of their value has been included in the previously cited figures for 1963.

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TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum ore (bauxite), all grades	3,403,000	3,455,000	3,405,172	[1] 3,254,301	3,482,142
Columbium-tantalum ore					[2] 2
Gold, troy ounces	5,826	4,932	4,011	[3] 2,592	[3] 3,548
Tin: Cassiterite concentrate, long tons					[2] 2
Nonmetals:					
Lithium minerals: Amblygonite			431	750	515
Sand, crushed	6,678	8,184	8,895	8,366	7,671
Stone, crushed	16,654	18,644	18,750	17,000	14,782

[1] Exports.
[2] Imports from Surinam by the Netherlands. The Netherlands also imported 11 tons of unspecified metallic ores from Surinam in 1963, most or all of which probably was cassiterite or columbite-tantalite or both.
[3] Revised figure, supersedes that given in commodity chapter, volume 1.

TRADE

Surinam's foreign trade increased sharply during 1963, but its composition and general pattern remained much the same as in the 2 preceding years. Total value of exports increased by US$3.7 million to US$46.0 million, while the value of imports increased by US $3.9 million to US$59.0 million.

Bauxite has been by far the most important of Surinam's relatively small number of export products and has customarily represented about 80 percent of the total value of all goods exported. In 1963, however, bauxite's dominance diminished a few percentage points as the aggregate of receipts for other commodities attained a record US$10.6 million, representing 23 percent of the total. Other than bauxite, the most valuable export commodities are wood products (plywood, particle board, and lumber) and rice.

As is the case in most underdeveloped countries, Surinam's economy depends heavily on imports of consumer and capital goods. In addition to considerable amounts of foodstuffs, the country has imported virtually all its requirements for metals, fuels, and machinery and other heavy manufactures as well as many of the raw materials it needs for use in agriculture, construction, and light manufacturing. In terms of value, mineral fuels and lubricants have represented more than half of all imports of metals and minerals. Semimanufactures of iron and steel and cement also were major import commodities.

The United States and the Netherlands have been Surinam's principal trading partners. The value of bauxite exports to the United States have exceeded the total value of all other exports to all countries; however, the Netherlands has generally received the largest share of exports other than bauxite. Imports from the United States normally exceed those from the Netherlands. The principal imports from the United States have been machinery and vehicles, flour, lubricants, tires and tubes, and woven fabrics. Most imports of raw or semimanufactured metals and nonmetals came from the Netherlands and other European countries, and most of the mineral fuel imports came from Trinidad and the Netherlands Antilles.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		Value (Surinam guilders) [1]
		Quantity	Principal destinations	
Metals:				
Aluminum:				
Bauxite, all grades, including calcined.	3,403,610	3,254,301	United States 2,968,900; Canada 277,729; Netherlands 3,132.	62,468,000
Metal (reexports):				
Unwrought	2	6	All to Netherlands	1,600
Semimanufactures	1	(2)	All to Brazil	300
Copper, unwrought (reexports)	32	54	West Germany 38; Netherlands 16	30,800
Iron and steel (reexports):				
Unwrought	602	751	All to Netherlands	21,000
Semimanufactures	60	6	Trinidad 5; French Guiana 1	3,400
Lead, unwrought (reexports)	30	24	Netherlands 18; West Germany 6	3,400
Zinc, semimanufactures (reexports).	25			
Total value, domestic products				62,468,000
Total value, reexports				60,500
Nonmetals:				
Amblygonite	431	750	All to West Germany	97,700
Cement (reexports)	27	10	All to Brazil	500
Sand, clay, and earth	1,323	6,662	Netherlands Antilles 5,677; Brazil 973; French Guiana 12.	60,000
Total value, domestic products				157,700
Total value, reexports				500
Mineral fuels (reexports):				
Petroleum refinery products:				
Gasolines. 42-gallon barrels	94	6	All to French Guiana	100
Distillate fuel oil do	38	38	do	600
Lubricating oil do	13	153	British Guiana 150; French Guiana 3.	7,300
Other do		4	All to Brazil	100
Mineral tar	17	19	All to British Guiana	2,000
Total value, reexports				10,100
Total:				
Value of metal and mineral exports.[3]				62,625,700
Value of all exports, f.o.b.[3]				78,978,000
Metals and minerals percent share in total exports.[3]				79.3

[1] The Surinam guilder or florin is equivalent to US$0.535 (US$1.00=Sur. fl.87).
[2] Less than 1 ton.
[3] Excludes reexports.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (Surinam guilders) [1]
Metals:				
Aluminum, semimanufactures	138	112	United States 51; United Kingdom 22; Switzerland 16.	195,100
Copper:				
Unwrought	1			
Semimanufactures	95	67	Netherlands 38; United Kingdom 17; United States 11.	167,500
Iron and steel:				
Unwrought	146	39	United States 37; Netherlands 2	16,000
Semimanufactures	9,357	9,536	Netherlands 4,625; Belgium 2,434; West Germany 1,679.	3,067,300
Gold, unwrought, troy ounces	66	20	All from United Kingdom	1,200
Lead, semimanufactures	28	24	Mainly from Netherlands	13,200
Mercury, kilograms	(2)	33	Netherlands 20; United States 13	700
Nickel, semimanufactures	(3)	(3)	United States Sur. f800; West Germany Sur. f600.	1,400
Tin, semimanufactures, long tons	5	3	Mainly from Netherlands	14,700
Zinc, semimanufactures	45	(4)	All from Netherlands	400
Other metals and metalliferous ores.	4,609	9,073		802,300
Total value, metals				4,279,800
Nonmetals:				
Abrasives, natural		2	Mainly from Netherlands	1,400
Cement:				
Refractory	56	41	United States 21; Netherlands 20	12,400
Other	21,997	81,862	Venezuela 67,917; Netherlands 6,637; Colombia 4,341.	2,848,000
Chalk	203	199	Netherlands 134; Belgium 65	14,300
Earths, pigment and siliceous	42	48	United States 40; Netherlands 8	12,500
Fertilizer materials:				
Nitrogenous	2,324	2,461	Netherlands 1,048; Trinidad 764; United States 649.	467,900
Phosphatic	114	120	All from Netherlands	18,900
Potassic	54	77	All from Netherlands	8,400
Other, not specified	158	235	Netherlands 211; United States 24	33,000
Total	2,650	2,893	Netherlands 1,456; United States 673; Trinidad 764.	528,200
Lime	625	73	Netherlands 42; United Kingdom 17; Trinidad 14.	10,700
Salt	936	994	West Germany 612; Netherlands 350; Netherlands Antilles 24.	69,200
Sand, clay, and earth	98	12	Mainly from the United States	4,600
Stone:				
Dimension:				
Marble and alabaster, rough.	4	(4)		100
Other	88	79	Netherlands 68; United States 11	11,200
Crushed stone, gravel, macadam.	33,741	20,090	Trinidad 14,846; Netherlands Antilles 5,190; French Guiana 29.	274,600
Other	33	28	Netherlands 26; British Guiana 2	3,900
Other, not specified or not elsewhere specified.				9,000
Total value, nonmetals				3,800,100

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (Surinam guilders) [1]
Mineral fuels:				
Solid fuels:				
Coal	80	119	Netherlands 112; United States 7	2,900
Other	71	42	All from Netherlands	4,800
Gases, liquified:				
LP gases—42-gallon barrels	3,445	7,644	Trinidad 5,765; Venezuela 1,879	158,500
Manufactured—do	2,204	69	United States 40; Trinidad 26; Netherlands 3.	7,100
Petroleum refinery products: [6]				
Gasoline:				
Aviation—1,000 42-gallon barrels.	6	9	Mainly from Trinidad	123,000
Other—do	120	141	Trinidad 133; Netherlands Antilles 6; United States 2.	1,234,000
Kerosine—do	34	43	Trinidad 41; Netherlands Antilles 1	396,700
Distillate fuel oils—do	395	460	Trinidad 449; United States 7; Netherlands Antilles 4.	3,576,700
Residual fuel oils—do	457	492	Trinidad 485; United States 7	2,909,600
Lubricating oil—do	17	24	United States 19; Netherlands 3; United Kingdom 1.	1,417,000
Paraffin and vaseline	36	42	United States 26; Netherlands 10; West Germany 6.	19,900
Other—1,000 42-gallon barrels	1	1	Mainly from Trinidad	37,900
Asphalt, natural bitumens, and mixtures. [5]	1,513	4,052	Trinidad 3,160; United States 826; Netherlands 55.	361,100
Benzol, toluol, xylol	50	187	United States 147; Netherlands 40	31,800
Mineral tar and pitch	47	89	Netherlands 68; United States 21	64,900
Total, mineral fuels				10,345,900
Total:				
Value of mineral and metal imports.				18,425,800
Value of all imports, c.i.f.				102,992,000
Metals and minerals percent share in total imports.				17.9

[1] The Surinam guilder or florin is equivalent to US$0.535 (US$1.00=Sur. fl.87).
[2] Data not available.
[3] Data incomplete.
[4] Less than 1 ton.
[5] Excluding LP gases and petroleum asphalt.
[6] May include some refinery asphalt.

COMMODITY REVIEW

METALS

Aluminum Ore.—Surinam's bauxite deposits are of two general types. The low-level type is found within about 30 miles of the coast along the southern edge of the coastal sediments near Moengo and Paranam in the northeastern part of the country. The deposits near Moengo and some of those near Paranam occur as blankets 10 to 20 feet thick on low hills with little or no overburden. Some of the deposits on the west side of the Surinam River in the Paranam area extend 50 feet below sea level and are overlain by as much as 80 feet of sediments. Most of the bauxite in these deposits is high-grade material and, after being crushed, washed, and dried, yields a product containing 55 to 62 percent alumina, 2 to 5 percent silica, less than 10 percent ferric oxide, and 2 to 3 percent titania. A product containing 85 to 90 percent alumina may be obtained by calcining the ore.

Undiscovered deposits of this type almost certainly occur along the westward extension of this same geologic-physiographic zone.

The high-level type has been found from 75 to 110 miles south of the coast in the Lely, Nassau, Hokahin, and Wientiwaai Mountains between the Marowijne and Surinam rivers in the eastern part of the country and in the northern part of the Bakhuis Mountains in the west-central part. The bauxite in these areas occurs as alumina enriched parts of residual laterites capping plateaus and hills some 1,000 to 2,000 feet above sea level. The iron content of the high-level deposits is high but the silica content usually is low. Some deposits have been explored but none have been worked.

Early in 1963 the Geological and Mining Service disclosed the preliminary results of its investigation of bauxite deposits in the Adampada-Kabalebo area of the Bakhuis Mountains of Nickerie District. Bauxite was discovered in the area in 1960 by a ground party checking an aeromagnetic anomaly. Subsequent explorations by the Service included the drilling of some 350 holes and the sampling of 10 selected bauxite areas scattered along a northeast-trending belt about 30 miles long. The aggregate reserve of the drilled areas has been estimated at 162 million tons of bauxite containing more than 45 percent of available alumina, including about 87 million tons containing more than 50 percent. Total reserves of these and other deposits in the area have been estimated to be in the order of 300 to 400 million tons, including some 150 million tons with more than 50 percent alumina.

The ore contains from 17 to 25 percent of Fe_2O_3, but ore with more than 50 percent Al_2O_3 usually has less than 3 percent SiO_2 and less than 3 percent TiO_2—often having less than 2 percent TiO_2. Average thickness of bauxite in the deposits ranges from 3 to 8 meters with a maximum of 20 meters. Thickness of overburden ranges up to 3.5 meters but averages about 1 meter. The largest of the deposits studied contains about 41.5 million tons of ore, of which about 19.3 million tons has more than 50 percent alumina.

The low-level deposits have been worked since 1922 when Surinam Bauxite Co. (Surinaamshe Bauxiet Maatschappij), a wholly owned subsidiary of Aluminum Company of America (Alcoa), began mining and exporting bauxite from deposits near Moengo. In 1937 the company expanded its operations and started mining ore from deposits in the vicinity of Paranam. Alcoa dissolved the old company in 1958 and organized Suriname Aluminum Co. (Suralco) to take its place. In 1942 N.V. Billiton Maatschappij, a Dutch concern, started mining and shipping bauxite from deposits at Onverdacht west of Paranam. Alcoa's subsidiaries and Billiton have been the only significant bauxite producers and were the only ones holding mining concessions as of the end of 1963.

Suralco has a far larger investment than Billiton in Surinam's bauxite industry. Since 1959 it has produced about 70 percent of the bauxite exported from the country. Approximately three-fourths of the company's output in recent years has been supplied by its operations in the Moengo area. The raw ore mined from deposits at Ricanau Hill is hauled 13 kilometers by rail to a mill at Kikus near Moengo for processing. Calcined abrasive-grade bauxite as well as

metallurgical- and chemical-grade bauxite is produced at Moengo. In addition, small amounts of especially high-grade bauxite are calcined for use in the refractory industry. Total capacity of the four calcining kilns at Moengo is 200,000 tons per year. After being crushed and dried or calcined, the processed bauxite is loaded into ore boats for the 96-mile trip to the Caribbean via the Cottica and Commewijne Rivers.

Because reserves of the Ricanau Hill deposits are nearly depleted, the company has been preparing unworked deposits at Adjoemakondre Hill to supply ore to the Moengo mill. Full-scale mining operations should begin at the new mine early in 1965.

Suralco's main operating installations in the Paranam area in 1963 included a washing plant, drying and calcining kilns, storage facilities, and a shiploading station on the west side of the Surinam River at Paranam about 20 river-miles south of Paramaribo. The company also operated a crushing and washing plant and a heavy-media separation plant (to remove iron-rich particles from low-grade ore) at Rorac about 5 miles downstream on the east side of the river. The Rorac product is barged to Paranam for further processing and shipment.

Early operations in the Paranam area were sustained by ores from Topibo Hill and other surface or near-surface deposits on the west side of the river; however, mines near Rorac have supplied the bulk of the ore in the last decade. These later will be worked out by early 1965, but by that time the company expects to have a new mine in production at the Onoribo IV deposit just west of Paranam. This ore body, which is approximately 2,200 feet wide and 4,000 feet long, lies 27 to 50 feet below sea level, and preparations for mining have involved dredging a new channel for a tidal river that flowed over the deposit, removing overburden by a cutter-suction dredge, and extensive dike, road, and bridge construction. The excavated area has been damned off and pumped out, and silt and other debris at the bottom will be removed during 1964. Another ore body, known as Onoribo II, is to be readied for mining by 1965 or 1966, and the small Onoribo III deposit will be developed later. The Onoribo I deposit is worked out.

Approximately 90 percent of Suralco's total bauxite output during 1959–63 was metallurgical grade, 6.5 percent was abrasive grade (calcined to 85 to 90 percent Al_2O_3 and less than 1 percent moisture), and a little less than 3 percent was chemical grade. In addition, the company produced small quanities of "calcined chemical" bauxite (for refractory uses) at Moengo, and in the latter part of 1963 began making a refractory-grade product at a new 50,000-ton supercalcining plant at Paranam. This plant encountered operational problems during 1963, and a small part of its output was insufficiently calcined to be marketed for refractory uses. These problems reportedly have been solved, and the company hopes to increase the quality and quantity of output in 1964.

The bauxite products produced at Moengo and Paranam are transported to the United States and other destinations by the Alcoa Steamship Co. in its own vessels as well as chartered vessels. Because of river bars and shallow coastal waters, large oceangoing vessels can be only partially loaded in Surinam and must complete their loads at

TABLE 4.—Suralco bauxite shipments by grade and plant

(Metric tons)

Grade	1962		1963	
	Moengo	Paranam	Moengo	Paranam
Metallurgical	1,554,773	460,643	1,432,864	562,432
Chemical	69,230		76,450	
Abrasive	185,158	[1] 919	181,915	1,525
Refractory	[2] 2,176	1,496	[2] 1,016	25,918
Total	1,811,337	463,058	1,692,245	589,875

[1] Insufficiently calcined for refractory uses.
[2] Calcined chemical-grade bauxite produced for refractory uses.

a transfer station in Trinidad which is kept supplied by smaller vessels. This procedure also is employed for Billiton's shipments.

Good progress was made during 1963 on the dam and 150,000-kilowatt powerplant being constructed by Suralco at Affobakka on the Surinam River about 60 miles south of Paramaribo. Closing of the dam was scheduled for the early part of 1964, and it was anticipated that enough water may be impounded in the future 600-square-mile lake to begin power generation in 1965. Most of this power will be used by the new alumina plant and aluminum smelter that Suralco began constructing in 1963 about 2 miles from Paranam. The 60,000-metric-ton refinery and the first 220,000-metric-ton alumina unit should be completed in 1965. A similar second alumina unit is planned and a third may be added. The company hopes to start baking pots in October 1964 and to have the refinery in production by July 1965, providing power is available.

These projects are being undertaken as part of a 75-year agreement signed in 1958 by Suralco and the Government of Surinam. In the so-called Brokopondo Agreement Suralco agreed to finance, construct, and operate the dam and powerplant and to build the alumina and aluminum plants as well. The latter are to be the private property of the company whereas the dam and powerplant are to be turned over to the government in the year 2033. In the meantime, 80 million kilowatt-hours of energy per year is to be made available to Surinam at cost, but the bulk of the energy to be generated is reserved for Suralco's use in its own plants or enterprises. The terms of the agreement grant the company exclusive bauxite exploration rights on domain lands and priority rights on private lands in that part of Surinam north of the Fourth Parallel and east of the Surinam River. The company is allowed up to 10 years to select an area of 500,000 hectares for general exploration and up to 20 years to choose an area or areas totaling not more than 20,000 hectares for mining concessions. Suralco also is granted an option to participate in the possible development of a hydroelectric project on the Tapanahony River under terms similar to those applying to the Brokopondo project.

The Billiton bauxite operation is considerably less complex than Suralco's. The raw ore is crushed and washed at Onverdacht near the mining areas and then railed 4 miles to the drying kilns, dry storage bunkers, and loading station at Smalkalden near Paranam. The bulk of the company's output is metal-grade bauxite, and a large

part is shipped to the alumina plant of the Olin Mathieson Chemical Corp. in the United States. Billiton has concluded an agreement with Suralco whereby the latter will process Billiton bauxite in its new alumina plant. Billiton will take up to 130,000 tons of the annual alumina output. A part of this alumina will be sold in the United States and a part will be sent to the new aluminum plant, its parent company is planning to build at Delfzijl, the Netherlands.

Several other firms, including the Suriname Minerals Corp. (a subsidiary of Ormet Corp.), Harvey Aluminum, and Reynolds Metals Co., are interested in Surinam bauxite and have applied for exclusive exploration rights in areas west of the Surinam River. Action on these applications has been deferred until the government's Bauxite Advisory Commission completes a study and makes recommendations concerning policy for future development of the country's bauxite resources.

Columbite-Tantalite.—Small quantities of columbite-tantalite have been found in several of the pegmatites and in nearby eluvial deposits in the so-called northern pegmatite zone of northeastern Surinam. A few tons of concentrate was recovered during 1962 and/or 1963, but the known deposits apparently are of only minor importance.

Gold.—Alluvial gold occurs along many of the rivers and creeks in northern Surinam and a few lode-gold deposits are known as well. Most of the gold produced comes from placer deposits in the Lawa River area near the south-central part of the border with French Guiana, although some also is produced in areas along the Surinam and Saramacca rivers in the north central part of the country. Surinam's annual gold production, however, is far short of the local demand by jewelers, dentists, and others, which is estimated at about 8,000 ounces per year. Gold output reached a 20-year low in 1962, less than half the annual average of some 5,300 ounces, but recovered somewhat in 1963.

The most productive gold concessions are those of N. V. Sarakreek Goudvelden, a Dutch mining firm, in the Lawa River area near Benzdorf. Prior to 1963 the placers on the concessions were worked in part by the company, utilizing several small draglines and washing plants, and in part by individual lessors with little or no mechanical equipment. During 1963 a 4.5-foot bucket-line dredge owned by Northshore Goldfields, Ltd., an American-financed, Canadian-registered firm, began operating on a royalty basis on Sarakreek property along Rufin Creek. Introduction of dredging operations should result in a substantial increase in gold output from the area.

Tin.—A few tons of cassiterite concentrate was exported to the Netherlands in 1963. The source of this cassiterite was not reported, but it probably came from pegmatites or associated eluvial deposits in the Jorka Creek area in the northeastern part of the country, near the border with French Guiana. One cassiterite-bearing pegmatite in this area has been described as having an outcrop 150 meters long and a maximum width of 25 meters and containing cassiterite disseminated throughout the rock as well as some rich "nests." A grab sample of the disseminated material indicated a grade of 70 grams per cubic meter. The grade of nearby eluvial material was reported to range from 200 to 1,000 grams per cubic meter. Furthermore, samples of

cassiterite-bearing alluvial material in the Jorka Creek area and in the Patamacca Creek area to the northwest ranged in grade from a trace to 500 grams per cubic meter of gravel.

NONMETALS

Construction Materials.—Data on the overall production of sand, gravel, and clays in Surinam are not available. Sand and clay evidently are produced in sufficient quantity to satisfy most local needs and some sand is exported, principally to the Netherlands Antilles. Rock suitable for some construction purposes is not readily available in the coastal area so appreciable quantities of crushed rock and gravel are imported from Trinidad and the Netherlands Antilles. Clay brick and tile and concrete blocks are manufactured in Paramaribo; 1,316 cubic meters of brick was produced in 1962. Cement, lime, and refractory brick are imported.

The Surinam Government operates a quarry and crushing plant near Phedra on the Surinam River where it crushes gneiss to gravel and sand for use in civil construction projects. In recent years the Suriname Aluminum Co. has been an important, if not the largest, producer and consumer of sand and gravel; construction of its dam at Affobakka has required roughly 350,000 cubic yards of concrete aggregate.

Lithium Minerals (Amblygonite).—In the latter part of 1963 the N. V. Billiton Maatschappij announced it had mined out the last of the amblygonite in a pegmatite in the Jorka Creek area on the Lower Marowijne River. This was the only amblygonite-bearing pegmatite known in Surinam. From 1961 to 1963 it yielded 1,696 tons of mineral containing about 9 percent Li_2O. All of the amblygonite recovered has been exported to the Netherlands and West Germany.

MINERAL FUELS

Petroleum.—The Colmar Surinam Oil Co. (N. V. Colmar Surinaamse Olie Maatschappij) is the only firm holding a concession for oil exploration in Surinam. This company is controlled by Gulf States Land and Industries, Inc., a subsidiary of Webb and Knapp, Inc. Its concession in Surinam includes most of the belt of sediments along the coast and that part of the continental shelf to which Surinam may establish sovereign rights. (Colmar has conducted extensive geophysical surveys onshore and offshore for a number of years but had done no drilling as of the end of 1963. Offshore seismic surveys apparently have indicated that area holds the most promise for finding oil or gas as the company reportedly has scheduled exploratory drilling from a drilling ship during 1964. It also is reported that a French investment group, headed by France's Bureau de Recherches de Pétrole, will join Colmar in a consortium to develop any oil or gas that may be found.

The Mineral Industry of Uruguay

By Garn A. Rynearson [1]

URUGUAY'S overall output of mineral commodities declined somewhat during 1963, reflecting a continuation of the generally depressed state of the nation's economy. The decline in output was due largely to the low level of activity in the important construction industry, because the extractive sector of the country's small mineral industry is based almost entirely on the production of a few nonmetallic minerals, particularly construction materials. The position of both industries should improve considerably upon implementation of two new major highway projects to be financed by loans totaling US$22.6 million from the International Bank for Reconstruction and Development and a new housing program involving US$6 million in AID funds to be matched by government peso funds.

The Republic of Uruguay is essentially a pastoral country with an economy based primarily on the production of wool and meat products for export, and roughly 60 percent of its total area of 72,172 square miles is utilized for grazing. Manufacturing is of secondary importance, the principal industries being food processing, textiles, construction, beverages, chemicals, metallurgy, and petroleum refining. The latter three depend almost entirely on imported raw materials. Mining is of minor importance in Uruguay as the country is notably poor in mineral resources other than construction materials.

Despite its strong leaning toward a state welfare system, the Government encourages private enterprise in all sectors, and Uruguayan law does not discriminate against a business enterprise because of foreign participation or ownership. However, the State is a strong competitor in the mineral industry through its autonomous entity Administración Nacional de Combustibles, Alcohol y Portland (ANCAP). ANCAP operates the country's petroleum refinery and one of its three operating cement plants. A fourth cement plant being erected by ANCAP will give it almost 45 percent of total capacity.

PRODUCTION AND TRADE

Data on the value of mineral commodities produced in Uruguay are not available for 1963 or for previous years. However, it is evident that the total value of the country's cement output far exceeds that of all other mineral products of domestic origin. A rough estimate based on export price indicates a value on the order of US$9 million for cement produced in 1963 whereas the total value of all other nonmetals,

[1] Physical scientist, Division of International Activities.

excluding those used in cement, probably was on the order of US$1.5 million.

Statistical data on mineral production are those reported by the U.S. Embassy at Montevideo and include figures obtained from both official and company sources. Figures on petroleum products were furnished by ANCAP, those on gashouse coke by Cía. del Gas y Dique Seco, those on cement by the cement producers, and those on lime by ASINCAL, the local association of lime producers. Data on other commodities were supplied mostly by the Uruguayan Bureau of Mines.

No attempt has been made to tabulate mineral trade data which have not been made available in complete form beyond 1961. It is hoped that a more nearly current presentation will be possible in future reviews.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Iron ore					1,031
Manganese ore	100				
Nonmetals:					
Alum	289	472	168	136	79
Barite	35		100		
Cement	422,146	414,754	389,095	374,420	339,727
Clay:					
Common	17,110	24,787	16,047	9,286	(1)
Refractory	141,952	142,786	66,351	1,681	3,217
Dolomite	942	991	11,324	(1)	26,806
Feldspar	358	724	891	703	287
Gem stones, exports [2]	21	70	72	81	92
Lime	(1)	(1)	(1)	[3] 32,400	[3] 30,000
Limestone	716,842	865,825	698,071	601,356	[4] 277,783
Mica	(1)	(1)	(1)	(1)	43
Quartz	2,417	3,218	1,748	739	1,681
Sand and gravel:					
Common sand	899,891	1,085,014	551,174	513,416	470,667
Crushed sand	31,584	29,830	23,438	30,881	32,401
Gravel	311,672	429,638	114,654	108,473	32,624
Stone:					
Granite, exports	(1)	(1)	942	(1)	(1)
Marble	1,080	1,630	1,557	1,188	2,043
Paving blocks	3,846	2,060	693	53	1,173
Curbstone, linear meters	1,573	1,770	(1)	(1)	(1)
Rough stone	85,378	86,930	62,505	94,807	39,738
Ballast	737,531	857,324	430,473	341,997	321,877
Talc	2,118	2,991	1,685	1,715	[3] 1,715
Mineral fuels:					
Coke, gashouse	28,210	31,563	23,476	22,551	21,160
Petroleum refinery products:					
Gasoline, thousand 42-gallon barrels	1,972	2,083	2,054	2,477	2,328
Kerosine, do	1,362	1,492	1,428	1,444	1,522
Gas oil, do	520	1,181	1,305	1,390	1,485
Diesel oil, do	355	302	253	349	513
Residual fuel oil, do	3,902	4,166	4,442	4,474	4,130
LP gases, do	12	13	26	83	53
Asphalt, do	64	65	71	123	81
Turpentine, do	49	31	31	36	26
Other, do	9	13	6	46	108
Total refinery products, do	8,245	9,346	9,616	10,422	10,246
Refinery fuels and losses, do	109	143	182	285	158
Total refinery throughput, do	8,354	9,489	9,798	10,707	10,404

[1] Data not available.
[2] Mostly agate, but probably includes some amethyst.
[3] Estimate.
[4] As reported.

COMMODITY REVIEW

METALS

The only metalliferous ores of possible economic significance that are found in Uruguay are the low-grade iron ores and the manganese ores which occur in several of the eastern departments. These deposits remain virtually unexploited. Gold formerly was produced in small quantities in the northern part of the country but no production has been reported for more than 20 years. Known occurrences of arsenic, copper, lead, mercury, tin, and zinc minerals and of pyrite apparently are of no commercial importance. Except for scrap, all metal requirements are supplied by imports.

NONMETALS

Cement.—Uruguay has three cement plants in operation, and another was being constructed in 1963. Total capacity of the four plants will be about 540,000 metric tons per year. The largest plant is that of Cía. Uruguaya de Cemento Portland S.A. (Lone Star Cement Co.) at Montevideo which has four kilns with a total capacity of 272,000 tons. The bulk of this company's output is ordinary portland cement, but it also produces up to 15,000 tons of rapid hardening cement. Clay is obtained nearby but limestone is quarried near Minas in the Department of Lavalleja about 70 miles northeast of Montevideo.

Administración Nacional de Combustibles, Alcohol y Portland has a 120,000-ton plant for making ordinary portland cement at Minas and a similar plant at Paysandú in the Department of Paysandú should begin operations in 1964. ANCAP produced 121,408 tons in 1962.

Cía. Nacional de Cemento, S.A. has a 36,000-ton plant near Pan de Azucar in the Department of Maldonado about 70 miles east of Montevideo. In addition to ordinary portland cement, this company produces up to 7,000 tons of white portland cement.

Some Uruguayan cement is exported to Argentina, Paraguay, and Brazil to alleviate shortages in those countries. Argentina imported 2,072 metric tons in 1961 and 1,084 tons in 1962. Brazil imported 1,169 tons in 1962 and 6,375 tons in 1963. Brazil has granted tariff concessions on cement and ANCAP hopes to increase exports to Rio Grande do Sul during 1964.

Other.—Relatively large quantities of sand, gravel, and stone are produced for domestic use and for export principally to Argentina. Limestone also is produced in large quantities for the local manufacture of cement and lime, but gypsum must be imported. Clays, dolomite, feldspar, and glass sand are produced for refractory and ceramic uses; talc for paper, soap, and toiletries; and a little mica is mined and ground for use in cement and stucco work. The northern part of the country produces some ornamental agate and amethyst, mostly for export. The only other nonmetals produced more or less regularly are small amounts of barite and alum-bearing rock. Known occurrences of asbestos, borax, emery, and graphite are not exploited.

FUEL AND ENERGY

Uruguay is practically devoid of resources of mineral fuels. Small deposits of peat and low-grade coals are known but are not utilized on a commercial scale. No deposits of oil or gas have yet been found. Furthermore, the country's hydroelectric potential is strictly limited and its natural fuelwood supply is small. Fuel requirements are supplied largely by petroleum products, refined in the country from imported crude petroleum, supplemented by imports of coal, coke, and some finished petroleum products. Of all energy consumed in 1961, petroleum was the source of about 65 percent, hydroelectric power 20.5 percent, wood and vegetable fuels 9 percent, wind power 3.5 percent, and coal 2 percent.

The 51,000-barrel-per-day refinery at La Teja, Montevideo, operates on its own account and on contract, processing imported crude petroleum to supply products for internal distribution and bunkers and, to a minor extent, for export. From 50 to 65 percent of the crude petroleum processed annually since 1958 was imported by ANCAP and the remainder was imported by three private companies—Esso, Texaco, and Shell. All four participate in the distribution of finished products. The total value of crude petroleum imported during 1963 was US$20.6 million compared with US$24.5 million for 1962 and US$20.7 million for 1961.

Uruguay also imports some finished petroleum products. Such imports in 1963 and 1962 (in parentheses) included 34,000 (120,000) barrels of gasoline, 147,000 (135,000) barrels of kerosine, 253,000 (167,000) barrels of distillate fuel, and 10,000 (14,000) tons of lubricants. No residual fuel oil was reported in 1963, but 232,000 barrels were imported in 1962. Total value of these imports in 1963 was US$3.15 million compared with US$6.6 million in 1962. These figures are derived from data reported by the U.S. Embassy, giving the Banco de la República Oriental del Uruguay as the official source.

The Mineral Industry of Venezuela

By Sumner M. Anderson [1] and Lester R. Brown Jr. [2]

VENEZUELA is a major world petroleum producer and an important iron ore producer. Although petroleum production had maintained a steady rise during the period 1959–63, its portion of the total world supply dropped from 14.2 percent in 1959 to 12.5 percent in 1963, and Venezuela's second ranking position among the producing countries was lost to the U.S.S.R. In 1963 production was second to that of the United States in the Western Hemisphere.

Venezuela's iron ore production declined both quantitatively and proportionately from sixth largest producer with 4.0 percent of the world output in 1959 to 11th largest producer with 2.3 percent in 1963. It dropped below Brazil to second position in Latin America and fourth in the Western Hemisphere.

In international trade, Venezuela was the world's leading exporter of petroleum, contributing to the liquid fuel requirements of many countries. Most of its iron ore exports, representing the bulk of production, were shipped to the United States and lesser tonnages to Western Europe.

Output of the mineral industries of Venezuela, as measured by products and associated services, was valued in 1962 at US$2,542 million, equivalent to 44.70 percent of the gross national product of US$5,762 million. Although the country has a diversity of mineral resources, 95.87 percent of its mineral income was from the petroleum industry which employs only 2 percent of Venezuela's labor force. Distribution of the remaining 4.13 percent of the mineral economy shows, in U.S. dollar values, iron ore US$82.0 million (3.22 percent), cement US$18.6 million (0.73 percent), diamonds US$3.0 million (0.12 percent), gold US$1.0 million (0.04 percent), and salt US$560,000 (0.02 percent). Coal valued at $102,000 and limestone (other than that used for cement manufacture) valued at US$32,400 represented a combined contribution of less than 0.005 percent. Comparable data for 1963 have not been made available, but production statistics suggest that the relative percentage of the petroleum industry was up slightly at the expense of the other combined segments of mineral productivity. The trend in iron ore production, the country's second ranking export, has been downward since 1960.

The extraordinary mineral wealth of the country has been largely responsible for the regularly favorable foreign trade balance and the average 4.5 percent annual growth of the gross national product

[1] Chief Latin America specialist, Division of International Activities.
[2] Latin America specialist, Division of International Activities.

during the years 1958–63. Other annual growth rate percentages in the same period were: Population 3.4; agricultural productivity 6.5; industrial productivity 8.0; crude petroleum output 4.4.

The dominant importance of the mineral industries domestically is as a provider of revenue and a basis for planned industrial development, increased employment, and economic advancement. In terms of 1963 resource utilization, Venezuela was self-sufficient or virtually so in petroleum products, natural gas, coal (other than metallurgical coking grade), cement and lime, common rock and minerals of construction, and salt, and partially self-sufficient in steel mill products. Small exploratory production of natural phosphate was started in 1963. All other metal and mineral products as well as manufactures were imported. Copper, manganese ore, mercury, nickel ore, asbestos, and magnesite have been produced in the past and may again be produced. Known unexploited resources include bauxite, chromite, pegmatite minerals, and sulfur. The largest and geologically most promising mining area of little or no mineral exploration is the Guayana Highlands, occupying the edge of the great Precambrian Brazilian shield south and east of the Orinoco in the State of Bolivar and the Territories of Delta Amacuro and Amazonas.

GOVERNMENT POLICIES AND PROGRAMS

Government efforts have been directed toward diversification of the economy, a more equitable distribution of land and income, improvement of education, housing, and social welfare, and a reduction of economic dependence on petroleum. An impressive program of public works included development of a national steel industry, a national petroleum organization, power projects, construction projects, and transportation facilities. In 1962 two large new bridges were opened to traffic, one over the Apure River at San Fernando and the other crossing the Aresting Channel, Margarita Island. A third bridge, completed in September, now spans the Lake Maracaibo strait, linking the growing city of Maracaibo and the western part of the State of Zulia with the main body of Venezuela east of the lake. Another bridge, started in December 1962 and scheduled for completion in about 3 years, will cross the Orinoco River near Ciudad Bolivar and provide access to the new steel plant and to a road being built into the Gran Sabana region of the State of Bolivar.

Perhaps the most imposing development plan is the multiphase project for the creation of a great industrial complex centering on the confluence of the Caroni River with the Orinoco River. The first phase of the project was the construction, a few kilometers upstream (south) of this point, of the Macagua Dam, begun in 1956 and completed in 1960. This dam entraps about half the flow of the Caroni River and feeds a 420,000-kilowatt-capacity powerplant. Actual output, reportedly ranging from 280,000 kilowatt in the dry season to 300,000 kilowatts in the wet season, supplies power to the Matanzas steel plant which has a reserve 6,000-kilowatt thermoelectric plant.

The second phase of the project was the Matanzas steel plant itself, wholly government-owned and officially named Division Siderúrgical del Orinoco, Corporación Venezolana do Guayana (CVG). Construc-

tion of this plant began in 1957 on the south bank of the Orinoco River, 17 kilometers (10.5 miles) west of the mouth of the Caroni River and near the ore docks of the Orinoco Mining Co. Production started from one train of its seamless-tube mill in mid-1961; from the first of its battery of eight electric smelting furnaces and its wire plant later in 1961; from two of its four open hearths, its rolling mills, and its merchant mill in 1962; and from the last of its open hearths and battery of smelting furnaces (including its one Strategic-Udy installation), another tube mill, and its foundry in 1963.

The third phase got underway in September 1963 with completion of negotiations with the International Bank for Reconstruction and Development (World Bank) for a US$85 million loan, to be matched by more than US$85 million of Venezuelan Government funds, for construction of one of the world's largest dams at Guri, 100 kilometers (about 60 miles) upstream from the mouth of the Caroni River. This dam would be capable of supporting a 6-million-kilowatt powerplant in addition to stabilizing the flow of water to the Macagua Dam downstream. The first phase of construction will require 5 years for completion. The industrial complex to be served by this combined power will be the new city of San Tomé de Guayana which will include the present towns of San Felix, Palua, Dalla Costa, and Puerto Ordaz, joined by a bridge being built across the Caroni River and encompassing the iron ore ports of the Orinoco Mining Co. and Iron Mines of Venezuela, the Matanzas steel plant, and an aluminum plant to be started jointly by the Venezuelan Government and Reynolds International. Feed for the aluminum plant will be imported alumina unless a successful conclusion of present research makes the treatment of imported bauxite by a new direct reduction process economically feasible. The population of the San Tomé de Guayana area increased from 4,000 in 1950 to 52,000 in 1963; it is expected to reach 140,000 by 1966 and possibly 250,000 by 1975.

To help implement and finance this social and economic reorientation, the government in late 1958 adopted a policy of granting no more petroleum or mining concessions and at the same time required the petroleum companies to pay royalties in advance, thus supporting the upward trend of the gross national product to a 1963 peak of US$6,201 million (US$737 per capita). However, these acts and other exactions from private enterprise generated a serious flight of both American and Venezuelan investment capital for the next 4 years; as public expenditures rose, private investment declined. The private direct investment was US$53 million in 1959, US$−145 million in 1960, US$−70 million in 1961, US$−184 million in 1962. Stoppage of the issuance of new petroleum concessions also decreased the amount of exploration and consequently the rate of development of petroleum reserves which remained at virtually the same level at the end of 1963 (17,013 million barrels) as they were at the end of 1959 (17,003 million barrels). During that period the ratio of production to reserves declined from 1:16.8 to 1:14.4.

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SOURCE MATERIAL

Basic information on the mineral industry of Venezuela was derived from publications of the Ministry of Mines and Hydrocarbons (Ministerio de Minas e Hidrocarburos), including its Annual Report (Memoria) for 1961 and 1962, its Account of Activities (Informe sobre las actividades) for 1962 and 1963, and various issues of its Weekly Letter (Carta Semanal).

All foreign trade value data and quantitative statistics on all commodities, except petroleum, were prepared from the Bulletin of External Trade (Boletin de Commercio Exterior) for 1961 and 1962, published by the General Bureau of Statistics and National Census of the Ministry of Development (Direccion General de Estadistica y Censos Nacionales, Ministerio de Fomento). Quantitative data on petroleum foreign trade are from publications of the Ministry of Mines and Hydrocarbons.

Additional information on various aspects of the industry were obtained chiefly from the following sources:

Data on Petroleum and Economy of Venezuela. Creole Petroleum Corporation, Coordination and Supply Department, Caracas, July 1963.

Economic Developments in Venezuela, 1962. Overseas Business Reports, U.S. Department of Commerce, Bureau of International Commerce, Washington. OBR–63–73, March 1963.

Engineering and Mining Journal, McGraw Hill Publishing Co., New York. V. 164, No. 9, September 1963.

Engineering and Mining Journal, Metal and Mineral Markets, McGraw Hill Publishing Co., New York. V. 35, No. 9, Mar. 2, 1964.

Fortnightly Review. Bank of London and South America, London. V. 29, No. 714, Feb. 22, 1964.

International Financial News Survey. International Monetary Fund, Washington, D.C. V. 16, No. 11, Mar. 20, 1964.

Latin American Business Highlights. Chase Manhattan Bank, New York. V. 14, No. 1, 1st Qtr., 1964.

Venezuela Up-to-date. Embassy of Venezuela Information Service, Washington, D.C. V. 10, No. 11, spring, 1962.

PRODUCTION

The mineral potential of Venezuela is much more diverse than 1963 production which was limited to two metallic ores and their products, four basic nonmetallic minerals and their products, unrecorded quantities of construction materials, and three natural hydrocarbons and their derivatives. Production trends are upward in the hydrocarbons and cement, unprogressively steady to erratic in the other nonmetallic minerals, and sharply downward in the metallic ores.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Gold—troy ounces	53,766	48,868	30,071	28,774	26,947
Iron ore—thousand tons	17,201	19,490	14,565	13,266	11,745
Iron and steel:					
Pig iron—do				123	302
Steel ingots and castings—do	[1] 50	47	75	225	364
Nickel, in ore	26	13			
Nonmetals:					
Asbestos	4,622	3,931	590		
Cement—do	1,872	1,487	1,513	1,535	[1] 1,570
Diamonds:					
Gem—carats	15,103	13,524	60,495	93,971	38,400
Industrial—do	69,673	46,378	68,413	75,867	27,597
Bort—do	10,209	10,964	5,268	6,655	3,676
Total—do	94,985	70,866	134,176	176,493	69,673
Gypsum:					
For cement manufacture, estimated	65,500	52,100	53,000	52,900	54,500
For other uses	600	5,880	7,033	9,936	9,967
Total	[1] 66,000	[1] 58,000	[1] 60,000	[1] 63,000	[1] 64,500
Lime	45,426	39,449	34,706	44,764	47,940
Limestone:					
For cement, estimated	2,434,000	1,933,000	1,967,000	1,963,000	2,028,000
For lime, agriculture, and construction	[1] 40,000	[1] 40,000	[1] 56,000	24,506	[1] 43,000
Total, estimated	2,474,000	1,973,000	2,023,000	1,988,000	2,071,000
Salt—thousand tons	82	59	133	145	[1] 60
Mineral fuels:					
Coal, bituminous—do	34	35	31	27	42
Natural gas:					
Gross production—million cubic feet	1,188,120	1,177,857	1,236,225	1,354,753	1,398,194
Flared; waste—do	647,390	574,952	548,791	629,029	560,882
Usable production—do	540,730	602,905	687,434	725,724	837,312
Injected, for repressuring—do	363,534	412,871	487,250	511,470	607,122
Produced for consumption—do	177,196	190,034	200,184	214,254	230,190
Transformed into products—do	20,750	18,138	17,652	20,638	20,825
Producers' fuel—do	99,906	108,974	116,065	117,409	125,432
Sold—do	56,540	62,922	66,467	76,207	83,933
Natural gas products:					
Natural gasoline—thousand 42-gallon barrels	4,580	3,919	2,349	3,348	3,251
Liquified petroleum gas (LPG)—do	1,995	3,309	5,764	4,758	5,088
Total—do	6,575	7,228	8,113	8,106	8,339
Petroleum, crude—do	1,011,452	1,041,708	1,065,790	1,167,954	1,182,983
Petroleum products:					
Aviation gasoline—do	1,840	1,888	1,982	2,088	3,719
Motor gasoline—do	38,262	36,068	37,175	38,979	38,238
Jet fuel—do	2,862	4,603	7,362	13,107	12,143
Kerosine—do	10,322	7,982	9,604	7,186	6,006
Distillate fuel oil—do	53,513	52,712	60,631	65,078	72,129
Residual fuel oil—do	170,721	194,779	198,001	216,669	212,549
Lubricants, including greases—do	1,247	1,693	1,813	2,049	2,306
Other—do	15,023	20,469	18,665	21,106	25,315
Total—do	293,790	320,194	335,233	366,262	372,405
Refinery fuel and losses—do	5,201	9,911	11,606	8,037	13,717
Total refinery throughput—do	298,991	330,105	346,839	374,299	386,122
Carbon black	[2]	[2]	[2]	[2]	[3] 4,500

[1] Estimate.
[2] Data not available.
[3] Approximate.

TRADE

The dominance of the minerals industries—preponderantly petroleum—in the economy of Venezuela is reflected in the foreign trade pattern which regularly shows a strongly favorable balance. Exports exceeded imports in value by 4,511 million bolivars in 1961 and 4,769 million bolivars in 1962. Converting these figures to U.S. dollar equivalents requires the application of two exchange rates for exports and one for imports; during 1961 and 1962 the official free market rate was 4.58 bolivars per dollar and the petroleum export rate 3.09 bolivars per dollar. Using these factors, the favorable trade balance was equivalent to US$1,768 million in 1961 and US$1,894 million in 1962. Other dollar values are shown in table 2.

TABLE 2.—Exports and imports of mineral commodity groups

(Thousand U.S. dollars)

Commodity	Exports		Imports	
	1961	1962	1961	1962
Minerals:				
Metals	98,426	94,531	57,185	72,049
Nonmetals	3,706	5,640	4,134	4,020
Solid fuels			13	110
Petroleum and derivatives	2,408,132	2,607,692	6,427	6,826
Total	2,510,264	2,707,863	67,759	83,005
All other commodities	40,033	37,574	1,700,562	1,810,899
Total trade	2,550,297	2,745,437	1,768,321	1,893,904

Despite the relative subordinance of the nonpetroleum segments of the mineral-producing industries, they provide more than enough foreign exchange to pay for all Venezuela's import requirements for metals, minerals, and mineral fuels, exclusive of finished manufactures.

TABLE 3.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal destinations	Value (bolivars)
Metals:				
Iron and steel:				
Iron ore—thousand tons	14,565	13,285	United States 10,346; Italy 686; West Germany 337.	401,044,935
Cast iron		74,481	Japan 64,458; Italy 10,023	15,218,558
Steel ingots and equivalent primary forms.		5,000	All to United States	1,441,580
Seamless tubes	6,014	758	Do	408,601
Nonferrous base metals, unwrought and semimanufactures thereof, not further described.		16,209	United States 8,411; Nigeria 1,370; Aruba 1,180.	14,837,598
Total value				432,951,262
Nonmetals:				
Asbestos, crude	381			
Cement, white	113,636	171,406	Surinam 60,862; Curacao 21,503; Costa Rica 20,701.	9,600,033

See footnotes at end of table.

TABLE 3.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal destinations	Value (bolivars)
Nonmetals—Continued				
Diamond____thousand carats	[1] 205	[1] 260	United States [1] 150; Israel [1] 65; Bermuda [1] 35.	16,178,499
Earths and clays, not further described.	15	88	Mainly to Colombia	10,981
Granite	1	45	Barbados 20; Curacao 20; Trinidad 5.	8,261
Sand, all types	585	280	Bonaire Island 270; Trinidad 10	31,451
Stones, not further described	750	2	Mainly to Netherlands	1,561
Other nonmetals, not further described.	[2]	1	Mainly to West Germany	649
Total value				25,831,435
Mineral fuels:				
Petroleum, crude thousand 42-gallon barrels.	743,711	810,485	Netherlands Antilles 271,444; United States 177,150; Canada 85,161; United Kingdom 57,835.	5,840,572,332
Petroleum refinery products:				
Gasoline____do	20,929	17,686	United States 6,832; Netherlands Antilles 2,689; Puerto Rico 1,833.	[4]
Jet fuel____do	2,146	13,023	[3]	
Kerosine____do	6,910	3,479	Argentina 1,142; United States 969; Netherlands Antilles 440.	
Distillate fuel oil____do	44,774	56,299	United Kingdom 10,084; Netherlands 8,847; United States 7,610.	
Residual fuel oil____do	188,297	191,365	United States 122,832; Netherlands Antilles 20,898; United Kingdom 15,572.	
Lubricants____do	1,390	1,783	Argentina [5] 645; Australia [5] 500; United Kingdom [5] 250.	
Asphalt____do	3,023	5,024	United States 4,704	
Other____do	5,784	2,705	[6]	
Total to country destinations. do	273,253	291,364	United States 151,510; Netherlands Antilles 29,397; United Kingdom 28,462.	[4]
Bunker fuels:				
Distillate fuel oil do	2,371	[4]	[4]	[4]
Residual fuel oil do	14,722	[4]	[4]	[4]
Total to bunkers. do	17,093	17,347	[4]	[4]
Total petroleum products. do	290,346	308,711	[4]	
Natural gas products:				
Natural gasoline do	1,215	795	Curacao (Netherlands Antilles) 741; United States 54.	
Liquified petroleum gas. do	3,028	2,623	Brazil 1,287; Curacao 440; United States 308.	
Total natural gas products. do	4,243	3,418	[4]	[4]
Total refined products. do	294,589	312,129	[4]	2,217,196,361
Total mineral fuels. do	1,083,300	1,122,614	United States 328,660; Netherlands Antilles 300,840; Canada 91,673; United Kingdom 86,297.	8,057,768,693
Total value, metals and minerals.				8,516,551,390
Percentage of all exports				98.02
Total value, all exports				8,688,639,443

[1] Approximate, based on data reported in kilograms. The figures are not consistent with reported production.
[2] Less than 0.5 tons.
[3] Included with "Other" under petroleum refinery products.
[4] Data not available.
[5] Estimate.
[6] Included with "Total to country destinations."

TABLE 4.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (bolivars)
Metals:				
Aluminum (including alloys):				
Unwrought (billets)	737	1,035	United States 1,016	2,125,500
Semimanufactures	8,315	6,027	Belgium-Luxembourg 2,079; United States 1,336; Canada 1,195.	15,963,141
Antimony, all forms	430	11	U.S.S.R. 4; West Germany 3; Belgium-Luxembourg 2.	28,550
Chromite	22	51	All from United States	4,583
Copper (including alloys):				
Unwrought	59	22	United States 14; West Germany 5.	84,701
Semimanufactures	5,703	5,117	United States 3,015; Canada 831; West Germany 351.	29,010,902
Iron and steel:				
Iron ore concentrate	1	(1)	Mainly from United States	456
Pig iron	237	753	United States 642; France 40; Japan, 29.	418,546
Ferroalloys	616	4,624	France 2,341; Switzerland 1,142; United States 238.	2,748,758
Iron and steel scrap	4	11,177	All from United States	1,487,299
Steel:				
Ingots and equivalent primary forms.	10,151	43,919	United Kingdom 15,768; West Germany 13,333; Mexico 6,348.	15,910,831
Semimanufactures:				
Bars, rounds and structural sections.	63,922	69,086	Belgium-Luxembourg 42,585; West Germany 12,961; France 7,372.	34,341,968
Plates and sheets:				
Uncoated	38,686	46,002	West Germany 16,330; Belgium-Luxembourg 14,686; United States 7,162.	29,079,106
Coated:				
Tinplate	45,452	64,932	France 28,354; United States 21,379; Canada 6,704; United Kingdom 6,501.	50,074,387
Galvanized and other.	23,887	22,947	Belgium-Luxembourg 13,762; United States 4,231; Japan 1,874.	18,787,507
Hoop and strip	1,952	1,000	United States 605; West Germany 198.	1,503,254
Wire	36,269	29,013	Belgium-Luxembourg 12,690; West Germany 6,837; France 3,589.	19,856,074
Pipe and fittings	86,983	120,396	United States 40,795; United Kingdom 24,328; West Germany 18,286; Japan 14,164; France 13,345.	93,150,510
Rails and accessories	2,164	1,917	United States 1,660; Italy 255	2,246,654
Various semimanufactures reported as plated with precious metals.	2,910	4,297	West Germany 1,419; Belgium-Luxembourg 1,093; France 567.	5,190,102
Other	1,900	1,154	United Kingdom 494; United States 211; Italy 191.	1,643,922
Lead:				
Unwrought, including argentiferous lead, antifriction metal, and type metal alloys.	1,891	1,885	United States 738; Mexico 391; Belgium-Luxembourg 283.	1,692,574
Semimanufactures, including those of alloys.	150	274	Australia 104; United States 92; United Kingdom 26.	355,340
Mercury ——76-pound flasks	114	135	Mexico 64; Italy 24; United States 22.	105,337
Nickel and its alloys, all forms	12	41	United States 37	110,728
Platinum and platinum group metals and their alloys, unworked and semimanufactures.	3,762 troy ounces	13,310	United States 8,777; West Germany 3,408; Japan 353.	144,614
Silver and its alloys:				
Unworked ——troy ounces	35,655	206,729	West Germany 168,181; United Kingdom 16,944; United States 14,628.	243,473
Semimanufactures ——do——	74,525	469,401	France 332,953; West Germany 61,826; United Kingdom 37,037.	299,218

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (bolivars)
Metals—Continued				
Tin and its alloys:				
Unworked---long tons	229	215	Denmark 97; United Kingdom 68; United States 25; West Germany 25.	1,322,314
Semimanufactures---do	40	22	United States 14; United Kingdom 6.	92,680
Zinc and its alloys:				
Unworked	221	179	Belgium-Luxembourg 75; United States 29; Canada 26.	223,491
Semimanufactures	182	579	Mexico 393; United States 138; Australia 36.	867,960
Nonferrous metals, various semimanufactures reported as plated with precious metals.	356	158	France 64; United States 28; United Kingdom 25.	466,895
Nonferrous metals, not otherwise described:				
Ore, concentrate and scrap	88	3,417	Norway 3,279; United States 125; Republic of South Africa 11.	258,615
Metal:				
Unworked	12	1	Mainly from Spain	2,751
Semimanufactures, other	6	18	Italy 7; United States 7	143,659
Total value, metals				329,986,400
Nonmetals:				
Abrasives	488	315	Italy 79; West Germany 66; United States 66.	736,055
Asbestos, crude, washed or ground.	3,934	3,452	Canada 3,356; United States 65	2,243,498
Barite	3,653	3,556	Morocco 3,150; United States 406	390,479
Bentonite	3,782	4,158	United States 4,123	650,313
Borates	266	388	Belgium-Luxembourg 254; United States 111.	319,136
China clay	4,201	6,407	United States 5,704; United Kingdom 406.	793,557
Cryolite	1	1	All from West Germany	1,675
Diamond, industrial.[2] thousand carats	15	2,840	United States 2,300; West Germany 505.	570,338
Diatomaceous earth	2,350	2,775	United States 2,730; United Kingdom 25; Sweden 9.	973,899
Feldspar	4,875	6,596	United States 6,526; West Germany 40; Switzerland 30.	652,988
Fertilizers and fertilizer materials (natural and maufactured):				
Nitrogenous	23,736	19,928	Belgium-Luxembourg 8,479; Netherlands 5,468; West Germany 4,805.	2,914,720
Phosphatic	10,324	4,183	United States 3,246; Netherlands 499; Belgium-Luxembourg 438.	2,325,383
Potassic	10,627	8,262	Italy 4,314; United States 2,121; France 1,661.	1,683,526
Fluorspar	169	550	Mexico 280; Austria 147; United States 103.	129,463
Fuller's earth	606	509	United States 411; West Germany 61; United Kingdom 37.	188,095
Graphite	59	145	United States 132; United Kingdom 8; West Germany 5.	129,035
Gypsum, crude and calcined	86	37	United States 28; West Germany 8.	38,432
Magnesite	384	766	Austria 563; Netherlands 171; West Germany 21.	472,979
Mica	411	333	All from United States	145,191
Refractory earths and rocks, not further described.	1,046	1,974	British Guiana 1,085; United States 726; Belgium-Luxembourg 141.	401,584

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961 quantity	1962		
		Quantity	Principal sources	Value (bolivars)
Nonmetals—Continued				
Sand	2,836	2,146	United States 2,003; Belgium-Luxembourg 111.	277,953
Sulfur:				
Unrefined	8,387	10,028	United States 10,026	894,471
Refined	594	529	United States 412; West Germany 53.	275,781
Stone, industrial, not further described.	592	3,194	United States 2,150; Belgium-Luxembourg 505.	528,158
Talc	1,469	1,769	United States 719; Italy 674; Norway 223.	665,108
Vermiculite	153	58	All from United States	10,460
Total value, nonmetals				18,412,277
Mineral fuels:				
Coal	42	3,140	United Kingdom 2,991	325,868
Coke	13,166	124,937	United Kingdom 123,947; Colombia 449; West Germany 397.	124,937
Briquets of coal and coke	82	103	United States 46; Belgium-Luxembourg 40; Colombia 12.	51,717
Crude oil and partly refined products.	214	17	All from United States	46,496
Petroleum refinery products:				
Gasoline, kerosine, and gas/diesel oil.	149	87	Netherlands 83; United States 4	52,155
Gasoline additives	18,326	12,275	United States 11,063; United Kingdom 1,201.	10,318,096
Lubricants	24,688	20,026	United States 17,470; Netherlands 1,697; United Kingdom 859.	15,654,383
Solvents	543	437	United States 256; Curacao 165; Netherlands 13.	319,053
Other	5,530	8,521	United States 8,045	4,874,808
Natural bitumen	161	101	United States 91; Trinidad 8	27,185
Carbon black	5,404	4,422	United States 4,378; Canada 33	3,316,776
Total value, mineral fuels				35,111,474
Total value, metals and minerals.				383,510,151
Percentage of all imports				9.83
Total value, all imports				3,900,018,380

[1] Less than 0.5 ton.
[2] Approximate; based on data reported in kilograms.

COMMODITY REVIEW

METALS

Aluminum.—In April 1963 the Government announced that Aluminio del Caroni, owned 51 percent by its operating agency Corporación Venezolana de Fomento (CVF) and 49 percent by Reynolds Metal Co. of Richmond, Va., would start construction in July of a plant on the Caroni River to produce aluminum metal from alumina from the Reynolds plant at Corpus Christi, Tex., or from bauxite if research on a new direct reduction process proves successful. Under terms of the partnership, Reynolds will retain complete control of management. The plant will utilize power from the Guri Dam and power project and will have an initial annual capacity of 22,700 metric tons (25,000 short tons) to supply the requirements of Venezuela. Ultimately the installation will be doubled to produce metal for export. Further

expansion to treat Venezuelan bauxite will be considered if economic deposits are developed.

Imported aluminum billets and sheets, amounting to 7,000 to 9,000 tons annually in recent years, have been processed by four plants: Reynolds Aluminum Extrusions, Maracaibo, re-rolls coiled hot-rolled sheet to thinner sheet and foil and extrudes 6-inch billets to profiles; Aluminio Nacional, S.A. (an affiliate of Kaiser Aluminum and Chemical Corp.); Guacara, re-rolls sheet into foil; Corporación Venezolana de Aluminio (affiliated with Montecatini and Alcoa), Mariara, extrudes billets into profiles; and Alcan de Venezuela (an affiliate of Aluminium, Ltd.), La Victoria, re-rolls coiled cold-rolled sheets into corrugated sheets.

Gold.—Minas de Oro de El Callao, C.A. (MOCCA), a government entity, continued to operate a number of mines in the old El Callao area, State of Bolivar, primarily for employment of the local inhabitants who, for the most part, had no other means of livelihood. The steadily declining output accounted for about 96 percent of Venezuela's gold production in 1963, and all that came from underground mining. Three percent came from placer panning in open operation areas ("areas of free avail"), and 1 percent from placer mining in registered concessions.

Iron Ore.—Venezuelan iron ore has been produced in the State of Bolivar from both sides of the Caroni River south of the Orinoco by two companies: Orinoco Mining Co. (subsidiary of United States Steel Corp.), which began operations in 1954 at Cerro Bolivar and does its shipping from Puerto Ordaz on the Orinoco, and Iron Mines Co. of Venezuela (subsidiary of Bethlehem Steel Co.), which began operations in 1950 at El Pao and does its shipping from Palua also on the Orinoco. From the start of operations to the end of 1963, the Orinoco Mining Co. has mined 106.6 million metric tons of ore with a remaining reserve of 632.7 million tons, and the Iron Mines Co. of Venezuela has mined 31.1 million metric tons of ore with a remaining reserve of 99.5 million tons.

Recent operations have been as follows:

	Metric tons		
	1961	1962	1963
Orinoco Mining Co.:			
Production	12,430,996	10,532,113	10,038,305
Sold in Venezuela	651,941	81,777	334,323
Exported to:			
United States	7,658,791	7,499,819	7,051,193
United Kingdom	1,626,425	1,196,307	1,383,746
West Germany	1,571,151	1,069,054	1,044,117
Italy	922,689	667,980	597,439
Total	11,779,056	10,433,160	10,076,495
Iron Mines Company of Venezuela:			
Production	2,134,440	2,733,767	1,706,747
Sold in Venezuela	52,158	429,941	108,668
Exported to United States	2,782,309	2,876,632	2,277,206
Total:			
Production	14,565,436	13,265,880	11,745,052
Sold in Venezuela [1]	704,099	511,718	442,991
Exported	14,561,365	13,309,792	12,353,701

[1] Approximately 95 percent of the ore sold in Venezuela goes to the División Siderúrgica del Orinoco (Matanzas steel plant) and the remainder to C.A. Venezolana de Cemento.

The downward trend in production since the peak year 1960 has been attributed to the general softening of the market internationally, to stiff competition from Canadian ores in the U.S. market, and to difficulty of the Venezuelan ores, which carry a fairly high percentage of fines, in meeting competition from beneficiated and pelletized ores. Factors adding to the somewhat accelerated decline in 1963 included a decrease in sales to the Matanzas steel plant and an interruption of exports by Iron Mines Co. of Venezuela when its transfer station at Puerto de Hierro on the Paria Peninsula reverted to the nation. On completion of new deep water loading facilities at Palua on the Orinoco River, Puerto de Hierro and its facilities became superfluous and were turned over to the Venezuelan Navy on November 1. To overcome competition in the export market, the Orinoco Mining Co. was considering a US$35 million to US$40 million investment in a plant to upgrade the present 60-percent iron content of its ore to 85 percent, utilizing natural gas from the East Venezuela oilfields and electric power to be generated at the Guri Dam. As planned, the plant would produce initially 1 million tons of enriched ore annually.

The Venezuelan Ministry of Mines and Hydrocarbons continued its exploratory survey of the San Isidro iron ore deposits south of Cerro Bolivar disclosing an ore reserve of 650 million tons with an average content of 60.17 percent iron. This is a government-reserve deposit destined eventually to supply the total ore requirements of the Matanzas steel plant.

The total Venezuelan iron ore reserve at the beginning of 1963 was estimated at over 2 billion metric tons with an average of 50 percent iron. Of this more than 1.3 billion was proved ore and the remainder probable ore.

Iron and Steel.—By the end of 1963, the Matanzas steel plant of the Corporación Venezolana de Guayana (CVG) was smelting iron ore and making pig iron, carbon steel ingots, blooms, slabs, billets, pipe, reinforcing bars, wire rods, wire, and structural shapes. The Strategic-Udy unit encountered three major difficulties during its intermittent 4 to 5 months trial runs: The ore driers were not ready for operation at the beginning of the rainy season, and an excessive burden was put on the kilns; the native coal from the Naricual mine failed to maintain its initially indicated specification of 5 percent ash and ran 20 percent ash, mostly in the form of clay, imposing an even greater burden on the kiln; and the hot-material-handling equipment proved incapable of withstanding continuous operation. The ore driers were finished and operative before the end of the year, but the trial runs were suspended pending installation of more durable hot-material-handling equipment and an effective quality control system at the Naricual mine, both of which were expected to be readied by mid-1964.

Aside from the Strategic-Udy furnace, the plant has eight Tysland Hole electric-arc furnaces, four Siemens-Martin open-hearth furnaces, and a foundry with two electric furnaces. A detailed description of the plant was published in 1959.[3] Dolomite and silica for fluxes are obtained locally; limestone is supplied from deposits on the Caribbean coast near Puerto La Cruz. Imported materials include about 100,000 tons per year of coke from England, 20,000 tons of manganese from

[3] Gonni, M. The Venezuelan Steel Works. Iron and Steel Eng., v. 34, No. 5, May 1959, pp. 71–93.

the Republic of South Africa, and 9,000 tons of ferroalloys—principally ferrosilicon—from European and U.S. sources.

Overall capacity of the plant, based on the nine primary furnaces operating in 1963, was 800,000 metric tons of pig iron per year, most of which was fed to the open-hearth furnaces and the foundry. The pig machine capacity was about 360,000 tons per year. Pig iron was sold to Japan and Italy in 1963, and steel billets were sold to the Ford Motor Co. in the United States. Annual capacities for iron and steel products include 295,000 tons of seamless pipe, 130,000 tons of structural shapes, 86,150 tons of reinforcing and merchant bars, 15,000 tons of barbed wire, 11,000 tons of plain and galvanized wire, and 1,200 tons of nails. Operations were expected to meet the needs of the petroleum industry for pipe, of the construction industry for structural shapes, and of the country as a whole for barbed wire. Venezuela was Latin America's second highest importer of tinplate with nearly 65,000 tons in 1962 and its highest per capita consumer (8.27 kilograms) but has not included tinplate in the short-term production expansion plans for its steel industry.

Aside from CVG and a few gray iron foundries making job castings and cast-iron pipe fittings, the iron and steel industry is represented by two private companies. Siderúrgica Venezolana, S.A. (SIVENSA), began full-scale operation of its plant in Caracas in 1954, feeding local scrap and iron ore mined locally to two electric-arc furnaces and producing merchant bar and reinforcing bar exclusively until 1962 when wire rod production was added. Ingot capacity is 75,000 tons per year and rolling-mill capacity about one-third higher. Rod production, amounting to 82,900 tons in 1962, has been consistently somewhat higher than ingot production which apparently is supplemented by purchases of ingot from abroad or from CVG or both. The company was planning a sizable program of diversification including facilities for making springs (which may have been installed and placed in operation during 1963), alloy steel bars and rods, and both ferrous and nonferrous castings. The other private company is Siderúrgica de Occidente, C.A. (SIDEROCA), near Maracaibo, which has been making about 12,000 tons per year of galvanized water pipe, ½-inch to 2-inch in diameter, from imported skelp.

NONMETALS

Cement and Gypsum.—Venezuelan cement was produced by the following four companies and seven plants controlled completely by Venezuelan capital:

	Plant location	
	City	*State*
Company:		
C. A. Venezolana de Cementos (VENCEMOS)	Pertigalete	Anzoategui
Do	Barquisimeto	Lara
Do	Maracaibo	Zulia
C. A. Fábrica Nacional de Cementos	La Vega	Federal District
C. A. Cemento Carabobo	Valencia	Carabobo
Cementos Coro C. A.	Coro	Falcon
C. A. Cementos de Táchira	San Cristobal	Táchira

Production started in 1909 with the plant at La Vega, a suburb of Caracas, and expanded to total self-sufficiency by about 1955. Output has been governed by local demand plus export marketability and has been far short of present capacity. The plant of VENCEMOS, inaugurated in 1949, located at Pertigalete on the Caribbean coast near Puerto La Cruz is the largest in the country with a capacity for producting 50,000 bags of cement a day. Its four kilns were fired by natural gas piped 97 kilometers (60 miles) from Anaco. Most of the other plants are fired by fuel oil, but the San Cristobal plant uses coal from its own company mine in Táchira.

VENCEMOS also operates Venezuela's only plaster plant with a 100-ton-per-day capacity at Pertigalete. Gypsum for calcining is transported by sea from the company's mine on the Paria Peninsula between Guiria and Puerto Hierro.

Diamond.—The exhaustion of certain rich diamond pockets worked in 1961 and 1962, coupled with an extended rainy season, accounted for the 60-percent drop in recorded production in 1963. The principal productive area for several years has been placers of the Paragua River and its tributaries in the Gran Sabana region of the State of Bolivar. The actual volume of production is obscured by the two-way contraband diamond traffic regularly operating across the Brazilian border. Official exports for 1963 showed 41,880 carats to the United States, 4,354 carats to England, 3,330 carats to France, and 19 carats to West Germany. The total 49,583 carats, comprised of both gems and industrial stones, was valued at only 6,362,542 bolivars (US$1,401,000).

MINERAL FUELS

Coal.—In a country abounding in petroleum and natural gas resources, coal has never figured prominently in the national economy. Between 1946 and 1963, most of the small production has been high-volatile bituminous coal from the State of Táchira. In 1961–62, 78 percent came from Cía. Minas de Carbon de Lobatera, owned by the government under the administration of the Corporación Venezolana de Fomento; 7 percent came from the captive mine of C. A. Cementos de Táchira; and 14 percent came from various small private mines within the State. Less than 1 percent was mined by C. A. Carbonera de Taguay in the State of Aragua. The coal was consumed by the local ceramic, cement, and brick industries.

Subbituminous coal and lignite at Naricual in the State of Anzoátegui was mined by the government until mid-1946 when it was closed down following a disastrous fire. Twelve years later, plans for the Matanzas steel plant revived interest in these coals for use in the iron smelting process, and an Interministerial Commission appointed by the Ministerio de Fomento and the Ministerio de Minas e Hydrocarburos rehabilitated and modernized the mine to a production capacity of 1,800 tons per day, rebuilt a railroad to the Caribbean port of Guanta, and remodeled docking and loading facilities. Most of this work was completed and shipments started by late 1962, but the coal was substandard for the use intended and corrective processing methods were being adopted during the latter part of 1963.

TABLE 5.—Distribution of Venezuelan petroleum production, exports, refinery feed, and land holdings, by companies, 1963

	Parent company		Crude production (thousand barrels)	Crude exports (thousand barrels)	Refinery throughput (thousand barrels)	Concessions [1] and assignations [2] as of December 31, 1963 (hectares [3])		
	Name	Nationality				Eastern [4]	Western [5]	Total
Private companies:								
Creole Petroleum Corp.	Standard Oil Co. (N.J.)	United States	480,362	337,652	162,754	441,770	294,731	736,501
Cía. Shell de Venezuela, Ltd.	Royal Dutch-Shell Group	British-Netherland	297,000	216,088	121,596	25,500	455,595	481,095
Mene Grande Oil Co.	Gulf Oil Corp.	United States	148,261	42,893	38,284	889,957	123,163	1,013,120
Venezuelan Sun Oil Co.	Sun Oil Co.	do.	67,905	65,333			20,000	20,000
Mobil Oil Co. of Venezuela	Socony Mobil Co.	do.	47,680	30,016	20,143	171,314	73,829	245,143
Richmond Exploration Co.	Standard Oil Co. of California	do.	23,752	17,243	6,445		135,158	135,158
Texas Petroleum Co.	Texaco, Inc.	do.	27,520	18,464	15,209	61,650	16,625	78,275
Phillips Petroleum Co.	Phillips Petroleum Co.	do.	24,987	22,430	1,245	71,043	10,000	81,043
Sinclair Venezuelan Oil Co.	Sinclair Oil Corp.	do.	20,402	8,500	13,730	143,798	131,468	275,266
Superior Oil Co. of Venezuela	Superior Oil Co. of California	do.	15,871	13,478			3,147	3,147
Venezuelan Atlantic Refining Co.	Atlantic Refining Co.	do.	8,074	2,598		152,295	11,864	164,159
San Jacinto Venezolano, C.A.	San Jacinto Petroleum Corp.	do.	7,569	6,457			10,797	10,797
Signal Oil and Gas of Venezuela	Signal Oil and Gas Co.	do.	5,490	4,593			10,375	10,375
S. A. Petrolera Las Mercedes	Texaco, Inc.—Ultramar	United States-British	4,211			76,196		76,196
Coro Petroleum Co.	Texaco, Inc.	United States	2,577	872		33,752	18,169	51,921
Caracas Petroleum, S.A.	Ultramar Co., Ltd.	British	2,375	3,950		41,722	28,488	70,210
Talon Petroleum, C.A.	Kirby Petroleum Co.	United States	324	327			3,063	3,063
International Petroleum Co.	Standard Oil Co. (N.J.)	do.		27,432		4,633	1,500	6,133
Continental Oil Co. of Venezuela	Continental Oil Co.	do.						
Cía. Española de Petróleos, S.A.	Cía. Española de Petróleos	Spanish						
Pan American Venezuela Oil Co.	Standard Oil Co. (Indiana)	United States						
Pancoastal Petroleum Co.		do.						
King Mill Oil Co.	King Mill Oil Co.	do.				81,702	15,065	96,767
Adela de Martin	[6]	Venezuelan						
Venezuelan American Independent Oil Producers Assoc.	Venezuelan American Independent Oil Producers Assoc.	United States						
Total private companies			1,184,360	818,326	379,406	2,195,332	1,363,037	3,558,369
Venezuelan Government:								
Corporación Venezolana del Petróleo			1,151			30,980	240,988	271,968
Instituto Venezolano de Petroquímica.					900			
Adjustments [7]				−7,841	−6,007			
Total country			[8] 1,185,511	810,485	374,299	2,226,312	1,604,025	3,830,337

[1] To private companies.
[2] To the Government.
[3] One hectare=2.471 acres.
[4] States of Guarico, Anzoátegui, Monagas, and Sucre, and Territory of Delta Amacuro.
[5] States of Barinas, Zulia, Trujillo, Merida, and Falcon.
[6] Individual owner.
[7] Company distribution not reported for adjustments downward to conform revised final total country production figures.
[8] Includes 2,628 thousand barrels of blended natural gasoline and condensates.

Source: Ministerio de Minas e Hidrocarburos, Oficina Tecnica de Hidrocarburos (Caracas); Informe sobre las actividades durante 1963 (Information on activities during 1963-1964.)

Petroleum.—Various aspects of the large and intricate petroleum industry reported in detail by the trade press are summarized by the tabulation of official data released by the Ministry of Mines and Hydrocarbons.

In conformity with official policy, no new concessions were granted in 1963, and President Leoni, inaugurated in March 1964, pledged himself to continue the oil policies of his predecessor. During 1963, the private companies returned 218,828 hectares, or 5.8 percent of the areas held at the end of 1962, to the Federal Reserve, and 1,200 hectares was assigned to the government-owned Venezuelan Petroleum Corporation (Corporación Venezolana del Petróleo).

In 1963, 503 new wells were completed (in 1962, 541), of which 5 were for the purpose of oilfield repressuring. Of the remaining 498 completions, 425 (85.3 percent) brought in new production. In the years 1959–62, increases in production of crude were general throughout the world but with some variations in growth rates: World total, 24.5 percent; Persian Gulf area, 34.0 percent; United States, 3.9 percent; South America (including Venezuela), 10.7 percent; and Venezuela, 15.5 percent. The Venezuelan trend continued upward in 1963 and is expected to continue upward again in 1964, but the rate comparison with other areas has not been calculated. Three of the private companies operating in Venezuela—Creole, Shell, and Mene Grande—accounted for 78 percent of the total production, 73 percent of the exports, and 85 percent of the refining in 1963, and they held 58 percent of the concessioned areas at the end of that year. Of the total production, 829,319,000 barrels had a gravity higher than 24.9 degrees API, 220,761,000 barrels had a gravity ranging from 24.9 to 14.0 degrees API, and 135,431,000 barrels had a gravity of less than 14.0 degrees API. Thirty-two percent of the petroleum produced was refined by 8 private companies and 1 government enterprise in plants in 13 localities. About 80 percent of the refinery products were exported excluding those refined in and exported from the Netherlands Antilles. There was an unexpected sharp increase in exports of both crude petroleum and fuel oils to Western Europe in 1962 and 1963 despite the maintenance of competitively high prices. This may be at least partly attributed to the unusually severe northern winter. Thirty-two privately owned depots distributed the remaining 20 percent of refinery products to industrial users and 1,631 service stations throughout the country.

The state-owned Venezuelan Petrochemical Institute (IVP) operated a fertilizer plant at Morón and has developed a growing export market for ammonia sulfate, superphosphates, and urea. Plans were studied to expand the petrochemical industry for the manufacture of synthetic rubber, plastics, detergents, chlorides, and caustic soda.

The Mineral Industry of Albania

By Bernadette C. Michalski [1] and K. P. Wang [2]

THE RAPID GROWTH of the small Albanian mineral industry in the 1950's began to taper off by 1961 and slackened sharply in 1963. The abandonment of Soviet and East European technical assistance programs in mid-1961 greatly affected Albania's mineral development, since four-fifths of all technical aid personnel were engaged in mineral activities. Chinese assistance apparently has not been able to fill the void. Overall mineral production increases during 1961–63 averaged 1 percent per year in value, as compared with 3 percent in 1959 and 5 percent in 1960.

Although by world standards Albanian mineral output, except for chromite, is insignificant, it is vital to the country's domestic economy. The mineral industry generated about 14 percent of the gross industrial product in 1962 and employed a notable share of the industrial labor force. In recent years, mineral products have provided about three-fifths of the country's exports by value. Chromite and iron-nickel ores together constituted from one-fourth to one-third of the total export value. In 1963, total trade turnover increased 12 percent over 1962.

PRODUCTION

Official Albanian mineral production statistics for 1963 were not available in time for inclusion in this chapter. Estimates based on available reports indicate that among major commodities, output levels of chromite, cement, and petroleum refinery products increased somewhat over those of 1962; coal output was about on a par with that of 1962, and nickel-iron ore production fell considerably short of anticipated goals and the 1962 output level.

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TABLE 1.—Production of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Chromite	248,000	289,075	232,458	257,287	[1] 281,000
Copper:					
Ore	105,000	81,477	80,491	[2] 84,000	[2] 84,000
Metal content of ore [2]	2,000	2,200	2,400	2,500	2,500
Smelter (blister)	1,006	944	1,289	[2] 1,270	[2] 1,800
Iron-nickel ore	176,263	255,015	358,465	425,139	[2] 300,000
Nonmetals:					
Cement—thousand tons	74	73	120	[2] 120	[2] 150
Mineral fuels:					
Coal—do	288	291	289	301	[2] 300
Petroleum:					
Crude—do	479	728	771	786	[2] 800
Refined products [3]—do	339	369	385	[2] 450	[2] 450

[1] Calculated on the basis of officially reported percentage changes.
[2] Estimate.
[3] Includes: Gasoline—53,900 tons in 1960 and 55,700 tons in 1961; gas oil—67,700 tons in 1960 and 62,600 tons in 1961; and diesel fuel—2,000 tons in 1960 and 3,400 tons in 1961; distribution of balance of total for 1960 and 1961 as well as totals for 1959 and 1962–63 are not available.

TRADE

Although Albanian-Soviet political differences had the greatest impact on technical assistance programs, they also influenced trade patterns. Expanded trade with mainland China and with some Western European countries was the result. The Albanian-Italian trade agreement for 1963 called for a 50-percent increase in crude oil shipments from Albania to Italy, from 100,000 metric tons in 1962 to 150,000 tons in 1963. Other mineral products to be exported from Albania were natural asphalt, iron-nickel ore, and chromite. In exchange, petroleum products and chemicals were to be shipped from Italy. Total trade between Italy and Albania was about US$8 million as compared with US$5.6 million in 1961. Trade with mainland China has been steadily rising, whereas trade with other East European countries showed little change.

TABLE 2.—Exports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	Principal destinations, 1961
Metals:			
Chromite	248,500	233,800	Czechoslovakia 62,900; Poland 55,200; East Germany 47,700; mainland China 36,600.
Copper, blister	761	1,304	Hungary 428; Czechoslovakia 191; U.S.S.R. 154; mainland China 150.
Iron-nickel ore	245,500	416,700	Czechoslovakia 345,400.
Nonmetals: Bitumen (natural asphalt)	28,400	28,100	Czechoslovakia 12,700; U.S.S.R. 11,900.
Mineral fuels:			
Coal	10,100	----------	Hungary 10,100.[1]
Petroleum:			
Crude—thousand tons	[2] 329.3	[2] 290.5	East Germany 120.9; U.S.S.R. 92.2.
Refined products (bitumen fluxate)—do	207.6	168.8	U.S.S.R. 98.8.

[1] Destination, 1960.
[2] Equivalent to about 2.2 million barrels in 1960 and 1.9 million barrels in 1961.

Source: Albanian official trade returns.

TABLE 3.—Imports of selected metals and minerals

(Metric tons)

Commodity	1960	1961	Principal sources, 1961
Metals:			
Iron, reinforcing rods for concrete	7,623	11,042	Czechoslovakia 4,289; Mainland China, 2,955.
Iron, sheet	981	1,301	U.S.S.R., 914; Poland 265.
Nonmetals: Cement	39,900	17,300	U.S.S.R. 9,900; Rumania 4,400.
Mineral fuels: Coke	8,323	5,954	All from Poland.

COMMODITY REVIEW

METALS

Bauxite.—Geologic explorations in 1963 reportedly uncovered refractory-grade bauxite deposits at Lesh Rreth, Kaharig Mountains, Krirje, and in southern Albania. No plans for exploitation were announced.

Chromite.—Chromite output in 1963 represented about 7 percent of the world's total, ranking the country first in Eastern Europe and second to the Soviet Union in the Sino-Soviet bloc. Albania's output consists of 38 to 45 percent CR_2O_3 grade ore. Virtually all the chromite was exported, mainly to Eastern Europe but also to mainland China and (during 1963) to Italy. The principal producing area has been Bulquize; lesser areas include Tropoye Rreth, Kukesh, and Pogradec. Much geologic exploration was conducted in 1963, mostly around Martanesh, in the hope of uncovering new ore deposits.

Copper.—In view of the copper shortage of the Sino-Soviet bloc, development of Albania's small deposits has received emphasis in the technical assistance programs of both the U.S.S.R. and mainland China. The principal mining area in 1963 was Rubik, where a smelter is located. Exploitation of deposits at Kurbnesh proved disappointing; however, the smelter there was in operation, processing ores from other areas. Albania's two small copper smelters consumed coke made from Polish coals. The country's 1963 copper-output target reportedly was barely fulfilled.

Two new copper deposits showed promise. One is at Gjegjaj near Kukesh Rreth and was apparently discovered in 1961. No details are known about the ore body, but construction of a copper smelter was underway in 1963 with completion scheduled for 1964. Fuel for the new Kukesh Rreth smelter is to be supplied by the Stalin Town petroleum coke plant. The second deposit is at Puke Rreth, where ores are said to average 3 to 6 percent copper.

A copper refinery as well as chromite benefication facilities were reportedly under construction at Lac in 1961. These projects were to be completed by the Chinese after Czech assistance ended. No subsequent information has been available on the progress at Lac.

Iron-Nickel Ore.—Albania's many iron-nickel mines did not fare particularly well in 1963. The Albanian press reports that the industry attained less than 60 percent of the plan for the year. Most Albanian ore, which averages about 1 percent nickel, was shipped to Sered,

Czechoslovakia, where there is a 2,000-ton-per-annum nickel refinery, however, some ore was exported to Hungary and mainland China.

Albania's leading iron-nickel mine in recent years has been Pishkash. Other known producers are at Cervenake, Bushtrice, and Prenjas; a new operation was reportedly started at Prenjas in 1963. Geological exploration during 1962–63 uncovered additional prospects in Puke, Pogradec, and Leskovik. Hematite is the main iron constituent of Albania's iron-nickel ores, but there is also some magnetite. No geological and reserve information is available on these deposits.

Iron and Steel.—As of 1963 Albania had no steel industry. Despite the absence of coking coal and the limited known supply of iron ore, plans are underway to construct an iron and steel plant at Elbasan with Chinese assistance.

NONMETALS

Cement.—Albania was known to have three cement plants prior to 1963; namely, Vlore, Shkoder, and Tirana, which together produced 119,764 tons of cement in 1961. A fourth plant of unspecified capacity was reportedly completed in 1963 at Fush-Kruje.

Phosphate.—A phosphate mine was opened in Buloret in 1963. Construction of a superphosphate plant at an unspecified location was reportedly underway at the end of 1963.

MINERAL FUELS

Coal.—Albania's 1963 output of coal apparently barely reached the planned target. Most of the coal, comprising mainly lignite with some bituminous coal, came from Memaliaj, Krava, Alarup, Mborjedrenova, and Priska. Coal is produced for domestic consumption. Albania depends upon Polish coking coal for copper smelting.

Petroleum and Natural Gas.—Albania's oil and gas exploration program achieved some success in 1963, with the discovery of natural gas at Bubullime and Divjake and a new petroleum-bearing formation at Patos. In the same year, however, overall production by the petroleum industry fell short of target. Cerrick, Albania's largest refinery, was rated at 300,000 tons per annum, and Kucevo, the only other oil refinery, was rated at 150,000 tons.

ELECTRIC POWER

The country's electric power output of approximately 250 million kilowatt-hours in 1963 was not adequate to support the industrial program. Two new hydroelectric plants, Shkopet and Bistrice, were in various stages of planning and construction at the end of 1963.

The Mineral Industry of Austria

By Justin B. Gowen[1]

ALTHOUGH Austria's mineral output is not large on a world basis, the production of a few important mineral and metal commodities for export has more than compensated for the import of those which are in short domestic supply. A substantial exportable surplus has been regularly produced in aluminum, antimony ore, graphite, iron and steel, magnesite, and talc. Other minerals produced in quantities of major significance to the national economy include copper, lead, zinc, iron ore, kaolinite, bentonite and illite clays, salt, coal, and petroleum.

In 1963 Austria's gross national product was valued at US$7,665 million ($7,188 million in 1962), of which about 3 percent was contributed by mining and quarrying and 5 percent by iron and steel. While mine production of the nonferrous metals does not meet domestic requirements for metallurgical products, the iron and steel industry, with a marketable production value estimated at more than $400 million in 1962, is the most important sector of Austria's mineral economy.

The principal basic mineral industries as listed in 1962 included 126 mines and quarries, 5 salt mines, 1,178 producing petroleum and gas wells, 6 salt and 8 magnesite mines and processing works, 5 nonferrous metal reduction works, and 5 iron and steel works. These industries employed about 105,000 persons, or 17 percent of the industrial labor force and 4.4 percent of the country's total gainfully employed.

Most of the companies involved in the operation of these industries were government owned; nationalized enterprises were responsible for the production of all of the copper and lead-zinc ores, more than 99 percent of the iron ore and pig iron, 95 percent of the crude steel, more than 96 percent of the coal, about 85 percent of the aluminum, and 83 percent of the electric power. Employment in the nationalized industries, including chemical, manufacturing, and transportation sectors, was 130,320, or 21 percent of the industrially employed in 1962.

SOURCE MATERIAL

Statistical data were obtained from publications of the Ministry for Trade and Reconstruction—Supreme Mining Authority, The Austrian Central Statistical Office, The Austrian Länderbank, the Credit Bank Association, and Embassy dispatches.

[1] West Europe specialist, Division of International Activities.

PRODUCTION

Production in 1963 showed a substantial increase in the fuels and salt sectors; metallic ores decreased only slightly. However, the continued downward trend in nonmetals, led by magnesite, has apparently reduced the total value of mine and quarry products for 1963, shown in detail as follows:

Commodity sector	Value of production (million U.S. dollars)				
	1959	1960	1961	1962	1963 [1]
Petroleum and natural gas	66.3	73.8	71.9	74.2	78.0
Stone and industrial minerals	45.4	55.1	66.2	60.0	52.0
Coal	40.4	43.8	40.3	42.3	45.0
Metallic ores	30.5	34.6	33.5	34.3	34.0
Salt and brine	5.7	6.1	6.5	6.7	8.0
Total	188.3	213.4	218.4	217.5	217.0

[1] Estimate.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Alumina, fused	(1)	6,327	[2] 15,000	[2] 15,000	[2] 12,000
Aluminum:					
Primary	65,563	67,970	67,654	73,831	76,464
Secondary	19,591	22,055	25,199	28,206	31,572
Semimanufactures, aluminum and aluminum alloys	27,912	30,049	30,528	31,896	30,723
Antimony:					
In concentrates	572	613	606	696	497
Crude	147	326	262	300	423
Bauxite (51 to 53 percent Al_2O_3, utilized mainly in abrasive and cement industry)	23,981	26,006	18,031	16,691	17,830
Cadmium, kilograms	19,600	14,600	19,000	22,100	19,700
Copper:					
In concentrates	2,473	1,985	1,910	1,987	1,885
Electrolytic	10,524	11,761	[3] 11,862	[3] 12,952	[3] 13,135
Other refined (remelted)	2,302	2,988	3,208	2,038	2,832
Copper sulfate	1,745	2,461	2,785	2,073	618
Semimanufactures, copper and alloys	34,440	43,944	38,892	34,800	37,480
Iron and steel:					
Iron ore (31 to 32 percent Fe), thousand tons	3,382	3,542	3,693	3,751	3,734
Pig iron, do	1,837	2,232	2,262	2,118	2,106
Ferroalloys:					
Ferromolybdenum	(1)	(1)	860	750	1,400
Ferrotitanium	(1)	(1)	250	----------	100
Ferrotungsten	(1)	(1)	1,700	1,450	1,900
Ferrovanadium	(1)	(1)	900	590	1,000
Crude steel, thousand tons	2,512	3,163	3,101	2,970	2,947
Semimanufactures for export	(1)	53	78	29	28
Finished steel:					
Wire rod, thousand tons	186	200	208	216	220
Other bars and rods, do	362	429	435	435	339
Hot strip, thousand tons	93	107	102	108	154
Plates and sheets, do	1,027	1,295	1,318	1,279	1,263
Railway track material, do	54	48	55	58	54
Forgings, do	53	59	70	65	66
Lead:					
Recoverable in concentrate	5,358	5,224	5,489	5,312	4,993
Smelter, including secondary and antimonial	12,347	12,444	12,342	12,172	9,782
Semimanufactures	3,288	3,588	3,723	3,624	3,634
Manganese content in iron ores	63,900	67,800	70,600	71,200	[2] 71,100
Nickel sulfate	155	191	180	183	[2] 185
Silver, troy ounces	[2] 62,372	58,193	58,193	68,481	64,300
Tungsten concentrate (60 percent WO_3 basis)	138	220	288	290	223

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals—Continued					
Zinc:					
Recoverable in ores and concentrates	5,917	6,577	6,034	6,590	7,091
Electrolytic	11,438	11,521	12,067	12,088	11,861
Fire refined	1,115	736	643	576	574
Nonmetals:					
Asbestos	------	[2] 60	512	456	579
Barite, marketable	3,690	4,381	2,464	1,081	2,049
Cement—thousand tons	2,417	2,830	3,084	3,057	3,304
Clays and clay products:					
China clay—do	298	323	344	336	349
Bentonite—do	3	3	4	3	3
Clay sand—do	49	51	57	50	47
Illite—do	------	------	29	66	[2] 70
Other clays—do	80	78	40	52	49
Diatomite	4,075	4,020	5,437	4,185	3,936
Feldspar	3,500	4,646	3,970	5,056	2,110
Graphite	62,091	88,036	80,971	89,282	99,589
Gypsum and anhydrite—thousand tons	564	663	680	684	585
Lime—do	622	678	711	671	685
Magnesite—do	1,201	1,625	1,799	1,607	1,313
Magnesite and chrome-magnesite products—thousand tons	186	260	295	275	223
Mica	98	144	88	15	------
Pigments (iron oxide)	2,939	3,459	3,516	3,308	4,120
Pumice (trass)	31,647	35,000	37,055	27,847	21,182
Quartz and quartzite	61,922	86,639	72,630	73,927	65,859
Quartz sand—thousand tons	177	166	198	190	199
Salt:					
Rock—do	1	2	3	5	5
Evaporated—do	126	132	139	147	166
Other—do	112	172	115	137	173
Sand, industrial—do	49	51	57	50	[2] 50
Talc and soapstone	51,233	82,277	84,948	75,771	65,644
Mineral fuels:					
Coal:					
Bituminous—thousand tons	134	132	106	99	104
Lignite—do	6,221	5,973	5,661	5,712	6,052
Coke:					
High-temperature—do	[3] 1,549	[3] 1,837	[3] 1,782	1,654	1,635
Low-temperature—do	[3] 270	[3] 263	[3] 254	315	330
Natural gas—million cubic feet	42,098	54,830	58,073	61,013	63,406
Petroleum, crude—thousand 42-gallon barrels	16,946	16,874	16,237	16,964	18,271
Gasoline—do	2,436	2,393	2,197	2,364	3,180
Kerosine—do	260	307	356	284	523
Gas-oil—do	4,692	4,521	4,758	5,845	6,302
Fuel oil—do	4,899	5,443	6,371	8,085	8,554
Lubricants—do	455	551	622	836	961
Asphalt—do	400	410	529	688	768

[1] Data not available.
[2] Estimate.
[3] Final figure; supersedes figure given in commodity chapter, volume 1.

TRADE

Gross exports in 1962 were valued at $1,263.4 million, of which $350 million represented minerals and metals. Iron and steel products ($208 million), magnesite products ($48 million), and aluminum ($31 million) provided the bulk of the exports, more than 50 percent of which went to European Economic Community (EEC) countries, principally the Federal Republic of Germany. Communist countries took 19 percent and the European Free Trade Association (EFTA) took 14 percent. Mineral exports to the United States were valued at about $8 million with metals predominating.

Gross imports in 1962 were valued at $1,551.8 million. About $310 million comprised minerals and metals and their semifabricated products, exclusive of gold; solid fuels and energy accounted for $92

million, petroleum and products $54 million, iron and steel $51 million, nonferrous metals $36 million, metalliferous ores and scrap $31 million and industrial minerals and products $46 million. The EEC countries (mainly the Federal Republic of Germany) were the principal source of supply accounting for about 46 percent, followed by the East European Communist nations with 29 percent, and the EFTA nations with 7 percent. Mineral imports from the United States were valued at about $14 million and consisted principally of coal and unspecified metalliferous ores.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Bauxite	7,794	5,048	All to West Germany.
Aluminum scrap	3,594	4,368	Italy 2,647; West Germany 1,721.
Metals and alloys, unwrought	28,305	41,804	West Germany 23,464; Italy 6,631; United States 2,729; Switzerland 2,266.
Plates, sheets, and strip	10,279	11,086	United Kingdom 2,291; Bulgaria 1,479; United States 1,411; Portugal 937.
Other wrought	4,663	4,513	West Germany 448; Belgium-Luxembourg 341; Italy 269; Czechoslovakia 178; United Arab Republic 119; Switzerland 109.
Antimony: Ores and concentrates	1,809	1,136	Belgium-Luxembourg 1,094.
Cadmium; unwrought and scrap	kilograms	13,500	West Germany 11,200; Netherlands 2,300.
Chromite	634	643	West Germany 540.
Copper:			
Matte and blister	151	276	Italy 206; West Germany 70.
Refined unwrought	1,240	1,640	West Germany 1,405; Italy 183; Switzerland 52.
Alloys	107	[1] 733	West Germany 378; Italy 354.
Scrap	99	721	West Germany 396; Italy 215; Hungary 100.
Semimanufactures	4,901	4,423	U.S.S.R. 972; West Germany 558; Sweden 488; Switzerland 192; Netherlands 182.
Gold, bullion and semimanufactures	troy ounces 5,948	10,707	West Germany 8,648; Netherlands 739; United Kingdom 289; Switzerland 161; France 161; Hungary 161.
Iron and steel:			
Iron ore	thousand tons 10		
Roasted pyrites	do 4	1	All to West Germany.
Scrap	do 5	5	Switzerland 2; Belgium-Luxembourg 1; West Germany 1; Italy 1.
Pig iron and castings	do 10	2	Italy 1.
Powder and sponge	76	116	West Germany 106.
Ferroalloys (all)	2,661	2,418	(2).
Steel:			
Ingots and semimanufactures for rerolling	thousand tons 432	442	West Germany 291; Italy 84; Belgium-Luxembourg 36.
Bars, rods, angles, shapes, and sections	do 147	156	Switzerland 29; Italy 27; West Germany 16; Poland 14.
Hoop and strip	do 25	46	Hungary 20; Switzerland 12; Czechoslovakia 4; Poland 4.
Plates and sheets	do 528	531	West Germany 130; U.S.S.R. 86; Switzerland 76; Italy 53.
Other coated sheets	do 10	9	Czechoslovakia 8.
Wire	do 25	31	Yugoslavia 6; Hungary 6; Italy 6.
Railway track material	do 21	29	Switzerland 22; Norway 2; Poland 1; Yugoslavia 1; Denmark 1.
Pipes tubes, and fittings [3]	do 21	20	West Germany 4; East Germany 3; Poland 2; Switzerland 1; Hungary 1.
Lead:			
Ores and concentrates	22	6	All to West Germany.
Scrap	10		
Lead, unwrought	2,874	2,723	Italy 2,692.
Bars, rods, sections, and wire	1	1	(2).
Magnesium, all forms	188	235	West Germany 99; India 27; United Kingdom 22; Italy 18; Netherlands 17; Belgium-Luxembourg 16; France 12.

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals—Continued			
Mercury—76-pound flasks	896	67	West Germany 58.
Molybdenum:			
Scrap—kilograms	17,416	18	All to West Germany.
Semimanufactures—do	245,813	126,100	United Kingdom 53,400; West Germany 19,200; United States 14,900.
Nickel:			
Scrap	151	134	West Germany 111; Switzerland 8; United Kingdom 11.
Semimanufactures	49	32	Czechoslovakia 9; West Germany 7; Yugoslavia 5; Bulgaria 4.
Platinum group, unwrought and semimanufactures—troy ounces	1,479	1,447	West Germany 579; Italy 547; United Kingdom 321.
Silver:			
Bullion—do	163,969	61,086	All to West Germany.
Other—do	96,452	102,882	Italy 51,441; West Germany 16,075; Yugoslavia 12,860.
Tantalum:			
Scrap—kilograms	400	300	All to West Germany.
Semimanufactures—do	2,200	1,700	Japan 1,000; West Germany 400; France 300.
Tin, all forms	106	16	All to West Germany.
Tungsten:			
Ores and concentrates	200	322	West Germany 302; United Kingdom 20.
Scrap	20	35	All to West Germany.
Semimanufactures	25	12	France 4; Italy 3; United States 2.
Zinc:			
Ores and concentrates	40	21	All to West Germany.
Scrap	60	86	Italy 45; West Germany 21; Yugoslavia 20.
Unwrought	5,096	3,689	Italy 2,977; Yugoslavia 560; West Germany 122.
Semimanufactures	22	7	Yugoslavia 4; Greece 2.
Nonmetals:			
Asbestos	342	233	West Germany 223.
Barite and witherite	30	----------	----------
Cement (hydraulic)	29,956	101,361	West Germany 55,864; Switzerland 45,475.
Chalk	1,262	2,870	Czechoslovakia 1,040; West Germany, 790; Italy 527.
Clays and refractories:			
Bentonite (not activated)	33	88	West Germany 42; Switzerland 40.
China clay (kaolin)	35,654	39,082	Italy 15,314; West Germany 9,764; Poland 7,703; Switzerland 6,039.
Fire and Dinas clays	52	58	Czechoslovakia 21; Switzerland 18.
Crude refractories	6,863	709	Italy 634; Switzerland 65.
Other refractories	27	24	Italy 21.
Corundum, artificial	5,798	9,530	(2).
Cryolite, natural	131	101	Italy 100.
Diatomite and other siliceous earths	179	103	Yugoslavia 26; Bulgaria 25; Switzerland 25.
Diamonds:			
Industrial—carats	(4)	----------	----------
Diamond and other gem stone powder.	(4)	----------	----------
Dolomite, unburnt, burnt, or sintered	15,067	14,799	West Germany 6,692; United Kingdom 2,944; France 1,140.
Feldspar	350	2,281	Czechoslovakia 1,980; Switzerland 300.
Graphite	20,018	18,226	West Germany 8,997; Italy 6,491; Yugoslavia 847.
Gypsum and anhydrite, crude or sintered.	34,362	39,867	West Germany 35,989; Switzerland 3,685.
Lime, burned, slaked, and hydraulic	209	237	West Germany 116; Turkey 80.
Limestone, industrial	18,500	----------	----------
Magnesite:			
Crude	603	773	West Germany 402; Italy 199; Switzerland 138.
Sintered	237,883	188,983	West Germany 76,033; United States 49,090; Italy 20,405; France 11,303; United Kingdom 11,025; Hungary 9,425.
Caustic calcined	97,026	96,600	West Germany 80,202; Italy 3,999; Czechoslovakia 3,279; Switzerland 3,071.
Magnesite brick	118,545	126,241	West Germany 30,445; France 17,987; Italy 11,638.
Chrome-magnesite products	137,311	108,655	France 22,704; West Germany 22,463; Italy 11,638.

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Nonmetals—Continued			
Mica, including splittings and waste	5	5	All to West Germany.
Pigments, earth	2,118	2,290	West Germany 1,225; United Kingdom 468; Netherlands 233.
Pumice	1	3	(2).
Pyrites	18,579	3,988	All to West Germany.
Quartz and quartzite	2,379	101	Rumania 895.
Salt, including brine	1,394	2,469	West Germany 2,468.
Sand:			
Quartz	373	909	West Germany 799.
Other	28,149	20,266	West Germany 14,799; Switzerland 5,446.
Talc and soapstone	62,382	55,891	West Germany 19,881; Poland 14,521; Italy 5,472.
Vermiculite and mineral wool	70,924	93,000	West Germany 92,149; Italy 381; Switzerland 228.
Mineral fuels:			
Coal and briquets:			
Subbituminous and lignite. thousand tons	32	20	West Germany 19.
Coke do		10	All to Czechoslovakia.
High-temperature distillation products. do	3	4	West Germany 3.
Pitch and pitch coke do	4	1	(2).
Petroleum:			
Crude petroleum. thousand 42-gallon barrels	5,325		
Distillate fuel oil do	627	1,452	All to West Germany.
Residual fuel oil do	32	79	West Germany 34; Yugoslavia 11; Syria 11.
Asphalt do	5	16	West Germany 13.
Other do	4		
Electric energy millions kilowatt-hours	2,534	2,596	West Germany 2,278; Switzerland 211; Italy 107.

[1] Includes 125 tons of master alloys.
[2] Data not available.
[3] Does not include steel pipe with a wall thickness of more than 4.75 millimeters, or a diameter of 114 millimeters or more. Data on these sizes are not published.
[4] Less than 2,500 carats.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Bauxite	18,468	13,159	(1).
Alumina and aluminum hydroxide	161,541	142,473	(1).
Metals and alloys, unwrought and scrap.	387	868	Hungary 33; West Germany 16; Czechoslovakia 624.
Metal, semimanufactures	1,491	1,916	West Germany 848; Switzerland 565; Yugoslavia 154; Netherlands 117.
Antimony metal, all forms	153	146	Belgium-Luxembourg 115; West Germany 20; Netherlands 11.
Arsenic, white	33	33	East Germany 20; West Germany 13.
Cadmium:			
Unwrought and scrap kilograms	10,300	4,300	All from Belgium-Luxembourg.
Semimanufactures do	12,600	8,400	West Germany 6,400; Belgium-Luxembourg 1,000; Netherlands 1,000.
Chromite	83,377	62,539	Philippines 30,072; Turkey 22,919; Iran 6,280; Cyprus 3,184.
Copper:			
Ores and concentrates	550	506	All from Italy.
Blister	5,325	4,894	Republic of South Africa 3,963; Central Africa Federation 506; Italy 258; West Germany 132.
Refined unwrought	20,583	17,347	West Germany 15,561; Chile 813; Central Africa Federation 371.
Alloys	106	131	West Germany 86; United States 24.
Scrap	2,694	2,640	West Germany 848; United States 809; Netherlands 527.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals—Continued			
Semimanufactures:			
Bars, rods, angles, sections, and wire.	2,168	2,032	West Germany 1,593; Switzerland 210; United Kingdom 104.
Plates, sheets, and strip	1,120	1,057	West Germany 862; Switzerland 90.
Other	788	785	West Germany 502; United Kingdom 82; Switzerland 61; Netherlands 40.
Gold and gold alloys:			
Bullion and other unwrought troy ounces	744,836	964,265	United Kingdom 825,020; Republic of South Africa 48,290; Switzerland 34,626.
Semiwrought and wrought ...do	1,318	1,029	West Germany 804; United Kingdom 225.
Iron and steel:			
Iron ore thousand tons	1,297	1,045	U.S.S.R. 313; West Germany 268; Greece 161.
Roasted pyrites ...do	430	377	Italy 373.
Scrap ...do	80	42	West Germany 40.
Pig iron and castings ...do	69	36	U.S.S.R. 12; East Germany 11; West Germany 6; Hungary 5.
Powder and sponge	1,442	1,369	Sweden 769; West Germany 600.
Spiegeleisen	1,725	2,152	West Germany 1,571; Republic of South Africa 458; U.S.S.R. 123.
Ferroalloys			
Ferrochromium thousand tons	12	10	France 2.0; Yugoslavia 1.8; Norway 1.4; Sweden 1.4.
Ferromanganese ...do	9	9	Norway 5.0; U.S.S.R. 1.4; France 0.8.
Ferrosilicon ...do	8	8	Norway 1.7; U.S.S.R. 1.6; Czechoslovakia 0.9; Italy 0.9.
Other ...do	4	5	Norway 3.7; Yugoslavia 0.3; Switzerland 0.1.
Steel:			
Ingots and semimanufacturers thousand tons	6	21	Hungary 18; West Germany 2.
Bars, rods, angles, shapes, and section.	68	47	West Germany 39; Italy 4; France 3.
Hoop and strip	13	10	West Germany 7; Czechoslovakia 2.
Plates and sheets	12	15	West Gernamy 10; Belgium-Luxembourg 2; United States 1; France 1.
Tinplate	8	13	West Germany 4; Belgium-Luxembourg 4; France 3; United States 1.
Other coated sheets	6	8	Belgium-Luxembourg 5; West Germany 3.
Wire	4	4	West Germany 3; Belgium-Luxembourg 1.
Railway track material	1	1	All from West Germany.
Pipes, tubes, and fittings	71	59	West Germany 36; United Kingdom 5; Italy 4; Hungary 4.
Lead:			
Ores and concentrates	4,650	4,285	Italy 4,280.
Scrap	237	66	West Germany 61.
Lead, unwrought	10,442	12,850	Yugoslavia 5,829; West Germany 2,781; U.S.S.R. 1,843; Rumania 1,033.
Semimanufactures	246	236	West Germany 194; Netherlands 24; Switzerland 15.
Magnesium:			
Unwrought and scrap	338	324	Italy 316.
Semimanufactures	10	7	West Germany 6.
Manganese ores and concentrates	56,297	14,243	U.S.S.R. 13,630; West Germany 305.
Mercury 76-pound flasks	1,363	806	Spain 522; West Germany 139; Italy 81; Yugoslavia 44.
Molybdenum metal, all forms	16	8	Netherlands 3; Hungary 2; West Germany 1; East Germany 1; France 1.
Nickel:			
Matte, speiss, etc	248	122	All from Canada.
Nickel and nickel scrap, unwrought	2,657	2,085	United Kingdom 1,430; Canada 544; France 102.
Nickel alloys, unwrought	13	26	United Kingdom 11; West Germany 11; Netherlands 4.
Nickel anodes	71	82	United Kingdom 54; West Germany 24.
Semimanufactures	293	289	West Germany 185; Switzerland 57.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals—Continued			
Platinum group metals, troy ounces, all forms.	3,987	1,801	West Germany 1,029; United Kingdom 611; U.S.S.R. 161.
Silver:			
Unwrought, thousand troy ounces	4,122	2,189	United Kingdom 833; West Germany 675; mainland China 675.
Semiwrought and semi-manufactures, do.	135	93	West Germany 51; Switzerland 23; United Kingdom 19.
Tantalum, unwrought, kilograms	3,500	3,200	Mainly from West Germany.
Tin, all forms	827	768	Netherlands 333; Malay Federation 142; West Germany 130.
Tungsten:			
Ores and concentrates	2,981	2,729	(1)
Metal, all forms	40	41	West Germany 31; France 6; United Kingdom 3.
Zinc:			
Ores and concentrates	9,420	13,128	Italy 12,800; Belgium-Luxembourg 204; Spain 124.
Scrap		28	All from West Germany.
Unwrought	8,032	6,008	U.S.S.R. 2,000; Poland 1,385; Rumania 1,260.
Semimanufactures	507	450	West Germany 424; Switzerland 17; Norway 6.
Nonmetals:			
Asbestos	20,942	16,019	Canada 10,115; U.S.S.R. 4,000; Cyprus 1,420.
Barite and witherite	8,804	8,559	Yugoslavia 4,032; West Germany 4,030; Italy 497.
Boron salts	4,169	4,178	United States 3,480 Turkey 698.
Cement (hydraulic)	15,325	12,984	France 4,135; West Germany 3,496; Belgium-Luxembourg 1,975.
Chalk	46	288	France 275.
Clays and refractories:			
Bentonite (not activated)	4,744	6,067	Hungary 5,940.
China clay (kaolin)	7,288	8,683	Czechoslovakia 4,857; West Germany 2,036; United Kingdom 1,562.
Fire and Dinas clays	454	353	West Germany 330.
Crude refractories	4,669	3,625	Czechoslovakia 1,688; West Germany 1,569; Portuguese East Africa 279.
Other refractories	78,198	89,962	Czechoslovakia 49,625; West Germany 34,330; East Germany 2,020.
Corundum:			
Natural	102	126	Greece 110; Netherlands 14; West Germany 2.
Artificial	2,439	2,431	West Germany 2,017; France 286; Yugoslavia 84.
Cryolite, natural	350	339	Denmark 337.
Diatomite and other siliceous earths	1,270	1,421	United States 873; West Germany 420; Hungary 59.
Diamonds:			
Industrial, carats	(2)	(2)	West Germany;[3] Italy.[3]
Diamond and other gem stone powder.	(2)	50,000	Switzerland;[3] Netherlands.[3]
Dolomite,[4] unburnt, burnt, or sintered	2,282	2,013	Italy 1,197; Norway 499; West Germany 317.
Feldspar	4,460	4,380	Yugoslavia 1,797; Italy 1,106; Sweden 840.
Fluorspar	12,644	8,139	West Germany 5,393; Italy 1,569; East Germany 906.
Graphite, natural	166	219	West Germany 164.
Gypsum and anhydrite:			
Gypsum, crude or sintered	3,736	3,690	Poland 1,944; West Germany 1,740.
Anhydrite	9,226	14,352	Poland 7,858; West Germany 6,286; Italy 187.
Lime, burned, slaked, and hydraulic	1,551	2,451	West Germany 1,517; Switzerland 933.
Limestone, industrial	1,331	1,512	West Germany 1,318; Sweden 188.
Magnesite:			
Crude	2,182	4,343	Turkey 4,240.
Sintered	781	1,505	Greece 1,500.
Caustic calcined	20	105	Greece 52; West Germany 43.
Magnesite and chrome magnesite products.	1,126	580	Italy 499; West Germany 31; East Germany 50.
Mica, including splittings and waste	198	234	West Germany 96; Norway 85.
Pigments, earth	386	427	France 268; West Germany 59; Italy 47.
Phosphate rock	154,398	193,327	Morocco 153,136; West Germany 31,592; Jordan 8,599.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Nonmetals—Continued			
Potash:			
Crude salts, natural	195,206	192,518	East Germany 178,943; U.S.S.R. 12,440; West Germany 946.
Potassium chloride	6,981	28,466	France 25,635; West Germany 2,606; U.S.S.R. 225.
Potassium sulfate	9,794	10,733	All from West Germany.
Potassium-magnesium sulfate	40,571	39,150	Do.
Other potash fertilizers	185	392	West Germany 340.
Pumice	848	406	Italy 255; West Germany 151.
Pyrites	53,946	30,609	Italy 12,192; Greece 11,008; Yugoslavia 7,085.
Quartz and quartzite	11,788	10,664	West Germany 9,056; Yugoslavia 854; Switzerland 339.
Salt, including brine	68	103	Yugoslavia 72; West Germany 31.
Sand, natural:			
Quartz	89,985	93,078	West Germany 62,071; East Germany 18,446; Czechoslovakia 8,325; Yugoslavia 3,256.
Other	49,125	43,974	West Germany 19,831; Czechoslovakia 8,377; Belgium-Luxembourg 6,914; Switzerland 6,505.
Sulfur	60,824	74,105	East Germany 20,778; Poland 15,428; United States 15,005; France 14,696.
Talc and soapstone	1,396	1,787	Italy 1,363; mainland China 140; Norway 138.
Vermiculite and mineral wool	2,241	600	West Germany 575.
Mineral fuels:			
Coal and briquets:			
Bituminous and anthracite. thousand tons	3,529	3,678	Poland 1,178; West Germany 1,022; U.S.S.R. 772; United States 319.
Subbituminous coal and lignite. do	535	634	East Germany 404; West Germany 192.
Peat do	5	6	West Germany 5.
Coke do	770	806	West Germany 330; Czechoslovakia 139; Italy 114.
Coal distillation products:			
Generator gas do	2	2	West Germany 1; Switzerland 1.
Coal tar do	7	6	All from Czechoslovakia.
High-temperature distillation products. do	5	7	West Germany 3; Poland 2.
Pitch and pitch coke do	19	20	West Germany 19.
Petroleum:			
Crude petroleum. thousand 42-gallon barrels	3,931	4,540	U.S.S.R. 2,588; Yugoslavia 1,952.
Carbon black	6,353	7,528	West Germany 3,948; Belgium-Luxembourg 1,347; Italy 899.
Gasoline thousand 42-gallon barrels	3,591	4,546	Italy 3,294; Czechoslovakia 347; U.S.S.R. 305.
Distillate fuel oil do	457	466	Italy 453.
Residual fuel oil do	5,230	5,924	Hungary 1,929; Italy 1,743; Czechoslovakia 1,136.
Lubricants do	268	290	Netherlands 114; West Germany 48; United Kingdom 38.
Liquid petroleum gas do	60	194	West Germany 91; Czechoslovakia 79; Italy 14.
Paraffin and petrolatum do	43	[5] 47	West Germany 20; East Germany 10; Rumania 6.
Asphalt do	519	516	Italy 357; Hungary 146.
Other do	66	[6] 29	United States 13; West Germany 4; Italy 4.
Electric energy. millions of kilowatt hours	101	89	Switzerland 44; Yugoslavia 31; West Germany 11.

[1] Data not available.
[2] Less than 2,500 carats.
[3] Distribution by weight not available.
[4] Excludes ornamental stone, 680 tons to 17 countries.
[5] Includes 1,000 barrels kerosine.
[6] Includes 3,000 barrels petroleum coke.

COMMODITY REVIEW

METALS

Aluminum.—The record-high production of aluminum in 1963 was due in part to increases in productive capacity during 1961 and 1962 and in part to favorable hydropower conditions which permitted a greater utilization of available capacity. Austria has two primary aluminum producers, both of which have undergone modernization and expansion during recent years. However, production at times has been limited by seasonal shortages in the power supply.

The Vereinigte Metallwerke Ranshofen-Berndorf is state owned and had a rated capacity of 68,000 tons of primary aluminum at the end of 1962. The Salzburger Aluminumgesellschaft m.b.H. is a wholly owned subsidiary of the Swiss Aluminum G.m.b.H. (Alusuisse) with works at Lend in Salzburg. Capacity was recently increased from 7,000 tons to 10,000 tons of primary aluminum annually.

Copper.—The Mitterberg mine of the nationalized Kupferbergbau Mitterberg GmbH at Muhlbach (Salzburg) was the sole producer of copper ores and concentrates. The concentrates were roasted at Gailitz, and smelted and refined by the Montanwerke Brixlegg GmbH at their Brixlegg (Tyrol) works where the 500th anniversary of the copper smelter was celebrated in October. Improvements and additions to the residues preparation and anode casting plants raised the annual capacity of the electrolytic copper refinery to about 13,000 tons annually. Current annual requirements for refined copper and copper alloys are estimated at 35,000 tons.

Iron and Steel.—During 1963 the Austrian iron and steel industry attained a capacity of about 3.8 million tons of crude steel annually; pig iron capacity remained at 2.4 million tons. Production by type is shown in table 4.

TABLE 4.—Crude steel production, by type

(Thousand metric tons)

Year	Open hearth	Electric	L–D	Total	Year	Open hearth	Electric	L–D	Total
1953	750	201	332	1,283	1959	868	351	1,293	2,513
1954	804	256	593	1,653	1960	990	400	1,773	3,163
1955	853	295	675	1,823	1961	904	378	1,819	3,101
1956	912	315	850	2,077	1962	814	327	1,829	2,970
1957	966	338	1,205	2,509	1963	(1)	(1)	(1)	2,947
1958	907	321	1,165	2,393					

[1] Data not available.

Since the development of the Linz-Donawitz (L–D) oxygen-blast steelmaking process and installation of the first production unit at Linz-Donau in 1952, L–D steel has assumed increasing importance in the Austrian iron and steel industry, accounting for nearly 62 percent of the crude steel output in 1962.

Possession of the licensing rights and the technical knowledge relating to the process has contributed to the high development of the Austrian industry and its export capability.

In mid-1963 there were in operation throughout the world a total of 50 L–D plants with a combined capacity of 37 million tons of crude steel, and an additional 40 with a combined capacity of 35 million tons were either under construction or being planned. The latter include a plant with a capacity of 2 million tons annually for the U.S.S.R.

Of the country's five major primary steel-producing enterprises (including consolidations), four are nationalized. The two largest—Vereinigte Oesterreichische Eisen-und Stahlwerke A.G. (VÖEST) with main works at Linz-Donau, and the Oesterreichisch-Alpine Montangesellschaft with main works at Donawitz—are integrated with blast furnaces, rolling mills, and metal fabrication plants and are jointly responsible for the development of the L–D process. These two enterprises account for 99.5 percent of the country's pig iron (VÖEST 68.5 percent) and all of the L–D steel (VÖEST 78.4 percent); Alpine-Montan accounts for all of the iron ore production.

In mid-1963 VÖEST had a reported capacity of 2 million tons of crude steel. Preliminary production figures for the year credited the enterprise with an output of 1.7 million tons of crude steel (1.73 million tons in 1962) and 1.2 million tons of sheets (1.21 million tons in 1962). Sales reached a new high of $223 million, of which 61.4 percent was in exports.

Gebruder Böhler Aktiengesellschaft, with a crude steel capacity of about 190,000 tons, and Schoeller-Bleckmann with 86,000 tons, both nationalized, specialize in high-grade steels and steel products. Felten Guilleaume Fabrik Elektrischer Kabel, Stahl-und Kupferwerke A.G., with a capacity of 100,000 tons of open-hearth steel, is a subsidiary of Acieries Réunies de Burbach-Eich-Dudelange S.A. ARBED in Belgium.

Lead and Zinc.—The Government owned Bleiberger Bergwerks-Union operating the Bleiberg mine in the ancient Bleiberg-Kreuth mining district in Carinthia continued to be the country's only producer of lead and zinc ores and concentrates. The company's lead smelter (capacity 14,000 tons refined lead annually) and electrolytic zinc plant (capacity 13,000 tons annually) at Gailitz, near Arnoldstein (Carinthia) accounted for the total output of refined lead, electrolytic zinc and electrolytic cadmium. Imported concentrates from the nearby Raibl mine in Italy were treated at Gailitz on contract. Austria's current requirements were reported to amount to approximately 20,000 tons of lead and 15,000 tons of zinc annually.

The Gailitz lead smelter uses a direct smelting process, largely of their own development, which utilizes a rotary ore hearth to smelt a pelletized mixture of lead oxide and sulfide concentrates and residues. About 80 percent of the lead content is recovered as bullion. Slag from the ore hearth is retreated in a rotary furnace for recovery of the remaining lead.

NONMETALS

Graphite.—During 1962 four new graphite mines were added to the two—Zettlitz and Trandorf—already operated in Lower Austria by Prysok and Co. KG. The Trandorf mine was converted from an open pit to an underground operation, while a flotation plant and additional grinding facilities were added to the surface plant. During 1962 the

company produced 65,388 tons of crude graphite, making it Western Europe's leading graphite producer.

The Kaisersberg graphite mine at Franz Mayr-Melnhof & Co. in Styria produced 21,421 tons, mainly for export; the Mühldorfer Grafitbergbau A.G., produced 2,523 tons.

Magnesite.—The U.S.-owned Oesterreich-Amerikanische Magnesit Aktiengesellschaft Radenthein remained Austria's leading magnesite producer in 1963. During 1962 this company produced 958,500 tons, or 58 percent of the country's output, of crude magnesite. The other producing companies were the Veitscher Magnesitwerke A.G. which accounted for 599,600 tons, or 37 percent of the 1962 total, the Steirische Magnesit Industrie A.G. with 64,000 tons (4 percent), and the Oestereichisch-Alpine Montangesellschaft with 14,900 tons (about 1 percent).

The decrease in production and exports of magnesite and magnesite products since 1961 is attributed to the general decline in Western steel production, and to the increase in L–D oxygen converter steel relative to open hearth and other types. The steel industry is a major consumer of magnesite and magnesite refractories, but the L–D process is reportedly less dependent on the high-grade magnesite, because it can utilize a greater proportion of cheaper refractories, such as dolomite.

MINERAL FUELS

Coal.—Less than 2 percent of Austria's coal production was bituminous coal suitable for coking. The remainder consisted of lignite (82 percent) and subbituminous coal (16 percent), all of which was consumed in approximately equal proportions in power generation, industry, and households. The 1962 production of 5.8 million tons was derived from 29 mines; 14 of these, accounting for 96 percent of the total were operated by 7 nationalized enterprises.

The Grünbach mine was the principal producer of bituminous coal.

Based on 1956 estimates and subsequent mining, the reserve of bituminous coal and lignite at the end of 1962 was estimated at about 250 million tons of which 2 million tons was coking coal.

TABLE 5.—Coal production, by company, in 1962

Company:	*Quantity*
Nationalized:	
Graz-Koflacher Eisenbahn und Bergbaugesellschaft	2,434
Wolfsegg-Traunthaler Kohlenwerks-Aktiengesellschaft	966
Lavanttaler Kohlenbergbau G. m.b.H	822
Oesterreichisch-Alpine Montangesellschaft	776
Salzach Kohlenbergbau G. m.b.H	371
Bergbau-Betrieb G. m.b.H	135
Steinkohlenbergbau Grünbach G. m.b.H	95
Private:	
Tauchener Kohlen-Industrie Aktiengesellschaft	168
Others	44
Total	5,811

Consumption of bituminous coal in Austria during recent years has ranged from 4.7 million tons in 1957 to 3.4 million tons in 1959. Con-

sumption during 1961 and 1962 by principal consumer groups was as follows:

	Thousand metric tons 1961	1962
Coke ovens	2,154	2,119
Gas works	288	418
Powerplants	63	76
Transportation	540	552
Industry	311	273
Household	243	328
At mines	4	4
Total	3,603	3,770
From imports	3,496	3,671

Petroleum.—During 1962 somewhat more than a quarter of Austria's total energy requirement, estimated at 19.2 million tons of standard coal equivalent, was supplied by petroleum and petroleum products; 70 percent of these was from domestic production of petroleum and natural gas. The three producing companies were—

1. The nationalized Oesterreische Mineralölverwalting Aktiengesellschaft, which accounted for 91 percent of the 1962 crude production.
2. Rohöl-Gewinnungs A.G., owned 50 percent each by the Mobiloil and Shell companies, which accounted for 8 percent.
3. Tiefbohrunternehmen Richard K. van Sickle, which accounted for 1 percent.

Reserves in December 1963 were estimated at 268.5 million barrels of crude oil and 31.5 billion cubic meters of natural gas.

On December 23, 1963, Austria made the last oil delivery arranged under the terms of the Moscow Memorandum of April 15, 1955, and the State Treaty of 1955 as compensation to the Soviet Union for the return to Austria of former German oil properties located in the former Soviet-occupied zone. Under the original terms of the oil agreement, which was to expire in 1965, Austria was to ship 1 million tons of crude oil per year to the Soviet Union for 10 years. The agreement was amended in 1960 following the visit of premier Khrushchev to Vienna. At that time the quantity of oil to be delivered was reduced to 0.5 million tons per year and the shipment for 1965 was canceled. In all, 7.5 million tons of crude oil priced at about $103 million was delivered under the terms of the amended agreement which was to expire on January 27, 1964.

The Mineral Industry of Belgium

By L. Nahai[1]

BELGIUM continued to be an important processor of ores, concentrates and metals and a metal supplier in world markets in 1963. The country produces iron and steel, copper, lead, tin, zinc, cobalt, cadmium, silicon, germanium, uranium, and radium from imported ores and concentrates and crude metals.

Except for coal certain quarry products (sand, and gravel, various dimension stones, and crushed rock) and a small iron ore reserve, Belgium has no economic mineral deposits. The country is self-sufficient in the pit and quarry products mentioned above (except for sand) and produces much of the coal needed by the economy.

Although Belgium's production of iron and steel is only about 2 percent of the world's output, the Belgium-Luxembourg Economic Union is the world's foremost exporter of iron and steel. In 1962 Belgium ranked fifth in production of smelter zinc, accounting for 6 percent of the world's output. Its cadmium exports also were equivalent to about 6 percent of world production.

The gross national product of Belgium, at current prices in 1962, was $12.74 billion. The extractive industry contributed $274 million (2 percent), the iron and steel industry $358 million (2.8 percent), and the petroleum-refining industry $36 million (0.3 percent). In addition, $226 million was contributed by the fired-clay products, ceramic, cement, and glass industries. The glass industry may account for one-third to one-half of this sum. Inclusion of glass in the foregoing figures makes it difficult to calculate the total contribution of the mineral industry to the gross national product.

Average employment in 1962 in coal mines, quarries, iron and steel plants (excluding iron and steel foundries), and nonferrous plants totaled 180,000 workers of whom nearly half were employed in the coal mines. Employment in lime and cement plants and petroleum refineries may bring the total to 200,000 workers in a total industrial force of nearly 1 million. Employment in coal mines in 1963 totaled 84,605 persons, of whom 64,327 were underground workers.

PRODUCTION

The industrial production of Belgium is estimated to have increased almost 6 percent. However, mineral and metal output did not increase at the same rate. Pig iron production increased by 3 percent, steel ingots by 2 percent, and rolled product by 7 percent. The coal in-

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dustry halted the downward trend in production, and output was slightly higher than in 1962. Cement production continued at about the same rate, but there were advances in nonferrous metal production.

Production trends during 1959–63 showed significant increases over the 1959 output for iron and steel, copper, and tin. Zinc production was below the 1959 level during 1962 and 1963.

A high level of construction and public works stimulated production of quarry and pit products. All of these products except clays and quartzite showed large increases during 1959–63.

Expansion of petroleum refinery capacity led to substantial increases in the output of petroleum products, making the country a net exporter in 1963.

TABLE 1.—Production of metals and minerals
(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum, secondary	2,724	2,772	1,860	2,844	(1)
Antimony, cadmium and other	4,848	4,596	4,620	4,812	(1)
Cadmium (exports) [2]	686	718	902	841	(1)
Copper, refined	185,700	211,800	221,600	221,500	271,500
Iron and steel:					
Iron ore—thousand tons	142	160	115	80	96
Pig iron and ferroalloys—do	5,965	6,553	6,445	6,749	6,958
Steel ingots and castings—do	6,434	7,181	7,012	7,351	7,525
Rolled steel—do	4,678	4,933	4,914	5,474	(1)
Lead, smelter (includes scrap)	88,441	92,705	99,890	93,151	(1)
Precious metals—thousand troy ounces	12,286	12,263	13,172	12,325	(1)
Selenium (exports) [2]—kilograms	56,499	32,900	24,000	[3] 14,000	(1)
Tin, smelter—long tons	5,945	7,947	6,002	8,607	7,044
Zinc, smelter [4]	224,302	247,563	245,548	206,156	205,700
Nonmetals:					
Cement—thousand tons	4,439	4,388	4,754	4,788	4,709
Clays	640,300	811,300	804,400	[5] 207,100	(1)
Dolomite (crude and calcined)	636,600	757,600	789,300	882,100	(1)
Gravel and sand (from dredging)—thousand tons	3,063	3,764	3,924	4,175	(1)
Lime—do	1,774	1,928	1,923	2,041	(1)
Limestone—do	3,379	3,779	4,857	5,345	(1)
Marble—cubic meters	14,400	14,000	14,800	14,200	(1)
Marl—thousand tons	1,302	1,212	1,229	1,304	(1)
Natural carbonates	268,200	419,200	910,200	876,400	(1)
Petit granit (Belgian bluestone)—cubic meters	382,548	430,908	344,688	731,900	(1)
Plaster	61,900	65,900	69,800	80,700	(1)
Plaster, agglomerate—thousand square meters	1,552	2,438	3,014	3,610	(1)
Porphyry (dimension stone and crushed)—thousand tons	3,582	3,155	3,361	4,085	(1)
Quartz and quartzites—do	578	817	1,132	283	(1)
Sand, industrial and other—do	4,367	5,040	5,929	6,753	(1)
Slate, roof and other	9,100	11,464	10,200	11,200	(1)
Mineral fuels:					
Anthracite—thousand tons	6,404	5,886	5,520	5,751	5,986
Bituminous coal—do	16,353	16,575	16,016	15,475	15,432
High-temperature coke—do	7,217	7,525	7,252	7,195	7,204
Fuel briquets—do	972	1,043	1,125	1,539	2,134
Petroleum products:					
Gasoline—thousand 42-gallon barrels	11,556	11,882	12,757	13,622	12,868
Kerosine—do	2,182	1,979	1,573	1,433	4,380
Distillate fuel oil—do	13,500	13,986	15,398	18,824	27,774
Residual oil—do	14,150	15,911	18,590	17,101	26,323
Lubricants—do	225	201	193	211	217
Other—do	3,074	3,909	6,221	6,979	12,002
Refinery fuel and loss—do	4,694	4,349	4,745	6,428	6,107
Total—do	49,381	52,217	59,477	64,598	[6] 89,671

[1] Data not available.
[2] Included in antimony, cadmium and other figures.
[3] Estimate.
[4] Includes production from reclaimed scrap.
[5] Probably includes kaolin only.
[6] Preliminary figure.

TRADE

Although all trade statistics refer to the Belgium-Luxembourg Economic Union (BLEU), Belgium's share of total trade, except in steel, is paramount. In 1963, 72 percent of the steel exports were from Belgium and 28 percent were from Luxembourg.

The total value of imports of minerals and metals in 1962, exclusive of diamond, was $1,135 million, or 25 percent of total BLEU imports. Fuels constitute the largest import group. The net cost of fuel imports during 1958–62 increased steadily from $227 million in 1958 to $298 million in 1962.

Exports of minerals and metals, valued at $1,395 million, accounted for 32 percent of all BLEU exports. In value, iron and steel ranked first in exports. In 1963 steel made up 20 percent of all BLEU exports.

Trade in diamond (industrial and gem) totaled $340 million, divided almost equally between imports and exports.

In 1962, 55 percent of all BLEU exports were to the European Economic Community (EEC). About 52 percent of mineral and metal exports were also to the Community. Of the total exports of treaty steel items (6.4 million tons) in 1962, 3.1 million tons was shipped to the Community. Steel semimanufactures covered by the European Coal and Steel Community treaty exclude forgings, cold drawn wire, pipes, and pipe accessories.

TABLE 2.—Belgium-Luxembourg: Value of metal and mineral trade in 1962

(Millions)

Commodity	Imports	Exports	Commodity	Imports	Exports
Iron ore	$106	$1	Nonferrous metals scrap	$32	$11
Iron and steel	132	836	Coal and coke	176	53
Nonferrous metal ores	58	4	Petroleum and petroleum products	260	111
Nonferrous metals and semifinished products	286	306	Nonmetallic minerals	63	46
Precious metals	18	13			
Iron and steel scrap	4	14	Total	1,135	1,395

TABLE 3.—Belgium-Luxembourg: Exports of metals and minerals[1]

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Ingots	610	808	Netherlands 524; Italy 169; West Germany 74.
Scrap	2,030	2,743	(2).
Rolled and extruded	52,138	58,598	(2).
Copper:			
Refined	198,356	210,123	(2).
Scrap	5,912	8,885	Chiefly to Netherlands, Italy, and West Germany.
Rolled and extruded, including alloys.	61,744	57,226	(2).
Gold:			
Ingots, bars, troy ounces powder.	16,075	45,011	(2).
Semifabricated. (value) thousands	$128	$579	(2).

See footnotes at end of table.

TABLE 3.—Belgium-Luxembourg: Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Iron:			
Pig and spie- thousand tons	48	58	(2).
geleisen.			
Scrap do	335	362	France 135; West Germany 146.
High-carbon ferroman- do	24	32	(2).
ganese and other ferro-			
alloys.			
Steel ingots and other do	764	514	France 192; West Germany 179; Netherlands 54 (total EEC 425).
primary forms.			
Rolled steel [3] do	5,785	6,360	West Germany 1,252; France 877; Netherlands 682 (total EEC 3,152); United States 859; Sweden 183; other Scandinavian countries 319; Canada 107.
Pipes and accessories do	170	195	(2).
Cold drawn wire	254	279	(2).
Forged and drawn	170	119	(2).
Lead:			
Pig	54,473	58,876	France 21,935; Netherlands, 16,498; West Germany 10,649.
Scrap	1,211	2,063	(2).
Antimonial lead and other lead alloys.	2,532	2,970	(2).
Rolled, extruded, other	6,583	7,106	(2).
White lead, litharge, red lead	4,612	5,000	(2).
Nickel:			
Scrap (including alloy scrap)	935	373	(2).
Alloys	29	6	(2).
Semifabricated	96	144	(2).
Platinum, (value) thousands	$121	$539	Netherlands 270; West Germany 119; France 100.
crude and semifabricated.			
Silver:			
Ingots, thousand troy ounces	6,337	8,198	West Germany 4,424; France 2,016.
bars, powder.			
Scrap, (value) thousands	$87	$133	(2).
waste, cinder.			
Semifabricated do	$18	$404	(2).
Tin:			
Ingot long tons	4,405	6,803	France 2,781; United States 1,887; West Germany 705; Netherlands 626; Canada 435.
Scrap do	301	166	(2).
Alloys and solder do	192	139	(2).
Powder and flakes do	97	230	(2).
Rolled and extruded do	43	66	(2).
Tungsten	6	6	(2).
Uranium, thorium, alloys	----------	33	(2).
Zinc:			
Slab	145,945	111,840	West Germany 42,037; United States 19,312; France 12,642; Brazil 4,459; Netherlands 4,257; United Kingdom 4,851; Switzerland 2,649; Sweden 2,053; Denmark 2,539.
Scrap	6,154	4,096	(2).
Rolled or extruded	17,360	16,467	
Dust	11,553	11,446	
Other	1,911	3,914	
Zinc sulfide, lithopone, etc	22,669	20,002	
Other nonferrous metals	9,755	9,025	
Nonmetals:			
Broken rock, ma- thousand tons	1,294	2,212	France 930; Netherlands 920; West Germany 359.
cadam, gravel.			
Building stone do	798	1,328	Netherlands 1,063; France 26.
Cement do	1,404	1,329	Netherlands 817; Ivory Coast 61; Israel 43; United Kingdom 39.
Chalk	43,631	49,010	Netherlands 22,298; West Germany 9,218; France 5,836.
Clays	38,598	27,142	France 17,936; Netherlands 6,751.

See footnotes at end of table.

TABLE 3.—Belgium-Luxembourg: Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Nonmetals—Continued			
Diamond:			
Industrial.....thousand carats..	4,407	4,216	United States 1,145; Netherlands 792; United Kingdom 773; U.S.S.R. 275; West Germany 235; Austria 204.
Crude gem quality.....do....	142	138	United States 91; Netherlands 37.
Polished gem.....do....	916	1,078	United States 456; Hong Kong 144; United Kingdom 110; West Germany 66; France 44; Singapore 42.
Bort.....do....	945	1,327	United States 268; West Germany 267; United Kingdom 214; Switzerland 135; Netherlands 135; France 125.
Powder, splinters.....do....	73	1,483	Netherlands 735; West Germany 153; Switzerland 102; France 79; United States 43; United Kingdom 41.
Total.....do....	6,483	8,242	
Dolomite, crude and calcined.....	333,595	384,928	Netherlands 198,201; France 161,358.
Gypsum, anhydrite, plaster.....	13,877	14,355	Netherlands 13,420.
Fertilizer raw material.....	16,945	24,826	Netherlands 15,314.
Limestone (flux).....	879,964	613,998	Netherlands 472,236; France 129,568.
Lime.....	306,796	317,238	
Sand.....thousand tons..	1,900	2,280	France 898; Netherlands 298; West Germany 259; Italy 208.
Sulfur.....	4,819	9,192	Republic of the Congo (Leopoldville) 1,358; Ceylon 1,020; Thailand 1,542; Indonesia 1,265.
Thomas slag.....thousand tons..	1,238	1,538	France 580,829; West Germany 398,742; Netherlands 132,312; Ireland 112,297.
Other minerals.....	133,118	129,830	Netherlands 118,359; France 2,711.
Ashes, slag, other rejects. thousand tons..	2,810	3,511	United Kingdom 161; Switzerland 103; Netherlands 719; West Germany 772; France 220.
Mineral fuels:			
Solid fuels:			
Coal and anthracite. thousand tons..	2,854	2,699	Netherlands 740; France 567; Italy 377; Switzerland 318; Denmark 230; Ireland 173; West Germany 164; Austria 4.
Coke.....do....	874	643	Luxembourg 228; France 253; Sweden 54; Denmark 34; Italy 30; West Germany 19; Norway 6.
Patent fuel.....do....	165	311	France 225; Luxembourg 2; Italy 1.
Total.....do....	3,893	3,653	France 1,045; Netherlands 740; Italy 409; Switzerland 318; Denmark 264; Luxembourg 230; West Germany 183; Ireland 173; Sweden 54; Norway 6; Austria 4.
Petroleum products:			
Gasoline thousand 42-gallons barrels..	3,197	3,686	West Germany 1,107; United Kingdom 666; France 609; Netherlands 589; Switzerland 419.
Kerosine.....do....	1,258	1,395	Netherlands 1,143; Switzerland 197.
Distillate fuel oil.....do....	5,931	6,022	Switzerland 1,977; Netherlands 1,688; West Germany 1,108.
Residual fuel oil.....do....	4,583	4,060	Netherlands 2,512; France 1,066.
Lubricants.....do....	738	790	Netherlands 187; Switzerland 170; Austria 86; Sweden 64; West Germany 55.
Other.....do....	1,397	1,632	West Germany 993; Netherlands 363.
Total.....do....	17,104	17,585	Netherlands 6,482; West Germany 3,263; Switzerland 2,777; France 1,687.
Bunkers.....do....	5,486	7,395	

[1] In addition, 190,000 and 237,000 tons of iron ore and 71,504 and 76,875 tons of zinc ore were exported in 1961 and 1962, respectively.
[2] Data not available.
[3] Treaty items only; excludes forgings, cold drawn wire, pipes and pipe fittings.

TABLE 4.—Belgium-Luxembourg: Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Alumina	9,195	9,550	France 3,780; West Germany 5,227.
Bauxite	5,071	5,513	British Guiana 4,848.
Ingots	69,641	68,303	France 38,832; U.S.S.R. 10,861; Canada 9,693; United States 3,950; West Germany 1,247.
Scrap	2,004	1,804	(1).
Rolled and extruded	13,022	16,313	(1).
Chromite	1,125	456	West Germany 213; Republic of South Africa 152.
Copper:			
Ore	5,842	5,969	Mainly from Canada and Cyprus.
Ingots	277,155	306,619	Republic of the Congo (Leopoldville) 184,533; United Kingdom 44,567; Peru 21,955; Rhodesia 10,211.
Scrap	19,854	32,065	Netherlands 10,785; France 9,868.
Semimanufactures:			
Unalloyed	2,676	3,139	(1).
Alloyed	3,139	3,385	(1).
Gold (ingots, bar, powder) thousand troy ounces	569	296	(1).
Iron and steel:			
Ore thousand tons	20,540	21,144	France 16,503; Sweden 4,191; Canada 253.
Pyrite cinder	113,061	58,991	(1).
Scrap thousand tons	197	123	United Kingdom 43; France 36; Netherlands 27.
Pig iron and spiegeleisen do	402	449	France 206; West Germany 86.
High-carbon ferromanganese do	52	56	(1)
Other ferroalloys do	32	26	(1).
Ingots, blooms, billets do	93	99	West Germany 44; France 26.
Rolled steel do	602	692	France 177; West Germany 163; Austria 40.
Lead:			
Ore	154,826	152,062	Canada 25,772; Morocco 15,338.
Ingots	14,178	19,354	United States 4,843; Mexico 4,303; West Germany 3,968; Netherlands 3,117; Peru 1,847.
Scrap	4,673	3,578	(1).
Other	540	649	(1).
Antimonial and other lead alloys	203	782	(1).
White lead, litharge, red lead	1,014	1,091	(1).
Manganese	272,579	208,501	Republic of the Congo (Leopoldville) 78,700; India 38,639; Republic of South Africa 38,048; Brazil 18,728.
Nickel:			
Refined	1,100	1,116	United Kingdom 799; Norway 147; Canada 88.
Other, including semifabricated	863	1,063	(1).
Platinum thousand dollars	682	1,022	(1).
Silver:			
Ingots, thousand troy ounces bars, powder	4,511	6,421	West Germany 4,221.
Semifabricated do	1,193	1,010	(1).
Tin:			
Ore long ton	10,107	9,976	Republic of the Congo (Leopoldville) 8,097.
Ingots do	764	1,155	Republic of the Congo (Leopoldville) 770; Netherlands 567; United Kingdom 212.
Other do	59	42	(1).
Solder and other alloy do	303	234	(1).
Tungsten minerals and concentrates	101	71	All from Korea.
Uranium and thorium concentrates	2,152	----------	
Zinc:			
Ore	504,005	447,516	Sweden 93,850; Finland 70,550; Republic of the Congo (Leopoldville) 53,977; Canada 46,178.
Ingots	17,715	35,719	Republic of the Congo (Leopoldville) 11,256; U.S.S.R. 7,603; Bulgaria 5,358; Canada 4,126; Australia 3,712; West Germany 1,682.
Scrap	135	1,205	(1).
Rolled, extruded, powder, other	251	285	(1).
Zinc sulfide, oxide, lithopone	3,090	3,198	(1).
Concentrates of titanium, molybdenum, zircon, and tantalum	----------	8,951	Canada 5,987; Australia 1,550.
Nonferrous metal ashes and residues	185,493	175,105	France 40,787; West Germany 34,813; Canada 17,579; Australia 17,089.

See footnotes at end of table.

TABLE 4.—Belgium-Luxembourg: Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Nonmetals:			
Asbestos	56,192	55,503	Canada 36,784; Republic of South Africa 7,329; U.S.S.R. 3,919.
Barite and witherite	32,716	29,746	West Germany 22,499; Morocco 5,158.
Brocken rock, thousand tons—macadam, gravel.	2,747	2,553	Netherlands 1,429; West Germany 802; France 279.
Building stone	127,457	119,261	France 65,672; West Germany 13,919; Italy 12,722.
Chalk	31,097	33,195	France 19,375; Netherlands 12,440.
Clays:			
Kaolin	44,513	46,268	United Kingdom 37,763.
Other clays	251,143	243,460	West Germany 131,236; France 47,161; Netherlands 31,884; United Kingdom 19,239.
Diamond:			
Industrial—thousand carats	6,428	5,604	United Kingdom[3] 3,019; Republic of the Congo (Leopoldville) 931; United States 341; Netherlands 333.
Gem (crude)—do	3,384	3,656	United Kingdom—Diamond Trading Company 2,791, other than Diamond Trading Company 153; United States 220; Liberia 147.
Gem (polished)—do	221	212	Israel 93; South Africa 59; United Kingdom 26.
Bort and powder—do	1,606	2,325	United Kingdom 1,424; United States 324; Republic of Congo (Brazzaville) 294.
Total—do	11,639	11,797	
Diatomaceous earth, tripolite, etc.	3,505	4,485	United States 2,248.
Dolomite, crushed and calcined	13,195	317,000	West Germany 5,039; France 4,430; Norway 3,998.
Feldspar, fluorspar, cryolite	38,494	38,651	Sweden 16,566; France 10,347; West Germany 4,568.
Graphite	1,256	920	France 300; Austria 237; West Germany 183.
Gypsum, anhydrite, plaster	349,741	354,493	France 328,802.
Limestone (flux)	71,701	54,298	France 53,754.
Lime	47,458	47,088	West Germany 23,687; France 21,813.
Magnesite, crude and calcined	4,568	4,014	Austria 1,491; Netherlands 990.
Mica	711	891	United Kingdom 229; Norway 173; Netherlands 75.
Natural fertilizers (animal and vegetable origin).	44,952	54,852	Netherlands 49,726; West Germany 2,755.
Phosphate rock	900,313	879,889	Morocco 779,124.
Potash	226,452	193,084	France 98,713; West Germany 42,602.
Pumice, emery, natural corundum	209,826	177,259	West Germany 174,897; Algeria 1,223.
Pyrite	336,771	318,619	Portugal 175,847; Spain 67,833; Cyprus 46,911.
Quartz and quartzite	11,894	13,305	West Germany 6,708; Netherlands 870.
Salt	610,026	691,146	West Germany 366,424; Netherlands 246,093.
Sand—thousand tons	4,520	4,785	Netherlands 4,502; West Germany 178.
Sodium nitrate, crude	21,767	22,260	Chile 22,189.
Sulfur	166,301	170,302	United States 62,707; Mexico 48,300; France 35,296.
Talc and steatite	13,633	15,084	France 4,702; Norway 4,293; Austria 3,535.
Other minerals	65,656	2,020	(1).
Ashes, slags, other metallurgical rejects.	358,596	317,869	France 215,867; Netherlands 93,153.
Mineral fuels:			
Solid fuels:			
Coal—thousand tons	4,043	4,753	West Germany 2,394; Netherlands 761; United States 923; France 278; United Kingdom 273.
Coke—do	253	277	Netherlands 211; West Germany 33; United Kingdom 25; France 1.
Patent fuel—do	154	163	Netherlands 110; West Germany 36.
Lignite briquets—do	92	93	West Germany 88; Netherlands 5.
Total—do	4,542	5,286	West Germany 2,551; Netherlands 1,087; United States 923; United Kingdom 298; France 279.

See footnotes at end of table.

TABLE 4.—Belgium-Luxembourg: Imports of metals and minerals—Continued
(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Mineral fuels—Continued			
Petroleum:			
Crude. thousand 42-gallon barrels.	57,734	63,118	Iraq 22,901; Iran 11,280; Venezuela 8,553; Kuwait 8,329; Tunisia 5,601; Libya 5,443.
Refinery products:			
Gasoline.....do....	3,166	3,647	Netherlands Antilles 2,828; Netherlands 205.
Kerosine, including jet fuels. do....	214	310	Netherlands 309.
Distillate fuel oil.....do....	6,263	8,340	Netherlands 2,600; Bahrain 1,581; United Kingdom 1,033, U.S.S.R. 818; Venezuela 543.
Residual fuel oil.....do....	11,915	15,384	Netherlands 7,742; U.S.S.R. 1,246; Venezuela 1,098; United Kingdom 918; France 832; West Germany 715.
Lubricants, including grease. do....	1,205	1,396	United States 906; Netherlands Antilles 266.
Liquified petroleum gas. do....	2,515	2,994	Netherlands 1,690; West Germany 876.
Other.....do....	703	666	West Germany 221; Netherlands 159; France 123; United States 109.
Total.....do....	25,981	32,737	Netherlands 12,705; Netherlands Antilles 3,094; West Germany 2,228; U.S.S.R. 2,064; United Kingdom 1,982.

[1] Data not available.
[2] Outside DeBeer's Central Organization except for 1962, which includes 96,620 carats from within the organization.

Although France continued to be the main source for iron ore, Belgium decreased its dependence on Lorraine iron ore supplementing it with imports from Sweden. In 1963 Lorraine iron ore constituted 7.5 million tons out of a total of 14.4 million tons of imports. The iron content of Lorraine ore was 2.9 million tons compared with 2.12 million tons contained in 4.98 million tons of Swedish ore imported. France received large quantities of Belgium's iron and steel products, copper, and building and fluxing stone. In 1962, West Germany was Belgium's largest market for iron and steel and zinc and its second largest for copper. France was the largest market for copper and lead. Much of the trade of quarry and pit products was with The Netherlands which also was an important market for iron and steel, lead, copper, and zinc. The Republic of the Congo was an important supplier of nonferrous metals and minerals.

In 1962, Belgium's principal mineral and metal imports from the United States were lead, diamond, and sulfur. The United States was Belgium's largest single market for all types of diamond (except powder and splinters). The United States also received about 13 percent of the iron and steel products and 17 percent of the slab zinc exported from Belgium.

COMMODITY REVIEW

METALS

Ferrous Metals.—The Belgian iron and steel industry showed a slight gain in pig iron and crude steel output in 1963. The industry depended almost entirely on imported iron ore. Of the iron ore imports of

the Economic Union, nearly two-thirds was shipped to Belgian plants; the remainder was shipped to plants in Luxembourg. Flux limestone, dolomite, and nearly three-quarters of the coking coal requirements were met from domestic sources.

During 1954–63, production capacity for crude steel increased about 53 percent. Total investment in the iron and steel industry, including captive coke ovens, power generating and distributing facilities, and other general services amounted to $734.36 million during 1954–62. The steel production facility will be increased by the construction of a 1.5 million-ton plant at Selzacte and enlargement of plants of Société Anonyme Cockrill Ougrée from the existing 2.25-million-ton annual capacity to 3-million-ton capacity. The Chertal plant of Esperance-Longdoz with a steel capacity of 700,000 tons began production in May 1963, and was inaugurated officially in November.

TABLE 5.—Belgium: Rated annual production of the steel industry

(Thousand metric tons)

Commodity	1963	1965
Pig iron	8,010	9,070
Crude steel	[1] 8,855	10,320
Rolled steel	6,454	[2] 9,490

[1] Actual capacity at the end of 1963 may have been close to 10 million tons.
[2] In 1967.

Production.—In 1963 the average level of pig iron production was 86.8 percent of maximum capacity; the corresponding figure for crude steel was 85 percent.

Increased consumption of sintered ore in the blast furnace, noted since 1958 (when 926,000 tons of sinter ore was used), continued in 1963 reaching a total of 5,153,000 tons. A reverse trend in coke consumption per ton of pig iron was noted—757 kilograms in 1963, compared with 980 kilograms in 1956.

Thomas steel constituted 87.28 percent of total steel output in 1963 compared with 82.5 to 86.7 percent of total production during 1954–62. Open-hearth steel and electric furnace steel accounted for the remainder of the crude steel output. Production of electric steel in 1963 was abnormally low because of an accident in one of the plants. Belgium began producing Linz-Donawitz-Arbed-Cnrm (LD–AC) oxygen-converter steel in the Ougrée plant of Société Anonyme Cockerill-Ougrée. The same company was building similar facilities in the Les Forges de la Providence plant.

Belgium produced a relatively small quantity of alloy and special steel. Of the ferroalloys, only ferromanganese is produced.

In 1962 rolled steel was produced in 35 mills, 19 of which were part of an integrated complex; 16 were independent installations.

TABLE 6.—Belgium: Salient iron and steel statistics

(Thousand metric tons unless otherwise specified)

	1961	1962	1963
Number of blast furnaces:			
Available—number of units	55	53	52
In operation—do	48	44	43
Pig iron production:			
Thomas pig iron	6,267	6,613	6,804
Open hearth pig iron	13	5	
Foundry pig iron	108	95	76
Spiegeleisen	66	57	72
Others	4	4	8
Total [1]	6,459	6,773	6,958
Raw material consumption for pig iron production:			
Iron ore directly in blast furnaces	11,137	10,226	9,676
Iron ore in sinter plants	3,293	4,914	5,062
Total	14,430	15,140	14,738
Manganese ore	165	153	170
Scrap	512	317	325
Coke	5,350	5,367	5,236
Number of steelworks:			
Thomas converters:			
Available—number of units	55	55	55
In operation—do	50	52	51
Open hearth furnaces:			
Available—do	21	21	21
In operation—do	12	13	13
Electric furnaces:			
Available—do	31	30	32
In operation—do	19	19	17
Crude steel production:			
Thomas	5,969	6,370	6,568
Open hearth	542	507	495
Electric	458	441	223
Bessemer and other	33	34	136
Castings, producing furnace type not specified			103
Total [1]	7,002	7,351	7,525
Ingots	6,888	7,228	7,423
Castings	114	119	102
Raw material consumption of steel works:			
Pig iron	6,329	6,706	6,950
Scrap	1,386	1,384	1,412
Ore	27	28	29
Semifinished rolled steel production:			
Rails and accessories	79	95	64
Profiles	168	270	317
Bars and rods	1,911	2,075	2,048
Wire rods	614	639	721
Semifinished, for pipes	5	3	
Hot-rolled coils	287	314	347
Hot strips	70	79	119
Plates, wide	39	43	34
Hot-rolled sheets, 4.76 millimeters or more	505	495	430
Hot-rolled sheets, 3 to 4.75 millimeters	82	88	103
Hot-rolled sheets, less than 3 millimeters	287	247	231
Cold-rolled sheets, less than 3 millimeters	808	1,048	1,275
Total [1 2]	4,856	5,398	5,699
Semifinished steel for sale	793	594	
Galvanized sheets	284	283	374
Tinplate	136	216	226
Condenser sheets	53	42	42
Wheel axles and others	11	14	[3]
Steel pipes	108	119	
Scrap consumption of rolling mills	26	21	16
Scrap consumption of independent steel foundries	97	102	85
Total employment (workers and staff)—persons	59,098	57,554	[3]

[1] Details do not necessarily add to total because of rounding.
[2] Total includes 2, 6, and 7 tons cold-rolled sheets more than 3 millimeters in 1961, 1962 and 1963 respectively.
[3] Not available.

Output of flat products in 1963 was nearly twice that of 1956. Much of the investment in the Belgian iron and steel rolling mills has been in facilities for production of flat products.

Hainaut and Brabant Provinces supply about 60 percent of the pig iron and steel output; Liege and Luxembourg Provinces supply the remainder. Société Anonyme Cockerill-Ougrée, with plants at Seraing, Ougrée, Athus, Grivegnée, Tilleur, and Ferblatil, is the largest producer of crude steel (2.2 million tons in 1960). Other important producers are Société Anonymes des Láminoirs, Hauts-Fourneaux, Forges, Fonderies et Usines de la Providence, Société Métallurgique Hainaut-Sambre (1.2 million tons of crude steel in 1960), and Société Anonyme Métallurgique d'Espérance-Longdoz which produces mostly flat products. With the inauguration of the Chertal plant, Espérance-Longdoz attained 1.5 million tons annual production capacity.

Thomas slag was an important byproduct of the steel furnaces. Output in the first 9 months of 1963 was 986,000 tons. In 1961 and 1962 Belgium exported 1.2 million and 1.6 million tons of Thomas slag, respectively.

TABLE 7.—Belgium: Composition of rolled-steel production

(Percent)

Type of product	1952	1956	1961	1962
Flat products	38.1	40.1	42.7	42.9
Bars and rods	40.3	39.6	39.5	38.4
Wire	10.5	10.5	12.6	11.8
Sections, rails, accessories	10.4	8.8	5.1	6.8

Consumption and Trade.—In 1962 the Belgium-Luxembourg Economic Union exported 514,000 tons of ingots and other primary forms of steel. A total of 6.995 million tons of rolled steel, pipes and accessories and other products also was exported. The total value of these exports was $836 million.

Total sales of Belgian steel increased slightly. For the first time exports to European Coal and Steel Community (ECSC) countries (2.40 million tons) exceeded exports to other countries (2.07 million tons). Steel products supplied to the Belgian market totaled 2.7 million tons including 1.74 million tons of Belgian steel and 510,000 tons of steel from Luxembourg. Imports were 486,000 tons of which 400,000 tons were from ECSC countries. In order of importance, principal consumers were plants making wire products and tubes, metal construction, and sheet-working industries. About 40 percent of steel delivered to domestic consumers was reexported after fabrication or transformation.

New Plants.—Sidmar, a new steel concern was established in Belgium in 1962 with participation of Belgium, Luxembourg, and French capital. The company's investment program calls for the building of a steel complex with two large-capacity blast furnaces, a Linz-Donawitz steel works with three converters, a slabbing mill, an 80-inch continuous hot wide-strip mill, and an 80-inch four-stand tandem cold mill. Crude steel production is not expected before 1967, but the cold mill may start operation in 1966.

TABLE 8.—Belgium-Luxembourg Economic Union: 1962 steel product exports classified by type

Type of product	Metric tons	Value (millions)
Flat products	2,249,792	$264
Bars and rods (excluding wire bars)	1,869,927	176
Profiles	1,445,619	153
Wire	278,948	12

TABLE 9.—Belgium: Total steel sales and shares of various markets

	1955	1959	1962	1963
Total sales—thousand tons	4,755	5,171	6,002	6,213
Share of market:				
Domestic—percent	32.1	27.7	27.7	28.0
Export:				
European Coal and Steel Community Countries—do	28.2	25.0	35.0	[1] 38.7
Other countries—do	39.7	47.3	37.3	[2] 33.3

[1] Includes France 989; Germany 666; Netherlands 484; Italy 257; Luxembourg 7.
[2] Includes United States 580; United Kingdom 128; other European countries including Eastern Europe 525; Puerto Rico 95; Canada 83; Latin American countries 181; Middle East including United Arab Republic (Egypt) and Turkey 236; African countries except United Arab Republic (Egypt) 140; other 102.

The Chertal plant of Espérance-Longdoz, which started operating in 1963 (first steel poured in May and first hot-rolled coil produced in August), comprises two converters, each 145-ton capacity, which produce LD and LD–AC steel. Pig iron for the converters is shipped from the company's plant at Seraing, 17 kilometers away. The rolling slabbing mill and wide-strip mill produce hot coils which are shipped to the Jemeppe plant of Espérance-Longdoz for cold reduction.

Nonferrous Metals.—Belgium depended entirely on foreign metals, ores, concentrates, and scrap for its large nonferrous smelting, refining, and rolling mill industries.

Of the items imported, which were valued at $376 million in 1962, copper comprised two-thirds of the metal imports and zinc concentrates comprised more than half of the ores and concentrates. In 1962 the Republic of the Congo was the source for 60 percent of copper ingots, 49 percent of crude tin, 31 percent of slab zinc, 12 percent of the zinc ore, and 82 percent of the tin ore. Virtually all the primary germanium, selenium, cobalt, uranium, and radium and important quantities of secondary cadmium, precious metals, and other nonferrous metals were obtained from raw materials produced in the Congo. West Germany and the United States were important suppliers of pig lead, France of aluminum, and the United Kingdom of copper.

TABLE 10.—Belgium: Imports and exports of nonferrous metals, ores, and concentrates in 1962

	Quantity (metric tons)	Value (millions)		Quantity (metric tons)	Value (millions)
Imports:			Exports:		
Metals	443,370	$261	Metals	400,525	$215
Semimanufactures	24,539	25	Semimanufactures	139,971	91
Ores and concentrates	838,553	58	Ores and concentrates	79,188	4
Scrap and metallic waste	214,168	32	Scrap and metallic waste	74,929	11
Total value		376	Total value		321

Source: Computed from data presented in L'Économie Belge en 1962, Ministère des Affaires Économiques et de l'Énergie, Direction Générale des Études et de la Documentation.

The products of the smelting and refining operations are exported as ingots and as rolled and extruded semifinished products. France, West Germany, and The Netherlands were the main recipients in the Common Market. The United States also imported significant quantities of zinc, cobalt, and cadmium from Belgium.

Copper, lead, and zinc account for about 95 percent by weight of all nonferrous metal output.

The remaining 5 percent comprised antimony, arsenic, cadmium, cobalt, columbium, gallium, indium, gold, silver and platinum metals, selenium, tantalum, and uranium. The cobalt was recovered from imported copper-cobalt alloys; germanium and uranium were recovered from imported concentrates. The other metals are byproducts of refining imported copper ingots and treating imported copper, lead, and zinc ores and scrap.

Production figures for the individual metals, other than tin, are not available, but current annual production rates may be estimated in tons as follows: antimony 1,500 to 2,000; cadmium 600 to 700; cobalt 2,000 to 3,000; germanium 80; sellenium 15 to 20; uranium oxide 250 to 400; and silicon 10 to 20. Precious metal production is 12 to 14 million ounces, of which 80 to 90 percent is silver. Much of the output is exported.

Belgium's consumption of principal nonferrous metals in 1962 follows:[2] aluminum 67,500; copper 65,300; lead 52,400; tin 3,200; zinc 122,100 tons.

Nonferrous metal smelting and refining in Belgium were dominated by two companies, the Société Générale Métallurgique de Hoboken and the Société des Mines et Fonderies de la Vieille-Montagne, with headquarters in Brussels and Angleur, respectively. Hoboken produces nearly all the copper, tin, and cobalt, and 50 percent of the lead. Vieille-Montagne controls 50 percent of the zinc and about 33 percent of the lead capacity. Both companies are also responsible for a large share of the output of minor metals.

Aluminum.—Because Belgium does not produce primary aluminum imported bauxite and hydrous and calcined alumina were used in the chemical industry and for making abrasives. The output of rolled and extruded aluminum products has increased from 26,700 tons in

[2] Metal Statistics 1953–1962. Metallgesellschaft Aktiengesellschaft, 50th annual issue, Frankfurt am Main 1963.

1955 to 80,700 in 1962. Annual capacity in 1963 was probably 100,000 tons.

Of the six companies that have aluminum rolling mills plants of Société Industrielle de l'Aluminum at Duffel, Laminoirs de L'Escaut at Burcht, and Aleurope in Ghlin-Baudour are the largest. Laminoirs de L'Escaut was planning to increase its capacity from 15,000 to 50,000 tons per annum.

Duties on aluminum ingot import from countries other than those of the Common Market and associated overseas countries were increased from 2 to 3 percent on January 1, 1963.

TABLE 11.—Belgium: Principal nonferrous metallurgical plants

Company and plant	Type of plant	Annual capacity (tons)	Remarks
Société Générale Métallurgique de Hoboken:			
Hoboken	Copper smelter	24,000	Antimony, bismuth, cadmium, cobalt, mercury, platinum, selenium, tantalum, various metal powders, and salts are recovered.
	Lead smelter and refinery	75,000	
	Tin smelter and refinery	10,000	
	Refinery for gold	75	
	Refinery for silver	500	
	Antimony refinery		
Olen	Electrolytic copper refinery	205,000	Refined copper and mill products, cobalt (powder, oxide, and salts), radium, silicon, and nuclear-grade uranium are produced.
	Copper mill		
	Cobalt refinery		
	Germanium refinery	60	
	Uranium refinery	650	
Société des Mines et Fonderies de Zinc de la Vieille-Montagne:			
Flône	Zinc smelter	48,000	
Valentin-Cocq	Zinc smelter	30,000	
	Zinc white	16,000	
Angleur	Zinc smelter and rolling mill	30,000	
Tilff	Zinc rolling mill	15,000	
Balen	Zinc refinery and rolling mill	65,000	In the Balen plant arsenic, bismuth, cadmium, copper, germanium, gold, silicon, and silver are recovered as byproducts.
	Lead smelter	42,000	
Campagnie des Métaux d'Overpelt-Lommel et de Corphalie, A.S.:			
Overpelt	Zinc refinery	40,000	Horizontal retort furnaces; refining by distillation; cadmium and silver as byproducts.
Lommel	Zinc rolling mill		
	Lead smelter	18,000	
	Zinc refinery	48,000	
	Lead rolling mill		
Société Industrielle d'Aluminum: Duffel.	Aluminum rolling mill	60,000	Largest plant in the country.
Laminoir de l'Escaut: Burcht	do.	15,000	Producer of sheets.
Aleurope: Ghlin-Badour	do.	12,000	Producer of sheets; owned 50 percent by Reynolds International, Inc.

Copper.—Belgium's copper industry is largely confined to electrolytic refining of imported blister and scrap, although annually 10,000 to 12,000 tons of copper metal also are produced from ores and concentrates.

Electrolytic copper was both exported as such and used domestically for production of semimanufactures of copper and copper alloys which also are exported in substantial quantities. Copper also is exported as sulfate; 1962 exports totaled about 12,800 tons.

Lead.—Seven companies with a total annual smelter capacity of 150,000 tons produced pig lead, Hoboken, Vieille-Montagne, and Overpelt-Lommel account for 50, 28, and 12 percent of production, respectively.

A large part of lead concentrates for the Belgian industry has been imported from the Tsumeb Corporation mine in South-West Africa. However, in 1962, this company installed a lead smelter and it was reported that export of concentrate to Belgium was to stop at the end of 1963. To replace concentrate from this source, the Société Générale des Minerais in 1962 made a 12-year contract with the Brunswick Mining and Smelting Corp. of Canada for supply of lead and zinc concentrates from the Bathurst mine. The Société Générale des Minerais supplied $11 million for financing development of the property and is to buy all concentrates produced during the first 5 years and all concentrates not required by Brunswick during the succeeding 7 years. This mine is expected to come into production in early 1964.

Zinc.—In 1963 Belgium was the world's fourth largest zinc producer. The country ranked first in Europe. Capacity is estimated at 350,000 tons, of which 65,000 tons is electrolytic (Balen refinery of the Vieille-Montagne).

About half of the zinc output was exported. The remainder was used domestically for galvanizing and for making mill products, zinc sulfide, and lithopone, largely for export.

Other Nonferrous Metals.—All primary tin is produced in the Hoboken plant which has the capacity to smelt 18,000 tons of concentrate. Nearly half of the tin supply is used by the steel industry in making tinplate.

Imported lead ores are the source for antimony. The principal producer is at Campine. Belgium was a leading cobalt and cadmium producer. The cadmium was recovered largely from imported zinc ores. The cobalt refinery at Olen was the second largest in the world and treated imported cobalt-copper alloys and cobalt concentrates.

According to the 1962–63 annual report of the Société Générale Métallurgique de Hoboken, because of large stocks of germanium at the Olen plant, production during this period was confined to monocrystals and to polycrystalline metals in special forms. The radium facility at Hoboken was at a standstill; sales were from stocks. The plant installed facilities for making enriched U_{235}. Imported uranium concentrates also are treated in this plant which produces uranium oxide, salt, and refined metal. Métallurgie et Mécanique Nucléaires of Dessel, established in 1962, made nuclear fuel elements.

The Société Anonyme Fansteel-Hoboken, established in November 1962 with a capital of US$7,200,000 commenced its activities on January 1, 1963. Fansteel Metallurgical Corporation of Chicago and Société Générale Métallurgique de Hoboken each have 50 percent of the shares of the new firm. The company will produce high-temperature metals—columbium, tantalum, tungsten, and molybdenum—and powder from these metals.

NONMETALS

The principal nonmetallic raw materials produced in Belgium are building stone such as marble, porphyry, limestone, slate, sand and

gravel from pits and from dredging of rivers, clays, dolomite, chalk, and marl. These are used mainly in the building industry with subordinate uses as fluxing limestone, refractory material, and glass sand. Domestic output meets the demand for cement, lime, common brick, pipe, wall and floor tile, structural glass, and most types of building stone. These quarry and pit products enter Belgium's foreign trade in significant quantities. In 1962 the total imports and exports were, respectively, 7.2 and 8.2 million tons. Thomas slag, cement, rejects of the steel industry, and various other mineral matter added 4.8 million tons to the exports and 610,000 tons to the imports.

Industrial minerals are imported. Of these, the most important are diamond for the cutting and polishing industry, fertilizer raw materials, sulfur, salt for both human consumption and the chemical industry, and gypsum. Imports and exports of all nonmetallic minerals into Belgium in 1962 were valued at $62.7 million and $46.5 million, respectively. These values do not include fired clay products such as brick, tiles, or ceramic and glass products; and diamond. In terms of value, Thomas slag and cement were the most important exports ($23.1 million and $16.7 million, respectively). Among the imports, phosphate rock ($11.1 million), asbestos ($8.4 million), clays ($4.7 million), salt ($4.6 million), and sulfur ($4.5 million) were the most important.

Cement.—In 1963 Belgium produced 1.2 percent of the world cement output. As a result of consolidation of producers in the last decade, 1963 output was obtained from relatively few plants. In 1959, the industry's capacity was estimated at 7.4 million tons in 18 plants—12 portland cement plants, 5 blast furnace slag cement plants, and 1 plant making both types.

Most of the cement plants are concentrated in the chalk, limestone and clay regions of Tournai, Mons, and Harcourt-Visé. Plants using blast furnace slag operate in the vicinity of the iron and steel centers of Charleroi and Liége. The industry's three leading producers were Ciments d'Oburg, Cimenteries et Briqueteries Réuniés (a subsidiary of Société Générale de Belgique), and Compagnie des Ciments Belge. The latter company primarily makes blast furnace slag cement; the other two make portland cement.

In 1962 nearly 27 percent of the domestic production was exported. The Netherlands, the only neighboring country with insufficient cement production, was the largest importer. Natural waterways and inland canals are used for transporting cement.

Clays.—Commercial deposits of common clay are abundant. The relatively large quantities of clay produced and imported are used in the manufacture of bricks and tiles and in a variety of fired products such as earthenware, stoneware, vitrified porcelain, and refractory products. The imported clay was principally refractory grade. West Germany was the principal source.

Diamond.—Industrial and gem quality diamond, bort, and powder are imported into Belgium, worked, and then re-exported as faceted and polished stones, graded and sorted industrial diamond, and bort powder and splinters. Because of the emergence of important diamond-polishing industries in Israel, West Germany, the United States, and other countries, Antwerp has lost its preeminent position as a

diamond-polishing center, although it is still the world's leading diamond-cutting center. In 1963, 10.1 million carats of diamond valued a $189 million was shipped to world markets; imports were 13.1 million carats valued at $193 million. Values of imports and exports of diamond in 1962 were about $170 million each. The increase of trade over that of 1962 resulted principally from higher imports of stones suitable for cutting and exports of polished diamonds. Trade in industrial diamond declined.

The United States was the most important single market for both gem and industrial diamond exported from Belgium. In 1963, exports to the United States accounted for 29 percent of the industrial, 41 percent of the polished stone, and 33 percent of the bort. The United Kingdom was also an important recipient of bort; its 1963 share was roughly the same as for the United States.

At the end of 1962, 12,136 workers and 2,200 apprentices were registered under the social security system as engaged in the diamond industry.

TABLE 12.—Belgium: Diamond trade in 1963

	Quantity (thousand carats)	Value (thousand U.S. dollars)	Average value per carat (U.S. dollars)	Principal sources and destinations (thousand carats)
Imports:				
Gem quality:				
Crude	4,421	107,226	24.25	United Kingdom 3,714 (including 294 outside Diamond Trading Corporation); United States 300; Liberia 104; France 88; Congo (Brazzaville) 80; Israel 37.
Polished	299	50,080	167.67	Israel 139; South Africa 56; United Kingdom 33; India 27; United States 18.
Industrial	5,148	27,562	5.35	United Kingdom 1,805 (including 1,689 outside Diamond Trading Corporation); Congo (Brazzaville) 1,715; United States 581; Ghana 490; Liberia 205.
Bort and powder	3,258	8,406	2.58	United Kingdom 1,298; Congo (Brazzaville) 1,066; United States 529; Switzerland 236.
Exports:				
Gem quality:				
Crude	354	17,592	49.72	United States 125; Netherlands 60; India 56; Israel 40; United Kingdom 31.
Polished	1,177	132,337	112.43	United States 481; Hong Kong 147; United Kingdom 128; West Germany 69; France 51; Singapore 47; Switzerland 37.
Industrial	3,963	27,552	6.95	United States 1,167; United Kingdom 823; Netherlands 560; Israel 236; U.S.S.R. 190; Czechoslovakia 181.
Bort	3,372	8,798	2.61	United States 1,117; United Kingdom 1,062; West Germany 253; Netherlands 192; Switzerland 188; Czechoslovakia 147; France 134; Japan 102.
Powder and cleaned splinters.	1,194	3,023	2.53	West Germany 311; Switzerland 223; Netherlands 141; Israel 138; Japan 84; United States 80; France 71.

Fertilizer Raw Materials.—Belgium is a leading European producer and supplier of phosphate, potash, and nitrate fertilizers produced from imported crude raw materials and atmospheric nitrogen. Sulfuric acid for superphosphate production is made from imported elemental sulfur and as a byproduct in the processing of metallic sulfide minerals. Morocco is the principal source of the phosphate, France and West Germany for the potash, Chile for the nitrate, and the United

States and France for sulfur. Most of the nitrogen fertilizer was produced by nitrogen fixation. In 1962, 22,000 tons of crude sodium nitrate was imported and 281,000 tons of nitrogen in nitrogen fertilizers was produced.

Sand and Gravel.—Sand was produced domestically for the metallurgical industry, for glassworks, and as concrete aggregate. Of the total sand production of 6.8 million tons in 1962, 1.4 million tons was glass sand, 1.0 million tons was for the metallurgical industry, 3.2 million tons was for building sand, and 1.1 million tons was for miscellaneous uses. Availability of large deposits of high-quality sand in Belgium has helped make Belgium the world's largest exporter of flat glass products. These exports amounted to nearly $104 million in 1962.

Belgium has a substantial net import of metallurgical and building sand. Sand and gravel was obtained from large dragline operations in the principal rivers and from exploitation of extensive pits.

Other Nonmetals.—High-quality limestone and marble (including a famous black marble occuring along the Meuse River) are produced for construction. Other stones produced are dolomite, porphyry, sandstone, chalk, marl, and calcareous tuffa. Slate is mined underground in the southern part of the country and is used mainly as roofing material, floor slabs, etc.; however, the output has been declining.

Belgium exports substantial quantities of dolomite in both crude and calcined forms. The 1962 exports may have equalled half of the tonnage of crude dolomite produced in the country.

The pumice imported from West Germany is used not as an abrasive but as a lightweight aggregate.

MINERAL FUELS

Energy requirements of Belgium are met by coal, wood, methane drained from coal mines, hydroelectric plants, and petroleum. Total gross internal apparent consumption of energy in 1962 is provisionally given as 39.2 million tons of standard coal equivalent. Coal and petroleum supplied 68 and 31 percent of the total, respectively. Relative positions of coal and petroleum have changed considerably in favor of petroleum. In 1952, the shares of coal and petroleum in total gross apparent energy consumption were 85 and 12 percent respectively. The balance of trade for solid fuels (coal, lignite, and briquets) has also changed; Belgium is a net importer.

Coal.—Reduction in coal production during 1959–63 resulted from a program which closed high-cost mines. In accordance with an agreement with the High Authority of ECSC, the Belgian Government undertook to reduce coal production capacity by 9.5 million tons over the 5-year period 1959–63. To meet this schedule, mines with a total capacity of 2.7 million tons had to be closed by the end of 1963. In midyear the government asked the High Authority of the ECSC for authorization to suspend mine closures of the remaining 1.8 million tons of capacity scheduled to be taken out of production by yearend. In justifying the request, the Belgian Government cited shortages of household coal developed in the severe winter of 1963 and pointed out the fact that since January 1, 1963, the coal industry has not benefited

from the protection offered under ECSC Treaty, Article 37, which restricted Belgian coal trade. The government also felt it unwise to close coal mines at the time when imports were increasing. The High Authority seemed willing to agree to the cessation of mine closures; only one mine was closed during the year. Thus the production rate may be stabilized at about the 1963 level.

Production of each of the coalfields of Belgium in 1963 and their relative shares in total output follow: Campine 10,067,000 tons (47 percent); Liége, 3,082,000 (14.4 percent); Charleroi 5,317,000 (24.8 percent); Centre 1,081,000 (5.1 percent); and Mons 1,871,000 (8.7 percent). Because mine closures have been in the southern fields, the share of the southern basins (Mons, Centre, Charleroi, and Liége) in total production diminished from 68 percent in 1952 to 53 percent in 1963. In 1963 the output per underground worker per day for the southern basins was 1.630 tons compared with 2.09 tons for Campine. The corresponding figures for 1960 were 1.452 and 1.792 tons per day, respectively.

Of the apparent consumption of 27.6 million tons in 1963, 20.3 million tons was supplied by Belgian coal and 7.3 million tons by imported coal. The domestic industry supplied nearly 68 percent of the 9.6 million tons of coking coal delivered to coke plants. A greater need for imported coal is predicted to cover anticipated rise in coal needs reflected in forecasts of the supply position for 1956–66.

Mine closures have improved the market for coal and reduced stocks of coal at Belgian mines. Since 1957 Belgium has been a net importer of coal.

TABLE 13.—Deliveries of domestic and imported coal to consumers

(Thousand metric tons)

End use	1962	1963	End use	1962	1963
Coke and gas ovens	9,567	9,660	Mine use (powerplants, issue to miners, etc.)	2,497	2,580
Thermal power stations	4,262	4,113			
Railroads	592	471			
Cement plants	780	786	Total consumption	26,318	27,584
Industry other than cement	1,947	1,866			
Domestic	6,673	8,108			
Total deliveries	23,821	25,004			

TABLE 14.—Belgium: Estimated annual production and requirements of coal for 1965–66

Consumer group	Domestic production (million metric tons)	Requirements (million metric tons)	Share of requirements met by domestic production (percent)
Households	5.30	6.60	80
Cokeries [1]	6.65	9.50	70
Other industries	3.25	3.25	100
Electric power	4.95	7.60	65
Exports	1.85	1.85	100
Total	22.00	28.80	76

[1] Includes direct consumption of coal in iron and steel industries.

In 1960, the ECSC High Authority isolated the Belgian coal market by setting a quota system for coal imports into Belgium, thus limiting competition from Common Market and other suppliers. This was one of the special measures taken by the High Authority to improve the competitive position of the Belgian coal industry during a transitional period. In January 1963 the quota was removed for the Common Market. This quota apparently applies to coking coal for making coke, for domestic industry, and for reexport. Other coals are free of restrictions and their imports are limited by commercial considerations.

Imports of U.S. coal in 1963 totaled 2 million tons, of which approximately 1.5 million tons was coking coal for Belgian use and for processing and reexport, 400,000 tons anthracite, 60,000 tons anthracite fine, 100,000 tons low-volatile steam coal fines and 30,000 tons semibituminous for railroad use. Of the coking coal, 100,000 tons was imported by a special authorization designed to increase coking coal stocks.

The requirements of the Belgian iron and steel industry and independent cokeries for coking coal in 1964 were estimated at about 9.4 million tons, of which about 6.4 million tons must be of domestic origin, leaving an estimated import requirement of about 3 million tons. The U.S. quota may equal half of the coking coal imports.

TABLE 15.—Belgium: Stocks of coal at mines and net imports

(Thousand metric tons)

	1957	1958	1959	1960	1961	1962	1963 [1]
Stocks [2]	1,400	7,000	7,495	6,565	4,394	1,350	454
Trade:							
Imports	5,192	5,359	4,983	4,006	4,197	4,916	7,543
Exports	4,408	2,892	2,311	2,437	3,016	2,985	2,525
Net imports	784	2,467	2,672	1,569	1,181	1,931	5,018

[1] December.
[2] Dec. 31, cited.

The Belgian coal industry has several private organizations. Fédération Charbonnière de Belgique (Fedechar), the Federation of Belgian Coal Companies, is a coal producers' association embracing practically all producers. Fedechar represents the common interests of its members. The Comptoir Belge des Charbons (Cobechar) is a central sales organization for coal and briquet producers. Cobechar was authorized by the ECSC to sell fuels of all its member companies as a group. As of February 1963, Cobechar was also to deal through wholesale dealers. Smaller private organizations are concerned with health and safety, medical, social, and other aspects of the industry.

L'Institute National de l'Industrie Charbonnière (Inichar), National Institute of the Coal Industry, is a Government agency which carries out principally projects in technical matters and safety. In November 1961, the government established the Directoire de l'Industrie Charbonnière, with powers of decision and control over coal mines. However, the duties of this organization were a matter of negotiations with the High Authority. The High Authority felt that

the terms of reference of the act were incompatible with the Common Market Treaty, because it empowered a national body to take action which properly belongs to community institutions.

Petroleum.—Belgium does not produce petroleum or natural gas, but has an important refining industry. Of the country's six refineries, five are in Antwerp and one is in Ghent. Belgium's 1963 throughput capacity was 13.2 million metric tons, compared with 402,550 tons in 1950.

Some exploration for petroleum was carried out. The Belgian Shell Co. applied to the Ministry of Economic Affairs and Energy in March 1962 for exclusive petroleum exploration rights in west Flanders. The company was recently accorded exploration rights, although a formal agreement with the ministry has not yet been concluded. This company spudded a drilling rig in 1963 at Houtem near Veurne to study the geological structure of the area. Petrofina, having completed one hole in the Campine area in 1962, was expecting to drill again in this area. Petrofina carried out this operation for a partnership of Société Campinoise de Recherches et Exploration Minérales (SCREM) and other companies which in 1960 were granted exploration and exploitation permits for the Campine area in the Province of Limburg. The Bataafse Petroleum Maatschappij has exploration and exploitation rights for the area Entre Sambre et Meuse in Hainaut Province; however, the company has done only petrological investigations so far.

TABLE 16.—Belgium: Petroleum refineries

Company	Refinery location	Annual throughput capacity		Remarks
		Thousand tons per year	Barrels per day	
Société Industrielle Belge des Pétrole (S.I.B.P.).	Antwerp	8,500	190,000	Second largest refinery in Europe, owned equally by British Petroleum and Petrofina. Produces gasolines, diesel and fuel oils, and LPG.
Albatros S. A. Belge Pourle Raffinage de Pétrole.	do	(1)	14,000	The company is controlled by French and Belgian capital; produces gasoline, butane, and propane.
Raffinerie Belge des Pétroles (RPB).	do	1,260	30,000	Owned by Signal Oil Company.
Esso Standard Belgium	do	2,075	47,000	The firm has scheduled an expansion of its refining capacity by one-third, to be completed in 1964.
Anglo-Belge des Pétroles	do	150	3,500	
Belgian Shell Company	Ghent	130	3,000	The company produces principally bitumen and lubricants.

[1] Data not available.

Refinery throughput in the first 9 months of 1963 was 9.0 million tons (an annual rate of 12 million tons), compared with 8.5 million tons (64.6 million barrels) in 1962. Total refinery product output in 1963, based on the first 9 months (8.2 million tons), was 39 percent more than in 1962. In the first 9 months of 1963 the following four products accounted for 83 percent of total output: residual fuel oil 36 percent, diesel oil 22 percent, motor gasoline 13 percent, and light residual oil 12 percent.

In spite of an increase in refinery capacity in recent years, until the end of 1962 Belgium was a net importer of petroleum products. In this year imports exceeded exports and bunkering by about 834,000 tons. However, in the first half of 1963 Belgium became a net exporter of about 371,000 tons of products. Petroleum bunker loadings by foreign aircraft and vessels engaged in international trade rose by 35 percent in 1962 over those of 1961.

Delivery of products to inland consumers increased at an annual rate of about 11 percent. However, the rate of increase for gas and diesel oil was 17 percent annually. Industry and transportation rank almost the same as consumers, each accounting for about 30 percent. Space heating and lighting follow next in consumption with about one-fifth of the total.

TABLE 17.—Belgium: Delivery of petroleum products to internal consumers

(Thousand metric tons [1])

Product	1959	1960	1961	1962
Motor and aviation gasoline [2]	1,296	1,235	1,306	1,370
Kerosine, including jet fuel	73	80	89	99
White spirits and special boiling-point liquids	25	31	33	41
Gas and diesel oil	1,878	2,100	2,372	3,148
Residual fuel oil	2,065	2,475	2,532	2,885
Lubricants	102	108	108	114
Bitumens	129	131	142	164
Refinery gases	270	329	417	459
Others [3]	151	166	271	371
Total	5,989	6,655	7,270	8,651

[1] Conversion rates to metric tons: motor gasoline 8.5 barrels; aviation gasoline 8.9; kerosine 7.75; gas and diesel oil 7.46; residual fuel oil 6.66; lubricating oil 7; bitumen 6.06.
[2] Including gasoline-type jet fuel.
[3] Paraffins, waxes, and petroleum coke.

Source: L'Économie Belge en 1962, Ministère des Affaires Économiques et de l'Énergie, Direction Générale des Études et de la Documentation.

The Mineral Industry of Bulgaria

By K. P. Wang [1] and Roman V. Sondermayer [2]

BULGARIA has a diversified mineral industry and produces not only for domestic consumption but also for export, mainly to other East European countries. The more prominent minerals, with output in percentages of the 1963 world totals, follow: Lead, 2; mine zinc, 1.6; and barite, cement, chromite, coal, copper, diatomite, fluorspar, gypsum, iron ore, manganese ore, pig iron, pyrite, salt, steel ingots, and sulfur 0.1 to 1.0 each.

Mineral output value, up to the refined product stage, represented approximately 6 percent of the gross national product in 1963. The mining industry alone employed about 120,000 workers, or a fifth of the country's industrial labor. Mineral exports, predominantly nonferrous metals, continued to be an important source of foreign exchange. Bulgaria's mineral expansion program, carried out with considerable U.S.S.R. technical and financial assistance, was moving so fast that many economic and technical problems were created.

The most important mineral developments in 1963 concerned iron and steel and petroleum. The Kremikovtsi iron and steel plant began partial operations late in the year and, when completed, will be Bulgaria's largest integrated steelworks. The Burgas petroleum refinery, built to process Soviet crude, also was commissioned in 1963. Annual capacity of the refinery will be 1 million tons of crude upon completion of the first stage, and 2 million tons upon completion of the second stage.

Developments in the nonferrous field were limited to modernization and expansion of existing facilities. Construction continued on the lead section of the well-known Plovdiv lead-zinc smelter and the beneficiation plant of the Medet copper project; the latter is scheduled to become one of the largest of its kind in Bulgaria.

Shortages in electric power and skilled workers contributed to lagging productivity in Bulgaria's mineral industry in 1963. Construction of various new powerplants was initiated to compensate for the deficiency in electricity. Night schools were established to train additional workers in the installation, operation, and maintenance of equipment. Many of these workers were recruited from farms.

PRODUCTION

Production of minerals and metals has shown steady increases in recent years. Bulgaria's 1963 output plans were fulfilled and certain

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long-term targets were revised upwards. The rate of mineral output increase in 1963 was 10 percent higher than in 1962. The largest advance took place in nonferrous metals. Output of electrolytic copper and steel doubled during 1959–63, and refined zinc production went up more than five times. Lignite output has steadily increased, whereas brown coal output has reached a somewhat stabilized level.

TABLE 1.—Production of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Copper:					
Concentrate (20 percent)	54,986	70,847	81,538	93,174	(2)
Blister	11,065	16,099	18,917	19,439	(2)
Electrolytic	8,217	14,044	15,013	18,287	20,000
Iron and steel:					
Iron ore (metal content)—thousand tons	172	188	193	258	600
Pig iron—do	177	192	206	223	201
Steel—do	230	253	340	423	461
Lead:					
Concentrate (70 percent)	114,918	119,672	114,343	134,857	(2)
Refined	32,740	40,406	40,913	43,700	51,000
Manganese ore	26,000	25,000	37,000	35,000	(2)
Zinc:					
Concentrate (52 percent)	106,864	112,949	106,703	120,594	(2)
Refined	9,094	16,909	22,122	51,725	56,000
Nonmetals: [3]					
Cement—thousand tons	1,433	1,586	1,749	1,893	2,200
Fertilizers:					
Nitrogenous	62,137	83,594	87,727	94,015	(2)
Phosphatic	30,850	40,853	55,764	69,640	(2)
Gypsum:					
Crude—thousand tons	110	120	135	117	[4] 120
Calcined—do	13	15	15	13	(2)
Lime—do	362	430	633	695	(2)
Pyrites, concentrate (42 percent)	114,600	118,510	121,707	142,303	(2)
Sulfuric acid (monohydrate)	90,700	122,645	191,914	247,039	269,000
Mineral fuels:					
Coal:					
Brown—thousand tons	9,374	10,060	9,931	9,624	(2)
Lignite—do	4,492	5,356	7,035	9,480	(2)
Black—do	353	409	401	439	(2)
Anthracite—do	150	161	190	197	(2)
Total—do	14,369	15,986	17,557	19,740	21,900
Coal briquets [4]—do	250	250	250	250	250
Coke—do	9	20	20	8	(2)
Petroleum, crude—do	192	200	207	199	(2)

[1] Bulgaria also produced 1,000 tons of asbestos, 62,000 tons of china clay, and substantial barite in 1963.
[2] Data not available.
[3] Barite has been produced in significant quantities, but no output data are available. Imports by the U.S.S.R. alone were 12,900 tons in 1961 and 21,500 tons in 1962.
[4] Estimate.

TRADE

Minerals and related products have been important in both the export and import trade of Bulgaria in recent years. The latest figures available, for 1962, showed that mineral exports totaled 96.7 million leva (1.27 leva equals US$1), or 13.2 percent of all exports. Ores and concentrates of nonferrous metals accounted for about half of the mineral exports by value and aggregated over 100,000 tons.

Imports of minerals and related products plus capital goods used by the mineral industry accounted for 259.6 million leva, or a third of the country's total imports in 1962. Ferrous products headed the list of mineral imports, with 43 percent of the total. Fuels ranked

next, accounting for about one-fifth of mineral imports. The Bulgarian Government expects to reduce the annual imports of steel products when the Kremikovtsi plant is in operation. However, no programs were in sight to substantially reduce coal and coke imports below the million-ton annual level and petroleum product imports below the 1.5-million-ton level.

Bulgaria's principal trading partner has been the Soviet Union; about four-fifths of all trade has been with that country in recent years. In 1961, the U.S.S.R. supplied Bulgaria with half of its imports of mineral industry machinery and equipment, three-fifths of the mineral raw materials including fuels, and half of the ferrous metals. With the completion of the Burgas refinery, Bulgaria probably will import an additional 1 to 2 million tons of crude oil annually from the Soviet Union but may reduce refinery product imports.

TABLE 2.—Exports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal countries of destination, 1962
Metals: [1]			
Iron and steel:			
Iron ore	12,181	27,952	Hungary 18,381; Rumania 9,571.
Steel	1,057	----------	[2] Italy 804; Hungary 253.
Lead [3]	20,258	18,013	Poland 4,773; Netherlands 2,023; U.S.S.R. 1,504.
Zinc [3]	13,757	40,358	West Germany 10,196; Czechoslovakia 8,744; Netherlands 6,679.
Nonmetals:			
Barite [4]	12,900	21,500	All to U.S.S.R.
Cement	155,260	224,045	U.S.S.R. 59,584; Sudan 15,110; Yugoslavia 9,686.
Mineral fuels:			
Coal:			
Anthracite	6,926	1,172	Yugoslavia 1,170.
Hard coal	48,984	50,520	All to Hungary.
Petroleum, crude	126,348	116,022	Italy 41,833; Yugoslavia 33,819; East Germany 15,053; Hungary 13,298.

[1] Sizable quantities of copper concentrate are exported, but reliable statistics are not available.
[2] For 1961.
[3] Also large tonnages of lead, zinc, and copper concentrates, which are not separately reported in Bulgarian statistics.
[4] Imports by the U.S.S.R. only.

TABLE 3.—Imports of selected metals and minerals from the U.S.S.R.

(Metric tons unless otherwise specified)

Commodity	1961	1962
Metals:		
Aluminum:		
Ingots	1,500	1,500
Semimanufactured products	926	1,634
Copper, semimanufactured products	1,087	1,246
Iron and steel:		
Iron ore	40,000	25,000
Pig iron	99,100	113,500
Ferroalloys	5,500	4,700
Pipes	16,500	19,100
Semimanufactured products	199,558	237,633
Tin, metal	80	70
Nonmetals:		
Asbestos	8,400	12,000
Apatite concentrate	119,300	117,400
Superphosphates	34,800	27,900
Graphite	1,200	700
Mineral fuels:		
Bituminous coal	505,000	932,000
Coke, metallurgical	105,000	106,000
Petroleum:		
Refined products:		
Gasoline	367,300	386,200
Kerosine	48,700	23,100
Diesel fuel	366,000	445,600
Heating oil	269,300	653,000
Lubricants	12,200	38,000
Bitumen	15,200	15,800

COMMODITY REVIEW

METALS

Iron and Steel.—The new Kremikovtsi iron and steel plant, covering 6,000 acres, is based upon an extensive local deposit of complex ore containing 30 to 46 percent iron and variable amounts of barite, silver, and manganese. The first of its two blast furnaces started operating in November 1963. When completed, the enterprise will also have a large open-pit mine, an iron ore beneficiation plant, barite recovery facilities, a coking plant, three oxygen converters, a steel-rolling mill, a cement plant, limekilns, and auxiliary workshops and laboratories.

The mine will yield 1.2 million tons of beneficiated iron ore annually during the initial stage and about 5 million tons ultimately. The two blast furnaces and two batteries of byproduct ovens are expected to produce annually a total of 1,120,000 tons of pig iron and 600,000 tons of coke. The three converters will have a combined annual capacity of 1,150,000 tons of steel, and an electric furnace will have a capacity of 150,000 tons. The rolling mill is designed to produce about 1 million tons of steel products per year.

Because Kremikovtsi only started production late in the year, the Lenin steelworks remained the foremost iron and steel producer during 1963. At the Lenin plant, construction of the sixth 70-ton Siemens Martin furnace was underway.

Nonferrous Metals.—During 1963, nonferrous metals were the most important branch of Bulgaria's mineral industry in output value. Quantities of lead, zinc, and copper produced in excess of requirements were available for export. Plant modernization and reconstruction

were major goals of management. Automation was introduced in many instances, and technologic processes were improved.

At the Plovdiv lead-zinc smelter, annual zinc capacity was expanded by 2,500 tons over the existing 30,000 tons through the installation of additional roasting facilities and six rectifiers for electrolysis. Cadmium capacity already installed was about 80 tons per year. The Bulgarians were planning to complete the lead division, ultimately to be rated at 40,000 to 50,000 tons of refined lead, before the end of 1963. Sulfuric acid facilities capable of producing 20,000 tons annually, about a third of the proposed capacity, were installed during the year. Plovdiv is slated to become a modern, fairly large nonferrous smelter.

Medet became the largest mine copper producer of Bulgaria, far ahead of Burgas in terms of daily output. Apparently, Medet was producing at an annual rate of about 4 million tons of 0.43 percent copper ore at the end of 1963, half the target for 1965. When completed, the mine may be capable of supplying 25,000 tons or more of contained copper yearly. Development of a new copper mine near Radka was behind schedule. The bulk of Bulgaria's copper concentrate was smelted at the Damyanov copper smelter in Pirdop, which had an annual capacity of about 20,000 tons at the end of 1963 and was due for substantial expansion.

NONMETALS

Abrasives.—The first abrasives plant in the country was under construction at Berkovitsa with Soviet technical assistance. Due for completion by 1964, the plant will have a yearly capacity of 2,500 tons of abrasive materials.

Cement.—During 1963, cement maintained its leading position among Bulgaria's nonmetallic mineral industries. Output increased slightly in all of the five existing plants, which are located in Dimitrovgrad, Devniya Reka, Temelkovo, Vratsa, and Pleven. At Devniya Reka, a new cement plant or an extension of the first one was scheduled for construction. The Kremikovtsi cement plant, planned for 1965, will be rated at 1.2 million tons annually. Bulgaria's 1963 total cement capacity was just above 2 million tons.

Fertilizers.—Reconstruction and expansion of the fertilizer plant at Stara Zagora was completed during 1963. Its annual capacity, about twice that of the Dimitrovgrad plant, is approximately 500,000 tons of nitrogenous fertilizers.

MINERAL FUELS

Coal.—Bulgarian coals, predominantly brown coal and lignite, were the most important energy sources in 1963. Brown coal output was static, whereas lignite output increased considerably over that of 1962. Production of bituminous coal remained small, although a new cleaning plant was placed in operation at Sliven to supply coking coal to the Kremikovtsi iron and steel plant. Only negligible quantities of anthracite were extracted in 1963. As in previous years, Bulgaria relied heavily on imports to meet its coke and anthracite requirements.

Most of the country's coal activities were centered around the

Maritza lignite basin, where open-pit operations were scheduled to furnish 15 million tons of lignite annually. Development of electrical generating capacity at the mine site was the basic approach to greater utilization of Maritza lignite. In the Sofia area, Bulgaria's second ranking but much smaller lignite basin, a new 350,000-ton-per-year mine started production in 1963. The mine is scheduled to be expanded to 1 million tons by 1965. Expansion of lignite operations is the most important part of Bulgaria's program to raise overall coal output to 37 million tons by 1965.

Petroleum and Natural Gas.—Bulgaria's small oil and gas industry, which provided only a minor share of overall requirements, was given encouragement for future expansion in 1963, as a result of discoveries of oil and gas fields near Dolni Dubnik in the Plovdiv area of northern Bulgaria. After the original discovery, all petroleum-drilling equipment and activities were concentrated in this area. Not much natural gas was utilized in Bulgaria in 1963, but plans were made to develop industrial markets near the gasfields.

A new refinery with 1 million tons of throughput capacity for processing Soviet crude was commissioned in Burgas on the Black Sea during 1963. When the second phase is completed, refinery output is expected to include about 610,000 tons of diesel fuel, 270,000 tons of gasoline, 600,000 tons of heating oil, and 60,000 tons of metallurgical fuel. A plant for producing ethylene, a basic raw material for making polyethylene and synthetic rubber, will be erected near the oil refinery.

The Mineral Industry of Czechoslovakia

By Roman V. Sondermayer[1] and K. P. Wang[2]

CZECHOSLOVAKIA is one of the most industrialized of the Communist nations and has extensive metallurgical and fabrication facilities. However, except for coal and magnesite, its mineral resources are relatively limited, and substantial imports of mineral raw materials, primarily from the U.S.S.R., are necessary in order to make the many industrial products needed by the economy.

The more prominent mineral and metal products produced in 1963, in percentages of world totals, were roughly as follows: Magnesite 7; coke 6; coal 3 to 4; pig iron and steel 2 to 3; antimony 3; graphite 2; and aluminum, barite, cement, feldspar, gypsum, iron ore, kaolin, limestone, lead, manganese, pyrite, tin, and zinc, 0.1 to 1. Minor amounts of uranium, bauxite, tungsten, petroleum, and natural gas were also produced.

Czechoslovakia's mineral output in 1963 was no greater than that in 1962, despite government efforts to raise efficiency of existing facilities and improve labor productivity. The winter was severe, and completion of many mines and plants was delayed. For example, certain coal mines designed to add more than 1 million tons of output annually to the national total and a 215,000-ton coal beneficiation plant were not completed. Only one-third of the 382,000 kilowatts of new electirc power capacity planned went into operation during 1963.

The mineral industry contribution to the 1963 gross national product was about 7 to 8 percent, with coal and iron and steel furnishing the predominant share. Imports and exports of mineral products were significant in the total trade of Czechoslovakia. Mineral raw materials, headed by iron ore, nonferrous ores and metals, and petroleum, comprised about one-half of total imports. Mineral and metal exports consisted largely of exports of semifinished products, but these comprised only about one-fourth of total exports. Czechoslovakia's coal-mining and iron and steel industries occupied an important position in Eastern Europe.

Few important mineral developments occurred. Most government effort was centered on improving existing facilities and introducing new equipment. Low productivity held back fulfillment of certain plans in mining and refining of metals. Shortage of electricity seriously affected mineral output.

The coal industry was developing new sources in 1963, but the overall output target was not achieved. Introduction of new auto-

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mated equipment met with some success, although coal-mining productivity was still far below U.S. and Western European standards.

Construction of the large iron and steel plant near Kosice continued. A new magnesite mine, Podrecany in Slovakia, of unknown capacity was being developed for the needs of the refractory magnesia plants at Kosice.

A petrochemical plant was commissioned at Valaske Mezici in 1963. The equipment used was from Czechoslovakia and East Germany. During the initial stage, production will be confined to aromatic derivatives such as ethylene, benzene, xylene, and toluene.

SOURCE MATERIAL

Information on activities in Czechoslovakia is somewhat limited. Czechoslovakia publishes a yearbook that contains statistics on the production of minerals and other information pertaining to the minerals industry; however, this book does not give complete coverage on production or trade. Data on trade in minerals were compiled principally from official sources in the U.S.S.R. and partly from statistics in the yearbook. Other information was provided by the technical press and dispatches from the U.S. Embassy in Prague.

PRODUCTION

The condition of the industrial economy in Czechoslovakia in 1963 was reflected to a large degree by the output of principal mineral and metal products such as coal and iron and steel. Coal production was below expectations; steel output, which accounted for one-tenth of the nation's gross industrial product, was about the same as in 1962. Data on production of nonferrous metals have not been officially reported, but output value in 1963 was about 1 percent of the gross industrial product. Cement production declined. During the 5-year span of 1959–63, almost all of the branches of the mineral industry that have consistently reported output attained significant increases.

TABLE 1.—Production of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Aluminum	26,000	[2] 40,000	[2] 50,000	[2] 60,000	[2] 59,000
Copper	(3)	(3)	[4] 4,960	(3)	(3)
Iron and steel:					
Iron ore thousand tons	2,968	3,120	3,294	3,477	3,408
Pig iron do	4,244	4,696	4,971	5,177	5,254
Steel do	6,136	6,768	7,043	7,639	7,600
Rolled products excluding pipe do	4,014	4,481	4,672	5,066	5,100
Pipe do	553	629	742	763	731
Manganese ore	156,000	154,000	101,000	83,000	(3)
Pyrites thousand tons	371	390	369	401	[2] 401
Nonmetals:					
Cement do	4,700	5,051	5,343	5,710	5,179
Fertilizers:					
Nitrogenous (N content)	133,264	139,881	146,200	153,916	153,800
Phosphatic (P_2O_5 content)	135,198	146,964	167,421	180,460	203,200
Gypsum:					
Raw	289,000	330,000	354,000	373,000	373,000
Calcined	24,000	26,000	27,000	24,000	(3)
Kaolin	261,000	273,000	300,000	319,000	(3)
Lime thousand tons	2,053	2,307	2,357	2,369	(3)
Salt do	161	168	188	[2] 182	[2] 182
Sulfuric acid	513,301	553,207	599,099	642,605	725,100
Mineral fuels:					
Coal:					
Bituminous thousand tons	25,124	26,214	26,233	27,149	28,300
Brown do	51,112	55,475	62,068	65,818	68,500
Lignite do	2,591	2,928	3,235	3,667	4,000
Coke:					
Bituminous do	7,878	8,458	8,537	8,930	9,299
Brown do	2,183	2,176	2,155	2,111	(3)
Manufactured gas million cubic feet	147,339	161,633	167,977	178,352	(3)
Petroleum:					
Crude thousand tons	123	137	154	177	(3)
Diesel fuel do	981	1,170	1,364	1,467	(3)
Kerosine do	57	83	86	118	(3)
Lubricants do	76	79	86	96	(3)

[1] In addition to reported commodities, Czechoslovakia is known to produce (figures represent 1963 production estimates, in metric tons) antimony 1,600; lead, mine 13,500, smelter 14,000; tin, mine 200; 725 76-pound flasks of mercury were also produced.
[2] Estimate.
[3] Data not available.
[4] Information not available in time for inclusion in commodity chapter of volume 1.

TRADE

Mineral trade, particularly imports, was of great importance to Czechoslovakia in 1963, as in the past.

Mineral and metal exports represented about one-fourth of all exports in 1963. The most significant products exported included rolled steel products, pipes, and coke. Czechoslovakia is a manufacturing country, relying mainly on foreign raw materials in order to make semifinished and finished products for consumption and export.

Czechoslovakia's mineral imports, consisting mainly of raw materials, were worth approximately 7 billion koruna [5] in 1963, half of all imports. Most of the country's requirements for nonferrous metals, iron ore, crude petroleum, and bituminous coal were met by imports.

Official Czechoslovakian trade statistics do not reveal the destination of exports or the origin of imports, but comparison of these data with the trade statistics of the U.S.S.R. shows the importance of the U.S.S.R. as a trading partner. Moreover, U.S.S.R. statistics show

[5] US$1 equals 7.2 koruna.

the export of a number of commodities to Czechoslovakia that are not recorded in Czech trade publications.

TABLE 2.—Officially recorded exports of selected metals and minerals[1]

(Metric tons unless otherwise specified)

Commodity	1962	1963
Metals:		
Steel:		
Rolled products	1,118,000	1,316,000
Pipe	248,000	244,000
Mineral fuels:		
Coal:		
Anthracite thousand tons	2,384	2,333
Bituminous do	1,180	1,792
Coke do	1,570	1,758

[1] Distribution by destinations not reported.

Source: Statisticke Prehledy (Statistical Summary) supplement to Statistika No. 2, 1964, Praguo, p. 61.

TABLE 3.—Exports of selected metals to the U.S.S.R.

(Metric tons)

Commodity	1961	1962
Metals:		
Steel:		
Rolled products	73,800	87,200
Pipe	113,600	140,200

Source: Compiled from Vneshnyaya Torgovlya S.S.S.R. za 1962 god, Foreign Trade of the U.S.S.R. for 1962, Moscow, 1963, 235 pp.

TABLE 4.—Officially recorded imports of selected metals and minerals[1]

(Metric tons unless otherwise specified)

Commodity	1962	1963
Metals:		
Iron and steel:		
Iron ore thousand tons	8,319	9,333
Pig iron do	254	189
Rolled steel do	811	705
Manganese ore	209,000	236,000
Nonmetals: Sulfur	133,000	174,000
Mineral fuels: Anthracite thousand tons	4,023	4,346

[1] Distribution by origin not reported; data do not include a number of commodities recorded as imported by Czechoslovakia from the U.S.S.R. in the official trade statistics of the latter.

Source: Statisticke Prehledy (Statistical Summary) supplement to Statistika No. 2, 1964, Prague, p. 61.

TABLE 5.—Imports of selected metals and minerals from the U.S.S.R.

(Metric tons unless otherwise specified)

Commodity	1961	1962
Metals:		
Aluminum:		
Metal	6,500	11,500
Rolled products	1,637	1,553
Antimony	1,200	200
Cadmium	162	201
Chrome ore, thousand tons	48	66
Copper:		
Metal	15,500	19,400
Rolled products	716	639
Iron and steel:		
Iron ore, thousand tons	5,078	5,988
Pig iron, do	91	185
Ferroalloys, do	27	25
Steel:		
Rolled products	86,600	96,200
Pipe	2,800	1,800
Lead	17,600	18,200
Manganese:		
Ore	90,000	107,000
Peroxide	1,700	900
Zinc	10,900	18,200
Nonmetals:		
Apatite:		
Ore	73,100	48,900
Concentrate	212,200	225,700
Asbestos	17,000	12,700
Cement	1,000	2,000
Graphite	118	113
Sulfur:		
Elemental	28,800	18,800
Acid	47,300	31,700
Mineral fuels:		
Coal:		
Anthracite, thousand tons	10	208
Bituminous, do	1,776	2,494
Coke, do	92	25
Petroleum:		
Crude, do	2,845	3,673
Refinery products:		
Gasoline, do	117	113
Kerosine, do	168	224
Bitumen, do	14	----
Paraffin, do	3	2
Others, do	6	5
Total, do	308	344

Source: Vneshnyaya Torgovlya S.S.S.R. za 1962 god. (Foreign Trade of the U.S.S.R. for 1962). Moscow, 1963, 235 pp.

COMMODITY REVIEW

METALS

Iron and Steel.—Iron and steel has long been the leading branch of Czechoslovakia's mineral industry. The long-range plan is to more than double the 1963 output of about 7.6 million tons of steel ingot when plants now under construction are completed. The iron-ore-supply picture showed no great improvement during 1963, and it is estimated that two-thirds of the iron ore came from the U.S.S.R. Continued and perhaps even greater dependence upon Soviet iron ore, manganese ore, and pig iron seems probable when the new Czech facilities are completed.

Nine iron and steel plants were operating during 1963, and some modernization of facilities and increase in pig iron capacity took place.

The East Slovakian iron and steel works near Kosice entered the fifth year of construction; this plant will eventually have an annual steel-ingot capacity of 7 million tons, through the installation of six large oxygen converters and other furnaces. The plan was to complete a cold-rolling mill in 1963, followed by the construction of blast furnaces, steel furnaces, and additional rolling mills. Planned completion date of the whole facility is not known, but a large steel complex is clearly in the making. The plant will probably be supplied with Soviet iron ore; new Soviet-gage railroads are reportedly being built.

Nonferrous Metals.—Activities in nonferrous metals were kept secret as usual. The only known Czechoslovakian aluminum plant, at Ziar, with an annual capacity of possibly 50,000 tons, continued to depend almost entirely on Hungarian bauxite. Lead imports appeared to be somewhat larger than the estimated 1963 local output of 13,500 tons of refined lead. Several hundred tons of tin and about 725 76-pound flasks of mercury apparently were produced during the year. About 5,000 tons of copper was produced in 1961, equivalent to about a third of the imports from the U.S.S.R. in that year and about a fourth of the imports in 1962. The Czechs have a well-established antimony industry of some world consequence and were involved in negotiations to assist Bolivia in building an antimony plant. However approval of this assistance program had not been given by the Bolivian Government at yearend.

NONMETALS

Czechoslovakia remained virtually self-sufficient in most nonmetals in 1963, and few developments of consequence occurred. Development of the new magnesite mine at Podrecany and improvements made in many of the 16 operating cement plants made nonmetals one of the most successful branches of the Czech mineral industry in 1963.

MINERAL FUELS

Coal.—Bituminous and brown coals and liquid fuels derived from brown coals accounted for 85 to 90 percent of the Czechoslovakian energy supply in 1963. Coal mining was greatly modernized during the year by the installation of many new machines, conveyors, and facilities which gradually became standard equipment. In the Ostrov-Karvina area, the country's foremost bituminous coal center, several new shafts were put into operation, although capital construction was behind schedule. Ostrov-Karvina has the best coking coal in Czechoslovakia.

The Mostov-Sokolovo basin provided 90 percent of the country's brown coal. To meet production targets, Sunday work became normal practice. Also, workers from other segments of the nation's industrial labor force spent their vacation working in the brown coal mines.

Some trace metal production is linked to the Czech coal industry. Germanium was recovered from certain coal-burning plants using Sokolovo brown coal and bituminous coal from Kladno and Plzen. Gallium recovery from coals also was considered.

Petroleum.—Crude oil production remained unimportant. Refined petroleum output, while much larger, was still a minor part of the

energy supply. Four regular oil refineries and one synthetic-oil-from-coal plant, with reported aggregate daily crude input capacity of about 65,000 barrels (roughly 8,800 metric tons), operated during the year. Crude oil imports came mainly through the Druzba pipeline from the U.S.S.R.

The Mineral Industry of Denmark

By Charles D. Hoyt[1]

DENMARK, a small country with fewer natural resources than most other countries, continued the expansion of its economy during 1963. Lacking nearly all mineral resources except some nonmetallics and construction materials such as limestone, chalk, clays, diatomaceous earths, and building stone, the country continued to depend on imports for nearly all its raw materials and fuels. Despite this absence of an indigenous natural resource base, the country, through advanced technology and a skilled labor force, combined with an ideal location, continued to expand its output of industrial goods of all types. In 1963 the country's total exports consisted of slightly over 40 percent manufactured items, which were almost entirely produced from imported raw materials, and 40 percent agricultural products, which also were highly dependent on imports (fertilizers) for continuance and expansion of the high degree of productivity.

Within the mineral and mineral-processing fields the only significant event during 1963 was the completion and startup (September–October) of the country's second major refinery, owned by a U.S. firm, the Gulf Corp.

GOVERNMENT POLICIES AND PROGRAMS

Mining activities in Denmark continued to be regulated by law No. 181, May 1950, which provides a State monopoly of all mineral deposits that were not exploited prior to February 23, 1932. Additional mineral legislation was passed on July 16, 1962, which specifically refers to petroleum exploration and exploitation. The May 1950 law allows the Danish Government to grant concessions, not exceeding 50 years, for prospecting for and extracting raw materials.

Under the 1950 mining law, an exclusive concession was granted to the Danish-American Prospecting Co. (owned by the Gulf Oil Corp.) in August 1950 for the prospecting and extraction of all minerals for 50 years. A condition of the concession was that production must begin within 10 years of the initial agreement. In 1957, the Standard Oil Co. of New Jersey took over the Gulf concession rights; however, nothing of significance was discovered and presumably the concession expired in August 1960 since there was no production within the prescribed 10 years. Under the same mining law, a 50-year conces-

[1] Staff engineer, Office of Program Coordination.

sion was granted for prospecting and mining molybdenum and certain other minerals in Greenland.[2]

PRODUCTION

The principal change in Denmark's modest mineral industry output has come in the fuels field with the rapid expansion of petroleum refining. Compared with 1962, production of refined products during 1963 increased by over 52 percent to 15 million barrels. This was because Denmark's second major refinery came on stream in October 1963. There were no appreciable changes in the output of the iron and steel industry. Nonmetals registered a decrease of about 7.5 percent in the production of portland cement and an expansion in phosphate fertilizer output. Other changes in the production pattern were minimal.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Iron and steel:					
Bog iron ore	[1] 110,000	[1] 95,000	85,000	95,000	85,000
Pig iron	58,000	69,000	64,000	68,576	70,000
Steel:					
Ingots	252,600	273,900	279,500	320,600	316,100
Semimanufactures, including castings	195,700	217,500	224,000	254,000	267,400
Nonmetals:					
Cement:					
Portland—thousand tons	1,234	1,268	1,375	1,418	1,310
Other—do	157	174	210	210	200
Chalk, washed	36,100	34,100	29,700	30,000	30,000
Clay, kaolin:					
Crude	6,200	6,300	7,800	8,000	7,500
Refined	4,400	4,900	11,900	12,000	12,000
Diatomaceous materials:					
Diatomite	16,500	16,000	19,500	20,000	[1] 20,000
Moler	185,700	185,300	193,100	209,400	200,700
Fertilizers:					
Superphosphate, 18 percent P_2O_5	170,825	107,601	56,560	[2]	[2]
Triple superphosphate, 30 percent P_2O_5	3,764				
Potassium superphosphate	423,932	556,652	644,533	778,278	[1] 850,000
Flint:					
Pebbles	4,863	3,964	5,040	5,000	5,000
Other forms	152,152	155,510	160,000	165,000	[1] 165,000
Gravel—thousand cubic meters	2,831	3,092	3,745	3,500	3,500
Lime, all forms	121,684	132,688	146,907	146,753	[1] 147,000
Limestone [1]—thousand tons	2,757	2,915	3,239	3,332	3,150
Mineral fuels:					
Coal—thousand tons	2,304	2,309	2,163	2,025	[1] 1,900
Coke—do	335	398	405	418	[1] 430
Fuel briquets—do	44	48	45	[1] 50	[1] 55
Peat—do	420	170	113	61	[1] 50
Petroleum refinery products:					
Gasoline—thousand 42-gallon barrels	[3]	[3]	674	2,059	3,531
Kerosine—do	[3]	[3]	[3]	131	359
Distillate fuel oil—do	53	52	368	1,966	3,157
Residual fuel oil—do	[3]	[3]	945	4,449	6,486
Lubricants—do	[3]	[3]	17	19	15
Other refined products—do	161	124	946	1,459	1,322
Refinery fuel and losses—do	8	20	94	[4]	465
Total—do	222	196	3,044	[5] 10,083	15,335

[1] Estimate.
[2] Data not available.
[3] If any, included with other.
[4] Data not available; may be included under specific items above.
[5] Total of listed detail; data on refinery fuels and losses not reported separately if at all.

[2] Although Greenland is politically a county of the Kingdom of Denmark, for geographic reasons Greenland is reported in a separate chapter; details concerning this mining concession are presented in the Greenland section.

TRADE

Since Denmark has no indigenous sources of petroleum, it must import its requirements as either crude oil for processing or finished petroleum products. While output of petroleum products increased by almost half in 1963 with the opening of the new refinery, crude imports were increased by over 40 percent to provide the throughput for the new installation.

As in previous years, Denmark depended on imports for the bulk of its mineral-resource-based needs in 1963. In addition to a large petroleum trade, significant quantities of iron and steel semimanufactures, fertilizers, and salt were imported. Lesser tonnages of practically all other mineral commodities also were imported. Denmark's principal exports in 1963 continued to be cement, refined cryolite, and building materials.

The principal changes in the trade pattern for 1963 were in the petroleum industry. In the nonmetallics and metals area, there were no really noteworthy differences in the trade volume. As in past years, West Germany, the United Kingdom, and Sweden were the principal trading partners for Denmark.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1962
Metals:				
Aluminum, all forms	3,100	2,879	3,248	Sweden 1,402; West Germany 459; Netherlands 429.
Copper:				
Waste and scrap	3,012	5,428	5,193	West Germany 3,589; Belgium-Luxembourg 1,279; Sweden 701.
Other forms	856	981	1,225	Sweden 557; Italy 152.
Iron and steel:				
Iron ore	56,921	68,775	50,974	United Kingdom 41,592; West Germany 15,277; Belgium-Luxembourg 6,080.
Scrap	20,450	27,942	38,781	West Germany 20,950; Sweden 2,896; Norway 2,136.
Steel:				
Ingots and equivalent primary forms.	1,783	2,177	3,802	All to Norway.
Semimanufactures	50,723	83,162	102,351	Sweden 60,743; Norway 8,860.
Lead, including alloys, all forms.	8,788	4,750	4,392	Norway 1,724; Switzerland 401; Netherlands 318.
Magnesium	46	54	56	Sweden 31; United States 20.
Nickel	53	200	238	United Kingdom 88; India 60; Netherlands 24.
Silver—troy ounces	59,188	48,225	16,718	Netherlands 32,150; Finland 9,645; Norway 6,430.
Tin:				
Unwrought:				
Unalloyed—long tons	109	18	53	Colombia 7; Sweden 5; Venezuela 4.
Alloys—do	3,871	632	653	Norway 122; Venezuela 119; Italy 68.
Semimanufactures—do	24	19	86	Sweden 18.
Zinc:				
Unwrought alloys	2,510	2,012	918	Brazil 1,798; Greece 42; West Germany 38.
Other forms	1,346	2,156	2,166	West Germany 843; Italy 334; Belgium-Luxembourg 281.
Base metals, not otherwise specified:				
Slag and ash	115,120	104,855	63,458	West Germany 99,742; Sweden 2,594.
Metals, all forms	73	33	52	(1).

See footnote at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1962
Nonmetals:				
Cement	164,764	156,786	142,196	United Kingdom 45,582; Canada 14,226; Mauritania 11,989.
Chalk	30,766	28,282	33,727	West Germany 16,763; Sweden 6,019; Finland 2,718.
Clays, all types	4,058	3,302	3,600	Finland 1,516; Sweden 1,456; Norway 278.
Cryolite	24,970	25,409	25,260	Japan 7,405; Canada 4,263; West Germany 4,158.
Diatomaceous earths:				
Moler	93,074	93,871	82,958	West Germany 49,793; United Kingdom 41,081; Netherlands 1,087.
Other	12,662	9,995	9,564	Norway 3,955; West Germany 2,350; Sweden 1,796.
Flint, all forms	22,597	28,478	26,606	West Germany 18,776; Sweden 2,061; Czechoslovakia 1,640.
Granite and sandstone	131,723	142,409	90,348	West Germany 142,301.
Gravel, all types	thousand tons 1,216	1,448	1,439	West Germany 1,443.
Lime	6,921	10,240	17,375	Norway 4,563; Sweden 4,554; Iceland 827.
Limestone	36,509	47,917	50,020	Sweden 21,324; West Germany 16,315; Norway 6,010.
Quartz	3,728	390	944	West Germany 351; Sweden 39.
Sands, all types	91,150	106,223	124,336	West Germany 66,591; Sweden 19,214; Finland 3,740.
Stone, crushed	211,483	261,459	342,886	West Germany 261,216.
Other nonmetals	2,381	2,744	1,509	(1).
Mineral fuels:				
Lignite and peat	38,187	31,065	58,079	West Germany 30,356.
Coke	24,518	40,792	53,145	Norway 16,642; Sweden 14,437; West Germany 7,226.
Petroleum:				
Gasoline	2,954	143,255	87,274	United Kingdom 54,827; United States 52,575; Sweden 34,018.
Kerosine	502	6,929	17,858	Norway 4,014; Sweden 2,914.
Gas and/or diesel fuel	8,385	86,959	42,713	Sweden 58,883; Norway 24,038; United Kingdom 3,975.
Residual fuel oil	31,796	299,588	218,986	Norway 140,766; United Kingdom 85,290; Turkey 36,736.
Lubricants	5,114	3,956	5,824	Sweden 1,824; Norway 794; Finland 575.
Other	16,452	5,275	4,034	(1).

[1] Data not available.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

	1961	1962	1963	Principal sources, 1962
Metals:				
Aluminum:				
Ingot, including alloy ingot	6,081	6,656	5,770	Norway 4,596; U.S.S.R. 1,009; United Kingdom 362.
Scrap and waste	834	364	1,279	Sweden 283.
Semimanufactures except foil.	6,145	7,908	9,407	Norway 1,974; Sweden 1,004; West Germany 805.
Foil	2,182	2,244	2,158	West Germany 780; United Kingdom 342; France 336.
Copper:				
Ingot, including alloy ingot	3,774	4,862	3,962	Belgium-Luxembourg 4,045; Sweden 525; United Kingdom 177.
Scrap and waste	283	107	17	West Germany 42; Sweden 37; Australia 22.
Semimanufactures	22,385	25,242	21,739	Sweden 9,216; Belgium-Luxembourg 5,997; United States 2,716.
Iron and steel:				
Iron ore	3,458	1,445	1,111	Sweden 1,411.
Pig iron and cast iron	75,365	110,627	81,651	West Germany 27,666; U.S.S.R. 27,598; Austria 20,803.
Ferroalloys	6,664	5,742	6,007	Norway 5,179.
Steel:				
Ingots and equivalent primary forms.	21,454	12,374	12,187	Norway 11,462; Sweden 419.
Semimanufactures	763,092	793,628	759,314	West Germany 282,319; Belgium-Luxembourg 176,040; United Kingdom 104,271.
Lead:				
Ingot, including alloy ingot	19,505	15,972	13,948	Sweden 5,522; Australia 2,692; Mexico 1,549.
Scrap and waste	3,536	3,850	3,689	Norway 1,552; East Germany 545; Czechoslovakia 361.
Semimanufactures	298	635	885	Belgium-Luxembourg 261; France 200; West Germany 95.
Magnesium, all forms	58	96	34	Italy 48; Norway 22; United Kingdom 17.
Manganese ore	1,739	5,751	6,429	Republic of South Africa 4,049; mainland China 955; Greece 446.
Mercury—76-pound flasks	2,727	580	754	Italy 261; Mexico 203.
Nickel, all forms	892	931	960	United Kingdom 468; Sweden 162; West Germany 59.
Platinum, all forms—troy ounces	1,704	1,800	1,865	United Kingdom 579; Netherlands 386; West Germany 322.
Silver, all forms—thousand troy ounces	3,608	4,244	3,177	United Kingdom 1,556; West Germany 1,010; Switzerland 566.
Tin, all forms—long tons	4,297	1,303	1,152	Malaya 299; Netherlands 209; West Germany 161.
Zinc:				
Semimanufactures	6,357	6,848	5,166	Belgium-Luxembourg 2,634; Poland 2,177; Yugoslavia 886.
All other forms	10,142	11,349	9,567	Norway 5,912; Belgium-Luxembourg 2,408; Netherlands 1,468.
Base metals, not otherwise included:				
Slag and ash	36,080	42,351	14,306	United Kingdom 42,031.
Metal	440	469	381	(1).
Nonmetals:				
Abrasives	3,120	3,486	2,743	Italy 2,004; West Germany 997; Netherlands 386.
Asbestos	19,576	21,114	17,417	Canada 7,410; Cyprus 5,200; U.S.S.R. 3,322.
Cement	1,497	12,852	1,362	West Germany 11,731; United Kingdom 775; Belgium-Luxembourg 265.
Clays, all types	61,243	64,085	66,383	United Kingdom 39,461; Czechoslovakia 14,109; West Germany 6,856.
Diatomaceous earths	1,476	1,107	1,342	United States 707; West Germany 241; France 96.
Dolomite	11,411	17,737	16,936	Norway 5,548; West Germany 4,284; Belgium-Luxembourg 4,120.
Feldspar, fluorspar, leucite, and related minerals.	5,301	6,150	6,754	Norway 4,742; Sweden 789.

See footnote at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

	1961	1962	1963	Principal sources, 1962
Nonmetals—Continued				
Fertilizers and fertilizer raw materials:				
Nitrogenous:				
Calcium nitrate	740,608	738,705	679,977	Norway 686,446; West Germany 52,259.
Other	54,934	47,424	57,022	Norway 15,184.
Phosphate:				
Phosphate rock	307,205	286,040	312,731	Morocco 229,347; Tunisia 19,090; United States 18,339.
Phosphate fertilizers	197,791	138,750	112,134	Netherlands 54,315; Belgium-Luxembourg 22,960; Norway 21,099.
Potassic, all types	379,756	288,197	286,654	West Germany 170,149; East Germany 51,816; France 34,719.
Undifferentiated	5,909	21,273	18,631	West Germany 11,277; Norway 9,835.
Graphite	408	583	370	Norway 292; West Germany 177; United Kingdom 72.
Granite and sandstone	18,833	29,288	27,346	Sweden 18,017; Norway 11,033; West Germany 220.
Gypsum	57,676	59,985	50,832	Poland 52,021; France 7,303; West Germany 659.
Limestone	16,058	22,862	41,607	Sweden 17,510; Norway 4,958.
Magnesite	2,458	2,546	3,368	Austria 1,107; Netherlands 1,036; Sweden 225.
Marble	9,065	13,128	10,155	Sweden 10,515; Italy 1,734; Norway 76.
Mica	159	116	232	Norway 76; United Kingdom 34.
Pyrites, unroasted	126,148	136,545	132,472	Spain 92,940; Norway 43,605.
Quartz and quartzite	16,718	20,606	18,470	Sweden 18,877; Norway 816; Belgium Luxembourg 530.
Salt	141,382	147,006	170,479	West Germany 84,771; Netherlands 24,772; United Kingdom 22,894.
Slate	4,051	5,642	5,483	Norway 1,862; Sweden 1,625; West Germany 1,516.
Stone, crushed	47,731	50,416	56,187	Sweden 42,270; West Germany 6,175; Norway 1,800.
Sulfur, elemental	4,021	9,826	12,473	France 7,965; Norway 1,071; West Germany 605.
Talc	11,559	11,792	11,079	Norway 9,695; Sweden 1,343; Austria 300.
Mineral fuels:				
Coal, all grades_thousand tons	3,971	4,158	4,173	Poland 2,351; United Kingdom 694; Belgium-Luxembourg 214.
Coke, all grades_____do	1,181	1,361	1,421	West Germany 751; United Kingdom 320; U.S.S.R. 193.
Crude oil_____do	237	1,256	1,779	Iran 610; Kuwait 362; Venezuela 160.
Petroleum refinery products:				
Gasoline_thousand tons	1,099	1,180	945	United Kingdom 393; Netherlands 272; West Germany 153.
Kerosine_____do	303	304	398	United Kingdom 166; Netherlands 70; Netherlands West Indies 11.
Gas and/or diesel oil_do	1,813	2,039	2,393	Netherlands 532; United Kingdom 519; Norway 242.
Residual fuel oil_____do	2,218	2,398	2,417	Netherlands 683; Norway 466; United Kingdom 401.
Lubricants_____do	72	83	68	United Kingdom 30; Norway 6; Netherlands 4.
Bitumen and asphalt. do	108	121	121	West Germany 57; Netherlands West Indies 34; Sweden 19.
Other_____do	126	122	109	West Germany 74; Netherlands 23; Norway 8.

[1] Data not available.

COMMODITY REVIEW

METALS

Iron Ore.—The only ferrous mineral in the country is a low-grade (40 percent iron) bog iron which is a spongy hydrated oxide of iron. The primary use of this material has been for gas purification. Output for 1963 declined to about 85,000 tons; and estimated two-thirds of the total production was exported, principally to the United Kingdom, with lesser amounts to West Germany.

Iron and Steel.—In 1963 the country's iron and steel requirements (1.1 to 1.2 million tons annually in recent years) continued to be supplied principally by imports. About three-quarters of the country's needs were provided by imports, and the remainder was supplied by Denmark's only steel producer, the Danish Steel Works, Inc. (Det Danske Staalvalsevaerk, A.S.). Ingot output in 1963 by this plant reached 316,100 tons, and rolled-steel production increased to about 270,000 tons. Output has approximately doubled since 1954. Iron and steel output at the Danish Steel Works was based principally on domestically generated scrap which originally was imported in the form of steel products, ships, machinery, etc.

The output of the country's single pig iron producer, Norden Cement-Iron Combine (Cement-Jern Konsortiet Norden), was also based on scrap. This metal was consumed primarily for iron castings within the country's large foundry industry, and only limited quantities were used for steel production. The country also has imported appreciable tonnages of pig iron (75,000 to 110,000 tons in recent years) to satisfy domestic needs. Preliminary figures indicate that pig iron imports for 1963 were slightly over 80,000 tons.

Nonferrous Metals.—All nonferrous metals must be imported, and total imports (in all forms including scrap) in the past few years have been about 85,000 tons annually. Preliminary import statistics for 1963 show that major nonferrous imports amounted to almost 79,000 tons, distributed as follows: copper 32.5 percent; aluminum 23.5 percent; lead 23.5 percent; zinc 19.0 percent; and tin 1.5 percent.

Only two significant producers refined and further processed nonferrous metals. The first of these was the Northern Cable and Wire Works, Inc. (A. S. Nordiske Kabel og Traadfabriker), whose output of cables and electric wires in recent years has been 31,000 to 35,000 tons annually. Semimanufactures of nonferrous metals also have been produced, along with iron wire products. In late 1963 it was reported that this company had joined with the United Kingdom aluminum producer, Aluminium, Ltd., to form a new company, Aluminord, A.S. Existing rolling facilities at one of the Northern Cable and Wire Works operations will be used for the venture. Efforts will be made to find new uses for aluminum in the packaging and construction industries. Plans called for doubling the present aluminum-rolling capacity of the Danish plant, which in 1963 was 12,000 tons annually. No schedule was announced for this proposed expansion. Aluminum, Ltd., was slated to provide the necessary capital, primary aluminum, and technical assistance for the new company.

The other major nonferrous firm was Paul Bergsøe and Son, which produced solders, type metals, babbitts, and a wide variety of lead, copper, tin, and antimony alloys. The firm has operated internationally, and there were affiliated companies and operations in Sweden, Norway, Finland, the United Kingdom, and Brazil. These associated companies operated under the general name Scandinavian Metal Corporation. Total output of the three Paul Bergsøe and Son Scandinavian plants has amounted to about 76,000 tons annually in recent years.

NONMETALS

Denmark's output of nonmetals increased in 1963. Most of the nonmetallics produced domestically were used within the construction field. Over 3 million tons of limestone was produced for the manufacture of cement (1.5 million tons output in 1963), and over 200,000 tons of a clayey diatomaceous earth (moler) was mined in 1963. About one-half the moler output was exported in bulk form, mainly to West Germany and the United Kingdom. The balance was used to manufacture refractory bricks and other refractory materials in Denmark; these also were exported, but to a great number of countries. The country lacks most nonconstruction nonmetallics. Salt, sulfur (pyrites), and fertilizers are consumed in moderate quantities and must be imported, along with most other nonmetals.

MINERAL FUELS

Coal, Coke, and Peat.—The bulk of the country's solid fuel needs were supplied by imports, practically all of which came from other European countries. Preliminary trade figures for 1963 show total solid fuel imports of almost 6 million tons (75 percent coal, 25 percent coke), practically the same as in 1962. Poland has been the principal source of coal and West Germany the chief supplier of coke, with the United Kingdom the most important secondary source of both coal and coke.

Domestic output of solid fuels was limited to production of low-grade lignite (output, about 2 million tons annually, goes almost entirely to powerplants) and to a small amount of peat, used principally as domestic fuel in rural areas. The reserves and quality of the lignite are very poor, and therefore there is practically no basis for any significant expansion within the domestic fuels industry.

Petroleum.—During 1963 Denmark continued its surge of building additional refinery capacity designed to supply rapidly expanding Danish and other Scandinavian markets. In the past few years Danish per capita oil consumption (1.55 tons in 1962) ranked second only to Sweden in Scandinavia and was among the highest in Europe. Total domestic sales in 1962 exceeded 7 million tons, compared with about half this amount in 1957; the average annual increase for this period was about 12 percent. It has been estimated that petroleum products currently supply 62 to 63 percent of the country's total energy requirements and that by 1970 this dependence on petroleum and its derivatives will have increased to about 70 percent. At this time the domestic consumption is expected to reach 10 million metric tons, which would be an almost trebling of consumption over 14 or 15 years.

Within the past 4 years major oil companies have started building large-scale refineries in Denmark, based on past growth rates and potential domestic and other Scandinavian markets. The first major refinery, built by the Tidewater Oil Company interests, was completed in 1961 at a cost of over $24 million. The refinery is at Kalundborg and had a refining capacity of 1.5 to 1.7 million tons (20,000 barrels per day crude throughput) in 1963. During 1962 this refinery was sold to Esso (New Jersey Standard) which planned to more than double the 1963 capacity. Esso supplied about 27 percent of the total

Danish markets in that year. Tidewater retained processing rights for 900,000 metric tons of refining capacity annually from the existing plant.

Denmark's second major refinery officially went on stream in early October 1963. This new refinery, at Stignaes in southwest Zealand, is owned by the Gulf Oil Corporation and was this corporation's first independent venture in Europe. The 1963 rated capacity was 30,000 barrels per day crude throughput. It is anticipated that one-third of the new refinery output will supply the 10 percent of total Danish requirements that have been provided by Gulf through imports; the balance will be exported to Sweden, Scandinavia's largest consumer of petroleum products. A third major refinery, under construction in late 1963 at Fredericia on the east coast of the Danish mainland, is to be owned by the Shell Oil Co. The facility will have a rated capacity of about 2 million tons per year upon completion, which is expected to be in late 1965. Shell interests supplied about 13 percent of total Danish markets in 1963.

Even when the third major refinery in Denmark is completed in late 1965, refinery capacity will not be equal to the current domestic needs of the country. Denmark still will require significant imports of petroleum in all forms to supply the country's rapidly expanding markets.

The Mineral Industry of Finland

By Anton W. T. Wei [1]

OUTPUT of minerals and metals in Finland increased in 1963, continuing the general upward trend of the past decade. Commodities of world significance included vanadium (about 10 percent of world output) and ilmenite concentrate (about 4.5 percent). However, because of the moderate tonnages of total world output, these two commodities occupied only relatively minor positions in Finland's mineral industry. According to the Central Statistical Office, the country's total 1963 mineral output was 8 percent above that of 1962, and basic metal production increased 4 percent. As in the past, Finland did not produce any mineral fuels in 1963. Excluding refined petroleum, the country's total value of mineral production in 1963 was roughly the equivalent of US$130 million. Refined petroleum output, all from imported feed stock, totaled 15.5 million barrels during the year.

Active geologic exploration and development of new mineral areas and existing facilities took place throughout 1963. Results of preliminary investigation and test drillings by the Geological Research Institute in the Nivala area were encouraging, with total reserves estimated at 5 million tons of nickel-copper ore averaging 0.7 percent nickel, 0.26 percent copper, 3.5 to 10 percent sulfur, and minute fractions of platinum. A final report on this exploration project was being prepared for submission to the Ministry of Commerce and Industry. It was reported that the eventual exploitation of this deposit would probably be assigned by the Ministry to Outokumpu Oy, a State-owned enterprise which operates the country's nonferrous metal and pyrite mines.

According to newspaper reports during the year, the Lohjan Kalkki Oy would begin mining a large apatite deposit near the village of Kuuslahti, 5 kilometers east of Siilinjärve in east-central Finland. Test drilling during the past 4 years had uncovered deposits reportedly about 12 kilometers long and 700 meters wide. While the ore bodies seemed rich enough to justify exploitation, their location far from the processing industry in Oulu would mean high transportation costs. In the meantime, the Typpi Oy fertilizer factory in Oulu, which went into operation in March 1963, established a new plant for the manufacturing of rare-earth oxides. At full capacity, the plant was reportedly capable of producing 100 metric tons of oxides annually.

Elsewhere, metallurgical investigation was continuing on the chromite ores of Kemi. These ores were being tested at the Pori

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testing plant, where various procedures were being tried in an attempt to improve the chromium-iron ratio in the concentrate. Exploration by driving shafts and by diamond drilling was carried out on the Kolari iron deposits. At yearend, no decision had been reached regarding the exploitation of these deposits.

GOVERNMENT POLICIES AND PROGRAMS

There did not appear to be any specific program to expand the government's role in the mining and metallurgical industry. However, the implemented and planned expansions of State-owned facilities in iron ore, iron and steel, petroleum, and nonferrous metals had the same effect.

In 1963, government-owned companies already were the only operators in the petroleum and nonferrous areas. Upon completion of new facilities as planned during the year, the government steel plant was to become the largest single producer and dominant in the field.

SOURCE MATERIAL

Information on production and significant developments in Finland's minerals industry is derived principally from foreign service dispatches of the U.S. Embassy in Helsinki. Data on mineral imports and exports are obtained from official Finish trade publications.

PRODUCTION

Of the total value of the minerals and metals produced in Finland in 1963, excluding refined petroleum, semimanufactures of iron and steel accounted for nearly 45 percent. Hydraulic cement and metallic copper each accounted for about 20 percent, and metallic nickel and lead concentrates each about 4 percent. Of the rest, the more significant items included vanadium pentoxide, lime, pyrite, and ilmenite. Although mineral output generally increased in volume in 1963 over that of previous years, a notable exception occurred in lead production, which fell to less than half the 1962 level. The year saw the first production of sulfur, which was produced in significant quantities, from the new Kokkola pyrite-processing plant.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963 [1]
Metals:					
Copper:					
Concentrate, metal content	29,400	28,100	34,000	35,100	33,800
Electrolytic	32,605	30,971	34,300	33,930	37,797
Gold [2] troy ounces	23,350	20,350	20,600	15,250	20,400
Ilmenite concentrate, 44 to 45 percent titanium dioxide	86,152	83,660	19,298	87,190	[3] 93,858
Iron and steel:					
Iron concentrate, 65 to 70 percent iron thousand tons	228	286	256	296	362
Pig iron do	108	105	147	341	375
Cast iron products do	84	95	107	112	109
Crude steel do	249	273	298	331	326
Steel rolled products, castings, forgings do	272	336	310	305	303
Lead concentrate:					
Gross weight	3,363	3,124	4,725	4,181	1,645
Metal content	1,929	1,592	3,120	2,868	1,145
Nickel:					
Concentrate:					
Gross weight	4,742	36,064	34,698	44,912	54,439
Metal content	294	2,149	1,999	2,431	2,929
Sulfate, metal content	84	114	161	162	156
Electrolytic		467	1,804	2,329	2,694
Selenium kilograms	5,986	5,152	6,031	5,351	6,993
Silver [2] troy ounces	522,750	390,350	456,150	380,500	579,950
Vanadium pentoxide	900	1,013	1,134	1,020	1,248
Zinc concentrate (about 54.5 percent zinc):					
Gross weight	98,383	77,044	85,388	96,045	119,988
Metal content	54,057	42,028	46,596	52,171	66,353
Nonmetals:					
Asbestos	8,546	9,556	9,379	9,860	9,254
Cement thousand tons	1,170	1,253	1,341	1,357	1,419
Diatomite	1,379	1,322	730	1,200	1,179
Feldspar thousand tons	8	9	15	15	13
Lime, unslaked do	210	220	220	220	212
Limestone and dolomite do	2,600	2,500	3,100	2,900	3,200
Marble	1,000	1,000	400	500	600
Pyrite, sulfur content	110,600	109,300	113,300	216,400	252,300
Soapstone or steatite cubic meters	1,700	2,800	1,100	880	800
Sulfur					38,000
Talc	7,716	9,986	6,320	6,430	5,000
Mineral fuels:					
Solid:					
Coke thousand tons	140	148	133	318	164
Fuel briquets do	14	8	11	15	18
Peat do	5	5	4	5	7
Liquid:					
Refined petroleum products:					
Gasoline thousand 42-gallon barrels	3,285	2,941	3,099	3,612	4,471
Kerosine and jet fuel do	256	264	192	127	134
Distillate fuel oil do	1,752	2,137	2,189	1,824	2,954
Residual fuel oil do	1,424	1,734	1,777	3,220	6,606
Miscellaneous do	840	902	1,339	1,285	1,372

[1] Preliminary data.
[2] Approximate, based on officially reported output in kilograms.
[3] Final figure; supersedes figure given in commodity chapter, volume I.

TRADE

The overall pattern of Finland's mineral trade in 1963 remained relatively unchanged. Value of mineral and metal imports totaled approximately 1.4 billion new marks (1 new mark=US$0.3125), representing roughly 36 percent of the country's total imports for the year. Mineral and metal exports totaled about 100 million new marks, or less than 3 percent of the country's overall exports in 1963.

COMMODITY REVIEW

METALS

Iron Ore.—Expansion of Finland's iron ore mining industry was advanced in 1963. Preparatory work continued on the Raajärvi iron mine in northwest Finland by Otanmäki. The mine was scheduled to start operation in the summer of 1964, and ore would be processed primarily by Rautaruukki Oy in its new facilities at Raahe. Excluding Finland's pyrite, which is used eventually as an iron raw material, Raajärvi will be the country's fourth producer of conventional iron ore. The Kolari iron deposit was explored by driving shafts and diamond drilling.

TABLE 2.—Exports of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1962	1963
Metals:		
Aluminum, all forms	745	995
Copper:		
Unwrought, including scrap	7,345	8,934
Semimanufactures	3,182	5,365
Ilmenite concentrate	37,773	(2)
Iron ore:		
Concentrate and sinter	174,380	210,539
Roasted pyrite	166,569	123,744
Iron and steel:		
Pig and cast iron	108,133	181,643
Scrap	3,102	3,022
Semimanufactures, low- and medium-carbon steel	4,974	6,827
High-carbon and alloy steel	1,409	2,007
Lead:		
Ore	5,367	(2)
Metal	207	----------
Tin, long tons	35	78
Tungsten ore	12	----------
Zinc:		
Ore	101,473	142,943
Metal	519	754
Nonmetals:		
Asbestos	5,725	5,744
Diatomaceous earth	127	101
Feldspar	11,175	7,946
Mica	75	60
Pyrite	71,011	54,624

[1] Countries of destination are not reported for 1962 and 1963.
[2] Data not available.

TABLE 3.—Imports of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1962	1963
Metals:		
Aluminum:		
Unwrought	6,812	4,058
Semimanufactures	10,704	10,283
Chromite	----------	20
Copper:		
Unwrought	6,297	2,736
Semimanufactures	2,014	2,002
Iron and steel:		
Iron ore	448,671	383,152
Pig and cast iron	3,433	7,056
Ingots and equivalent primary forms	80,408	60,000

TABLE 3.—Imports of metals and minerals—Continued
(Metric tons unless otherwise specified)

Commodity		1962	1963
Metals—Continued			
Iron and steel—Continued			
Semimanufactures:			
Low- and medium-carbon steel			
Bars, rods, angles, shapes, sections		116,994	74,926
Hoop and strip		17,208	16,578
Rails and accessories		47,094	62,436
Sheets and plates		236,227	238,020
Tubes, pipes, accessories		69,632	60,252
Wire		16,157	12,803
Alloy and high-carbon steel, all shapes		14,623	13,428
Ferroalloys:			
Ferromanganese (including spiegeleisen)		2,586	2,640
Ferrosilicon		4,688	4,435
Ferrosilicomanganese		1,034	1,742
Ferrochromium		1,172	1,011
Other		245	145
Scrap		128,051	82,373
Lead:			
Unwrought		10,824	15,497
Semimanufactures		889	606
Magnesium, unwrought		8	20
Mercury	76-pound flasks	812	754
Nickel, unwrought and anodes		418	182
Tin, all forms	long tons	523	339
Tungsten, unwrought		1	2
Zinc:			
Unwrought		4,715	5,862
Semimanufactures		407	301
Nonmetals:			
Abrasive		389	247
Asbestos		6,866	6,087
Cement		3,466	6,780
Clays:			
Kaolin		107,564	113,529
Other		51,579	58,708
Fertilizer raw materials:			
Phosphate rock		235,424	253,758
Potassic salt		139,013	139,790
Gypsum and anhydrite		60,084	80,477
Limestone		100,659	74,017
Quartz and quartzite		397	2,550
Quartz sand		57,995	54,338
Salt		274,430	267,332
Steatite		2,844	2,583
Sulfur		83,545	59,372
Mineral fuels:			
Coal:			
Anthracite		247,435	282,448
Bituminous:			
Gas and coking	thousand tons	15	18
Dust	do	1,561	1,256
Other	do	797	627
Lignite	do	8	8
Coke	do	357	352
Petroleum:			
Crude	do	1,510	1,549
Refinery products:			
Gasoline	42-gallon barrels	176	209
Kerosine		24,784	26,938
Diesel oil	thousand tons	1,049	1,358
Residual oil	do	844	586
Lubricants		54,775	50,424
Other		6,575	8,773

[1] Countries of origin are not reported for 1962 and 1963.

Iron and Steel.—Oy Vouksenniska Ab, a privately owned steel company, initiated in 1963 a relatively extensive 2-year development program covering its plants at Imatra and Turku (Abo). The equivalent of US$5 million was allocated to replace an old blast furnace at Turku with one of modern design, capable of producing 120,000 tons of pig iron annually, and to modernize the steel mill at Imatra. This modernization will include new hardening and tempering furnaces for continuous-process heat treatment of steel. Orders for most of the

heavy machinery and equipment had been placed with West German suppliers; the balance was to be supplied by Swedish or local firms.

Construction of the 350,000-ton-annual-capacity blast furnace and sintering plant at Raahe by the State-controlled company of Rautaruukki Ab continued throughout 1963. These initial facilities, supplied by the U.S.S.R., were scheduled to begin operations in early 1964, with iron ore supplied largely by the State-owned Otanmäki Oy. As of 1963, expansion plans included the addition of a melting shop, oxygen plant, and plate mill. The melting shop was to consist of two 50-ton Linz-Donawitz converters and three single-strand continuous-casting machines with an initial annual production of 400,000 tons of steel for the plate mill. Upon completion of these facilities, Rautaruukki Ab would become the largest steel plant in the country, surpassing Vouksenniska Ab. Construction plans also allow for the addition of a third converter and an additional continuous-casting machine at a later date.

Nonferrous Metals and Pyrites.—The State-owned firm of Outokumpu Oy remained the sole nonferrous metals and byproduct pyrite producer in Finland. At its Outokumpu mine, which accounted for over two-thirds of the country's total mine copper output in 1963, pebble mills were substituted for rod mills in the concentrating plant. In its first full year of operation, the new Pyhäsalmi mine produced about 4,300 tons of copper in concentrates, 286,800 tons of pyrite concentrates, and 18,400 tons of mine zinc. The balance of Finland's 1963 mine copper output was contributed by the Ylöjärvi, Vihanti, and Kotalahti mines; Vihanti was the country's major zinc producer and Kotalahti was the only producer of mine nickel.

In its first year of operation, the Kokkola plant of Outokumpu Oy treated about 230,000 tons of pyrite concentrate from Pyhäsalmi, producing 38,000 tons of sulfur and 152,000 tons of pyrite sinter. The plant also generated about 268 million kilowatt-hours of electricity from the waste heat of the metallurgical facility. The research section at Harjavalta, Finland's only copper smelter and nickel refinery, accomplished the separation of cobalt from nickel. Reports indicate that tests were being conducted to recover the cobalt. In the meantime, expansion and modification begun in 1962 at the nearby Pori copper refinery were practically completed during 1963. This refinery produced all of Finland's electrolytic copper, which was oxygen-free high-conductivity material, as well as refined gold, silver, and selenium.

In addition to investigations of the Nivala copper-nickel deposit, preparatory work was carried on at the Kaavi copper and pyrite deposit. However, no definite plans had been made for the start of actual mining.

MINERAL FUELS

Coal and Coke.—Lacking domestic coal production, Finland's demands for this fuel were supplied by imports. Total coal consumption of 2,175,000 tons in 1963 was 1.2 percent less than the 2,202,000 tons consumed in 1962. The marked increase in coal consumption for electric power generation, and the lesser increases in use as locomotive fuel, in the paper and woodworking industry, and for gas and coke manu-

facturing were more than offset by the sharp decline in other minor industries where a fuel oil replaced coal in significant quantities. Coal used for space heating also showed a small decline in 1963.

Approximately two-thirds of the country's consumption of coke in 1963 was supplied by direct imports; the balance was produced domestically from imported coal. Total coke consumption in 1963 was 484,000 tons, compared with 528,000 tons in 1962. The marked decrease of coke used for space heating in 1963 was offset slightly by the minor increase of coke consumed for metallurgical purposes.

Petroleum.—Owing to the expansion program completed in late 1962, the annual input capacity of the Neste Oy Naantali plant, Finland's State-owned and sole oil refinery, was raised from 1.2 to 2.4 million tons. Output of refined products increased to more than 15.5 million barrels, compared with 10 million barrels in 1962. Anticipating continued growth of Finland's consumption of petroleum products, Neste Oy was planning to build oil storage facilities, a harbor, and a second refinery near Porvoo, about 48 kilometers east of Helsinki. Construction of six storage tanks of about 190,000 barrels each began in March 1963, on the site at Sköldvik, which would bring the company's total storage capacity to about 6.3 million barrels. As of early 1963, no final decision had been made on the construction schedule of the refinery, but according to company calculations the consumption of petroleum in the Helsinki economic area alone would justify the erection of this refinery before 1970.

The possibility of the eventual construction of a gas and oil pipeline from Leningrad to Helsinki was also in the news in early 1963. According to a Soviet spokesman, the building of this overland pipeline has been agreed upon in principle between the governments of Finland and the U.S.S.R. If built, the line would be a continuation of the Soviet Leningrad line, scheduled for completion in 1965.

The Mineral Industry of France

By L. Nahai [1]

FRANCE in 1963 ranked third in world production of iron ore, fourth in aluminum, fifth in bauxite, gypsum, and potash, and sixth in cement and in iron and steel. In Western Europe, France was the leading producer of iron ore, bauxite, aluminum, sulfur, and some quarry products and supplied some of the requirements of this area for these commodities as well as for potash.

The national product of France, excluding services, grew in real terms in 1963 by about 5 percent. Sufficient data on mineral production in 1963 are not available to determine whether the mineral industry as a whole had the same growth rate. The substantial drop in production of solid fuels and iron ore may not have been sufficiently compensated by increases in production of petroleum, natural gas, and sulfur to insure a total increase comparable to that of the national product.

Value of mineral output in 1962 was about US$1,590 million [2] including: Solid fuels US$704 million, quarry products US$344 million, metallic minerals US$241 million, nonmetallic minerals other than quarry products US$142 million, and petroleum and natural gas US$106 million. The remainder was accounted for by a value assigned to the uranium mineral output. The total value was equivalent to 2.5 percent of the gross domestic product (production intérieure brute) of US$64,000 million in 1962 prices.

France continued to be an important consumer of minerals. In the case of nonferrous metals (with the notable exception of aluminum), the country remained partially or totally dependent on foreign sources. French smelting facilities were inadequate to meet even domestic needs for most of these metals, notably copper, for which France has no ore smelters. Many industrial minerals such as asbestos, magnesite, and mica, as well as crude phosphate, must also be imported.

In 1962, the mining industry, other than quarrying and slate production, employed 256,000 workers, of which 204,000 were in coal and lignite mining, 26,000 in iron, and 12,400 in potash mining. Approximate employment in quarry and slate mining was 90,000 and in cement and lime plants 13,500. Petroleum exploration, production, and refining employed 27,000. Among metallurgical plants, the iron and steel industry employed about 131,000, the ferroalloy industry 4,500, and the nonferrous metal industry, including secondary metal producers, 9,500. The total of 531,000 workers was about 1 percent of France's industrial labor.

[1] European Common Market specialist, Division of International Activities.

[2] All reported values in France have been converted to U.S. currency at the rate of 1 franc equals US$0.20255.

Starting in 1946 France has had a number of economic development plans, the current or fourth plan spanning the period 1962–65. The successive plans have set production objectives for the basic sectors of the economy, including the mineral producing and processing sector. Although execution of the plans has not been mandatory on industry and other enterprises, the government has provided financial assistance and guidance to such enterprises as have been willing to carry out their expansion program within the objectives of the plan. French industry and agriculture have been very cooperative in this endeavor.

PRODUCTION

Overall French industrial production in 1963 increased by 4.9 percent. Petroleum had the greatest growth rate in the mineral industry. Because of a 7.5 percent increase in natural gas production, sulfur recovered from natural gas increased by 10.5 percent. Nonferrous production increased 7.2 percent, primarily because of increases in aluminum, lead, and zinc production. In response to the rising industrial output, consumption of iron and steel increased by 4 percent, but the increased requirements were met mainly from imports and stocks so that the 1.8-percent rise in iron and steel output did not parallel the rise in industrial activity or steel consumption.

Decline in the index of metallic ore production resulted mainly from lower iron ore output, partly as a result of a strike and partly because of reduced shipments to the European Coal and Steel Community. Solid fuel production declined because of a strike.

Official production data on quarry products and construction materials for 1963 are not available. Increase in public works and construction must have helped maintain the increasing trend in production of materials used by this industry. Monthly averages for a number of items, including lime and cement, increased. However, production of sand and gravel from pits declined slightly. The severe winter adversely influenced output, with production in the first quarter equal to only 13.3 percent of the total for the year.

A 10.3-percent rise in production of salt paralleled that of the chemical industry, but potash production remained at about the same level as in 1962.

TABLE 1.—Index of industrial production

(1959 base = 100)

	1962	1963	Variation 1963–62 (percent)
All industrial production including construction	121	127	+5.0
All industrial production excluding construction	122	128	+4.9
Metal ore mining	109	95	−12.8
Mining and preparation of miscellaneous minerals	117	117	----------
Metal production	116	118	+1.7
Metal working	125	130	+4.0
Building and public works	116	124	+6.9
Construction material mining	118	126	+6.8
Ceramics and fabrication of building materials	123	131	+6.5
Solid fuels	92	84	−8.7
Petroleum	135	159	+17.8
Chemical industry	137	151	+10.2

TABLE 2.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite:					
For alumina—thousand tons	1,607	1,932	2,053	2,058	(1)
For other uses—do	150	135	172	136	(1)
Total—do	1,757	2,067	2,225	2,194	2,003
Alumina: [2]					
Hydrated	608,223	621,986	635,005	650,206	(1)
Calcined	564,929	594,251	583,514	534,701	(1)
Metal, primary	173,011	238,490	279,456	295,097	298,400
Metal, secondary	44,538	43,950	43,000	47,000	(1)
Rolled and extruded, including foil	107,500	128,245	138,700	157,100	163,900
Castings	65,100	70,800	71,400	81,400	(1)
Antimony, smelter	2,280	2,170	2,265	778	(1)
Arsenic [3]	6,034	6,276	7,077	4,786	(1)
Beryllium	11	21	14	15	(1)
Bismuth, smelter—kilograms	60,188	50,195	58,107	55,216	44,000
Cadmium—do	244,400	254,000	254,000	245,000	260,000
Chromium	789	820	708	352	(1)
Cobalt, smelter	306	533	549	631	(1)
Copper:					
Mine	537	562	513	414	379
Secondary blister	4,938	5,348	4,364	6,227	6,458
Refined:					
Electrolytic	27,705	28,543	22,853	25,966	25,436
Secondary from scrap	11,670	11,641	11,598	11,545	7,103
Total	39,375	40,184	34,451	37,511	32,539
Gold—troy ounces	45,300	39,610	45,976	45,751	(1)
Iron and steel:					
Iron ore	60,938	66,964	66,606	66,301	57,885
Pig iron and blast furnace ferroalloys	12,472	14,145	14,566	13,959	14,306
Spiegeleisen and high carbon ferromanganese	352	386	407	408	368
Other ferroalloys [4]	181	216	246	207	(1)
Steel ingots and metal for casting	15,219	17,281	17,570	17,240	17,557
Rolled steel	11,179	13,142	13,465	13,086	13,198
Lead:					
Concentrate	25,652	28,440	29,153	21,643	(1)
Contained metal in lead and zinc concentrates	16,633	18,553	18,856	14,275	6,520
Smelter	69,928	74,387	70,808	70,567	77,628
Secondary	17,881	17,457	10,790	9,107	} 27,972
Antimonial lead [5]	14,306	18,002	16,006	14,621	
Total	102,115	109,846	97,604	94,295	105,600
Magnesium	1,758	2,140	2,070	2,170	1,790
Manganese	578	936	816	1,119	(1)
Nickel, metal content of pure nickel, cast nickel, ferro nickel and nickel oxide	6,527	9,631	10,449	10,244	9,600
Silicon	10,895	15,776	19,215	16,707	(1)
Silver—thousand troy ounces	2,010	3,170	2,610	2,414	(1)
Tantalum				445	(1)
Thorium	200	199	163	74	(1)
Tin:					
Ore		29	224	401	(1)
Metal content—long tons		21	156	281	274
Titanium	5	28	23	18	(1)
Tungsten concentrate, gross weight	804	607	657	624	(1)
Uranium:					
Ore	550,305	684,352	823,796	795,503	(1)
Metal content	804	943	1,104	1,041	(1)
Concentrate (chemical)	1,200	1,737	3,420	4,044	4,642
Metal content	731	984	1,246	1,521	1,529
Metal	525	1,040	960	1,032	1,204
Zinc:					
Concentrate	28,958	31,466	28,549	31,787	(1)
Zinc content of zinc and lead conentrates	15,981	17,176	15,680	14,275	16,088
Smelter	148,034	[6] 149,091	[6] 162,032	[6] 164,221	[7] 168,000
Zinc dust	2,477	3,779	4,963	4,923	4,500
Remelted zinc	28,126	31,676	31,819	31,656	(1)
Zirconium—kilograms	38	39	23	39	(1)

See footnotes at end of table.

TABLE 2.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Alabaster	1,240	1,590	1,260	1,030	(1)
Asbestos	21,192	26,002	27,892	25,400	
Barite	86,418	106,014	86,189	83,978	(1)
Beach pebble	110,542	107,980	159,143	198,708	(1)
Building stone:					
Granite and similar rocks—thousand tons	933	775	870	953	(1)
Limestone—do	3,560	3,373	2,977	2,636	(1)
Marble—do	134	155	180	165	(1)
Other—do	162	105	127	109	(1)
Total—do	4,789	4,408	4,154	3,863	(1)
Cement, all types—do	13,999	14,159	15,381	16,882	17,800
Chalk and similar calcareous rocks—thousand tons	3,260	3,599	3,960	3,253	(1)
Clays:					
Bentonite—do	26,144	22,000	26,736	18,367	(1)
Brick and tile clay—thousand tons	8,001	7,723	7,557	7,902	(1)
Ceramic and pottery clay	342,016	403,220	220,449	284,429	(1)
Clay and marl for cement industry—thousand tons	4,312	4,923	5,817	6,194	(1)
Kaolin and kaolinitic clay	256,753	235,977	257,026	240,059	(1)
Refractory clay—thousand tons	804	864	1,057	893	(1)
Diatomaceous earth	102,350	127,431	107,437	127,090	(1)
Dolomite:					
For agriculture	64,859	74,760	85,649	121,533	(1)
Crude for calcining	437,950	535,354	541,187	474,958	(1)
Other	194,444	156,842	142,879	249,816	(1)
Feldspar and pegmatites	124,491	137,505	173,205	172,924	(1)
Fluorspar	100,176	135,484	194,987	215,200	225,000
Gypsum:					
For agriculture	6,561	10,750	8,835	11,130	(1)
Plaster and cement—thousand tons	3,737	3,715	3,798	3,898	(1)
Anhydrite		50,525	28,371	87,441	(1)
Lava	3,754	5,154	10,081	10,265	(1)
Lime:					
Hydraulic	878,658	968,271	801,404	770,752	(1)
High grade (fat lime)—thousand tons	2,591	2,926	2,946	2,792	(1)
Limestone:					
For agriculture—do	872	705	641	763	(1)
For iron and steel industry—do	4,232	4,501	3,917	3,994	(1)
For lime and cement—do	14,675	15,613	16,659	18,213	(1)
For sugar mills—do	411	517	528	544	(1)
Total—do	20,190	21,336	21,745	23,514	(1)
Marl	196,378	179,669	230,341	305,096	(1)
Mica	304	311	138	86	(1)
Millstone and grindstones	1,285	1,781	1,441	1,357	(1)
Mine fill—thousand tons	13,252	12,427	11,499	12,073	(1)
Ochre and mineral pigments	6,178	6,011	7,772	5,698	(1)
Phosphatic chalk	76,856	58,024	81,500	67,442	(1)
Potash—thousand tons	9,488	9,919	10,860	11,024	11,058
Pumice	1,872	903	1,320	1,702	1,722
Puzzolana and pilli	437,883	431,352	440,642	473,325	507,600
Pyrite	294,387	277,093	285,438	303,954	251,316
Quartz	278,307	322,146	347,646	268,394	(1)
Road building, foundation, and ballast materials (other than sand and gravel):					
Ballast—thousand tons	31,025	34,497	39,914	42,392	(1)
Foundation material—do	1,787	1,966	2,394	2,583	(1)
Paving block and curbing—do	196	168	178	163	(1)
Ground rock for road fillers—do	438	535	541	475	(1)
Total—do	33,446	37,166	43,027	45,613	(1)
Salt—do	3,466	3,724	3,845	4,247	[7] 4,124
Sand and gravel (alluvial only):					
By dredging—do	38,425	40,804	46,404	47,516	(1)
By other winning methods—do	20,542	21,130	23,302	27,629	(1)
Total—do	58,967	61,934	69,706	75,145	(1)

See footnotes at end of table.

TABLE 2.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals—Continued					
Sand, industrial:					
Glass—thousand tons	1,084	1,127	1,105	1,236	(1)
Foundry—do	1,154	1,434	1,617	1,610	(1)
Miscellaneous—do	432	354	355	395	(1)
Total—do	2,670	2,915	3,077	3,241	(1)
Slate:					
Roof	128,169	110,574	106,865	114,972	(1)
Other	34,401	39,401	40,668	44,145	(1)
Sulfur—thousand tons	437	796	1,108	1,355	(1)
Talc	175,566	187,785	222,648	209,903	194,000
Mineral fuels:					
Bituminous and anthracite coal—thousand tons	57,607	55,966	52,363	52,369	47,754
Lignite—do	2,175	2,276	2,906	2,882	2,475
Peat—do	31	19	30	[7] 31	[7] 33
Coke oven coke—do	13,425	13,933	13,757	13,785	13,735
Gas coke—do	1,020	695	430	246	146
Coal briquets—do	6,563	6,072	6,091	6,937	7,999
Natural gas—million cubic feet	97,554	164,805	224,592	261,091	280,672
Petroleum:					
Crude—thousand tons	1,618	1,976	2,163	2,370	2,522
Refinery products—do	[8] 27,625	[8] 29,650	34,948	37,609	44,094
Carbon black	31,200	[7] 35,000	[7] 70,000	(1)	(1)

[1] Data not available.
[2] Hydrated and calcined alumina are successive stages of alumina production and are not to be added.
[3] Arsenic content of final products.
[4] Excludes ferromolybdenum, ferrotungsten, and ferrovanadium, where production data are for contained metals.
[5] Lead content.
[6] Includes distilled zinc from scrap and residues
[7] Estimate.
[8] Shipments.

TRADE

Imports and exports of tabulated minerals and metals in 1963 were equivalent to 28.7 and 17.6 percent of total imports and exports, respectively. Iron and steel, including scrap, ranked first in export values followed by petroleum products, accounting for 9.8 and 3 percent, respectively, of all exports of France. Mineral fuels were the largest imports both in tonnage and value, accounting for 57.2 percent of mineral and metal imports and 16.5 percent of all imports. For petroleum, France had an adverse trade balance of about US$707 million.[3]

In 1963, 38.3 percent of all exports of France were to the other countries of the European Economic Community (EEC)[4] and 54.5 percent to countries of the EEC and the European Free Trade Association (EFTA)[5] combined. The corresponding import figures were 35.8 percent from the EEC and 47.9 percent from the EEC and EFTA combined. For the minerals and metals tabulated, France's exports to the EEC were 48.18 percent and to the EFTA 17.5 percent of the total. For the same commodities, imports from the EEC were 36.7 percent and from the EFTA 6.2 percent of the total.

[3] According to Éléments Statistiques, Activité de l'Industrie Pétrolière, 1963, the adverse balance was US$683 million. The discrepancy results from the fact that this source uses general export figures which include re-exports of refined products.
[4] The EEC includes Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany.
[5] The EFTA includes Austria, Denmark, Norway, Portugal, Sweden, Switzerland, and the United Kingdom.

TABLE 3.—Summary of metal and mineral trade in 1963

(Thousand metric tons unless otherwise specified)

Commodity	Imports		Exports	
	Quantity	Value (thousand U.S. dollars)	Quantity	Value (thousand U.S. dollars)
Iron ore, exclusive of pyrite but including pyrite cinder	3,505	36,035	21,547	79,562
Iron and steel scrap	577	19,099	1,195	38,905
Pig iron and ferroalloys, powder, shot, etc	256	23,988	359	42,008
Iron and steel	3,638	475,805	[1] 5,221	[1] 714,505
Nonferrous:				
Ore [2]	1,575	94,531	[3] 212	5,286
Scrap	45	9,908	114	31,018
Metals	389	239,791	183	89,432
Semimanufactures	28	32,695	57	49,229
Precious metals other than gold thousand troy ounces	26,714	42,640	2,945	6,199
Slags, scalings, dross, other than Thomas slag	751	884	989	4,584
Nonmetals other than stone, sand, and gravel [4]	4,595	76,474	4,540	100,721
Stone, sand and gravel	2,981	12,703	5,005	14,945
Industrial diamond and other natural abrasives	(5)	7,584	(5)	(5)
Mineral fuels:				
Coal, coke, and other solid fuels	22,785	463,764	1,069	16,851
Petroleum:				
Crude	43,258	821,917		
Refinery products	4,608	140,916	7,736	249,770
Natural and manufactured gas	214	9,252	420	9,488
Total	70,865	1,435,849	9,225	276,109
Grand total	89,206	2,507,986	48,647	1,452,503

[1] The total which includes cast iron pipe and fittings and old rails is slightly different from total calculated from ECSC data.
[2] Including copper matte, nickel matte, speiss, etc., silver and platinum ores, uranium and thorium ores.
[3] Of the total 205,900 was bauxite.
[4] Includes lime and cement.
[5] Data not available.

Source: United Nations. Commodity Trade Statistics, 1963. Statistical Papers, ser. D, v. 13, Nos. 1–12, pp. 2155–2282.

French exports of iron and steel to EEC countries which totaled about half of mineral exports to all destinations and exports of iron ore, sulfur, and potash were the principal minerals traded between France and the rest of the EEC. Among the EFTA countries, Austria, the United Kingdom, and Switzerland were important markets for French potash and other fertilizers. Switzerland was the largest market for petroleum products, and the United Kingdom was the third largest after Algeria. France also shipped 36.6 percent of its sulfur to EFTA countries with the United Kingdom as the largest market.

Iron and steel, solid fuels, and some nonferrous metals (copper, lead and zinc) were France's principal imports from its Common Market partners. Of imports from Algeria, valued at US$571 million, petroleum accounted for US$306 million. Phosphate rock and metallic ores imported from Morocco accounted for 18.7 percent of the value of all imports from that country, which totaled US$209.8 million.

France's export in 1962 to the United States comprised iron and steel, aluminum, chromium, cobalt, fluorspar, and potash. Principal imports from the U.S. were coal, boron minerals, and titanium.

TABLE 4.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962 [1]
Metals:			
Aluminum:			
Alumina, calcined	138,333	167,745	Spain 88,436; Switzerland 62,569; Poland 15,031.
Bauxite	256,312	266,628	West Germany 153,091; United Kingdom 102,734; total EEC 158,699.
Ingots	123,807	105,184	Belgium-Luxembourg 39,182; United States 30,463; West Germany 11,381; Netherlands 6,705; Italy 5,078; Argentina 2,513; total EEC 62,346.
Scrap	2,237	7,317	Italy 3,704; West Germany 3,312; total EEC 7,283.
Semifabricated	26,718	29,201	Belgium-Luxembourg 5,581; West Germany 2,255; Italy 1,945; Denmark 1,172; total EEC 10,969.
Antimony	152	82	Switzerland 34.
Beryllium, including semifabricated	2	3	United Kingdom 2.
Bismuth	65	45	United Kingdom 44.
Cadmium	24	22	Italy 6; Spain 5.
Chromium:			
Chromite ore	10	61	EEC 41.
Metal	416	192	United States 150.
Cobalt	231	443	United States 365.
Copper:			
Ores and concentrates	685	----------	
Matte	2,700	428	Italy 189; West Germany 158; total EEC 408.
Scrap	18,687	22,692	Belgium-Luxembourg 7,651; Italy 7,192; West Germany 4,174; total EEC 19,062.
Ingots, including alloys	12,906	15,514	West Germany 6,521; Belgium-Luxembourg 5,676; Italy 2,798; total EEC 14,066.
Copper:			
Refined	1,579	2,477	West Germany 1,309; Italy 648; total EEC 2,309.
Semifabricated	22,666	17,731	Switzerland 3,324; Morocco 1,679; West Germany 1,271; total EEC 4,468.
Gold:			
Re-export—troy ounces	68,224	27,489	Netherlands 10,513; West Germany 7,555; Switzerland 3,987; Belgium-Luxembourg 3,762.
All forms—do	55,428	32,504	Salvador 8,925; Algeria 6,623; Netherlands 5,401.
Iron:			
Ore—thousand tons	25,855	25,683	Belgium-Luxembourg 16,265; West Germany 9,070; United Kingdom 326; total EEC 25,336.
Pyrite cinder—do	402	361	West Germany 294; United Kingdom 46; total EEC 315.
Scrap—do	1,161	1,190	Italy 1,112; West Germany 35; Belgium-Luxembourg 12; total EEC 1,188.
Pig iron, spiegeleisen, and high carbon ferromanganese.—do	415	380	Belgium-Luxembourg 203; West Germany 86; Italy 40; United States 39; total EEC 330.
Ferroalloys except high carbon ferromanganese.—do	66	53	(2).
Ingots, blooms and billets—do	270	168	West Germany 1,322; Italy 572; Switzerland 304; Belgium-Luxembourg 201; United States 188; Netherlands 135; total EEC 2,230.[3]
Rolled steel—do	5,440	4,833	
Cast iron pipes and other—do	117	118	(2).
Lead:			
Ores and concentrates	8,501	4,914	Belgium-Luxembourg 4,108; total EEC 4,504.
Scrap	1,669	7,551	Italy 7,415; total EEC 7,551.
Pig	6,178	5,484	Switzerland 3,854; West Germany 719; total EEC 1,227.
Semifabricated	1,166	770	Norway 210; Algeria 148; Tunisia 39; Morocco 36.
Magnesium:			
Scrap	76	58	West Germany 20.
Ingots	19	5	(2).
Wrought	10	19	Israel 11.
Manganese:			
Ores and concentrates—thousand tons	768	1,622	Italy 856; Switzerland 285; Netherlands 228; total EEC 1,161.
Metal	30	20	(2).

See footnotes at end of table.

TABLE 4.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962 [1]
Metals—Continued			
Mercury----76-pound flasks	319	319	Upper Volta 174; Algeria 58.
Molybdenum, all forms	4	11	(2).
Nickel:			
Matte	51	412	West Germany 322; Italy 8; total EEC 333.
Scrap	1,665	1,095	United Kingdom 443; Italy 378; total EEC 630.
Ingots	3,334	5,351	USSR 3,009; West Germany 465; total EEC 652.
Anodes	264	304	West Germany 124; Italy 52; Spain 35; total EEC 196.
Semifabricated	478	680	Spain 157; Netherlands 98; Belgium-Luxembourg 59; total EEC 309.
Palladium group---thousand dollars	5,316	54	Belgium-Luxembourg 14; Switzerland 13; United States 7; Brazil 6.
Platinum----troy ounces	23,920	31,861	Netherlands 11,028; Brazil 5,498; Switzerland 5,337.
Silver:			
Crude----thousand troy ounces	932	3,922	United States 2,443; Switzerland 707; Spain 418.
Semifabricated----do	1,125	1,222	Mainly to Netherlands.
Thorium and uranium ores and concentrates.	679		
Tin:			
Ores and concentrates	1,559	471	Spain 382; Netherlands 78.
Scrap	78	41	United Kingdom 34; West Germany 6.
Ingots	178	158	Switzerland 43; Netherlands 31.
Semifabricated	185	133	Tunisia 53.
Titanium, vanadium, molybdenum and zirconium ores and concentrates.	743	521	West Germany 411; Netherlands 50; total EEC 469.
Titanium, metal	14	4	(2).
Tungsten:			
Ore and concentrate	395	486	West Germany 385; United Kingdom 100; total EEC 385.
Metal, wrought, unwrought, and scrap.	69	67	West Germany 24; total EEC 27.
Uranium and thorium alloys	6	1	All to Italy.
Zinc:			
Ore and concentrate	24,100	7,282	Belgium-Luxembourg 4,501; Norway 2,703; total EEC 4,579.
Scrap	16	300	Italy 294; West Germany 6; total EEC 300.
Dust	1,578	1,185	Norway 1,175.
Slab	2,313	4,813	West Germany 4,080.
Semifabricated	2,549	2,600	West Germany 1,942; total EEC 1,980.
Other ores and concentrates	404	249	Sweden 22.
Other metals (germanium, hafnium, vanadium, uranium, zirconium, and gallium).	26	15	West Germany 9; Belgium-Luxembourg 3.
Nonmetals:			
Asbestos	11,390	10,062	Belgium-Luxembourg 3,067; West Germany 2,615; Argentina 1,471; total EEC 5,774.
Barite	22,226	18,351	Algeria 7,856; Nigeria 3,978; Switzerland 1,467; total EEC 1,415.
Borates	65	124	(2).
Cement----thousand tons	1,344	1,263	West Germany 269; Ivory Coast 141; Algeria 113; Madagascar 86; Switzerland 85; Italy 82.
Chalk	200,870	208,941	West Germany 89,157; Belgium-Luxembourg 53,213; Netherlands 24,814; total EEC 180,560.
Clays:			
Kaolin, including calcined	46,290	52,350	West Germany 40,873; Netherlands 3,368; Switzerland 1,698; Belgium-Luxembourg 1,128.
Refractory	292,001	306,014	Italy 164,830; West Germany 75,117; Belgium-Luxembourg 45,520; Switzerland 14,716.
Bentonite	2,613	2,867	Algeria 414; Belgium-Luxembourg 360; Tunisia 330; Switzerland 245.
Other	23,840	29,734	West Germany 20,537; Belgium-Luxembourg 5,990; Italy 1,518.
Crushed rock and gravel	thousand tons 1,566	2,123	Switzerland 942; West Germany 814; Belgium-Luxemburg 277; total EEC, 1,147.
Cryolite, natural	2	119	EEC 119.

See footnotes at end of table.

TABLE 4.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962 [1]
Nonmetals—Continued			
Diamond, including powder. thousand dollars	887	1,294	West Germany 241; Belgium-Luxembourg 216; India 167; total EEC 565.
Diatomaceous earth	3,025	14,663	West Germany 11,713; Netherlands 1,075; total EEC 13,459.
Dolomite, including calcined	20,759	24,430	West Germany 7,678; Belgium-Luxembourg 4,776; Switzerland 2,596; Colombia 2,002; total EEC 12,650.
Earth pigments	5,431	6,261	Netherlands 1,769; West Germany 806; Morocco 400; total EEC 2,843.
Feldspar, leucite, and fluorspar	48,965	57,835	West Germany 34,648; Belgium-Luxembourg 10,352; Switzerland 3,238; total EEC 48,042.
Fertilizer raw materials:			
Animal and plant origin	23,034	28,645	Switzerland 16,327; West Germany 3,579; Spain 2,850; Canary Islands 2,640; total EEC 6,153.
Rock phosphate	3,565	1,228	Switzerland 939; total EEC 219.
Potash:			
Crude	244,745	139,875	Belgium-Luxembourg 68,334; Netherlands 48,447; West Germany 10,658; Switzerland 9,511; total EEC 130,080.
Potassium chloride. thousand tons	1,248	1,045	United Kingdom 227; United States 162; Japan 109; Ireland 61.
Potassium and magnesium sulfate.	10,998	13,503	Morocco 3,400; Switzerland 2,629; Tunisia 2,346; Italy 1,469.
Mixed	1,933	70,168	Belgium-Luxembourg 22,491; Switzerland 21,746; Italy 21,369.
Other	263	1,522	Switzerland 881; Italy 541.
Graphite	1,165	1,185	Belgium-Luxembourg 332; West Germany 328; Italy 173; United Kingdom 153; total EEC 833.
Gypsum and plaster	670,300	684,229	Belgium-Luxembourg 324,870; Sweden 134,352; United Kingdom 49,686; Netherlands 41,449; total EEC 395,821.
Lime	110,650	106,740	West Germany 68,516; Belgium Luxembourg 22,164; Algeria 4,703.
Limestone	247,199	223,995	West Germany 95,428; Belgium-Luxembourg 53,248; Switzerland 50,949; total EEC 148,696.
Magnesite	790	821	Gabon 661; Italy 79; total EEC 96.
Marble and other building stones	116,665	109,951	Belgium-Luxembourg 62,451; West Germany 24,785; Switzerland 12,819; total EEC 95,634.
Mica	164	164	West Germany 22; Spain 18.
Pumice and other natural abrasives	458	667	West Germany 559; total EEC 611.
Quartz and quartzite	1,781	1,448	Belgium-Luxembourg 779; Italy 504; total EEC 1,311.
Salt	98,097	104,748	Belgium-Luxembourg 78,719; West Germany 8,722; Netherlands 6,327; total EEC 93,769
Sand thousand tons	999	1,061	Switzerland 419; West Germany 413; Belgium-Luxembourg 108; Italy 108; total EEC 629.
Slate	6,361	7,375	Netherlands 6,125; total EEC 7,290.
Soapstone and talc	44,257	44,819	West Germany 10,538; Switzerland 8,674; United Kingdom 7,119; Belgium-Luxembourg 5,016; total EEC 17,697.
Sulfur	574,975	547,042	United Kingdom 143,949; West Germany 73,854; Netherlands 55,582; Belgium-Luxembourg 32,313; total EEC 161,838.
Other mineral materials	169,230	206,502	Switzerland 175,336; West Germany 17,657; total EEC 27,353.
Slags and ashes:			
Other rejects of the iron and steel industry.	537,475	584,950	West Germany 400,150; Belgium-Luxembourg 106,496; Switzerland 60,002; total EEC 515,018.
Blast furnace dust	431,681	277,585	West Germany 167,648; Belgium-Luxembourg 109,937; total EEC 277,585.
Metalliferous ashes and residues	23,473	18,209	Belgium-Luxembourg 15,334; West Germany 1,399; Italy 892.
Other slags and ashes	92,244	34,846	Belgium-Luxembourg 16,705; Switzerland 12,826; West Germany 4,735; total EEC 22,020.
Thomas slag	287,955	299,318	Austria 139,218; Switzerland 119,857; United Kingdom 35,700.

See footnotes at end of table.

TABLE 4.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962 [1]
Mineral fuels:			
Coal—thousand tons	1,372	1,361	West Germany 674; Belgium 278; Spain 274; total EEC 1,027.
Coal briquets—do	27	36	Italy 22; Switzerland 13; total EEC 23.
Coke—do	106	160	West Germany 111; Italy 16; total EEC 129.
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	15,402	12,464	Algeria 3,424; United Kingdom 2,683; Switzerland 1,127; West Germany 778.
Kerosine—do	5,244	4,766	Algeria 926; Singapore 552; Switzerland 523; Tunisia 435.
Diesel oil—do	1,606	564	United Kingdom 307; Netherlands 80; Belgium-Luxembourg 77.
Gas oil—do	16,294	18,099	Netherlands 3,495; Switzerland 2,845; Algeria 2,657; West Germany 2,518; United Kingdom 2,094.
Fuel oil—do	18,647	15,347	United Kingdom 2,654; Algeria 2,071; Netherlands 1,403; Belgium-Luxembourg 749; Tunisia 692.
Lubricants—do	1,276	1,306	United Kingdom 199; Algeria 195; Belgium-Luxembourg 173; Morocco 108.
Liquefied petroleum gas—do	1,960	1,994	Algeria 538; Belgium-Luxembourg 390; Italy 238; Portugal 195.
Asphalt—do	1,132	781	Algeria 377; Switzerland 184; Belgium-Luxembourg 105.
Other—do	112	103	Morocco 44; Italy 21.
Total—do	61,673	55,424	
Bunkers—do	13,267	14,341	

[1] In the case of most items, the total export to the European Economic Community (EEC) is indicated; some part or all of this EEC total is duplicated in the listing of individual countries wherever Belgium, Italy, Luxembourg, the Netherlands, and/or West Germany appear as a separate entry.
[2] Data not available.
[3] Destinations given are those for steel commodities covered by the European Coal and Steel Community treaty; data on destinations for nontreaty items are not included.

TABLE 5.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962 [1]
Metals:			
Aluminum:			
Alumina, calcined	136,000	195,002	Guinea 146,965.
Bauxite	120,728	101,838	Greece 43,633; Guiana 32,047; Surinam 22,936.
Ingots	42,685	51,565	Cameroon 45,870.
Scrap	521	1,328	Algeria 442; Morocco 73; United Kingdom 41; West Germany 38; Canada 36.
Semifabricated	4,177	7,763	West Germany 3,328; Switzerland 769; Netherlands 609.
Antimony	980	2,175	Mainland China 876; U.S.S.R. 669; West Germany 414.
Bismuth	516	565	United Kingdom 300; Netherlands 105; Japan 74.
Cadmium	651	853	Belgium-Luxembourg 357; U.S.S.R. 154; Republic of the Congo 135; United States 91.
Chromite ore and concentrate	197,747	160,820	U.S.S.R. 55,537; Turkey 41,815; Madagascar 18,232; Iran 17,097.
Cobalt:			
Concentrate	9,309	9,695	Mainly from Morocco.
Metal	162	180	Belgium-Luxembourg 103; Republic of the Congo (Léopoldville) 30.

See footnotes at end of table.

TABLE 5.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962 [1]
Metals—Continued			
Copper:			
Scrap	6,630	9,035	Algeria 5,169; West Germany 1,439; total EEC 2,000.
Ingots, including alloys	11,507	7,055	Republic of the Congo (Léopoldville) 4,877; Belgium-Luxembourg 1,093; total EEC 1,385.
Refined	222,752	226,680	Belgium-Luxembourg 85,773; Federation of Rhodesia 35,570; Republic of the Congo (Léopoldville) 29,128; Canada 13,243; Chile 10,403; total EEC 91,667.
Semifabricated	4,791	6,192	West Germany 2,492; Belgium-Luxembourg 932; United Kingdom 571; total EEC 3,919.
Gold:			
Reexport—troy ounces	120,212	69,381	Switzerland 35,752; United Kingdom 16,558; Netherlands 14,596.
All forms—do	9,677	10,320	Switzerland 4,468; West Germany 1,736; Algeria 1,350; United States 1,250.
Iron and steel:			
Ore—thousand tons	1,699	1,896	Sweden 612; Brazil 211; Peru 187; Belgium-Luxembourg 183; Morocco 173; Spain 159; total EEC 184.
Pyrite cinder	14,737	18,968	Italy 8,673; Spain 5,984; Belgium-Luxembourg 4,311; total EEC 12,984.
Scrap	742,380	367,102	Belgium-Luxembourg 174,888; West Germany 86,083; Netherlands 29,531; total EEC 291,587.
Pig iron, spiegeleisen, and high carbon ferromanganese.—thousand tons	189	175	West Germany 1,708; Belgium-Luxembourg 1,070; total EEC 2,893.[2]
Other ferroalloys—do	23	15	
Ingots, blooms, and billets—do	792	651	
Rolled steel—do	2,344	2,617	
Cast iron pipes and other—do	4	2	
Lead:			
Ores and concentrates	92,353	97,638	Morocco 68,512; Canada 12,781; Australia 5,005.
Scrap	3,083	2,351	Algeria 1,688; Belgium-Luxembourg 170; West Germany 153.
Pig	66,510	67,392	Belgium-Luxembourg 23,138; Morocco 20,849; Tunisia 13,706; total EEC 27,948.
Semifabricated	102	168	West Germany 93; Belgum-Luxembourg 17; United Kingdom 17; total EEC 119.
Magnesium:			
Scrap	5	21	Sweden 17.
Ingots	464	1,176	Canada 215; Norway 202; United Kingdom 141.
Wrought	52	48	West Germany 16; Austria 12.
Manganese ore and concentrate	701,391	717,285	Morocco 271,789; Republic of South Africa 230,922; U.S.S.R. 125,067; India 40,134.
Mercury—76-pound flasks	15,200	14,968	Italy 7,629; Spain 5,163.
Molybdenum:			
Ore	5,731	3,241	United States 2,776.
Metal	33	26	Austria 14; Netherlands 8.
Nickel:			
Matte	14,744	13,771	Mainly from New Caledonia.
Scrap	1,773	1,670	United Kingdom 432; West Germany 360; Switzerland 151.
Ingots	4,231	4,127	United Kingdom 2,926; Canada 1,085.
Anodes	316	371	United Kingdom 194; Switzerland 121.
Semifabricated	1,308	1,368	United Kingdom 704; West Germany 255; Switzerland 231.
Palladium group—troy ounces	31,443	52,181	U.S.S.R. 24,595; Netherlands 23,181.
Platinum—do	88,029	111,660	U.S.S.R. 61,922; United Kingdom 23,792 West Germany 9,581.
Silver:			
Crude—thousand troy ounces	9,641	18,813	United Kingdom 10,921; West Germany 2,119; Belgium-Luxembourg 2,039; mainland China 1,927.
Semifabricated—do	765	587	Switzerland 242; United Kingdom 183; West Germany 127.
Precious metal ashes and debris	4,632	24,994	Switzerland 19,189; Netherlands 2,022.
Thorium and uranium ores and concentrates.	1,569	3,226	Madagascar 1,024.

See footnotes at end of table.

TABLE 5.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962 [1]
Metals—Continued			
Tin:			
Scrap	69	60	Switzerland 51.
Ingots	10,812	11,454	Malaya 5,469; Belgium-Luxembourg 2,908; United Kingdom 1,003; total EEC 3,946.
Semifabricated	28	25	United Kingdom 17; Belgium-Luxembourg 3.
Titanium:			
Ore	77,151	81,997	Malaya 37,500; Senegal 21,393; Spain 15,416; Austria 7,441.
Metal	74	178	United States 112; Japan 30.
Tungsten:			
Ores and concentrates	2,335	2,010	South Korea 661; Czechoslovakia 447; Brazil 262; U.S.S.R. 250.
Wrought, unwrought and scrap	36	39	Netherlands 14; West Germany 14.
Zinc:			
Ores and concentrates	325,533	297,917	Algeria 74,418; Morocco 52,809; Italy 44,947; Peru 29,993; Canada 17,080; total EEC 57,478.
Scrap	8,610	10,711	Netherlands 7,091; Belgium-Luxembourg 2,024; total EEC 9,847.
Dust	4,120	4,150	Belgium-Luxembourg 4,037; total EEC 4,037.
Slab	31,649	32,423	Belgium-Luxembourg 11,523; U.S.S.R. 5,106; Spain 4,800; total EEC 15,590.
Semifabricated	710	588	West Germany 449; Switzerland 9; total EEC 496.
Zirconium ore	16,650	18,940	Australia 17,082; Senegal 1,775.
Other ores and concentrates	16,046	15,538	Morocco 10,198; Australia 1,455.
Other metals	5	6	West Germany 3.
Nonmetals:			
Asbestos	78,017	97,420	Canada 56,938; U.S.S.R. 24,545; Union of South Africa 10,659.
Barite	54,516	51,731	West Germany 44,588; Morocco 4,351; total EEC 44,642.
Borates	25,995	32,542	Turkey 19,122; United States 13,420.
Cement	12,980	30,013	West Germany 15,652; Italy 11,195.
Chalk	4,430	6,433	Belgium-Luxembourg 6,204; total EE 6,411.
Clays:			
Kaolin, including calcined	127,398	151,966	United Kingdom 117,336.
Refractory	174,271	154,844	West Germany 115,279; Belgium-Luxembourg 19,522; United Kingdom 11,192.
Bentonite	82,787	86,087	Algeria 35,491; Morocco 22,518; Greece 19,889.
Other	16,769	15,668	United Kingdom 5,608; West Germany 3,219; India 2,670.
Crushed rock and gravel	716,371	974,524	Belgium-Luxembourg 939,256; total EEC 972,904.
Cryolite, natural	2,213	1,425	Denmark 1,395.
Diamond:			
Industrial—thousand dollars	3,511	4,676	Belgium-Luxembourg 1,310; United Kingdom 1,216; Ireland 1,029; total EEC 1,766.
Powder—do	1,759	2,094	United Kingdom 845; Belgium-Luxembourg 577; Netherlands 449; total EEC 1,037.
Diatomaceous earth	12,549	10,669	Algeria 7,042; West Germany 947; total EEC 1,773.
Dolomite including calcined	168,135	189,926	Belgium-Luxembourg 164,285; West Germany 9,271; Norway 8,201; total EEC 173,556.
Earth pigments	1,284	665	Netherlands 263; Spain 221; total EEC 366.
Feldspar, leucite, and fluorspar	7,976	10,248	West Germany 6,963; Norway 2,368; total EEC 7,343.
Fertilizer raw materials:			
Animal and plant origin	1,252	898	Belgium-Luxembourg 487; West Germany 40; total EEC 585.
Rock phosphate—thousand tons	1,880	2,117	Morocco 1,230; Tunisia 507; Senegal 185; Algeria 147.
Potash:			
Potassium magnesium sulfate	19,746	41,592	Belgium-Luxembourg 40,502.
Mixed		20	[3].
Graphite	5,220	4,855	Madagascar 2,638; Italy 1,223; total EEC 1,603.
Gypsum and plaster	18,303	20,825	West Germany 18,459; total EEC 20,506.

See footnotes at end of table.

TABLE 5.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962 [1]
Nonmetals—Continued			
Lime	115,668	106,004	Belgium-Luxembourg 91,290; West Germany 13,200.
Limestone	159,383	141,587	Belgium-Luxembourg 138,259; total EEC 141,587.
Magnesite	27,324	28,636	Austria 12,774; Greece 9,857; Czechoslovakia 2,657.
Marble and other building stone	48,340	64,153	Italy 25,837; Norway 12,249; Union of South Africa 6,063; total EEC 33,156.
Mica	3,529	3,324	India 1,789; Norway 611; Republic of South Africa 253.
Pumice and other natural abrasives	26,299	32,743	Italy 15,985; West Germany 15,147; total EEC 31,847.
Pyrite	471,537	439,317	Spain 216,443; Cyprus 148,059; Portugal 41,397; Algeria 28,725.
Quartz and quartzite	6,665	4,620	Belgium-Luxembourg 2,139; Italy 865; West Germany 825; total EEC 3,880.
Salt	69,364	77,749	Algeria 41,740; Tunisia 19,331; Italy 13,898; total EEC 16,677.
Sand—thousand tons	837	1,053	Belgium-Luxembourg 541; Netherlands 473.
Slate	508	1,173	Italy 441; Belgium-Luxembourg 340; West Germany 279; total EEC 1,060.
Soapstone and talc	6,728	7,012	Italy 4,194; Austria 1,275; Norway 1,058; total EEC 4,194.
Sulfur	143,206	147,509	Mexico 57,198; Italy 4,201; total EEC 4,522.
Other mineral materials	389,602	813,306	Switzerland 772,944; West Germany 17,360; total EEC 23,421.
Slags and ashes:			
Blast furnace dust	2,905	20	EEC 20.
Metalliferous ashes and residues	6,234	11,876	West Germany 4,928; Morocco 2,419; Belgium-Luxembourg 1,650; Tunisia 1,015.
Other slags and ashes	18,783	39,103	Belgium-Luxemborg 20,932; West Germany 18,151.
Other rejects of the iron and steel industry.	611,848	704,924	West Germany 466,399; Belgium-Luxembourg 231,639; total EEC 703,892.
Thomas slag	608,022	885,428	Belgium-Luxembourg 581,125; West Germany 304,253; total EEC 885,378.
Mineral fuels:			
Coal—thousand tons	10,334	10,807	West Germany 6,185; total EEC 7,823. Netherlands 1,059; United States 778.
Coal briquets—do	419	520	Belgium 223; West Germany 80; total EEC 481.
Coke—do	5,530	4,694	West Germany 3,442; Netherlands 994; total EEC 4,694.
Lignite briquets—do	495	487	West Germany 478; total EEC 487.
Petroleum:			
Crude—thousand 42-gallon barrels	262,059	277,920	Algeria 98,496; Kuwait 59,552; Iraq 53,862; Venezuela 18,186; Saudi Arabia 15,397.
Refinery products:			
Gasoline—do	6,279	6,640	Algeria 1,131; U.S.S.R. 1,009; Rumania 988; Italy 728; Venezuela 517.
Gas oil—do	1,695	1,633	Algeria 532; U.S.S.R. 383; Rumania 286; Saudi Arabia 116.
Fuel oil—do	7,938	11,389	U.S.S.R. 3,308; Algeria 3,002; Rumania 1,865; Italy 908.
Lubricants—do	73	131	Netherlands 26; West Germany 20; United Kingdom 18.
Liquefied petroleum gas.—do	320	369	West Germany 113; Algeria 110; Belgium-Luxembourg 73.
Petroleum coke—do	586	728	United States 379; West Germany 273; Netherlands 76.
Other—do	404	552	Indonesia 302; United States 68; Algeria 61; East Germany 29.
Total—do	279,354	299,362	

[1] In the case of most items, the total import from the European Economic Community (EEC) is indicated; some part or all of this EEC total is duplicated in the listing of individual countries wherever Belgium Italy, Luxembourg, the Netherlands, and/or West Germany appear as a separate entry.

[2] Origins given are for those steel commodities covered by the ECSC treaty; data on origin of nontreaty items are not included.

[3] Data not available.

COMMODITY REVIEW

METALS

Iron and Ferroalloy Ores.—Although production of iron ore in France declined in 1963, the country maintained its position as the world's third largest iron ore producer, accounting for 11 percent of the world production and 73 percent of the European Economic Community (EEC) production. The bulk of the production continued to be from the Lorraine Basin. The minette ore from this basin, smelted to produce high-phosphorus basic pig iron, has met practically all the requirements of the steel industry of Eastern France and of the Saar area's steel industry of West Germany, as well as substantial proportions of the iron ore requirements of the Belgian and Luxembourg steel industries. The Ruhr steel plants of West Germany, however, continued to use very little minette ore. In 1963, French ore constituted 93 percent of iron ore shipments to French steel mills.

TABLE 6.—Marketable iron ore production by basin, total iron ore shipments and stocks

(Thousand metric tons)

	1959	1960	1961	1962	1963
Production:					
Lorraine	57,235	62,725	62,400	62,422	(1)
West (Normandy and Anjou)	3,331	3,849	3,881	3,646	(1)
Pyrénées	330	354	300	203	(1)
Other basins	42	36	25	30	(1)
Total	60,938	66,964	66,606	66,301	57,885
Iron content	18,853	19,957	19,708	19,706	17,240
Shipments:					
Domestic	36,043	39,416	40,153	38,347	36,380
ECSC countries	24,065	26,310	25,568	25,699	[2] 21,341
Other destinations	438	519	424	325	267
Total	60,546	66,245	66,145	64,371	57,988
Stocks	5,178	5,739	6,151	8,059	7,711

[1] Data not available.
[2] Includes Belgium 8,165; West Germany 6,799 (of which 6,577 to the Saar); and United Kingdom 267.

Decline in production of iron ore in 1963 resulted partly from a 19-day strike. Increasing preference of the EEC steel producers for high-grade ore was also a factor. Although total imports of the Community in 1962 and 1963 were about 58 million tons annually, 21.4 million tons were imported from member countries (mainly France) in 1963, compared with 25.8 million tons in 1962. France also imported iron ore to meet part of the needs of the steel plants of the north and to supplement its own production of low-phosphorus high-grade iron ore for open-hearth and oxygen steel which has been produced in increasing quantities. These imports were nearly twice the 1962 level because the plant at Dunkirk used imported ore. The 2,766,000 tons imported in 1963 included 1,025,000 tons from Africa (Mauritania 339,000, Liberia 448,000 and North Africa 170,000); 503,000 tons from Sweden; 571,000 tons from Brazil; 361,000 tons from other non-EEC countries and 192,000 tons from EEC countries. To meet competition, price of Lorraine ore was reduced by US$0.25

per ton in July 1963. Prices in 1962 were about US$3.55 per ton on basis of 32 percent iron.

In 1962, approximately 76 iron mines were active in France of which 58 operated by 37 companies were in the Lorraine Basin. More than half of the mines in Lorraine each produced in excess of 1 million tons of ore in 1961, which was the last year for which output data by mines were available. Most of the mines are controlled by the large steel producers. Union Sidérurgique Lorraine (SIDELOR), with eight mines in the Lorraine Basin, produced 15 percent of the output and this company together with Lorraine-Escaut and de Wendel accounted for one-third of the basin's production.

TABLE 7.—Principal iron mining companies and mines

Mining company	Mines	1961 production (thousand metric tons)	Remarks
Lorraine Basin:			
Union Sidérurgique Lorraine (Sidelor).	Redange and Micheville-Brehan.	[1] 985	30 to 35 percent Fe worked open pit (Redange) and open pit and adit (Micheville).
	Landres-Mairy	[2] 1,638	Shaft entry.
	Orne-Pauline and Saint Marie.	[2] 2,254	32 percent Fe. Orne-Pauline is an adit mine; shaft entry to Saint Marie.
	Fond de la Nove	[2] 1,991	33 percent Fe; shaft entry.
	Aubone-Moineville	[3] 2,208	Shaft entry.
Total		9,076	
de Wendel et Compagnie.	Hayange, Moyeurre and Joeuf.	7,502	7,003,000 tons of the total was calcareous ore.
Société Anonyme de Lorraine-Escaut.	Angevillers, Tucquegnieux, Jarney and Longewy.	[2] 1,085 [1] 419	Calcareous ore 28 percent Fe; siliceous 32 percent; adit entry.
		[2] 1,381	35 percent Fe; shaft entry.
		[2] 870	34 percent Fe; shaft entry.
		[2] 134	Calcareous ore 27 percent Fe; siliceous.
		[1] 243	35 percent.
Total		4,132	
Société Minière des Tenes Renges.	Mont Rouge and Saint Michel.	[2] 1,980 [1] 1,088	Calcareous ore 28 percent Fe; siliceous 35 percent; adit entry.
Société Métallurgique de Knutange.	Aumetz	[2] 689 [1] 316	Calcareous ore 28 percent Fe; siliceous 37 percent; shaft entry.
	Boulange	[2] 503 [1] 441	Calcareous ore 28 percent Fe; siliceous 34 percent; shaft entry.
	Havange	[2] 479 [1] 313	Calcareous ore 30 percent Fe; siliceous 30 percent; shaft entry.
Total		2,741	
Société des Forges et Aciéries de Nord et Lorraine.	Hettange-Grande Ida	[2] 1,812 [2] 933 [1] 248	32 percent Fe; adit entry. Calcareous ore 30 percent Fe; siliceous 34 percent.
Total		2,993	
Union de Consommateurs de Produits Métallurgique et Industriels (UCPMI).	Sainte-Barbe	[2] 846 [1] 147	Calcareous ore 31 percent; siliceous 35 percent; shaft and adit entries.
	Roncourt	[2] 314 [1] 708	Are similar to that at Sainte Barbe shaft entry.
Total		2,015	

See footnotes at end of table.

TABLE 7.—Principal iron mining companies and mines—Continued

Mining company	Mines	1961 production (thousand metric tons)	Remarks
Lorraine Basin—Continued			
Aciéries Réunies de Barbach-Euich-Dedelange (ARBED).	Heydt, Kraemer, Burbach and Maxeville and Bois-du-Four.	[2] 1,423 [1] 578	Heydt is open pit; others are adit mines. Kraemer and Burbach produce calcareous ore 26 to 27 percent Fe, the other two mines siliceous ore, 28 percent Fe.
Total		2,001	
Société des Mines de Bazailles.	Bazailles	[1] 1,976	35 percent Fe; shaft entry.
Société des Mines d'Anderny-Chevillon	Anderng-Chevillon	[2] 1,795	33 percent Fe; shaft entry.
Société des Mines de Fer de Giraumont.	Giraumont-Fleury	[2] 1,766	32 percent Fe; shaft entry.
Société des Mines d'Ammermont-Dommary	Ammermont-Dommary	[2] 1,687	33 percent Fe; shaft entry.
Société des Forges et Aciéres du Nord et de l'Est.	Prennes	[2] 1,634	34 percent Fe; shaft entry.
Société anonyme des Hauts Fourneaux de la Chiers.	Saulnes-Sud and Gustav Wiesner.	1,595	Saulnes-Sud, siliceous ore, 36 percent Fe; open pit; Gustaf-Wiesner, calcareous ore, 28 percent, Fe shaft entry.
Société des Aciéreis et Tréfileries de Neuve-Maisons, Chatillon.	Maron-Val-de-Fer	[2] 1,028 [1] 548	Calcareous and siliceous ores, 30 percent Fe; adit entry.
Total		1,576	
Other		16,845	Includes nine companies with production 1 to 1.5 million tons in 1961; 13 other companies with production 170,000 to 800,000 tons in 1961.
Normandy district:			
Société des Mines de Soumont.	Soumont	971	Siderite, some hematite, 46 percent Fe, after calcining.
Société des Hauts Fourneaux, Forges et Aciéries de Denain et Anzin.	La Fervière-aux-E'tangs	684	Carbonate ore, 47 percent Fe after calcining; shaft entry.
Compagnie des Forges de Chatillon, Commentry et Neuve-Maisons.	Halouze	585	Carbonate ore, calcined to 48 to 50 percent Fe; shaft entry.
Other		564	

[1] Siliceous.
[2] Calcareous.
[3] Siliceous and calcareous, undifferentiated.

Selective mining is required to assure a satisfactory blend of the calcareous and siliceous fractions. The average iron content dropped by 2.3 percent during 1953–62; in 1962 it was 28.8 percent on wet basis. On calcining, the grade is increased to about 39 percent iron; an additional 17 percent is combined oxygen. In the calcined ore, the ratio of iron to gangue is not much less than 1 : 6.[6]

As a result of mechanization, productivity in mines of Lorraine more than doubled during 1952–62. It averaged 13.5 tons per man-shift in 1962 for underground and open-pit mines combined, although in some mines it attained 24 tons per man-shift. Mining cost varied from US$1.50 to US$3.40 per ton, the lower figure being applicable only to open-pit mines.

[6] Malcor, Henri. Stahl und Eisen, (Düsseldorf, Germany), v. 83, No. 10, October 1963, pp. 1277–1286.

Reserves of the Lorraine Basin were estimated at 3,300 million tons of calcareous ore and 2,800 million tons of siliceous ore.[7] Calcareous ore is defined as that having a $CaO : SiO_2$ ratio greater than 1.3:1. If the 1962 production ratio of calcareous ore to siliceous ore were to be continued, the reserves of the calcareous ore would be exhausted before all the siliceous ores would be used. Reserves of the two types of ores have a ratio of 1.2:1 in favor of the calcareous ore, but sale of the calcareous ore in 1962 was 3.9 times that of the siliceous ore. The Institut de Recherches de la Sidérurgie (IRSID) has done research on methods to increase the ratio of siliceous ore to calcareous ore in blast furnace burden and on methods to beneficiate the ore to meet competition from imported high-grade ores.

Beneficiation of minette ore has proven difficult because of a number of factors. Fine grinding is required to separate the different components of the ore, although with sintering this is not as serious a matter as it was prior to the initiation of sintering. Furthermore, in some cases, 25 to 40 percent of the ore's iron value is carried by chlorite in which the iron and silica are chemically combined. Also nearly 25 percent of total minette iron ore output consists of iron-bearing shales, which on grinding cause serious dust problems in the sinter plant.[8] Wet gravity separation followed by flotation has the disadvantage that the lime is removed easily and iron recovery is poor. Beneficiation involving previous drying of an ore which is not highly chloritic, followed by high-intensity magnetic separation, and preliminary roasting of chloritic ore followed by magnetic separation has been successful; therefore, building of a large plant is envisaged. Since 1950, quality of the ore fed to furnaces has been improved by sintering which has been widely adopted. Four new sintering plants were started during the year. It is expected that by 1965, 25 million tons of ore will be sintered annually and self-fluxing sinter in which limestone is added will be used increasingly.

Of the ferroalloy ores, France has produced only tungsten and insignificant quantities of manganese in the past. Manganese and chromite were the most important ferroalloy ores imported.

Total manganese consumption was 693,000 tons in 1962 (708,000 tons in 1961), of which the iron and steel industry consumed about 619,000 tons. The iron and steel industry also accounted for 80 to 90 percent of chromite consumption. The chemical industry was the principal consumer of the remainder of the chromite.

Iron and Steel.—*Production.*—In 1963, France produced 4.6 percent of the world's pig iron and 4.7 percent of the world's crude steel compared with 5.1 and 5 percent, respectively, in 1962. In spite of the relative decline, actual 1963 output of both pig crude steel increased. In the EEC, France ranked second after West Germany with 24 percent of the Community's crude steel output. Pig iron production in 1963 was equivalent to 81.4 percent of maximum possible output and crude steel production equalled 84.2 percent of capacity.

The number of operating blast furnaces has gradually decreased as a result of modernization programs which included the dismantling of numerous old and obsolete furnaces. The fourth plan for 1962–65

[7] Work cited in footnote 6.
[8] Work cited in footnote 6.

calls for renovating 26 old furnaces and building of 12 new ones to bring total capacity to 20.5 million tons by 1965, compared with 17.56 million tons in 1963.

In spite of a substantial reduction in rate of coke consumption in the blast furnace, France still had the second highest coke consump-

TABLE 8.—Salient iron and steel industry statistics

(Thousand metric tons unless otherwise specified)

	1961	1962	1963
Number of blast furnaces: [1]			
Available	143	141	143
In operation	115	104	97
Pig iron production	14,566	13,959	14,306
Raw materials consumption for pig iron production:			
Iron ore directly in blast furnaces	33,303	28,295	21,860
Iron ore in sintering plants	7,912	11,279	17,135
Total	41,215	39,574	38,995
Sinter in blast furnaces	7,421	10,067	14,335
Manganese ore:			
In blast furnaces	598	582	569
In sintering plants	44	37	39
Limestone	667	487	430
Scrap	1,219	883	833
Coke in blast furnaces	13,905	12,789	12,091
Metallurgical rejects	1,232	1,199	1,120
Raw material consumption per ton of pig iron produced:			
Coke—kilograms	956	917	846
Sinter—do	516	722	1,003
Scrap—do	85	65	58
Number of steelworks: [1]			
Thomas converters:			
Available	102	105	104
In operation	99	102	99
Open-hearth furnaces:			
Available	99	94	94
In operation	67	66	60
Electric furnaces:			
Available	127	131	128
In operation	104	109	108
Crude steel production:			
Ingots	17,211	16,870	17,211
Castings	359	370	346
Total	17,570	17,240	17,557
Raw material consumption of steelworks:			
Pig iron, spiegeleisen, and ferroalloys:			
From Thomas converters	11,375	10,996	10,767
From open hearth	1,211	1,113	1,070
From electric and other	455	652	1,242
Total [2]	13,041	12,761	13,079
Scrap	6,307	6,131	6,204
Lime	1,793	1,727	1,746
Iron ore	140	147	151
Consumption per ton of crude steel produced:			
Pig iron—kilograms	735	735	739
Scrap—do	363	361	368
Total rolled steel production	13,465	13,086	13,198
Total consumption of iron and steel industry:			
Iron ore	41,355	39,722	39,146
Scrap	7,598	7,088	7,115
Coke	14,680	13,714	13,522
Coal other than coking coal	1,423	1,570	1,605
Fuel oil	801	909	1,093
Thomas slag production	2,415	2,375	2,351
Average total employment (workers and staff) persons	132,609	130,854	130,591

[1] At yearend except where otherwise noted.

[2] Includes high carbon ferromanganese and other ferroalloys as follows: 1961—358,000 tons; 1962—339,000 tons; and 1963—327,000 tons.

Source: Bulletin de la Chambre Syndicale de la Sidérurgie Française, 1963, No. 441.

tion per ton of pig in the Community after Luxembourg, essentially because of the low grade of iron ore used. To reduce coke consumption further, liquid fuel and powdered coal injection as well as oxygen enrichment of the blast were practiced.

Thomas pig iron constituted 84 percent of the total output. The almost threefold increase in hematite and semihematite pig iron production, largely from imported ore, did not materially alter the predominant position of Thomas pig iron.

TABLE 9.—Estimates of effective production capacity of pig iron and crude steel

(Thousand metric tons)

	1959	1961	1962	1963	1965
Pig iron	13,500	15,650	16,100	17,560	20,500
Crude steel	16,180	18,560	19,545	20,835	[1] 22,400

[1] The fourth plan's target of 24.5 million tons output in 1965 has been revised downward.

TABLE 10.—Iron and steel production by processes

(Thousand metric tons)

	1959	1960	1961	1962	1963
Pig iron:					
Thomas	10,937	12,337	12,672	12,169	12,069
Open hearth	274	407	358	270	782
Phosphorous (foundry)	391	425	464	448	447
Open hearth (foundry)	282	332	367	372	444
Spiegeleisen and high carbon ferromanganese	352	386	407	410	368
Special pig iron (foundry)	236	258	289	290	196
Total	12,472	14,145	[1] 14,566	13,959	14,306
Crude steel:					
Thomas	9,263	10,458	10,404	10,026	9,833
Open hearth	4,554	5,130	5,062	4,926	4,774
Electric	1,291	1,494	1,566	1,526	1,526
Bessemer	109	102	112	101	81
Kaldo, L-D, and similar	----	95	423	658	1,341
Creuset	2	2	3	3	2
Total	15,219	17,281	17,570	17,240	17,557

[1] Includes 9,448 tons of special pig iron for steelmaking.

Practically all the Thomas pig iron was produced in the east and north districts; the respective share of these districts in total output in 1963 were 74 and 19 percent, respectively. Foundry iron was produced mostly in the center and southeast districts. Of the 97 blast furnaces in operation on December 31, 1963, 72 were in the east, 15 in the north, 5 in the southwest, 1 in the southeast and 4 in the west districts.

Thomas steel and open-hearth steel constituted respectively 56 percent and 27 percent of 1963 total crude steel output. There has been a significant increase in steel produced by the Linz-Donawitz, Kaldo, and similar processes, using oxygen, although tonnagewise the output is still small.

Production of high-grade and alloy steel amounted to 1,132,000 tons in 1963, compared with 1,459,000 tons in 1962 and 1,532,100 tons in 1961. Of the 1963 total, structural high-grade carbon steel represented

36.7 percent, structural alloy steel 37.8 percent, ball-bearing steel 5.2 percent, and stainless steel 14.8 percent. Stainless steel production increased to 212,000 tons in 1963 from 179,000 tons in 1962.

As with pig iron, the east and north districts were predominant in steel; those districts accounted for 64.4 and 25 percent, respectively, of the total production in 1963. In the same year, 82.8 percent of the Thomas steel was produced in the east district. The east and north districts each produced 46 and 44 percent of the open-hearth steel, respectively. Fifty-eight percent of the electric steel originated in the center and southeast districts.

TABLE 11.—Pig iron and steel production by district

(Thousand metric tons)

Commodity and district	1959	1960	1961	1962	1963
Pig iron:					
East 1	4,824	5,227	5,501	5,490	5,503
East 2	4,783	5,442	5,478	5,118	5,045
North	1,894	2,262	2,329	2,264	2,708
Center	39	13			
Southwest	194	256	278	279	271
Southeast	110	150	187	146	99
West	628	795	793	662	680
Total	12,472	14,145	14,566	13,959	14,306
Crude steel:					
East 1	4,537	5,015	5,236	5,146	5,076
East 2	5,669	6,324	6,314	6,198	6,229
North	3,367	3,970	3,988	3,966	4,392
Center	660	831	856	817	779
Southwest	82	117	110	85	73
Southeast	256	307	320	315	324
West	648	717	746	713	683
Total	15,219	17,281	17,570	17,240	[1] 17,557

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

Source: Bulletin de la Chambre Syndicale de la Sidérurgie Française.

In rolled steel, the share of flat products in total output continued to increase; growth in this category consisted mainly of cold rolled thin sheets. Investment in flat product facilities accounted for 53.4 percent and 60 percent, respectively, of total investment expenditures in rolling mills in 1961 and 1962. Of the total tinplate production in 1962, 421,400 tons was made electrolytically and 172,400 tons was made by hot dip.

Investments in the iron and steel industry as a whole during 1961 and 1962 were equivalent to US$395 million and US$435 million, respectively. Investment in 1963 dropped 25 percent to about US$326 million. Keen competition for the steel market and resulting low prices adversely affected resources for self-financing of the industry. Furthermore, the industry's indebtedness now corresponds to 70 percent of yearly sales. Production of steel pipes increased slightly.

Consumption.—Apparent consumption of steel [9] converted to crude steel totaled 16,107,000 tons compared with 15,386,000 tons in 1962 and

[9] In the trade data used for calculation of apparent consumption only European Coal and Steel Community (ECSC) treaty items have been included which comprise the majority of rolled products but exclude forged products, cold drawn wire and steel pipes and fittings.

14,718,000 tons in 1961. Per capita consumption for 1961, 1962, and 1963 were 337, 329, and 320 kilograms, respectively. Delivery of domestic steel to the home market in 1963 remained practically the same as in 1962 although there was a 4-percent consumption increase.

TABLE 12.—Rolled steel production by type and district

(Thousand metric tons)

	1959	1960	1961	1962	1963
Distribution by type:					
Rails and accessories	330	445	440	460	338
Heavy structural	784	855	877	897	848
Wire rods	1,553	1,814	1,931	1,753	1,870
Bars	2,804	3,196	3,253	3,210	3,067
Pipe skelp	494	650	606	554	529
Flat products:					
Wide plates	52	66	76	78	81
Hot rolled sheets:					
4.76 millimeters or more thick	870	939	1,055	928	935
3 to 4.76 millimeters thick	309	366	478	511	516
Less than 3 millimeters thick	1,014	1,165	968	734	641
Cold rolled sheets less than 3 millimeters thick	2,081	2,667	2,770	2,929	3,282
Hot rolled strips for tubes	839	935	982	998	1,061
Other	49	44	27	34	30
Total, flat products	5,214	6,182	6,356	6,212	6,546
Total	11,179	13,142	[1] 13,465	13,086	13,198
Galvanized and other plated sheets [1]	326	357	370	360	407
Condenser sheets [1]	173	208	222	196	178
Tinplate [1]	514	604	537	588	592
Distribution by district: [2]					
East 1	3,415	3,879	4,090	3,967	3,853
East 2	3,942	4,715	4,861	4,739	4,853
North	2,676	3,146	3,072	2,999	3,169
Center	367	456	486	467	430
Southwest	31	40	38	32	29
Southeast	142	173	175	165	157
West	606	733	743	716	708
Total	11,179	13,142	13,465	[3] 13,086	[3] 13,198

[1] Detail does not add to total because of rounding.
[2] Excluded from total because these forms are produced from items listed above.
[3] Does not include galvanized sheets, condenser sheets, and tinplate, which are produced from other listed items and which therefore are not additive.

Source: Bulletin de la Chambre Syndicale de la Sidérurgie Française.

TABLE 13.—Production and shipment of steel pipes

(Metric tons)

	1960	1961	1962	1963
Production:				
Pipes with a diameter over 406 millimeters (16 inches)	68,600	(1)	64,257	50,000
Pipes with a diameter of less than 406 millimeters (16 inches)	983,500	(1)	1,018,284	1,040,000
Total	1,052,100	1,192,700	1,082,541	1,090,000
Deliveries:				
Internal market	582,900	614,350	663,000	726,000
Franc-zone	107,100	70,600	65,284	71,000
Other markets	293,500	325,200	290,000	242,000
Total	983,500	1,010,150	1,018,284	1,039,000

[1] Data not available.

TABLE 14.—Steel and foundry iron delivery to the internal market

(Thousand metric tons)

	1961	1962	1963
Steel:			
Domestic market:			
Merchants and dealers	2,301	2,396	2,421
Steel for conversion into another product [1]	2,424	2,240	2,291
Manufacturing industries	1,589	1,539	1,502
Construction and associated industries	898	908	883
Automobile industry	908	1,042	1,080
Railroads	469	444	479
Other	989	943	880
Total	9,578	9,512	9,536
Of which:			
Tinplate	230	229	257
Special steel	968	949	925
Export market [2]	4,969	4,433	4,475
Total steel [2]	14,547	13,945	14,011
Pig iron:			
Domestic market	1,657	1,407	1,387
Of which foundry	1,100	1,075	1,026
Export market	415	380	292
Total pig iron	2,072	1,787	1,679

[1] For making pipes and tubes, wire drawing, cold rolling, etc.
[2] Total excludes pipes, cold drawn wire, and forgings.

Rate of activity of the consumer goods industries followed an upward trend; notably automobile manufacture increased by 13 percent. Steel consumers met the increased demand by drawing on their stocks and through increased imports. Consumer stocks were low at the end of the year.

The increase in the industrial production in 1962 (6 percent) was not paralleled by similar increase in steel demand. This is explained by the fact that the index of production refers to a number of industries which consume little or no steel. Furthermore, capital goods industries expanded at a slower rate than in the previous year. A similar disparity between the activity of steel-using industries and steel deliveries from French mills is explained by increased imports and withdrawal from stocks.

International steel prices continued to decline for the 4th consecutive year until the latter months of 1964 because of competition from other sources. The average value of French steel exports to countries outside the ECSC dropped from US$153 per ton in 1960 to US$126 in 1962 and US$116 in 1963. This situation led to mounting pressure to increase the external tariff of ECSC countries for rolled steel products.

Trade.—In 1963, France exported 292,000 tons of pig iron and blast furnace ferroalloys, 268,000 tons ingots, blooms, and billets as well as 4,803,000 tons of rolled steel including steel pipes, cold drawn wire, and forged products.[10] Of the rolled steel products, approximately 140,000 tons were special and alloy steels. In addition 122,000 tons of cast iron pipes and accessories were also exported. The European Economic Community received 88 percent of the pig iron, 51 percent of ingots, blooms, and billets as well as 54 percent of ECSC treaty rolled steel items (which exclude steel pipes and fittings, cold drawn

[10] Office Statistique des Communautés Européenes Sidérurgie. 1964, No. 2.

wire, and forged steel). Other large destinations for steel and the quantities shipped to them were Switzerland—315,300 tons; United Kingdom—114,000 tons; other European countries—630,000 tons; United States—271,100 tons; Asia and Oceania (excluding franc zone countires)—264,700 tons; Africa (excluding franc zone countries)—80,000 tons; and total franc zone—376,900 tons.

Imports of steel into France increased significantly. The EEC was the import source for 81 percent of pig iron and blast furnace ferroalloys, 95 percent of ingots, blooms, and billets, as well as 92 percent of rolled steel. Sheets, including tinplate constituted the largest commodity group both in imports and exports.

TABLE 15.—Iron and steel trade in 1963

(Thousand metric tons)

Type of product	Imports		Exports	
	Tons	Percent	Tons	Percent
Ingots, blooms, and billets	674	19	268	5
Hot rolled coils	443	12	112	2
Railroad material	5		90	2
Sections	357	10	500	10
Bars and rods	516	14	731	14
Wire rods	107	3	631	13
Hot rolled strips	200	5	216	4
Plates	48	1	36	1
Sheets, including galvanized and tinplate	1,070	30	1,880	37
Steel pipes	99	3	422	8
Cold drawn wire	42	1	111	2
Forged and formed	64	2	74	2
Total	3,625	100	5,071	100

Source: Office Statistique des Communautés Européennes. Sidérurgie, 1964, No. 2. Data are preliminary figures and are not exactly reconcilable with those given in table 14.

The opening of the Moselle Canal between Thionville in Lorraine and the junction of the Moselle and Rhine Rivers at Koblenz in West Germany promised to improve the competitive position of the Lorraine steel industry. The industry expected to make savings in the transport costs for imports of Ruhr coke and exports of steel to West Germany, particularly in the growing steel market of southern Germany. The 271-kilometer canal can handle 1,500-ton vessels.

Principal Companies and Plants.—There were 55 firms with 76 plants producing iron and steel in France during 1963. Of these, six firms produced 69 percent of 1963 total crude steel output. In terms of annual production capacity, 60 of the 75 plants had the following size distribution: More than 2 million tons—1; 1.5 to 2 million tons—2; more than 1 to 1.5 million tons—4; more than one-half to 1 million tons—9; half a million tons and less—45.

The integrated plant at Dunkirk, which started production of pig iron in February 1963, was the largest and newest plant in France. It has two blast furnaces, designed to produce 5,000 tons of pig iron per day, and three 140-ton converters. Plates and hot rolled strips and coils are main products. The plant operated largely on imported high-grade iron ore. De Wendel and SIDELOR announced their intention to establish a 1.6-million-ton-per-year-capacity plant at Gandrange on the banks of the Moselle Canal. It will consist of an oxygen steel plant and a continuous merchant mill.

TABLE 16.—Selected iron and steel companies

District and company	1963 production (thousand metric tons)	Plant location	Furnaces				Remarks
			Blast	Thomas converter	Open hearth [2]	Oxygen converter	
East: [1]							
Union Sidérurgique Lorraine (Sidelor).	2,400	Aubone, Hautmont, Homécourt, Micheville and Rombas.	21	17	9 (3)	----------	The company was formed in 1950 when certain Lorraine Basin operations of Pont-à-Mousson and Marine et Homécourt were joined. The company produces heavy sections, wire rods, merchant steel, and strip.
Société Lorraine de Laminage Continue S.A. (SOLLAC).	(3)	Ébange, Sérémange, Florange.	------	4	4	----------	Formed in 1948, it began operations in 1953. De Wendel has controlling interest, Pont-à-Mousson owns 40 percent, and three other companies own the small remainder of the shares. Sollac has only rolling mills. It produces sheets and strips and owns a large part of France's electrolytic tin capacity.
Société des Fonderies de Pont-à-Mousson.	(3)	Pont-à-Mousson, Belleville.	5	4	--------	----------	Company produces heavy plate, forgings, centrifugal cast pipes and tubes.
Lorraine-Escaut	2,056	Brevilly, Thionville, Longwy, Sedan, Anzin, Maubeuge, Laval Dieu.	14	17	16(8)	----------	Owned 49 percent by De Wendel and 51 percent by Longwy-Raty. Produces heavy sections, wire rods, merchant steel, sheets, and strips.
De Wendel et Cie S.A.	2,736	Hayange, Moyeuvre, Joeuf, Messempre.	24	17	6	----------	Produces heavy sections, wire bars, merchant steel, sheets, and strips.
S.A. des Hauts Fournaux de La Chiers.	(3)	Longwy, Blagny, Vireux-Molhain.	5	5	5(2)	----------	Produces wire bars, merchant steel, sheets, and strips.
Société Métallurgique de Knutange.	1,600	----------	9	6	--------	----------	Produces heavy sections, merchant steel.
S.A. des Laminoirs Hauts Fourneaux, Forges, Fonderies et Usines de la Providence.	(3)	Rehon, Hautmont.	6	5	3(1)	----------	Produces sections, merchant steel sheets and strips.

See footnotes at end of table.

TABLE 16.—Selected iron and steel companies—Continued

District and company	1963 production (thousand metric tons)	Plant location	Furnaces				Remarks
			Blast	Thomas converter	Open hearth [2]	Oxygen converter	
East [1]—Continued							
Union de Consommateurs de Produits Métallurgiques et Industriels (UCPMI).	(3)	Hagondange	6	5	4	2	Produces heavy sections and wire bars.
North:							
Union Sidérurgique du Nord de la France (USINOR).	3,297	Dunkirk, Denain, Montataire, Valenciennes, Louvroil-Hautmont, Anzin.	14	12(1)	20	30 L-D and 1 oxygen.	Formed in 1948 by merger of Denain-Anzin and Forges et Acieries du Nord et d'Est, it is largest steel company. Produces heavy sections, plates, merchant steel, sheets, and strips.
Société Metallurgique de Normandie.	(3)	Mondeville	3	4	4		Produces merchant steel, sections, wire rods, drawn wire products, rounds for tubes.
Center:							
Cie des Ateliers et Forges de la Loire (CAFL).	(3)	Onzion, St. Etienne, St. Chamond, Ondaine, Le Boucau, Firminy, Unieux, Assailly.	4		5(11)		Produces wire bars, merchant steel, strips, and sheets (more than 3 millimeters thickness).
Société des Forges et Ateliers de Creusot (USINES Schneider).	(3)	Le Creusot			2(6)		Produces heavy and medium plates and sheets in special and alloy steels, wire rods, round and square.

[1] Districts apply to majority of plants owned by each company.
[2] Number in parentheses refers to electric furnaces
[3] Data not available.

Application of the Société Métallurgique de Knutange, Paris, and l'Union de Consommateurs de Produits Métallurgiques et Industriels (UCPMI), Paris, to merge was under study by the High Authority of the ECSC at yearend. The proposed new firm, to be called La Société Mosellane de Sidérurgie (SOMOSID) with a capital of Fr150 million, would rank as France's fifth largest steel producer. Its 2 plants at Hagondange and Knutange in Lorraine have a coke oven plant, 14 blast furnaces, 2 Thomas converters, and 1 open-hearth furnace as well as rolling mills and metalworking installations. The two firms in 1962 produced 4.8 million tons of iron ore, 5.6 million tons of pig iron, and 1.6 million tons of steel.

Ferroalloys.—France's diversified ferroalloy industry continued to produce a wide variety of ferroalloys and ferroalloy metals in blast furnaces, electric furnaces, and by alumina-thermic methods. Output was mainly for domestic consumption. The large steel companies in the north and east produced special steels and much of the blast fur-

nace ferroalloys. The Société des Acièrs fin de l'Est and Société des Acièries de Pompey among others also produced special steels in the east. However, electrometallurgical plants for production of these steels and ferroalloys were concentrated in the center and southeast districts, with the St. Étienne-Lyon area as the most important center. Hydroelectric power plants in southeast France have consistently supplied low-cost electricity to the electrometallurgical plants. Major producing firms in 1963 were Compagnie des Ateliérs et Forges de la Loire with plant at St. Étienne, Société des Forges et Ateliérs du Creusot with plant at Le Creusot, Société d'Électro-Chimie, d'Électro-Métallurgie et des Acièries d'Électriques de Ugine (Ugine) with plant at Ugine, and Compagnie de Produits Chimiques et Electrométallurgiques Péchiney (Péchiney), with plant at Chedde. Ugine, the largest ferroalloy producer in the country, continued to make cobalt, manganese, molybdenum, titanium, vanadium, and zirconium metals as well as their ferroalloys. Péchiney produced chromium and manganese metals at its Chedde plant and ferrochrome at Isbergues in Pas-de-Calais Département.

TABLE 17.—Consumption of ferroalloy metals and production of electric furnace ferroalloys by the iron and steel industry

(Metric tons)

Commodity	1960	1961	1962	1963
Consumption of ferroalloy metals:				
Nickel	13,082	11,617	9,409	10,756
Cobalt	478	421	387	495
Chromium metal	183	165	117	175
Chromium in ferrochrome	28,568	29,168	25,540	26,560
Molybdenum	1,586	1,645	1,295	1,394
Tungsten	704	830	625	545
Vanadium	200	234	222	220
Titanium	581	733	503	592
Production of electric furnace ferroalloys:				
Ferrosilicon [1]	107,632	130,854	105,293	(2)
Ferrochromium	59,923	67,397	56,919	(2)
Ferromanganese	27,869	26,251	28,531	(2)
Silico-spiegel	14,266	15,656	12,475	(2)
Ferrotitanium	5,659	4,736	2,778	(2)
Ferronickel				(2)
Ferroaluminum	496	611	563	(2)
Other	463	538	393	(2)
Total	216,308	246,043	206,952	(2)
Ferromolybdenum [3]	2,069	1,985	1,620	(2)
Ferrotungsten [3]	860	1,130	883	(2)
Ferrovanadium [3]	484	449	279	(2)

[1] Adjusted to 50 percent silicon. Includes minor ferro-silico-magnesium, ferro-silico-aluminum, and ferro-silico-manganese-aluminum alloys.
[2] Data not available.
[3] Contained ferroalloy metal.

Source: For consumption data—Syndicat des Producteurs d'Aciers fins et spèciaux. For production data—Ministère de l'Industrie, Bureau Centrale de Statistique Industrielle (Paris). Annuaire de Statistique Industrielle. Seizième Annèe, 1963, p. 59.

Of the ferroalloys produced in electric furnaces in 1962, nearly 50 percent was ferrosilicon which was produced from domestic quartz and quartz-bearing rocks. Manganese ore as well as blast furnace ferromanganese and spiegeleisen serve as raw material for electric-furnace production of medium and low carbon ferromanganese. Since

1959, ferronickel production has not been reported; the ferroalloy was imported from the plant of Société le Nickel in New Caledonia. Electrolytic nickel was made by Société Sopumet.

France exports ferromanganese regularly. A substantial share of the chromium metal output is also exported—55 percent in 1962, mainly to the United States.

Iron and Steel Scrap.—Scrap collection increased by 1.7 percent. Consumption of scrap per unit production of pig iron and crude steel diminished so that total consumption of the steel industry was only 0.3 percent more than in 1962. Sources of scrap supply in the last 3 years were as follows:

	1961	1962	1963
Home scrap (steel industry's own):			
Thousand tons	4,070	4,041	4,103
Percent of all scrap	54.1	57.6	58.3
Purchase:			
Thousand tons	3,455	2,974	2,934
Kilograms per ton of steel produced	200	175	170

Nonferrous Metals.—France was more important as a consumer of nonferrous metals than as a producer or refiner. Of the major commodities in this group, only aluminum was produced in significant quantities from domestic resources. Most of the copper, lead, and zinc requirements were met by imports in form of concentrates and metals. Antimony, bismuth, cadmium, chromium, cobalt, magnesium, manganese, gold and silver, thorium and uranium metals were produced directly or as byproducts from domestic and imported ores.

Société Minière et Métallurigique de Penarroya (Penarroya), Société Anonyme des Mines et Fonderies de Zinc de la Vieille Montagne, and Compagnie Royale Asturiénne des Mines were the principal firms producing lead, zinc, and their byproducts, and Compagnie des Produits Chimiques et Electrométallurgiques Péchiney (Péchiney) was dominant in aluminum production.

In addition to principal primary nonferrous metallurgical plants tabulated, there are secondary producers of nonferrous metals. Their products include aluminum, copper, lead, zinc, and tin.

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TABLE 18.—Principal primary nonferrous metal plants

Name and location	Type of plant	Annual capacity (tons)	Remarks
Aluminum:			
Compagnie de Produits Chimiques et Électro-Métallurgiques Péchiney:			Capital of Péchiney in 1962 was Fr430 million ($71 million). In 1962 it produced 472,000 tons of alumina and 239,100 tons of aluminum.
Gardanne	Alumina	365,000	Bayer process; further expansion is planned.
Salindres	do	200,000	
St. Auban	do	40,000	
Noguères	Aluminum	90,000	New plant completed in 1960 is to be enlarged to 120,000-ton capacity. Power is obtained from a thermal plant using Lacq natural gas.
St. Jean-de-Maurienne	do	69,000	Aluminum alloys are also produced.
Sabart	do	18,900	
Auzat	do	18,500	
L'Agentière	do	17,500	
Chedde, Pa Praz, Riouperoux, and La Saussaz.	do	32,700	
Ugine:			
La Barasse	Alumina	150,000	
Lanneméz an	Aluminum	50,000	Much of the required power for expansion will be from thermal plant using natural gas.
Venthon	do	16,500	
Société Francaise pour l'Industrie de l'Aluminium: Marseille.	Alumina	60,000	
Copper:			
Compagnie Générale d'Électrolyse du Palais: Palais-sur-Vienne.	Copper smelter, electrolytic and copper refining facilities (electrolytic refinery).	26,500	Produces copper cathodes, wire bars, billets and slabs and by-product nickel sulfate; 1961 production 22,854 tons copper.
Lead:			
Société Minière et Métallurgique de Penarroya: Noyelles-Godault.	Dwight-Lloyd roasters, water jacket lead smelters and refining facilities, pipe and rolling mill.	80,000	Soft and antimonial lead are produced and semifabricated; silver and bismuth are also recovered; 1961 production: lead 71,609 tons; silver 77,114 kilograms.
Nickel:			
Société Le Nickel S.A.: Le Havre.	Nickel refinery		Produces nickel metal and oxide.
Zinc:			
Société Miniere et Métallurgique de Penarroya: Noyelles-Godault.	Zinc smelter and rolling mill.	20,000	Zinc blast furnace using the Avonmoth process. Slab and semifabricated zinc are produced; 1961 production 16,200 tons of slab zinc.
Compagnie Austurienne des Auby-lez-Douai (Nord).	Zinc smelter, refinery, rolling mill; cadmium recovery plant.	60,000	Plant uses two New Jersey zinc distillation units. Sulfuric acid is also produced using blende roaster gases.
Mortagne-du-Nord	Zinc smelter	10,000	Closed in 1962.
Société des Mines et Fonderies de Zinc de la Vieille Montagne:			
Viviez (Aveyron)	Electrolytic zinc, rolling mill.	78,000	Plant also makes zinc base alloys and zinc sulfate and recovers cadmium; 1961 production 67,600 tons zinc.
Creil (Oise)	Zinc smelter	10,000	New Jersey distillation plant. Zinc white is also made.

In 1963, the value of imports of all nonferrous metals and semimanufactures, ores, and scrap totaled US$377 million compared with US$365 million in 1962. Precious metal imports, other than gold, added another US$43 million to the total. Of the 1963 imports of nonferrous metals, semimanufactures and scrap copper accounted for

US$165 million followed by lead (US$16 million), zinc (US$23 million), nickel (US$16 million), aluminum (US$41 million) and tin (US$30 million). Some of the important sources of imports were Belgium-Luxembourg, Federation of Rhodesia and Nyasaland, Republic of the Congo (Léopoldville), and the United States for copper; the United Kingdom for nickel; Cameroon for aluminum; Belgium-Luxembourg, Morocco, and Tunisia for lead; and Belgium-Luxembourg for zinc.

French exports of nonferrous base metals were valued at nearly US$175 million in 1963. Significant commodities included aluminum and copper as metal and semimanufactures, as well as ingot nickel. Main recipients of these exports were the Common Market countries for aluminum, copper, lead and zinc and the U.S.S.R. for nickel.

Bauxite and Alumina.—In 1963, France produced 6.6 percent of world bauxite and ranked fifth among world producers. Domestic production provided an adequate supply for the aluminum industry and for export of 205,900 tons. Visible and indicated reserves were estimated to total 30 million tons in 1962 of which 80 percent was in the Département of Var and the remainder in Hérault and Ariège in the south of France. The inferred reserve was estimated at 40 million tons. Usable reserves have increased because the aluminum industry in 1962 successfully used bauxite with 7 percent silica. Of the 1962 output, 1,766,000 or 82 percent was produced in Var and 392,000 in Hérault and Ariège.

Bauxite was mined by subsidiaries of Péchiney and by the following companies (1961 production in parentheses): Bauxites et Alumines de Provence 336,000 tons; Ugine 199,000 tons; Comptoir de l'Extraction et de Vente de Bauxites 148,000 tons; Bauxites de France (unreported); and Union des Bauxites (unreported). Péchiney operated five mines (Le Récoux, Maron, Pélicon, Engardin, Mazauges) in the Var Département centered around the town of Brignoles, three in Hérault (Arboussas, Camebelliès and Cazouls-les-Béziers) and one in Ariège (Péreille). The Récoux-Maron area at the north end of the region traditionally has supplied a large part of the bauxite for alumina production. Nearly three-fourths of the 1962 production was from underground mines. Operations in Hérault are open pit.

Of the total calcined alumina produced in 1962, 589,000 tons was used in aluminum production. In addition to domestic alumina production, Péchiney and Ugine through their participation in Compagnie Internationale pour la Production de l'Alumine (FRIA) obtained alumina produced in Guinea. Export of alumina to Poland and larger exports to Spain were instrumental in increasing 1962 alumina exports.

Aluminum.—After increasing primary aluminum capacity from 159,000 tons in 1955 to 312,000 tons in 1962, the industry had a pause in expansion during 1963 and was concerned with fuller utilization of existing capacity, lowering power consumption, and improving efficiency of the industry. With production constituting 27.5 percent of the West European production in 1963, France was the fourth largest aluminum producer in the world. The Government's fourth plan calls for aluminum production of 345,000 tons by 1965. Expan-

sion in production reportedly will be based on thermal power produced from natural gas.

Production of semimanufactures and castings increased by 52 and 25 percent, respectively, during 1959–63. Of aluminum castings produced in 1963, 18,800 tons were die castings.

France's consumption of aluminum for domestic use and exports increased to 242,500 tons in 1963 compared with 235,600 tons in 1962 and 152,000 tons in 1957. Consumption between 1957 and 1963 rose at an average annual rate of about 10 percent. Part of the growth resulted from increases in French exports of semifabricated aluminum. End-uses of aluminum by percentage, were probably about the same as in 1962: Transportation 33; construction 8; electrical 13; packaging 12; mechanical equipment 9; domestic and office equipment 10; powder and granules 3; chemical and agricultural 3; iron and metallurgical 3; other 7.

Exports of aluminum ingots (alloyed and nonalloyed) totaled 124,691 tons (17.5 percent more than in 1962) and of aluminum semimanufactures, including foil, 33,079 tons. Imports (excluding alloys) from all sources other than Cameroon were 7,213 tons and from Cameroon 45,535 tons. Imports of alloys and semimanufactures including foils were 3,123 tons and 12,181 tons, respectively.

Since July 1963, crude aluminum imports (nonalloyed) from Common Market countries have been subject to an 8 percent duty whereas aluminum has been subject to a 9-percent common external tariff. The import tariff from non-Community countries was 13.4 percent. For semimanufactures, the two sets of tariffs are very close and vary from 15 to 22 percent, depending on the type of semimanufacture.

All aluminum sales in France were handled by L'Aluminium Français, a holding company in which several companies making aluminum and aluminum products participate. In addition to aluminum produced in France, L'Aluminium Français disposed of a certain share of aluminum produced by Compagnie Camerounais de l'Aluminium Péchiney-Ugine (ALUCAM) in Edea, Cameroon. This share amounted to 46,400 tons in 1962 and 47,033 tons in 1963, so that total aluminum available to France in 1963 was 345,398 tons compared with 340,910 in 1962. Total shipment by L'Aluminium Français was 336,500 tons in 1962 compared with 321,000 tons in the previous year.

In 1963, Péchiney and Ugine remained France's only primary aluminum producers. Péchiney, with 10 reduction plants, produced about 234,700 tons of aluminum in 1963 (78.6 percent of total production) and Ugine produced 63,700 tons. The last phase of expansion of Ugine's Lannémezan plant was completed at the beginning of the year and the plant was producing at a rate 20 percent higher than in 1962. Péchiney and Ugine held joint interests in other aluminum companies and cooperated in foreign operations; and, through l'Aluminium Français, they cooperated in power and raw materials distribution, research, and the development of markets.

Aluminum reduction plants were mainly in the Alps and Pyrénées areas where hydroelectric power was available. However, Péchiney's Noguères plant, the largest and most modern plant in France, and the new Lannémezan plant use thermal power generated from the Lacq gasfield.

Nearly half of the 40 to 50 aluminum rolling mills and fabrication plants of France are located in or near Paris. Compagnie Générale du Duraluminium et du Cuivre (Cégédur) is Péchiney's subsidiary in aluminum fabrication. Cégédur's largest plant, at Iasoire, had an annual capacity of 70,000 tons of rolled and extruded products. Tréfileries et Laminoirs du Havre and Compagnie Française des Métaux, the other principal producers of aluminum products, merged in 1962 into a single company called Tréfimétaux which was reported to be the largest producer of aluminum and copper mill products in the EEC. The largest plant of Tréfimétaux was in Paris and had a capacity for production of 40,000 tons of sheet, plate, extruded wire, and cable. Ugine does not have rolling mills of its own, but through an 8-percent ownership of Cégédur and participation in l'Aluminium Français, avails itself of rolling facilities.

Also during 1962, a consortium consisting of Cégédur, Tréfimétaux, and Forges de Crans created a new company called Rhenalu, which planned to construct a large aluminum rolling mill at Neuf-Brisach-Biesham, in eastern France. When this mill is completed in 1965, it will be one of the largest mills in Europe, with an annual capacity in excess of 100,000 tons.

Aluminium Français has two research laboratories at Chambery, Savoie, and at Centre Technique de l'Aluminium, Paris.

Copper.—The few hundred tons of mine production of copper were obtained from gold-silver-arsenic ores of the Salsigne mine at La Combe but the metal was not recovered in France. France did not have facilities for smelting copper ore, and the copper smelting (secondary) and refining industry was relatively small. Despite the small production the country was the sixth world consumer of copper in 1962 and regularly exports significant quantities of copper-base semimanufactures. Requirements were met by imports of refined metal. These imports in 1963 totaled 220,600 tons unwrought and 10,737 tons wrought. Refined copper was bought under long-term arrangements by the Groupement d'Importation et Répartition des Métaux, a private but Government-approved organization for importation and distribution of copper at a uniform price.

Consumption of primary and secondary copper in 1963 was 249,300 tons compared with 243,700 in 1962. Production of semifabricated copper totaled 359,600 tons, indicating direct use of a large tonnage of scrap—113,200 tons metal content in 1962.[11] Total scrap consumption in 1963 was 153,600 tons including scrap used for production of secondary copper. Because much of this scrap was generated locally, imports of copper scrap were relatively small, less than 10,000 tons in 1962 and reportedly 8,500 tons in 1963. Gross weight of shipments of copper and copper alloy semimanufactures (exclusive of copper castings and copper sulfate) in 1963 totaled 355,846 tons[12] which included 159,626 tons of wire, 97,300 tons of rods and sections, 60,994 tons of sheets and strips, and 37,927 tons of tubes.

Shares of principal consumers of copper in 1962 in percent were as follows: Electrical industry, including machinery production and

[11] Metallgesellschaft Aktiengesellschaft. Metal Statistics, 1954–63. Frankfurt am Main (Germany), 1964, pp. 131–134.
[12] Work cited in footnote 11.

power distribution 51; building, public works, merchant marine and aircraft 17; export of semimanufactures 9; road vehicles 7; post, telephone, and telegraph 4; and miscellaneous 12.

Compagnie Générale d'Électolyse du Palais has accounted for nearly all the electrolytic copper output. Several companies, including Palais, produced secondary copper, as well as brass, bronze, and other alloys from scrap. Among these were J. Barthelemy and V. Champigneulle at Nancy; Compagnie Française des Métaux at Givet; Société Française des Métaux at Alliage Blancs at St. Denis and Lyon; Société Anonyme Affineries de Juvisy at Juvisy; Société Française d'Affinage de Cuivre at Poissy; and Péchiney's Affinerie de la Corneuve which produced brass and bronze ingots.

Prices of copper during the last 6 months of the year varied from $648 to $656 per ton.

Lead-Zinc.—In 1962, there were 10 lead-zinc mines in production. Three of these (Pessens, l'Hermita, and Villenauvette), operated by Société des Couleurs Zinciques, produced zinc only for making zinc white and lithopone. Vieille Montagne had one active mine in southern France called Gard at Saint Félix de Pallières. Penarroya operated six mines also in southern France: Les Malines, Peyrebrune, Pierrefitte, La Plagne, St. Sebâstien-d'Aigrefeuille, and Loubatière; the last two mentioned were closed in 1962 after producing a total of 8,982 tons of lead minerals. Penarroya was developing the new Largentièra lead mine in 1963, and this property was to start production in 1964. A new zinc mine was put in operation at Figeac during 1963; information on its ownership is not available. Most of the lead ores, particularly from Plagne, are argentiferous. Ores from Pierrefitte, Malines, and Peyrebrune have more zinc than lead.

Penarroya remained the largest producer of lead-zinc ore in France and the sole producer of primary lead. In 1962 the company produced 18,767 tons of lead and 22,085 tons of zinc concentrates in France. Its metal production was 75,569 tons of lead and 21,076 tons of zinc.

Vieille Montagne and Compagnie Asturienne des Mines were the principal zinc producers, mainly operating on imported ore. Production of Vieille Montagne in France in 1961 was 75,942 tons of zinc and 1,353 tons of zinc dust.

Penarroya produced all primary lead in one plant at Noyelle-Godault. The Avonmouth-type smelter for treating mixed lead-zinc ores in this plant, which began operation in May 1962, attained full capacity during the year. The bulk of the lead, however, was produced in a blast furnace. Three companies produced secondary lead from scrap in four plants. Secondary and antimonial lead constituted about one-fifth of the total lead output of France.

Consumption of lead in 1963 totaled 170,100 tons (156,300 tons in 1962); thus domestic primary and secondary smelter production (including metal recovered from imported ores) was equal to about two-thirds of consumption. In 1962, the lead content of domestic ore output provided only 14 percent of the domestic smelter production and met only 9 percent of domestic requirements. End-uses of lead in 1962 and their percent of total consumption were: Cable shielding 31, semimanufactures 16, batteries 24, oxides 16, and other 13.

Although the industry supposedly experienced difficulty in obtaining adequate supply of ores and concentrates, imports in 1963 totaled 132,270 tons, 35 percent more than in 1962. Imports of lead metal, including alloys, were 67,789 tons, and those of wrought lead were 239 tons. The bulk of ore imports comes from Morocco where Penarroya, through Penarroya-Moroc, participates in three mining companies and the smelter of Fonderies Penarroya-Zellidja.

Lead prices in dollars per ton during the year were as follows: December 31, 1962, to April 17, 1963, US$170; April 18 to May 28, 1963, US$178; May 29 to August 12, 1963, US$186; August 13 to August 21, 1963, US$190; and August 22 to yearend, US$194.

Although the Mortagne zinc smelter of Asturienne des Mines stopped working in 1962, there was a slight increase in zinc production resulting from the operation of the Avonmouth-type smelter at Noyelle-Godault. This furnace produced 16,683 tons of zinc and 1,851 tons of lead in 1962. With operation of this plant, horizontal retorts for zinc production were shut down. Semimanufactures production totaled 64,900 tons, of which 62,100 tons were rolled zinc. A larger share of French zinc consumption was produced in French installations than was the case with lead, although the share of domestic ores in total output was quite small (8.7 percent in 1962).

Zinc consumption in 1963 was estimated at 180,800 tons, evclusive of 6,800 tons of zinc dust. Galvanizing accounted for 71,000 tons of the total. In 1962 relative shares of various end users in percent were as follows: Rolled zinc 38; galvanizing 31; zinc alloys 13; brass 11; zinc oxide 5; miscellaneous 2.

In view of smaller domestic ore production, the industry had difficulty in fully meeting ore requirements of the smelting industry. In 1963, imports of zinc ore and concentrate totaled 281,000 tons, zinc ingot metal (including alloys) imports were 20,625 tons, and those of wrought zinc were 2,556 tons.

Capacity for roasting zinc ores in France was sufficient to meet the requirement of the smelters; however, some of the domestic and North African ore used in France was roasted abroad, particularly in Belgium.

Prices of zinc increased during the year from US$207 per ton during the January-March 15 period to US$263 from September 12 to yearend.

Nickel.—Société le Nickel produced nickel and nickel oxide from matte imported from New Caledonia in the company's only plant in France which is at Le Havre. Some secondary nickel also was produced by electrolysis of monel metal and scraps of copper-nickel-zinc alloys; 431 tons of secondary nickel were produced in 1962.

In 1963, 1,846 tons of nickel and 4,459 tons of nickel alloy semimanufactures were produced. The nickel alloys were principally copper-nickel and copper-nickel-zinc alloys. Decline in production of nickel in 1963 was partly compensated by larger imports of 4,680 tons compared with 4,127 tons in 1962.

Nickel consumption in France rose again in 1963 to 15,172 tons compared with 13,099 tons in 1962 and 15,384 tons in 1961. Price of nickel at the beginning of 1963 was US$1.77 per kilogram.

Precious metals.—Salsigne was the only gold mine in France. The ore carried 10 to 12 grams of gold, (0.32 ounce), 20 to 35 grams of

silver (0.65 ounce), 400 to 450 grams of bismuth, and 2 to 2.5 kilograms of copper. Since 1905 this mine has produced more than 1.28 million troy ounces (40 metric tons) of gold, 3.2 million to 3.5 million troy ounces (100 to 110 tons) of silver, 7,000 to 8,000 tons of copper,[13] and 700 to 800 tons of bismuth. Gold was also recovered from imported ores. Lead-zinc ores, both domestic and imported, were the principal source for silver output in France. Penarroya's silver production in 1961 was almost 2.48 million troy ounces (77,114 kilograms) the same amount as the total reported for the country. Gold bearing concentrate was shipped to Sweden for recovery of the precious metals.

Re-export of gold shown in the mineral and metal trade table presumably refers to gold entering France for processing and re-export. Imports of precious metals other than gold in 1963 totaled 26,714,000 troy ounces (830,900 kilograms) valued at $42,640,000. The individual metals and their respective values were: Silver 26,543,600 troy ounces (825,600 kilograms), US$32,511,000; platinum group metals 170,400 troy ounces (5,300 kilograms), US$10,128,000. Exports were 2,945,000 troy ounces (91,600 kilograms) valued at US$6,199,000, of which silver accounted for 2,883,918 troy ounces (89,700 kilograms) and US$2,401,000.

Tin.—Since 1960 tin concentrates have been obtained from St. Renan in Brittany which was exploited initially by hydraulicking and in 1963 by dredging. The deposit was prospected and explored by Bureau de Recherches Géologiques et Minières and Société Americaine de Prospection et d'Études Minières which together formed the Campagnie Minière de Saint-Renan to work the deposit. Reserves are estimated to total 8 million tons of gravel with 600 grams of tin per cubic meter. Production of about 5,000 tons of concentrate during 1947–57 was obtained from the Abbaretz deposit also in Brittany. Tin concentrate has been shipped abroad for smelting because France has no tin smelters. Tin recovered from scrap totaled 400 tons in 1962 and was used mainly in the chemical industry and for making alloys.

Consumption requirements have been met by metal imports, which totaled 11,252 tons in 1963. Tinplating accounted for 57 percent of consumption in 1962; other important end uses were solder 21 percent, bronzes 8 percent, and antifriction metal 5 percent.

Tungsten.—Le Montmins mine, the last French property producing tungsten, was closed at the end of 1962, having produced 624 tons of concentrate with 67 to 72 percent WO_3 during that year. France produced 13,500 tons of concentrate during 1943–62 from a number of mines of which Le Montmins was the most important.

Consumption in 1962 was 2,361 tons of concentrate of which 1,760 tons was used in the ferroalloy industry and the remainder for other purposes.

Uranium and Other Atomic Energy Minerals.—The Commissariat à l'Énergie Atomique (CEA) produces directly natural uranium, thorium, plutonium, and lithium. Independently or in collaboration with industry, it produces graphite, zirconium, and beryllium. As of 1963, heavy water and enriched uranium were not produced. Completion of the Pierrelatte gas diffusion plant for separation of U^{235} will

[13] Rouveyrol, P. L'Or en France (Gold in France). Mines et Métallurgie, No. 5, May 1964, pp. 237–238.

supply enriched uranium. The initial phase of this plant is due for operation in 1964.

TABLE 19.—Production of uranium concentrate

(Metric tons)

	1961	1962	1963
Concentrate:			
Domestic ore	2,936	2,181	2,101
Imported ore	484	1,863	2,541
Metal content:			
Domestic ore	1,128	1,035	1,022
Imported ore	118	486	507
Total metal content	1,246	1,521	1,529

In 1962 there were 17 active mines and some ore was obtained from exploration and development. The CEA was the largest ore producer in France, accounting for 87 percent of the 1962 output. Haute Vienne, Loire Atlantique, and Loire Départments produced 38, 20, and 15 percent, respectively, of total ore output.

Purchase of uranium ore from private producers since July 1, 1962, has been governed by new contract terms published in July 1961, which were to be valid until December 31, 1966. Under the new terms, the lower limit of ore grade is 1.5 parts per thousand instead of 2 parts per thousand of uranium content. Price of the ore is set by the formula (grade of ore in parts per thousand minus 1) times $8.10 per kilogram of contained uranium, with an upward limit of $8.10 per kilogram of contained uranium for ore with more than two-thousandth uranium. Uranium concentrate is produced from domestic and imported ore by the CEA and private companies.

In 1962 CEA produced roughly half of the concentrate (metal content) and private industry produced the remainder; however, private industry obtained most of its concentrate from imported ore. The concentrate was produced in five mills.

TABLE 20.—Uranium mills

Name and locations	Rated annual ore treating capacity (metric tons)	Remarks
Société Industrielles des Minerais de l'Ouest:		
Bessines near Limoges	400,000	Produces magnesium uranate by sulfuric acid treatment and ion exchange or solvent extraction. Ore is obtained from mines of La Crouzelle Division. In 1962, 400,000 tons of ore treated.
L'Ecarpière	300,000	Treats ore from Vendée Division and from private mine in Brittany to produce magnesium uranate; in 1962, 305,000 tons of ore treated.
Commissariat L'Enérgie Atomique:		
Guegnon (Saone et Loire)	(1)	Treats concentrates produced in Mouanna in Gabon. In 1962 plant treated 1,320 tons of concentrates.
Bois-Noirs (Loire)	(1)	158,000 tons or ore treated in 1962. Uranyl nitrate is produced.
Le Bouchet	(1)	This plant treats urano-thorianite of Madagascar to produce sodium uranate.

[1] Data not available.

Natural uranium metal was produced in Malvesi and Le Bouchet, Le Bouchet, south of Paris, had a production program of 400 tons of uranium which was achieved in 1963; it also produced thorium. The plant in 1962 produced 144 tons of thorium nitrate and 22 tons of thorium hydroxide. In addition, facilities were planned for Le Bouchet to produce calcined UO_2 and granulated uranium trioxide as fuel elements. Malvesi was the larger production facility for natural uranium with an annual capacity of 600 tons (626 tons produced in 1962).

In 1962 about 100 tons of zirconium with less than 120 parts per billion of hafnium for nuclear use was produced by Nobel-Bezel in Cuise-Lamatte plant. Hafnium was recovered and concentrated to produce halfnium oxide with 94 percent metal.

Other Nonferrous Metals.—France consumes about 3,000 tons of antimony annually. No mine production has been reported since 1959, but the metal has continued to be recovered from imported ores at two plants, one in Mayenne and the other in l'Aisne.

Bismuth produced in France has been shipped abroad for refining. Domestic smelter production supplies only about one-tenth of requirements.

Cobalt consumption in 1962 was reported at 390 tons compared with 480 tons in 1961 and 670 tons in 1960. Local production by and large covers requirements.

NONMETALS

Besides building materials and quarry products, France produces a fair range of nonmetallic minerals, but for many items, such as asbestos, barite, borates, cryolite, industrial diamonds, dolomite, graphite, magnesite, mica, phosphate rock, and pyrite, it has depended partly or entirely on imports. During 1959–62 there has been a continuous upward trend in production of the raw materials of the building industry. In spite of the severe winter, rate of activity in home-building and public works increased 7 percent in 1963, a fact which must have helped sustain the upward trend. Similarly, sulfur production has increased at a rapid rate and is believed now to be at an optimum rate; salt production also has increased. Significant production trends in other commodities were not apparent.

The value of nonmetals produced in 1962, exclusive of building raw materials and quarry products, totaled about US$142 million. Potash, salt, and sulfur accounted for 60 percent, 18 percent, and 16 percent, respectively, of the total value. Building raw materials and quarry products were valued at US$344 million, of which US$41 million was accounted for by materials used in industry, about US$4 million by materials used in agriculture, and US $299 million by the building industry, including sand and gravel (US$108 million), other building materials such as stones, clays, cement, limestone, and gypsum US$102 million, and material for roadbuilding and similar uses US$89 million.

In 1962 France was a net exporter of cement, chalk, crushed rock and gravel, diatomaceous earth, fluorspar, gypsum, kaolin and refractory clay, lime and limestone, marble and other building stones, potash, salt, sand, sulfur, and talc. Import and export value of nonmetals, including cement, totaled $98 million and $101 million, respectively.

Trade in slag and ashes including Thomas slag, added US$15 million to imports and US$11 million to exports. Among imports, phosphate rock (US$29,472,000), asbestos (US$16,441,000), Thomas slag (US$9,074,000), clays (US$8,430,000), and pyrite (US$5,096,000) were the most important. Potash, cement, and sulfur exports were valued at US$40 million, US$17 million, and US$13 million, respectively.

Cement and Lime.—In 1963 France ranked sixth as a world cement producer; it was third in the Common Market after West Germany and Italy. At the beginning of the year there were 61 plants in operation with an aggregate capacity of about 19 million tons. Of the 61 plants, only 5 had an annual capacity of less than 100,000 tons and these plants contributed only 1.6 percent to the 1962 output. Fifty plants ranged in capacity from 100,000 to 500,000 tons and together accounted for 76.4 percent of output. Six plants had capacities exceeding 500,000 tons per year and produced 22 percent of the 1962 output. Average annual production per plant in this year was 275,000 tons compared with 140,000 in 1952. The turnover of the industry in 1962 was equivalent to US$263 million. The capacity was expected to increase to 22 million tons in 1964.

Cement production has grown in the last decade, sustained by public works and new dwellings of which 3.5 million were built between 1945 and 1962. Nevertheless, France ranked sixth in Europe in construction of new dwellings.[14] The fourth plan envisages building 1.3 million new dwellings during 1961–65.

Production in 1963 was 6.5 percent more than in 1962 and 90 percent more than 1952; plants operated at 86 percent capacity (87.6 percent in 1962). As a result of the extreme winter, industry suffered a production loss of approximately 900,000 tons in January and February compared with a similar period in 1962, so that the production gain for 1962 was less than the 7.5 rate of increase for 1962 and 1961. The production target for 1965, according to the fourth plan, is 19.5 million tons per year.

About 70 percent of the 1962 output was portland cement and 17 percent was metallurgical cement. In the same year 2,875,000 tons of blast furnace slag was used, 260,000 tons more than in 1961. Fly ash consumption reached 390,000 tons in 1962 against 330,000 tons in 1961.

France shipped 16,950,000 tons of cement to the domestic market in 1963, 15,630,000 tons in 1962 and 14,440,000 tons in 1961. Per capita consumption for the whole of France in 1963 was 352 kilograms compared with 479 kilograms in West Germany and 438 kilograms in Italy. In 1962 per capita consumption in the Mediterranean area of France was 481 kilograms followed by the Southeast with 415 kilograms. The Paris region was the largest consuming area with 2,722,000 tons, followed by Nord and Pas-de-Calais with 1,225,000 tons, East 1,086,000, Rhône-Isère-Savoie 931,000 tons, and Bouches-du-Rhône 656,000 tons.

Cement imports have been small and have had no great impact on the French cement market. In 1963, 67,957 tons of cement and clinker were imported—32,202 tons from Belgium-Luxembourg, 13,173 from West Germany, 10,400 tons from Italy, and the remainder from other European countries. French cement exports were 1,081,334 tons,

[14] Syndicat National des Fabricants de Ciments et Chaux Hydrauliques (Paris). Assemblée Générale du 7 Mai 1963, Rapport du Délégué General. 14 pp.

TABLE 21.—Cement production by types

(Thousand metric tons)

	1959	1960	1961	1962
Portland	8,990	9,281	9,607	11,757
Slag	2,566	2,381	2,837	2,203
Special	1,166	1,130	1,860	1,475
Other slag cements	738	865	404	626
Total	13,460	13,657	14,708	16,061
Natural cement	175	121	177	397
Mortar cement	364	381	496	424
Total	13,999	14,159	15,381	16,882

including 440,544 tons to West Europe (West Germany 248,332, Italy 54,103), 508,313 tons to Africa (Ivory Coast 159,978, Dahomey 55,207, Cameroon 58,517, and Gabon 22,466).

The industry invested $27.5 million in 1962 (exclusive of $3.5 million absorbed in the building of a new plant) and planned to invest $29 million during 1963. Total investments in 1962 equaled 12 percent of the turnover. The investment program during 1962 and 1963 called for construction of a new plant, replacement of 10 old kilns in existing plants by 8 new kilns, and addition of 2 new kilns also in existing plants. As part of the 1963 modernization program seven new kilns were built: Two dry kilns, four wet kilns, and one vertical kiln.

Société des Ciments Français with 11 plants throughout France, Ciments La Farge with 11 plants including 5 in southeast France, and Établissements Poilet et Chausson with 6 plants mostly in northern France together probably controlled half of the country's production. Gargenville and Beffe of Poilet et Chausson are two of the largest plants. Areas of large plant concentrations are Pas-de-Calais and Aisne Départements where chalk and clayey limestones are used as raw materials; Seine-et-Oise where chalk and clay are used; and Moselle where limestone and blast furnace slags are used. In southeast France plants are in Isère, Savoie, Bouches-du-Rhône, Gard, Ardèche, Drôme Départements, and others. Some seven or eight plants are scattered in western France. As of January 1963, the geographical distribution of cement production capacity in percent was as follows: Nord and Pas-de-Calais Départements, 16.2; Paris and Paris basin area, 21.5; Southeast, 20.9; Mediterranean, 13.4; Southwest, 12.1; East, 11.7, and West, 4.2.

Fuel and electricity consumption of the cement industry in 1962 with 1961 consumption in parentheses were as follows: coal 2,350,000 tons (2,300,000); fuel oils 320,000 tons (260,000); natural gas 170 million cubic meters (150 million); electricity 1.46 billion kilowatts (1.36 billion).

The industry employed 13,400 workers in 1963. Labor cost was estimated at 30 percent of production cost, fuel and energy cost at 50 percent, and other costs at 20 percent. Cement prices were increased 3.5 percent in May 1962 and the 1963 lime price index was 115 based on 1958 prices as 100.

Nearly three-fourths of the hydraulic lime output of France was produced by some 40 cement plants. The remaining fourth was pro-

duced by about 40 lime burners which do not make any cement. Geographical distribution of lime producing capacity in percent as of January 1, 1963, was as follows: Paris and Paris basin, 20.1; Southwest, 31.4; Southeast, 22.5; East, 7.4; Mediterranean, 6.8; West, 5.2; Massif Central, 2.5; and Nord and Pas-deCalais Départments, 3.2.

High-purity or fat lime (chaux grasse) was produced by a number of large plants which, except for one, were integrated with iron and steel, ferroalloy, or chemical industries to which they deliver their output. Eight of these plants were in the Meuse area. In addition, there were a number of small plants with an annual production of less than 5,000 tons distributed fairly widely.

Construction Materials and Quarry Products.—In 1963 raw materials for the manufacture of cement, lime, plaster, brick, tile, ceramic and refractory materials, and building stones were produced in sufficient quantities to meet the country's requirements and to leave an exportable surplus for a number of commodities. The 1962 output comprised about 43 million tons of building materials; 75 million tons of sand and gravel; 45 million tons of road and foundation building material; 26 million tons of material for the industry such as kaolin and refractory clays, limestone, glass and foundry sands, limestone for the cement and steel industry, chalk, barite, and others; and 1,250,000 tons of materials for soil improvement and other agricultural uses, including limestone, gypsum, marl, phosphate, and phosphatic chalk.

Available preliminary data indicate increases in 1963 monthly average production for flux limestone, alluvial sand and gravel, industrial sand, road building materials, cement, and hydraulic lime.

The industry employed 87,100 persons, of which 74,600 received hourly pay and the remainder were salaried employees. This figure does not include workers in limestone and clay quarries which were captive operations of the cement plants. L'Union Nationale Interprofessionalle des Matériaux de Construction et Produits de Carrières is the industry's professional organization.

TABLE 22.—Size of quarry and sand and gravel operation in 1961 [1]

(Number of employees)

	0 to 5	6 to 10	11 to 20	21 to 50	51 to 100	101 to 200	201 to 500
Sand and gravel	808	281	199	103	12	2	3
Industrial sand	105	29	13	11	1	1	----
Road building materials	578	307	265	115	20	9	----

[1] Annuaire Statistique de la France, 1963.

A large variety of building stones are available throughout the country so that most Départements are not far from a source of building stones. Similarly, plants utilizing quarry products are generally close to the source of raw materials and products are not transported more than 250 kilometers from producer to the consumer. The majority of the quarries and sand and gravel pits are small.

Fluorspar.—France regularly has produced enough fluorspar to meet its own industrial needs and to have a surplus for exports which comprises mainly metallurgical grade fluorspar to West Germany and

acid grade to the United States. It is estimated that of the 1962 output, 65,000 tons was flotation concentrate, 98 percent CaF_2, and the remainder cleaned and cobbed ore of about 60 percent CaF_2.

The French steel industry used 32,574 tons of fluorspar in 1963. Annual fluorspar consumption in France was reported at 132,000 tons:[15] 60,000 tons by the metallurgical industry, 65,000 tons by the chemical industry, and 7,000 tons by the ceramic industries. Of the chemical grade, the aluminum industry used 67 percent, and the remainder was used for making various fluorine chemicals. Of the quantity used by the metallurgical industry, 33,000 tons were used in steelmaking and the remainder for making ferroalloys.

At the end of 1962 there were 24 operating fluorspar mines: 11 in the Massif Central, 3 in Tarn, 6 in Var, 1 in the Vosges, and 3 in the Pyrénées-Orientale Départements. Of the 24 mines, 1 produced 75,000 tons or 38 percent of 1961 output; 15 had an annual production less than 5,000 tons, 3 from 5,000 to 10,000 tons, and 5 from 10,000 to 20,000 tons. The Massif Central area is no longer dominant in the output because of mining[16] in the Départements of Tarn and Var.

There were flotation plants at Chambarel near Le Barlet mine, La Bastide near the Escaro mine, and at Orbiel, Les Arcs, and Langeac.

TABLE 23.—Production of fluorspar ore by areas

(Metric tons)

Area	1959	1960	1961	1962
Massif Central (Départements of Ardèche, Aveyron, Indre, Haute-Loire, Nièvre, Puy-de-Dôme, Haute-Saône, and Saône-et-Loire.)	33,499	47,800	41,157	84,405
Tarn	26,712	28,073	28,004	26,558
Alpes-Maritimes				5,234
Creuse	1,773	1,160		124
Var	27,719	30,211	32,018	26,425
Vosges		720	1,486	1,419
Rhône	401	1,371	2,000	
Ardennes	60	41	4	31
Pyrénées Orientale	10,012	26,108	90,318	82,904
Total	100,176	135,484	194,987	227,100

Source: Ministère de l'Industrie (Paris). Statistique de l'Industrie Minérale. Années 1959–62.

Potash and Other Fertilizer Materials.—In 1963 France produced 16 percent of world potash, ranking behind the United States, the Federal Republic of Germany, and East Germany. Production and sales were about the same as in 1962. Bromine was recovered as a byproduct of potash; output was determined by the 1,600 tons sold.

Consumption of compound fertilizers in the fertilizer year 1962–63 (July 1 to June 30) was 561,500 tons of K_2O compared with 549,270 tons of P_2O_5 and 236,960 tons of nitrogen. The corresponding consumption figures for 1961–62 were 504,620 tons of K_2O; 489,890 tons of P_2O_5; and 216,260 tons of nitrogen. In 1962–63 consumption of compound fertilizers was 62 percent of total consumption for potash, 49 percent for phosphate, and 35 percent for nitrogen fertilizers.

[15] Chermette, A. Le Spath-Fluor Français en 1962. Continued series in: Mines et Métallurgie, issues 3571 to 3579, March to December 1963. 38 pp. total.

[16] Chermette, A. Le Spath-Fluor Français en 1962. Continued series in: Mines et Métallurgie, issues 3571 to 3579, March to December 1963. 38 pp. total.

France exported 73,198 tons of crude potash in 1963, mainly to Belgium-Luxembourg and the Netherlands, and 1,238,000 tons of potassic fertilizers to the following destinations: West Europe 768,445 tons (Belgium-Luxembourg 198,997, United Kingdom 197,742, Switzerland 71,035, Ireland 60,495, the Netherlands 56,931, Italy 43,357); the United States 142,714; Japan 122,639; and Ceylon 41,225.

The Government-controlled Mines Domaniales de Potasse d'Alsace (MDPA), has been the sole potash producer because since 1959 the privately owned mines of Kali Sainte-Thérèse have been absorbed in the MDPA and mines near Dax in southwest France were closed in that year. All the potash is marketed by the Société Commerciale des Potasses Alsace. A research center, Centre de Recherches de la Société d'Etudes Chimiques pour l'Industrie et l'Agriculture was established by MDPA in 1959.

During 1945–62 about US$200 million was spent to modernize mining and beneficiation of the Alsace potash mines and to increase their production capacity. All mine shafts were equipped with skips, bringing total hoisting capacity to 45,000 tons per day. Underground haulage was improved by introduction of larger mine cars and belt conveyors. Mining was increasingly mechanized and room and pillar method was introduced some years ago. The share of this mining method in total output has increased. Continuous miners have been introduced in some places.

TABLE 24.—Principal potash mines in Alsace

(Metric tons)

Name of mine	Production K_2O content of mine run ore in 1962	Remarks
Amélie	1,031,989	Average daily production of ore was 8,500 to 9,000 tons.
Théodore	237,445	New flotation plant in 1960 with about 250 tons/hour capacity.
Théodore I	45,305	
Marie	156,945	
Anna	52,262	
Anna I	57,191	
Joseph	98,198	
Prince Eugene I	33,406	
Marie Louise, Marie I, Max, and Fernand	19,279	

Potash (K_2O) was recovered by hot leach, flotation, and levigation. The share of ore treated by flotation increased. Of the 1,655,543 tons of K_2O equivalent produced in 1962, 1,110,623 tons was from hot leach, 478,490 tons from flotation, and 66,430 tons by levigation. A plant for producing potassium carbonate and potassium bicarbonate was put into operation in 1962.

Salt.—Of the salt produced in 1962, 54 percent was from brines of saline springs in Lorraine and 30 percent from marine marshes, almost entirely from along the Mediterranean. The salt from brine wells was used entirely as dissolved salt in the chemical industry, mainly for making sodium carbonate. Of the 1,267,282 tons of marine salt, 646,246 tons were used for industry and agriculture, 158,977 for

domestic consumption, 6,445 tons for fisheries, and 18,057 tons were exported.[17]

Crude rock salt, mined near Nancy, was used in agriculture (30,666 tons), chemical industry (53,013 tons), and export (60,543 tons). Rock salt is also mined in Franche-Comte region in mines near Besancon and Lons-le-Saunier and in the southwest region Départements of Haute Garonne, Landes, and Basse Pyrénées. The rock salt from these two regions is reported as refined salt.

TABLE 25.—Salient statistics of the potash industry

(Thousand metric tons unless otherwise specified)

	1959	1960	1961	1962	1963
Production:					
Mine run ore	9,488	9,919	10,860	11,024	11,058
K_2O content	1,659	1,733	1,904	1,922	1,915
Marketable ore, K_2O [1]	(2)	1,534	1,710	1,722	(2)
Average daily output of mine run ore—tons	33,993	35,057		40,329	(2)
Bromine production—do	1,611	1,997	(2)	(2)	(2)
Average grade—percent K_2O	17.49	17.47	17.53	17.44	(2)
Average output of mine run ore per underground man shift—kilograms	6,822	7,227	7,952	8,189	(2)
Production by mining methods:					
Room and pillar—percent	49.9	57.0	60.4	60.8	(2)
Longwall—do	40.0	43.0	39.6	39.2	(2)
Ore treated	9,136	9,653	(2)	10,691	(2)
K_2O content	1,596	1,683	(2)	1,854	(2)
KCl produced (50 percent K_2O equivalent basis)	2,798	2,968	3,317	3,311	(2)
K_2O equivalent	1,399	1,484	1,658	1,656	1,668
Recovery of treatment—percent	87.7	88.2	89.6	89.3	(2)
Sales of potash, K_2O:					
France [3]	777	810	888	995	917
Foreign	695	727	808	668	756
Total sales	1,472	1,537	1,696	1,663	1,673
Number of workers at end of year—persons	10,909	10,730	(2)	10,503	(2)

[1] Marketable ore is the total sale of potassium chloride and crude salt as is.
[2] Data not available.
[3] Includes franc area. Exports to these areas in 1961 and 1962 were 43,725 and 31,089 tons, respectively.

TABLE 26.—Salt production

(Thousand metric tons)

	1959	1960	1961	1962	Production by areas in 1962
Crude rock salt	170	156	177	142	Entirely from Meurthe-et-Moselle in Lorraine.
Refined salt (from rock salt and spring brine).	405	452	492	546	Moselle 60; Franche-Comté region 221; Southwest region (Haute Garonne, Landes and Basses Pyrénées) 42.
Brine from saline springs	2,120	2,391	2,288	2,292	Meurthe-et-Moselle 1,342; Moselle 285; Franche-Comté (Jura) 626; Basses Pyrénées 39.
Marine salt from salt marshes.	771	725	888	1,267	This salt was obtained from 12,848 hectares (31,745 acres) of evaporation area—10,930 hectares (27,025 acres) along the Mediterranean and 1,910 hectares (4,720 acres) along the Atlantic Ocean. Production from the Mediterranean coast was 1,206 and from the Atlantic 61.
Total	3,466	3,724	3,845	4,247	

[17] Ministère de L'Industrie (Paris). Annales des Mines, Statistique de l'Industrie Minérale (1962). Annales des Mines. 1964, p. 61.

Household consumption accounted for 187,405 tons of the refined salt; industry, agriculture, and fisheries for 332,701 tons; 20,791 tons were exported. It is not known whether all of the refined salt reported was obtained from rock salt.

France imported 62,709 tons of salt in 1963 (37,720 tons from Algeria, 17,486 from Tunisia, and 9,501 from West Europe) and exported 137,265 tons of salt to the following destinations among others: Belgium-Luxembourg 92,235; West Germany 16,018; and African countries 5,113.

Sulfur and Pyrite.—Over 99 percent of the elemental sulfur output in France was recovered from the Lacq natural gas by Société Nationale de Pétrole d'Aquitaine (SNPA). Starting with output of 28 tons in 1957, sulfur production increased to 1,417,700 tons in 1963, making France an important world supplier.

Compagnie de Raffinage Shell-Berre produces relatively small tonnages from refinery gases; Nobel-Bozel also produces small tonnages. In 1962 Shell produced 3,070 tons and Nobel-Bozel 4,920 tons of sulfur; their total output in 1963 was about 9,500 tons.

During the year SNPA was building a sulfuric acid plant at Lacq to recover about 1.5 percent sulfur contained in the residual gases in the form of hydrogen sulfide and sulfur dioxide. Daily production will be 400 tons of 94 percent sulfuric acid.[18]

Sulfur consumption totaled 506,380 tons in 1962 distributed by consumers as follows: Sulfuric acid 320,850; agriculture 54,700; carbon disulfide 55,280; sulfur dioxide, sulfite products, and paper pulp 54,700. Production of sulfuric acid increased in 1963 to 2,395,000 tons from 2,214,000 tons, an increase of 8 percent, indicating a sulfur consumption in 1963 closer to a range of 530,000 to 550,000 tons.

Sulfur exports in 1963 totaled 1,012,000 tons, almost double the 1962 tonnage; in addition, 471,000 tons were supplied to the domestic market. With exports of 700,000 tons to West Europe, France was the dominant supplier in this area. Some destinations of French sulfur in 1963 and the corresponding tonnages were: West Germany 141,543; United Kingdom 198,216; the Netherlands 79,059; Sweden 51,119; Belgium-Luxembourg 43,142; African countries 124,617; Brazil 42,205. Sulfur imports were 115,021 tons, of which 67,927 tons were from Mexico and 44,620 tons from the United States.

Severe winter conditions affected pyrite production in the early months of the year resulting in smaller total production in 1963. Domestic production was supplemented by imports which were 395,622 tons in 1963. In 1962, 634,800 tons of pyrite were used for sulfuric acid production, and 4,800 tons were used to manufacture paper. Major pyrite users are in northern France.

In 1962, pyrite was produced in the following mines with their individual outputs in tons in parentheses: Chizeuil (84,370) and Saint-Bel (198,357). A 600-ton-per-day beneficiation plant with jig and flotation concentrates Chizeuil ore to a product with 45 percent sulfur.

[18] Sulphur (London). No. 50, February 1964, p. 95.

MINERAL FUELS

Coal.—The severe winter of 1962–63 and the 33-day strike of March 1 to April 5 in the nationalized coal mines greatly influenced the industry and the coal market during 1963. The strike cost 5.3 million tons of coal production, but this was partially made up during the balance of the year. While production declined, apparent consumption rose 5 percent. The additional demand and lost production was met by imports which exceeded the 1962 imports by 6,305,000 tons and by withdrawal of about 2.5 million tons from stocks. Coal met 58 percent of energy requirements exclusive of gasolines. In absolute quantities the position of coal has slightly improved as an energy source, but additional energy needed has been supplied largely from other sources; thus, coal's share in total energy produced has declined.

TABLE 27.—Energy consumption by sources

Type of fuel	1959	1960	1961	1962	1963 [1]
Quantity:					
Solid fuel, million tons of standard coal equivalent	70.0	69.5	70.7	74.8	76.8
Petroleum products, do.	35.1	38.7	42.0	48.8	57.2
Gas, do.	2.3	4.4	6.0	7.3	7.4
Hydroelectric power, do.	13.1	16.2	15.5	14.2	17.7
Total, do.	120.5	128.8	134.2	145.1	159.1
Share of total:					
Solid fuel, percent	58.1	54.0	52.7	51.6	48.3
Petroleum products, do.	29.1	30.0	31.3	33.6	35.9
Gas, do.	1.9	3.4	4.5	5.0	4.7
Hydroelectric power, do.	10.9	12.6	11.5	9.8	11.1
Total, do.	100.0	100.0	100.0	100.0	100.0

[1] Provisional

Source: Comité Professionnel du Pétrole. Elements Statistiques, Activité de l'Industrie Pétrolière 1963, v. 1. Paris, 1964. 216 pp.

But for about 200,000 tons annually, all bituminous coal and anthracite in France were produced in mines which were nationalized in 1946. The industry was administered by Charbonnages de France, a public corporation with a 14-member board of directors under the joint control of the Minister of Finance and Economic Affairs and the Minister of Industry. Members of the board are designated by the Government and are drawn from Government, labor, and consumers. The corporation exercises general direction on the coal industry and coordinates activities of the individual basins, presents annual production plans to the Government for approval, and makes recommendations on coal trade. Charbonnages has established nine regional coal authorities known as houillères de coal mine basin which in turn are composed of 16 members representing Charbonnages, coal consumers, and labor. Each of these authorities has responsibility for the management of mines in its own region. In 1947 Charbonnages also created the Centre d'Etudes et Recherches de Charbonnages de France (Cherchar) for carrying out technical and scientific research.

Production.—An overall program, called the adaptation plan, announced by the French Government in 1960, set a production target of 53 million tons of coal in 1965. The target was fixed with the objec-

tive of closing marginal mines and making prices of French coal more competitive. The target for 1963, according to this plan, was 53.7 million tons, which was not achieved because of the miners strike. The output was equivalent to 62 percent of apparent consumption compared with 78.2 percent in 1962 and 77.8 percent in 1961.

The coal mines of Nord and Pas-de-Calais Départements, which account for nearly half of the national output, registered a production loss of 9.8 percent. The 7.9-percent loss in the Lorraine field, France's second largest basin, was below the loss for the industry as a whole.

TABLE 28.—Salient statistics of the coal and lignite industry

	1959	1960	1961	1962	1963
Coal:					
Production thousand metric tons	57,607	55,966	52,363	52,369	47,754
Apparent consumption do	70,500	69,646	70,665	72,900	76,800
Stocks at yearend do	11,049	13,328	11,974	8,692	6,213
Number of operating mines	(1)	95	86	83	(1)
Average number of days worked	291	287	378	280	256
Average daily output metric tons	198,100	195,200	188,500	197,045	186,500
Number of men working daily at yearend:					
Underground	138,385	130,052	120,480	117,394	115,090
Surface	58,263	55,218	51,720	49,125	46,795
In associated plants	9,814	9,952	10,079	10,108	9,894
Production per man-shift:					
Underground man-shifts only kilograms	1,717	1,795	1,878	1,922	1,958
Total man-shifts do	1,162	1,215	1,262	1,305	1,332
Power production by pithead steam plants:					
Quantity million kilowatt hours	9,495	8,847	10,428	12,152	(1)
Share of thermal power produced in France percent	29.7	27.8	27.2	25.7	(1)
Share of total power produced in France percent	14.7	12.3	13.6	14.6	(1)
Lignite:					
Production thousand metric tons	2,175	2,276	2,906	2,882	2,475
Stocks at yearend do	439	502	489	500	485
Average number of days worked	261	251	252	244	256
Average daily output metric tons	8,200	9,100	11,500	11,800	9,700
Number of men working daily at yearend:					
Underground	2,575	2,303	2,148	1,982	1,853
Surface	1,460	1,398	1,202	1,118	1,066
Associated plants	96	140	149	136	146
Production per man-shift:					
Underground man-shifts only kilograms	2,570	2,791	3,090	3,700	3,890
Total man-shifts do	2,258	2,668	3,824	4,120	3,579

[1] Data not available.

TABLE 29.—Coal production classified by rank

(Million metric tons)

Quality	Volatile matter (percent)	Quantity			
		1959	1960	1961	1962
Anthracite	5 to 10	2.9	3.0	3.0	3.2
Semianthracite	7 to 14	9.5	9.3	8.7	8.6
Bituminous (low volatile) [1]	14 to 18	5.9	5.8	5.6	5.7
Bituminous (medium)	16 to 28	16.1	15.4	14.2	14.0
Bituminous (high volatile)	25 to 41	19.2	19.6	18.2	18.1
Bituminous (high volatile)	[2] 40 to 42	[3] 4.0	2.8	2.7	2.8
Total		57.6	55.9	52.4	52.4

[1] The bulk of the production in this class contains 14 to 18 percent volatile matter; small tonnages have a higher volatile content.
[2] Applies to the bulk of production in this category.
[3] Includes production from nonnationalized mines.

Source: Office Statistique des Communautes Européenes (Luxembourg). Charbon et autres Source d'Énergie, No. 2, 1964.

Based on data for 11 months of 1963, 28.9 million tons of the production was coking coal or 60 percent of total output (63.4 percent in 1962). Respective shares of Nord/Pas-de-Calais, Lorraine, and Centre-Midi in coking coal production in the first 11 months of 1963 were 43, 39, and 18 percent, respectively.

In 1962 there were 83 mines or mining centers in operation (120 in 1954) with 337 shafts of which 116 were hoisting shafts. Average mine depth was 533 meters. Of the total output, including waste mined with coal, 43.1 percent came from seams of less than 1.5 meters with dips up to 45° and another 42 percent from seams of 1.5 to 4 meters width with the same range of dips. Seams with dips less than 20° accounted for 53.7 percent of the output. In the same year two-thirds of the production was mined in longwall faces entirely within the footwall and hanging wall and much of the remainder was mined from thick seams which required use of slicing, cut and fill, or room-and-pillar mining methods. Sixty percent of the coal was obtained from faces which were allowed to cave after coal extraction. In spite of this, 13 million cubic meters of fill were brought into the mines—65 percent by hydraulic methods, 17 percent by mine cars and skips, and 18 percent in dry pipes.

TABLE 30.—Production of coal by mining methods

(Percent of total output)

Method of mining	1960	1961	1962
Pick hammers alone	34.4	31.3	29.0
Pick hammers and explosives	12.5	12.3	12.4
Coal cutters[1]	17.3	19.1	19.4
Explosives (shot from solid)	19.0	18.5	20.0
Plough and plough-scraper	12.1	13.3	13.1
High-pressure air-breaking with or without coal cutter	3.9	5.2	6.0
Other	.8	.3	.1

[1] Explosives and pick hammers are used for breaking down the coal.

Source: Charbonnages de France. Rapport de Gestion, Exercise 1962. Paris, 1963. 139 pp.

Mechanization of French mines has increased much during the last decade. A fully mechanized mine is defined as one where breaking and loading are mechanized [19] and a semimechanized mine is one where either mining or loading is mechanized.

In October 1963, 53.5 percent of coal mined underground was obtained from mechanized operations, and 28.5 percent was obtained from semimechanized operations. Corresponding figures for October 1962 were 50.5 and 27.2 percent and for 1953, 19.7 and 24.4 percent. In addition to modern equipment for coal faces, such as coal cutters, ploughs, and cutter loaders, the use of hydraulic and self-advancing steel props has been adopted.

In the mines of Charbonnages de France during 1962, for winning the coal there were 21,520 pneumatic picks (exclusive of drilling equipment used for drilling into rocks and coal), 241 longwall and other coal cutters, 40 chain shearing machines, 138 cutter-loaders, 150

[19] Winning of coal by pneumatic or electric-pick methods is not considered a mechanized operation.

coal ploughs, and 46 other types of cutter-loaders. For loading coal, 267 loaders, 53 chain conveyors, and 307 mechanized shovels were in use; for loading rocks, 128 chain conveyors, 536 mechanical shovels, and 6 other types of loaders were in use. Consumption of electricity underground (exclusive of use in exhausting) has grown from 1.82 kilowatt hours per ton in 1952 to 5.02 [20] kilowatt hours per ton in 1962. Capacity of transformers installed underground has grown from 106,910 to 340,928 tons during the same period.

TABLE 31.—Status of mechanization of coal, October 1963

	Average number of operating faces	Average daily production all faces (metric tons)	Average daily production per face (metric tons)	Average length (meters)	Average face advances (centimeters)
Mechanized faces:					
Longwall with long faces	215	68,698	320	138	151
Longwall with long faces and multiple attack	130	22,467	173	212	27
Small operations (room and pillar and cut and fill methods)	123	14,157	116	29	161
Total and/or average	468	105,322	228	131	96
Semimechanized:					
Longwall with long faces	278	48,463	174	83	111
Small operations (room and pillar, etc.)	54	7,515	130	42	169
Total and/or average	337	55,978	166	76	117
Other	82	16,240	198	98	116
Total and/or average	887	177,540	200	106	104

Source: Charbonnages de France. Bulletin d'Information Techniques. January–February 1964, No. 114.

TABLE 32.—Haulage units in use in underground coal mines

Type of unit	1960	1961	1962
Locomotives (total power in kilowatts)	48,000	52,634	51,761
Mine cars less than 2,000-liter capacity	185,991	182,739	162,650
Mine cars with more than 2,000-liter capacity	17,252	20,817	21,482
Shaking conveyors, kilometers	145	123	70
Scraper conveyors, do	180	212	223
Belt conveyors, do	311	305	309
Flexible conveyors, do	6	7	8

Source: Charbonnages de France. Rapport de Gestion, Exercise 1962. Paris. 1963. 139 pp.

Thanks to the coal plough, the Nord/Pas-de-Calais Basin's share of coal from mechanized mines increased from 43 percent in October 1962 to 46.6 percent in October 1963. In this area, 95 faces have a plough and one-fourth of the basin's production is obtained by its use. Semimechanized operations accounted for one-third of the production in the same period. Lorraine, the most mechanized basin, produced 86.9 percent of its output in October 1963 from mechanized faces compared with an 83.8 percent production for the same month in 1962. Centre-Midi remained poorly mechanized with a 27.7 percent output in 1963.[21]

[20] Provisional figures.
[21] Charbonnages de France. Bulletin d'Informations Techniques. January–February 1964, No. 114, pp. 3–5.

Replacement of small operations with long faces results in a statistical increase in average length of face and decrease in advance. For all underground mines, average length was 106 meters in October 1963 compared with 102 meters in 1962; corresponding figures for Lorraine were 156 and 142 meters. Daily advance was 104 centimeters in 1963 and 105 centimeters in 1962 with 55 and 61 centimeters, respectively, for the Lorraine Basin. Number of working faces was reduced from 929 to 887 but daily production increased from 175,506 to 177,540 tons. As a result of lengthening working face and increasing mechanization, production per working face increased from 189 tons in October 1962 to 200 tons a year later.

As a result of mechanization, productivity has improved. Increase in underground productivity per man-day in 1963 compared with 1962 figures was highest in Lorraine (95 kilograms), followed by the Nord/Pas-de-Calais area (30 kilograms) and Centre-Midi Basins as a whole (20 kilograms). Because the coal is deteriorating with depth and because there have not been sufficient qualified workers, there has been a relatively small increase in production in the Nord/Pas-de-Calais Basin.

Production cost of coal in 1962 was US$15.98 per ton compared with US$15.24 per ton in 1961. The 1962 cost was composed of labor US$10.53, supply US$2.9, and overhead, taxes, and amortization US$0.95. Fringe benefits in the year were equal to 98.97 percent of wages. Price received per ton in 1962 was US$13.42 so that the Charbonnages de France's loss in the year amounted to $83,529,250 compared with $53,191,750 in 1962 and $6,269,750 in 1959.

Consumption.—Actual consumption of coal in 1963 must have exceeded apparent consumption, as was the case in 1962 when the former was estimated at 75 million tons. Consumption was at record high in 1956 and 1957, at 78 and 78.5 million tons, respectively.

TABLE 33.—Average output per man-shift in principal coal basins (bituminous and anthracite)

(Kilograms)

	1959	1960	1961	1962	1963
Nord/Pas-de-Calais:					
Underground	1,507	1,562	1,610	1,633	1,663
Underground and surface	1,030	1,068	1,099	1,129	1,149
Lorraine:					
Underground	2,424	2,580	2,704	2,808	2,903
Underground and surface	1,616	1,704	1,760	1,839	1,902
Centre-Midi:					
Underground	1,739	1,855	1,997	2,099	(1)
Underground and surface	1,154	1,230	1,317	1,392	(1)
Blanzy:					
Underground	1,939	2,027	2,112	2,202	2,182
Underground and surface	1,292	1,361	1,422	1,487	1,455
Loire:					
Underground	1,632	1,757	1,818	1,789	1,717
Underground and surface	1,105	1,197	1,231	1,208	1,165
Cevennes: [2]					
Underground	1,538	1,643	1,683	1,743	1,663
Underground and surface	1,014	1,059	1,064	1,119	1,145
Aquitaine: [2]					
Underground	1,705	1,840	2,077	2,172	2,338
Underground and surface	1,134	1,240	1,381	1,445	1,536
France:					
Underground	1,717	1,795	1,878	1,922	1,958
Underground and surface	1,162	1,215	1,262	1,305	1,332

[1] Data not available.
[2] Includes small tonnages of coal produced in open-cast mines.

TABLE 34.—Coal availability and distribution

(Thousand metric tons)

	1959	1960	1961	1962	1963
Net production [1]	57,606	55,960	52,358	52,359	47,754
Middlings, foreign coal, etc.	145	62	64	113	561
Stock variations [2]	+3,606	+2,241	−1,195	−3,060	−2,408
Total	54,145	53,781	53,617	55,532	50,723
Consumption by mine	7,765	7,119	7,767	8,791	7,954
Delivery to miners	1,336	1,342	1,254	1,234	1,201
Delivery for transformation:					
Mine coke ovens	8,617	9,538	9,483	9,584	8,862
Steel plant coke ovens	2,180	2,400	2,434	2,467	2,121
Gas coke ovens	1,546	1,575	1,333	1,099	661
Briqueting plants	5,224	4,848	4,838	5,241	4,983
Total	26,668	26,822	27,109	28,416	25,782
Exports [1]	1,499	1,444	1,361	1,337	[3] 953
Total available from domestic production	25,978	25,515	25,147	25,779	23,988
Imports [1]	11,037	10,114	10,334	10,807	15,584
Delivery from imports:					
Coal mine coke ovens	803	524	460	706	1,368
Steel plant coke ovens	3,392	3,275	3,372	3,230	3,587
Gas coke ovens	869	825	607	554	1,103
Briqueting plants	742	813	945	1,312	2,724
Mines, for use, blending, or stocks	27		21	4	378
Stock variations [2]	+1,377	+867	+1,003	+497	−2,799
Available from imports	3,827	3,810	3,926	4,504	9,223
Available for domestic distribution	29,805	29,325	29,073	30,283	33,211
Railroads	3,038	2,681	2,517	2,306	2,263
Gas works	1,330	885	543	321	181
Electricity	5,028	4,728	5,049	5,978	7,659
Iron and steel	1,236	1,412	1,387	1,624	1,649
Other industries	10,851	11,147	10,908	10,762	10,861
Domestic and small industries	8,322	8,472	8,669	9,292	10,598

[1] Data presented differ slightly from those given elsewhere in chapter because of differences in sources
[2] Plus (+) denotes addition to stocks; minus (−) denotes withdrawal from stocks.
[3] Includes reexports.

Source: Bureau de Documentation Minière (Paris). Combustibles Minéraux Solides, Statistique Annuelle Définitive. Pt. 2, 1963.

Powerplants, the iron and steel industry, domestic users, and industry other than iron and steel were the four principal consumers of French coal. Total sales of solid fuels in 1963 probably exceeded the 1962 figure of 61 million tons. Of the coal which was produced and imported in 1963, 41 million tons were transformed as follows, into electricity, coke, and briquets, in thousand tons: Electricity 15,600, coke 17,700, and briquets 7,600.

Consumption by the iron and steel industry has been influenced by variation in steel output and by reductions in coke consumption per ton of pig iron produced; consumption decreased from 967 kilograms in 1961 to 846 kilograms in 1963.

In industries other than iron and steel and small industries, the share of total energy needs supplied by solid fuels has decreased from 58.6 percent in 1960 to 49.7 percent in 1962, whereas that supplied by fuel oil increased from 8.5 to 40.4 percent and that supplied by natural gas increased from 1.6 to 9.9 percent during the same period. To encourage use of coal by industry, a central steamplant was put into operation at the end of 1962 to supply steam for heating to a number of industrial consumers of gases. The installation supplies steam to users at a cost lower than could be obtained from smaller individual plants.

TABLE 35.—Consumption and receipt of solid fuel [1] by the iron and steel industry

(Thousand metric tons)

	1959	1960	1961	1962	1963
Coke consumption	13,130	14,497	14,680	13,714	13,522
Of which blast furnaces	12,515	13,730	13,905	12,789	12,091
Coke receipts:					
From plants' own coke ovens	3,793	4,174	4,215	4,190	4,098
From coke ovens of coal mines	5,156	5,631	5,553	5,308	5,076
From imports	4,181	4,690	5,015	4,254	4,445
Coking coal consumption	5,558	5,695	5,784	5,744	5,674
Coking coal receipts	5,558	5,709	5,798	5,700	5,717
Of which from France	2,183	2,411	2,436	2,465	2,129
Other coal consumption	1,304	1,454	1,423	1,570	1,606
Other coal receipts	1,300	1,409	1,385	1,628	1,636
Of which from France	1,277	1,373	1,336	1,558	1,521
Recycled coke breeze	105	95	94	99	89

[1] Data have not been reconciled with those presented elsewhere in this chapter because of variations in sources.

Source: Bulletin de la Chambre Syndicale de la Sidérurgie Française, No. 144, 1963, pp. 11–12.

Domestic users, including small-scale industry, remain an important market for coal, especially when a winter is colder than normal. Sale of all solid fuels, including coke, semicoke, and briquets, to this consumption sector increased from 16 million tons in 1961 to 18 million tons in 1962 because of the severe winter 1962-63.

Consumption by the railroads and gas producers has diminished, first because of the rapid electrification of French railroads and secondly because of inroads made by natural gas and gases that were made from petroleum products. In 1962, Gas de France closed 18 installations producing gas from coal. By contrast, 208,000 tons of petroleum products was used during 1962 for gas generation compared with 145,000 tons in 1961. Distribution of total gas supply in 1962 by production method (in percent) was gas from coal 42, natural gas 42, refinery gas 7, and liquefied gas 9.

Coal and lignite consumption by Electricite de France increased from 6.2 million tons in 1961 to 8 million tons in 1962 when 57 percent of the 82,300 million kilowatts produced was from thermal plants. Of total power produced by standard thermal powerplants in 1962 69 percent was generated through use of coal and lignite as fuel; 11 percent each through use of natural gas (from Lacq) and petroleum; and 9 percent through use of manufactured gas.

The severe winter and shortfall of domestic production increased coal imports in 1963 by 44 percent. The Common Market countries supplied 52 percent of the imports. Germany, including the Saar, ranked first among Common Market as well as world suppliers. Shipments from the United Kingdom and the U.S.S.R. increased substantially from 1962, when imports were 791,000 and 947,000 tons, respectively. Imports from the United States were 178,000 tons more than the previous year. France was not a large exporter of coal; exports totaled 983,000 tons in 1963. Principal destination and quantities in thousand tons were: West Germany 544; Belgium 278; Switzerland 288. All coal imported from countries other than those in the Community are handled by Association Technique de l'Importation Charbonniere.

Prices of coal in U.S. dollars per ton f.o.b. mines of Nord/Pas-de-Calais as of June 1963 were in the following ranges depending on size: Anthracite (with volatile matter less than 10 percent) 29 to 31.50; anthracite coal (10 to 14 percent volatile matter), 22 to 29.50; low-volatile coal (14 to 18 percent volatile matter) 17 to 25; coal with volatile matter more than 18 percent, 15 to 17; and high-volatile coal (more than 30 percent) 15 to 17.50. For the whole bituminous coal group, price of fines varied from US$11 to US$15 per ton f.o.b. mines. Seasonal price adjustments are made with small discounts during off seasons and premiums during cold months.

TABLE 36.—Imports of coal, coke, and coal and lignite briquets in 1963

(Thousand metric tons)

	Coal	Coke	Coal briquets	Lignite briquets	Total
West Germany	6,159	4,552	84	470	11,265
Saar	2,695	1,061			3,756
Netherlands	1,066	975	212	8	2,261
Belgium	894	347	476		1,717
Total EEC countries	8,119	[1] 5,889	772	478	15,258
United Kingdom	2,124	27	46		2,197
Poland	361				361
U.S.S.R.	1,836				1,836
United States	2,577				2,577
Other countries	567			17	584
Total	15,584	5,916	818	495	22,813

[1] Includes 15,000 tons of coke from Italy.

Source: Bureau de Documentation Minière. Combustibles Minéraux Solides. Statistique Annuelle Définitive, 1963. Pt. 2.

Stocks of coal have shown a steady decline since 1960. Of the 1963 stocks, 896,000 tons was marketable coal and 4,958,000 tons low-value coal.

Preparation.—Coal washing capacity in 1962 was 22,700 to 24,000 tons of coal per hour of which 19,300 tons were in new or modernized plants installed since 1946. Ratio of mine-run coal to marketable coal in the same year was 1.585 to 1 and nearly 32 million tons of waste were rejected by washing. During 1952–62 share of washed coal in total output increased from 72 to 86.3 percent. During the same period, heavy media separation (with magnetite the commonest medium) and flotation methods gained in importance at the expense of jigs, penumatic tables, and rheolaveurs.

As of 1962, coal supplied to coke ovens, domestic users, and patent fuel producers had an ash content not exceeeding 9 percent. Nut-size coal is treated in heavy media units. For washing of fines from 0.5 to 10 millimeters, majority of installations use pneumatic jigs but there is a tendency to use magnetite cyclone. Flotation is used for sizes less than one-half millimeter; 4 million tons of flotation concentrates are produced annually.

Manpower.—Number of underground and surface workers of coal and lignite mines has shown a continuous decline. However, the rate of reduction of underground workers slowed down in 1962 and 1963 to 2 percent of the labor force engaged in the corresponding previous

TABLE 37.—Further processing of mine-run coal by various methods

(Percent)

Method	1952	1960	1961	1962
Pneumatic tables	7.9	2.9	2.3	2.2
Jigs	64.7	48.3	45.6	45.0
Rhéolaveurs	18.8	4.5	3.6	2.6
Heavy media	5.6	35.9	39.8	40.6
Flotation	2.7	7.0	7.4	7.7
Miscellaneous	.3	1.4	1.3	1.9

year compared with 8 percent in 1961 and 6 percent in 1960. Reduction of surface workers, resulting largely from concentration of surface installations, remained about 5 percent in 1962 and 1963.

The reason for the strike of March 1 to April 5 was the miners' estimate of a lag between wage levels in public and private industry. The Government established a fact-finding committee to examine the relationship of wage levels in the principal nationalized and public enterprises to those in the private sector. On the basis of the committee's findings, the Government offered the miners an increase of 6.5 percent effective April 1, 1963, to be raised by stages to a total of 12.5 percent by April 1, 1964. Essentially, this wage package plus a small cash payment and assurance of the equivalent of a 4th week of vacation, were accepted.

Aside from the creation of a committee to compare coal industry wages with private industry wages, the Government appointed a Secretary General for Energy in charge of coordinating the energy industries and created a commission comprising representatives of Government, coal industry, and labor to study the future of the industry.

Patent Fuels.—Production of patent fuels increased substantially in 1963 because makers of patent fuels other than mines doubled their output presumably from imported coal. Of the 1963 output, 6,681,000 tons was classified as boulet (egg-shaped agglomerates used for domestic heating), 1,029,000 tons was special agglomerates which have been favorably received by consumers and 289,000 tons was briquets specially for industrial use.

Lignite.—Charbonnages de France was the largest lignite producer but Électricité de France operated Hostens and Arjuzanx mines in the Landes region of southwest France, using lignite for power production. These are open-pit operations with highest productivity in France. Mines of Charbonnages de France are in Provence in southeast France; these mines together with other small mines accounted for two-thirds of the 1963 lignite output. Lignite shipments to users other than mines' own use and briquetting plants totaled 1,795,000 tons; 843,000 tons to power plants; 819,000 tons to industry, and 133,000 tons to domestic users and small industry.

Coke.—France was not self-sufficient in coke. Capacity for producing coke including semicoke in 1962 was 24,300 tons per day; this figure includes the Carling coke batteries which were put in operation in March 1962. Coke for the steel industry was supplied from the industry's own coke ovens, from coke ovens of Charbonnages de France,

TABLE 38.—Production of patent fuels (briquets)

(Thousand metric tons)

	1959	1960	1961	1962	1963
Mine plants	5,319	4,860	4,947	5,419	5,287
Other plants:					
Coastal	147	1,046	995	1,301	2,382
Interior	1,097	166	149	217	330
Total	6,563	6,072	6,091	6,937	7,999

and from imports, mainly from West Germany including the Saar region. Mines in Nord/Pas-de-Calais produced nearly 1.8 times as much coke as the Lorraine mines. Although 67 percent of the 13,619,000 tons of coke received by the steel industry in 1963 was made in France, all of this coke was not produced from French coking coal. Of the 18,220,000 tons of coal charged to coke ovens in 1963, 33 percent was foreign coal. This was more than the 26 percent average for the previous 4 years because of the strike in 1963.

Much of the early effort of the Centre d'Études et Recherches des Charbonnages de France (Cherchar) in the field of carbonization was devoted to improving the domestic coking coal supply position by

TABLE 39.—Production, availability, and distribution of coke

(Thousand metric tons)

	1959	1960	1961	1962	1963
Coal charged to coke ovens:					
Domestic	12,758	13,917	13,730	13,686	12,160
Imported	5,080	4,580	4,590	4,635	6,060
Total	17,838	18,497	18,320	18,321	18,220
Production:					
Coke oven:					
At mines	7,271	7,707	7,777	8,070	8,055
Nord/Pas-de-Calais	4,385	4,801	4,777	4,660	4,473
Lorraine	1,883	1,872	1,879	2,308	2,419
In iron and steel plants	4,244	4,363	4,420	4,384	4,315
By gas companies and independents	1,909	1,862	1,555	1,332	1,365
Total [1]	13,425	13,933	13,753	13,785	13,735
Semicoke	288	297	278	269	271
Gas coke	1,020	695	429	247	146
Availability and distribution:					
Coke produced	13,425	13,933	13,753	13,785	13,735
Coke receipts and fines		196	166	72	2
Consumption at coking plants and by labor	1,192	1,111	860	981	1,039
Available for distribution	12,233	13,018	13,059	12,876	12,698
Stock variation [2]	+17	−85	+200	−68	−370
Imports	4,334	5,070	5,530	4,694	5,916
Importers stock variation [2]	−5	+5	+21	+50	+439
Total available from domestic production and imports	16,555	18,168	18,368	17,588	18,545
Delivery to coking plants		199	160	66	5
Exports	144	123	105	160	154
Distribution:					
Railroads	83	82	78	78	[3] 95
Electricity	7	3	1	4	1
Iron and steel	13,091	14,470	14,829	13,791	[3] 13,669
Other industries	1,832	1,904	1,888	1,845	[3] 2,006
Domestic use and small industries	1,398	1,387	1,307	1,644	[4]
Total	16,411	17,846	18,103	17,362	18,386

[1] Total includes semicoke and distilled agglomerates produced in mines but not shown in details by areas.
[2] Plus indicates addition to stocks, minus indicates withdrawal from stocks.
[3] Figures are calculated on the basis of 10 months.
[4] Not available.

Source: Bureau de Documentation Minière (Paris). Combustibles Minéraux Solides, Statistique Annuelle Définitive. Part 2, Years 1959-63.

blending increasing proportions of relatively poor coking coals of Lorraine with domestic and imported coking coal. In 1960 it was reported that four commercial plants were using the "stamped charged" method of charging coal to coke ovens. This procedure developed by Cherchar, improves the quality of coke produced from a given blend or produces the same quality coke, using less of the strongly coking coal in the blend. The use of semicoke or char to replace coking coal in the blend and the preheating of coal prior to charging into the oven are other approaches which have been investigated in the last 2 or 3 years.

Coal Chemicals.—Increase in production of coal chemicals in 1962 resulted from planned expansion of the coke producing capacity. However, as in other countries, coal chemicals are having difficulty in maintaining their competitive position with natural gas for making nitrogen fertilizers and with petroleum for making aromatic and other organic chemicals. Consequently, prices of coal chemicals have generally dropped, influencing adversely the economics of coke oven plants.

Petroleum and Natural Gas.[22]—Domestic production of crude petroleum in 1963 was 5.4 percent of the refinery throughput. Consumption of petroleum products attained a record of 36 million tons. Two new refineries which came on stream in 1963 added 6 million tons to the annual refining capacity which stood at 51.8 million tons at the end of 1963. Significantly, these refineries as well as the one at Feyzin, which is to come on stream in 1964, were all inland. Imports of crude petroleum from the franc area increased at the expense of imports from the Near East which in the past had constituted the bulk of the French supply. Cost of net imports of petroleum and petroleum products totaled US$450 million. Petroleum products supplied 35.9 percent of the 1963 energy requirements, and together with natural gas they supplied 40.6 percent. Tempo of exploration was less than in the previous year but development drilling increased. The recoverable reserve was 28 million tons (202 million barrels).

Government Activity.—The French Government was a petroleum producer, refiner, and distributor of petroleum products. The Régie Autonome de Pétrole was set up by a decree of July 29, 1939, to exploit the Saint-Marcet natural gas discovery. The Bureau de Recherches Pétrolières (BRP), set up by the Government in 1945, has majority interest in a number of companies of which the following companies were active in exploration and production in France: Compagnie d'Exploration Pétrolière (CEP), Compagnie des Pétroles France-Afrique (COPEFA), Société de Prospection et d'Exploitation Pétrolières en Alsace (PREPA), Société Anonyme Française de Recherches et d'Exploitation de Pétrole (SAFREP), Société Nationale des Pétroles d'Aquitaine (SNPA), and Société Nationale de Recherche et d'Exploitation des Pétroles en Algérie (SNREPAL). Bureau de Recherches Pétrolières carried out 55 percent of exploration and 50 percent of the total drilling in 1962; it also produced 17 percent of the oil and 94 percent of the natural gas for the country.

[22] Comité Professionnel du Pétrole. Éléments Statistiques, Activité de l'Industrie Pétrolière. Paris, France. V. I, 1962, 211 pp.; v. 2, 1962, 334 pp.; and v. I, 1963, 216 pp.

TABLE 40.—Salient statistics of the petroleum and natural gas industry

(Metric tons unless otherwise specified)

	1955	1959	1962	1963
Length of hole drilled—thousand meters	146.6	393.7	263.8	236.5
Production:				
Crude petroleum—thousand tons	878.4	1,617.8	2,370.2	2,522.0
Natural gas—million cubic meters	274.0	2,614.0	6,996.0	7,518.0
Of which marketed—do	256.0	1,645.0	4,740.0	4,861.0
Products obtained from refining of natural gas:				
Liquefied products—thousand tons	24.5	140.4	423.6	437.6
Sulfur—do	----------	426.3	1,345.1	1,408.5
Refining:				
Number of refineries	13	14	14	15
Capacity of refineries (atmospheric distillation)—thousand tons	30,235.0	37,440.0	44,540.0	51,830.0
Refinery throughput—do	25,086.0	30,766.0	39,863.0	46,702.0
Foreign trade:				
Imports:				
Crude—do	24,832.0	29,171.0	37,161.0	43,258.0
Products—do	952.0	2,125.0	3,070.0	4,276.0
Exports of products including bunkering—do	6,111.0	6,512.0	7,526.0	8,006.0
Consumption:				
Internal market—do	15,846.0	20,890.0	30,044.0	35,902.
French bunkering—do	1,293.0	1,377.0	1,518.0	1,339.0
Other consumption, including refinery and distribution losses—thousand tons	3,000.0	4,100.0	4,620.0	5,000.0
Stock:				
In refinery—do	5,690.0	8,077.0	10,519.0	11,774.0
In distribution channels—do	2,918.0	3,496.0	3,914.0	4,540.0
Transportation:				
Tankers:				
Units	90	109	103	93
Deadweight—thousand tons	1,776	2,676	3,055	2,945
Tank cars:				
Units	10,138	12,050	14,191	16,150
Capacity—thousand cubic meters	265	371	511	620
Tank trucks:				
Units	5,528	6,535	8,019	8,248
Capacity—thousand cubic meters	57	76	99	100
Barges:				
Units	652	716	740	788
Capacity—thousand cubic meters	303	350	364	411
Coastal vessels:				
Units	35	43	50	51
Deadweight—thousand tons	54	79	100	107
Employment:				
Exploration and production	(1)	11,650	10,923	11,043
Refinery	(1)	16,850	15,710	15,895
Distribution	(1)	84,750	84,550	84,600
Other	(1)	1,150	1,300	1,355
Total	(1)	114,400	112,483	112,893
Investments:				
Exploration and production—millions of dollars	(1)	452.29	[2] 312.94	(1)
Tankers—do	(1)	53.07	----------	(1)
Pipelines—do	(1)	0.81	[2] 85.07	(1)
Refinery—do	(1)	70.28	[2] 125.58	(1)
Distribution—do	(1)	57.93	[2] 78.99	(1)
Other—do	(1)	2.43	[2] 11.34	(1)
Total—do	(1)	636.81	[2] 636.92	(1)

[1] Data not available.
[2] Provisional.

The competitive position of crude tar has deteriorated because refinery asphalts are making inroads into crude tar markets for road use and because distillation of crude tar is not always economically advantageous. During the first quarter of 1962, stocks of benzene obtained from crude light oil (crude benzol) increased to about a quarter of national output so that tariff and other measures were necessary to improve the situation during the second half of the year. In 1962, Société Nationale des Pétroles d'Aquitaine put into operation a 70,000-ton-annual-capacity benzene plant, using petroleum feedstock as a base. This increased the potential capacity of benzene from

petroleum to about 80,000 tons per year, the same capacity as for coal. In 1962 coal mines and their associates, using coke oven gas as synthesis gas, produced 438,000 tons of ammonia (47.5 percent of national output) and 343,000 tons of nitrogen fertilizers (40.5 percent of national output). Corresponding figures in 1961 were 410,000 tons of ammonia and 328,500 tons of nitrogen fertilizer.

Exploration.—At yearend 128,700 square kilometers of area in France were covered by exploration and exploitation permits, compared with 128,500 square kilometers in 1962 and 130,800 in 1961. As of the end of 1963, 20 companies had exclusive permits or had requested exclusive permits for petroleum and gas exploration in France covering a total area of 160,796 square kilometers. Among these firms were the following with their respective areas in square kilometers: Société Nationale des Pétroles d'Aquitaine 30,453; Régie Autonome des Pétroles 28,906; Compagnie d'Exploration Pétrolière 18,045; and Société Esso de Recherches et d'Exploitation Pétrolières 11,622. The first three companies which are Government owned accounted for 48 percent of the area.

The number of exploration wells drilled in 1963 increased but development well drilling and geophysical activity decreased. Depth of all wells drilled (excluding shallow depth core drills) during the year was 236,000 meters, 8 percent less than in 1962.

TABLE 41.—Summary of drilling activities

	Oil wells	Gas wells	Dry wells	Total	Meters drilled
Total, all basins:					
Exploration:					
1961	4	1	102	107	166,325
1962	11	----	88	99	163,788
1963	4	1	101	106	169,000
Development:					
1961	58	----	19	77	91,667
1962	54	----	[1] 20	[1] 74	[2] 73,509
1963	24	----	13	37	52,000
Core drills: [3]					
1961	----	----	----	30	22,913
1962	----	----	----	31	17,915
1963	----	----	----	27	15,000
Distribution of 1962 total by basin:					
Exploration:					
Paris Basin	3	----	57	60	64,953
Aquitaine Basin	5	----	8	13	60,429
Alsace Basin	3	----	2	5	4,243
Jura Basin	----	----	3	3	4,801
Rhodan area and Languedoc	----	----	16	16	26,855
Development:					
Paris Basin	43	----	15	58	40,615
Aquitaine Basin	8	----	5	13	30,959
Alsace Basin	3	----	----	3	1,935
Core drills: [3]					
Paris Basin	----	----	----	28	16,110
Aquitaine Basin	----	----	----	3	1,805

[1] Excludes two dry wells not reported by basin in 1962 detail.
[2] Revised data, apparently including two additional wells, totals 82,000 meters drilled, but breakdown by basin was not reported.
[3] Excludes shallow depth core drills.

Crude Oil Production.—In 1963, 77.6 percent of the output was obtained from the Aquitaine Basin. Société Esso de Recherches et d'Exploitation Pétrolières was the largest producer with 74 percent of the country's output, mainly from Parentis and Cazeux fields in Aquitaine, followed by Compagnie d'Exploration Pétrolière with 11

percent. Six other companies accounted for the remainder of the output.

At the end of 1962, there were 36 producing fields in France: 15 in the Paris Basin, 11 in Alsace, and 10 in Aquitaine. Only 16 fields produced more than 100,000 barrels during the year. There were 384 oil wells in these fields—42 producing under natural pressure, 270 pumped, 1 gas lift, 54 closed and 17 abandoned. Of the flowing wells, 34 were in the Aquitaine Basin.

Most of the oil-bearing rocks are limestone and dolomite and anticlines are the commonest oil-bearing structure. Production by oil-bearing zones in 1962 was as follows: Middle Jurassic 16 percent; Upper Jurassic and Lower Cretaceous 78 percent; and Upper Cretaceous and Tertiary 6 percent. Gravity of French crudes varies from 20° to 41° API, but Parentis and Cazeux fields, which together accounted for 65 percent of 1962 output, have 32.7° API gravity oil.

TABLE 42.—Petroleum production by basins and principal producing fields

(Thousand metric tons unless otherwise specified)

	1959	1960	1961	1962	1963	Principal fields
Alsace Basin:						
Société Anonyme d'Exploitation Minieres Pechelbronn.	22.8	22.3	20.6	14.5	6.2	Pechelbronn.
Société de Prospection et Exploitations Pétrolieres en Alsace (PREPA).	45.8	41.5	33.1	29.5	27.8	Scheibenhard Eschau.
Paris Basin:						
Compagnie d'Exploration Pétroliére (CEP).	38.1	110.1	181.3	262.0	278.0	Chailly-en-Biére, St. Firmin des Bois, Chuelles, Chateaurenard.
Compagnie Pétroliére de Sud Est Paris (COPESEP).	19.2	133.7	141.9	110.7	85.1	St. Martin-de-Bossenay, Gisy.
Société Pétroliére de Recherches dans la Région Parisiene (PETROREP).	145.4	178.3	122.1	110.8	92.7	Coulommes.
Régie Autonomes des Petroles (RAP).	10.4	56.8	70.1	81.4	75.8	Villemer, Valenee-en-Brie, Chartrettes.
Aquitaine Basin:						
Esso Petroleum Exploration and Development Co.	1,236.0	1,345.4	1,503.2	1,674.5	1,870.0	Parentis, Cazaux, Mothes, Lugos, Laverne la Teste, Mimizan Nord.
Société Nationale de Pétrole d' Aquitaine (SNPA).	100.1	88.4	91.1	85.0	86.4	Lacq Superieur.
Total	1,617.8	1,976.5	2,163.4	2,368.4	2,522.0	

Trade.—Imports of crude oil from Algeria continued its increase, although at a smaller rate. This country, which was the principal producer in the franc zone, contributed 35 percent of total imports. In tonnage, the Middle East remained the largest supplier with 53 percent of the total, although in 1959 this area shipped 85 percent of total French imports. Cost of crude imports was US$821,917,000. France had a net export of 3,730,400 [23] tons petroleum products with a net value of US$174,900,000.

Fuel oils have constituted the most important imports—60 percent of total in 1963. Although 1963 fuel oil imports were exceptionally high, they have increased every year since 1959. Among the suppliers, U.S.S.R. and Rumania increased their exports substantially in 1963.

[23] Comité Professionnel du Pétrole. Eléments Statistiques, Activité de l'Industrie Pétrolière. 1963, v. 1. Paris, 1964, 216 pp.

TABLE 43.—Oilfield characteristics

Basin and field	Geological horizon	Average depth (meters)	API density (gravity degrees)	Sulfur content (percent)	Number of production wells [1]	Cumulative production (thousand tons) [1]
Paris Basin:						
Chailly-en Bière	Middle Jurassic (Dogger).	1,650	35.4	0.21	25	383
Chartrettes	do	1,650	34.9	.13	18	128
Châteaurenard	Lower Cretaceous (Neocomian).	550	27.0	.34	25	147
Chuelles	do	550	27.0	.34	43	124
Coulommes	Middle Jurassic (Dogger).	1,900	33.2	.20	30	661
St. Firmin	Lower Cretaceous (Neocomian).	550	27.0	.34	38	217
St. Martin-de-Bossenay	Middle Jurassic (Dogger).	1,400	32.8	.21	12	479
Valence-en-Brie	do				2	17
Villemer	do	1,520	31.4	.50	10	148
Aquitaine:						
Parentis	Lower Cretaceous to Upper Jurassic (Aptian to Portlandian).	2,350	32.6	.41	30	10,152
Mothes	do	2,470	20.9	.73	4	458
Lugos	do	1,630	20.6	.73	6	209
Cazaux	Lower Cretaceous and Upper Jurassic (Albo-Aptian and Purbeckian).	2,500	32.6	.35	24	866
Lacq Superieur	Upper Cretaceous (Senonian).	660	20.6	4.10	38	2,320
Alsace:						
Scheibenhard	do	600–900	31.4–40.6	.21–.14	20	150
Other					20	174

[1] As of Dec. 31, 1963.

Fuel oils were the major shipments from these two sources and some of the shipments may have been for re-export.

TABLE 44.—Imports of crude petroleum by origin

(Thousand metric tons)

	1959	1960	1961	1962	1963
Franc zone:					
Algeria	695.7	6,496.6	11,182.7	12,699.4	15,215.0
Other	742.1	824.5	830.3	820.3	783.9
Total	1,437.8	7,321.1	12,013.0	13,519.7	15,998.9
Middle East:					
Iran	1,976.0	1,367.4	813.6	1,478.0	2,038.0
Iraq	9,237.1	7,811.8	6,893.0	7,225.9	9,259.9
Kuwait	7,270.9	7,404.0	8,752.4	8,202.8	8,084.3
Qatar	3,250.6	1,593.3	1,573.7	1,540.9	1,194.0
Saudi Arabia	3,101.9	2,981.0	2,335.4	2,083.0	1,792.7
Other				159.1	465.7
Total	24,836.5	21,157.5	20,368.1	20,689.7	22,834.6
United States	77.4	63.1	50.0	16.9	
U.S.S.R.	124.9	139.9	112.6	86.5	114.5
Venezuela	2,496.5	2,293.2	2,449.1	2,597.9	2,649.3
Other	197.6	48.3	24.8	249.9	1,660.8
Grand total	29,170.7	31,023.1	35,017.6	37,160.6	43,258.1

Of the 8,006,400 tons of products exported, 1,719,600 tons were shipped to the franc zone; 477,500 tons of gas oil; 368,600 tons of motor gasoline; 355,000 tons of heavy fuel oils; 95,400 tons of lubricants;

156,100 tons of kerosine and white spirits; 79,600 tons of asphalt; and 53,100 tons of gas petroleum. The remainder comprised aviation gasoline, gas oil, light fuel oil, and other products. The largest market for French petroleum products was Switzerland, followed by West Germany, Algeria, and the United Kingdom. Switzerland was the largest market for French gasoline and gas oil, West Germany for fuel oils, and Belgium-Luxembourg for liquified petroleum gas. Jet fuel was the most important export to the United States.

TABLE 45.—Trade in petroleum products

(Metric tons)

	1963	Principal destinations and sources
Exports:		
Gasoline	1,387,926	Switzerland 374,707; Algeria 308,353; West Germany 207,172; United Kingdom 202,035; Nigeria 51,359; Sweden 29,274; Tunisia 24,967.
Jet fuel	443,724	United States 136,692; Switzerland 89,425; Algeria 41,366; West Germany 25,550; United Kingdom 20,966; Spain 15,993; Italy 10,018.
Kerosine	451,355	Algeria 86,278; United Kingdom 73,736; Nigeria 43,693; Cyprus 33,493; Tunisia 29,796; Greece 27,462; Libya 25,959; Netherlands 25,717.
White spirit and special gasoline	18,249	United Kingdom 5,658; Switzerland 3,798; West Germany 2,839; Belgium-Luxembourg 2,010.
Other medium and light oils	84,086	West Germany 41,215; United Kingdom 24,318; Netherlands 9,696; Italy 7,766.
Gas oil	2,305,255	Switzerland 703,845; Algeria 386,673; West Germany 364,690; United Kingdom 287,408; Belgium-Luxembourg 167,530; Netherlands 141,675.
Fuel oils	2,627,013	West Germany 684,657; United Kingdom 309,948; Algeria 296,483; Netherlands 264,503; Switzerland 202,156; Greece 125,780.
Lubricants	222,825	United Kingdom 37,051; Algeria 32,782; Belgium-Luxembourg 20,524; West Germany 17,347; Morocco 15,355; Italy 13,158; Tunisia 10,365.
Liquefied petroleum gas	221,803	Belgium-Luxembourg 50,751; Algeria 41,178; Spain 34,342; Portugal 27,484; Italy 12,820; United Kingdom 11,495.
Other	244,156	Algeria 54,924; Switzerland 47,499; Belgium-Luxembourg 27,441; Morocco 24,302; United Kingdom 21,005; West Germany 16,956; Italy 12,598.
Total	8,006,392	Switzerland 1,437,204; West Germany 1,372,296; Algeria 1,249,032; United Kingdom 993,620; Netherlands 467,901.
Imports:		
Gasoline	699,720	Venezuela 160,241; Rumania 134,680; Algeria 79,546; Italy 68,498; U.S.S.R. 55,002; Saudi Arabia 40,895; Netherlands 37,110; Iraq 24,342.
Jet fuel	3,594	Algeria 2,955; United States 541.
Kerosine	10,189	Iraq 2,965; Kuwait 2,699; Italy 2,088; Netherlands 941; East Germany 673.
White spirit and special gasoline	10,555	Kuwait 5,618; Italy 3,072; United Kingdom 1,189; Iraq 575.
Gas oil	433,015	United States 65,133; U.S.S.R. 54,883; Rumania 51,253; Algeria 46,692; Kuwait 41,343; Venezuela 34,009; Italy 28,792; Iraq 28,287.
Fuel oils	2,570,575	U.S.S.R. 758,520; Rumania 559,428; Algeria 350,173; Venezuela 208,891; Kuwait 165,975; Iraq 191,102; Netherlands 90,290.
Lubricants	21,236	United States 13,392; West Germany 15,214; United Kingdom 2,259; Netherlands 1,214.
Liquefied petroleum gas	66,800	Algeria 18,173; West Germany 2,482; Netherlands 8,698; Belgium-Luxembourg 8,067; United Kingdom 5,132.
Petroleum coke	341,817	United States 269,692; West Germany 61,119; Netherlands 10,633.
Other	118,530	Indonesia 55,516; United Kingdom 31,389; United States 15,585; Netherlands 3,772; West Germany 2,317.
Total	4,276,031	U.S.S.R. 869,230; Rumania 746,003; Algeria 498,264; United States 411,163; Venezuela 404,837; Kuwait 239,932.

Source: Éléments Statistiques, Activité de L'Industrie Pétrolière. 1963 v. 1.

In February 1963 the Government issued 10 decrees which in effect will regulate the import, processing, and distribution of petroleum, petroleum products, and residues from nonfranc areas. The decrees, which are to be effective from September 1, 1965, to September 1, 1975, renew the special permit for petroleum imports granted in 1959 to the following companies: Compagnie Française de Raffinage, Antar Pétroles de l'Atlantique, Union Industrielle des Pétroles (UIP) Esso Standard S.A.F., Mobil Oil Française, Société Shell Française, Société Française de Pétroles B.P., Compagnie des Produits Chimiques et Raffinerie de Berre. These companies are now authorized to continue importing petroleum for an additional 10 years. At the same time a new license was issued to Union Générale des Pétroles (UGP) which was formed in 1960 as the French Government's instrument for refining and marketing Saharan crude oil. The decree establishes for each company quantities of gasoline which it may refine from nonfranc area crude. Gasoline which the French-owned companies may produce from nonfranc crude has been increased from 2,762,301 tons in the present quota to 3,678,690 tons for 1965–75, but the allotments have been left unchanged for foreign-owned companies (2,320,984 tons).

As a result of the large increase in the quantities of gasoline that the UGP–UIP group is licensed to produce from nonfranc crude (870,000 tons for 1965–75 compared with 238,187 tons under the quota prevailing in 1964), the relative share of total imports allocated to all the other companies was reduced. Furthermore, the Government may increase the quantity of crude that one company may import by 15 percent annually without increasing the quantities allowed to others. A decree was issued confirming the right of the Compagnie Française de Raffinage to import enough crude petroleum from nonfranc areas to enable the company to make available for French internal consumption 25 percent of all the refined petroleum products that can be produced for this market by all companies from nonfranc petroleum. Henceforth, every investment by the companies for new plants and equipment must be approved by the Government.

Refining.—During 1963, French refineries treated 46.7 million tons of crude petroleum with a gross output of 44.1 million tons of products and a net output of 42.8 million tons—12 percent more than in 1962. Crude from the franc zones represented 40 percent of the refinery throughput, and refineries operated at 89 percent of capacity as in the previous year. In 1963, fuel oils, excluding domestic fuel oil (a distillate cut), accounted for 33 percent, and domestic fuel oil accounted for 19.5 percent of gross production; other products in percent were gasoline 19.1, gas oil 10.6, bitumen 4.1, as well as propane and butane 3.1.

The two new refineries, both inland, at Reichstett and Herrlisheim in the vicinity of Strasbourg increased total annual capacity to 51.8 million tons, distributed as follows: Lower Seine 18 million tons, Atlantic coast 8.5 million tons, Mediterranean 15.9 million tons, and Alsace 6.5 million tons. The Feyzin refinery, also inland, was to come on stream in 1964. The South European pipeline from Lavera to Karlsruhe and Ingolstadt supplied the two Strasbourg refineries and will also supply the refinery at Feyzin.

TABLE 46.—Production of refinery products, 1955 and 1961–63

(Thousand metric tons)

	1955	1961	1962	1963
Refinery throughput	25,086	37,074	39,863	46,702
Aviation gasoline	8	92	88	69
Motor gasoline	5,110	6,930	6,983	7,943
Special gasolines	54	224	249	423
Kerosine and white spirits	504	475	383	404
Jet fuels	407	1,179	1,371	1,542
Distillate fuel oil	3,739	4,415	4,352	4,756
Domestic fuel oil	1,508	4,883	6,463	8,609
Residual fuel oil	9,685	12,094	12,516	14,643
Asphalt	1,087	1,590	1,641	1,777
Lubricants	541	696	777	813
Paraffin and waxes	24	34	41	42
Petrochemical feedstock	34	363	433	503
Liquefied petroleum gas	476	1,023	1,117	1,352
Refinery gases	79	832	951	1,105
Other	110	118	244	113
Total	23,366	34,948	37,609	44,094

Source: Comité Professionnel du Pétrole (Paris). Activité de l'Industrie Petrolière. V. I, 1962, 211 pp.; v. I, 1963, 216 pp.

The 18 refineries which were in operation at the end of 1963 were owned by 9 companies, including the 2 companies that own the Strasbourg refineries. Of the nine companies, Compagnie Française de Raffinage, Compagnie de Raffinage Shell-Berre, Esso Standard S.A.F., and Société Française des Pétroles B.P. were the largest with 24.3, 19.7, 13.7, and 13.3 percent, respectively, of total 1963 installed capacity. The Merkwiller refinery belonging to Antar Pétroles de l'Atlantique and Société Anonyme d'Exploitation Minières Pechelbronn stopped operation in May 1963.

Secondary processing facilities in French refineries included thermal cracking in 10 refineries; reforming (mostly catalytic) in 13 refineries, and vacuum distilling in 10 refineries.

Consumption.[24]—A record 36 million tons of refined petroleum products was marketed during the year. The 18.5-percent expansion in 1963 resulted in part from the severe winter conditions that increased total sales of domestic fuel oil (a distillate cut) from 6,897,400 tons in 1962 to 9,027,300 tons in 1963. With a normal winter, internal demands would have been closer to 35 million tons, or a 17.8-percent increase. Sale of other products also increased compared with 1962 figures—25.5 percent for heavy fuel oil, 8.9 percent for gasoline, 11.9 for gas oil, 6.5 percent for kerosine, 3.9 percent for light fuel oil. The share of industry in total consumption increased at the expense of transportation.

[24] Equivalent to sales to civilian users. The figures do not take into account refineries' own consumption, refinery storage, and transportation losses or change in stocks of consumers and retailers.

TABLE 47.—Capacities of petroleum refineries, 1963

(Thousand metric tons)

Company and location	Principal secondary processing facilities				
	Atmospheric distillation	Catalytic cracking	Thermal reforming	Catalytic reforming	Thermal cracking
Antar Pétroles de l'Atlantique: Donges	4,000	1,600	450	2,100	----------
Société Française des Pétroles B.P.:					
Lavera	4,000	----------	635	1,000	----------
Dunkirk	2,900	----------	----------	1,600	----------
Compagnie Française de Raffinage:					
Gonfreville	6,600	2,665	2,260	1,800	----------
La Mède	6,000	1,627	2,270	2,400	300
Esso Standard S.A.F.:					
Bordeaux	2,300	----------	----------	670	----------
Port-Jérôme	4,800	3,040	----------	1,660	----------
Mobil Oil Française:					
Frontignan	1,730	1,500	----------	500	----------
Gravenchon	1,100	----------	300	600	----------
Union Industrielle des Pétroles: Ambès	1,700	900	520	480	----------
Compagnie Rhénane de Raffinage: Reichstett-Venheim	3,200	----------	----------	2,000	3,000
Compagnie de Raffinage Shell-Berre:					
Berre-l'Etang	4,200	2,300	1,400	2,000	800
Pauillac	500	----------	----------	----------	----------
Petit-Couronne	5,500	2,700	----------	1,700	1,000
Société de Raffinage de Strasbourg: Herrlisheim-Drusenheim	3,300	----------	----------	1,800 to 2,500	----------
Union pour le Raffinage et la Pétrochemie: Feyzin [1]	1,700	----------	(2)	(2)	(2)
Total	53,530	16,332	7,835	20,310 to 21,010	5,100
Under construction:					
Arctar Pétroles de l'Atlantique: Rennes	1,200	(2)	(2)	(2)	(2)
Esso Standard of France, Inc.: Fos-Sur-Mer	2,500	(2)	(2)	(2)	(2)

[1] Due on stream in 1964.
[2] Data not available.

TABLE 48.—Petroleum supply position

(Million metric tons)

	1962	1963
Crude oil supply:		
Production from franc Zone:		
France	2.37	2.52
Algeria and Sahara	20.70	23.89
Gabon and Congo	.95	1.00
Total	24.02	27.41
Imports from outside franc Zone:		
For French refineries [1]	20.51	24.40
For custom refining [1]	3.49	3.82
Total [1]	24.00	28.22
Withdrawals from stocks	----------	.02
Total crude available for refining or exports	48.02	55.65
Crude oil disposal:		
Loss and local sales	.36	.31
Additions to stocks	.58	.50
Exports (from franc Zone production, largely Algerian crude)	7.18	8.14
Shipments to French refineries for processing	39.90	46.70
Total	48.02	55.65

See footnote at end of table.

TABLE 48.—Petroleum supply position—Continued

(Million metric tons)

	1962	1963
Refinery operations:		
Refinery feed	39.90	46.70
Changes in stocks of partly refined products	.04	3.90
Refinery consumption and losses	3.31	
Refinery product output	36.55	42.80
Refinery product supply:		
Production [1]	36.55	42.80
Imports [1]	3.04	4.40
Withdrawals from refinery stocks	.12	----------
Withdrawals from distributors stocks	.15	----------
Hydrocarbon extracts produced from natural gas and other unspecified additions to product supply	.53	.51
Total products available for consumption or exports	40.39	47.71
Refinery product disposal:		
Additions to refinery stocks	----------	1.00
Additions to distributors stocks	----------	.40
Shipments for use: French market:		
Motor gasoline	6.36	6.93
Jet fuel	.59	.68
Gas oil	2.11	2.36
Domestic heating oil	6.90	9.03
Light fuel oil	2.89	3.00
Heavy fuel oil	6.90	8.66
Liquefied petroleum gas	1.11	1.29
Petrochemical feedstock	.68	.80
Lubricants	.57	.60
Bitumen	1.45	1.64
Other	.75	.91
Total	30.31	35.90
Other markets and adjustments	1.03	1.10
Bunkering of French ships	1.52	1.34
Total French market	32.86	38.34
Ships to other franc-zone countries	2.00	1.90
Bunkering of foreign ships	.56	.67
Exports	4.97	5.40
Total non-French market	7.53	7.97
Grand total disposal	40.39	47.71

[1] Data presented differ slightly from those given elsewhere in the chapter because of differences in sources.

Sales of domestic fuel oil were distributed as follows: Heating of homes 3,940,900 tons, industrial space heating 3,270,700 tons, agriculture 1,203,100 tons, and others 154,700 tons. Principal customers for heavy fuel oil were: Industry 5,840,700 tons, Electricité de France 1,431,400 tons, French railroads 849,500 tons, domestic space heating 469,000 tons, other 73,100 tons, making a total of 8,663,700 tons. Here the increase was less influenced by the weather than by larger sales to Electricité de France and industry. Increased industrial activity and a shift by industry toward greater use of petroleum products were the reason for larger sales to industry.

The 8.9-percent increase in gasoline consumption was less than the increase in the number of motor vehicles in service: 9,045,600 in 1963 compared with 8,079,100 in 1962. An important factor was a decline in average miles driven because of road congestion. This was especially true in the Paris Basin where gasoline consumption increased 6.1 percent compared with the 8.9 national average. However, sales of high octane gasoline increased.

Direct sales of liquified petroleum gas to consumers increased during the year, presumably because of new customers and expanded consumption by existing customers. Gas works also took 122,700 tons, mainly propane.

TABLE 49.—Estimated breakdown of petroleum consumption by end users

(Thousand metric tons and percent)

	1962		1963	
	Tonnage	Percent	Tonnage	Percent
Transport:				
Road	8,049	25.0	8,887	23.5
Coastal and river	492	1.5	508	1.3
Maritime	2,077	6.5	2,006	5.3
Railroad	1,151	3.6	1,245	3.3
Air	732	2.3	798	2.1
Agriculture	1,465	4.6	1,670	4.4
Domestic space heating and other domestic use	5,621	17.5	6,641	17.5
Industry:				
Thermal electricity	978	3.0	1,608	4.2
Production of gas	210	.6	330	.9
Production of steam	4,426	13.8	5,612	14.8
Furnace use	3,381	10.5	4,175	11.0
Bakeries	413	1.3	491	1.3
Lubrication	150	.5	155	.4
Road pavement	1,376	4.3	1,641	4.3
Other	1,126	3.5	1,572	4.2
Other	475	1.5	569	1.5
Total	32,122	100.0	37,908	100.0

The share of various prdoucts in total consumption has changed significantly since 1950 with fuel oil increasing percentagewise and motor gasoline and gas oil decreasing; however, gas oil did not decrease as steeply as motor gasoline.

The Paris area was the largest market for petroleum products with 21.8 percent of the total in 1963.

TABLE 50.—Distribution of petroleum product consumption by product type

(Percent)

	1950	1953	1956	1959	1962	1963
Motor gasoline	27.0	27.8	25.2	24.2	21.2	19.5
Gas oil	9.6	9.6	8.7	7.5	7.0	6.6
Fuel oil	50.4	49.6	51.7	52.6	55.5	58.1
Other products	13.0	13.0	14.4	15.7	16.3	15.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Transportation and Distribution.—In 1963, 91 percent of the 39.9 million tons of crude received in French ports were carried in French tankers. As of December 31, 1963, France had 93 tankers, distributed in size categories on the basis of deadweight tonnage as follows: 2—75,000 or more; 9—50,000 to 74,999; 7—40,000 to 49,999; 33—30,000 to 39,999; 41—15,000 to 29,999; and 1—10,000 to 14,999. Sixty-two have been put into service since 1955. For internal transportation, in 1963 there were 788 barges with a total capacity of 411,153 cubic meters; 14,714,839 tons of oil were carried by river transportation.

TABLE 51.—Consumption of petroleum products by geographical areas in 1963

	Quantity (thousand metric tons)					Share of total (percent)
	Motor gasoline	Gas oil, domestic fuel oil, and light fuel oil	Heavy fuel oil	Other products	Total	
Paris region	1,327	3,208	1,679	1,597	7,811	21.8
Rhône-Alpes	621	1,480	768	409	3,278	9.1
Province, Cote d'Azur, and Corsica	600	1,044	784	775	3,203	8.9
Normandy	414	912	1,306	292	2,924	8.2
Nord and Pas-de-Calais	347	999	1,174	252	2,772	7.7
Loire	342	596	563	267	1,768	4.9
Acquitaine	383	588	431	359	1,761	4.9
Brittany	293	546	213	262	1,314	3.6
Picardy (Aisne-Oise-Somme)	210	585	340	146	1,281	3.6
Lorraine	252	588	298	129	1,267	3.5
Centre	338	579	89	211	1,217	3.4
Midi-Pyrénées	316	463	99	264	1,142	3.2
Languedoc	263	425	211	151	1,050	2.9

Besides the South European crude pipeline from Lavera to Karlsruhe and Ingolstadt in Germany, there is a product pipeline from Le Havre to Paris (Trapel) which transported 3,279,000 tons of products in 1963. The Lavera-Karlsruhe line is 760 kilometers long with 25 million tons annual capacity which will be increased to 30,000,000 tons in 1965. The Le Havre-Paris line consists of 243 kilometers of 10-inch line and 182 kilometers of 12-inch with a total carrying capacity of 4,000,000 tons. Another line (94 kilometers long, 12 inches in diameter) from Parentis to Bec d'Ambès connects the Parentis field to the Esso refinery and extends another 4 kilometers at 16 inches in diameter to Bec d'Ambès. This line has a carrying capacity of 243 cubic meters per hour and transported 1,862,588 tons of crude in 1963.

There were 44,000 gas stations in 1962 with average disposal of 200 cubic meters of products per month. Names of principal companies and approximate number of their stations were as follows: Total[25] 7,000, Azur 6,000, Esso 5,700, Shell 5,600, Antar 4,600, Pétroles B.P. 3,500, Mobil 2,000, Avia 2,000, Petrofina 2,000, UIP 1,800, and others 4,000.

Natural and Manufactured Gas.—In spite of a strike from March 7 to March 21 at the Lacq field, natural gas production increased by 7.5 percent in 1963. Lacq is France's largest natural gasfield and contributed 95.8 percent to the 1963 and 94.4 percent to the 1959–63 output. Recoverable reserves of natural gas as of December 31, 1962, were reported at 160 billion cubic meters.

In 1963, 4,847.6 million cubic meters of natural gas were delivered to the following users: 1,521 million to Gaz de France, 1,309 million for production of electricity, 1,215 million to chemical or parachemical industries, 278 million to lime, glass, and ceramic industries, 222 million to iron and steel and nonferrous metal industries, and 262 million to other industries. The remainder, 40 million cubic meters or 0.8 percent, was used in transportation as motor gasoline condensate. Of total natural gas sales of 4,854.5 million cubic meters in 1963,[26] the Paris region took 26.8 percent, Aquitaine where the gas is produced

[25] Brand name.
[26] Sales figures are slightly different from deliveries.

took 29.8 percent, Midi-Pyrénées took 14.23 percent and Rhône-Alps took 11.81 percent.

As of January 1, 1963, 4,250 kilometers of pipeline transported Lacq natural gas to consumers. In southwest France natural gas is marketed by Société National des Gaz du Sud Ouest and in other areas by Compagnie Française du Méthane.

TABLE 52.—Production, availability, and distribution of natural and manufactured gas

(Billions of kilocalories [1])

	1959	1960	1961	1962
Production:				
Gasworks gas	10.1	8.5	5.9	5.5
Coke oven gas	22.7	23.9	24.2	24.8
Drained methane	.5	.5	.6	.5
Blast furnace gas	47.3	51.7	52.7	48.6
Refinery gas	9.9	11.5	14.1	16.0
Natural gas	15.1	27.3	37.4	43.5
Total	105.6	123.4	134.9	138.9
Imports and from stocks	1.6	2.6	3.0	3.8
Available, gross	107.2	126.0	137.9	142.7
Consumption for heating coke ovens, other uses, loss, and stocks	44.2	49.4	52.8	50.6
Available, net	63.0	76.6	85.1	92.1
Distribution:				
Domestic	10.2	11.0	11.6	13.1
Commercial	2.2	2.4	2.6	3.0
Industrial:				
Electricity	19.1	25.3	28.7	27.8
Iron and steel	15.7	17.3	17.9	18.3
Mechanical air, electrical	1.2	1.5	1.8	2.1
Chemical	7.9	10.9	13.6	17.0
Other	3.8	5.0	5.9	6.9
Subtotal	47.7	[2] 60.1	[2] 68.0	72.1
Gasoline	.7	.6	.6	.5
Exports and loss	2.2	2.5	2.3	3.4
Total	63.0	76.6	85.1	92.1

[1] 1,000 kilocalories is equivalent to 0.15 standard coal equivalent volume of gas in cubic meters of 4,200 kilocalories per cubic meter and it can be obtained by dividing number of kilocalories by 4,200.
[2] Detail does not add to total because of rounding.

Exploitation of the St. Marcet and Lacq gasfields has made a significant change in the structure of the gas industry of France which had previously been almost entirely dependent on coal distillation. Gaz de France has continued to produce gas from coal mainly from its coking plants in the Paris area and in the neighborhood of Strasbourg and Raven.

In 1962, natural gas constituted 31 percent of all gas produced compared with 14 percent in 1959. Excluding blast-furnace gas, of which production has been fairly stable since 1959 and which is almost wholly used for underfiring coke ovens and for power production in steel plants, the share of natural gas in the total gas production increased to 46 percent in 1962 at the expense of manufactured gas. The share of gasworks gas dropped from about 17 percent in 1959 to 5.8 percent in 1962, and the share of coke oven gas dropped from 39 percent in 1954 to 26 percent in 1962. Some 450 gasworks were closed during 1947–62. In absolute units there actually has been a slight increase in coke oven gas production. In view of the large increase in refinery

capacity, the volume of refinery gas has increased by almost two-thirds, but its share of total gas production other than blast-furnace gas increased by only 1 percent.

Of the several notable byproducts of French gas production and processing, sulfur is by far the most significant.

TABLE 53.—Production and sale of natural gas

(Million cubic meters)

	1959	1960	1961	1962	1963
Production:					
Société Nationale des Pétroles d'Aquitaine	2,295	4,116	5,715	6,684	7,206
Régie Autonome des Pétroles	310	300	303	312	298
Société Esso de Recherches et d'Exploitation Pétrolières	9				14
Total	2,614	4,416	6,018	6,996	7,518
Sales:					
Powerplants	403	827	1,363	1,506	1,302
Other industries	636	1,133	1,609	1,908	1,986
Cities	209	586	965	1,275	1,513
Gasoline	75	70	64	59	54
Total	1,323	2,616	4,001	4,748	4,855

TABLE 54.—Products obtained by refining of natural gas

(Thousand metric tons)

	1959	1960	1961	1962	1963
Liquefied gas:					
Régie Autonome des Pétroles (RAP)	12.1	11.6	11.7	11.3	11.2
Société Nationale des Pétroles d'Aquitaine (SNPA)	40.7	84.5	108.6	128.2	125.7
Total	52.8	96.1	120.3	139.5	136.9
Gasoline:					
Régie Autonome des Pétroles (RAP)	12.4	12.2	12.2	12.4	11.3
Société Nationale des Pétroles d'Aquitaine (SNPA)	68.4	147.6	266.9	252.7	269.1
Total	80.8	159.8	279.1	265.1	280.4
Residues [1]	6.8	12.1	14.5	19.0	20.3
Sulfur [1]	426.3	790.5	1,104.7	1,345.1	1,408.5

[1] Entirely from SNPA operations.

Natural gas from the Sahara was expected to be added to the French supply starting in 1965, when the Arzew plant is scheduled to supply 500 million cubic meters of methane per year to Gaz de France. The gas, as liquid methane, will be carried by tankers to Le Havre where it will be re-gasified for delivery to the lower Seine and Paris area. Building of a methane tanker in France was started in 1963. It will have a capacity for 25,500 cubic meters of liquefied gas and a 11,500-ton cargo.

The Government's participation in refining was through 60-percent ownership of Union Industrielle des Pétroles and 100 percent ownership of Union Générale des Pétroles. Compagnie Française de Pétrole, which is a member of the Iraq Petroleum Co. group, Abu Dhabi Marine Area, Ltd. and Dubai Marine Area, Ltd., is also 35 percent Government owned. This company, through its subsidiary, Compagnie Française de Raffinage, is the largest refiner of petroleum in France.

The Mineral Industry of East Germany

By Roman V. Sondermayer [1] and Bernadette C. Michalski [2]

EAST GERMANY, a fairly industrialized area with a well-developed metallurgical base, produced many mineral products in 1963 from domestic and imported raw materials. The emphasis given to the mineral industry is shown by the fact that 1.5 billion East German marks [3] of new investments were made during the year. However, in relationship to world mineral output only brown coal and potash were of considerable significance. The metallurgical industry has been expanded much beyond the domestic raw material base and this has resulted in heavy import demands. The principal mineral products with production expressed in percentages of 1962 world totals were approximately as follows: Fuel briquets, 51 percent; brown coal coke, 21 percent; potash, 17 percent; coal, 9 percent; fluorspar, 3 percent; salt, 2 percent; silver, 2 percent; aluminum, barite, cement, copper, gypsum, iron ore, lead, pig iron, pyrites, steel ingots, tin, and zinc from 0.3 percent to 1.5 percent.

During 1963, the major events in the mineral industry were concentrated in the production of brown coal, development of facilities for production of chemicals from brown coal, continued construction of the Brandenburg steel complex, and completion of the Druzba pipeline. The refinery at Schwedt, at the western end of the Druzba pipeline, was under construction in 1963 and was expected to be operational in 1964. The coke quenching installation in Lauschammer, scheduled for production in 1964, should bring about an increase in the quality and quantity of high temperature brown coal coke.

The overall activity of the mineral economy was sluggish in 1963. Construction and investments failed to achieve planned goals partly because of low labor productivity. During the winter of 1963, the regime introduced new measures to boost the economy. According to official reports, one of the measures introduced was an effort to encourage labor incentive by scaling labor pay to the profit made by the enterprise. This approach to stimulating productivity was completely new in East Germany.

PRODUCTION

The most advanced segments of the mineral economy were brown coal mining with its related industries, and potash production and

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[3] The par value exchange rate for East German marks is 1 mark equals US$0.4505; the noncommercial transaction rate is 1 mark equals US$0.268863.

processing facilities. With the exception of alumina and copper ore, output statistics on nonferrous metals were, as usual, not published. However, it is known that some lead, zinc, tin, nickel, and uranium also were produced.

Output of iron ore in 1963 made no appreciable gain over the previous year, and only nominal increases were reported in production of pig iron and steel. Output of pig iron rose by only 1 percent and that of steel by 2 percent.

Enough major nonmetallics were extracted for domestic consumption. The potash industry maintained its leading position among the nonmetallics, although the cement industry also had a successful year.

The major domestic source of primary energy was coal; brown coal and related industries were the dominant elements. Petroleum requirements were covered by imports and by the production of synthetic oils from brown coal. Only very minor quantities of crude petroleum and natural gas were produced.

TABLE 1.—Production of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Alumina	55,300	58,900	58,200	60,000	(2)
Aluminum [3]	35,000	40,000	55,000	55,000	55,000
Copper ore—thousand tons	1,572	1,613	1,687	1,700	(2)
Iron and steel:					
Iron ore—do	1,599	1,642	1,643	1,642	1,650
Pig iron—do	1,898	1,995	2,031	2,075	2,125
Steel—do	3,207	3,337	3,444	3,622	3,626
Rolled products—do	2,488	2,613	2,703	2,798	(2)
Nonmetals:					
Cement—do	4,205	5,032	5,275	5,432	5,460
Fertilizers:					
Nitrogenous (N content)—do	329	333	330	338	(2)
Phosphatic (P_2O_5 content)—do	139	166	172	181	(2)
Gypsum [3 4]	253,000	250,000	257,400	273,800	275,000
Quicklime, hydrated lime, and dead-burned dolomite—thousand tons	3,033	3,051	2,827	3,344	(2)
Potash, crude—do	1,600	1,665	1,675	1,752	1,854
Sulfur:					
Elemental (from pyrites)	50,000	47,000	41,000	42,000	44,000
Acid	562,400	595,900	668,200	702,708	750,000
Mineral fuels:					
Coal:					
Bituminous and anthracite—thousand tons	2,841	2,721	2,671	2,580	2,483
Brown—do	214,783	225,465	236,926	247,200	254,219
Brown coal briquets—do	54,048	56,052	57,996	59,727	60,256
Coke:					
Oven and beehive—do	1,005	1,008	1,030	1,031	1,042
Gashouse—do	3,135	3,206	3,084	3,122	3,262
Lignite—do	6,536	6,691	6,635	6,630	6,526
Manufactured gas—million cubic feet	118,400	123,900	124,500	130,400	133,800
Petroleum:					
Refinery products:					
Gasoline—thousand tons	1,077	1,080	1,167	(2)	(2)

[1] In addition to reported commodities, East Germany is a known producer of the following (figures represent production estimates in metric tons unless otherwise specified): copper (smelter output)—35,000; lead (smelter output)—26,000; nickel (content of ore)—100; tin (mine output)—720 long tons; tin (smelter output)—600 long tons; zinc (smelter output)—4,000; fluorspar—75,000; salt—2,000,000 and peat 500,000. Petroleum refinery products are also produced, but reliable estimates of output cannot be made.

[2] Data not available.

[3] Estimate.

[4] Crude, based on reported calcined figures.

TRADE

In spite of increased production in 1963, East Germany remained dependent upon imports to provide a major part of its supplies of mineral raw materials and a significant share of its processed mineral product requirements. Official trade statistics[4] are incomplete because they omit listings of a number of commodities recorded as exported to or imported from other countries in the foreign trade records of those countries (notably the U.S.S.R. and Poland). These statistics also do not include data on the geographic distribution of individual commodities in trade. Nevertheless, the basic geographic and commodity patterns of East Germany's international trade in minerals and mineral products is evident. Throughout 1963 mineral trade was characterized by the import of raw materials and the export of semifinished and finished products.

Officially reported mineral exports in 1962 were confined to nonmetals (the foremost of which were cement and potash) and to mineral fuels (chiefly brown coal briquets). However, import statistics of the Soviet Union and Poland give East Germany as the source of iron and steel semimanufactures and a number of nonmetals and petroleum products not specified in East German trade statistics.

TABLE 2.—Export of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1961	1962
Nonmetals:		
Cement—thousand tons	239,100	181,100
Gypsum, burned	37,802	35,819
Potassic materials (K_2O equivalent)—thousand tons	1,047	1,147
Sulfur	33,552	41,719
Mineral fuels:		
Coal:		
Bituminous	200	600
Brown coal briquets—thousand tons	6,205	6,602
Brown coal coke—do	118	114
Petroleum:		
Refined products:		
Gasoline	370,303	387,982
Diesel oil	376,258	369,904
Natural and manufactured gas—million cubic feet	185	207

[1] Official import statistics of the Soviet Union and Poland indicate that East Germany also exported quantities of the following mineral commodities: Steel semimanufactures, fluorspar, graphite, cryolite, kaolin, mica, ashpalt, paraffin, other petroleum products (in addition to gasoline and diesel oil), and carbon black.

[4] Statistisches Jahrbuch Der Deutschen Demokratischen Republik 1963 (Statistical Yearbook of the German Democratic Republic 1963). Leipzig, 1963, pp. 361–366.

Import statistics also do not list all the mineral commodities listed in export data for the U.S.S.R. and other countries. However, these data, although incomplete from the viewpoint of the range of commodities covered, show appreciable imports of several major items.

Through its integration into the joint economic efforts of the Soviet Ekonomicheskoy Vzayimopomoshchi (S.E.V.),[5] East Germany has become the leading importer of minerals and mineral products from the U.S.S.R. Moreover, the U.S.S.R. ranks as the principal supplier of these commodities. Significant quantities of aluminum, copper, lead, pig iron, pipes and other rolled steel were imported from the U.S.S.R. in 1963. Crude and refined petroleum were also important among imports from the U.S.S.R.

TABLE 3.—Officially recorded imports of metals and minerals[1]

(Metric tons unless otherwise specificed)

Commodity	1961	1962
Metals:		
Aluminum:		
Bauxite	262,858	285,941
Alumina, calcined	23,161	17,001
Chrome ore, Cr_2O_3 content	26,153	34,861
Iron and steel:		
Iron ore, Fe content—thousand tons	1,096	1,260
Pig iron—do	563	629
Semimanufactures, including materials for rerolling—do	1,927	2,192
Manganese ore, Mn content	78,996	87,899
Nonmetals:		
Pyrites, sulfur content	110,115	94,125
Mineral fuels:		
Coal:		
Anthracite and bituminous—thousand tons	7,936	8,881
Brown coal—do	5,952	5,727
Coke—do	2,843	2,966
Petroleum, crude—do	2,270	2,591
Natural and manufactured gas—million cubic feet	205	207

[1] Distribution of imports by origin not reported; data do not include a number of commodities reported as exported to East German in trade statistics of other countries.

[5] Council for Economic Mutual Assistance, set up under an intercountry agreement that also includes the U.S.S.R., Albania, Bulgaria, Czechoslovakia, Hungary, Mongolia, Poland, and Rumania.

TABLE 4.—Imports of selected metals and minerals from the U.S.S.R.

(Metric tons unless otherwise specified)

Commodity		1961	1962
Metals:			
Aluminum		45,600	41,600
Bronze		2,100	2,200
Cadmium		192	142
Chrome ore		12,000	17,000
Copper:			
Metal		25,300	30,600
Rolled products		900	----
Iron and steel:			
Iron ore	thousand tons	2,046	2,521
Pig iron	do.	556	624
Ferroalloys	do.	1	1
Scrap	do.	106	99
Steel:			
Rolled products	do.	1,291	1,423
Pipe	do.	100	120
Lead		27,200	29,700
Manganese:			
Ore		179,000	216,000
Peroxide		3,300	3,600
Pyrites		330,000	190,000
Zinc		24,000	25,900
Nonmetals:			
Apatite:			
Ore		31,600	26,200
Concentrate		542,500	593,500
Asbestos		12,100	14,000
Graphite		1,200	1,700
Mineral fuels:			
Coal:			
Anthracite	thousand tons	247	892
Bituminous	do.	5,206	5,893
Coke, metallurgical	do.	1,380	1,378
Petroleum:			
Crude	do.	2,077	2,437
Refinery products:			
Gasoline	do.	220	197
Kerosine	do.	43	----
Diesel fuel	do.	223	272
Lubricants	do.	3	4
Undistributed	do.	26	27
Total	do.	515	500

Source: Vneshnyaya Torgovlya S.S.S.R. za 1962 god (Foreign Trade of the U.S.S.R. for 1962). Moscow, 1963, 235 pp.

COMMODITY REVIEW

METALS

Aluminum.—Two aluminum plants were operating in East Germany during 1963. The plant at Bitterfeld produced some 35,000 tons of aluminum from imported alumina during the year. The plant at Lauta turned out alumina and aluminum from imported Hungarian and Yugoslavian bauxites. The aluminum capacity of the Lauta plant was about 20,000 tons annually. Both plants were modernized during 1963.

Copper.—Copper was mined in Mansfeld near Halle, and smelted at the Wilhelm Pick Kombinat, at Eisleben. The Kombinat has a capacity of 30,000 tons of copper annually. In addition to copper, the plant produced soft lead, pure selenium, cadmium, silver, gold, platinum and vanadium in undisclosed quantities.

Iron and Steel.—Large postwar investments were made to develop the iron and steel industry with the assistance of the Soviet Union.

Iron ore mined in East Germany has been low grade and was mainly produced by mining enterprises around the "Thuringen Waldes" near Schmiedefeld and Badeleban. Output has been far below demand, and efforts were made in 1963 to expand iron ore production through modernization of facilities. Because of unfavorable geologic conditions and high consumption of iron and steel products East Germany is likely to continue to depend largely upon foreign iron ore.

During 1963 the three most significant iron and steel plants in operation were: The West Iron Smelting Works (VEB Eisenhutten Werk West), the Brandenburg Steel Works and Rolling Mills (VEB Stahl und Walz Werke Brandenburg), East Iron Smelting Combine (VEB Eisenhuttenkombinat Ost-EKO).

The postwar West plant uses domestic siliceous ores and coke produced from brown coal. According to available information, the 10 low-shaft furnaces of the plant have a reported combined output of around 250,000 metric tons of pig iron.

Facilities at the modern Brandenburg plant included 12 150-ton open-hearth furnaces and rolling mills capable of producing blooms and slabs up to 9 tons in size. Work was underway to increase the annual capacity to 3 million tons by 1964. The plant employed about 6,500 workers in 1963.

The East Iron and Steel Combine is an integrated plant, based upon Soviet iron ore and on coke imported from other East European countries. The sintering and blast furnace units have rated annual capacities of approximately 1 million tons. Steelmaking facilities include six 50-ton open-hearth furnaces, four 15-ton basic Bessemer converters, and several electric furnaces. A continuous strip mill is scheduled to increase the capacity for sheet output fivefold.

Another 15 small plants scattered around the country produced about 3 million tons of steel during 1963.

Other Metals.—Small quantities of other metals were produced in 1963. The old Freiberg Electrolytic Lead Works was expanded. The Sankt-Egidien Nickel Works was near completion, but details on production were withheld. Uranium was produced in Erzgebirge.

NONMETALS

Cement.—The cement industry with its 13 plants and output of 5.5 million tons covered domestic requirement for 1963.

Potash.—The area's principal nonmetallic product was potash. More than half of the total production came from Erfurt where reserves are extensive. Half of the potash output was exported.

Because of the drive to increase agricultural production in the communist area, potash mines were being modernized and many new facilities were under construction.

Other Nonmetals.—East Germany produced adequate quantities of salt, clays, dolomite, and other minerals for domestic consumption.

MINERAL FUELS

Coal.—Extensive reserves of brown coal and large-scale extraction have made this segment of the mineral industry the most important

source of energy. Brown coal is also the foundation for the chemical industry.

Large deposits of brown coal near the surface permit open pit mining with use of heavy equipment for mass production. The latest trend in the development of brown coal deposits has been to build facilities near the deposits to convert brown coal into gas, electric energy, and chemicals without costly haulage of the raw material. Methods have been devised for converting brown coal to coke for use in smelting domestic iron ores.

Four brown coal hydrogenation plants producing liquid fuels were in operation during 1963. Production of synthetic fuels may decline, with the Schwedt oil refinery covering more of the overall liquid fuel demand.

Petroleum.—Little crude petroleum was extracted in the area during 1963. The regime was trying to increase supply by organizing large oil and gas exploration programs with the assistance of Soviet specialists and equipment. So far, no significant discoveries of oil or natural gas have been announced and the area continued to be heavily dependent upon imported crude petroleum to cover domestic needs.

A refinery processing domestic crude oil at Leutzkendorf, was reported to have an annual capacity of 800,000 tons. The Schwedt refinery, terminal of the Druzba pipeline supplying crude oil from the U.S.S.R., was near completion in 1963.

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The Mineral Industry of Federal Republic of Germany

By L. Nahai [1]

THE FEDERAL REPUBLIC OF GERMANY (West Germany) ranked 3d in world production of pig iron and crude steel, 6th in smelter copper and lead and 10th in cadmium in 1963. In nonmetallics it was second in production of barite, feldspar, and potash, fourth in cement, and fifth in salt. The country was the leading producer of crude petroleum and bituminous coal in Western Europe and ranked fourth as a world producer of bituminous coal. As a large consumer of minerals and metals, it also continued to play an important role with respect to other commodities.

The gross national product of West Germany increased by 6 percent in 1963. However value of mineral production may not have attained that level of growth; the slight drop in production of iron and steel and some of the nonferrous metals may not have been sufficiently compensated by the increased production of petroleum and building raw materials.

The country was partially dependent on foreign sources of some raw metals; domestic production supplied only part of the iron, lead, and zinc ores consumed by the metallurgical industry. Other metals and ores and a number of industrial minerals including asbestos, magnesite, mica, phosphate, and native sulfur were not produced at all. However, the country was self-sufficient in pit and quarry products used in the building, cement, and ceramic industries. Imports were mainly in the form of ores, concentrates, and crude metals, which were treated by the Federal Republic's diversified metallurgical and processing industry to produce an extensive range of metal and mineral products.

The gross national product of West Germany at current prices in 1963 totaled approximately $94,000 million. Available published data in 1962 do not report the contribution of the mineral industry as a whole to the gross domestic or national product. In 1961, the latest year for which data are available, the contribution of mining to the gross domestic product of US$77,840 million (in current prices) was US$2,200 million, or 2.82 percent. However, this figure is only part of the total contribution because it excludes the value output of the important pit and quarry products and of the petroleum and smelting industries. A more useful measure of the role of the mineral industry is the total sales, for which rather detailed information is availa-

[1] West Europe specialist, Division of International Activities.

ble. For the types of operations tabulated, the sales were about 16 percent of the total of US$76,400 million for all the industry. These activities also employed over 1 million persons, 38 percent of whom were engaged in coal mining.

TABLE 1.—Employment and total sales in the mineral industry in 1963

Industry	Employment [1] (workers and staff)	Total sales (millions)		
		Domestic	Foreign	Total
Mines:				
Coal	411,453	US$1,634	US$503	US$2,137
Lignite and pech	40,119	271	19	290
Iron	10,537	49	2	51
Nonferrous metal mines	4,191	13	1	14
Potash and salt	20,877	129	46	175
Other	6,051	28	5	33
Quarries:				
Stone	34,798	270	4	274
Sand and gravel	14,959	160	5	165
Slate, clays, other	9,322	47	7	54
Cement	22,347	421	9	430
Lime, gypsum, chalk	17,366	165	7	172
Pumice	9,030	121	1	122
Metallurgical plants:				
Iron and steel	346,811	3,398	944	4,342
Nonferrous metals	81,281	912	183	1,095
Oil and gas	10,765	223		223
Petroleum refineries	31,207	2,658	144	2,802
Coal chemicals	4,508	67	11	78
Total	1,075,622	10,566	1,891	12,457

[1] December 1963.

PRODUCTION

West German industrial production in 1963 increased by 3.6 percent. Some sections of the mineral industry increased more, but the important iron and steel industry and the three principal primary nonferrous metals declined, although output of secondary lead and zinc increased significantly. Aluminum continued its growth both in ingot metal and semimanufactures. While increased competition in world markets has not permitted a marked increase in potash production, growth in the chemical industry, which in 1963 had a production almost 10 points above that of 1962, has indirectly favored salt mining. Similarly, high levels of construction and public works stimulated the output of pit and quarry products. Coal production has varied little in the last 5 years, but crude and natural gas production and refinery throughput have increased substantially.

TABLE 2.—Production of metals and minerals

(Metric tons, unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite	4,504	3,812	4,232	4,657	[1] 4,500
Alumina (hydrous and anhydrous)	481,800	510,100	513,500	517,300	(2)
Metal, primary	151,165	168,936	172,558	177,824	208,782
Metal, remelted	19,800	20,564	18,821	19,459	15,861
Alloys, remelted	93,262	113,127	116,629	123,281	140,538
Semimanufactures	191,081	202,590	234,100	245,829	255,047
Bismuth, smelter	140	119	108	131	126
Cadmium, smelter	420	409	432	254	223
Cobalt, smelter	(2)	(2)	1,620	1,646	1,508
Copper:					
Mine	1,781	1,778	1,647	1,727	2,204
Smelter	64,100	62,400	64,200	68,800	(2)
Refinery:					
Primary	210,934	233,907	232,433	238,441	235,207
Secondary (from scrap)	70,959	75,167	71,917	69,801	67,611
Alloys	24,216	32,334	39,771	34,611	34,486
Gold—thousand troy ounces	[3] 74	[3] 85	[3] 81	[3] 137	[3] 127
Iron and steel:					
Iron ore—thousand tons	18,063	18,869	18,866	16,643	12,898
Pig iron—do	21,365	25,461	25,160	23,976	22,619
Spiegeleisen and ferromanganese—do	237	278	271	275	290
Steel ingots and metal for casting—do	29,435	34,100	33,458	32,563	31,597
Rolled steel—do	19,351	22,531	21,688	21,356	20,758
Lead:					
Mine	52,552	49,894	49,576	50,135	51,896
Smelter [4]	149,534	147,664	140,621	148,690	139,736
Secondary	42,885	59,129	62,996	67,727	89,805
Magnesium, semimanufactures	194	249	279	257	373
Molybdenum, smelter	(2)	88	119	127	115
Nickel, smelter	1,000	2,584	3,000	3,641	1,935
Platinum—troy ounces	868	1,447	965	1,543	1,736
Silver:					
Ore content—thousand troy ounces	1,898	1,843	1,880	1,958	(2)
Smelter—do	12,058	14,548	16,181	15,374	12,063
Tin (including secondary)—long tons	2,075	1,868	2,008	2,321	2,212
Tin alloys and solder	16,064	18,162	17,283	17,216	18,535
Tungsten, smelter	(2)	555	611	550	532
Zinc:					
Mine	82,079	86,327	87,261	86,758	93,403
Zinc recovered from pyrite	23,600	28,200	34,700	25,700	(2)
Smelter:					
Primary [5]	137,934	141,792	140,952	129,843	105,205
Secondary	59,189	60,789	62,333	59,510	67,786
Nonmetals:					
Barite	441,624	498,200	470,800	464,700	484,809
Basalt lava and sand—thousand tons	2,417	2,785	3,378	4,112	(2)
Calcite	33,300	33,400	36,200	35,600	(2)
Cement—thousand tons	22,852	24,905	27,144	28,593	[6] 30,554
Chalk	82,834	91,163	88,210	73,615	72,282
Clays:					
Kaolin	339,800	344,200	373,500	383,070	[3] 408,834
Refractory:					
Klebs and plastic refractory clay	181,000	199,000	201,000	196,000	193,000
Other—thousand tons	3,577	4,109	4,471	4,473	(2)
Bleaching	271,100	326,200	374,200	345,100	(2)
Diatomaceous earth	50,588	46,392	65,500	61,500	89,385
Feldspar	178,166	268,443	269,710	[7] 263,000	(2)
Fluorspar	123,337	130,158	121,100	105,770	87,037
Graphite	11,214	11,583	12,110	11,906	(2)
Gypsum:					
Crude, including anhydrite, alabaster, and other—thousand tons	796	955	1,012	961	1,059
Burnt, for construction and other purposes—thousand tons	932	1,006	995	989	942
Lime:					
Burnt, including hydraulic lime and sintered dolomite—thousand tons	8,730	9,709	9,924	9,698	9,775
Ground (not dead burnt)—do	1,720	1,746	1,867	2,033	2,371
Limestone:					
Crude—do	36,922	44,839	48,888	48,858	49,298
Marketable—do	7,851	8,872	8,706	8,335	7,755
Ochre and mineral pigments	19,300	18,300	(2)	17,297	(2)
Pegmatites	57,700	60,500	67,300	65,900	(2)

See footnotes at end of table.

TABLE 2.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals—Continued					
Potash:					
Crude:					
Gross weight—thousand tons	17,422	18,642	19,509	18,413	18,537
Potassium dioxide (K_2O) content—do	2,144	2,316	2,400	2,264	(2)
Marketable, K_2O content—do	1,835	1,979	2,044	1,938	(2)
Pumice—do	3,665	4,302	5,351	5,707	(2)
Pyrite	469,539	537,476	532,575	410,121	404,170
Quartzite	372,900	350,100	341,900	295,300	(2)
Salt:					
Rock—thousand tons	3,970	4,360	4,346	4,560	5,226
Spring—do	329	339	341	346	362
Sand and gravel—do	83,406	96,798	110,273	124,643	132,358
Sand, industrial:					
Molding sand—do	1,013	1,026	957	858	781
Ground quartz sand—do	238	238	222	603	906
Unground quartz and glass sand—do	3,123	3,566	3,911	4,065	3,858
Siliceous earth	45,700	49,400	50,100	52,100	(2)
Slate, roof	64,700	66,500	55,300	49,600	43,807
Slate, other, including ground—thousand tons	220,400	244,200	234,000	224,700	(2)
Stone:					
Crushed and unworked—do	52,382	55,611	63,234	72,299	79,598
Building—cubic meters	153,845	173,161	193,858	155,610	216,945
Sulfur, elemental	79,733	84,136	84,190	90,700	[1] 86,400
Talc and talc schists	27,546	29,281	29,600	27,600	38,771
Trass and tuff	26,800	58,800	74,900	78,200	(2)
Mineral fuels:					
Solid fuels: [3]					
Bituminous coal and anthracite—thousand tons	141,687	142,287	142,740	141,136	142,116
Lignite—do	93,652	96,138	97,194	101,251	106,658
Pech coal—do	1,780	1,783	1,763	1,760	1,841
Coke:					
At mines—do	35,930	37,221	37,044	36,054	35,213
At steel mills—do	7,037	7,533	7,490	7,144	6,882
At gasworks—do	5,014	5,220	4,948	4,958	4,890
From lignite—do	595	602	601	600	600
Coal briquets—do	4,710	5,219	4,869	5,663	6,353
Lignite briquets—do	15,205	15,245	15,515	15,800	15,834
Peat:					
Agricultural use—thousand tons	845	812	523	612	[1] 770
Fuel—do	882	790	753	826	[1] 830
Natural gas—million cubic feet	14,466	16,709	17,960	23,007	34,148
Petroleum:					
Crude—thousand tons	5,103	5,530	6,204	6,776	7,383
Petroleum products:					
Fuel oil—do	8,580	13,341	17,407	19,312	23,046
Motor gasoline—do	4,474	5,383	6,539	7,262	8,176
Diesel oil—do	4,430	4,842	5,573	6,155	7,246
Liquefied gas—do	604	770	846	853	1,102
Turbofuel—do	219	208	366	572	558
Kerosine—do	46	52	50	58	81
Lubricants—do	429	481	512	564	554
Bitumen—do	1,078	1,160	1,387	1,804	2,304
Total, including other products [9]	21,289	28,021	34,969	39,304	46,439

[1] Estimate.
[2] Data not available.
[3] Revised figure; differs from that given in commodity chapter, volume 1.
[4] Including production of refinery lead by battery makers.
[5] Includes zinc recovered from imported ores.
[6] Includes cementlike mortar.
[7] Exclusive of Saar.
[8] Excludes output of small producers of 763,000 tons in 1962 and about the same in 1963.
[9] Includes refineries' own consumption, not detailed above.

TRADE

Imports and exports of tabulated minerals and metals in 1963 contributed 50 and 31 percent of total imports and exports, respectively. Coal and coke ranked first in export value with 16.7 percent of all exports from the Republic, followed by iron and steel (including scrap), with 7.3 percent. Petroleum and petroleum products con-

tributed the largest import group in value, accounting for 64 percent of mineral imports and 32 percent of all imports.

In 1963, 34 percent of all exports from West Germany went to the six countries of the European Economic Community (EEC); 62 percent went to the EEC countries and the European Free Trade Association (EFTA) countries combined. The EFTA includes Austria, Great Britain, Denmark, Norway, Portugal, Sweden, and Switzerland. The import figures were 32 percent from the EEC countries and 51 percent from the EEC and EFTA countries combined. For the minerals and metals tabulated, West Germany's exports to the Common Market in 1962 (approximately US$1,216 million) were 50 percent of the US$2,430 million exports to all destinations; for the same commodities, 27 percent of the value of imports (estimated at US$2,940 million) was from the EEC countries. In view of large imports of crude petroleum and other raw material from sources other than EEC, these countries are less important as sources of imports than as destinations for Germany's exports.

TABLE 3.—Mineral and metal trade in 1963

Commodity	Imports		Exports	
	Quantity (thousand metric tons)	Value (millions)	Quantity (thousand metric tons)	Value (millions)
Iron ore including pyrite cinder	28,916	US$282	547	US$2
Iron and steel scrap	638	21	1,299	42
Pig iron and ferroalloys	690	57	907	52
Steel	4,252	574	7,311	1,063
Nonferrous metal ores	3,192	115	112	10
Nonferrous metal scrap	97	36	37	12
Nonferrous metals	907	453	145	80
Semimanufactures	59	48	140	114
Precious metals		147		20
Metalliferous ashes and slags, including Thomas slag	2,777	23	1,996	14
Nonmetals	13,221	163	13,365	106
Coal, coke, other solid fuels	10,450	558	30,747	2,441
Petroleum and petroleum products	53,373	4,184	6,034	626
Total	118,572	6,661	62,640	4,582

TABLE 4.—Exports of metals and minerals

(Metric tons, unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963 [1]
Metals:				
Aluminum:				
Alumina, anhydrous	73,873	66,103	71,503	Italy 1,918; Rumania 920; United Kingdom 809; Netherlands 656; total EEC 3,003.
Ingots, including alloys	3,827	6,025	14,185	Netherlands 3,118; Switzerland 1,334; Belgium-Luxembourg 1,279; total EEC 5,189.
Scrap	521	1,475	1,451	Italy 1,113; France 140; Netherlands 103; total EEC 1,448.
Semifabricated	41,758	47,079	54,788	Switzerland 11,633; United States 5,898; Belgium-Luxembourg 5,508; Netherlands 5,183; France 3,727; total EEC 18,876.

See footnotes at end of table.

TABLE 4.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963 [1]
Metals—Continued				
Antimony	409	1,030	781	Italy 301; France 273; Belgium; Luxembourg 89; Netherlands 81, total EEC 743.
Bismuth	133	139	115	United Kingdom 63; Netherlands 20; France 12; Sweden 9; total EEC 38.
Cadmium	78	64	49	Netherlands 11; France 7; India 6; total EEC 23.
Chromium	176	48	55	India 15; Austria 13; Italy 12; total EEC 16.
Cobalt	833	1,018	886	United States 630; Japan 96; Canada 42.
Columbium and titanium	6	18	28	France 20; Italy 3; total EEC 24.
Copper:				
Scrap, including alloy	11,411	14,737	20,728	Italy 5,497; Netherlands 4,491; Belgium-Luxembourg 4,318; total EEC 15,551.
Refined	80,265	116,048	73,057	Austria 14,240; U.S.S.R. 9,906; Czechoslovakia 7,390; United Kingdom 6,008; Hungary 5,397; total EEC 11,871.
Alloys and master alloys	1,063	1,873	1,028	Austria 296; Italy 234; Netherlands 207; total EEC 535.
Semifabricated	58,336	64,552	72,791	United States 14,224; Netherlands 11,841; Poland 7,539; Switzerland 6,853; total EEC 19,809.
Gold and gold alloys:				
Unwrought—troy ounces	126,898	156,703	203,707	Chile 60,700; Switzerland 47,904; Portugal 24,884; Italy 18,261; Netherlands 17,136; total EEC 36,169.
Semifabricated—do	32,022	50,541	87,450	Austria 41,763; Denmark 10,481; Switzerland 8,391; total EEC 11,349.
Iron and steel:				
Ore—thousand tons	258	282	286	Austria 271; France 8; Netherlands 3; total EEC 13.
Pyrite cinder	5,048	4,509	261	Belgium-Luxembourg 261.
Scrap—thousand tons	1,273	1,098	1,299	Italy 1,103; France 121; Austria 35; Netherlands 13; Belgium-Luxembourg 11; total EEC 1,249.
Pig iron and ferro-manganese—do	747	870	895	Italy 328; Belgium-Luxembourg 127; United States 78; France 62; total EEC 519.
Other ferroalloys—do	21	17	11	Switzerland 2; Italy 1; Belgium-Luxembourg 1; Republic of South Africa 1; total EEC 3.
Ingots, blooms, billets—do	1,276	999	1,128	France 420; Switzerland 213; Italy 172; Belgium-Luxembourg 73; Greece 41; total EEC 700.
Rolled steel—do	4,741	4,860	5,348	France 1,453; Italy 896; Netherlands 796; United States 459; Switzerland 417; total EEC 3,364.
Pipes and other—do	934	956	835	
Lead:				
Scrap	2,815	5,148	8,829	Italy 5,406; Netherlands 2,886; total EEC 8,809.
Refined and soft unrefined	22,868	18,231	17,968	France 4,484; Belgium-Luxembourg 3,144; Netherlands 2,947; United States 1,957; Austria 1,382; total EEC 10,742.
Semifabricated	4,362	3,353	2,623	Finland 346; Switzerland 334; Sweden 296; Denmark 159; total EEC 467.
Magnesium, ingots, scrap, and wrought.	577	202	509	Italy 166; United States 116; France 38; total EEC 320.
Manganese:				
Ores and concentrates	6,721	5,999	6,705	Italy 946; Turkey 917; Sweden 854; Denmark 621; Netherlands 533; total EEC 2,189.
Metal	802	1,182	1,244	United Kingdom 718; Italy 222; United States 113; total EEC 265.
Mercury—76-pound flasks	6,150	1,044	754	Netherlands 290; Portugal 116; total EEC 319.
Molybdenum, wrought, unwrought and scrap.	28	23	36	France 10; Sweden 10; total EEC 13.

See footnotes at end of table.

TABLE 4.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963 [1]
Metals—Continued				
Nickel:				
Ingots, scrap, anodes	834	1,075	1,084	France 404; Netherlands 191; Bulgaria 59; total EEC 697.
Semifabricated	4,513	4,965	4,133	United Kingdom 1,304; Netherlands 664; France 225; Japan 140; total EEC 1,334.
Platinum, unwrought and semifabricated.	troy ounces 90,438	123,041	121,143	Switzerland 29,923; Hong Kong 17,715; Italy 17,072; Sweden 12,924; total EEC 36,459.
Silicon	11	6	62	France 56.
Silver, metal, wrought and semifabricated.	thousand troy ounces 5,020	4,904	5,045	Switzerland 1,028; Sweden 911; Netherlands 616; total EEC 1,537.
Tantalum, wrought and unwrought.	10	11	6	Austria 2; United States 1; total EEC 1.
Tin:				
Ingots	18,855	1,677	1,387	France 523; Austria 126; Netherlands 103; Czechoslovakia 102; total EEC 708.
Semifabricated	162	135	130	Italy 16; Austria 8; total EEC 25.
Titanium, vanadium, molybdenum, columbium, tantalum, zircon ores and concentrates.	826	809	846	Switzerland 330; Czechoslovakia 159; Austria 155.
Tungsten, wrought and unwrought.	244	222	252	United States 137; Sweden 50; Switzerland 26.
Uranium and thorium alloys		13	4	All to Italy.
Zinc:				
Ores and concentrates	19,170	12,941	33,097	Belgium-Luxembourg 17,389; United Kingdom 12,534; Netherlands 3,174; total EEC 20,563.
Scrap	885	2,068	3,231	Italy 2,392; France 517; Belgium-Luxembourg 276; total EEC 3,216.
Dust and powder	1,940	2,034	1,742	Czechoslovakia 677; Austria 210; Switzerland 182; Italy 161; total EEC 374.
Semifabricated	5,933	4,699	5,654	Denmark 720; Netherlands 595; Turkey 342; Sweden 336; France 329; total EEC 992.
Slab	31,701	25,392	29,870	United States 9,174; Switzerland 2,576; Philippines 2,509; Sweden 2,255; France 2,018; Belgium-Luxembourg 1,845; Netherlands 1,823; total EEC 7,057.
Zirconium	2	2	7	Sweden 6.
Alkali earth and rare earth metals.	2,710	2,895	3,073	(3).
Other nonferrous metals	13	11	9	Italy 3; Rumania 3; United States 2 total EEC 3.
Other ores and concentrates	18,257	2,113	10,292	France 10,216; total EEC 10,237.
Nonmetals:				
Asbestos	928	370	298	Austria 134; Switzerland 57; total EEC 43.
Barite and witherite	123,894	99,798	103,997	France 57,689; Belgium-Luxembourg 16,174; Netherlands 13,609; total EEC 87,513.
Cement, portland and other	972,437	833,704	783,603	Netherlands 421,241; France 228,090; total EEC 649,748. EEC 87,513.
Chalk	476	421	776	Denmark 469; total EEC 77.
Clay:				
Kaolin	33,834	38,399	52,302	Italy 16,681; Switzerland 7,689; Finland 6,282; Netherlands 5,571; France 5,511; total EEC 30,731.
Refractory	367,088	346,404	366,379	Netherlands 82,323; Italy 74,979; Belgium-Luxembourg 62,907; France 52,559; total EEC 272,770.
Other	474,496	467,795	418,192	Netherlands 209,855; France 67,963; Belgium-Luxembourg 62,863; Italy 40,806; total EEC 381,487.
Crushed rock and gravel.	thousand tons 4,601	4,411	6,006	Netherlands 3,801; Belgium-Luxembourg 1,265; Switzerland 877; total EEC 5,080.
Diamonds:				
Industrial.	thousand dollars 4,396	609	678	Netherlands 213; United Kingdom 116; Belgium-Luxembourg 114; total EEC 348.
Powder	do 47	45	88	Netherlands 27; France 16; Italy 16; total EEC 70.

See footnotes at end of table.

TABLE 4.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963 [1]
Diatomaceous earth	4,018	3,807	3,639	EEC 1,503; Belgium-Luxembourg 576; Netherlands 415; Switzerland 371; Italy 368; Sweden 309.
Dolomite	70,775	84,881	57,506	Netherlands 36,370; Belgium-Luxembourg 7,332; France 6,621; total EEC 50,423.
Earth pigments	3,306	2,909	2,556	EEC 1,236; Switzerland 484; Belgium-Luxembourg 434; Sweden 359; Netherlands 335; France 324.
Feldspar, leucite, nepheline, nepheline syenite.	34,904	25,658	11,948	Netherlands 3,916; Belgium-Luxembourg 2,748; Italy 2,748; total EEC 11,383.
Fertilizer raw materials:				
Animal and plant origin	125	1,980	4,665	Netherlands 4,598; total EEC 4,607.
Rock phosphate	30,163	33,543	36,225	Austria 34,405; Switzerland 1,750.
Crude potash	87,356	84,355	73,188	Netherlands 25,479; Belgium-Luxembourg 24,115; United Kingdom 23,059; total EEC 49,836.
Potassium chloride and sulfate up to 52 percent K_2O, potassium-magnesium sulfate up to 30 percent K_2O.	thousand tons 1,589	1,281	1,458	United Kingdom 182; United States 181; Netherlands 144; Denmark 135; total EEC 293.
Fluorspar	34,904	14,335	11,598	Austria 6,344; Netherlands 1,663; Switzerland 1,475; total EEC 2,173.
Graphite	5,430	6,635	4,145	Italy 1,432; United States 1,310; United Kingdom 458; Hungary 309; total EEC 2,030.
Gypsum	178,799	186,961	190,475	Netherlands 95,635; Belgium-Luxembourg 27,123; Sweden 18,783; total EEC 137,756.
Lime	299,520	282,642	291,840	Netherlands 233,797; Switzerland 20,955; Belgium-Luxembourg 18,380; France 14,300; total EEC 266,496.
Limestone	40,241	26,507	36,998	Netherlands 26,865; total EEC 31,159.
Magnesite, crude, sintered and calcined.	4,201	2,524	3,920	Netherlands 1,466; France 1,349; total EEC 3,381.
Mica	323	429	486	Switzerland 244; Sweden 76; Austria 63.
Pumice, emery, other natural abrasives.	692,038	633,398	705,835	Netherlands 477,525; Belgium-Luxembourg 209,696; total EEC 700,911.
Pyrite	600	1	11	[2].
Quartz and quartzite	43,350	45,098	43,247	Italy 13,202; Austria 10,690; Switzerland 5,868; Belgium-Luxembourg 3,617; total EEC 22,118.
Salt	699,865	792,737	890,298	Belgium-Luxembourg 425,317; Sweden 179,480; total EEC 467,988.
Sand	827,275	924,513	1,125,345	Netherlands 678,886; Switzerland 190,815; total EEC 846,029.
Slate	25,514	20,228	40,404	Netherlands 28,757; Sweden 5,837.
Soapstone and talc	1,155	1,058	1,206	Sweden 329; Switzerland 251; Denmark 186; total EEC 30,682.
Stone:				
Marble and other dressed limestone.	3,013	8,530	10,981	Belgium-Luxembourg 8,577; Netherlands 1,227; total EEC 9,882.
Other stones	271,373	262,780	307,489	Netherlands 297,178; France 4,304; Belgium-Luxembourg 4,234; total EEC 306,238.
Flint and tar macadam	26,424	13,869	16,791	Netherlands 12,937; total EEC 16,711.
Sulfur	16,358	21,704	11,725	United Arab Republic (Egypt) 6,673; Denmark 3,071; total EEC 1,208.
Other nonmetals	220,351	265,001	296,766	Netherlands 112,893; United States 31,992; Austria 26,888; total EEC 159,252.
Slags and ashes:				
Slags, ashes, other rejects.	thousand tons 1,256	1,187	1,262	Netherlands 793; France 393; total EEC 1,248.
Metalliferous ashes and rejects.	41,925	61,210	58,640	Belgium-Luxembourg 27,647; Netherlands 17,109; United Kingdom 4,414; total EEC 48,361.
Other slags and ashes	226,403	225,624	266,962	Netherlands 213,462; France 43,433; Switzerland 9,401; total EEC 257,186.
Thomas slag	363,609	366,243	408,219	France 311,780; Austria 33,820; Chile 16,290; Netherlands 15,291; total EEC 328,909.

See footnotes at end of table.

TABLE 4.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963 [1]
Mineral fuels:				
Hard coal——thousand tons	16,934	17,909	16,352	France 6,164; Netherlands 3,992; Belgium-Lumxebourg 2,809; Italy 1,142; Austria 949; Switzerland 800: total EEC 14,107.
Lignite (brown coal)	248,964	220,121	196,361	Mainly to the Netherlands.
Lignite briquets——thousand tons	1,457	1,448	1,514	France 475; Belgium-Luxemourg 245; Netherlands 225; Switzerland 206; Austria 202; total EEC 1,107.
Hard coal coke——do	10,920	10,289	12,046	France 4,547; Belgium-Luxembourg 3,360; Sweden 895; Denmark 761; Switzerland 515; total EEC 8,800.
Lignite semicoke	24,602	25,266	26,619	Denmark 20,853; Switzerland 5,686.
Peat and other, including their semicokes.	167,747	158,503	151,298	Netherlands 62,119; United States 31,745; Switzerland 23,474; total EEC 83,903.
Petroleum products:				
Gasoline——thousand 42-gallon barrels.	9,976	9,997	10,589	Switzerland 3,885; United Kingdom 2,270; Sweden 1,816; Denmark 898.
Kerosine and jet fuel. do	142	1,711	1,197	Netherlands 658; Denmark 256; United Kingdom 184.
Distillate fuel oil——do	5,580	5,841	8,555	Switzerland 5,072; Denmark 1,527; Netherlands 918.
Residual fuel oil——do	14,785	8,535	12,809	Netherlands 4,897; Switzerland 3,897; United Kingdom 1,396; Belgium-Luxembourg 1,148.
Lubricating oil——do	569	525	625	Netherlands 180; Austria 80; Belgium-Luxembourg 78; United Kingdom 78.
Liquefied petroleum gas. do	2,673	2,640	2,575	Belgium-Luxembourg 947; Denmark 717; Netherlands 672.
Asphalt——do	415	664	951	Switzerland 348; Denmark 304; Netherlands 238.
Other——do	911	1,053	1,290	France 308; Switzerland 243; Cameroon 151; Sweden 75.
Total——do	35,051	30,966	38,591	
Bunkers——do	17,323	8,117	20,802	

[1] For most items, the total export to the European Economic Community (EEC) is indicated; part or all of this EEC total is duplicated in the listing of individual countries wherever Belgium, France, Italy, Luxembourg, or the Netherlands appears as a separate entry.

[2] Data not available.

TABLE 5.—Imports of metals and minerals

(Metric tons, unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963 [1]
Metals:				
Aluminum:				
Bauxite	1,563,288	1,391,418	1,508,017	Yugoslavia 736,602; Greece 343,461; France 147,904; Hungary 90,926; Indonesia 51,177; total EEC 151,428.
Alumina-anhydrous	27,741	34,618	49,665	Mainly from Guinea.
Ingots	138,716	117,989	120,671	Norway 30,428; Canada 26,357; United States 20,034; Switzerland 11,318; France 4,732; total EEC 5,082.
Scrap	45,913	41,936	43,934	United States 19,546; Netherlands 6,150; France 5,028; Austria 2,593; Belgium-Luxembourg 2,352; total EEC 13,534.
Semifabricated	11,801	12,623	18,440	Belgium-Luxembourg 7,635; Nethe lands 2,374; France 1,507; United States 805; Switzerland 504; total EEC 11898.
Antimony:				
Ore	2,209	1,648	2,165	Turkey 1,477; mainland China 284; Thailand 265.
Metal	3,592	3,602	4,782	Mainland China 2,649; U.S.S.R. 932; Czechoslovakia 921; Hungary 162.
Bismuth	236	280	254	Netherlands 80; Belgium-Luxembourg 53; United Kingdom 42; mainland China 32; total EEC 134.
Cadmium	810	918	1,003	Belgium-Luxembourg 331; U.S.S.R. 235; United States 150; Netherlands 101; total EEC 435.
Chromium:				
Chromite	324,159	228,122	174,496	Republic of South Africa 71,439 U.S.S.R. 57,929; Turkey 28,049 Iran 12,546.
Metal	49	39	75	France 52; United Kingdom 18.
Cobalt	770	580	466	Belgium-Luxembourg 280; United States 60; France 39; total EEC 345.
Columbium and titanium	230	322	388	United States 329; Japan 26.
Copper:				
Ores and concentrates	130,022	133,624	158,545	Cyprus 90,512; Chile 36,492; Canada 8,394; Morocco 8,145; Norway 7,576; Algeria 3,279.
Matte	8,107	7,453	2,358	Norway 1,125; Austria 510; Burma 331.
Scrap, including alloy scrap	34,133	27,032	42,834	Netherlands 11,158; France 5,494; Switzerland 5,113; Denmark 4,602; total EEC 19,403.
Ingots for refining	122,070	101,019	122,100	Rhodesia 46,557; Chile 32,211; Peru 18,042; Republic of South Africa 7,066.
Refined, not alloyed	346,801	300,814	255,211	Chile 77,157; United States 57,140; Belgium-Luxembourg 49,436; Rhodesia 36,073; total EEC 51,408.
Refined, alloyed	31,046	36,670	38,979	United Kingdom 12,307; France 6,113; Argentina 5,731; Netherlands 5,211; total EEC 12,815.
Master alloys	1,007	547	476	United Kingdom 162; Switzerland 149.
Semifabricated	27,642	20,105	26,496	Belgium-Luxembourg 15,116; Netherlands 2,983; Sweden 2,500; total EEC 20,224.
Gold:				
Unwrought—troy ounces	2,637,936	3,031,782	2,174,194	U.S.S.R. 1,286,865; Switzerland 422,654; United Kingdom 209,623.
Semifabricated—do	9,998	9,356	12,892	United States 8,584; Austria 3,665.
Scrap and ashes [2]	30	17	21	Austria 7; United States 4; Italy 2; Sweden 1; Denmark 1; total EEC 3.

See footnotes at end of table.

TABLE 5.—Imports of metals and minerals—Continued

(Metric tons, unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963 [1]
Metals—Continued				
Iron and steel:				
Ore.....thousand tons..	32,628	29,069	27,000	Sweden 7,967; France 6,802; Brazil 2,587; Liberia 1,655; total EEC 6,810.
Pyrite cinder.....do....	2,481	1,864	1,915	Spain 555; France 221; Italy 197; Belgium-Luxembourg 197; Sweden 181; total EEC 675.
Scrap.....	941,304	621,220	638,277	Belgium-Luxembourg 209,039; Netherlands 207,571; United Kingdom 102,409; total EEC 450,455.
Pig iron thousand tons.. and spiegeleisen.	340	611	479	Spain 94; Finland 68; U.S.S.R. 64; Republic of South Africa 56; United Kingdom 45; total EEC 84.
High-carbon ferro- do.... manganese.	78	71	71	France 37; Norway 12; Republic of South Africa 10; total EEC 40.
Other ferroalloys....do....	169	138	140	Norway 66; France 21; Yugoslavia 12; Switzerland 10; total EEC 25.
Ingots, blooms, bil- do.... lets.	285	241	223	Belgium-Luxembourg 166; France 24; United Kingdom 10; Austria 6; Sweden 4; total EEC 192.
Rolled steel.....do....	3,168	4,032	4,020	Belgium-Luxembourg 1,468; France 1,227; Austria 465; Netherlands 302; total EEC 3,048.
Pipes and other.....	80	104	123	(4).
Lead:				
Ores and concentrates.....	146,711	144,748	109,198	Sweden 31,418; Peru 30,525; Canada 7,737; Morocco 6,318; Greece 5,865.
Scrap.....	1,264	1,285	1,246	Belgium-Luxembourg 616; Netherlands 241; total EEC 987.
Pig and refined.....	76,539	99,962	100,563	United Kingdom 28,561; Austria 18,327; France 13,902; Peru 11,120; Belgium-Luxembourg 8,791; Netherlands 5,738; Mexico 5,358; total EEC 28,474.
Semifabricated.....	478	1,233	1,843	Belgium-Luxembourg 878; France 420; Yugoslavia 370; total EEC 993.
Magnesium:				
Scrap.....	124	131	78	Sweden 31; Netherlands 26; Austria 10; total EEC 26.
Ingots.....	26,274	29,883	30,940	Norway 15,147; United States 10,522; Italy 3,001.
Semifabricated.....	95	126	159	Austria 89; United States 46; United Kingdom 23.
Manganese:				
Ores and concentrates.....	553,898	518,314	730,684	Republic of South Africa 237,378; India 102,666; Gabon 73,272; U.S.S.R. 71,752.
Metal.....	1,603	1,664	1,476	Japan 764; Republic of South Africa 441; United States 111; France 84.
Mercury.....76-pound flasks..	27,093	23,554	16,331	Italy 11,197; Spain 2,495; mainland China 1,218; Yugoslavia 435; Mexico 319.
Molybdenum, including scrap..	122	89	65	Netherlands 23; Austria 21; United States 17; total EEC 25.
Nickel:				
Ores and concentrates.....	16	20	693	All from Greece.
Matte.....	1,225	488	1,260	Greece 569; Canada 496.
Scrap.....	3,463	3,820	4,325	United States 1,682; Netherlands 688; France 590; United Kingdom 550; total EEC 1,281.
Ingots.....	19,587	18,909	19,217	United Kingdom 6,363; Norway 4,976; Canada 4,780; United States 1,785.
Semifabricated.....	1,014	868	516	United Kingdom 148; United States 106; Switzerland 85; France 20; total EEC 90.
Anodes.....	450	354	392	France 129; Switzerland 78; Netherlands 55; total EEC 201.
Platinum, un- troy ounces.. wrought and semifabricated.	115,740	106,420	325,349	U.S.S.R. 163,904; United Kingdom 100,149;
Palladium.....troy ounces..	102,880	108,670		Switzerland 21,251; total EEC 24,338.
Selenium.....	125	73	[3] 110	(4).
Silicon.....	13,675	12,442	12,704	Italy 3,300; France 2,925; Sweden 2,550; Switzerland 2,176; total EEC 6,230.

See footnotes at end of table.

TABLE 5.—Imports of metals and minerals—Continued

(Metric tons, unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963 [1]
Metals—Continued				
Silver:				
Ores and concentrates, including platinum.	2,811	3,457	2,402	All from Peru.
Scrap and ashes, including platinum.	221	202	257	Switzerland 68; Austria 43; Norway 40; Sweden 33; Netherlands 31; total EEC 47.
Metal, thousand troy ounces.	44,907	40,975	41,631	Mexico 17,887; Peru 4,897; Belgium-Luxembourg 4,824; total EEC 6,220.
Wrought and semifabricated.				
Tantalum, wrought and unwrought.	5	6	3	France 2.
Tellurium	10	10	[2] 3	(4).
Tin:				
Ores and concentrates	6,386	8,105	8,499	All from Bolivia.
Scrap	410	229	364	Netherlands 231; Switzerland 33; total EEC 249.
Ingots	28,361	12,278	11,783	Malaya 4,635; Netherlands 3,087; mainland China 1,006; Belgium-Luxembourg 998; total EEC 4,088.
Semifabricated	12	8	21	Netherlands 3; Switzerland 3.
Titanium, columbium, vanadium, molybdenum, zircon ores and concentrates.	400,209	311,201	319,387	Norway 201,016; Canada 66,189; Australia 34,360; United States 5,705.
Tungsten:				
Ores and concentrates	5,324	4,756	3,975	U.S.S.R. 1,720; Bolivia 631; Argentina 627.
Metal, wrought and unwrought.	164	124	80	France 32; Switzerland 22.
Uranium ores and concentrates	61	23	26	Canada 6; total EEC 40.
Uranium and thorium alloys	----------	28	----------	
Zinc:				
Ores and concentrates	138,433	133,604	124,648	Sweden 40,993; Finland 13,966; Peru 12,180.
Scrap	416	865	792	Netherlands 315; Belgium-Luxembourg 231; Spain 77; total EEC 546.
Dust and powder	1,200	2,303	3,822	Belgium-Luxembourg 2,381; Yugoslavia 555; total EEC 2,399.
Slab	141,579	128,611	136,109	Belgium-Luxembourg 44,144; Netherlands 14,322; Canada 13,217; Norway 9,768; Austria 9,274; total EEC 65,519.
Semifabricated	8,379	10,022	11,210	Belgium-Luxembourg 4,421; Yugoslavia 4,181; France 2,180; total EEC 6,618.
Zirconium, crude and semifabricated.	13	13	13	United States 9; United Kingdom 2; total EEC 1.
Alkali earth and rare earth metals.	14	457	1,612	France 1,492; United Kingdom 110; total EEC 1,492.
Other metals	7	2	3	Belgium-Luxembourg 2; United Kingdom 1; total EEC 2.
Other ores and concentrates	210	80	62	Austria 61.
Nonmetals:				
Asbestos	123,279	128,147	143,434	Canada 78,897; U.S.S.R. 28,702; Republic of South Africa 20,643; total EEC 2,878.
Barite and witherite	9,961	1,112	5,853	Morocco 4,179; Italy 974; total EEC 1,487.
Borates	38,342	32,780	44,625	United States 44,101; Turkey 498.
Cement, portland and other	32,880	36,652	34,833	France 25,095; Switzerland 5,304; Poland 2,057; total EEC 25,326.
Chalk	115,030	132,950	127,263	France 88,557; Denmark 26,685; Belgium-Luxembourg 11,099; total EEC 99,700.
Clays:				
Kaolin	292,281	299,417	338,619	United Kingdom 232,173; France 35,626; Czechoslovakia 34,500; United States 10,993; total EEC 36,695.
Refractory	186,509	147,462	172,242	Czechoslovakia 56,707; Republic of South Africa 51,630; France 34,223; total EEC 36,986.
Other	200,889	209,731	217,642	Netherlands 86,929; France 51,288; Czechoslovakia 17,748; United Kingdom 13,879; Belgium-Luxembourg 13,731; total EEC 152,341.

See footnotes at end of table.

TABLE 5.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963 [1]
Nonmetals—Continued				
Crushed rock and gravel. thousand tons	3,007	4,034	5,235	Denmark 1,840; France 1,802; Netherlands 67; Belgium-Luxembourg 23; total EEC 2,751.
Cryolite, natural	2,301	3,368	2,982	All from Denmark.
Diamonds:				
Industrial. thousand dollars	11,237	6,733	6,260	Belgium-Luxembourg 2,792; United Kingdom 889; Republic of South Africa 791; total EEC 3,398.
Powder do	1,493	1,325	1,948	Belgium-Luxembourg 970; United States 375; Netherlands 252; total EEC 1,225.
Diatomaceous earth	62,528	75,278	62,645	Denmark 46,544; France 7,385; Yugoslovia 4,437; United States 3,603; total EEC 7,569.
Dolomite	104,869	60,104	119,263	Belgium-Luxembourg 84,169; Norway 13,105; Austria 12,678; total EEC 92,916.
Earth pigments	2,154	2,095	2,248	Austria 1,030; France 599; Sierra Leone 444; total EEC 700.
Feldspar, leucite, nepheline, nepheline syenite.	98,972	98,473	37,863	Italy 12,648; Norway 9,186; France 7,703; Republic of South Africa 4,617; total EEC 20,405.
Fertilizer raw materials:				
Animal and plant origin	9,948	7,797	13,937	Netherlands 6,842; France 3,670; Peru 3,075; total EEC 10,605.
Rock phosphate. thousand tons	1,512	1,622	1,642	Morocco 72; United States 39; U.S.S.R. 25; Senegal 16.
Potash, crude	18,167	15,102	16,875	Mainly from France.
Potassium chloride and sulfate up to 52 percent K_2O, potassium-magnesium sulfate up to 30 percent K_2O.	10,215	21,700	31,659	France 22,760; Italy 6,002; Israel 2,896; total EEC 28,762.
Fluorspar	98,972	65,617	47,391	France 24,740; Spain 10,750; mainland China 5,564; Mexico 3,846; total EEC 25,410.
Graphite	16,602	14,455	13,319	Austria 8,685; Czechoslovakia 1,166; Madagascar 1,087.
Gypsum	59,503	65,705	73,981	Austria 42,637; France 30,890; total EEC 31,193.
Lime	85,201	77,249	67,325	France 61,511; Poland 5,416; total EEC 61,608.
Limestone	282,502	299,163	382,158	Sweden 273,151; France 75,535; Belgium-Luxembourg 15,507; total EEC 92,302.
Magnesite, crude, sintered and calcined.	211,079	214,180	204,398	United Kingdom 143,408; India 2,335; Norway 721; United Kingdom 445; Republic of South Africa 394.
Mica	4,654	4,483	4,485	
Pumice, emery, other natural abrasives.	10,762	9,604	191,956	Italy 174,037; Greece 15,645; total EEC 174,510.
Pyrite thousand tons	1,284	1,337	1,500	Spain 653; Norway 508; Finland 95; Yugoslavia 55; Portugal 54.
Quartz and quartzite	28,532	28,094	25,179	Norway 4,459; Sweden 7,112; Yugoslavia 3,528; total EEC 3,429.
Salt	15,334	25,156	56,411	Netherlands 40,323; France 11,045; Switzerland 2,610; total EEC 51,484.
Sand	994,515	1,110,460	1,210,810	France 561,515; Belgium-Luxembourg 313,694; Netherlands 302,512; Denmark 22,011; total EEC 1,177,722.
Slate	4,228	4,629	4,551	Italy 1,381; France 1,146; Norway 577; total EEC 3,055.
Soapstone and talc	49,168	50,840	50,055	Austria 18,924; France 10,755; Norway 7,896; total EEC 16,515. Greece 25,371; Spain 9,721; Yugoslavia 9,362; total EEC 215,198.
Stone:				
Marble and other dressed limestone.	88,868	115,155	131,315	Italy 43,480; Austria 36,642; France 13,910; Portugal 8,624; Greece 7,751; Yugoslavia 6,148; total EEC 63,622.
Other stone	556,828	561,881	456,213	Sweden 178,912; Denmark 163,397; Austria 82,659; Belgium-Luxembourg 41,952; Netherlands 37,012; total EEC 113,000.
Flint and tar macadam	83,240	102,224	166,969	
Sulfur	160,252	219,659	292,288	France 118,471; Mexico 86,306; United States 75,877; total EEC 118,571.

See footnotes at end of table.

TABLE 5.—Imports of metals and minerals—Continued
(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963 [1]
Nonmetals—Continued				
Other nonmetals	97,057	96,609	94,662	Netherlands 21,069; France 18,153; Republic of South Africa 15,084; Hungary 9,566; Norway 6,110; total EEC 45,411.
Slags and ashes:				
Slags, ashes, thousand tons other rejects of the iron and steel industry.	1,654	1,726	1,976	Belgium-Luxembourg 987; France 429; United Kingdom 320; total EEC 1,505.
Blast furnace dust	305,697	181,330	264,145	All from France.
Metalliferous ashes and rejects.	58,048	59,360	51,409	Netherlands 8,306; Belgium-Luxembourg 7,903; United States 6,979; total EEC 21,042.
Other slags and ashes	118,793	107,760	72,790	Denmark 53,119; Netherlands 11,350; total EEC 16,192.
Thomas slag	530,233	443,922	412,969	Mainly from Belgium-Luxembourg.
Mineral fuels:				
Hard coal—thousand tons	6,785	7,295	7,762	United States 5,090; United Kingdom 616; France 535; Belgium-Luxembourg 472; Poland 428; Netherlands 405; total EEC 1,412.
Hard coal briquets	215,845	377,090	653,438	Netherlands 390,053; Belgium-Luxembourg 233,061; United States 30,304; total EEC 623,134.
Lignite thousand tons (brown coal).	1,116	1,121	1,162	Czechoslovakia 1,142; Austria 20.
Lignite briquets	163,910	235,942	408,365	Czechoslovakia 289,463; Denmark 52,121; Hungary 43,414; Netherlands 23,048.
Hard coal coke	279,853	318,043	323,937	Netherlands 282,051; Belgium-Luxembourg 17,410; United Kingdom 12,282; total EEC 303,690.
Lignite semicoke	114,635	120,865	108,952	Mainly from Czechoslovakia.
Peat and other including their semicokes.	13,367	27,603	31,000	Netherlands 25,813; Denmark 5,169; total EEC 25,813.
Petroleum:				
Crude—thousand 42-gallon barrels.	216,403	245,400	296,526	Iran 71,711; Iraq 40,454; Saudi Arabia 30,883; Kuwait 19,381; Qatar 9,908 (total Near East 172,337); Libya 48,024; Venezuela 30,708; Algeria 20,085; Nigeria 6,808.
Products:				
Gasoline—do	4,506	4,994	5,213	France 1,630; Netherlands Antilles 916; U.S.S.R. 832; Rumania 619.
Kerosine and jet fuel. do	1,377	1,455	1,151	Netherlands Antilles 535: Netherlands 174: France 138.
Distillate fuel oil. do	5,440	8,209	10,760	Netherlands 3,094: Venezuela 3,033; Netherlands Antilles 1,141; France 983; U.S.S.R. 797.
Residual fuel oil. thousand 42-gallon barrels	31,370	62,510	69,835	Netherlands 14,034; Venezuela 12,136; Netherlands Antilles 7,904; France 5,583; Italy 5,569.
Lubricating oil—do	1,200	1,534	1,249	United States 414; United Kingdom 245; Venezuela 225.
Liquefied petroleum gas. do	105	264	411	Netherlands 212; France 157.
Asphalt—do	2,137	2,833	5,352	Netherlands 1,792; Belgium-Luxembourg 1,194; Italy 908.
Others—do	838	1,026	1,221	United States 1,034; Switzerland 48; Netherlands 47.
Total—do	46,973	82,825	95,192	

[1] For most items, the total import from the European Economic Community (EEC) is indicated; part or all of this EEC total is duplicated in the listing of individual countries wherever Belgium, France, Italy, Luxembourg, or the Netherlands appears as a separate entry.
[2] Including platinum.
[3] Estimate.
[4] Data not available.

COMMODITY REVIEW

METALS

Iron and Ferroalloy Ores.—The decline in iron ore production and shipment, which started in 1962, became steeper in 1963, This decline

has resulted from changes in the West German iron ore supply situation.[2] Raw material costs reportedly constituted 80 percent of the cost of production of pig iron. To improve its competitive position, the West German steel industry, particularly in the Ruhr, has increasingly used high-grade imported ore, which in terms of metal content has been cheaper than domestic ore. In 1962 average iron content of imported ore in the Ruhr was 58.2 percent, compared to the average grade of West German mine ore in 1963 which was approximately 27 percent.

TABLE 6.—Iron ore production, shipment, and stocks

(Thousand metric tons)

	1959	1960	1961	1962	1963
Production:					
Mine-run ore	18,063	18,869	18,866	16,643	12,898
Marketable ore:					
Direct shipping	5,955	5,157	5,472	5,050	3,095
Concentrating	7,006	8,386	7,614	6,381	5,495
Total	12,961	13,543	13,086	11,431	8,590
Iron content	4,277	4,558	4,423	3,899	3,124
Shipments:					
Ore	12,714	13,601	12,964	11,092	8,517
Iron content	4,226	4,575	4,384	3,790	3,092
Stocks at yearend	1,476	1,099	1,301	1,947	2,280

In 1963 the iron content of domestic ore shipped was equivalent to 14 percent of the pig iron produced, compared with 28 percent in 1953. This decline has taken place despite a rationalization of the domestic industry initiated some years ago to amalgamate small mines and close marginal ones. The number of mines operating has been reduced from 90 in 1952 to about 30 in 1963. The share of domestic ore in total consumption may increase when the Staffhorst iron mine, which was discovered in 1959, comes into production. This deposit, with 37 percent iron content, was developed by a consortium of steel producers for an annual production of 8 million tons. By the end of April 1963, the shaft was down to a depth of 407 meters.

Percentage shares of selected mining districts in total production of mine run iron ore in 1963 were: Salzgitter 41; Ilsede 19; Dogger ore region 8; Siegerland-Wied 6; Osnabrucek 5; and Weser-Wiehengebirge 4.

In 1963 Sweden was the leading supplier of iron ore to West Germany with 29 percent of iron ore imports, followed by France with 25 percent, Brazil with 10 percent, and Liberia with 6 percent. Other suppliers included Peru, India, Venezuela, and Canada. It is expected that shipments from Liberia will increase because West German capital is being invested in developing a low-grade deposit there. French ore is shipped principally to the Saar.

Pyrite cinder is also an important iron source in Germany; in 1963, 3 million tons of pyrite cinders were used in sintering plants which produced nearly 25 million tons of sinter for blast furnaces.

[2] Eisen and Stahl. January 1962, p. 10.

TABLE 7.—Operating iron mines in 1963

Mining company	Mining district	Mines
Erzbergbau Salzgitter, A. G.	Salzgitter	Haverlahwiese I and II, Georg, Hannoverische Treue, Worthlah.
	Ilsede	Peine.
	Amberg-Kreideerz	Kleiner-Johannes.
Ilseder Huette, Peine	Ilsede	Lengede-Broistedt, Buelten-Adenstedt.
	Salzgitter	Dörnten.
Barbara Erzbergbau, A. G., Goslar	Weser-Wiehengebirge	Wohlverwahrt-Nammen
	Baden - Württemberg Doggererz.	Kahlenberg.
Mannesmann, A. G., Erzbergbau	Upper Hesse	Vereinigte Wilhelm.
	Taunus-Hunrück	Doktor Geier.
Erzbergbau Siegerland, A. G.	Siegerland-Wied	Füsseberg-Friedrick Wilhelm, Georg, Eupel, Neue Haardt, Reutersbruch.
Harz-Lahn-Erzbergbau, A. G., Bad Harzburg.	Lahn-Dill	Lindenberg, Fernie, Waldhausen, Strichen.
Hessische Berg- und Huettenwerke, A. G., Wetzlar.	do	Königszug, Georg-Joseph.
Hessische Berg- und Huettenwerke, Gewerkschaft "Louise" Brauneisenstein-Bergwerke.	do	Falkenstein.
	Upper Hesse	Mücke Deckenbach.
Luitpoldhuette. A. G., Amberg	Kreideerz	Am Erzberg.
Eisenwerk-Gesellschaft Maximilianshuette m.b.H.	Amberg-Kreideerz	Auerbach, Sulzbach-Rosenberg.
Erzbergbau Porta-Damme, A. G.	Osnabrück	Damme.

Chromite and manganese ore requirements are met entirely by imports. About 90 percent of the chromite was used in making ferrochrome and chrome refractories; the balance presumably was used in chemical manufactures.

Iron and Steel.—*Production*—In 1963 West Germany produced about 8.2 percent of world pig iron and about 8.2 percent of world crude steel. Pig iron and steel output represented, respectively, 74.7 and 80.3 percent of maximum possible output. In 1963, output of steel was the lowest since 1960, when West Germany produced 10 percent of world total. Compared with 1962 figures, pig iron production dropped nearly 6 percent, crude steel 3 percent, and rolled steel 3 percent. In the last quarter of 1963, however, crude steel production exceeding the same quarter of 1962 by 4 percent, owing to increased orders in the third quarter. Thus, the production outlook was favorable at yearend. Total orders for 1963 were 492,000 tons above those

TABLE 8.—Maximum production capacity and actual production of pig iron and crude steel

Year	Pig iron [1]			Crude steel		
	Capacity (thousand metric tons)	Production		Capacity (thousand metric tons)	Production	
		Actual (thousand metric tons)	As percent of capacity		Actual (thousand metric tons)	As percent of capacity
1959	25,225	21,602	85.6	32,915	29,435	89.4
1960	27,130	25,739	94.9	35,335	34,100	96.5
1961	28,380	25,431	89.6	36,885	33,458	90.7
1962	29,880	24,251	81.1	38,030	32,563	85.6
1963	[2] 30,650	22,909	74.7	[2] 39,340	31,597	80.3

[1] Including spiegeleisen.
[2] Provisional.

of 1962, with foreign orders exceeding those of 1962 by about 1 million tons. Furthermore, prices firmed up from low discount prices that prevailed in midyear.

In 1963, Thomas pig iron constituted 62 percent of total pig iron output and open hearth pig iron supplied 29 percent. The share of Thomas pig has declined steadily from 70 percent of total output in 1959; that of open hearth has increased from 21 percent in 1959. Pig iron capacity was to be expanded to 32 millions tons in 1964. Nordrhein/Westfalen, where the Ruhr is located, is the foremost pig iron-producing State; the Saar ranked second. In 1963 these two States produced 68 and 14 percent of the total, respectively. Table 9 shows trends in production of crude steel.

TABLE 9.—Production of crude steel by processes

Type of process	1962		1963		Variation in 1963 in relation to 1962 (percent)
	Production (thousand metric tons)	Percent of total	Production (thousand metric tons)	Percent of total	
Open hearth	15,048	46.2	14,017	44.3	−6.9
Thomas	13,211	40.6	12,440	39.4	−5.8
Electric	2,567	7.9	2,647	8.4	+3.1
Oxygen	1,684	5.2	2,453	7.8	+45.7
Other	53	.1	40	.1	−24.5
Total	32,563	100.0	31,597	100.0	

Use of sinter in blast furnaces continued to increase. During the year sinter constituted 54 percent of the blast furnace charges. Despite the decline of total steel output, shares of oxygen and electric steel in total production increased; the former by 46 percent. This trend has been apparent for a number of years; for example production of electric steel in 1963 was 4.6 times that of 1953. It is expected that in terms of tonnage, oxygen steel will exceed electric steel in 1964.

While total output of rolled steel declined in 1963—bars by 4 percent, structural steel and sections by 5 percent, plates by 13 percent, and hot strips by 7 percent—output of medium and thin sheets increased by 5 percent and 12 percent, respectively. The continued increase in production of flat products has been apparent since 1953. Of total investment of $2.4 billion in the German iron and steel industry during 1955–62, $565 million, or 23 percent, was invested in flat mills.

Consumption and Trade.—Flat products constituted the largest iron and steel commodity group exported in 1963. In 1963 EEC received 58 percent of West Germany's export of pig iron and ferroalloys; 62 percent of the ingots, blooms, and billets; and 54 percent of finished rolled steel including cast iron and steel pipes and forged steel.

TABLE 10.—Salient statistics of the iron and steel industry

(Thousand metric tons unless otherwise specified)

	1961	1962	1963
Blast furnaces available	154	153	148
Blast furnaces in operation at yearend	123	118	106
Pig iron production:			
Thomas pig iron	16,257	15,181	14,080
Open hearth pig iron	6,769	6,886	6,705
Foundry iron	690	668	603
Spiegeleisen and high-carbon ferromanganese	271	275	290
Other	1,444	1,241	1,231
Total	25,431	24,251	22,909
Ratio of pig iron to crude steel—percent	76.0	74.5	72.5
Consumption of raw materials for pig iron production:			
Iron ore directly in blast furnaces	25,944	20,377	[1]
Iron ore in sinter plants	18,166	19,923	[1]
Total	44,110	40,300	36,123
Pyrite cinder	3,793	3,788	3,785
Iron ore sinter	21,155	22,956	24,969
Manganese ore	472	509	587
Scrap	891	840	752
Coke per ton of pig iron—kilograms	803	753	726
Iron ore per ton of pig—tons	1.8	1.66	1.58
Scrap per ton of pig iron—kilograms	35	34	33
Number of steelworks:			
Thomas converters available	87	87	78
Thomas converters in operation	72	69	60
Open hearth furnaces available	209	202	190
Open hearth furnaces in operation	135	113	134
Electric furnaces available	179	182	182
Electric furnaces in operation	150	145	150
Crude steel production:			
Metal for casting	730	670	575
Thomas steel	14,368	13,211	12,440
Open hearth	15,457	15,048	14,017
Electric steel	2,365	2,567	2,647
Oxygen-blown steel	1,201	1,684	2,452
Other	67	53	41
Total	33,458	32,563	31,597
Consumption in steelworks:			
Pig iron	22,362	21,696	20,786
Pig iron per ton crude steel—kilograms	668	666	658
Iron and manganese ore [2]	1,043	1,050	793
Scrap	12,883	12,845	12,938
Scrap per ton crude steel—kilograms	394	403	417
Rolled-steel production:			
Rails and accessories	600	557	566
Sections	2,109	2,082	1,918
Bars and rods	6,041	5,307	5,122
Wire bars	2,094	2,063	2,216
Semifinished for pipes [3]	1,278	1,127	1,101
Hot-rolled coils	227	425	457
Hot strip and skelp	2,047	2,123	1,981
Plates (wide)	386	359	314
Hot-rolled sheets 4.76 millimeters and more	3,472	3,497	3,035
Hot-rolled sheets 3 to 4.75 millimeters [3]	435	424	476
Hot-rolled sheets less than 3 millimeters	1,134	991	3,572
Cold-rolled sheets less than 3 millimeters	1,865	2,401	
Total	21,688	21,356	20,758
Galvanized sheets	253	258	233
Tin plates	359	413	[4] 396
Condenser sheets	305	284	----
Forgings	584	484	436
Welded-steel pipes	579	691	566
Seamless pipes	1,452	1,360	1,333
Scrap consumption for casting production:			
Iron castings [5]	3,896	3,789	3,706
Steel castings	701	656	569
Total employment (workers and staff) at yearend	579,500	580,300	575,500

[1] Data not available.
[2] Including Krupp-Renn "luppen."
[3] Includes 4, 10, and about 15 tons of cold-rolled sheets of same thickness in 1961, 1962, and 1963, respectively.
[4] Ten months only.
[5] Including circulating plant scrap.

TABLE 11.—Composition of rolled steel produced for selected years

(Percent)

Type of product	1953	1959	1961	1962	1963
Flat products	40.6	44.6	43.8	47.3	46.9
Bars and rods	29.8	26.6	27.6	24.6	24.4
Wire rods	9.0	10.3	9.6	9.6	10.6
Rails	5.4	3.9	2.8	2.6	2.7
Sections	10.1	8.3	9.6	9.6	9.1
Pipes	5.1	6.3	6.6	6.3	6.3

Medium and thin sheets, tinplate, and other sheets constituted the largest import commodity group, followed by bars, wire bars, coils, and plates. Common Market countries, particularly Belgium-Luxembourg and France, were principal suppliers and accounted for 74 percent of rolled steel.

Apparent consumption of steel in West Germany during the first three quarters of 1963 was at an annual rate of 28,700,000 tons, on the basis of ingot steel, or an average of 495 kilograms per person. In arriving at this general figure only ECSC treaty items have been included in imports; however, imports of nontreaty items were only about 1 percent of total imports. Orders of finished rolled steel for domestic consumption in 1963 totaled 15,725,000 tons.

Principal companies and plants.—There were 72 iron and steel producing firms (exclusive of subsidiaries) in West Germany in 1963, of which about 20 had integrated operations. Huetten und Bergwerke Rheinhausen is the steelmaking enterprise of Krupp. The Bochumer Verein, with which Capito and Klein merged in 1962, is a subsidiary of Huetten und Bergwerke Rheinhausen. In 1961, the first eight companies listed in table 13 produced 62 percent of all crude steel in the country, and their share of total production in 1963 was probably about the same.

TABLE 12.—Iron and steel trade in 1963

Type of product	Imports		Exports	
	Metric tons	Percent	Metric tons	Percent
Ingots, blooms, and billets	232,126	5.46	1,128,300	15.43
Hot-rolled coils	462,505	10.88	331,141	4.53
Railroad material	9,486	.22	173,831	2.38
Sections	259,160	6.10	607,389	8.31
Bars and rods	709,864	16.70	1,460,045	19.97
Wire rod	480,938	11.31	445,943	6.10
Strip	253,467	5.96	255,623	3.49
Plates	306,683	7.21	1,115,741	15.26
Sheets, including tinplate	1,414,295	33.26	957,798	13.10
Pipes	116,357	2.74	765,291	10.47
Other	6,844	.16	69,993	.96
Total	4,251,725	100.00	7,311,095	100.00

TABLE 13.—Selected iron and steel companies

Company and location	Production (thousand metric tons)		Plant location	Principal facilities
	1961	1963		
August-Thyssen Huette A. G., Duisburg-Hamborn.	2,986	3,171	Duisburg-Hamborn.	Coke ovens; sintering plants; blast and open hearth furnaces; Thomas converters; and rolling mills including section, hot strip, and cold strip mills.
Phoenix-Rheinrohr A. G., Duesseldorf.	3,206	2,950	Duisburg-Ruhrort/ Meiderich, Muelheim/Ruhr, Dinslaken, Duesseldorf -Lierenfeld, Immigrath, and Hilden.	Sinter plants; blast and open hearth furnaces; bessemer oxygen converters; plate, merchant, and strip mills; and seamless tube plant.
Kloeckener-Werke A. G., Duisburg.	2,516	2,561	Bremen and Hagen-Haspe.	Coke ovens; sintering plant; blast, open hearth, and electric furnaces; rolling mills including section, bar, wire rod, hot strip, cold-rolling, and wire mills; steel foundry; wheel and tire plant; hot dip and electrolytic tinning lines.
Hoesch Westfallhuette A. G., Dortmund.	2,290	2,300	Dortmund	Blast and open hearth furnaces; Thomas steelworks; rolling mill including section, merchant, wire rod, wide strip, and cold-rolling mills; hot dip and electrolytic tinning lines.
Dortmund Hoerder Huettenunion A. G., Dortmund.	2,839	2,270	Dortmund and Hoerde.	Ore-sintering plant; blast and open hearth furnaces; Thomas converters, rolling mill for heavy steel, and steel foundry shop.
Hüetten-und Bergwerk Reinhausen, A.G., Rheinhausen-Neiderrhein.	2,214	(1)	Rheinhausen	Blast, open hearth, and electric furnaces; Thomas converters; section, rod, and plate mills.
Huettenwerk Oberhausen A. G., Oberhausen/Rhineland.	2,190	1,882	Oberhausen and Gelsenkirchen.	Blast and open hearth furnaces; Thomas steel plant; and rolling mills including merchant, wire, plate. and sheet mills.
Mannesmann A. G., Duesseldorf.	2,354	(1)	Huckingen, Grillo, Finke Finnentrop, and Hahnsche Werke.	Blast furnaces; Thomas steel and open hearth works; electric furnaces; rolling mills including section, medium plate, tube plate, sheet bar, sheet and cold-rolling mills; galvanizing shop; and tube plants.
Huettenwerke Salzgitter, Salzgitter-Druette.	1,619	1,350	Salzgitter and Watenstedt.	Coke ovens; blast and open hearth furnaces; Thomas converters, blooming, slabbing, and continuous billet and bar mills; and heavy and medium plate mills.
Bochumer Verein fuer Gusstahlfabrikation A. G., Bochum.	1,477	(1)	Toisdorf and Osnabrueck.	Blast, open hearth, Lenz-Donowitz (LD), and electric furnaces; steel foundries; rolling mills including wire and cold-rolling mills; and press and forge shops.
Roechling'sche Eisen und Stahlwerke G.m.b.H., Voelkingen-Saar.	(1)	2 1,000	Voelkingen-Saar	Coke ovens; sintering plant; blast, open hearth, and electric furnaces; Thomas converters; heavy, medium, and small section mills; hot strip and wire mills.
Ilseder Huette, Peine	875	(1)	Peine, Gross-Ilseder.	Coke ovens; sintering plant. blast and open hearth furnaces, Thomas converters, and rolling mills.
Rheinsche Stahlwerke, Essen.	921	770	Muelheim (Ruhr), Gelsenkirchen Oberkassel, Witten, and Remscheid.	Coke ovens; blast, open hearth, and LD furnaces; heavy and medium plate, bar, and wire rod mills; press and forge shapes; wheel and axle plants; and steel and pipe foundries.
Eisenwerk, Gesllschaft Maximilianshuette m. b. H., Sulzbach-Rosenberg.	704	654	Sulzbach-Rosenberg and Haidhof.	Blast, open hearth, and electric furnaces; Thomas converter, rolling mills including section, sheet, and bar mills; and foundry.

1 Data not available.
2 Estimate.

The High Authority of the ECSC on July 10, 1963, authorized the merger of August-Thyssen Huette (ATH) and Phoenix-Rheinrohr under certain specific conditions pertaining to a contract for delivery of hot-rolled strip by ATH to Huettenwerke/Siegerland. ATH complied with the conditions set by the Authority to reduce delivery of hot rolled strip by ATH to Huettenwerke/Siegerland, and this action prepared the way for the merger. The new company, with a total ingot capacity of about 8 million tons, will be the second largest producer in West Europe after FINSIDER, the Italian steel combine.

The High Authority also approved an agreement between Huettenwerke Salzgitter and Ilseder Huette designed to prevent the development of an excess production capacity for wire rod products. Salzgitter will build a new wire-rolling mill, and Ilseder Huette will refrain from building such a mill for 10 years. Under the agreement, Salzgitter, under its own name and for its own account, will sell rods rolled from its own billets and, under Ilseder Huette's name and account, will sell rods from billets supplied by this company. Ilseder Huette, in its own name and for the account of Salzgitter, will sell products rolled from the Salzgitter billets.[3]

Terms of an agreement between ATH, Mannesmann, and Huettenwerk Oberhausen for cooperation in hot- and cold-rolled wide strip production were published, but signing of an agreement has not been reported.

During the year, ATH was erecting at Hamborn an additional blooming mill train and a second wide strip mill, which will roll strips up to 2 meters wide. To meet steel requirements of these mills, the company in June 1962 brought two new oxygen Linz-Donawitz convertors into operation; each furnace has a daily capacity of 150 to 180 tons. Building of this new melting shop was phased ahead of the new rolling mills because available rolling-mill capacity was 3.7 million tons per year, compared with a steel production capacity, excluding the new plant, of 3,250,000 tons.

Both the Hüetten-und Berkwerk Rheinhausen and Bochumer Verein reported investment projects during the year. Rheinhausen's investments include completion of oxygen steel works, erection of a blast furnace, and blooming and medium section mills. Bochumer Verein will install facilities for hot-rolled strip up to 1.6 meters wide and for increased open hearth capacity at Bochum. The company also plans expansion of the cold-rolling mill plant at the Dusseldorf-Benrath works of the former Capito and Klein.[4]

Ferroalloys.—Data on production of ferroalloys other than blast furnace ferromanganese and spiegeleisen and the breakdown of "other ferroalloys" included in trade are not available. In 1962, Germany was a net importer of ferromanganese and "other ferroalloys" but a net exporter of spiegeleisen.

Several of the large iron and steel companies produce blast furnace ferromanganese and ferrosilicon. Among these are Phoenix-Rheinrohr A. G., at Duisburg, Huettenwerk Oberhausen A. G. at Oberhausen, Luitpoldhuette at Amberg, and August-Thyssen Huette at Hamborn. Gesellschaft fuer Elektrometallurgie, the largest ferrochrome producer, has a rated annual capacity of 75,000 to 100,000 tons.

[3] Metal Bulletin. July 20, 1963.
[4] Metal Bulletin. July 9, 1963, p. 13.

TABLE 14.—Principal ferroalloy producers

Company	Plant Location	Type of products
Gesellschaft fuer Elektrometallurgie, Duesseldorf.	Weisweiler, and Nuer-emberg,	Refined manganese; low-carbon ferro-chrome; ferroalloys with tungsten, molyb-denum, boron, cobalt, columbium, tantalum, zircon, and phosphorus.
Herman C. Starck, Berlin	Goslar Laufenburg	Tungsten and ferrotungsten.
Badische Wolframerz-Gesellschaft, Solingen.	Solingen	High- and low-carbon ferrochrome, ferro-tungsten, and ferromolybdenum.
Theodore Goldschmidt, A. G	Essen	Ferroalloys with tungsten, vanadium, titanium, and other.
Metallwerk Dr. Alexander Nacker: Gesellschaft fuer Elektromet-alurgie	Munich	Refined manganese and silicon.
Phoenix-Rheinrohr A. G	Dusseldorf	Standard manganese.

Nonferrous Metals.—Practically all nonferrous metals are mined, but mine output does not meet domestic requirements. Domestic smelters met substantial percentages of copper, lead, zinc, and aluminum requirements; they recovered small but important quantities of bismuth, chromium, cobalt, tungsten, vanadium, cadmium, columbium, tantalum, and rare metals, chiefly from imported raw materials. Metals such as antimony, gold, mercury, nickel, magnesium, platinum, tin, titanium, and uranium were imported, principally in refined form.

Metallgesellschaft, with numerous subsidiaries and affiliated companies, produced the greatest variety of nonferrous metals. The Federal Government, through its controlling interest in Vereinigte Aluminium Werke, A. G. (United Aluminum Works, Inc.), was a producer of aluminum. Preussische Bergwerks-und Huetten-Aktiengesellschaft (Prussian Mining and Smelting Works, Inc.—Preussag) remained an important producer of lead and zinc and their semifabricated products, and byproducts. Preussag is a holding company which holds

TABLE 15.—Consumption of nonferrous base metals

(Metric tons unless otherwise stated)

Commodity	Consumption			Ratio of production to consumption, 1963 (percent)
	1961	1962	1963 [1]	
Aluminum	404,228	414,082	417,000	88
Antimony	2,775	3,618	4,100	[2]
Bismuth	233	261	250	50
Cadmium	1,102	1,138	1,200	19
Cobalt	1,210	997	1,050	150
Copper	690,388	621,407	615,000	49
Lead	280,472	276,350	284,000	81
Magnesium	28,670	28,705	34,700	[2]
Mercury—76-pound flasks	18,522	22,931	14,794	[2]
Nickel	20,373	17,362	21,800	9
Selenium	129	105	110	[2]
Tellurium	10	9	3	[2]
Tin	21,698	21,308	18,400	12
Titanium	235	311	410	[2]
Zinc	393,002	368,300	365,000	47
Total	1,845,162	1,754,744	1,763,533	

[1] Subject to revision.
[2] Production data not available; therefore ratio not calculable.

Source: Ne-Metalle, February 12, 1964.

interest in Unterharzer Berg- und Huettenwerks (57.1 percent) and Metallwerke Unterweser (100 percent) and owns many others. The Federal Government had a controlling interest in this concern until 1959 and still held a small share in 1963.

In addition to the principal primary nonferrous metallurgical plants listed in table 16, there were two dozen important secondary producers of nonferrous metals. Their products included aluminum, copper, cobalt, lead, zinc, magnesium, and tin.

TABLE 16.—Principal nonferrous metallurgical plants

Company	Type of plant	Annual capacity (tons)	Remarks
Aluminum:			
Vereinigte Aluminium Werke, A. G., Bonn:			
Lippewerk at Luenen	Alumina	130,000	
	Aluminum	39,000	
Erftwek at Grevenbroich.	Aluminum	30,000	Reduces alumina from Lippewerk.
Nabwerk at Schwandorf.	Alumina	110,000	Provides alumina for Innwerk.
Innwerk at Toeging	Aluminum	55,000	This plant has hydroelectric power.
Rheinwerk at Norf	do	44,000	There are 162 cells in 3 buildings and 2 smelting furnaces. Preburnt electrodes can be produced at the rate of 25,000 tons per year.
Alwerke at Bonn	do	3,000	High-purity aluminum.
Copper:			
Norddeutsche Affinerie, Hamburg.	Copper smelter, refinery, and rolling mill.	70,000 blister, 130,000 electrolytic refined, and 6,000 fire-refined copper.	This company, affiliated with Metallgesellschaft, A. G., is the largest copper refinery in the country. Besides copper and lead, the plant produces antimony, bismuth, gold, silver, tin, nickel, and cobalt.
	Lead smelter and refinery.	25,000	
Duisburger Kupferhuette, A. G., Duisburg.	Copper smelter, refinery, and rolling mill.	15,000 blister, 15,000 refined.	Chemical-metallurgical plants treat burned pyrite and recover gold, silver, cadmium, indium, and thallium. Annually 1,000 to 1,500 tons of cobalt also is recovered from burned pyrite.
	Zinc refinery	8,000	Treats zinc oxide clinkers produced during treatment of burned pyrite.
Metallhuettenwerke Luebeck, G.m.b.H.	Copper refinery	13,000	Recovers copper from burned pyrite blister, and scrap.
Bieber and Company, Kupferhuette Ertel.	do	(1)	Recovers copper from burned pyrite.
Lead-zinc:			
Unterharzer Berg-und Huettenwerke, Goslar:			
Plant at Oker	Lead smelter and refinery.	40,000	This plant smelts lead concentrate from Rammelsberg mine and recovers antimony, gold, and silver. Antimonial lead is also produced.
Plant at Harlingerade	Zinc smelter and refinery.	60,000	Smelts zinc concentrate from Rammelsberg ore using the New Jersey Zinc process with vertical retorts. It is the largest cadmium producer in the country and accounts for 60 to 70 percent of the country's mercury production. Germanium, indium, iridium, and thallium are other byproducts.
Harzer Berg- und Huettenwerke, Goslar:			
Plant at Clausthal	Lead smelter	30,000	Smelts concentrates from Bad Grund mine.
Plant at Lautenthal	Lead refinery	30,000	An important silver producer.

See footnote at end of table.

TABLE 16.—Principal nonferrous metallurgical plants—Continued

Company	Type of plant	Annual capacity (tons)	Remarks
Lead-zinc—Continued			
Stolberger Zink Aktiengesellschaft fuer Bergbau und Huettenbetrieb, Aachen:			
Plant at Muensterbusch.	Zinc smelter and rolling mill.	50,000	Slab zinc, mercury recovered as a byproduct.
Plant at Nievenheim.	Zinc smelter and sulfuric acid plant.		
Plant at Binsfeldhammer.	Lead smelter	65,000	Refined and high-purity lead, battery lead, antimonial lead, and silver byproduct.
Blei- und Silberhuette Braubach, G.m.b.H.: Plant at Braubach/Rhein.	Lead smelter	35,000	Owned by Metallgesellschaft, the plant treats ores and secondary materials and produces antimonial lead and byproduct silver. It can refine 2 million ounces of silver annually.
"Berzelius" Metallhuettengesell-schaft, G.m.b.H.: Plant at Duisburg-Wanheim.	Zinc smelter and refinery.	35,000 40,000	Produces standard- and high-grade zinc alloys and cadmium.
Metallwerke Unterweser, A. G.: Plant at Nordenham.	do	25,000	Treats concentrates, pyrite, ashes, and scrap.
Aktiengesellschaft des Altenbergs fuer Bergbau und Zinkhuettenbetrieb, Essen-Bergeborbeck: Plant at Borbeck.	Zinc smelter	30,000	Treats ores, concentrates, and ashes and produces slab zinc and zinc dust.
Precious and rare metals:			
Deutsche Gold- und Silber Scheidenanstalt (Degussa), Frankfurt/Main: Plants at Frankfurt and Hanau.	Blast and cupelling furnaces, silver and gold electrolytic refineries, etc.	----------	The company recovers precious metals from bullion and scrap material. It also produces high-purity indium, thallium, zirconium, thorium, etc.

[1] Data not available.

The Norddeutsche Affinerie produced roughly 60 percent of all refined copper. Vereinigte Aluminium Werke had 45 percent of the country's alumina and 82 percent of the aluminum capacity. The Binsfeldhammer plant of Stolberger Zink A.G., was the largest lead producer and the Harlingerade plant of Unterharzer Berg- und Huettenwerke, G. m.b.H., was the largest zinc producer.

In 1963 the metal content of ores produced in West Germany were equivalent to 18 percent of estimated lead consumption and 26 percent of the zinc consumption of the country. Lead-zinc ores also supplied antimony, cadmium, silver, and other metals.

The position of the nonferrous metal industry (including precious metals) improved during 1963, with the production index reaching 243, compared with 235 in 1962 (1950–100). Increased output and higher prices brought total sales to approximately US$1,490 million, compared with US$1,440 million in 1962. Of the output of semifinished products in 1963, copper and copper alloys accounted for 592,911 tons, aluminum for 255,047 tons, zinc for 69,611 tons, and lead for 43,287 tons. The industry had sharp competition from foreign producers, especially those of other Common Market countries. Because of imports there was a downward trend in production of zinc semimanufactures.

TABLE 17.—Production of ingots, semimanufactures, and castings of major nonferrous metals[1] and their alloys

(Thousand metric tons)

Commodity	1962	1963	Commodity	1962	1963
Nonferrous metals and alloys	1,171	1,217	Castings	271	279
Semimanufactures	960	975			

[1] Aluminum, copper, lead, and zinc.

Total consumption of primary and secondary nonferrous metals and alloys increased 0.5 percent in 1963. Supplies of tin, cadmium, and electrolytic manganese were low, but significant stocks of most nonferrous base metals were available through midyear.

TABLE 18.—Commercial stocks of nonferrous metals

(Thousand metric tons)

Commodity	Stocks			
	Dec. 31, 1960	Dec. 31, 1961	Dec. 31, 1962	June 1963
Aluminum (nonalloyed)	56.0	63.0	50.8	58.7
Refined copper	53.7	60.4	51.9	44.8
Lead	45.5	37.0	45.5	51.7
Zinc	39.8	45.4	41.4	58.1
Tin	2.0	2.1	1.6	1.3

In 1963 the value of imports of all base nonferrous metals, semifinished products, and ores and scrap totaled US$652 million, compared with US$677 million in 1962. Precious metal imports added US$146 million—gold US$72 million, silver US$53 million, and platinum group US$21 million. Of the 1963 imports of nonferrous metal ingots, semimanufactures, and scrap, copper accounted for 45 percent, aluminum for 17 percent, zinc for 6 percent, tin for 5 percent, and lead for 4 percent. Among the Common Market countries, Belgium-Luxembourg was a significant source of zinc, refined copper, aluminum semifinished products, cadmium, and cobalt.

A significant part of the production of nonferrous smelters and refineries is exported, principally as semifinished products; nonferrous metal exports totaled US$322 million in 1963. Copper (including semimanufactures and scrap) accounted for 33 percent of the value. Main recipients in the Common Market were the Netherlands for refined copper and semimanufactures and aluminum and Belgium-Luxembourg for refined lead. France imported slab zinc and refined lead.

Aluminum.—Operation of the "Rheinwerk" aluminum plant of Vereinigte Aluminum Werke at Norf increased aluminum production in 1963. About 367,000 tons of domestically produced aluminum was available, compared with 315,300 tons in 1962. Increased use of aluminum in construction led to a 4-percent increase in output of semimanufactures from 245,829 tons in 1962 to 255,047 tons in 1963—174,000 tons rolling mill products, 58,000 pressings and forgings, and 23,000 conductor material. Compared with 1962 figures, rolling mill

products increased by 7 percent, but pressings and forgings and conductor material both decreased by about 11 percent.

The European Economic Commission grants West Germany quotas for import of aluminum from countries other than the European Economic Community at a preferential import duty rate of 5 percent (compared with 9 percent full rate) and quotas for aluminum scrap at 0.75 percent import duty. For the first 6 months of 1964, the Commission granted Germany a 60,000-ton quota for aluminum and a 7,500-ton quota for aluminum scrap at these preferential rates. Since May 1, 1962, imports of aluminum scrap from the Community have been duty-free.

To meet competition from imports, West German smelters, starting June 1, 1963, granted a rebate of $25 per metric ton of primary aluminum from the $540 per ton price. The rebate is revocable at any time. In 1963 the price of imported primary aluminum, including customs duty and equalization tax on imports, remained at $514.

Per capita consumption of primary and secondary aluminum in 1962 was 7.5 kilograms, compared with 13.4 kilograms in the United States.[5] Transport accounted for 24.7 percent, electrical engineering for 17.5 percent, canning and packaging for 9.6 percent, and building for 6.7 percent of total consumption. The share of the building industry was much less than in the United States but it is expected to increase and contribute to an anticipated rise in the total consumption of the country.

Copper.—All of West Germany's 1963 copper mine production was derived from lead-zinc ore and pyrite. Imported copper concentrate, cupriferous pyrite, and pyrite cinder were smelted almost entirely in the Norddeutsche Affinerie for production of blister copper. Refined copper was produced from this blister and imported copper ingots, from scrap, and by remelting refined copper.

Of the total 1963 refined copper production, 235,207 tons was electrolytically refined and 67,611 tons was fire refined. Copper semimanufactures output was 592,911 tons, 2.8 percent higher than in 1962.

Since the second quarter of 1961, consumption of refined copper has declined steadily. Of the total consumption of 621,400 tons in 1962, about 370,000 tons, or 60 percent, was supplied by copper content of imported ore, net imports of blister, and refined copper, scrap, and matte. Domestic scrap generation accounted for much of the remainder of the total consumption.

Lead and Zinc.—In 1963 there were 8 lead-zinc mines in operation, all of which were directly or indirectly connected with smelters; in 1957 there had been 21 operating mines. Employment in lead-zinc mines was 3,000, or about one-third of that of a decade ago. Nearly one-third of the lead produced by smelting of ore in 1963 was supplied by domestic ores; the figure for zinc was closer to 75 percent, compared with nearly 66 percent in 1962. The increase in mine production of zinc in 1963 was due to operation of a new beneficiation plant at the Sachtleben pyrite mine at Meggen, starting in July. This mine is expected to be an important source of zinc ore.

[5] Aluminium. January 1964.

The slightly increased domestic mine output of lead did not quite balance the lower imports, so that primary lead smelter output was 6 percent lower in 1963. Secondary lead output, however, increased sufficiently to more than balance the lower primary smelter output. Increased imports of lead bullion coupled with the overall increase in smelter output made more lead available to consumers in 1963 than in 1962. Smelter zinc production was the lowest since 1955, resulting also in reduced cadmium production.

Production of semifinished products of both lead and zinc declined—lead from 47,003 tons in 1962 to 43,287 tons in 1963, and zinc from 75,641 tons in 1962 to 69,611 tons in 1963. Imports of Yugoslav zinc sheets are cited as a cause of the decline.

Other Nonferrous Metals.—A small amount of primary tin was produced by the Norddeutsche Affinerie. It is estimated that 30 percent of the annual consumption has been used for tinplating, and the bulk of the remainder in making solder, tin bronze, babbitt metal, pewter, and type metal, all largely for export. Although tin imports in 1963 were lower than in 1962, production of tin alloys and solders increased from 17,216 metric tons in 1962 to 18,535 metric tons in 1963. However, requirements for tin in making electrolytic tinplate have declined because of technological improvements in tinplating.

In 1963, 373 tons of magnesium semifinished products and 31,614 tons of magnesium castings were produced from imported metal.

Uranium was mined by Gewerkschaft Brunhilde at Ellweiler in an opencast mine. The ore in this mine contains about 0.12 percent U_3O_8 and is treated in a nearby mill. Both acid and alkaline processes are used. Another company, with a fluorspar mine near Waelsendorf in Bavaria, was engaged in uranium exploration in 1962; the property may have produced ore in 1963.

Enriched-uranium fuel elements were made by Nuklear-Chemie und Metallergie, G.m.b.H., at Wolfgang near Hanau from imported material. This was the only uranium processing in the country.

NONMETALS

West Germany produced a fair range of nonmetallic minerals and quarry products, but for many items such as asbestos, cryolite, industrial diamonds, magnesite, mica, phosphate rock, and sulfur, it has depended entirely on imports. During 1959–62 there has been a continuous increase in production of the raw materials of the building industry. Construction value attained a new record of $14,600 million in 1963. Fluorspar, slate, and quartzite output dropped during this period; no significant trend is shown in other commodities, except an increase in salt production.

The value of nonmetals produced in 1963 is not yet available, but in 1962 the value of these minerals, exclusive of building raw materials, totaled about $195 million. Potash and salt accounted for 49 percent and 16 percent of the total. Building raw materials (stones, sand and gravel, lime, gypsum, slate, lava, and pumice, the latter used essentially as a building material) were valued at $545 million. Stones, lime, and sand and gravel accounted for 43, 25, and 22 percent of this total. Cement added another US$400 million to the value

of building material. However, some of the cement is produced from slags rather than from quarry products.

In 1963 West Germany was a net exporter of barite, cement, clays, fluorspar, gypsum, potash, pumice, quartz and quartzite, salt, crushed rock, and gravel. Import and export values of nonmetals totaled approximately US$163 million and US$106 million, respectively. Among imports, phosphate rock US$25,428,000; asbestos US$20,169,000; pyrite US$19,386,000; marble and other stone US$13,118,000; crushed rock and gravel US$11,138,000; magnesite US$9,109,000; and sulfur US$7,055,000; were the most important items. Potash, cement, and barite were valued at US$49,318,000, US$11,480,000 and US$2,199,000, respectively.

Cement.—The production of cement has shown a continuous increase in the last decade, with the 1963 output more than twice that of 1954. The ratio of portland cement to total output is not available for 1963 but probably was about the same as the 72 percent in 1962.

In 1962, nearly 28.6 million tons of cement was available to the economy. Price of portland cement packed in bags in lots of 10 tons, f.o.b. Essen, has been US$17.50 per ton since 1960.

In 1963, 93 cement plants were reported in operation. At the end of 1961 West Germany had a production capacity of 30 million tons of cement; plans were to increase capacity to 33 million tons by the end of 1963.

TABLE 19.—Cement production,[1] by types

(Thousand metric tons)

Type of cement	1959	1960	1961	1962
Portland	16,601	18,063	19,500	20,739
Eisenportland (iron portland)[2]	3,187	3,477	3,788	3,936
Blast furnace[3]	2,025	2,466	2,832	2,873
Other cement and cementlike mortar	1,039	899	1,024	1,045
Total	22,852	24,905	27,144	28,593

[1] Data for 1959 exclude Saar and West Berlin; 1960–63 data exclude West Berlin.
[2] Eisenportland contains at least 70 percent by weight of portland cement clinker and not more than 30 percent granulated basic blast furnace slag.
[3] Blast furnace cement may contain 15 to 99 percent portland cement but in practice carries 40 to 50 percent.

During the last 5 years, although production of cement increased by 34 percent, the labor force did not increase proportionately. There were 22,347 workers in the cement industry in December 1963, only slightly more than the 21,970 recorded in 1959.

Although cement plants were located throughout the country, there was a concentration in the Beckum-Lippstadt-Padeborn area of Nordrhein-Westfalen State. In 1956, 41 cement plants with 38 percent of the total capacity were there. Other large producers were in the Osnabruck and Hannover areas; the Elbe estuary; the Neckar, Lahn, and Main Valleys; and Bavaria. The two largest companies were Portland Zementwerke Heidelberg, A.G. (Heidelberg Portland Cement Works, Incorporated), and the Dyckerhoff Portland Zementwerke, A.G. (Dyckerhoff Portland Cement Works, Incorporated).

Clays and Clay Products.—Domestic clay output met requirements for making bricks and fired clay products such as earthenware, stoneware,

vitrified porcelain, and tiles. Production of brick has shown a steady increase from 4,912,000 cubic meters in 1959 to 15,430,000 cubic meters in 1962. West Germany also produced all types of refractory products; output totaled 2,476,000 tons, with a value of about US$130 million, in 1962.

Most of the kaolin and all of the bleaching clays were produced in Bavaria. In 1962, 41 percent of the so-called special clays were produced in Rhineland-Pfalz, 21 percent in Nordrhein-Westfalen, and 19 percent in Bavaria. In 1963, kaolin imports exceeded exports, while refractory and other clay exports were more than twice the imports.

Fertilizer Raw Materials.—The West German fertilizer chemical industry was a highly developed branch of the economy, with plants to produce major types of fertilizers (nitrogenous, phosphatic, and potassic), singly and in combination. The value of the products of the fertilizer industry was US$437.5 million in 1962. Of the necessary raw materials, phosphate rock and most of the sulfur had to be imported.

The small growth in West German potash production in 1961 was followed by a decline in 1962, in both production and exports. According to an industry spokesman, Canadian potash was competing effectively with West German potash, especially in the Far East. In 1963, however, production was almost the same as in 1962, and there was a significant improvement in exports. The States of Niedersachsen and Hesse in 1962 produced 57 and 39 percent of the total output, respectively; the small remainder was accounted for by Baden-Wuerttenberg.

TABLE 20.—Chemical fertilizer production

(Metric tons)

Type of fertilizer	1962	1963
Potash, K_2O equivalent	[1] 1,937	[1] 1,948
Potash salt to 42 percent K_2O	430	383
Potassium chloride over 42 percent K_2O	1,228	1,309
Potassium sulfate	166	150
Other potash salts	72	71
Phosphatic, contained P_2O_5:		
Superphosphate	51,946	53,411
Ground Thomas slag	399,400	431,115
Chemically combined	265,394	284,284
Other	67,285	74,358
Nitrogen, contained N:		
From synthetic ammonia	730,034	756,759
From coke and gas works	105,768	103,633
Calcium cyanamide	83,127	90,090
Chemically combined	254,280	270,258

[1] Totals include a small quantity of raw salt (Hederich-kainite).

Source: 1962 data from Industrielle Produktion 1962, Reihe 3, page 3; 1963 data from Produktion ausgewaehlter industrieller Erzeugnisse, Reihe 2, December 1963, pages 6 and 8.

Domestic shipment of potassium fertilizers in the fiscal year July 1, 1962, to June 30, 1963, totaled 1,099,831 tons, compared with 1,038,808 tons in 1962. This was equivalent to 72.9 kilograms per hectare of arable land, compared with 70.6 kilograms in 1960–61. A subsidy on use of fertilizer, which was set at 9.6 percent during 1962, was eliminated on May 1, 1963.

TABLE 21.—Principal crude potash producers in 1962

Company	Production (metric tons)		Remarks
	Mine-run ore	K_2O equivalent	
Vereinigte Kaliwerke Salzdetfurth, A.G.	6,367,000	665,519	Company operates 4 underground mines and plants at Hattorf in Hesse and Salzdetfurth, Sigmundshall, and Hansa in Niedersachsen.
Wintershall, A.G.	6,812,374	596,851	Production is from 4 mines. The largest is Heringen (mainly carnallite) in Hesse. Others are Neuhof in Hesse and Bergmanssegen-Hugo (largely sylvanite) and Hildesia Mathildenhall in Lower Saxony.
Burbach Kaliwerke	2,596,450	350,041	This company is owned 75 percent by Wintershall. Produces from 3 underground mines: Siegfried-Giessen, Niedersachsen-Rietel, and Konigshall-Hindenburg (largely sylvanite) all in Niedersachsen.
Kali-Chemie, A.G.	1,411,905	146,230	The company is associated with Deutsche Solvay-Werke G.m.b.H, the large salt and chemical producer. Produces ore (mainly sylvanite) from Friedrichshall mine in Niedersachsen.

Sales of potash were handled by Verkaufgemeinschaft Deutscher Kaliwerke (Sales Association of the German Potash Works), a syndicate that was formed in 1955 for a 5-year period with offices in Hannover. The association was licensed in 1961 for an additional 3-year period from December 1962 to December 1965.

Thomas slag, the only phosphorus-bearing fertilizer raw material produced in West Germany, was supplemented by imports of phosphate rock. In 1963, 3,054,000 tons of Thomas slag was produced containing about 469,000 tons of P_2O_5. Of this, 2,591,000 tons was shipped to slag mills presumably for fertilizer use. Trade of Thomas slag during 1963 was almost in balance. Apparent consumption of phosphate fertilizers in 1961–62 and 1962–63 in terms of P_2O_5 content was 633,927 and 718,764 tons, respectively.

Salt.—The bulk of West Germany's salt output in 1962 originated in Nordrhein-Westfalen (48.5 percent), Baden-Wuerttemberg (33.9 percent), and Niedersachsen (17.5 percent). In the same year, one company, Deutsche Solvay-Werke, G.m.b.H., produced 48.48 percent of total output.

Sand.—The value of all sands produced in 1962 totaled US$136 million. Following the trend of construction activity, production of sand used in building and roadmaking increased at an average rate of 12 percent per year during 1954–62. Of the total 1962 building sand output, 11,327,000 tons was used in roadbuilding and the remainder in construction. Quartz and quartz sand and glassmaking and molding sand are also produced. Most of the quartz sand is used in glassmaking.

Stone.—Production data tabulated on stone refer to stone used for making roads, railroads, and waterworks, but exclude dimension stone. The production of 80 million tons of stone valued at $262 million (calculated on the basis of 1962 average values of $3.28 per ton) represents an increase of 10 percent in tonnage. Of 1962 output, 38,215,000 tons was classified as aggregate for highway construction, 14,034,000 tons as chips of better quality stone, 7,560,000 tons as roadbase, and

4,592,000 tons for use in tar and asphalt material. The remainder was higher grade material such as riprap, stone for harbors and waterways, and roadbase.

TABLE 22.—Principal rock salt producers

(Metric tons)

Company	1962 production	Remarks
Deutsche Solvay-Werke, G.m.b.H.	2,210,780	Mines salt (200 meters thick) in Borth and Wallach underground mines at depth of about 850 meters. Mines are in Nordrhein-Westfalen State.
Staatl. Saline Friedrichshall	661,130	A 26-meter salt bed is mined at about 200-meter depth in "Koenig Wilhelm II" mine in Baden-Wuerttemberg State.
Salzwerk Heilbronn	(1)	Mine working a 40-meter salt bed in Baden-Wuerttemberg State.
Gewerkschaft Braunschweig-Lueneburg	243,472	Salt is recovered as a byproduct of potash from Grasleben and Heidewinkel mines in Niedersachsen. This company is a subsidiary of SalzdetfuerthA.G.
Burbach-Kaliwerk A.G.	268,102	A subsidiary of Wintershall A.G., works the Asse underground mine in Niedersachsen State.
Mariaglueck Bergwerksgesellschaft m.b.H.	287,244	A subsidiary of Salzdetfuerth A.G., the company also produces potash in the Mariaglueck mine in Niedersachsen State.

[1] Data not available.

Sulfur.—Domestic production of contained sulfur in 1963 is estimated at about 265,000 tons—177,000 tons of sulfur in pyrite, and about 88,000 tons of elemental sulfur recovered from various chemical processes and petroleum refineries.

The local market for elemental sulfur continued to expand, with imports 33 percent greater than in 1962 and 82 percent greater than in 1961. The increase was due to the trend away from using pyrite in making sulfuric acid and an increase in sulfuric acid production. In 1962, 13 percent of sulfuric acid was made from elemental sulfur, compared with 9 percent in 1961. Pyrite, still the most important raw material, accounted for 61 percent of acid production in 1962, compared with 67 percent in 1961. Smelter gases and other raw materials such as hydrogen sulfide, ferrosulfate, and spent oxide accounted for the remainder.[6]

TABLE 23.—Salient statistics on sulfur, pyrite, and sulfuric acid

(Metric tons, unless otherwise specified)

	1961	1962	1963
Sulfur:			
Production	84,190	90,666	
Net imports	160,252	219,659	292,288
Consumption	228,083	288,621	
Exports	16,358	21,704	11,715
Pyrite:			
Production	532,575	410,121	404,170
Net imports	1,284,047	1,337,005	1,499,695
Consumption	1,816,447	1,747,126	
Exports	600	1	11
Sulfuric acid: Production, sulfur trioxide thousand tons	2,533	2,531	2,706

[6] Sulphur. August 1963.

Despite competition from elemental sulfur, the market for pyrite, both domestic and imported, remained assured. The bulk of the domestic production has been from the Meggen mine of Sachtleben A.G. in Westfalen, a subsidiary of Metallgesellschaft A.G., which is interested in the zinc content of the ore. The Duisburger Kupferhuette A.G., the major firm processing pyrite, was owned by the three largest sulfuric acid producers, thus providing a continuing market for pyrite.

A notable change in 1963 import sources was the large increase in tonnages received from Norway and reduction in imports from Cyprus and Turkey.

Other Nonmetals.—West Germany remained an important consumer of abrasives and industrial diamonds. Stone production statistics list millstones and whetstones; in 1963, 192 and 362 cubic meters of these abrasive stones were produced, respectively. Some of the country's output of quartz and quartz sand was used as abrasives.

The Meggen pyrite-barite mine of Sachtleben in Westfalen, with a production of 173,986 tons of salable barite, was the largest producer in 1963. Vereinigte Werke Dr. Rudolf Alberti and Company was the second largest barite producer with a total of 111,363 tons from three mines in the Bad Lauterberg area (Harz), four mines in Sontra, Hesse, and three mines in the Bayreuth area of Bavaria.

MINERAL FUELS

In 1963 coal and lignite supplied 63.7 percent of West Germany's energy consumption, petroleum and natural gas supplied 33.4 percent, and the remainder was provided chiefly by hydropower and fuelwood. Net fuel imports totaled 53,874,000 tons of standard coal equivalent, or 21.6 percent of total energy consumption.

There has been a significant change in the energy supply pattern of West Germany. Although energy consumption has increased, coal has not shared in the increase and its relative position in the total energy picture has deteriorated. The greatest inroads have been made by heavy and light fuel oils, the consumption of which increased from 2.1 million metric tons in 1955 to 24.4 million tons in 1963. In 1955, energy derived from oil constituted only 8.4 percent of total energy consumption, compared with 32.6 percent in 1963.

TABLE 24.—Domestic energy consumption [1]

(Thousand metric tons of standard coal equivalent)

Year	Coal	Lignite and pech coal	Total coal	Petroleum	Hydropower [2]	Gas [3]	Wood and peat	Other	Total
1959	119,654	30,173	149,827	36,782	5,154	820	2,122	163	194,868
1960	126,313	30,966	157,279	46,510	6,513	932	1,798	209	213,241
1961	121,399	31,136	152,535	55,633	6,535	1,051	1,642	189	217,585
1962	122,869	32,579	155,448	68,457	5,827	1,339	1,745	204	233,020
1963	124,232	34,276	158,508	81,332	5,508	1,859	1,870	223	249,300

[1] Domestic production plus imports minus exports adjusted for stock variation. Imports included imports from East Germany and direct shipments of U.S. coal to U.S. troops stationed in Germany; exports include shipments to West Berlin and East Germany.
[2] Excludes power used by pumping plants.
[3] Unassociated and associated natural gas and drained gas from coal mines.

Source: Zahlen zur Kohlenwirtschaft, volume 63, February 1964.

The pressure for establishing an energy policy has been generated mainly by the coal industry which, particularly since 1958, has encountered severe competition from other energy sources. The Government's overriding policy is that energy should be made available at the lowest cost and the public should have freedom of choice in the fuel it uses. Consistent with this, it is the stated objective of the Government to maintain an annual coal output of 140 million tons. This policy was reiterated during the energy debate of March 29, 1963, in the Bundestag (Lower House of Parliament), although it was made clear that the Government was not guaranteeing this level of production, but looked upon it as a desirable goal. The Government has taken a number of steps to assist the industry, but has avoided quantitative control on petroleum imports except as a last measure. Nonetheless, the Government early in 1963 issued a regulation which subjects to Government approval all import contracts for crude oil and several oil products for periods longer than 9 months, in contrast to the less restrictive previous policy, which required approval only for agreements of 2 years or more duration. This enabled the Government to introduce quota restrictions on shorter notice, without increasing liability for contract cancellations. The coal industry has consistently favored licensing of crude and fuel oil imports and limitations of the refining capacity to the expected expansion of energy consumption.

Several other measures were taken to protect the coal industry. A protective tariff of $5 per ton on coal imports from countries other than the ECSC countries, which was first put into effect on February 16, 1959, was extended to the end of 1964. Annually, however, a duty-free quota is established. On April 11, 1963, the $5-per-ton duty on heavy fuel oil and $2.50-per-ton duty on light fuel oil established on May 1, 1960, were extended for 6 years. The duties will be applied at the original rates until April 30, 1967, and reduced to half these rates between May 1967 and April 1969. On March 1, 1962, railroad freight rates for transport of coal by rail and inland waterways were reduced. There were press reports in October 1963 that the Federal Government was considering a subsidy for new powerplants which would use domestic hard coal as a fuel. However, by yearend no subsidy program was implemented.

Government and industry did not rely on protective measures alone to assist the industry, but continually have attempted to increase the efficiency of the industry. For this purpose a Law for Promotion of Coal Mines Rationalization came into force on September 1, 1963. The aims of the law were twofold: First, to create larger and more efficient units by combining neighboring mines and by increased mechanization and automation; and second, to close mines, which, because of unfavorable seams or poor plant facilities, cannot be operated economically even with the application of the best technical and managerial methods. To carry out this program, the law created for a period of 5 years an Association for Rationalization of Coal Mines (Rationalisierungsverband des Steinkohlenbergbaus). The Association is a public corporation, administratively independent but supervised by the Ministry of Economy. Membership in the Association is compulsory for companies that produced an average of 100,000 tons

or more of marketable coal per year in 1959–61. By provision of the law, the Federal and State Governments guarantee loans for investment in the industry, up to US$375 million. In case of mine closures, a premium of US$6.25 per ton of average annual mine production during 1959–61 is to be paid, one-half by the Federal Government and one-half by the organization from funds obtained by an assessment on the membership. A supplementary premium is to be paid for operators who completely quit coal mining. The total cost of the premiums is expected to be about US$31 million.

Elements of the foregoing energy policy have been regarded as temporary in nature and were intended to meet the immediate problems of the coal industry. Formulation of a long-term policy awaits determination of a unified European Economic Community energy policy. In the immediate future and when the full effect of the mechanization program is felt, the coal industry should be able to maintain the desired level of output. It is felt, however, that future increments in energy consumption will be met primarily from oil.

Bituminous Coal and Anthracite.—*Production.*—Production of coal increased by about 1 million tons (0.7 percent). The increase is attributed largely to an additional 1.6 workdays; the daily rate of production in 1963 was only 453 tons more than 1962. Of the total output, 75 percent was "Flammkohle and Fettkohle," which are medium to high-volatile coking coals; 3.83 percent was "Esskohle," or bituminous to semianthracite, and 9.6 percent was semianthracite to anthracite.

As in previous years, the Ruhr accounted for the bulk of the output, followed by Saar and Aachen. The Ruhr has 93 percent of the total measured and indicated reserves which are estimated at 222.9 billion tons to a depth of 2,000 meters. The balance of the reserve is in the Aachen area with 4 percent, Saar 2.9 percent, and Lower Saxony 0.1 percent.

Coal was produced by relatively few companies with large individual outputs, and the trend was toward still larger operations. In 1962, 36 firms had annual production exceeding 1 million tons; 20 of these produced over 2.5 million tons. In the same year, 75 percent of the total output was obtained from 70 mines, each producing more than 1 million tons. Fifty-seven mines produced 76 percent of the Ruhr's output. Average per-man output increased about 7 percent.

TABLE 25.—Production of coal, coal briquets, and coke in 1963, by areas

(Thousand tons)

	Ruhr	Aachen	Lower Saxony	Saar	Total [1]
Bituminous coal:					
Total	117,156	7,785	2,260	14,915	142,116
Per working day	389.2	25.9	7.5	49.9	472.5
Briquets	4,958	830	565	6,353	[2] 6,614
Coke:					
At mines	31,796	1,921	----------	1,496	35,213
At steel plants	1,268	(3)	(3)	3,089	[4] 6,682

[1] Excluding production by small mines which totaled 670,000 tons.
[2] Including 261,000 tons of briquets produced by independent plants.
[3] Not available.
[4] Including 2,325,000 tons in other areas.

TABLE 26.—Production of coal and coke and employment in 1962, by companies

Company	Coal		Coke		Employment
	Thousand metric tons	Percent of area total	Thousand metric tons	Percent of area total	
Ruhr:					
Auguste Victoria, Gewerkschaft	2,775	2.39	594	1.82	8,688
Concordia Bergbau A.G.	1,536	1.33	402	1.23	4,545
Dortmunder Bergbau A.G.	5,541	4.78	1,384	4.24	16,035
Emscher-Lippe Bergbau-AG.	1,204	1.04	882	2.70	4,185
Essener Steinkohlenbergwerke A.G.	6,584	5.68	2,143	6.56	19,842
Ewald-Kohle A.G.	6,033	5.21	1,064	3.26	18,253
Friedrich Heinrich A.G, Steinkohlenbergwerk	2,407	2.08	746	2.28	7,169
Friedrich Thyssen Bergbau A.G.	1,921	1.66	1,221	3.74	6,451
Kokerei August Thyssen			1,389	4.25	647
Graf Bismarck G.m.b.H., Steinkohlenbergwerk	2,732	2.36	339	1.04	7,338
Graf Moltke Bergbau A.G.	1,081	.93			2,789
Hamborner Bergbau A.G.	2,836	2.45			7,758
Hansa Bergbau A.G.	2,565	2.21	1,308	4.00	7,976
Harpener Bergbau-A.G.	6,149	5.31	2,270	6.95	19,022
Heinrich Robert A.G., Steinkohlenbergwerk	1,383	1.19	549	1.68	4,414
Hibernia A.G., Bergwerksgesellschaft	10,148	8.76	1,967	6.02	30,100
Hoesch A.G. Bergbau	5,950	5.13	1,905	5.83	17,422
Huettenwerk Oberhausen A.G.	4,622	3.99	1,647	5.04	13,302
Huetten- u. Bergwerke Rheinhausen A.G.	5,405	4.66	1,453	4.45	17,004
Ilseder Hutte, Steinkohlenbergwerke Friedrich der Grosse	1,462	1.26	311	.95	3,599
Klockner-Werke A.G. Bergbau	4,653	4.01	1,174	3.60	15,459
Lothringen, Bergbau-A.G.	1,740	1.50	759	2.33	6,465
Maerkische Steinkohlengewerkschaft	2,656	2.29	506	1.55	7,336
Mathias Stinnes, A.G. Steinkohlenbergwerk	3,606	3.11	571	1.75	13,562
Monopol Bergwerks G.m.b.H.	1,659	1.43	690	2.11	4,958
Niederrheinische Bergwerks A.G.	2,413	2.08			5,330
Rheinelbe Bergbau A.G.	6,780	5.85	2,275	6.97	20,789
Rheinpreussen A.G.	4,606	3.97	1,376	4.22	15,538
Rheinstahl A.G. Bergbau	4,636	4.00	1,578	4.83	14,008
Gebruder Stumm G.m.b.H.	1,647	1.42	508	1.55	5,420
Walsum m.b.H., Bergwerksgesellschaft	2,631	2.27			6,519
Westfalen A.G., Steinkohlenbergwerk	1,846	1.59	380	1.17	3,916
Others	4,690	4.06	1,267	3.88	16,934
Saar: Saarbergwerke A.G.	14,919	100.00	1,468	100.00	45,498
Aachen:					
Carl-Alexander, Gewerkschaft	1,012	12.58	123	6.38	3,199
Eschweiler Bergwerks-Verein	5,303	65.88	1,804	93.62	17,898
Sophia-Jacoba, Gewerkschaft	1,409	17.51			5,282
Lower Saxony: Preussag, Ibbenburen	2,236	98.56			7,119

Source: Jahrbuch des deutschen Bergbaus, 1963.

TABLE 27.—Production of coal, by size and number of mines

(Production in metric tons)

Year	Less than 100,000		100,000 to 499,999		500,000 to 999,999		1,000,000 and more		Total	
	Number	Production	Number	Production	Number	Production	Number	Production	Number	Production
1959	15	678,979	22	7,501,179	56	42,835,785	64	90,670,816	157	141,686,759
1960	14	645,649	21	7,729,622	50	38,578,811	64	95,333,011	149	142,287,093
1961	13	665,698	18	6,213,395	46	35,886,884	66	99,974,564	143	142,740,541
1962	8	336,770	19	6,290,549	38	28,044,546	70	106,463,693	135	141,135,558

TABLE 28.—Average output per man-day at bituminous coal mines

(Kilograms)

	1959	1960	1961	1962	1963
Ruhr:					
Underground	1,887	2,102	2,246	2,417	2,575
Underground and surface	1,677	1,859	1,982	2,128	2,273
Overall	1,464	1,639	1,749	1,878	2,011
Aachen:					
Underground	1,516	1,702	1,836	1,929	1,998
Underground and surface	1,340	1,501	1,612	1,698	1,775
Overall	1,187	1,332	1,452	1,522	1,596
Lower Saxony:					
Underground	1,368	1,739	1,969	2,082	2,059
Underground and surface	1,181	1,500	1,727	1,834	1,827
Overall	1,060	1,340	1,520	1,602	1,598
Saar:					
Underground	1,806	2,013	2,197	2,369	2,531
Underground and surface	(1)	(1)	1,899	2,029	2,162
Overall	(1)	1,586	1,807	1,925	2,050
West Germany including Saar:					
Underground	1,841	2,057	2,207	2,372	2,521
Underground and surface	(1)	(1)	1,942	2,082	2,218
Overall	(1)	1,605	1,731	1,853	1,978

[1] Data not available.

Source: Zahlen zur Kohlenwirtschaft. Vol. 63, February 1964.

TABLE 29.—Number of coal-hoisting shafts and production, by depths, in 1962[1]

Depth intervals (meters)	Shafts		Production	
	Number	Percent of total	Thousand metric tons	Percent of total
Up to 500	25	12.5	14,954	10.6
500 to 700	60	30.0	43,896	31.1
700 to 900	75	37.5	58,041	41.1
Over 900	40	20.0	24,245	17.2
Total	200	100.0	141,136	100.0

[1] Excluding Saar.

Because of industry's own efforts in rationalization, the number of operating mines has declined. Since 1958, 30 mines with a productive capacity of 13.5 million tons have been closed; 12 of these closed between April 1962 and mid-1963. West German coal mines are relatively deep.

Availability, Disposal, and Trade.—It is difficult to assess precisely domestic coal consumption. In 1962, coal sales in West Germany, mine consumption, including miners' household and mine power plant, and coal delivered to coking plants totaled 131,788,000 tons. But all of the coke produced (43,198,000 tons, excluding that produced in gasworks) was not consumed domestically. Deducting coke exports, converted to coal, about 118 million tons of bituminous coal and anthracite was consumed in the domestic economy. Of the total output of coal in 1963, 99,345,000 tons, or 70 percent, was shipped for conversion to coal briquets, coke, and electricity.

The stocks of coal and coke at the end of December 1963 stood at 3,785,000 tons (2,381,000 tons of coal and 1,404,000 tons of coke), compared with 9,923,000 tons in 1962 and 11,988,000 tons in 1961. The 8-million-ton reduction in stock during 1962 and 1963 resulted chiefly from sales during the abnormally cold winter of 1962–63.

TABLE 30.—Coal and coke availability, consumption, and sale

(Thousand metric tons)

	1959	1960	1961	1962
Coal:				
Availability:				
Production	141,687	142,287	142,740	141,136
From stocks		4,429		2,349
Imports[1]	7,104	6,829	6,788	7,650
Other adjustments	626	648	840	1,012
Total	149,417	154,193	150,368	152,174
Disposal:				
Delivery to coke ovens	57,147	59,730	59,803	57,889
Consumption by mines	10,498	10,080	9,515	9,291
Consumption by miners	2,625	2,602	2,452	2,450
Mine power in excess of consumption by mines	3,897	4,238	4,596	5,359
To stocks	2,141		752	
Available for sales	73,109	77,543	73,250	77,185
Exports[1]	16,367	17,715	16,856	17,678
To West Berlin	2,525	2,376	2,303	2,360
To East Germany (interzonal)	1,039	248	154	348
Domestic sales:				
Railroads	7,608	7,510	7,031	6,848
Other transportation	652	465	291	197
Powerplants	10,626	13,090	12,889	14,420
Gas and water works	6,489	6,956	6,579	6,865
Iron and steel	2,215	2,035	1,770	1,741
Other industries	16,739	17,435	16,075	16,005
Household and small consumers	8,426	9,153	8,850	10,300
Military	423	560	452	423
Total	53,178	57,204	53,937	56,799
Coke:				
Availability:				
Production	42,967	44,754	44,534	43,198
From stocks		1,701	503	
Imports	337	426	279	315
Total	43,304	46,881	45,316	43,513
Disposal:				
Mine consumption[2]	2,072	1,961	1,774	2,100
To stocks	1,621			119
Available for Sales	39,611	44,920	43,542	41,294
Exports	8,951	10,657	10,692	10,187
To West Berlin	268	291	220	232
To East Germany (interzonal)	333	207	81	120
Domestic sales:				
Iron and steel industry	19,534	22,458	21,912	19,833
Other industries	4,221	4,419	4,235	3,938
Household and small consumers	5,146	5,468	5,191	6,213
Military	954	1,236	1,032	569
Transportation, powerplants, and gasworkers	204	184	179	202
Total domestic sales	30,059	33,765	32,549	30,755

[1] Trade figures for coal and coke differ slightly from those given in metal and mineral trade tables, presumably owing to revisions.
[2] Includes small quantities used by the coke plants and others.

Source: Jahrbuch des deutschen Bergbaus, 1962 and 1963.

Although West Germany has ranked as an important coal exporter in Europe, it also has regularly imported coal. The Common Market countries received 86 percent of the coal export; France is the largest recipient. Coke exports to the Common Market, principally France and Belgium-Luxembourg, comprised 73 percent of the total. Of the coal imports, 61 percent were from the United States and 24 percent were from the Common Market. Imported coal may be marketed only in the north coastal areas of the country. Coal shipments between

East and West Germany and shipments to West Berlin are also significant.

Although there is a $4-per-ton duty on coal imports, the Government establishes annually a duty-free quota. For 1963 and 1964 this quota was 12,023,000 tons, with 10,040,000 tons as the U.S. share.

Marketing and Price.—In March 1963, the High Authority of the European Coal and Steel Community (ECSC) approved an arrangement under which two independent sales agencies of almost equal magnitude were established to market Ruhr coal. A previous proposal of the Ruhr coal producers to establish a single sales agency had been rejected both by the High Authority and by the Court of Justice of the ECSC during 1962.

TABLE 31.—Coal movement between Federal Republic of Germany, West Berlin, and East Germany

(Thousand metric tons)

	1959	1960	1961	1962	1963
Shipped from West Germany—					
To West Berlin:					
Coal briquets	2,398	2,358	2,279	2,344	2,541
Coke	269	291	220	232	385
Total	2,667	2,649	2,499	2,576	2,926
To East Germany:					
Coal	1,039	248	154	348	726
Coke	333	207	81	121	129
Total	1,372	455	235	469	855
Total to West Berlin and East Germany	4,039	3,104	2,734	3,045	3,781
Shipped from East Germany—					
To West Germany:					
Lignite briquets	3,261	3,351	3,238	3,494	3,534
Soft coke and other	294	318	318	307	307
Total	3,555	3,669	3,556	3,801	3,841
To West Berlin:					
Lignite briquets	795	978	856	843	1,122
Dry coal	83	92	82	85	91
Total	878	1,070	938	928	1,213
Total to West Berlin and West Germany	4,433	4,739	4,494	4,729	5,054

The two sale agencies established were the Ruhr Coal Sale Agency Praesident and the Ruhr Coal Sale Agency Geitling. The High Authority reportedly will insure that these organizations meet the requirements of minimum competition required by the Treaty. A decision of December 11, 1963, permitted coal users with annual consumption exceeding 30,000 tons to buy their coal either directly from one of the two sales agencies or from wholesalers. Sales to iron and steel plants and their coke ovens and to the State railways were reserved to the two sale agencies.

The prices of various sizes of coal and coke at mine at the end of 1963, in U.S. dollars per ton, follow: Fettkohle (bituminous coking coal) $16.62 to $17.87; Esskohle (bituminous to semianthracite) $14.87 to $17.75; anthracite $26.25 to $26.62; and coke $25.25. Coal prices were increased 2 to 3 percent for most coal grades after new wage contracts were concluded in 1962.

The average c.i.f. values per ton of bituminous coal and anthracite (including briquets) imported in 1963 in U.S. dollars per ton follow: Belgium-Luxembourg $16.12; France $15.50; Netherlands $14.50; Poland $14.75; United Kingdom $10.68; United States $14.82; and the U.S.S.R. $10.05.

Labor.—In 1963, average employment in the bituminous coal and anthracite industry totaled 421,337, consisting of 316,916 underground and surface workers, 27,714 workers in coal washeries, 26,335 workers engaged in capital investment and general services, and 50,372 staff members. Labor employed in the industry continued to decrease, but the rate of decrease fell. For surface and underground workers, employment in 1963 was 6 percent less than in 1962, compared with a decrease of 8 percent in 1962 with respect to 1961.

TABLE 32.—Total employment in the coal industry

Type of coal and area	1961	1962	1963
Bituminous and anthracite:			
Ruhr:			
Underground	230,822	213,232	200,685
Surface	64,810	61,343	57,186
Total [1]	387,637	363,593	343,977
Saar:			
Underground	31,750	28,352	26,105
Surface	6,761	6,433	6,104
Total [1]	51,046	47,152	43,931
Aachen:			
Underground	19,609	18,036	16,497
Surface	5,078	4,766	4,183
Total [1]	30,292	28,335	26,120
Niedersachsen:			
Underground	5,019	4,798	4,778
Surface	1,453	1,440	1,378
Total [1]	7,629	7,366	7,309
All areas underground and surface	365,302	338,400	316,916
Total [1]	476,604	446,446	421,337
Lignite:			
Rhineland:			
Open pit	10,577	10,376	10,299
Surface workers	9,743	9,618	9,654
Total [2]	20,387	20,045	20,006
West Germany:			
Underground	2,242	1,883	1,518
Underground and surface	31,135	30,549	30,126
Total [1]	35,620	35,140	34,767
Pech:			
Underground	4,292	3,905	3,774
Underground and surface	6,230	5,740	5,542
Total [1]	6,840	6,337	6,136

[1] Total includes coal washery, general services, and mine staff.
[2] Includes about 50 underground workers and staff ranging from 3,152 in 1960 to 3,259 in 1963.

Source: Zahlen zur Kohlenwirtschaft, volume 63, February 1964.

A new wage contract was agreed upon in September 1963 by the Employers Association of the Ruhr Coal Industry and the Mine and Energy Workers Union which provided increases for 350,000 hourly

and 40,000 salaried employees. The contract provided a Deutsche Mark 0.75 (19-cent) increase per shift for all wage groups effective October 1, 1963, and another similar increase effective July 1, 1964. The salaries of white collar workers rose 6 percent, also payable in the same two equal steps. Shift-time for 85,000 surface workers was reduced from 8¼ to 8 hours. The employers estimate that the wage and salary increases, together with the wage group and worktime adjustments, will cost about $87 million annually.

Coke.—Coal-mining companies continued to produce considerably more coke than steel companies. During 1959–63 coal producers' coke output totaled 181,462,000 tons compared with 36,086,000 tons produced by steel companies. The steel industry in 1963 used 17,062,000 tons of coke compared with their production of 6,682,000 tons, indicating a substantial coke sale by the coal industry. Production of coke has declined since 1960; in 1963 total coke output was about 3 million tons less than in 1960. The decline presumably was due to declining coke consumption per unit of steel produced and declining consumption for household space heating. Disposal of coke produced by the coal companies and imported coke (304,402 tons) totaled 36,730,382 tons. Important recipients of this coke were the iron and steel industry (11,915,532 tons), household and small consumers (7,701,969 tons), other industries (3,684,940 tons), and exports and shipments to West Berlin and East Germany (12,526,857 tons).

At the beginning of 1963 there were 58 coking plants with a total of 580 batteries and 9,008 cells, excluding coke oven plants operated by steel companies.

Lignite (Braunkohle).—In 1963, 85 percent of the lignite was produced in the Rhineland where 95 percent of the reserves are located. In Rhineland one firm alone produced about 96 percent of the area's output in large open pit operations using bucket-wheel excavation. The bulk of the brown coal is used for power generation and briquetting.

TABLE 33.—Production of lignite, lignite briquets, and pech in 1963, by areas

(Thousand metric tons)

Commodity	Rhineland	Lower Saxony (Helmstedt)	Hessen	Bavaria	Total
Lignite:					
Total	90,140	6,790	4,076	5,652	106,657
Per working day	299.5	22.4	13.5	18.8	354.2
Pech				1,841	1,841
Lignite briquets:					
Total	14,163	1,504		167	15,834
Per working day	47.0	5.0		0.6	52.6

Source: Zahlen zur Kohlenwirtschaft, volume 63, February 1964.

All the so-called pech coal was produced in Penzberg, Bavaria. Approximately 40,000 to 50,000 tons of this formerly was used in U.S. Army installations in Bavaria, but in 1963 these requirements were supplied from U.S. sources.

TABLE 34.—Production of lignite and lignite briquets[1] in 1962, by companies

Company	Lignite		Lignite briquets		Total employment
	Metric tons	Percent of total	Metric tons	Percent of total	
Rheinland:					
Rheinische Braunkohlenwerke A.G	81,906,464	95.94	12,526,729	88.54	19,748
Wilhelm Werhahn, Abt. Horremer Brikettfabrik	1,304,630	1.53	732,242	5.18	850
Victor Rolff KG, Braunkohlenbergwerk und Brikettfabrik	1,413,853	1.66	889,019	6.28	1,043
Others	743,761	.87			290
Total	85,368,708	100.00	14,147,990	100.00	21,931
Lower Saxony:					
Braunschweigische Kohlenbergwerk	6,400,031	93.27	1,348,500	90.56	5,538
Others	461,924	6.73	140,485	9.44	304
Total	6,861,955	100.00	1,488,985	100.00	5,842
Hessen:					
Preussische Elektrizitaets-A.G	1,843,261	49.03			2,013
Braunkohlen-u. Brikett-Industrie A.G	848,702	22.57	6,169	100.00	608
Others	1,067,947	28.40			1,157
Total	3,759,910	100.00	6,169	100.00	3,778
Bavaria:					
Bayerische Braunkohlen Industrie A.G	4,880,719	92.79	156,675	100.00	1,555
Others	379,217	7.21			167
Total	5,259,936	100.00	156,675	100.00	1,722

[1] Jahrbuch des deutschen Bergbaus, 1963.

Brown coal does not loom so large in trade, but brown coal briquet imports from East Germany are significant in meeting household and industrial needs of West Germany and West Berlin.

Coal Byproducts and Coke Oven Gas.—In line with the declining output of coke, production of coke oven gas and other byproducts of coke ovens continued to decline modestly from the peak level of 1960.

TABLE 35.—Lignite availability, consumption, and sale
(Thousand metric tons)

	1959	1960	1961	1962
Availability:				
Production[1]	93,665	96,138	97,194	101,265
Disposition:				
To briquet plants	31,676	31,438	31,847	32,553
To semicoke and other plants	3,934	3,724	3,796	3,675
Total	35,610	35,162	35,643	36,228
Consumption by mine[2]	11,152	10,945	10,383	10,318
Consumption for energy sold	1,386	1,419	1,403	1,517
To stocks		33	35	
Sales	45,517	48,579	49,730	53,202
Exports	14	201	233	219
Domestic sales	45,503	48,378	49,497	52,983
Power plants	39,837	42,347	44,038	47,736
Industry	5,512	5,894	5,304	5,096
Other	154	137	155	151

[1] Includes 13,000 tons of imports and intake from stock in 1959 and 14,000 tons intake from stock in 1962.
[2] Includes 11,000 tons consumption by miners in 1959 and 12,000 tons per year in 1960–62.

Source: Jahrbuch des deutschen Bergbaus, 1962 and 1963.

TABLE 36.—Production of coal byproducts[1] and coke oven gas[2] use
(Thousand metric tons, unless otherwise specified)

	1959	1960	1961	1962	1963
Crude tar	1,728	1,811	1,794	1,748	1,703
Crude benzol	523	556	548	532	512
Ammonia (nitrogen content)	104	108	107	102	100
Gas:					
Total production—thousand cubic meters	21,391	22,608	22,434	22,108	21,809
Receipts of blast furnace gas—do	1,740	2,097	1,794	1,414	1,314
Total available—do	23,131	24,705	24,228	23,522	23,123
Gas use:					
Combustion	8,585	9,063	9,032	8,743	8,367
Plants own consumption	1,301	1,345	1,252	1,079	968
Sales	13,047	13,967	13,704	13,496	13,528
Loss	1.98	330	240	204	260

[1] From coke ovens of collieries and steel plants.
[2] Allgas quantities converted to equivalent of 4,300 calories at 0° C, 760 millimeters of mercury pressure, and dry.

Source: Zahlen zur Kohlenwirtschaft, V. 63, February, 1964.

Petroleum.—In 1963 the Federal Republic of Germany was the largest producer of crude oil in Western Europe. Its 1963 output of 7,382,700 tons (53,325,000 barrels) was 0.6 percent of the world total and 15.5 percent of West German refinery throughput. Petroleum reserves at the start of 1963 were 81,778,000 tons (590,682,000 barrels) proved and 106,225,000 tons (767,263,000 barrels) probable. Natural gas reserves were 1,278 billion cubic feet proved and 424 billion probable. Important discoveries, notably in the Barrien field near Bremen, may have increased the gas reserves.

Production of crude and consumption of petroleum products and refinery throughput set new records in 1963. Net imports grossed almost US$1 billion. Three new refineries came into operation, adding 6,300,000 tons (45,505,000 barrels) annually to the country's refining capacity. The new Caltex refinery is at Raunhein; the other two plants and the four refineries under construction are in the south, shifting the refining center from the north to the south.

Petroleum's share of the West German energy market increased at the expense of coal to 32.6 percent, compared with 29.4 percent in 1962. Competition within the industry remained sharp and owing to the new refineries, prices of petroleum products in Bavaria declined.

TABLE 37.—Producing oilfields

Field	Producing horizons	Estimated total reserves Jan. 1, 1963 (thousand tons)	Structure
North German basin:			
Emsland—west of Ems River	Upper Jurassic to Lower Cretaceous.	39,820	Anticlines.
Weser-Ems—between Weser and Ems Rivers.	Middle Jurassic to Lower Cretaceous.	27,853	Salt domes and stratigraphic traps.
Hannover—between Elbe and Weser Rivers.	Upper Triassic to Upper Cretaceous.	25,526	Fault traps and salt domes.
Schleswig-Holstein—north of Elbe River.	Middle Jurassic and Lower and Upper Cretaceous.	14,765	Salt domes.
Upper Rhine Valley	Eocene to Pliocene	3,471	Fault trap.
Bavaria (Alpine Foreland)	do	1,803	Stratigraphic traps.

A law abolishing import duties on crude effective January 1, 1964, was passed; it also provided for a corresponding increase in the level of internal taxation on petroleum products. Federal excise tax on petroleum products yielded $1,034 million in 1963 compared with $945 million in 1962 and $831 million in 1961. Revenues of the Federal Government for all oil duties and taxes in 1962 have been estimated at $1.25 billion.

Production, Consumption, and Trade.—Contribution of the North German basin to the total 1963 output was 93 percent; the remainder was almost equally divided between the Upper Rhine Valley and the Alpine Foreland fields of Bavaria. The area between the Elbe and Weser, with 32 percent of total production, ranked first among the producing areas.

TABLE 38.—Petroleum production by areas, 1959–63

(Metric tons, unless otherwise specified)

Area	1959	1960	1961	1962	1963
North German basin:					
North of Elbe (Schleswig-Holstein)	449,781	490,297	592,537	743,909	800,024
Between Elbe and Weser (Hannover)	1,865,437	1,999,651	2,125,131	2,209,409	2,378,738
Between Weser and Ems	1,142,960	1,330,990	1,582,087	1,624,141	1,709,720
West of Ems (Emsland)	1,352,697	1,356,243	1,540,997	1,772,276	1,982,505
Upper Rhine Valley	178,140	212,984	217,263	235,408	250,246
Alpine Foreland (Bavaria)	113,743	139,727	146,448	191,210	261,467
Total	5,102,758	5,529,892	6,204,463	6,776,353	7,382,700
Rate of increase, percent	15	8	12	9	9

Of the 115 fields which produced in 1963, 60 had a production exceeding 10,000 tons (approximately 70,000 barrels). Of the 60 fields, 43 were in the North German basin. Ruhle in Emsland was the largest field, followed by Hankensbuettel in the Hannover area and Georgdorf. These three fields produced 11, 8, and 7 percent of the country's output respectively. Nearly 77 percent of the domestic crude production comes from German-controlled companies. Production by companies in 1962 follows: Gewerkschaft Elwerath 1,505,000 tons; Deutsche Erdoel A. G. 1,345,000 tons; Wintershall A. G. 1,091,000 tons; Preussag 710,000 tons; Deutsche Schachtbau- und Tiefbohr G.m.b.H. 393,000 tons; C. Deilmann Bergbau G.m.b.H. 247,000 tons; and others 63,000 tons. Mobil Oil A. G. in Deutschland through Celle, its local subsidiary, was West Germany's largest foreign-owned crude producer, followed by Brigitta, a joint subsidiary of Shell and Esso. These companies in 1962 produced 1,013,000 and 410,000 tons, respectively.

While refinery throughput has shown a continuous increase during the last decade, rate of increase was only 19.2 percent in 1963 and 12.9 percent in 1962, compared with 32 percent in 1960 and 43.5 percent in 1959. There has been a significant change in the relative shares of the various refinery products in total output.

In 1962 West Germany was the third largest free world consumer of petroleum products, after the United States and United Kingdom, and it may have had the same rank in 1963. Motor vehicle registration in 1963 increased to 10,830,419, 4.9 percent more than in 1962. Despite increased road transportation a shift has taken place starting in 1955, in the relative position of heating oil (light and heavy fuel oil) and

automotive fuels in total consumption; heating oil is gaining in share of total consumption. During 1959–63 the rate of annual increase for heating oil was 15 to 35 percent, compared with 12 to 17 percent for motor gasoline and 9 to 11 percent for diesel oil. Diesel oil, besides being diesel automotive fuel, is also increasingly used for commercial heating.

West Berlin did not produce any crude or refined products, and consumption requirements were met entirely from West Germany refineries.

TABLE 39.—Relative shares of production and consumption [1] of refinery products, 1955 and 1959–63

(Percent)

	1955	1959	1960	1961	1962	1963
Production:						
Automotive fuels	57	43	37	36	36	37
Heating oil	19	40	48	50	49	50
Other products	24	17	15	14	15	13
Consumption:						
Automotive fuels	59	41	38	35	32	29
Heating oil	22	46	50	54	57	58
Other products	19	13	12	11	12	13

[1] Excluding refinery consumption.

With increasing refinery capacity, crude imports have increased every year since 1948, except for a small decline in 1952; 1963 import was 2.4 times that of 1959. Although the absolute quantity imported from the Near East has increased, there has been a decline in percentage of imports from this area. Of the 1963 imports of 40,438,500 tons, the Near East supplied 23,526,200 tons, or 58 percent, compared with

TABLE 40.—Consumption of petroleum products

(Metric tons)

Commodity	1959	1960	1961	1962	1963
Domestic:					
Gasolines—all kinds	4,929,354	5,751,865	6,597,649	7,566,456	9,272,770
Kerosine including turbofuel	101,664	178,867	258,321	325,358	363,070
Diesel oil	4,302,400	4,666,000	5,353,500	5,922,500	6,480,700
Fuel oil	10,058,700	13,880,400	18,223,000	24,368,100	30,218,900
Liquefied petroleum gas	487,364	553,906	690,462	809,679	1,031,125
Lube oil and greases	612,072	650,444	674,033	700,864	699,457
Petroleum coke	85,521	138,909	169,897	197,910	229,067
Bitumen	1,211,944	1,355,328	1,679,172	2,054,581	2,756,614
Other products	302,987	397,113	303,806	503,346	665,111
Total	22,092,006	27,572,832	33,949,840	42,448,794	51,716,814
Consumed by refineries:					
Fuel oil	812,737	987,896	1,172,814	1,343,272	1,757,267
Refinery gas, petroleum coke and residues	638,585	799,477	952,911	1,105,927	1,338,238
Total	1,451,322	1,787,373	2,125,725	2,449,199	3,095,505
Total bunker deliveries:					
Gas and diesel oil	637,425	639,193	598,320	608,956	552,423
Fuel oil	1,180,121	1,675,653	1,894,696	2,161,234	2,120,498
Lubricants	29,000	32,500	34,400	33,500	32,819
Total	1,846,546	2,347,346	2,527,416	2,803,690	2,705,740
Grand total	25,389,874	31,707,551	38,602,981	47,701,683	57,518,058

70 to 81 percent during 1959–62. Other sources of crude in 1963 were Algeria, which contributed 6,594,700 tons (16 percent) and Venezuela, 4,278,300 tons (10.6 percent).

Imports of refined products, principally distillate and residual fuel oils, attained their maximum in 1962. Refined products are imported substantially by the refining companies.

In the last several years Switzerland has been an important export destination for German refinery products but the importance of this country is expected to diminish when its first refinery, being built at Aigle, comes into operation. Much of the trade with the Netherlands and United Kingdom is essentially exchange of products within individual companies.

Transportation, Distribution, and Marketing.—According to industry sources, West Germany's tanker fleet at the end of 1963 consisted of 91 units (including tank lighters) totaling 1,285,369 tons deadweight. Esso Tankschiff Reederei G.m.b.H. (Standard Oil of New Jersey), with 14 units totaling 503,987 tons deadweight, controls more than a third of the total tonnage of the West German tanker fleet. Of the North German ports, Wilhelmshaven can berth 60,000-ton-deadweight tankers, Unterweser 50,000-ton tankers, and Hamburg 30,000- to 40,000-ton tankers. It is planned to increase the maximum tonnage that Hamburg can berth to 50,000 tons by deepening the Elbe River.

Rail, highway, and canal haulage facilities have been unable to handle the very large volumes of crude imports, especially to the inland refineries. As a result, a fairly extensive pipeline construction program has been underway. Two pipelines from North Sea ports and a third from Lavera near Marseilles on the Mediterranean have been built to carry crude to inland refineries. Another pipeline from Genoa is to be completed in 1964. Gathering lines, totaling 1,000 kilometers, connect the oilfields to various refineries.

Crude oil from overseas destined for West German refineries was off-loaded at the following ports (percentage of total shown in parentheses): Wilhelmshaven (38 percent), Hamburg-Brunsbuettelkoog (24 percent), Rotterdam (21 percent), Marseilles (11 percent), Bremen (3 percent), and Emden (3 percent). Of the crude oil imported into West Germany, 68.4 percent was delivered from the port to refinery by pipeline. The remainder was either off-loaded directly from ocean carrier to refinery or delivered by inland tankers or tank cars.

TABLE 41.—Transportation of crude oil and products by various means in 1962

(Metric tons)

Transportation means	Crude oil	Automotive fuel oil and heating oil	Other products	Total
Railroads	3,911,600	11,310,800	3,045,400	18,267,800
Tank trucks	79,700	4,679,700	2,196,200	6,955,600
River barges	2,746,600	21,582,800	891,900	25,221,300
Ocean tankers	25,414,200	7,452,500	406,800	33,273,500
Pipelines	21,349,500	----------	----------	21,349,500

Source: Erdoel und Kohle, December 1963, p. 1238.

Deliveries of crude oil to West German refineries by long-distance pipelines increased to 28.2 million metric tons in 1963. Of this total, 15.51 million tons were carried by the North West pipeline (Wilhelmshaven to the Ruhr), 7.87 million tons by the Rotterdam-Rhine pipeline, and 4.8 million tons by the South European pipeline (Marseilles to Karlsruhe).

Refinery products have been distributed almost entirely by inland waterways, railroads, and highways. Although river barges at times transport crude, they have been far more significant in transportation of products. In 1963, there were about 800 of these barges with a total capacity of approximately 500,000 tons. The railroads distribute oil products to consumers who are not directly on the waterways and to large consumers who have their own sidings. As of June 30, 1963, there were 29,421 privately owned railroad tankers for oil distribution.

It is believed that the refinery product pipeline from Esso's Cologne refinery to several industrial areas around Essen and Dusseldorf is the country's only such line. Construction of refineries in various parts of the country and their nearness to consumers obviate the need

TABLE 42.—Major crude pipelines

Pipeline	Diameter (inches)	Length (kilometers)	Annual throughput capacity [1] (million tons)	Tonnage transported in 1962 (million)	Remarks
International:					
Rotterdam-Venlo-Wesel-Wesseling. [2]	24	303	8.5/20	7.0	Completed in 1960; supplies the Gelsenkirchen and Godorf refineries and, through the Wesseling-Kelsterbach line, the Caltex refinery at Raunheim.
South European (Lavera-Karlsruhe).	34	806	13/30	.1	Supplies crude to the DEA/Scholven A.G. and Esso A.G. refineries at Karlsruhe and, through the Rhine-Danube pipeline, the Esso and Deutsche Shell A.G. refineries at Ingolstadt.
Genoa-Ingolstadt [3]	----------	1,000	16/18	----------	Under construction by Ente Nazionale Idrocarburi to supply crude to its Ingolstadt refinery. At Ulm the line will divide into 2 branches, 1 to Ingolstadt and 1 to Heilbronn.
National:					
North West, (Wilhelmshaven-Cologne).	28	384	18/22	14.2	Completed in 1958. The capacity was increased from 15 to 18 million tons annually. Supplies refineries at Lingen, Dinslaken, Oberhausen, Duisburg, Cologne, Scholven, and Wesseling.
Rhine-Danube (Karlsruhe-Neustadt).	26	280	8/15	----------	Completed in November 1963, this is an extension of the South European pipeline which will supply crude to the Monheim refinery and the Esso and Shell refineries in Ingolstadt.
Karlsruhe-Mannheim	----------	66	2/5	----------	Extension of the South European pipeline.
Wesseling-Kelsterbach (near Frankfurt).	----------	150	2	----------	Extension of the line from Rotterdam to serve the Caltex refinery near Hoechst.

[1] 2d figure denotes alternate capacity.
[2] From Venlo on the West German-Netherlands frontier, the line divides. One line (45 kilometers long) goes to Wesel to join the 45-kilometer 16-inch Wessel-Gelsenkirchen pipeline, and another (103 kilometers long) goes to Wesseling.
[3] Extension of this line from Ingolstadt to Heilbronn is planned.

for distribution of products by pipeline, and in case of emergency products have been carried by crude pipelines.

Practically all West Berlin requirements were provided by barges. Several firms continued building new and expanding existing storage facilities in West Berlin. Completion of these will bring the total refinery products storage capacity to 500,000 cubic meters.

It is estimated that 80 percent of the gasoline and 20 percent of diesel oil sold were handled by service stations and that the remainder for each product was sold directly to the consumers. Nearly 80 percent of the heating oil has been sold through coal retailers and wholesalers. Six companies controlled approximately 70 percent of all gas stations. These companies and their number of stations follow: Aral A.G. 6,200; Deutsche Shell A.G. 5,250; Esso A.G. 5,220; BP Benzin und Petroleum A.G. 4,000; Deutsche Erdoel A.G. 3,500; and Deutsche Gasoline Nitag A.G. 3,200. At the end of 1963 there were about 38,820 gas stations in West Germany, of which about 3,000 were independent; the remainder had a special business relationship with the refining companies. The largest distributor of motor fuels in West Germany is Aral; Gelsenkirchner Bergwerks A.G. controls this firm through its own 47-percent direct share and by administering Mobil's 11-percent share. Aral has no domestic crude or refinery production and obtains all its supplies from German refining companies.

TABLE 43.—Petroleum refineries in operation at end of 1963

Company and refinery location	Throughput capacity	
	Thousand tons per year	Barrels per day (approximate)
BP Benzin-und Petroleum, A.G.:		
Hamburg	2,300	52,000
Dinslaken	4,400	110,000
Caltex Oil (Germany) G.m.b.H.: Raunheim (near Frankfurt)	2,000	(2)
Deutsche Erdoel A.G. (DEA): Heide	3,000	60,000
DEA-Scholven G.m.b.H: [1] Karlsruhe	2,000	40,000
Deutsche Shell A.G.:		
Hamburg-Harburg	3,000	60,000
Monheim	280	6,000
Godorf	4,000	70,000
Ingoldstadt	2,300	47,000
Erdoelwerk Frisia A.G.: Emden	1,500	28,000
Esso A.G.:		
Hamburg	2,700	50,400
Cologne	3,700	75,500
Karlsruhe	3,600	70,000
Gelsenberg-Benzin A.G.: Gelsenkirchen-Horst [3]	6,000	110,000
Gewerkschaft Deutsche Erdoel Raffinerie:		
Deurag-Neurag, Misburg	2,000	35,000
Emsland, Lingen	3,200	60,000
Mineraloel und Asphaltwerke A.G.: Ostermoor	500	5,000
Mobil Oil A.G.: Bremen	1,500	28,600
Purfina Mineraloelraffinerien: Dusiburg	2,000	40,000
Ruhrchemie A.G.: Oberhausen-Holten	550	10,000
Scholven-Chemie A.G.: Gelsenkirchen-Buer [3]	2,600	50,000
Union Rheinische Braunkohle-Kraftstoff A.G. (Rhine Brown Coal): [3] Wesseling	3,000	65,000
Others	1,300	(2)
Total	57,430	(2)

[1] Joint undertakings of Deutsche Erdoel A.G. (DEA) Hamburg (40 percent), Scholven-Chemie A.G., Gelsenkirchen (40 percent), and Continental Oil Co., New York (20 percent).
[2] Data not available.
[3] These plants have hydrogenation units which treat tars to produce something similar to residual fuel oil. Hydrogenation capacities are Gelsenkirchen-Horst 13,300 barrels per day, Scholven 8,800 barrels per day, and Wesseling 9,500 barrels per day.

Refineries.—Refinery throughput in 1963 was 47,188,072 tons.

Refinery capacity has increased continuously since 1956. At the end of 1963, 30 refineries were in operation with a total throughput capacity of 57.4 million tons; 4 refineries with 10.4 million tons capacity were under construction. Of the operating plants, 13 had individual capacities exceeding 2 million tons per year (76 percent of the total), and 7 had capacities of 1 to 2 million tons per year (21 percent of the total). In addition seven refineries aggregating 16 million tons' annual throughput were planned and refinery throughput was expected to reach 59.6 million tons in 1964.

In 1962, 57 percent of the capacity was in the Rhineland and 43 percent in North Germany. The refining capacity as of January 1, 1964 (including Esso Ingoldstadt), according to geographic regions, follows: Rhein-Ruhr 45 percent; South Germany 21.7 percent; Hamburg 13.9 percent; Niedersachsen 14.9 percent; Schleswig-Holstein 5.6 percent; and Bremen 2.4 percent. Nearly 31 percent of the refinery capacity is U.S.-owned.

TABLE 44.—Refineries under construction and planned

Company and refinery location	Throughput capacity		Due date of completion
	Thousand tons per year	Barrels per day (approximate)	
Under construction:			
Esso A.G.: Ingolstadt	3,400	68,000	Early 1964.
Erdoel Raffinerie Neustadt G.m.b.H.: Neustadt/Danube	2,500	55,000	1964.
Erdoel Raffinerie Ingolstadt A.g.: Ingolstadt	2,000	40,000	1964.
Erdoel Raffinerie Mannheim G.m.b.H.: Mannheim	2,500	50,000	1964.
Planned:			
Amoco-Saarbergbau	2,000	40,000	1966.
Union Generale des Pêtroles: Speyr	2,000	40,000	1965.
BP Benzin-und Petroleum, A.G.: Augsburg	2,000	40,000	1967.
Deutsche Erdoel A.G.: Bavaria	2,000	40,000	1967.
Gelsenberg Benzin A.G. and Mobil Oil A.G.: Woerth (near Karlsruhe)	2,500	50,000	1966.
Scholven-Chemie A.G.: Bavaria	2,000	40,000	1966.
Suedpetrol: Heilbronn	4,000	80,000	1966.

TABLE 45.—Salient features of refineries completed or under construction, 1963

Company and location	Annual refining capacity (million tons)	Breakdown of refining capacity (percent)	Facilities for secondary refining and annual capacity (tons)	Completion date
Esso A.G.: Karlsruhe	3.6	Gasoline 15 to 20; turbofuel, diesel oil, light fuel oil 30 to 40; heavy fuel oil 25 to 45; bitumen 5;[1] refinery gas 5;[1] liquefied petroleum gas 2.5.	Catalytic reforming 700,000; Hydrofining 1,600,000; thermal cracking 850,000.	April 1963.
DEA-Scholven G.m.b.H. (Deutsche Erdoel Aktiengesellschaft (DEA), 40 percent; Scholven-Chemie, 40 percent; Continental Oil, 20 percent); Karlsruhe.	2.0	Gasoline 25; turbofuel, diesel oil, light fuel oil 17.5; heavy fuel oil 28; bitumen 5;[2] refinery gas 3.5;[2] liquefied petroleum gas 3.5.	Catalytic reforming 500,000; Hydrofining 700,0000; Visbreaker 700,000.	1963.
Caltex Oil (Germany) G.m.b.H.: Raunheim (near Frankfurt).	2.0	Not reported	Catalytic reforming 175,000; Isocracker 300,000; steam cracker 70,000.	1963.
Deutsche Shell A.G.: Ingolstadt.	2.3	Gasoline 18; turbofuel, diesel oil 10; light fuel oil 31; heavy fuel oil 27; bitumen 11.	Catalytic reforming 330,000; Hydrofining 530,000; Visbreaker 530,000.	December 1963.
Erdoel-Raffinerie Mannheim G.m.b.H. (Wintershall, 60 percent; Marathon, 40 percent): Mannheim.	2.5	Gasoline 25 to 30; turbofuel, diesel oil, light fuel oil 30 to 35; heavy fuel oil 30 to 35; refinery gas 7 to 9.[3]	Hydrotreater 120,000; catalytic reforming 200,000; Hydrofining 150,000.	1964.
Esso A.G.: Ingolstadt	3.4	Gasoline 15 to 20; turbofuel, diesel oil, light fuel oil 30 to 40; heavy fuel oil 40 to 50; liquified petroleum gas 2.5; refinery gas 5.	Catalytic reforming 550,000; Hydrofining 1,600,000.	Early 1964.
Erdoel-Raffinerie Neustadt G.m.b.H. (Gelsenberg Benzin A.G., 50 percent; Mobil Oil A.G., 50 percent): Neustadt-Danube.	2.5	Gasoline 23; turbofuel, diesel oil, light fuel oil, 32; heavy fuel oil 36; liquified petroleum gas 5 to 6; refinery gas 3.	Catalytic reforming 670,000; Hydrofining 950,000.	1964.
Erdoel-Raffinerie Ingolstadt (Ente Nazionale Idrocarburi, 100 percent): Ingolstadt.	2.0	Gasoline 24; turbofuel, diesel oil 10.5; light fuel oil 26; heavy fuel oil 36; refinery gas 3.5.	Catalytic reforming 400,000.	1964.

[1] 200,000 tons of bitumen and 240 million cubic meters of gas per year.
[2] 100,000 tons of bitumen and 180 million cubic meters of gas per year.
[3] 470 million cubic meters of gas per year.

Natural Gas.—Natural gas produced in Germany consists of unassociated gas and of associated or dissolved gas. In 1963 there were 33 gasfields with individual annual production exceeding 1,000,000 cubic meters—18 in the North German basin, 11 in Bavaria, and 4 in the Upper Rhine Valley. North Germany was the principal producing area, accounting for 80 percent of the 1963 output. Bavarian fields ranked next with 24 percent. Rehden, the largest field, accounted for 23 percent of the country's total output. Prospects for the future yield of the Bierum structure, which is bisected by the German-Netherlands border, led Gewerkschaft Brigitta to announce in September 1963 its plans to build a pipeline to deliver gas from this field to Hamburg.

Municipal gas supply systems are the major users of natural gas, accounting for about 50 percent of consumption, followed by the chemical and iron and steel industries. Petrochemical plants are the principal users of refinery gases.

Much of the gas is transported in public utility lines which distribute it mixed with coke oven gas. At the beginning of 1963 there were probably about 900 kilometers of pipeline exclusively for natural gas. An 80-kilometer line built in 1962 connected the Bentheim gasfield to Dorsten; the latter is the largest coke oven producing center of Germany and is located on the Ruhrgas network. The natural gas, after dilution and processing, is pumped in the network and excess gas is sent directly to Duisburg. A second line completed in 1962 connected Rehden field to Landesbergen. Gasversorgung Sueddeutschland G.m.b.H. (South German Gas Supply Co.) is building, or has completed, a 240-kilometer gas pipeline from Mannheim to Freiberg and a 130-kilometer line from Mannheim to Ulm.

Gasversorgung Sueddeutschland G.m.b.H., Stuttgart; Gas-Union G.m.b.H., Frankfurt; and Ruhrgas, Essen (the latter handling mainly coke oven gas), which are engaged in gas transportation, reportedly agreed to cooperate in exchanging gas supply and to coordinate building of gathering pipeline systems in the country. In mid-1964 Gasversorgung Suddeutschland and Gas-Union will start to take increasing quantities of coke oven gas for the areas they are serving. In case of need this operation was to start in the winter of 1963–64.

Exploration and Development Activities.—Discovery of the Groningen gasfield in the Netherlands and the deeper producing formations in the Rehden gasfield in West Germany stimulated interest in possible new concessions in the North Sea Continental Shelf. In April 1963 the Oberbergamt Clausthal, on behalf of the four coastal States, granted a concession to a consortium consisting of Preussische Bergwerks- und Huetten A.G. (Preussag), Amoco Hanseatic, C. Dielmann Bergbau G.m.b.H., Deutsche Erdoel A.G., Deutsche Schachtbau- und Tiefbohrgesellschaft G.m.b.H., Gewerkschaft Elwerath, Gelsenkirchener Bergwerks A.G., Gewerkschaft Brigitta (a subsidiary of Esso and Shell), and Wintershall A.G. were preparing to explore and exploit within the German portion of the North Sea Continental Shelf outside the 3-mile limit. The consortium was to start drilling the first exploration well and was scheduled to spud a well in April 1964 on a Dielmann concession of 190,000 acres north of the East Frisian Island of Borkum.

The Continental Oil Co. acquired the exploration rights of Niedersachsen G.m.b.H., Hannover, in Lower Saxony (transfer of rights to take place January 2, 1964) and three exploration rights in its own name in the same State.

Development drilling declined in 1963 because of the expected removal of import duties on crude and uncertainty about the protection of the competitive position of domestic crude. Well drilling totaled 434,000 meters in 1963, compared with 504,000 meters in 1962. The 1963 total comprised 125,000 meters of exploration wells, 89,000 meters of extension, 200,000 meters of production, and 20,000 meters of service wells.

Legislation on Petroleum and Natural Gas.—In accordance with the mineral oil protocol of the EEC Treaty the Government abolished, starting on January 1, 1964, customs duties amounting to $20 per ton on crude imports. These duties are replaced by correspondingly higher internal taxes. To help the domestic producers adjust to the new conditions, the law provides a 6-year subsidy on a decreasing scale (from US$12.50 to US$5 per metric ton) for domestic crude and low-interest loans for oil exploration by German firms outside the Common Market countries. The sums assigned for these purposes are US$310 million for subsidy and US$200 million for credit. A ceiling of US$77.5 million was set for 1964; production in excess of 6.2 million tons will not be subsidized. The law also abolished preferential treatment given to the three tar-hydrogenation plants which produce a substance similar to residual fuel oil.

With regard to the exploration and exploitation of oil and gas resources in the area of the North Sea, as of the end of 1963, West Germany had not ratified the Geneva Convention on the Continental Shelf of April 29, 1958. In a proclamation of January 20, 1964, the Government stated that it would submit to the legislative bodies the draft of a law approving the Convention. To eliminate legal uncertainties before Germany ratifies the Convention and it comes into force, the Government considers the Federal Republic to have exclusive sovereign rights in exploring and exploiting the natural resources of the seabed and the subsoil of the submarine areas adjacent to the German coast but outside the area of the German territorial sea, to a depth of 200 meters or, beyond that limit, to where the depth of the superjacent waters admits of the exploitation of the natural resources of the areas.

The Mineral Industry of Greece

By J. M. West[1]

THE MINERALS sector of the Greek economy contributed an estimated 3.5 percent to the approximate US$3.5 billion gross national product in 1963. Some 20,000 persons were employed in the mining industry out of a total population of 8.5 million. Largest employment was in lignite followed by stone, magnesite, and bauxite mining. The mine production index, reported by the National Statistical Service, suffered a small setback in 1963 from the previous year as output of most minerals (with the notable exception of coal) fell off. However, other indices went up in 1963: coal-petroleum 13.2 percent—largely due to coal; nonmetals 13.1 percent—because of cement; and basic metals 13.7 percent—because of new pig iron and steel operations. Greece's share of world production was about 3 percent each for bauxite and barite, 2 percent for magnesite and chromite, and 0.5 percent each for lead and zinc.

Lignite which was important domestically, providing over half of the country's electrical power, came into use during 1963 for manufacturing nitrogenous fertilizers. Greece, with one of Europe's lowest electric consumption rates—318 kilowatt-hours per capita in 1963—was deficient in power and striving to expand its generating facilities. Coal output had more than doubled since 1959. Most mine products, except coal, went to export markets. Cement and steel made significant contributions to national income. The country was dependent on foreign sources for crude oil; its single refinery fell somewhat short of satisfying requirements for refined petroleum products.

Planning continued on the ESSO-T. Pappas (U.S. investment group) US$110-million-plus complex in the Thessaloniki area which will include an oil refinery, ammonia plant, petrochemical works, and steel mill. Construction was due to start on some components in 1964. At Ptolemais, coal mining capacity was being expanded and a US$70-million government-owned nitrogenous fertilizer plant was completed. Other fertilizer plants were under construction, one near Karvali (phosphates). Also in 1963 Halyvourgiki started up the country's first blast furnace near Athens; equipment was being brought in to Larymna mines, Euboea, to produce nickel and steel; aluminum smelter construction started on the Gulf of Corinth; several cement plants were adding capacity; and the Government was looking for investors to develop the Kozani asbestos deposits.

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GOVERNMENT POLICIES AND PROGRAMS

The need to increase investment in industrial enterprises was probably the foremost economic problem facing the Greek Government. Heavy reliance had to be placed on foreign investors because of hesitancy of local entrepreneurs. Greece had favorable laws regarding investment and repatriation of money, and the Government was especially eager to attract U.S. capital. The Greek 5-year plan 1960–64, aimed primarily at industrialization, gave particular attention to mining activity and development of related basic industries. The process was expected to accelerate after the country's entry, as an associate member, into the European Common Market on November 1, 1962. Agreements signed did not provide for trade in coal, coke, iron ore, and steel mill products, since these were controlled by the European Coal and Steel Community (ECSC). Entry into ECSC was under discussion in 1963.

In the area of public investment one of the chief agencies was the Industrial Development Corporation (IDC), essentially government controlled and 45 percent owned by the Greek State. The IDC was active in encouraging exploitation of the country's minerals and promoting industrial development. Among IDC activities in 1962–63 were prospecting for molybdenum, antimony, and manganese deposits; investigations of mining properties under option, including Chalkidiki, Cavala iron, and Rodopi mines; exploration of Kirki zinc mines; studies of calamine ore, bentonite, and perlite potentials; iron ore beneficiation; and a feasibility study for a zinc plant.

PRODUCTION

Cement and lignite coal in nearly equal shares contributed about half of Greece's estimated US$100 million in mineral production value during 1963; steel ran a poor third in importance. Among minerals produced bauxite was foremost followed by lead-zinc ores, sea salt, magnesite, iron ore, and chromite, in about that order. Of the coal, which was mined mostly in the Ptolemais area, about 90 percent was used for electric power generation. Cement production could hardly keep up with demand although output boomed ahead an estimated 20 percent over 1962. Steel was produced from scrap, the main product being concrete reinforcing bars. Chromite output declined because of poor market conditions, with only two mines reported operating. An upward trend in bauxite production was halted, at least temporarily, by export limitation as efforts were made to save developed supplies for soon-to-start domestic aluminum smelting. Output dropped 10 percent from 1962 despite high world demand. Crude petroleum, all imported (Greece having no production), was refined at Aspropyrgos. Throughput was slightly higher than in 1962. Phosphate fertilizers were manufactured from imported phosphate rock by Hellenic Chemical Products and Fertilizers Co. at Drapetsona. Production of barite and bentonite rose in 1963.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Arsenic, white	10	[1] 10	[1] 3		
Bauxite thousand tons	918	884	1,120	1,321	[1] 1,200
Chromite:[2]					
Crude	65,293	45,691	77,854	56,247	4,500
Refractory ores (39.5 percent or higher Cr_2O_3)	7,377	19,428	16,913	4,900	5,200
Concentrates:					
Metallurgical grade (53 percent Cr_2O_3)	12,341	15,454	13,863	14,837	11,444
Submetallurgical grade (44.4 percent Cr_2O_3)	968		362	4,424	
Total, refractory ores and concentrates	20,686	34,882	31,138	24,161	16,644
Gold troy ounces	4,340	4,823			
Iron and steel:					
Iron ore thousand tons	156	297	292	212	120
Steel ingots and castings do	90	[1] 125	[1] 140	[1] 155	[1] 180
Lead:					
Metal in ore	10,000	9,200	11,600	13,200	[1] 13,200
Refined	3,739	3,091	2,964	3,000	[1] 4,000
Manganese concentrates (40-45 percent MnO_2)	35,000	31,216	28,300	13,696	[1] 20,000
Silver thousand troy ounces	150.3	105.5	113.4	138.2	[1] 128.6
Zinc, metal in ore	12,000	14,700	17,547	17,181	[1] 18,200
Nonmetals:					
Barite thousand tons	130	102	75	71	[1] 85
Bentonite do	20	24	25	21	[1] 40
Cement do	1,444	1,637	1,837	[1] 1,855	[1] 2,221
Emery	7,000	7,000	7,200	7,600	[1] 7,500
Gypsum	80,511	85,197	89,686	[1] 90,000	[1] 90,000
Kaolin	2,500	26,000	25,200	34,958	[1] 35,000
Magnesite (crude) thousand tons	112	187	148	218	[1] 250
Marble thousand cubic meters	20	20	25	44	[1] 40
Perlite thousand tons	2	28	17	30	[1] 30
Pumice do	65	80	70	80	[1] 80
Pyrites do	129	164	188	144	[1] 150
Salt do	98	97	119	115	[1] 85
Santorin earth (pozzolan) do	85	180	190	188	[1] 200
Talc	2,066	1,822	1,854	2,415	[1] 2,500
Mineral fuels:					
Coal (lignite) thousand tons	1,609	2,551	2,504	2,695	3,480
Coke (from gas) do	19	23	23	22	[1] 20
Petroleum products:					
Gasoline thousand 42-gallon barrels	991	1,906	1,976	1,953	2,178
Kerosine and jet fuel do	1,190	1,544	1,416	1,423	1,294
Distillate fuel oil do	2,723	3,324	3,783	4,048	4,503
Residual fuel oil do	3,913	5,068	5,219	5,092	4,775
Other do	202	246	227	468	601

[1] Estimate.
[2] Data on chromite refractory ore and concentrates supplied by Hellenic Chrome Mining Co., Inc., Athens.

TRADE

Greece traded largely with the European Economic Community; also, a fair amount with European Communist countries. Crude oil came mainly from Saudi Arabia, phosphate rock from Morocco, and sulfur from the United States. Metal and mineral imports in 1962, the latest year for which data were available, totaled roughly US$120 million, about 6 times the value of mineral exports. Crude oil and petroleum products comprised about 40 percent of the mineral import value, the crude being slightly over half of this. Steel accounted for about 40 percent also. Imported hard coals were used by the railroads and coke by steel industry. Bauxite, the most important mineral export, comprised 28 percent of the mineral and metal shipment value in 1962, with magnesite and its calcined products second at 20 percent.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Bauxite---thousand tons	1,050	901	West Germany 380; U.S.S.R. 308; United Kingdom 63.
Semimanufactures	323	797	Turkey 347; Cyprus 47.
Chromite ore and concentrate	28,394	19,537	Norway 7,900; West Germany 4,360; Sweden 4,013; France 3,200.
Copper:			
Ore and concentrate	81	----	
Matte	110	----	
Iron and steel:			
Iron ore and concentrate---thousand tons	275	248	Austria 147; West Germany 96; Netherlands 5.
Iron pyrites (roasted)---do	42	25	Netherlands 24.
Steel semimanufactures	6,256	2,927	South Vietnam 2,362; Cyprus 133.
Lead ore and concentrate	14,413	12,260	West Germany 8,760; France 3,500.
Manganese ore and concentrate	27,625	7,780	West Germany 3,596; France 1,668; United States 1,536.
Nickel ore and concentrate	104	----	
Zinc ore and concentrate	30,168	31,139	France 15,299; West Germany 9,771; Bulgaria 3,935; Poland 2,134.
Nonmetals:			
Abrasives (emery and pumice)	17,446	76,040	United States 65,739; France 1,854; Italy 1,724.
Barite	60,629	61,805	United States 31,140; Burma 9,652; Oman 8,635.
Cement	68,457	29,017	Libya 24,974.
Clays (kaolin, bentonite, and others).	36,953	48,656	France 20,544; Libya 8,312; United Kingdom 3,383.
Magnesite (crude and calcined)	95,134	104,350	Netherlands 30,005; United States 22,836; Italy 12,925; West Germany 12,843.
Marble	10,433	16,671	West Germany 6,714; Italy 5,487; France 900.
Pyrites (unroasted)	16,910	47,460	Italy 35,020; Austria 8,100.
Talc	37	118	Cyprus 55; United Kingdom 48.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Metal	5,466	5,962	Austria 1,847; Canada 1,305; France 1,096.
Semimanufactures	655	860	West Germany 345; Italy 108.
Antimony metal and semimanufactures.	43	----------	
Arsenic, white	18	----------	
Copper:			
Unrefined metal	2,116	4,969	Unspecified.
Refined metal	1,902	2,382	Republic of the Congo 700; West Germany 624; Belgium-Luxembourg 365.
Scrap	789	882	Italy 361.
Semimanufactures	490	318	Unspecified.
Iron and steel:			
Ingots, slabs, thousand tons blooms, and billets.	81	108	West Germany 69; Belgium-Luxembourg 7; U.S.S.R. 3.
Semimanufactures [1] ------do	250	315	West Germany 85; Belgium-Luxembourg 80; France 30; United Kingdom 15; U.S.S.R. 15.
Scrap ------do	10	5	Unspecified.
Lead:			
Ore and concentrate	1,856	5,090	Morocco 4,580; Algeria 510.
Metal and alloys	615	1,749	Unspecified.
Tin metal and scrap	277	264	Federation of Malaya 148; Netherlands 55.
Zinc:			
Metal and scrap	5,005	5,344	Belgium-Luxembourg 1,976; West Germany 1,406.
Semimanufactures	291	238	Unspecified.
Nonmetals:			
Asbestos	2,064	3,386	Republic of South Africa 1,768; Rhodesia 837; Canada 773.
Cement	2,721	2,481	Denmark 1,067; West Germany 798; France 367.
Phosphate rock ----thousand tons	144	148	Morocco 77; Tunisia 68.
Potash ------do	23	16	Unspecified.
Sulfur	12,710	8,531	United States 5,020; France 1,070.
Mineral fuels:			
Coal and coke ----thousand tons	236	213	Poland 78; West Germany 37; United States 35; U.S.S.R. 32; Italy 12.
Petroleum:			
Crude oil [2] ------do	1,602	1,460	Saudi Arabia 882; U.S.S.R. 388; Iran 190.
Refined products:			
Gasoline ------do	15	27	United Kingdom 5; United States 5; Netherlands Antilles 4.
Distillate fuel oil ------do	148	213	Italy 64; Rumania 58; U.S.S.R. 52; United States 26.
Residual fuel oil ------do	611	853	U.S.S.R. 187; Rumania 139; Italy 81.
Liquefied petroleum gases	6,448	1,058	Yugoslavia 398; Italy 207.
Lubricants-thousand tons	23	24	United States 12.

[1] Estimated.
[2] May include some shale oil.

COMMODITY REVIEW

METALS

Aluminum.—Greece, with a large reserve of bauxite but relatively expensive electrical power for smelting, was on its way to becoming a primary aluminum producer by 1965–66. Foundation work began in April 1963 on a planned US$113 million project at Paralia, near Distomon, northwest of Athens, to produce initially 200,000 tons of alumina and 62,500 tons of aluminum metal annually utilizing 450,000 tons per year of bauxite to be obtained mainly from the nearby Eleusis and Parnassos deposits. The company, Aluminion Ellados (The Aluminum Co. of Greece) was formed by Péchiney, of France, with controlling share; Industrial Development Corp. (I.D.C.), held

partly by the Greek State; Reynolds International, a subsidiary of U.S.-based Reynolds Metals Co.; and by several other investors. A subsidiary, Bauxitai Parnassou, was developing the bauxite deposits. Electric power for smelting was due late in 1965 from the Kremasta hydroelectric station being built by Kaiser Engineering (associated with the U.S. firm, Kaiser Aluminum Co.) on the Acheloos River, in western Greece. The new industry would consume one-fourth of the country's electrical output when fully operating.

A combine of Péchiney and Ugine (France) and Viochalco (Greece) interests was setting up operations to make semifinished aluminum and foil products. Kaiser was also considering aluminum fabrication in Greece using metal from the new smelter. Domestic aluminum consumption was 6,000 to 7,000 tons in 1963. Of the forthcoming output over 50,000 tons of metal and 80,000 tons of alumina was expected to be available for export. West Europe, because of rising metal consumption and Greece's Common Market ties, would be a prime outlet.

Bauxite.—Bauxite production was about 10 percent lower than in 1962. Most of the ore was exported; West Germany and the U.S.S.R. had been the largest purchasers in 1962. Under terms of a 1960 agreement between the Greek Government and the Péchiney group (Aluminum Co. of Greece) to assure the company an adequate ore supply, the Greek Minister of Commerce placed a ceiling of 1 million tons on 1963 exports of bauxite. The ceiling, renewable annually for 30 years in absence of intervening mutual agreements, was imposed after negotiations between the Péchiney group and major Greek bauxite mine operators had deadlocked over proposals to supply the group with bauxite at the formulated price. The Bank of Greece was instructed to issue licenses to individual bauxite exporters for half of their 1962 allotments pending official enactment of new export quotas. Operators pressed for a higher ceiling.

Greek reserves of bauxite have been estimated at 12 million tons proven plus 50–60 million tons of possible ore, mainly located south of Mt. Parnassos but with some on the Island of Euboea and the Chalkidiki Peninsula. The Greek Government was obliged by its contractual agreements to limit bauxite exports until smelter supplies totaling 30 million tons of ore could be established. One company felt it should not be subject to export restriction arguing that its mine came into operation after the contracts were signed.

Chromite.—Crude ore production at the Xerolivado mine, the chief producer, was 46,464 tons compared with 51,406 tons in 1962; 11,444 tons of metallurgical grade concentrate was produced in 1963 and at yearend 18-month stock remained unsold. Although the Domokos mine was closed in October 1961, the mill continued to operate through August 1962 on stockpiled ore, producing 4,424 tons of submetallurgical grade concentrate during the 8 months before shutdown. Refractory ore was produced at the Tsagli mine. Competition with low-priced Russian chromite was a serious problem. In view of this, the Industrial Development Corp. (Greek combine) considered establishing domestic chrome-steel and refractory manufacturing operations.

Copper.—Consumption of copper, based on imports, was estimated at 7,000 tons in 1962 and probably slightly higher in 1963. There was

no domestic production. Copper deposits in the Skouries area, Chalkidiki Peninsula, were being explored jointly by Nippon Mining Co. (Japan) and Central Chalkidiki Mines (Greece), the Greek company holding mineral rights to over 30,000 acres of property. Studies so far indicated the ore to average 1.5 percent copper. The Japanese firm reportedly was planning a US$3 million flotation plant depending on outcome of exploration.

Iron Ore.—Output of iron ore dropped sharply in 1963 from that in 1962. During 1962 ore was exported mainly to Austria and West Germany. At the start of 1963 the Hondrodimos mine on the Island of Thassos was idle with large stocks on hand. A survey of Thassos deposits by the French Bureau de Recherches Géologiques et Miniéres indicated iron ore on the order of 70 million tons. Generally these deposits run about 30 percent iron. Halyvourgiki applied for concession to mine government-owned deposits on Thassos Island and negotiated with French leaseholders of idle mines on Serifos Island for short term ore supply. ESSO-Pappas also was interested in establishing ore sources.

Iron and Steel.—Pig iron was produced in Greece for the first time, when in mid-1963 one of a pair of blast furnaces built by Halyvourgiki, S.A., at Elefsis, near Athens, was blown in.[2] The 500,000-ton British- and West German-equipped plant featured oil injection to blast furnaces and LD steelmaking. Production was limited initially as complaints were voiced that imported steel, especially from the Soviet bloc, was being dumped below fair price on the local market. The Greek Government followed up by imposing an antidumping duty on reinforcing bars (the new plant's chief product) and investigated other charges. However, no fines were collected. The company also requested relief from export duties and taxes.

U.S. investors, ESSO and T. Pappas, with others possibly joining, continued plans and negotiations to establish an integrated steel operation as part of its Thessaloniki steel-petrochemical complex. The project taking shape would call for US$25–$30 million in steelmaking and US$50–$55 million in rolling mill facilities. Capacity was planned for 270,000 ingot tons, initially, expanding to 1 million tons per year. Salzgitter, of West Germany, was originally named to supply the plant but discussions were being held in late 1963 with Republic Steel Corp. (United States) over installing a used U.S. mill and possibly obtaining pig iron from the Halyvourgiki works. Negotiations also were carried on with M. W. Kellogg Co. (United States) for erection of a sponge iron plant.

Greek consumption of steel, estimated at 485,000 tons in 1962, was expected to climb to 600,000 tons in 1964 and 1,250,000 tons in 1971. A big factor in such a rise would be shipbuilding and its increased plate requirements. Over half of the steel consumed in 1962 was imported but, with the new facilities, Greece was expected soon to fill its own requirements.

Lead and Zinc.—Lead was smelted and zinc ore was concentrated for export by Mines de Laurium, a French company, at its deposit near Laurium, southeast of Athens. Lead metal output was 1,965 tons in

[2] Goatman, Ian W. Halivorgiki—Greece's First Integrated Steelworks. Steel and Coal (London), Nov. 15, 1963, pp. 958–960.

the first half of 1963. The company produced about 5,500 tons of lead concentrate and 7,800 tons of zinc concentrate in 1962, accounting for roughly one-fourth of the country's output of each. Also, Mediterranean Mines was active at Laurium and Hellenic Chemical Products and Fertilizers Co., Ltd., ran a concentrator at Kassandra.

Results of an IDC feasibility study favored construction of a US$17-million zinc smelter processing domestic ore and producing 15,000 tons of zinc annually. Such a refinery, situated in northern Greece, would draw mainly from Lavrion and Kassandra deposits where proven reserves are adequate for at least 10 years. Its establishment would encourage prospecting on nearby Greek islands. The IDC gave priority to the smelter project and commenced surveys of zinc mines in the Circe area, near Alexandroupolis. A byproduct sulfuric acid plant of 25,000 to 30,000 tons capacity was being planned.

Nickel.—Hellenic Chemical Products and Fertilizers Company, Ltd., through its Larymna Mines Co., acquired control of nickel-iron deposits on the Island of Euboea and signed agreements with Societe Le Nickel (France) forming Societe Miniére et Metallurgique Larco to exploit the Larymna deposits and produce nickel and steel in Greece. Only small tonnages of the ores had been mined previously. A US$15-million plant installation was expected to be in operation by mid-1965 with capacity of 4,000 tons of electrolytic nickel and 80,000 to 100,000 tons of steel annually.

NONMETALS

Asbestos.—An 8-year concession held by Kennecott Copper Corp. to explore asbestos deposits in the Kozani area expired at the end of 1963. The company reportedly spent about US$1.5 million for exploration and research but had not satisfied government expectations. Commercial production was not achieved; however, development appeared certain to continue as Copper Range Co., a U.S. firm, and other companies showed interest.

Cement.—Consumption in 1963 was estimated at 2.2 million tons compared with 1.8 million in 1962. Besides gray cement, about 20,000 tons of white cement was produced. Loans totaling US$1.7 million were approved to expand General Cement Co. plants at Volos and Piraeus. American Cement Co. (United States) was interested in entering the Greek cement industry with a plant to be built at Patras, and Atlas Cement Co. (Greece) planned a cement plant at Elefsis. Titan Cement Co. studied the problem of using Ptolemais lignite at its Thessaloniki plant but might continue with oil since prices were lowered in early 1963. The 200,000-ton plant, opened in 1962, was being expanded to 600,000 tons by 1964–65. Chalkis Cement Co. planned to add a kiln in 1964 raising capacity to about 500,000 tons per year.

Magnesite.—Greece, a minor producer and insignificant consumer of magnesite, exported in 1963 a total of 123,524 tons, 101,079 tons calcined and the rest crude. The calcined product went mainly to the United States (29,359 tons), The Netherlands (28,354 tons), and West Germany (22,875 tons); Italy took about half of the crude. Several refractory plants were on order for the Island of Euboea. Magnesite, Ltd. (Greece), signed with NIKEX Hungarian Foreign Trading Co.

(Hungary) to supply a magnesite brick plant, and a British firm, General Refractories, Ltd., invested with the Greek Chemical Products and Fertilizer Co. in a US$3 million magnesite and chromite refractory plant to be built at Laurium.

Sulfur, Pyrites, and Fertilizers.—Sulphur Hellas, S.A., processed imported sulfur in its 35,000-ton grinding plant, completed in 1962. Pyrites, produced mostly by Hellenic Chemical Products and Fertilizers Co., Ltd., at Kassandra and Lavrion, were shipped to the company's Drapetsona fertilizer plant for making sulfuric acid. Kassandra pyrites also were exported to Italy and Austria. Hellenic was the only Greek fertilizer producer in 1962, with output totaling 268,652 tons.[3] However, several plants were under construction including a 312,000-ton nitrogenous fertilizer plant in the Ptolemais lignite area, making test runs in late 1963, and a 250,000-ton phosphate fertilizer plant at Karvali due to be operational in 1964. A 155-ton-per-day phosphoric acid plant was on order for the Karvali plant. Chemical Industries of Northern Greece was beginning on acid and fertilizer plants at Drapetsona and Tsayezi, and a 105,000-ton ammonia plant was planned in connection with a new petroleum refinery (ESSO, Pappas, and others) near Thessaloniki. Such large-scale expansion was destined to provide several times the current Greek consumption of fertilizers and leave large tonnages for export.[4]

MINERAL FUELS

Coal.—Greek production of lignite in 1963 was 29 percent greater than in 1962. The Ptolemais region, near Kozani, with a reserve estimated at 450 million tons, was the most important source of coal, providing about 70 percent of all production. Other sources included Aliveri and Megalopolis area mines.

Work proceeded on installing three new excavators at Ptolemais in 1963 to boost output capacity from 1.8 to 4.0 million tons. The increase was to supply a local nitrogen fertilizer plant just completed, which can consume 1.0 million to 1.2 million tons per year of coal, and to fuel a third unit at the Ptolemais thermal power station. A contract was let for the 115,000-kilowatt unit to a Swiss firm, Brown Boveri, for delivery in late 1965. This would raise Ptolemais generating capacity to 320,000 kilowatts. Preliminary studies were being pressed by the Public Power Corp. on a proposed 250,000-kilowatt thermal plant at Megalopolis. Total capacity of existing thermal and hydroelectric facilities in Greece was placed at 695,000 kilowatts in 1963, with expansions underway scheduled to double this capacity by 1968–69.

Greek demand for coal was met mostly by domestic lignite production but some importation of hard coal and coke was necessary. Poland and the U.S.S.R. in 1962 supplied 77,643 and 32,365 tons, respectively, of hard coal; agreements with the U.S.S.R. called for coal and coke shipments to Greece totaling 62,000 tons in 1963 and 67,000 tons in 1964. Coal imports from the United States were 34,834 tons in 1962 after having fallen to nothing in 1960–61. Coke imports in 1962 totaled 31,310 tons, mainly from West Germany and Italy.

[3] Bureau of Mines. Mineral Trade Notes. V. 57, No. 2, August 1963, pp. 22–23.
[4] Nitrogen (London). Fertilizer Industry in Greece. No. 21, January 1963, pp. 1–5.

Petroleum.—Crude oil was imported and refined at the Aspropyrgos refinery, owned by the Greek State and operated under lease by a private corporation. In 1963 the refinery imported 1,842,000 tons of crude, processed 1,849,000 tons, and put out 1,824,000 tons of products. Production was 2.3 percent greater than in 1962. Crude imports in 1963 were divided, as follows: For the lessee, 1,068,000 tons from Saudi Arabia and 321,000 tons from Iran; for the government, 454,000 tons from the U.S.S.R.

A proposed US$24 million 2.5-million-ton-per-year refinery to be built by the ESSO–T. Pappas group at Salonica was marking time while negotiations continued with the Greek Government.

Petroleum exploration was disappointing; several projects were active in 1963. A drill hole by British Petroleum Exploration Co., (Greece), Ltd., at Klissoura struck a small flow of oil at 15,500 feet but the well was noncommercial. Undaunted, the company started a second hole about 15 miles to the northwest. Drilling by the Greek Institute for Geology and Sub-Surface Research and Institut Francais du Petrole at Anemorahi, Epirus, disclosed traces of oil before the hole was abandoned at 8,400 feet. A second hole was being tried in the Epirus area by the government and a French contractor, Forenco. The French firm, Safor, concluded drilling at Kataria, on the Island of Rhodes, apparently without success, and was investigating sites on Karpathos. Mediterranean Supply, S.p.A. (Italy) submitted a proposal to explore for oil north of Larissa.

The Mineral Industry of Hungary

By Roman V. Sondermayer [1] and K. P. Wang [2]

HUNGARY does not produce a great variety of mineral products, and few are of world consequence. Mineral consumption is much larger than production and requires substantial imports. Bauxite, primarily for export, is the only significant mineral product by world standards. The more prominent Hungarian minerals, with output in percentages of the 1963 world totals, were roughly as follows: Bauxite, nearly 5 percent; and aluminum, cement, coal, pig iron, manganese ore, and steel ingots, 0.3 to 1.1 percent. Coal and petroleum and natural gas were of significance to the domestic economy.

Hungary's mineral and metal output value in 1963 was estimated to be 7 to 10 percent higher than in 1962. The contribution of the mineral industry to the 1963 gross national product was about 6 percent, and the 156,000 workers employed represented roughly one-eighth of the country's total labor force. Mineral trade, particularly imports, was vital. Mineral and metal imports consisted chiefly of raw materials, while exports were largely semimanufactured forms.

Major developments during 1963 included discovery of a new manganese deposit at Urkut, commencement of construction of a 300-ton-per-day manganese benefication plant at Eplezny, expansion of steel rolling capacity by 400,000 tons per year, completion of a new superphosphate plant at Szolnik, and commissioning of a large cement plant at Vac. A long-term agreement in late 1962 called for much larger future shipments of Hungarian alumina to the U.S.S.R. for metal reduction.

Coal was Hungary's principal source of energy in 1963, although natural gas became more important. Most coal deposits are low rank so that imports of high-rank coals, particularly coking coal, were indispensable. A new oilfield near Somogy Megue and several gasfields in the Transdanubian area reportedly were discovered during the year.

Development of mineral resources has been retarded by severe shortages of electric energy. The aluminum industry was the most severely affected, and was not able to fully utilize the newly completed reduction capacity. This situation led to the agreement covering increased exports of aluminum raw materials to the U.S.S.R. Rail transport also created difficulties. Since most mineral imports came from the U.S.S.R. where the railroad gage is different, rail cars with minerals had to be unloaded or the wheels had to be changed before proceeding. There was also a shortage of rail cars for transport of mineral products.

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PRODUCTION

Mineral output of Hungary has shown on overall steady increase in recent years. In 1963, however, production of bauxite, the country's most important mineral product, was 8 percent lower than in 1962. A severe winter was the principal reason for the decline. Although 7 percent more iron ore was produced in 1963 than in 1962, output satisfied only one-fourth of requirements. Nonferrous base-metal production, though not reported, was undoubtedly far short of demand.

Hungary's most valuable mineral product continued to be coal, mostly brown coal. The overall coal output increased 7 percent over that of 1962. Increase in bituminous coal production was approximately 11 percent. The general rise in mineral output during 1963 should not obscure the fact that the mineral industry had the lowest rate of increase of any of the Hungarian economy.

TABLE 1.—Production of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite	937,812	1,189,913	1,366,053	1,468,000	1,362,000
Alumina	191,515	217,998	224,445	233,000	239,000
Aluminum	45,669	49,534	51,062	52,732	55,500
Rolled products	10,838	13,504	15,349	(2)	(2)
Aluminum alloyed products	3,917	3,433	4,343	(2)	(2)
Iron and steel:					
Iron ore thousand tons	439	516	605	682	731
Pig iron do	1,104	1,246	1,306	1,382	1,388
Steel do	1,759	1,887	2,053	2,333	2,374
Rolled products do	1,141	1,234	1,449	1,610	1,688
Manganese ore	154,333	123,276	124,838	129,226	120,019
Nonmetals:					
Cement thousand tons	1,432	1,571	1,601	1,700	1,800
Fertilizers:					
Nitrogenous	244,948	278,087	330,083	353,000	387,000
Phosphatic	234,410	270,087	331,188	429,068	512,864
Kaolin, crude	937,812	1,189,913	1,366,053	(2)	(2)
Lime, calcined	535,224	583,658	612,818	621,166	621,656
Sulfur:					
Elemental	2,358	3,186	3,460	(2)	(2)
Acid	147,784	164,296	188,848	(2)	(2)
Mineral fuels:					
Coal:					
Hard thousand tons	2,734	2,847	3,071	3,343	3,711
Brown do	18,548	19,447	20,389	20,648	21,932
Lignite do	4,074	4,230	4,717	4,662	4,831
Briquets do	1,054	1,050	1,123	1,188	1,200
Coke do	362	499	597	654	660
Natural gas million cubic feet	11,795	12,078	11,419	12,005	21,598
Petroleum: Crude thousand tons	1,035.9	1,216.7	1,456.9	1,641	1,756

[1] In addition to reported commodities, Hungary is known to produce (figures where given represents 1963 production estimates) silver, 64,300 troy ounces; peat, 60,000 metric tons; arsenic, copper, gold, uranium, china clay, and diatomite.
[2] Data not available.

TRADE

As in previous years, Hungary was a net importer of most mineral raw materials, with bauxite and manganese ore as the major exceptions. The country depended heavily on foreign iron ore, high-rank coals, petroleum, and nonferrous base metals during 1963. As

a member of the Soviet Ekonomicheskoy Vzayimopomoshchi (SEV),[2] most of Hungary's trade in mineral and other commodities was with other (Communist) countries.

Hungary's most important trading partner was the U.S.S.R., which supplied the country with the bulk of its imports of raw materials and obtained small quantities of semimanufactures and finished products in return.

The long-range Hungarian-U.S.S.R. agreement to exchange alumina for aluminum means that much more aluminum metal will be available in Hungary for consumption in the future.

TABLE 2.—Export of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963
Metals:			
Aluminum:			
Bauxite ---thousand tons--	701	719	667
Alumina ---do---	144	126	134
Aluminum, ingots	7,734	5,983	9,315
Iron and steel: Rolled products ---thousand tons--	360	510	525
Mineral fuels:			
Petroleum:			
Refined products:			
Gasoline ---thousand tons--	96	118	82
Diesel fuel ---do---	174	196	162
Heating oil ---do---	216	263	231

Source: Statisztikai Havi Kozlemenyek (Monthly Statistical Statement) No. 6, 1964, Budapest.

TABLE 3.—Export of selected metals and minerals to the U.S.S.R.

(Metric tons unless otherwise specified)

Commodity	1961	1962
Metals:		
Aluminum	1,000	----------
Iron and steel: Rolled products	1,800	7,600
Mineral fuels:		
Petroleum:		
Refined products:		
Diesel fuels	1,700	----------
Lubricants	13,000	13,200
Other	15,800	15,600
Total	30,500	28,800

Source: Vneshnyaya Torgovlya S.S.S.R. za 1962 god (Foreign Trade of the U.S.S.R. for 1962 Moscow, 1963, 235 pp.

[2] Council for Economic Mutual Aid, set up under an intercountry agreement that includes the U.S.S.R., Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and Mongolia.

TABLE 4.—Import of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963
Metals:			
Iron and steel:			
Iron ore—thousand tons	2,034	2,243	2,351
Rolled steel	221,206	219,237	197,209
Mineral fuels:			
Coal—thousand tons	1,725	1,712	2,513
Coke—do	879	910	1,013
Crude petroleum—do	1,412	1,540	1,828
Heating oil—do	83	67	135

Source: Statisztikai Havi Kozlemenyek (Monthly Statistical Statement) No. 6, 1964, Budapest.

TABLE 5.—Import of selected metals and minerals from the U.S.S.R.

(Metric tons unless otherwise specified)

Commodity	1961	1962
Metals:		
Cadmium	70	100
Chromite	8,000	14,000
Cobalt	40	----
Copper	7,800	8,400
Iron and steel:		
Iron ore—thousand tons	1,725	1,999
Pig iron	35,800	94,800
Ferroalloys	15,600	17,200
Steel:		
Rolled products	87,200	109,200
Pipe	6,000	8,900
Lead	8,000	8,500
Mercury—76-pound flasks	825	1,503
Tin	690	----
Nonmetals:		
Asbestos	8,200	10,100
Cryolite	1,000	1,000
Fire clay	400	600
Graphite	1,300	1,100
Sulfur	22,200	26,100
Mineral fuels:		
Coal—thousand tons	434	297
Coke—do	543	523
Petroleum:		
Crude—do	1,376	1,521
Refined product:		
Gasoline—do	54	58
Diesel fuel—do	66	80
Heating oil—do	36	59
Lubricants—do	12	12
Total—do	168	209

Source: Vneshnyaya Torgovlya S.S.S.R. za 1962 god (Foreign Trade of the U.S.S.R. for 1962), Moscow, 1963, 235 pp.

COMMODITY REVIEW

METALS

Bauxite and Aluminum.—The central Hungarian mountains continued to be the only major producing area for bauxite, alumina, and aluminum. Hungarian and Soviet experts made plans to expand two aluminum plants, one at Szekesfehervar and the other at Koebarya, each by 10,000 tons per year. The U.S.S.R. is expected to provide the technological knowledge and the financial means for these projects.

Work began on implementing the long-term agreement between the U.S.S.R. and Hungary to produce more bauxite and alumina in

Hungary and then send the additional alumina to the U.S.S.R. for reduction into aluminum. The plan by 1980 is to export 330,000 tons of alumina annually and receive 165,000 tons of aluminum ingot.

Iron and Steel.—Much work was done by the Hungarian Government in 1963 to improve the domestic iron-ore position; output was increased to 731,000 metric tons during the year. However, Hungary continued to rely on iron ore imports from the U.S.S.R., which amount to about 2 million tons annually. A new beneficiation plant was under construction near Miskolc in 1963, scheduled to supply iron concentrate to the Lenin Steel Works and the Ord Steel Works. A method was developed to separate siderite from barite for the Rudabanya deposit, yielding an initial concentrate containing 40 percent iron. Tests were conducted by the Hungarian Academy of Science to recover iron from tailings of alumina plants, with no economic results as yet.

Pig iron production was at about the same level as 1962, but steel ingot production increased slightly to about 2.4 million tons. The Cepel Iron and Steel Works was being reconstructed in 1963. The addition of 400,000 tons per year of new rolling-mill capacity portends greater output of steel products in the near future.

NONMETALS

Cement.—A new million-ton-per-year cement plant was brought into production in the fall of 1963 at Vac. Experts from East Germany assisted in the design and construction of the plant. Equipment also was supplied by that country. Thus, Hungary's cement capacity has been increased by about 50 percent to roughly 3 million tons.

Fertilizers.—The new sulfuric acid and superphosphate plant at Szolnik, completed in 1963, has an annual capacity of 120,000 tons of sulfuric acid and 200,000 tons of superphosphate. This plant was constructed with Soviet assistance.

MINERAL FUELS

Coal.—Production of all kinds of coal in Hungary increased slightly during 1963; about 70 percent was brown coal. In the Mecsek brown coal basin at Zobak in southern Hungary, mining of a 65-million-ton seam began in 1963. Ten years of work and 700 million forints (11.7 forints equal US$1) have gone into this project. The main shaft, already more than 600 meters deep, reportedly is to be extended. Production, which is expected to reach 1,500 tons daily by the end of 1964, presumably will be increased subsequently. Equipment includes underground conveyor belts to transport the coal to bunkers and automatically controlled hoisting skips.

New lignite deposits of some consequence were developed near Miskolc during 1963. An additional 150,000-ton-per-year briquetting unit was being constructed at the Hidas briquet plant.

Petroleum and Natural Gas.—Hungary's 1963 crude oil output of nearly 1.8 million tons came from 2 major fields, Levosy and Nagylenguel, and 42 very small fields. The potential of the newly discovered oilfield at Vizvar near the Yugoslav border has not yet been determined, but it reportedly produces both natural gas and oil.

The Szony oil refinery was enlarged during the year, and a new unit for regeneration of old lubricants was constructed. The Druzba pipeline was in operation in 1963, bringing in most of the imported oil, including crude oil from the U.S.S.R.

Large natural gas deposits were discovered in the Hungarian plains, and several pipelines were under construction to bring the gas to the consuming centers. These new gas finds are expected to give the coal industry stiff competition as an energy source.

The Mineral Industry of Ireland

By Walter C. Woodmansee [1]

RELATIVE to world supply and consumption, the metal and mineral economy of Ireland remained small. Its contribution to the country's national income was small compared with that of other industrial sectors. However, recent developments have stimulated the mineral industry and improved its domestic position. The most noteworthy of these developments is the 8-million-ton lead-zinc-silver deposit which was discovered in 1961 at Tynagh (County Galway). During 1963 this deposit was being prepared for large-scale mining operations, which are expected to begin in 1965. Foreign investment in this operation exceeded £10 million [2] through 1963, and the discovery has caused increased prospecting and exploration for base metals in other parts of the country. During 1963, about 60 companies and many individuals had mineral leases on 1,500 square miles in Ireland. Most of these companies are based or financed in Canada.

The only mineral commodity of world significance produced in Ireland in 1963 was sod and milled peat. Output has been 4 to 5 million tons annually, second only to that in the U.S.S.R. The mining and quarrying industries showed a marked expansion in 1962 (23 percent, based on value of product), owing principally to increased peat output and continuing high demand for construction materials. Gross value of mine and quarry products contributed about 2 percent of total industrial production in 1962. Small secondary metal production and the manufacturing of finished metal products, fertilizers, cement, brick, and other construction materials contributed 5 to 6 percent. During 1963 the growth rate in mining and quarrying was reduced to about 7 percent, because of lower demand.

Mining and quarrying activities employed approximately 10,000 people in 1963, mainly in peat mining and bog development, and secondly in stone and sand and gravel quarrying. The fertilizer, construction materials, and metal-working industries employed 14,000 to 15,000 people, most of whom were involved in metal fabrication.

GOVERNMENT POLICIES AND PROGRAMS

Mineral policy in Ireland was revised by the Petroleum and Other Minerals Development Bill of 1959, which encouraged foreign investment in Ireland by permitting foreign companies to hold exploration and mining leases granted by the State, which continues to reserve

[1] Foreign mineral specialist, Division of International Activities.
[2] One pound is equal to US$2.80.

mineral ownership. The new regulations provide for mineral licenses covering larger areas, up to 10 square miles, so that geophysical and geochemical methods are more effective. A company or individual is permitted to hold more than one license if prospecting and exploration are carried out satisfactorily. Tax legislation benefiting mining investment has been effective since 1956.

SOURCE MATERIAL

Much of the production data is derived from various nonofficial sources. The trade tables are based on "Trade Statistics of Ireland," compiled by Ireland's Central Statistics Office in Dublin.

PRODUCTION

Ireland's domestic metal production is limited to two firms—Irish Steel Holdings, Ltd., which makes open-hearth steel at Haulbowline (County Cork), and Metal Refiners, Ltd., which makes small quantities of secondary refined lead, high-grade zinc, and alloys at Clondalkin, 7 miles from Dublin.

There was no metal-mine production during 1963, owing to the closure in 1962 of the only active metal mine, the copper mine at Avoca (County Wicklow). However, renewed and successful activity in base-metal exploration, since 1962, indicates the likelihood of a return to copper-lead-zinc-silver mining, probably by 1965.

Among nonmetals, mine output of both barite and gypsum increased during 1963. New deposits of barite were under development. Quarry production of crushed rock, dimension stone, clay, and sand and gravel expanded steadily, owing to high demand in the building and construction industries. Cement output remained about on a par with that of 1962.

Coal and gasplant coke output remained relatively unchanged, but milled peat and peat briquet production expanded rapidly under the government's ambitious peat-bog development program.

Output of gasoline and fuel oils has steadily increased at the Whitegate oil refinery (County Cork) to a level which provides for nearly all the domestic requirements in these fuels.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962 [1]	1963 [1]
Metals: [2]					
Copper, metal content of ore	4,297	6,244	5,928	2,389	----
Lead, metal content of ore	1,339	1,343	253	----	----
Steel ingots and castings, thousand tons	23	30	28	19	[3]
Zinc, metal content of ore	1,182	1,249	167	----	----
Nonmetals:					
Barite	8,307	10,618	4,227	343	9,246
Cement, thousand tons	628	745	744	[4] 906	[4] 901
Clay, refractory	[3]	15,936	16,174	18,096	17,804
Construction materials: [5]					
Sand and gravel, thousand tons	830	1,159	1,330	1,575	1,616
Limestone, do.	1,623	1,871	1,817	2,383	2,356
Gypsum, do.	138	181	167	[6] 175	[5] 199
Pyrite, including cupriferous, do.	[7]	22	51	38	----
Superphosphate, do.	206	233	238	310	320
Other [8], do.	793	922	1,296	1,302	1,497
Mineral fuels:					
Coal:					
Anthracite, do.	155	130	117	123	131
Semibituminous, do.	79	77	84	81	78
Coke, gas plant, including coke breeze, do.	91	113	123	122	120
Peat: [9]					
Briquets, do.	44	124	211	225	293
Milled, excluding briquets, do.	4,359	194	676	996	1,606
Sod, do.		2,960	2,874	2,811	2,694
Moss, do.	12	13	19	22	23
Petroleum refinery products: [10]					
Gasoline, thousand 42-gallon barrels	963	2,495	2,630	2,784	2,895
Jet fuel, do.	2	58	47	----	----
Kerosine, do.	50	215	66	73	1
Distillate fuel oil, do.	1,769	3,104	3,281	3,412	3,590
Residual fuel oil, do.	1,681	4,121	4,022	4,364	4,462
Other, do.	280	82	170	137	345
Refinery fuel (including losses), do.	421	824	678	659	704
Total	5,166	10,899	10,894	11,429	11,997

[1] Largely provisional or estimated.
[2] Small quantities of secondary lead and zinc, including alloys, are produced by one company, but output is not known.
[3] Data not available.
[4] Includes clinker.
[5] Totals are based on private sales and do not include large quantities of granite, limestone, sandstone, quartzite, sand and gravel, and other materials used by government agencies in maintenance of public roads.
[6] Final figure; supersedes figure given in commodity chapter, volume 1.
[7] Included with "Other nonmetals."
[8] Includes granite and other igneous rocks, quartz, calcite, roofing slate, pyrite (1959), and other sands, gravel, and clays.
[9] Figures for peat production apparently are based on marketed peat.
[10] Petroleum refinery production statistics are from World Petroleum Statistics, U.S. Bureau of Mines.

TRADE

Ireland's metals and minerals trade occupied only a small part of the country's total trade in 1962. Metal and mineral exports and reexports (principally petroleum products) totaled £8.6 million, 5 percent of the total value of £174 million for all exported goods. Estimated total value of metal and mineral imports in 1962, excluding manufactured products, was £48.1 million, 14 percent of the value of total imports (£273.7 million). These imports, far in excess of exports, were mainly in crude and refined petroleum (£18.8 million), coal (£8 million), and iron and steel (£8 million).

Ireland's limited needs in the ferrous and nonferrous metals continued to be met largely by imports of the metals, principally in the

semifabricated forms. The small output of nonferrous metal ores through 1962 was shipped abroad for processing.

Imports of all types of fertilizers, phosphate rock, and basic slag remained high, and the entire salt supply continued to be imported. Although petroleum derivatives are the most important products for export, large quantities of cement and raw construction materials also enter the export market.

Great Britain [3] remained the dominant source of imported anthracite and bituminous coals. Crude petroleum imports continued from the Middle East, and most petroleum refinery products came from Great Britain.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962 [1]
Metals:			
Copper:			
Ore and concentrate	28,474	15,190	West Germany 6,472; Belgium-Luxembourg 4,521; Sweden 4,196.
Scrap:			
Unalloyed	1,515	1,282	Spain 527; Netherlands 387; Great Britain 218.
Alloys	639	657	Mainly to Great Britain.
Iron and steel:			
Pyrite cinders	17,645	12,778	Great Britain 12,401.
Scrap	18,167	14,454	Italy 4,867; Spain 3,414.
Unwrought and value, pounds semimanufactures.	625,921	331,567	Mainly to Northern Ireland.
Lead, ore and concentrate	1,269	----------	
Silver, bullion troy ounces	9,400	(2)	
Zinc, ore and concentrate	1,562	----------	
Nonferrous metals, n.e.s.: [3]			
Scrap	1,817	3,138	Great Britain 836.
Unwrought and value, pounds semimanufactures.	514,243	418,919	Netherlands, Italy, Northern Ireland.
Nonmetals:			
Barite	8,555	----------	
Cement	237,425	236,978	Great Britain 147,603; Northern Ireland 89,375.
Gypsum	83,449	86,630	(2).
Fertilizers	6,926	7,649	(2).
Stone, industrial	84,924	87,987	Great Britain 61,860; Northern Ireland 25,634.
Other	136,366	178.610	Great Britain 125,204.
Mineral fuels:			
Coal, coke	62,281	40,549	Norway 25,411; Netherlands 9,744.
Peat	41,633	38,179	Northern Ireland 22,805; Great Britain 15,230.
Peat moss	12,154	16,747	Mainly to Great Britain.
Petroleum refinery products: [4]			
Gasoline thousand 42-gallon barrels	35	62	All to Northern Ireland.
Distillate fuel oil do	1,001	988	Great Britain 964; Northern Ireland 24.
Residual fuel oil do	1,658	765	Great Britain 727; Northern Ireland 38.

[1] Great Britain and Northern Ireland, comprising the United Kingdom, are listed separately in Ireland trade publications.
[2] Data not available.
[3] Not elsewhere specified (n.e.s.).
[4] In 1961, reexports were (thousand barrels) aviation gasoline, 400; kerosine, 567; and lubricants, 18. In 1962, reexports, valued at £2,250,865, included (thousand barrels) aviation gasoline, 311; kerosine, 573; and lubricants, 17. Total value of metal and mineral reexports in 1962 was £2,663,180.

[3] Great Britain and Northern Ireland, comprising the United Kingdom, are listed separately in Ireland trade publications.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962 [1]
Metals:			
Aluminum: [2]			
Unwrought	3,662	4,976	Canada 4,635.
Semimanufactures	2,504	3,129	Great Britain 1,915; United States 33.
Copper: [2]			
Unwrought	233	200	Great Britain 198.
Semimanufactures	4,385	4,408	Great Britain 3,772.
Iron and steel:			
Iron ore, scrap	20	289	All from Great Britain.
Pig iron, sponge iron	3,699	3,408	Great Britain 3,154.
Other unwrought	6,331	9,998	Great Britain 7,067.
Semimanufactures	128,406	143,879	Great Britain 78,431; Belgium 19,128; West Germany 12,291.
Lead [2]	583	546	Great Britain 526.
Tin [2] long tons	63	45	All from Great Britain.
Zinc: [2]			
Unwrought	2,503	2,773	Belgium 1,687; Great Britain 457.
Semimanufactures	81	145	Great Britain 108.
Nonferrous ores, scrap	280	314	Great Britain 181.
Nonferrous metals, other	224	259	Great Britain 242.
Nonmetals:			
Asbestos	2,015	2,941	Cyprus 1,517; Republic of South Africa 794; Canada 444.
Borax	1,017	1,127	[3].
Cement	36,387	5,825	Great Britain 5,391.
Clay, refractory	10,185	9,234	Great Britain 8,417.
Clay, construction	3,812	5,289	Great Britain 2,520.
Fertilizers:			
Nitrogenous	123,478	128,657	Netherlands 48,446; West Germany 27,787; Great Britain 12,848.
Phosphatic:			
Phosphate rock	225,500	225,366	Morocco 220,621; Algeria 4,745.
Basic slag	66,709	123,326	Mainly from Belgium.
Other	28,112	19,452	Belgium 14,411.
Potassic	119,319	145,016	France 60,944; West Germany 40,043; East Germany 30,503.
Other	11,166	10,059	Chile 4,420.
Pyrite	16,168	2,680	[3].
Refractory materials	10,610	10,039	Great Britain 8,235.
Sand	34,188	31,878	Belgium 25,893.
Salt	37,522	41,896	Great Britain 32,924.
Stone:			
Dimension	1,379	1,551	Mainly from Italy.
Crushed	3,983	19,873	Belgium and West Germany, unknown quantities.
Sulfur	35,757	46,808	United States 41,505; Mexico 5,009.
Other value, pounds	317,503	334,122	Mainly from Great Britain.
Mineral fuels:			
Coal:			
Anthracite thousand tons	57	58	Great Britain 57.
Bituminous [4] do	1,744	1,430	Great Britain 552; Poland 307; United States 228.
Briquets, coal, coke, peat do	3	3	Mainly from Great Britain.
Coke do	7	16	Great Britain 13.
Petroleum:			
Crude or partly refined thousand barrels	10,867	11,324	Iraq 6,781; Iran 2,825; Saudi Arabia 1,718.
Refinery products:			
Gasoline do	531	463	All from Great Britain.
Kerosine, jet fuel do	1,401	1,392	Great Britain 1,355; Bahrein 37.
Distillate fuel oil do	70	70	Mainly from Great Britain.
Residual fuel oil do	1,094	1,330	Great Britain 1,124; British West Indies 203.
Lubricants do	179	180	Great Britain 177.
Liquefied petroleum gases	3,910	6,410	Mainly from France.
Bituminous and asphaltic mixtures.	80,930	102,855	Dutch West Indies 71,921; Great Britain 29,238.
Other:			
Reported by volume. thousand 42-gallon barrels.	22	25	Great Britain 22.
Reported by weight	2,945	2,608	Indonesia (mineral jelly, waxes) 1,116; Great Britain 500.

[1] Great Britain and Northern Ireland, comprising the United Kingdom, are listed separately for Ireland trade publications.
[2] Includes alloys.
[3] Data not available.
[4] Includes imports for bunkers.

COMMODITY REVIEW

METALS

Aluminum.—Aluminum ingot has not been produced in Ireland, and all requirements for ingot, as well as partial requirements for semimanufactures, have been supplied entirely by imports. Consumption has increased with the recent establishment of several light metal industries. Aluminum foil and extruded products were made by Unidare, Ltd., at Finglas (County Dublin) during 1963. Irish Aluminium Company, Ltd., produced aluminum castings and finished products at Nenagh (County Tipperary).

Copper.—Mine production of copper was terminated with the closing of the Avoca mine (County Wicklow) of Saint Patrick Copper Mines in September 1962. The mine failure was attributed to excessive ore dilution, caused by caving, which resulted in ore grade of only 0.9 percent copper.

Smelter and refined copper have not been produced in Ireland. Concentrate output from previous years was shipped abroad for processing. Ireland's copper supply continued to be provided essentially by imported semimanufactured products.

Exploration for copper and renewed exploration activity for lead and zinc were relatively high during 1962–63. Prudential Petroleum Co. of Canada was drilling in the Killeen Mountains near Newport (County Tipperary), and Dennison Mines, Ltd., also of Canada, was involved in a drilling venture near Allihes (County Cork).

The important Tynagh lead-zinc-silver deposit, scheduled for production in 1965, contains 0.6 percent copper, which is recoverable as a byproduct. Copper also is associated with lead-zinc ores at Consolidated Mogul's mine at Silvermines (County Tipperary).

Iron and Steel.—Open-hearth steel capacity at the Irish Steel Holdings, Ltd., plant at Haulbowline (County Cork), the only steel plant in the country, was doubled to 80,000 tons with the addition of a new 70-ton open-hearth furnace and other improvements during 1962–63. Steel production has been based essentially on domestic scrap generation and imported pig iron, since there are no blast furnaces in the country. The steelplant produced light sections, mainly rounds and flats, and galvanized and corrugated sheets. Output of crude sheet and semimanufactures, however, has been only 20,000 to 30,000 tons per year, and 80 to 90 percent of domestic steel consumption has been based on imports.

Lead and Zinc.—Exploration and development of the Tynagh (County Galway) lead-zinc-silver deposit, discovered in 1961, continued through 1963. The property controller and operator is Northgate Exploration, Ltd., of Toronto, Canada. The deposit has been stripped to near-surface oxidized and residual ore, which will be mined by open pit, with first-stage production of 2,000 tons per day. A flotation mill was under construction at yearend. The concentrate produced at the mine site will be smelted in Belgium, West Germany, France, and the United Kingdom. Metallurgical companies in these countries are large investors in the mining operation.

Recent deep drilling by Irish Base Metals, Ltd., a subsidiary of Northgate, has delineated a large primary sulfide ore body below the oxidized zone, down to depths of a few hundred feet. Ore reserves are estimated as follows: Oxidized and residual ore, 4.5 million tons, 9.3 percent lead, 7.3 percent zinc, 0.6 percent copper, 3.5 ounces silver per ton; primary sulfide ore, 3.5 million tons, 4.8 percent lead, 4.3 percent zinc, 0.6 percent copper, 2 ounces silver per ton. Production is expected to be underway in 1965.

This significant discovery has encouraged widespread base-metal exploration in similar geologic terrain of other parts of the country. Zenmac Co., Canada, has discovered a lead-zinc-silver deposit at Loughrea (County Galway), near Tynagh. Consolidated Mogul Mines, Ltd., Toronto, Canada, acquired holdings of Silvermines Lead and Zinc Co., Ltd., of Nenagh (County Tipperary) at Silvermines (County Tipperary) and has initiated an exploration and development program in the vicinity of the old mines.

NONMETALS

Barite.—Small quantities of barite have been produced in Ireland for many years, both to meet limited domestic requirements and for the export market. Barite is associated with the lead and zinc sulfides at Silvermines. Magnet Cove Barium Corp. of the United States, which obtained a sublease on the property from Silvermines Lead and Zinc Company, Ltd., in 1962, has stripped a 700,000-ton deposit for open-pit mining. The company plans barite production of 50,000 tons per year. Discoveries of barite also have been reported in recent years in Counties Wicklow and Monaghan and also in the Benbulben Range (County Sligo).

Cement.—Irish cement output continued to provide an exportable surplus, in spite of the high level of domestic consumption caused by the continuing construction boom in Ireland. Cement, Ltd., an Irish company with close Danish associations, is by far the leading producer of cement in the country. Plants at Drogheda (County Louth) and Castlemungret (County Limerick) had a total annual capacity of approximately 900,000 tons of finished cement in 1963. Expansion plans for 1964–65 call for two new kilns and annual capacity of 1.2 million tons. Cement, Ltd., is one of the largest and fastest growing companies in Ireland. Total employment was approximately 1,000 in 1963.

Fertilizers.—Consumption of fertilizers has expanded rapidly because of government-encouraged efforts to improve crop and grazing lands. A large part of the annual supply continued to be provided by imports of nitrogenous, phosphatic and potassic varieties in 1963, but domestic output has increased and new plants were planned or under construction. Irish Nitrogen, Ltd., a semi-State body, continued work on a 150,000-ton nitrogenous fertilizer plant at Arklow (County Wicklow), near the now defunct Avoca copper mine. Original plans called for the use of Avoca pyrite but, under revised plans, domestic and imported sulfuric acid, petroleum byproducts, and fuel oil will be utilized at the plant.

Shell Chemical Co. joined with Albatross-Windmill Fertilizer Co. to form Shell and Albatross, Ltd. This new company, expected to produce chemicals as well as fertilizers, has its headquarters at New Ross (County Wexford), where Albatross-Windmill has a new 100,000-ton superphosphate factory. Superphosphate capacity of Shamrock Fertilizer Company, Ltd., at North Quay (County Wicklow) was recently enlarged to 100,000 tons per year.

Gypsum.—Production at the Kingscourt (County Cavan) deposit of Gypsum Industries, Ltd., continued at a rate of 100,000 tons per year. This company also controls deposits in Counties Meath and Monaghan. A large gypsum deposit reportedly was discovered at Glengevlin (County Cavan) during unsuccessful drilling for oil.

Sulfur.—Sulphac, Ltd., a company formed by W. and M. Goulding, Ltd., Ireland's leading fertilizer company, and Freeport Sulfur Co., New York, has sulfuric acid plants in Cork and Dublin. The latter is a new plant. Sulphac's sulfur supply is principally from the U.S. gulf coast. Pyrite from Spain had formerly been used in older and smaller plants.

MINERAL FUELS

Peat.—Output of sod (machine turf) peat remained higher than that of milled peat but has been gradually reduced in recent years; milled peat output has expanded rapidly. This trend toward emphasis on milled peat is due to increased demand for briquetting and fuel in the newer thermal powerplants. The main uses of sod peat have been in domestic and industrial heating and in older powerplants. Peat moss is largely baled and exported for agricultural use.

The government's current 5-year Economic Development Program (1959–64) called for extensive bog drainage work, which continued in 1963. Railroad and bridge construction to and in bog areas also has been part of the program. The Bord na Mona (Peat Development Board), responsible for providing an adequate peat supply for powerplants and home fuel uses, produced a large part of the milled peat, including that for conversion to briquets. The board also produced a significant share of the country's sod peat. During the year ending in March 1963, the board produced 1,543,000 tons of milled peat, the highest achieved by the company and a 14-percent increase in briquets over the preceding annual period; 24,000 tons of sod peat; and 301,000 bales of peat moss. A large part of the total sod peat output was produced by peat farmers.

Exports of peat moss during the year ending March 1963 increased considerably over those of 1962 and went to Great Britain, the Channel Islands, the Canary Islands, and the United States. The board operated briquet factories at Boora, Derrinlough, Croghan, and Lullymore, all in County Offaly. These plants were constructed during 1959–62 and have a total annual capacity of approximately 300,000 tons.

Petroleum.—Ambassador Ireland Oil Co., Ltd., a consortium of Ambassador Oil Co. of Texas, Conoco, and Sohio, continued its exploration program for oil into 1963, when the fourth hole was in progress. This Ireland-based company operated under contract with the government, which granted extendable 5-year exploration rights. Drilling

commenced in 1960, and during 1960–62 three dry holes totaling 23,000 feet were drilled. Drill site selection was based on aerial, seismic, and surface geologic investigations.

The Irish Refining Co., Ltd., of Whitegate (County Cork), Ireland's only petroleum refinery, which went into production in 1959, continued to expand output of gasoline and fuel oils to meet rising demand in the country. Forty percent of Irish Refining is owned by Esso, 40 percent by British Petroleum-Shell, and 20 percent by Caltex. Refinery capacity is 45,000 barrels per day.

During 1963 production from this refinery provided for nearly all the gasoline consumption of 3 million barrels, an exportable surplus of distillate fuel oil beyond consumption of 2.4 million barrels, and a large part of residual fuel oil requirements of 5.4 million barrels. Irish Refining discontinued production of jet fuel and kerosine, supplies of which were subsequently provided by imports from Great Britain. Lubricants, liquefied petroleum gas, and other minor petroleum products also are supplied principally by imports.

Irish Shell and British Petroleum, the largest wholesale suppliers of petroleum products in Ireland, opened an oil depot at Limerick in 1962. This depot, with storage capacity of 150,000 barrels, is supplied with products from Whitegate refinery and aviation fuel from Great Britain.

The Mineral Industry of Italy

By F. L. Klinger [1]

ITALY'S mineral industry is the third most important in the European Economic Community (EEC). Although the country is relatively deficient in most basic industrial raw materials such as the common metals and mineral fuels, it has become increasingly important to the world's mineral economy as a market for raw materials produced by other countries. Based principally on imported materials, the Italian iron and steel and petroleum industries have shown spectacular growth during the past 10 years. Italy now ranks sixth in free-world steel production and has the largest petroleum refining capacity in Western Europe.

Italy's gross national product in 1963 was estimated at Lit28,165 [2] billion, equivalent to US$45 billion. The gross industrial product (at current prices) was estimated at Lit10,948 billion (US$17.5 billion), of which 1.9 percent was attributed to the mining industry, 2.7 percent to the petroleum and coal derivatives industry, 3 percent to production of building materials, and 6 percent to the metallurgical industry. Although the total government revenue obtained from the mineral industry was not available, it may be of the order of 25 percent (the petroleum industry alone accounted for 14 percent of all government revenue in 1962 and 1963).

Employment in the mining industry in 1963 was estimated at 102,000 or about 2 percent of the industrial labor force. In addition, an estimated 500,000 or 9 percent of industrial labor was employed in primary metal extraction and processing, in manufacturing petroleum- and coal-derivatives, and in processing of construction materials. Employment in the mining industry declined about 2 percent as compared to 1962 but may have increased to some extent in the minerals processing industries because of new plants completed during the year.

High production costs and foreign competition continued to be the main problems of the industry in 1963. Labor costs increased as much as 25 percent as new contracts were negotiated during the winter of 1962–63 in the mining and processing industries. Efforts to reduce costs have led to increased production efficiency through installation of modern machinery and centralization of production; a prime example of this trend is the concentration of Italy's iron and steelmaking facilities in large integrated plants at coastal locations. The rising costs of production in 1963 also increased the pressure on government

[1] Foreign mineral specialist, Division of International Activities.
[2] The lira (Lit) is the official monetary unit of Italy. In this chapter values have been converted from lire to U.S. dollars at the rate of Lit1 = US$0.00160.

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to relax certain controls over prices and plant construction, notably in the petroleum industry.

TABLE 1.—Employment in Italian mineral-based industries in 1951 and 1961

Industry	Employment	
	1951	1961
Extractive:		
Metallic minerals	23,768	20,506
Nonmetallic minerals	70,567	72,680
Mineral fuels	24,327	10,661
Manufacturing:		
Metallurgical industry (primary)	145,071	191,689
Petroleum and coal derivatives	18,715	23,984
Nonmetallic mineral processing	206,668	311,546

Source: Istituto Centrale di Statistica (Rome), Annuario di Statistiche Industriali [1962]. V. 7, 1963, p. 117.

The lead, zinc, and sulfur industries continued to receive protection from foreign competition, under article 226 of the Rome Treaty, to allow reorganization and improvements in competitive position. In December the EEC agreed to extend the protective measures for an additional year in the cases of lead and zinc. Full protection for the sulfur industry was scheduled to expire in December but partial protection was to continue until 1968.

GOVERNMENT POLICIES AND PROGRAMS

The Italian Government participates to a large extent in the mineral industry. Most iron and manganese mining, iron and steel production, and a portion of the cement industry are controlled by the government through its organ, Istituto per la Ricostruzione Industriale (IRI). The government agency for metallic ores, Azienda Minerali Metallici Italiana (AMMI), accounts for about 20 percent of Italian lead and zinc production as well as other metals, and is responsible for coordinating exploration and development of the country's metallic mineral resources. A government-owned company, Ente Nazionale Idrocarburi (ENI), produces most of Italy's crude petroleum and natural gas, controls or has interests in about 25 percent of the nation's petroleum refineries, and conducts most of Italy's foreign operations in the petroleum field. The government also controls most of the country's electric-power industry as a result of nationalization in 1962.

The lead, zinc, and sulfur industries continued to be subsidized by the government in 1963. Financial aids were also maintained in other mining sectors such as the Sardinian coal-mining industry, and in mercury mining where the high production tax was finally abolished in 1962.

Generally, Italian trade policy encourages imports of minerals or metals which are needed for the manufacturing industry but restricts or imposes duty upon materials which can be produced in adequate amounts within the country. In metals, for example, imports of ores of aluminum, copper, iron, and manganese are duty-free but ingots or semimanufactures are usually taxed at basic rates ranging from 5 to 18 percent ad valorem. Additional tariff protection is given to lead,

zinc, and sulfur but the Italian tariffs are scheduled to be replaced by lower EEC rates in 2 or 3 years as the "transition" periods end.

SOURCE MATERIAL

The principal sources of information were statistical publications of the Italian Government or of its affiliated organizations operating within the mineral industry. Statistics on production and foreign trade were mainly obtained from publications of Istituto Centrale di Statistica (ISTAT), especially "Annuario di Statistiche Industriali" and "Statistica Mensile del Commercio con l'Estero." For the iron and steel industry, the principal sources were "Rilevazioni Statistiche" (published in Milan by Associazione Industrie Siderurgiche Italiane (ASSIDER)), and "Siderurgia" (published in Luxembourg by Istituto Statistico delle Comunità Europee); for the nonferrous metals, "Metalli Non Ferrosi e Ferroleghe" (published by AMMI) and for the petroleum industry, various publications by the Ministry of Industry and Commerce including "Bollettino Petrolifero," "Bollettino Ufficiale degli Idrocarburi," and "Industria del Petrolio in Italia". Information on oil and gas exploration and development in Italy was largely drawn from the annual summaries published in the "Bulletin of the American Association of Petroleum Geologists." Much additional information of both specific and general nature in all fields was obtained from dispatches and statistical summaries compiled by the U.S. Embassy in Rome, from various industrial periodicals, and from company reports.

In general, Italian publications were preferred over foreign sources and where detailed studies involving translations were impracticable, an effort was made to check foreign information with official sources. Also, where ISTAT foreign trade statistics differed from those published by government agencies more directly concerned with the mineral industry, as in the case of coal and petroleum, the industrial sources were considered more authoritative.

PRODUCTION

The overall volume of production in the mining industry in 1963 declined by 4.5 percent as compared with 1962. Output of solid fuels decreased 20 percent, metallic minerals 15 percent, nonmetallic minerals 5 percent, and crude petroleum production decreased about 1 percent. Despite the general decrease, increases were shown in production of several mineral commodities such as bentonite, potash salts, salt, natural gas, feldspar, and bituminous rock. In the manufacturing industry, production of aluminum as well as iron and steel increased whereas output of lead and zinc dropped slightly below the levels of 1962. Cement production increased by 10 percent, and output of petroleum products rose nearly 15 percent.

TABLE 2.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite	294,243	315,470	323,121	309,324	269,609
Alumina	205,180	222,186	231,057	225,227	238,726
Metal:					
Primary	74,924	83,646	83,352	81,238	91,430
Secondary	30,000	42,000	45,000	56,000	(1)
Semimanufactures	70,000	83,000	90,000	97,000	(1)
Antimony:					
Ore	857	1,162	1,817	2,057	592
Regulus	177	449	508	406	475
Oxide	5	15	140	43	113
Sulfide	102	58	64	60	20
Arsenic ore (15.8 percent As)	2,980	3,759	3,750	1,622	----------
Cadmium	250	294	346	247	279
Copper:					
Ore (concentrate, 22 percent Cu)	2,656	2,349	2,688	2,896	4,527
Cupriferous pyrite (2 percent copper)	101,974	88,972	77,715	78,000	(1)
Metal:					
Primary (cement)	6,988	4,600	4,700	4,268	(1)
Secondary (refined)	19,000	15,500	14,000	12,000	(1)
Semimanufactures, including alloys	195,300	233,900	275,000	294,000	323,000
Alloys, in ingots, from scrap	16,300	27,700	33,000	31,500	(1)
Gold:					
Ore (0.007 to 0.01 percent Au)	1,358	1,411	246	----------	----------
Metal, troy ounces	3,261	3,310	600	(1)	(1)
Iron:					
Ore (47 to 49 percent Fe), thousand tons	1,237	1,245	1,203	1,151	1,006
Pyrite cinders [2], do	(1)	(1)	(1)	924	888
Pig iron, do	2,098	2,683	3,056	3,556	3,741
Ferroalloys, do	94	141	145	122	127
Steel (ingot tons), do	6,762	8,229	9,124	9,757	10,157
Hot rolled, do	5,202	6,631	7,198	7,547	7,980
Cold rolled, do	913	1,166	1,157	1,306	1,664
Lead:					
Ore (62.5 percent Pb)	83,225	79,203	76,002	66,307	51,117
Metal:					
Primary	44,042	41,651	45,150	41,986	41,934
Secondary, from scrap and residues	(1)	(1)	6,100	4,800	(1)
Alloys, in ingots	6,000	10,000	14,000	12,000	(1)
Semimanufactures	(1)	36,072	38,000	38,000	(1)
Magnesium	4,500	5,446	5,595	5,703	5,508
Manganese ore (25 percent Mn)	50,374	46,804	47,218	44,500	45,287
Mercury:					
Ore	247,203	294,259	291,110	275,119	256,941
Metal, 76-pound flasks	45,833	55,492	55,405	54,535	54,506
Pyrite (including cupriferous pyrite)	1,517,800	1,546,460	1,580,186	1,584,524	1,398,840
Silver (999/1,000 fine), troy ounces	1,060,749	943,946	973,139	929,832	[3] 1,005,941
Tungsten ore (65 percent WO_3)	5	7	2	1	2
Uranium ore	687	964	60	(1)	(1)
Zinc:					
Ore (52.6 percent Zn)	224,617	232,171	239,836	236,361	205,557
Ore (19 to 24 percent Zn)	47,655	45,093	33,772	31,736	7,252
Metal:					
Primary	73,951	79,869	78,403	77,671	73,596
Refined from scrap and residues	5,400	5,900	5,200	4,400	(1)
Semimanufactures	(1)	8,540	8,700	9,800	(1)
Nonmetals:					
Asbestos	47,662	[3] 51,423	56,984	55,553	57,532
Barite (crude)	121,322	143,267	141,520	121,915	106,599
Bentonite	95,910	126,534	131,333	111,357	142,927
Borax	9,720	11,435	13,402	(1)	(1)
Boric acid (96 to 97 percent in acid)	2,489	2,657	1,772	1,378	514
Bromine:					
Elemental	714	1,278	1,512	(1)	(1)
Inorganic bromides	170	200	282	(1)	(1)
Organic bromides	338	354	536	(1)	(1)
Celestite (90 percent)	(1)	830	1,070	600	654
Cement, thousand tons	14,227	15,849	17,991	20,248	22,087
Cement rock, do	(1)	(1)	(1)	3,985	4,426
Clays:					
For bricks and terracotta, do	18,241	18,752	22,448	(1)	(1)
For cement (including clay shale), do	2,257	2,338	2,201	(1)	(1)
Bleaching and refractory	102,518	99,186	179,673	179,965	353,556
"Bianchetto" (kaolinitic and bauxitic)	11,500	----------	12,000	(1)	(1)
Kaolin	[3] 58,037	86,815	[3] 86,154	73,822	73,562

See footnotes at end of table.

TABLE 2.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals—Continued					
Construction materials:					
Asphalt rock (for surfacing)-thousand tons	406	407	106	105	115
Bituminous rock-do			149	152	183
Building and ornamental stone: [4]					
Marble in blocks-do	671	835	992	889	867
Other stone, in blocks, slab, etc-do	8,898	12,432	13,196	(1)	(1)
Broken stone in quarries-do	4,382	7,225	5,783	(1)	(1)
Sand and gravel-do	20,329	25,632	28,768	34,700	(1)
Miscellaneous-do	170	165	184	(1)	(1)
Diatomite	51,799	47,072	57,198	(1)	56,589
Dolomite	434,338	489,744	650,862	(1)	(1)
Earths:					
Coloring	8,109	9,104	6,608	(1)	(1)
Foundry	284,390	342,816	350,127	(1)	(1)
Feldspar	60,952	86,441	94,699	92,588	101,819
Fertilizers:					
Superphosphate (P_2O_5 content)	264,899	228,913	246,253	221,861	242,960
Nitrogenous (N_2 content)	521,273	648,871	669,686	643,608	682,506
Potassic (K_2O content)	(1)	(1)	137,200	177,900	187,500
Fertilizer materials:					
Potash salts (15 percent K_2O)	76,415	331,508	908,320	1,037,995	1,263,676
Thomas slag	91,000	100,000	132,000	121,000	118,000
Leucite (10 percent K_2O)	(1)	(1)	895	80	(1)
Fluorspar	157,933	162,347	156,564	155,559	124,495
Graphite	3,136	3,718	4,068	3,359	1,709
Gypsum [5]-thousand tons	1,910	1,825	2,001	[6] 2,972	(1)
Iodine (crude)-kilograms	15,028	12,570	12,547	11,000	(1)
Lime (hydraulic)-thousand tons	(1)	(1)	5,200	5,355	(1)
Limestone:					
For building purposes-do	8,514	10,521	8,573		
For lime and cement-do	17,816	19,943	19,471	52,300	(1)
Other-do	11,463	15,382	13,407		
Magnesite	6,860	5,973	6,784	8,414	6,815
Pozzolan-thousand tons	2,772	3,170	2,915	3,012	(1)
Pumice-do	234	313	257	317	(1)
Pumicite	133	113	146	(1)	(1)
Salt:					
Rock salt-thousand tons	1,282	1,582	[3] 1,626	1,727	1,943
Evaporated-do	708	1,019	1,216	[6] 1,200	(1)
Silica sand-do	1,648	1,903	2,097	2,404	(1)
Sulfur:					
Ore (25 to 30 percent S)	1,431,450	1,278,330	1,221,155	1,083,859	965,858
Concentrate (90 percent S)	33,572	56,786	75,787	90,042	94,911
Fused, in briquets	121,511	81,020	69,750	53,919	41,788
Talc and steatite	109,258	124,391	[3] 143,626	127,161	135,520
Mineral fuels:					
Asphalt rock, for distillation	(1)	(1)	81,159	48,988	98,907
Coal:					
Anthracite	31,236	19,537	23,654	16,160	13,797
Sulcis coal	707,424	717,141	717,574	676,024	571,425
Briquets	24,000	27,000	29,000	59,000	127,000
Coal derivatives	234,730	264,054	285,864	301,962	306,552
Coke:					
From coke ovens-thousand tons	3,054	3,715	3,876	4,326	4,460
From gas ovens-do	(1)	(1)	(1)	756	719
Lignite:					
Picean (high grade)-do	48	7	4	1	
Xiloid (20 percent H_2O)-do	1,174	1,239	1,521	1,775	1,366
Natural gas-thousand cubic meters	6,117,549	6,447,224	6,862,710	7,150,580	7,267,598
Natural gasoline-thousand 42-gallon barrels	560	551	535	515	515
Petroleum:					
Crude-do	11,551	13,613	13,434	12,308	12,155
Refined products-do	191,929	226,032	269,253	321,563	372,579

[1] Data not available.
[2] Estimate (total of material consumed in agglomerating plants plus net exports).
[3] Revised figure; supersedes that given in commodity chapter, volume 1.
[4] Not including limestone.
[5] Not including alabaster or dimension stone.
[6] Estimate.

TRADE

Mineral and metal exports in 1963 were valued at US$587 million, or 11.6 percent of the value of all exports. Mineral fuels (principally

refined products) were valued at US$281 million, or 5.5 percent of all exports, followed by metals (US$211 million, or 4 percent) and nonmetals (US$95 million, or 2 percent).

Imports of minerals and metals were valued at US$2.1 billion or 28 percent of the value of all imports. Metals were valued at slightly more than US$1 billion, or 14 percent of all imports, followed by mineral fuels (US$943 million, or 12.5 percent) and nonmetals (US$124 million or 1.6 percent). Iron and steel materials were the most important category, valued at US$682 million, followed by crude petroleum (US$665 million), coal and coke (US$176 million), copper (US$160 million), and other minerals (US$177 million).

TABLE 3.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963
Metals:				
Aluminum:				
Ore	-------	-------	930	(1).
Ingots and scrap	91	135	252	Switzerland 137.
Semimanufactures	6,797	7,267	8,284	United States 3,970; West Germany 251; Greece 199.
Antimony	1	3	-------	
Beryllium:				
Ore	37	-------	-------	
Oxide—kilograms	240	-------	3,000	(1).
Bismuth	1	3	-------	
Cadmium	42	83	3	(1962: Belgium-Luxembourg 19; Republic of the Congo (Léopoldville) 15.)
Chromium:				
Chromite	-------	-------	1,500	France 1,500.
Semimanufactures	2	-------	-------	
Cobalt	1	4	-------	
Copper:				
Ore [2]	3,021	4,314	2,534	Spain 1,980; Switzerland 342.
Raw, including metalline	37	36	-------	
Ingots and scrap	287	363	269	Belgium-Luxembourg 131; West Germany 111.
Alloys	7	2	1	(1).
Semimanufactures	12,755	9,681	8,990	Israel 1,767; Portugal 776; Switzerland 664; Iran 639.
Iron and steel:				
Pyrite cinder [3]—thousand tons	720	617	661	Austria 352; Netherlands 115; Belgium-Luxembourg 81.
Scrap—do	1	2	2	France 1; Belgium-Luxembourg 1.
Pig iron, sponge and grit.—do	1	1	1	(1).
Ferroalloys—do	19	8	6	Australia 1; Austria 1; West Germany 1.
Steel:				
Ingots, blooms and billets.—do	133	111	88	Spain 52; Switzerland 34; Argentina 2.
Other rolled—do	757	839	792	(See table 9.)
Lead:				
Ore [2]	4,903	5,603	4,460	Austria 4,000.
Ingots and scrap	28	90	113	(1).
Semimanufactures	187	86	406	Morocco 305.
Magnesium:				
Crude and scrap	4,439	4,559	4,161	West Germany 2,977 (crude).
Wrought	330	372	332	Norway 119; West Germany 80; Austria 69.
Manganese ore	556	644	738	West Germany 738.
Mercury—76-pound flasks	32,680	35,726	75,728	Japan 13,222; United Kingdom 13,068; West Germany 12,204; France 8,639; United States 7,803; Belgium-Luxembourg 2,741.
Molybdenum	13	1	-------	
Nickel:				
Scrap	5	-------	2	(1).
Semimanufactures [4]	734	728	987	Iran 410; Morocco 247; Turkey 44.

See footnotes at end of table.

TABLE 3.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963
Metals—Continued				
Precious metals: [4]				
Gold—thousand troy ounces	132	6	(1)	(1).
Platinum and related metals. do	16	14	26	United Kingdom 18; United States 2, West Germany 1.
Silver do	158	80	103	(1).
Tantalum [5]	--	--	6	(1).
Tin:				
Ingots and scrap—long tons	11	23	6	(1).
Alloys do	17	190	16	(1962: Sweden 141.)
Semimanufactures do	19	53	8	(1).
Tungsten:				
Ore	--	11	--	
Powder and other	--	8	2	(1).
Uranium and thorium—kilograms	100	--	--	
Zinc:				
Ore [2]	78,091	67,006	41,309	France 11,585; Belgium-Luxembourg 11,490; Austria 10,060.
Slab	6,366	2,122	302	United States 268.
Alloys and scrap	6	2	1	(1).
Semimanufactures	365	382	309	Switzerland 227.
Zirconium ore	--	2	38	(1).
Other metallic ores [3]	253	5,693	6,487	United Kingdom 4,822; Belgium-Luxembourg 1,352.
Other metals—kilograms	2,400	700	--	(1962: Switzerland 200; United Kingdom 100; U.S.S.R. 100.)
Nonmetals:				
Abrasives (natural):				
Corundum and garnet	517	11	6	(1).
Emery	63	12	61	(1).
Pumice stone	100,446	135,445	343,825	West Germany 177,931; United States 97,776.
Other	89	117	495	(1).
Andalusite, kyanite, etc	54	303	218	(1).
Asbestos	9,206	7,890	6,412	France 2,659; Belgium-Luxembourg 743.
Barite and witherite	38,642	46,773	22,408	Nigeria 4,550; Rumania 3,300.
Bentonite	19,358	28,234	30,061	Libya 12,497. (1962: Switzerland 11,005.)
Chalk	389	760	225	(1).
Clay and earth:				
Coloring earths	831	1,118	(1)	(1).
Diatomite	4,543	2,949	1,332	(1961 and 1962: West Germany.)
Fuller's earth	59	97	23	(1).
Kaolin	94	111	272	(1).
Kaolinitic earth	18	3	48	(1).
Refractory clays	595	969	869	(1).
Other clays	195	103	282	(1).
Construction materials:				
Building and ornamental stone:				
Alabaster	669	859	884	(1).
Marble	217,357	238,468	251,951	West Germany 58,490; United States 37,988; France 23,485; United Kingdom 19,730; Lebanon 13,431.
Serpentine	(1)	874	987	Switzerland 357; West Germany 294.
Other	28,986	32,580	32,024	Switzerland 8,956.
Crushed stone, chips and powder.	283,316	300,955	339,859	West Germany 49,321; Belgium-Luxembourg 43,407; Switzerland 36,925.
Cement, including clinker	71,567	135,142	149,176	Sudan 51,806; Switzerland 22,242; Libya 14,722.
Gypsum and anhydrite	7,953	7,185	9,367	France 1,014.
Lime	9,488	13,555	18,646	Libya 14,600.
Limestone	1,115	1,054	702	(1).
Cryolite	--	5	1	(1).
Dolomite	10,167	11,345	11,526	Switzerland 5,151; Egypt 2,275.
Feldspar	16,654	17,005	19,433	West Germany 11,700; Netherlands 2,500.
Fertilizers:				
Nitrogenous—thousand tons	1,396	1,344	1,462	Mainland China 412; Egypt 241; Spain 179; Greece 164; Yugoslavia 142.
Phosphatic do	98	115	120	Greece 29; Yugoslavia 21; Nigeria 6.
Potassic do	59	65	77	Japan 26; United States 19; Indonesia 10.
Fluorspar	67,069	49,116	38,268	United States 34,755.
Graphite	1,695	1,613	1,516	France 1,091.
Lithium minerals	(1)	--	20	(1).
Magnesite, raw and calcined	180	203	108	(1).
Mica [6]	61	40	48	(1).

See footnotes at end of table.

TABLE 3.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963
Nonmetals—Continued				
Precious and semiprecious stones (natural):				
Diamonds:				
Uncut thousand carats or semifinished.	(1)	10	(1 7)	Value (thousand lire): United Kingdom 116,357.
Industrial do	(1)	35	7 35	(1).
Other do	(1)	10	(1 7)	(1).
Other stones kilograms	1,192	571	1,087	(1).
Pyrite	227,584	158,268	101,853	Netherlands 53,055; Switzerland 37,238.
Quartz:				
Crushed or powdered	257	586	191	(1).
Other	9,394	3,967	5,038	(1).
Salt	43,080	28,820	75,458	Norway 31,721; United Kingdom 21,041.
Sands:				
Feldspathic and kaolinitic	91	270	1,068	(1).
Siliceous	626	3,616	1,686	(1).
Other	119,125	189,250	175,868	Switzerland 174,025.
Strontium minerals	289	91	89	(1).
Sulfur:				
Ore	------	991	------	
Crude and refined	41,120	14,071	7,657	Yugoslavia 4,273; Cyprus 1,290; Thailand 577.
Talc and steatite	50,173	51,602	47,173	United States 15,700; United Kingdom 6,541; West Germany 5,311.
Other mineral materials	22,309	34,895	46,331	United Kingdom 45,995.
Other ashes and residues, including kelp ash.	24	85	17	(1).
Mineral fuels:				
Asphalt and bitumen (natural)	701	251	398	(1).
Asphaltic and bituminous rock	8,482	8,229	8,753	(1961: United Kingdom 8,436.)
Coal	5,567	4,708	24,143	France 21,784.
Coal tar and other derivatives	2,616	5,260	3,914	France 3,139.
Coke and semicoke	166,439	173,531	149,068	Austria 64,543; Switzerland 26,078; Yugoslavia 20,693.
Lignite	20	------	------	
Peat	------	6	------	
Pech	20,913	30,016	44,292	France 22,870; Spain 18, 370.
Petroleum:				
Crude thousand 42-gallon barrels.	3,248	2,275	1,222	United Kingdom 1,140.
Refined products:				
Gasoline do	15,272	16,063	15,555	Switzerland 3,287; Austria 3,175; France 1,404; United Kingdom 1,220; Sweden 777.
Kerosine do	2,977	2,802	3,636	Netherlands 590; Switzerland 516; United Kingdom 456.
Distillate fuel oil do	19,010	25,335	30,876	Switzerland 9,570; Netherlands 4,821; France 3,869; West Germany 3,180.
Residual fuel oil do	17,109	16,772	17,434	United Kingdom 3,549; Switzerland 2,201; Austria 1,985; Algeria 1,542; Cyprus 1,251.
Lubricating oils do	117	193	283	Switzerland 99; Austria 40.
Liquefied petroleum gas. do	161	193	545	France 123; Brazil 96; Lebanon 74; Libya 30.
Asphalt do	720	746	863	Austria 428; Switzerland 187.
Other do	119	66	90	Switzerland 68.
Total do	55,485	62,170	69,282	
International bunkers:				
Gasoline [8] do	661	2,026	2,937	
Jet fuel do	1,870	2,894	3,328	
Distillate fuel oil do	3,106	3,526	3,706	
Residual fuel oil do	24,206	25,623	28,561	
Total bunkers do	29,843	34,069	38,532	

[1] Data not available.
[2] Includes ashes and other residues.
[3] Includes other iron ore and furnace waste.
[4] Includes alloys.
[5] Form unspecified.
[6] Mostly ground and scrap.
[7] 1963 value in thousand lire: Uncut 127,226; industrial 6,403; other 18,458.
[8] Includes 121,000 barrels of lubricating oils in 1961 and 132,000 barrels in 1962.

TABLE 4.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963
Metals:				
Aluminum:				
Bauxite	261,946	293,721	349,605	Yugoslavia 232,179; India 48,164; Australia 22,226; Guiana 25,084.
Ingots	25,706	44,022	54,112	United States 13,040; Canada 10,780; Norway 10,803; Austria 6,315.
Scrap	29,943	47,448	52,989	United States 18,964; Canada 14,424; France 6,337.
Powder	130	134	154	Austria 85.
Semimanufactures	6,555	10,287	16,113	Belgium-Luxembourg 4,036; France 4,476; West Germany 2,568.
Antimony, unworked	382	394	598	West Germany 301; Belgium-Luxembourg 264.
Beryllium:				
Ore	940	----	----	(1961: India 228; United Kingdom 190; Mozambique 120.)
Oxide kilograms	300	300	100	(1).
Bismuth, unworked	26	33	42	United Kingdom 29.
Cadmium, crude or unfinished	58	25	52	Japan 12; United States 11; Belgium-Luxembourg 9.
Chromium:				
Chromite	76,534	56,503	44,737	U.S.S.R. 27,270; Turkey 7,172; South Africa 6,702.
Crude and scrap	19	19	30	(1).
Cobalt, crude or unfinished	435	235	365	Belgium-Luxembourg 308; United Kingdom 11.
Copper:				
Ash and residue	817	455	363	Switzerland 342.
Crude	12,260	12,664	9,995	South Africa 4,202; Mexico 1,848; Uganda 1,687; Rhodesia-Nyasaland 1,485.
Ingots (refined)	185,867	227,426	213,837	United States 52,189; Rhodesia-Nyasaland 46,361; Republic of the Congo (Léopoldville) 27,200; Chile 25,834; Belgium-Luxembourg 20,037; United Kingdom 17,660.
Alloys	91	96	343	United Kingdom 208; Belgium-Luxembourg 103.
Scrap	23,356	23,440	21,870	France 9,191; West Germany 5,472.
Powder	362	812	500	West Germany 320; United Kingdom 162.
Semimanufactures	5,398	6,809	11,215	Yugoslavia 3,370; West Germany 1,489; Switzerland 1,259.
Iron and steel:				
Iron ore [2] thousand tons	3,389	4,461	5,240	Algeria and Tunisia 846; Brazil 757; Venezuela 651; India 582; Liberia 555; Sweden 519; Peru 489; Chile 346; Mauritania 147.
Iron and steel scrap do	3,399	[3] 4,078	[3] 3,910	West Germany 1,145; United States 1,081; France 1,077.
Ferroalloys do	64	79	104	France 34; West Germany 18; Belgium-Luxembourg 11; South Africa 11; Norway 6.
Pig iron do	884	796	890	West Germany 328; U.S.S.R. 234; Belgium-Luxembourg 85; East Germany 67.
Sponge, shot, and grit do	7	7	8	France 3; Sweden 3.
Steel:				
Ingots, blooms, billets do	792	446	601	West Germany 160; Rumania 137; France 74; U.S.S.R. 73; Belgium-Luxembourg 62.
Other rolled products do	1,602	2,518	3,352	See table 10.
Lead:				
Ore	8,966	8,156	20,966	Morocco 8,731; Bulgaria 6,177; Greece 4,513.
Ashes and residues	790	1,427	1,258	Canada 468.
Ingots	39,227	47,876	38,965	Australia 12,016; Mexico 10,197; Peru 6,780.
Scrap	13,406	20,624	21,381	France 7,510; West Germany 5,175; Switzerland 2,833.
Semimanufactures	2,908	4,715	3,813	Yugoslavia 3,447.
Magnesium:				
Ingots	8	49	30	(1).
Scrap	445	89	348	West Germany 278.
Semimanufactures	6	20	43	(1).

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued
(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963
Metals—Continued				
Manganese:				
Ore	138,774	103,393	168,391	Egypt 60,424; Republic of the Congo (Léopoldville) 49,661; U.S.S.R. 23,815.
Crude and scrap	174	112	130	(1).
Mercury—76-pound flasks	35	609	392	(1962: Yugoslavia 580.)
Molybdenum:				
Ore	1,524	1,168	1,133	United States 1,133.
Powder and scrap	2	36	7	(1962: United States 24; United Kingdom 8.)
Semimanufactures	12	17	12	Austria 6; Netherlands 4.
Nickel:				
Ore	1	10	----------	
Matte, speiss, etc	1,022	1,024	1,062	Canada 960.
Ingots	5,089	4,433	6,164	United Kingdom 3,030; Canada 1,459; Norway 804; Finland 415.
Scrap	1,004	645	607	United States 259; France 145.
Semimanufactures [5]	871	1,865	1,430	United Kingdom 709; West Germany 208.
Precious metals: [5]				
Gold—thousand troy ounces	1,488	3,697	2,472	Switzerland 1,652; United Kingdom 746.
Platinum and platinum group. do	86	79	63	United Kingdom 40; U.S.S.R. 10; Switzerland 4.
Silver do	21,862	18,602	19,509	West Germany 6,623; United Kingdom 5,105; United States 3,360.
Tantalum:				
Ore	----------	----------	3	(1).
Scrap and other	1	1	7	(1).
Tin:				
Ore—long tons	5	----------	----------	
Ingots do	4,492	4,341	4,763	Malaysia 4,294.
Alloys and scrap do	413	869	670	Netherlands 281; Malaysia 261.
Semimanufactures do	63	79	112	West Germany 72.
Titanium:				
Ore	82,628	68,671	98,913	Finland 27,183; Norway 19,800; U.S.S.R. 18,553; Spain 15,250; Australia 15,091.
Crude, scrap, and worked	18	66	24	United States 7; Japan 7; United Kingdom 4.
Tungsten:				
Ore	93	118	80	(1).
Powder and semimanufactures	19	34	33	United States 3; Netherlands 1; Sweden 1.
Uranium and thorium:				
Ore	----------	283	42	(1).
Metal	1	1	1	(1).
Vanadium, ore and metal	1	1	----------	
Zinc:				
Ore	2,554	1,093	9,065	Peru 8,616.
Ashes and residues	15,942	9,293	9,454	West Germany 3,249; Switzerland 3,027; Sweden 588.
Ingots	12,953	26,837	29,417	Australia 6,109; Republic of the Congo (Léopoldville) 2,915; Austria 2,081; Bulgaria 2,074.
Alloys	2,072	2,544	1,909	Belgium-Luxembourg 1,415.
Scrap	4,623	5,237	7,117	West Germany 2,160; France 1,431.
Semimanufactures	442	2,571	3,741	Belgium-Luxembourg 2,255.
Zirconium:				
Ore	6,807	7,539	11,156	Australia 10,564.
Metal	12	16	1	(1).
Other metals:				
Ore	3,511	1,900	2,016	Australia 763; Bolivia 546; South Africa 203.
Ashes and residues	22,710	11,141	12,778	France 2,794; Yugoslavia 1,861; Hungary 1,316; Canada 955.
Crude or worked—kilograms	110	70	10	(1962: United States 50.)
Nonmetals:				
Abrasives (natural):				
Pumice stone	45	86	20	(1).
Emery	2,199	1,777	1,723	Greece 1,663.
Corundum and garnet	495	258	205	(1).
Other	1,264	1,161	1,359	West Germany 1,280.
Andalusite, kyanite, etc.	6,939	11,438	12,018	India 8,242; United Kingdom 1,686.
Asbestos	43,831	40,844	38,757	South Africa 16,317; Canada 14,156.
Barite and witherite	11,096	19,429	21,595	Spain 13,604; Morocco 7,050.
Bentonite	3,982	4,344	4,018	United States 907.
Borates	37,219	58,208	50,175	Turkey 46,200; United States 3,294.
Chalk	6,342	5,597	5,887	France 5,157.

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963
Nonmetals—Continued				
Clays and earths:				
Coloring earths	189	1,043	242	(1).
Diatomite	8,861	2,508	1,663	United States 940.
Fuller's earth	9,079	6,410	7,007	Algeria 4,090; United States 1,020.
Kaolin	186,122	205,656	227,643	United Kingdom 158,654; United States 13,237.
Kaolinitic earth	5,791	3,114	4,285	West Germany 3,728.
Refractory clays	371,798	460,084	474,109	France 182,894; West Germany 146,677; Czechoslovakia 54,480.
Other clays	52,050	48,083	50,707	United Kingdom 45,797.
Construction materials:				
Building and ornamental stone:				
Alabaster	549	746	1,615	Iran 1,448.
Marble	63,688	101,403	122,353	Portugal 62,658; Yugoslavia 22,455.
Other, including slate	16,434	19,968	22,533	Norway 4,944; Sweden 5,253.
Crushed stone, chips, and powder.	3,503	4,228	4,934	France 3,506.
Cement, including clinker	99,248	190,108	120,638	Tunisia 54,509; France 50,834; Yugoslavia 7,848.
Gypsum and anhydrite	599	403	556	(1).
Lime	168	750	2,720	(1).
Limestone	2,121	1,656	921	(1).
Cryolite	549	462	1,080	Denmark 1,060.
Dolomite	979	2,165	1,082	(1962: West Germany 1,337.)
Feldspar	8,349	9,678	11,441	West Germany 4,810; Sweden 2,370; South Africa 1,670.
Fertilizer materials:				
Phosphate rock. thousand tons	1,385	1,574	1,479	United States 650; Tunisia 435; Morocco 262.
Potash salts, natural do	48	38	38	France 23; West Germany 9; East Germany 5.
Potash (K_2O) do	107	157	132	Israel 45; U.S.S.R. 34; Spain 21; France 17.
Thomas slag do	12	24	18	Belgium-Luxembourg 11; Egypt 4.
Other natural fertilizers do	4	7	2	France 2.
Fluorspar	7,489	8,126	9,935	Spain 8,312.
Graphite	9,066	8,908	10,367	Austria 7,937; West Germany 1,419.
Leucite and nepheline	21	49	270	(1).
Lithium minerals	(1)	20	413	(1).
Magnesite:				
Raw	11,509	15,152	12,612	Greece 10,398.
Calcined	42,099	32,518	26,472	Austria 13,206; Yugoslavia 9,455.
Mica:				
Sheet	1,205	1,665	669	India 374.
Scrap	1,522	2,033	1,165	United Kingdom 310; United States 296.
Pegmatite	1,390	1,340	1,536	(1).
Precious and semiprecious stones (natural):				
Diamonds:				
Uncut or semi-finished. carats	(1)	100,000	135,000	Belgium-Luxembourg 70,000.
Industrial and other. do	(1)	245,000	20,000	Belgium-Luxembourg 10,000.
Other stones:				
Uncut or semifinished. kilograms	25,869	11,116	[6] 76,039	(1).
Industrial and other. do	2,076	1,958		
Dust and cuttings do	[7] 20,127	(1)	30	Netherlands 15; Belgium-Luxembourg 6.
Pyrite	532,284	689,922	766,110	Cyprus 355,478; U.S.S.R. 243,620; Yugoslavia 82,828.
Quartz:				
Crushed or powdered	25,693	21,123	30,725	West Germany 13,438.
Other	12,388	9,414	14,931	West Germany 7,908.
Salt	139,647	143,710	55,851	Spain 54,658.
Sands:				
Feldspathic and kaolinitic	4,326	2,915	6,791	West Germany 6,123.
Siliceous	299,981	364,633	435,774	Belgium-Luxembourg 201,406; France 124,395.
Other	5,693	8,848	14,377	West Germany 9,736.
Sulfur:				
Ore	-------	3	100	(1).
Crude and refined	105	124	58	(1).
Talc and steatite	6,713	8,803	13,179	Austria 8,672; India 2,547.
Other mineral materials	24,925	26,218	28,730	South Africa 12,257; West Germany 7,768.
Other slags and ashes, including kelp ash	216	20,681	1,018	(1).

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963
Mineral fuels:				
Asphalt and bitumen (natural)	2,857	2,444	2,509	United States 2,150.
Asphaltic and bituminous rock	2	28	27	(1).
Coal—thousand tons	10,194	10,785	11,217	United States 7,248; West Germany 1,672; U.S.S.R. 1,340; Poland 784; United Kingdom 268.
Coal derivatives—do	57	63	85	Czechoslovakia 21; United States 21; U.S.S.R. 12; West Germany 8.
Coke and semicoke—do	243	327	674	West Germany 425; United Kingdom 127; Hungary 25.
Lignite, including agglomerates—do	250	237	289	West Germany 173; East Germany 66; Yugoslavia 39.
Peat, including agglomerates—do	3	10	4	West Germany 4.
Petroleum:				
Crude—thous. 42-gal. bbls	244,800	299,663	345,973	Kuwait 99,374; Iraq 72,022; Saudi Arabia 58,053; U.S.S.R. 50,243; Libya 21,401; Egypt 16,630; Algeria 11,472.
Petroleum products:				
Gasoline—do	986	1,059	1,031	Netherlands Antilles 360; United States 256; Iran 123.
Kerosine—do	6	12	25	(1).
Distillate fuel oil—do	56	41	271	Rumania 112; Saudi Arabia 83.
Residual fuel oil—do	13,295	19,094	20,994	U.S.S.R. 6,525; Kuwait 4,580; Netherlands Antilles 2,729; Rumania 1,973.
Lubricating oil—do	789	876	1,121	United States 752.
Liquefied petroleum gas—do	363	275	163	France 155.
Paraffin and petrolatum—do	182	200	219	United States 65; Indonesia 57.
Petroleum coke—do	738	849	1,070	United States 936.
Lube extracts—do	(1)	490	620	United States 549.
Other hydrocarbon gases—do	(1)	61	34	France 34.
Asphalt—do	1	2	1	(1).
Total petroleum products—do	(1)	22,959	25,549	

[1] Data not available.
[2] Includes ash, slag, dust, and other waste of iron and steel.
[3] Includes 152,000 tons of used rails.
[4] Includes 66,000 tons of used rails.
[5] Includes alloys.
[6] Mostly semiprecious.
[7] Includes 20,000 kilograms of chalcedony powder.

COMMODITY REVIEW

METALS

Aluminum.—Italian production of primary aluminum in 1963 increased by 12 percent as compared with 1962. The increase was almost entirely due to a 10,000-ton rise in production by plants of the Montecatini Co., particularly a new plant at Bolzano which entered production during the year. Montecatini accounted for two-thirds of the national production in 1963; 29 percent was produced by Società Alluminio Veneto per Azioni (SAVA) at Porto Marghera and 5 percent by a subsidiary of the Aluminium Company of Canada at Turin.

Imports of primary metal in 1963 increased by 23 percent over those of the previous year, and imports of scrap and semimanufactures rose by 11 and 57 percent, respectively. Italy's consumption of primary aluminum appeared to exceed 145,000 tons, but not all of the Italian production was absorbed by the domestic market because of competing imports from the United States, Canada, Norway, and Austria.

Bauxite production fell 13 percent because of decreasing reserves at Montecatini's San Giovanni Rotondo mine near Foggia. This mine produced 72 percent of Italian bauxite in 1963 as compared with 77 percent in 1962. The decreasing reserves caused Montecatini to begin intensive geological exploration in areas known to contain bauxite in the Matese Mountains of Campania.

The drop in domestic bauxite production was compensated by a 23 percent increase in imports. Imports from Yugoslavia increased 43,000 tons, 23 percent over those of 1962, and imports from new sources (Australia and Surinam) made up for a 27,000-ton reduction in imports from India.

New plant facilities added during the year by Montecatini included rolling mills and extrusion presses at Belluno and Porto Marghera, and a new plant was under construction at Porto Marghera. Most facilities were intended to increase production of aluminum sheeting and very wide plates. The company's plan to set up an aluminum reduction plant with a capacity of 100,000 tons of metal per year in Sardinia was temporarily suspended.

Copper.—Italian copper resources are small and are of low grade. Domestic ores consist of two types:

Chalcopyrite concentrates (containing about 20 percent copper) produced as byproducts from lead, zinc, and other metal mines in Sardinia and northern Italy, and cupriferous pyrite containing about 2 percent copper. Concentrate production has averaged less than 3,000 tons annually since 1958 but apparently increased in 1963 despite the closing of the Agordo mine near Belluno during the previous year. Production of cupriferous pyrite averaged about 80,000 tons per year from 1960 through 1962 and may have continued at this level during 1963. Most of the copper produced from these ores was probably used in manufacturing copper sulfate, of which Italy has produced about 75,000 tons annually since 1948.

Total copper consumption in 1962 was 308,000 tons including 214,000 tons of refined copper. Of total consumption, 83 percent was used for copper and alloy semimanufactures, 11 percent for copper and alloy castings, and 6 percent for chemicals. Incomplete data indicate that total consumption increased in 1963, as consumption of refined copper rose by 6 percent and production of semimanufactures increased by nearly 10 percent.

Production of primary copper in 1963 was about 1 percent of total consumption. Output of refined copper was estimated at 12,000 long tons [3] and an estimated 30,000 tons of copper-alloy ingots were produced from scrap. Production of semimanufactures increased by 29,000 tons, principally in copper wire (11,800 tons) and in alloy rods and sections (13,700 tons). Employment in the semimanufactures industry increased to an estimated 19,000 in 1963.

Exports of copper concentrates in 1963 amounted to about half of production. Other copper exports (in percent of national production) were: copper sulfate (6 percent), semimanufactures (3 percent), and refined copper (2 percent). These exports were valued at US$9.7 million.

[3] The British Bureau of Non-Ferrous Metal Statistics (Birmingham.) Bulletin for June 1964. V. 17, No. 6, Aug. 18, 1964, p. 8.

Imports of copper in 1963 totaled about 257,000 tons, 5 percent less than in 1962. Refined copper made up 83 percent of the tonnage, followed by scrap (8 percent), semimanufactures (4 percent) and raw copper (3 percent). In both quantity and value, copper was the principal metal imported (after iron and steel). Imports were valued at US$160 million.

Iron and Steel.—The Italian iron and steel industry is the third largest of the European Coal and Steel Community (ECSC) and the fourth largest in Western Europe. In 1963, Italy produced 14 percent of ECSC steel and 2.7 percent of world output. The industry has ranked eighth in world production since 1958.

In the Italian economy, the iron and steel industry in 1963 accounted for an estimated 2 percent of the gross national product and 5 percent of gross industrial output. The industry has tripled productive capacity over the past 10 years and continued its growth in 1963 as steelmaking capacity increased by 8 percent and a major new steelworks was nearing completion at Taranto. Potential for growth of the industry was illustrated by steel consumption which rose 12 percent over that of 1962 and exceeded productive capacity by more than 20 percent. Although steel production and sales continued to be hampered by foreign competition, investments in production equipment and services for the industry were estimated at US$335 million, more than twice the figure for 1962. Employment remained at approximately the same level as in 1962, with the 1963 monthly average being slightly higher and the yearend total slightly lower than in the previous year. Relative stability in labor relations was achieved by early 1963 as 3-year contracts were signed in both public and private segments of the industry. The contracts provided for a 12-percent raise in minimum wage, a reduction in the workweek (to 43 hours), and other benefits. At the end of 1963, the industry employed 58,500 persons, or 0.7 percent of all industrial labor.

The industry is heavily dependent on imported raw materials. All of the coking coal, most of the iron ore and alloying materials, and half of the scrap requirements were imported in 1963. The reliance on imports and the need to reduce costs have resulted in concentration of Italy's primary iron and steel production in large integrated steelworks on the coast at Genoa, Piombino, Naples, and Taranto. Most of the ferroalloys and special steels are produced in the northern interior where there is abundant hydroelectric power.

The largest organization in the iron and steel industry is Società Finanziaria Siderurgica (FINSIDER), a holding company which includes the steel firms of Italsider, Dalmine, and Terni as well as the mining organization, Società Mineraria Siderurgica (FERROMIN). The FINSIDER group, which is owned 50.55 percent by IRI, produced 91 percent of the pig iron and 53 percent of the steel produced in Italy in 1963. The remainder was produced by private firms, of which the largest are Fiat and A. F. L. Falck. Italsider, a combine of the Ilva, Cornigliano (SIAC), and Breda companies is the largest Italian producer as well as the largest single steel complex in Europe.

The main difficulties experienced by the industry during 1963 were cutbacks in steel production and a buildup of manufacturer's inventories which resulted from excessive imports of low-cost steel from

other member countries of the ECSC. This was due to the offering of steel at "dumping" prices by East European nations and the subsequent lowering of prices within the Community to levels which Italian producers were unable to meet. Decisions by the ECSC High Authority to forbid the "alignment" of ECSC prices to low East European quotations and to raise Community tariffs to the Italian level were expected to provide some relief during 1964. In the meantime the competitive position of the industry is expected to improve as productive capacity more closely approaches national demand and improvements in steelmaking efficiency continue. The oxygen process, already in use at the Cornigliano (Genoa) steelworks, was being installed at the Bagnoli (Naples) works in 1963 and will be the only process used at the Taranto works which was scheduled for completion in late 1964. The Taranto plant was expected to increase Italy's steelmaking capacity by an estimated 20 percent.

Iron Ore.—Italy has no significant deposits of high-grade iron ore. Iron concentrate produced in 1963 accounted for 19 percent of iron raw material consumption and an estimated 16 percent of iron production. Conventional ores provided 13 percent of the total iron requirements, and pyrite cinders provided 3 percent. The tonnage of pyrite cinders consumed was only about one-fourth of total production, as most of this product is normally exported to other West European countries.

In 1963 iron ore production and mine employment decreased by 14 and 17 percent, respectively, continuing declines which began in 1961. The decreased activity was apparently due to the relatively high costs of production and increased imports of higher grade ore. The average iron content of domestic crude ore is usually below 40 percent and practically all of the ore must be beneficiated before use. Of the total crude ore produced in 1963, 56 percent of the tonnage and 80 percent of the iron was recovered as concentrate. Concentration methods included screening, washing, spiraling, heavy-media and magnetic separations, flotation, and sintering. The main sources of production continued to be Elba (pyritic hematite-magnetite ores), Aosta (magnetite), the Bergamo-Brescia region (siderite), and Sardinia (oxide-carbonate-silicate and magnetite ores).

Production of pyrite cinder appeared to be slightly less than in 1962, although information on plant stocks was not available. Consumption in iron ore agglomerating plants decreased by 25 percent, probably because of competition from imported iron ore. The competitive position of Italian pyrite cinder is expected to improve, however, when Montecatini's new roasting plant at Follonica (southeast of Piombino) is completed. This plant, which was nearing completion at the end of 1963, will produce about 1,100 tons per day of pelletized iron concentrate containing 65 to 66 percent iron. Production was scheduled to begin early in 1964. The magnetizing reduction process, which employs fluidized-bed techniques, was developed by Montecatini and Dorr-Oliver, Inc.

Imports of iron ore increased by nearly 1 million tons and were 22 percent greater than in 1962. South American countries supplied 43 percent of all imports, followed by Africa (30 percent), India (11 percent), and Sweden (9 percent). Imports from Peru and Chile

were doubled, and deliveries from Algeria, Brazil, and Sweden were substantially increased as imports from India fell by 450,000 tons, or nearly 50 percent below the level of 1962.

Scrap.—Estimated total scrap consumption in 1963 was 7.4 million tons, an increase of about 5 percent or 400,000 tons as compared with 1962. As in 1962, about half of scrap requirements were met by imports, with the principal supplying countries being West Germany, the United States, and France, in that order. About 60 percent of imported scrap came from EEC countries.

TABLE 5.—Salient iron mining statistics

(Metric tons unless otherwise specified)

	1959	1960	1961	1962	1963
Total production	2,045,000	2,138,000	2,065,000	1,983,000	1,709,000
Average iron content—percent	33.2	32.5	32.5	33.1	35.4
Merchantable ore	1,204,000	1,222,000	1,158,000	1,097,000	970,000
Average iron content—percent	48.9	47.3	48.4	48.0	49.1
Mine stocks (December)	698,000	610,000	620,000	544,000	628,000
Principal sources of ore, by province (in percent of total merchantable production):					
Livorno	33	36	38	(1)	(1)
Sardinia	28	26	23	(1)	(1)
Bergamo-Brescia	18	18	19	(1)	(1)
Valle d'Aosta	17	15	16	(1)	(1)
Others	4	5	4	(1)	(1)
Employment (December)—units	2,886	2,888	2,782	2,482	2,046
Average yield per 8-hour shift:					
Underground	4.28	4.51	4.61	5.09	4.91
Open pit	7.22	7.67	7.99	7.80	9.07
Average hourly wage (direct wage):					
Underground—lire	224	237	250	272	351
Open pit—do	205	217	228	241	304

[1] Data not available.

Sources: Istituto Statistico delle Comunità Europee (Luxembourg). Siderurgia. V. 2, 1964, 208 pp. (Production and employment figures differ slightly from Italian Government statistics.)
Istituto Centrale di Statistica (Rome). Annuario di Statistiche Industriali [1962]. V. 7, 1963, 293 pp.

Pig Iron.—Production of pig iron in 1963 increased by 185,000 tons, 5 percent over that of the previous year. The increase was mainly due to the first full year's operation of a new blast furnace at the Cornigliano steelworks near Genoa. The new furnace, which has an annual capacity of 800,000 tons of pig iron, began operation in the summer of 1962 and increased the industry's productive capacity to 4,140,000 tons.

Production in 1963 was 90 percent of total capacity and constituted 7 percent of the EEC output. Hematitic (Martin) iron made up 76 percent of the total production; phosphorous (Thomas) iron made up 18 percent; and 6 percent was produced in electric furnaces. Domestically produced pig iron accounted for 37 percent of Italy's crude steel output, as compared with 72 to 92 percent in other EEC countries.

Imports of pig iron were 12 percent more than in 1962. West Germany continued to be the principal supplier, followed by the U.S.S.R. As in 1962, about half of all imports were from EEC countries and 30 percent came from East Europe.

Ferroalloys.—Ferroalloy production in 1963 was 4 percent greater than in 1962 but was still about 12 percent less than the record productions of 1960–61. The principal gain was shown by ferrosilico-manganese which rose by 9,000 tons, or 35 percent, and small increases were

shown in most other items. Production of ferrochrome dropped by 50 percent, continuing a sharp decline which began in 1961, but apparent consumption (production plus net imports) was little changed from 1961–62 levels. Apparent consumption of total ferroalloys in 1963 increased by nearly 20 percent over the previous 2 years but much of this increase may have remained in plant stocks. Reported consumption of spiegeleisen and carbon-ferromanganese in steel production accounted for only 60 percent of the available supplies.

Net imports of ferroalloys in 1963 were nearly 40 percent above the previous year, with the principal increases shown by manganese ferroalloys and ferrochromium. France remained the principal supplier, although its share was reduced as imports from Belgium-Luxembourg increased by more than 10,000 tons and substantial gains were also made by West Germany, Norway, and Switzerland.

Exports of ferroalloys during the same period were about 27 percent less than in 1962. Shipments of ferromanganese nearly doubled but substantial decreases were apparent in ferrochromium and ferrosilicon with the latter more than 50 percent lower than in 1962. Exports to non-EEC countries increased during 1963.

TABLE 6.—Production of ferroalloys

(Metric tons)

	1959	1960	1961	1962	1963
Spiegeleisen	3,872	6,604	6,948	4,403	5,569
Siliceous spiegeleisen	253	1,563	1,326	1,347	1,778
Siliceous pig iron (10–12 percent)	3,067	4,646	2,562	2,253	983
Ferromanganese (refined)	3,809	5,004	4,248	3,290	5,386
Ferromanganese (carbon)	19,109	25,448	28,934	23,220	23,731
Ferro-silico-manganese	21,792	24,667	26,241	25,187	34,280
Ferrosilicon	22,862	46,062	51,812	43,905	44,212
Ferrochromium (refined)	237		365	1,195	297
Ferrochromium (carbon)	13,757	20,542	16,272	8,982	4,932
Silico-chrome	91		317	1,135	
Silico-aluminum	606	646	1,107	629	644
Calcium silicide	3,825	4,679	2,921	4,146	3,735
Ferromolybdenum	634	1,065	1,089	957	846
Ferrotitanium	125	176	153	165	202
Ferrophosphorus	98	128	626	711	471
Ferrovanadium	37	93	84	50	81
Ferrotungsten	53	98	88	35	34
Total	94,227	141,421	145,093	121,610	127,181

Sources: Associazione Industrie Siderurgiche Italiane (Milan). Rilevazioni Statistiche. Production 1963. March 10, 1964.
Istituto Centrale di Statistica (Rome). Annuario di Statistiche Industriali [1962]. V. 7, 1963, 293 pp.
Azienda Minerali Metallici Italiana (Rome). Metalli Non Ferrosi e Ferroleghe. 1962 Statistics. August 1963, 165 pp.

Steel.—Italy's crude steel production in 1963 exceeded 10 million tons and was nearly 14 percent of EEC output. As compared to 1962, production increased by 4 percent, and productive capacity increased by 5 percent to approximately 11.1 million tons annually. Production was 91.5 percent of total capacity, slightly higher than in 1962, but the increase of 400,000 tons in production was small compared to domestic demand which rose by 1.5 million tons. Total steel consumption was estimated at 13.7 million tons and exceeded production by nearly 25 percent as compared with 20 percent in 1962. The rise in demand was

TABLE 7.—Ferroalloy trade

(Metric tons)

	1962	1963	Principal destinations and sources, 1963
Exports:			
Spiegeleisen	6	8	(1).
Ferromanganese (carbon)	501	48	(1).
Ferromanganese (refined)	795	1,992	Australia 1,100; United States 400.
Ferrosilicomanganese	295	60	(1).
Ferrosilicon	3,783	1,709	West Germany 606; United Kingdom 218.
Ferrochromium	2,313	1,973	Austria 850; Belgium-Luxembourg 438.
Other	3	20	(1).
Total	7,696	5,810	
Imports:			
Spiegeleisen	13,494	19,370	West Germany 11,084; South Africa 3,227; U.S.S.R. 2,905.
Ferromanganese (carbon)	42,200	52,842	France 24,398; Belgium-Luxembourg 10,861; West Germany 6,394; South Africa 6,265.
Ferromanganese (refined)	1,437	1,875	France 1,104; West Germany 444.
Ferrosilicomanganese	2,712	5,624	Norway 4,599.
Ferrosilicon	6,220	7,505	Switzerland 2,384; France 1,828; Yugoslavia 1,551.
Ferrochromium	10,362	14,990	France 5,426; Sweden 2,387; Norway 1,810; South Africa 1,697.
Ferromolybdenum [2]	813	981	West Germany 327; France 251; U.S.S.R. 155; Austria 123.
Ferrotitanium	465	407	France 296; United Kingdom 99.
Ferrotungsten	188	131	France 53.
Ferroaluminum	196	67	(1).
Other	498	650	France 274; New Caledonia 160.
Total	78,585	104,442	

[1] Data not available.
[2] Includes ferrovanadium.

Source: Istituto Centrale di Statistica (Rome). Statistica Mensile del Commercio con l'Estero. 4th series, No. 12, December 1962, 341 pp. and December 1963, 363 pp.

mainly due to increases of 25 percent in the automobile industry, 13 percent in the mechanical industry, and 4 percent in the construction industry.

Open-hearth steel made up about half of the total production, with 42 percent made in electric furnaces and 6 percent in Thomas converters. Special steel accounted for 12 percent of total production and included 564,000 tons of high-quality carbon steel as well as 657,000 tons of alloy steel. The alloy steel figure includes 506,000 tons of structural steel, 82,000 tons of stainless steel, and 46,000 tons of bearing steel.

Production of hot-rolled items in 1963 increased by 430,000 tons, 6 percent over that of 1962. The principal gains were shown in commercial bars and rods (up 235,000 tons) and coils (up 100,000 tons); these items constituted 36 percent and 20 percent, respectively, of total production. Hot-rolled sheet and strip made up 16 percent of production, followed by seamless tube (10 percent) and rails and heavy sections (10 percent). Production increases of 28 percent and 35 percent, respectively, were shown in cold-rolled sheet (up 360,000 tons) and tinplate (up 55,000 tons) as compared with 1962.

TABLE 8.—Salient statistics of iron and steel industry
(Thousand metric tons unless otherwise specified)

	1961	1962	1963
Production:			
Pig iron:			
Blast furnace	2,771	3,307	3,508
Electric furnace	285	249	232
Total	3,056	3,556	3,741
As percent of crude steel produced	34	38	37
Percent produced in steel works	94	94	94
Steel:			
Open hearth	4,986	5,160	5,266
Electric	3,506	3,960	4,235
Thomas converter	632	637	655
Bessemer converter—metric tons	97	45	19
Oil furnace—do	—	628	742
Total	9,124	9,758	10,157
Ingots	8,924	9,560	9,960
Castings	201	197	196
Special steel	1,569	1,337	1,221
Hot rolled products:			
Rails and accessories	190	172	151
Beams and heavy sections	533	595	634
Bars and rods	2,277	2,465	[1] 2,848
Wire rod	653	603	563
Plates, wide	25	25	13
Coils	1,405	1,538	1,636
Sheets	883	902	846
Strips	415	417	429
Seamless tube	781	793	817
Rims and wheels	36	37	43
Total (national production)	7,198	7,547	7,980
Other rolled products:			
From coils (from national production and imports):			
Cold rolled sheets	1,139	1,295	1,655
Hot rolled sheet and strip	317	271	239
Other cold rolled sheet	18	11	9
Magnetic sheet	56	68	77
Tinplate	173	159	214
Galvanized and other plated sheet	104	105	113
Semifinished, for pipes	264	289	276
Welded pipe	325	490	549
Rough forgings and castings	242	242	227
Consumption:			
Apparent steel consumption, kilograms/capita	224	248	[2] 268
Raw materials:			
Pig iron production:			
Iron ore (direct to furnaces)	2,610	3,443	3,506
Iron ore (agglomerated)	2,360	2,451	2,554
Pyrite cinders (in agglomerates)	453	313	232
Manganese ore (direct and agglomerated)	91	85	60
Coke (kilograms per ton of pig iron produced)	642	664	636
Coke (in blast and electric furnaces)	1,984	2,379	2,398
Coke (in agglomerating plants)	108	132	145
Scrap	40	30	19
Limestone, lime, etc	657	[3]	[3]
Methane (million cubic meters)	664	[3]	[3]
Steel production:			
Scrap	6,546	6,996	7,459
Pig iron	3,319	3,672	[2] 3,764
Iron ore	269	325	227
Spiegeleisen and carbon-ferromanganese	55	61	[2] 65
Manganese ore	2	1	[2] 1
Lime, phosphate and other additives	509	[3]	[3]
Methane—thousand cubic meters	269,410	[3]	[3]
Production facilities:			
Number of blast furnaces operating—(available)	11(12)	12(13)	12(13)
Number of open hearth furnaces operating—thousand cubic meters	51(65)	50(62)	49(60)
Number of electric furnaces operating—do	153(196)	152(185)	156(194)
Number of Thomas converters operating—do	2(5)	3(5)	3(5)
Employment (December, each year)—units	56,349	59,713	58,561
Average direct hourly wage—lire	357	402	462

[1] Includes 145,000 tons of rolled iron from rerolled scrap.
[2] Estimate based on figures for 9 months (January to September).
[3] Data not available.
Sources: Associazione Industrie Siderurgiche Italiane (Milan). Rilevazioni Statistiche. Production 1963. March 10, 1964.
Istituto Statistico delle Comunità Europee (Luxembourg). Siderurgia. V. 3, 1964, 208 pp.
Bulletin de la Chambre Syndicale de la Sidérurgie Française (Paris). Italie-Statistiques de la Production Sidérurgique 1963. No. 446 (red series), 1964.

Exports of steel in 1963 were about 8 percent less than in 1962. The total tonnage decreased by 70,000 tons, principally in small-diameter bars, and in ingots, blooms, and billets. As in 1962, rolled steel products made up 85 percent of all exports, with the principal items being tubes (37 percent); uncoated sheet (25 percent); ingots, blooms, and billets (10 percent); and small-diameter bars (6 percent). Of all steel exports, 11 percent went to EEC countries as compared to 7 percent in 1962. Exports of steel to the U.S.S.R. and other East European countries probably fell at least 30 percent below the 1962 level; shipments of EEC treaty items [4] were one-third less and although data on tube products was incomplete, Argentina appeared to have replaced the U.S.S.R. as the principal importing country. Spain replaced Argentina as the principal destination of ingots and other crude forms.

Imports of steel increased by nearly 900,000 tons, 28 percent more than in 1962. Most of the increase occurred in flat rolled products such as coils (up 352,000 tons), sheet and strip (up 228,000 tons), and coated sheet (up 80,000 tons including a 50,000-ton increase in tinplate). Imports of steel ingots, blooms, and billets increased by 155,000 tons.

Rolled products constituted 82 percent of all steel imports, and ingots and other crude forms, 15 percent. Of EEC treaty items, Common Market countries supplied 60 percent followed by the U.S.S.R. and other East European countries (12 percent); Japan (9 percent); and other West European countries (9 percent). Imports from Japan increased to 351,000 tons as compared with 68,000 tons in 1962. Most of the Japanese steel was in coils for re-rolling.

General Steel Industry Expansion.—The iron and steel industry is engaged in an expansion program intended to increase steelmaking capacity to 15.8 million tons annually by 1966. Oxygen-steelmaking

TABLE 9.—Exports of rolled steel products [1]

(Thousand metric tons)

Commodity	1962	1963	Principal destinations, 1963
Coils	15	15	EEC (France) 6; West Europe 7; Israel 2.
Rails and accessories	7	11	U.S.S.R. 75; West Germany 47; France 47; Switzerland 25; Spain 22; Egypt 14; Israel 13; other West Europe 56; other East Europe 46.
Wire rod	28	10	
Bars	110	55	
Sections	16	19	
Strip	29	13	
Sheet (uncoated)	205	225	
Tin plate and other	34	45	
Transformer sheet	18	15	
Total EEC Treaty items	462	408	
Cold drawn wire	7	8	(2).
Steel pipe and fittings	338	323	Argentina 137; U.S.S.R. 50; Libya 24; Colombia 9; United States 9; Nigeria 7.[3]
Total rolled steel	807	739	
Rough forgings	16	19	(2).
Used rails	16	34	(2).
Iron pipe and fittings	7	8	(2).

[1] Istituto Statistico delle Comunità Europee (Luxembourg). Siderurgia. V. 2 and V. 3, 1964.
[2] Data not available.
[3] Istituto Centrale di Statistica (Rome). Statistica Mensile del Commercio con l'Estero, 4th series, No. 12, December 1963, 363 pp.
[4] EEC treaty items, which made up 57 percent of all steel exports and 95 percent of imports in 1963, do not include tube products, cold-drawn wire, rough forgings, or used rails.

TABLE 10.—Imports of rolled steel products [1]

(Thousand metric tons)

Commodity	1962	1963	Principal sources, 1963
Coils	570	922	Japan 233; West Germany 176; U.S.S.R 94; Belgium-Luxembourg 82; Canada 59; Netherlands 39; United Kingdom 35; Austria 34.
Rails and accessories	9	17	West Germany 667; France 555; Belgium-Luxembourg 344; United Kingdom 127; Netherlands 126; Japan 117; Austria 69; Sweden 55; East Europe 50; Yugoslavia 43; United States 39.
Wire rod	94	143	
Bars	159	184	
Sheet piling	2	1	
Sections	274	320	
Plates (wide)	24	13	
Strip	119	199	
Sheet (uncoated)	909	1,057	
Tinplate and other	176	257	
Transformer sheet	51	67	
Total EEC Treaty items	2,387	3,180	
Rough forgings	41	42	[2].
Cold drawn wire	16	29	[2].
Steel pipe and fittings	47	60	[2].
Used rails	152	66	[2].
Total rolled steel	2,643	3,377	
Iron pipe and fittings	27	41	[2].

[1] Istituto Statistico delle Comunità Europee (Luxembourg). Siderurgia. V. 2 and v. 3, 1964, pp. 208.
[2] Data not available.

facilities will make up 30 percent of this capacity. In 1964, total steelmaking capacity is expected to increase to more than 13 million tons when the new works at Taranto begins production late in the year. Initial capacity at Taranto will be about 2 million tons each for pig iron, ingot steel, and rolled products consisting chiefly of wide strip, sheets, and plates. A large-diameter pipe mill has been in operation since late 1961, using plates obtained from SIAC in Genoa until local production begins.

In oxygen steelmaking, two oxygen plants had been installed at the Cornigliano steelworks by October 1963 and were supplying six open-hearth furnaces. At Bagnoli, one oxygen plant was completed and two more were under construction. Facilities at Taranto will consist of two 285 to 330-ton basic oxygen converters, possibly the largest in the world.

Four blast furnaces were under construction in 1963; two at Taranto; one at Piombino; and one at Trieste. Italian pig iron capacity is expected to reach 5.9 million tons by the end of 1964 and 8.4 million tons by 1966. Italsider's cold-rolling plant at Novi Ligure (near Genoa) began production of cold-rolled sheet early in 1963. Initial capacity of the plant was 250,000 tons annually, to be increased to 850,000 tons by the end of 1964. The plant will be fed with hot-rolled flats from the Cornigliano and Taranto works.

A plant to produce rolled stainless steel products was under construction in 1963 at Terni in central Italy. The plant will have an initial capacity of 30,000 tons and is a joint venture of Terninoss S.p.A. and the United States Steel Corp.

Lead and Zinc.—Lead-zinc ores are one of the principal mineral resources of Italy. Mine production of zinc was the largest in Western Europe until 1963 when, because of cutbacks in Italian production, Spain became the principal producer and Italy's output was matched by West Germany. In mine production of lead, Italy ranks second

in the EEC (after West Germany) and fifth in Western Europe. Most of the cadmium and silver produced by Italy are obtained as by-products from the lead-zinc ores and are sometimes the deciding economic factors in mine operation. In addition, concentrates of fluorspar and barite are obtained from the mill operations.

Most of the mines are in Sardinia, principally in the Iglesias region. Other important deposits are worked in northern Italy near Varese and Bergamo (Lombardy) and near Bolzano, Belluno, and Udine in the Venetian provinces. Total proved reserves in all mines in 1962 were 850,000 tons of lead ore (5 to 10 percent lead) and 1,850,000 tons of zinc ore; 70 percent of the zinc reserves and 85 percent of the lead reserves are in Sardinia. Mining and processing of lead and zinc ores is mostly done by three organizations: Società Montecatini, which includes the Monteponi and Montevecchio Company; Società Mineraria e Metallurgica di Pertusola; and the government agency, Azienda Minerali Metallici Italiana (AMMI). The Montecatini organization produced about half of the country's lead and 40 percent of the zinc in 1963. Monteponi and Montevecchio operated at least six mines and seven plants in Sardinia including smelters at Monteponi and San Gavino and another at Vado Ligure near Genoa. The Vado Ligure plant, with a zinc production capacity of 12,000 tons per year, was closed in 1963 as part of Montecatini's plan to centralize metal operations at its Porto Marghera plants near Venice. Zinc production at Porto Marghera was scheduled to increase from 20,000 to 30,000 tons in 1964. Società di Pertusola operates four mines and plants in Sardinia, as well as others in northern Italy and smelters at La Spezia (lead) and Crotone (zinc). AMMI operated two mines and three plants in Sardinia, other mines in northern Italy near Bergamo and Belluno, and the Ponte Nossa zinc plant at Bergamo. At the end of 1962, total annual metal production capacity in Italy was 72,000 tons of lead and 91,000 tons of zinc. Employment in mines and plants in December 1963 was approximately 8,250.

Production of lead and zinc ores in 1963 dropped by more than 20 percent. Production of lead concentrates decreased by 15,000 tons and of zinc concentrates by 56,000 tons. The decreases were partly due to strikes in the early part of the year and also to low metal prices, but there has been a steady decline in lead ore production for several years. Rising prices in the latter months of 1963 allowed the industry to recoup some of its losses, to increase production, and to accelerate plans for reorganization. By the end of the year, a new mine (Marzio-Brusumpiano) had been opened by Miniere Riunita Varesine (MIRIVA) in northern Lombardy and another mine, near Nuoro in Sardinia, was scheduled for production in 1964 by RIMISA, a subsidiary of the Monteponi and Montevecchio Company. MIRIVA also had 12 exploration permits in Sardinia.

The decreased output of Italian mines in 1963 was accompanied by increased imports of both lead and zinc ores, and metal production was maintained at about the same level as in the previous year. Zinc production dropped by 4,000 tons or 5 percent below 1962 while lead production was practically unchanged. The total supply and consumption of both metals in Italy in 1963 was apparently not significantly changed as compared to 1962. In the latter year, lead consump-

tion was 111,000 tons, including 91,000 tons of refined lead, and consumption of zinc was 153,000 tons, including 106,000 tons of refined metal.

Exports of lead concentrate in 1963 decreased by 20 percent (1,200 tons) while exports of zinc concentrates dropped by 27,000 tons, or 40 percent as compared with 1962. Of concentrates exported in 1962 and 1963, about two-thirds of the lead and 15 to 40 percent of the zinc were reported as temporary exports, probably for smelting and refining and re-import into the country. Exports of zinc metal decreased by 85 percent to 300 tons while exports of lead were slightly increased.

Imports of lead ores in 1963 increased by 13,000 tons and were more than twice the quantity imported in 1962. Imports of lead scrap also increased slightly but the tonnage of ingots dropped by 9,000 tons and was nearly 20 percent below the 1962 level. Imports of zinc ores increased 8,000 tons, and combined imports of ingots and scrap rose about 5,000 tons. About one-fifth of the imported lead and zinc ingots were reported as temporary imports.

Because of the importance of the lead-zinc industry to the Italian economy as well as to the EEC, the Italian Government has given high priority to reorganization and development of the industry. The State minerals agency, AMMI, and the Montecatini group plan to construct three new milling plants in Sardinia with a total investment of 54 billion lire (US$86 million), of which about two-thirds will be spent by the Monteponi & Montevecchio Co. for a new smelter at San Gavino and new flotation plants at Campo Pisano and at the open-pit mine near Sos Enattos. AMMI planned to construct two new smelters, one at Porto Vesme and the other at Massua, and was conducting new explorations for lead and zinc in Sardinia as well as on the mainland. AMMI's program in 1963 also included plans for a zinc-plating plant in the Friuli-Venezia Giulia region to use the metal produced at its Ponte Nossa plant.

Magnesium.—Italian production of magnesium metal has averaged about 5,500 tons per year since 1960. With domestic consumption about 800 tons annually, approximately 80 percent of production is exported, mainly to West Germany.

Most, if not all, of this metal has been produced electrolytically from dolomite by Società Italiana per il Magnesio e Leghe di Magnesio in its plant at Bolzano. In 1963 the company began a program of modernization and extensions to the Bolzano plant which will raise productive capacity to 10,000 tons annually in 1965.

In Sardinia, the country's first plant for production of magnesium oxide from sea water was nearing completion at San Antioco near Cagliari. The plant will have a productive capacity of 50,000 tons per year and is expected to begin production in 1964. This project, costing about 10 billion lire (US$16 million), was financed by Italian, British, and German capital under the company name of SARDAMAG.

Manganese Ore.—Italy is the only producer of manganese ore (containing more than 20 percent manganese) within the European Economic Community. Annual production has remained fairly constant over the past 10 years, averaging 47,000 tons of beneficiated ore with an average manganese content of 25 to 30 percent. Although

data on its use was not available, the ore produced in 1963 would account for 75 percent of blast furnace consumption, or an estimated 25 percent of the manganese used in ferroalloy production. At the end of the year, ore stocks at the mines were 18,000 tons and employment had decreased to 134 as compared with 246 in 1959.

Almost all domestic production came from FERROMIN's Gambatesa mine, north of La Spezia. Deposits of manganiferous iron ore, with an average manganese content of 15 to 18 percent, were formerly mined near Grosseto but production was stopped in 1958.

Imports of manganese ore increased by 64,000 tons, or 62 percent more than in 1962. The apparent rise in demand was not accounted for by increased consumption in the iron and steel industry but may have been due to stock requirements or other industrial uses. In 1963, Egypt replaced Angola as the principal source of supply and imports from the Republic of the Congo (Léopoldville) tripled as compared with 1962.

Mercury.—Italy, closely followed by Spain, continued to rank first among world producers of mercury in 1963 and accounted for 23 percent of estimated world production. Although the tonnage of crude ore produced has declined each year since 1960, metal production has remained fairly constant at about 55,000 flasks. As in previous years, most mercury production came from the mines east of Grosseto which are operated by the government-controlled Società Mineraria Monte Amiata and by the private concern, Stabilimento Minerario del Siele. These two companies accounted for about 90 percent of production, from cinnabar ores containing an average mercury content of 0.5 to 0.7 percent.

Recently installed Gould furnaces at Monte Amiata's Abbadia San Salvatore mine have increased productive capacity and have raised mercury recoveries to about 95 percent as compared with 85 percent recovered by use of the older Czermak-Spirek furnaces. The Siele company was also improving mercury recovery at the Cerreto Piano mine by use of flotation. Employment in mercury mines and plants was 1,400 at yearend.

In 1962 Monte Amiata was exploring for mercury elsewhere in Italy, including Sardinia, and had purchased the Castagneto della Trinità mine 30 kilometers northwest of Rome.

Exports of mercury in 1963 were more than double those of 1962 and exceeded the year's production by 21,000 flasks. This was attributed to the higher prices obtained in the latter part of 1963 and to release of company stocks. Most of the increased deliveries went to Japan, the United Kingdom, and West Germany. The decreased level of stocks at the end of the year was expected to result in increased production during 1964.

Uranium.—Radioactive mineral investigations have been conducted in Italy by Società Minerali Radioattivi Energia Nucleare (SOMIREN), a subsidiary of AGIP Nucleare in the ENI group, and also by Società Montecatini and Società Chimica e Mineraria per l'Uranio. Most of the deposits are located in northern Italy at Val Serio (Lombardy), Val Rendena (Trentino), Val Maira (Piedmont), and in Cuneo Province, but others were reported from Lazio

(Rome area), from Calabria, and from Sardinia. None of the occurrences appear to be of economic importance.

The largest deposits were reported to occur near Novazzo in Val Serio. In 1961 SOMIREN completed more than 1,000 meters of exploratory tunnels and estimated that the deposits contain 600,000 tons of material having an average U_3O_8 content of 0.12 percent. Previously, SOMIREN had estimated that the Val Rendena concession contained 80,000 tons and the Val Maira concession contained 50,000 tons of uranium-bearing material. In 1959 Società Chimica e Mineraria per l'Uranio reportedly mined 244 tons of material containing 0.15 percent U_3O_8 from its concessions in Cuneo Province.

In 1961, AGIP Nucleare and Società Italiana Meridionale Energia Atomica (SIMEA) were constructing two research reactors near Bologna as well as the Latina nuclear powerplant south of Rome. In December 1961 a contract was signed with the United Kingdom for the purchase of nuclear fuel for the Latina plant.

Other Metals.—Italy's small production of antimony came from oxide and sulfide deposits in the Cagliari district of Sardina. Production decreased to one-fourth of the 1962 level while imports of metal increased by 200 tons.

A small amount of tungsten ore has been produced annually from the Traversella mine 50 kilometers north of Turin. The mine, operated by the Fiat company, produces concentrates of iron, sulfur (pyrite), copper, and tungsten from ore consisting largely of iron and copper sulfides. Scheelite, which constitutes 0.002 to 0.005 percent of the ore, is recovered by tabling and flotation. The ore also contains small amounts of lead, bismuth, cobalt, molybdenum, and traces of uranium. The plant is run on two shifts and has an ore capacity of 360 tons per day.

Italy imports relatively large quantities of titanium and zirconium concentrates. Imports of titanium concentrates in 1963 increased by 30,000 tons about 45 percent more than in 1962. Most of this material was probably used by the chemical industry for manufacture of titanium dioxide, production of which has risen steadily from 13,600 tons in 1956 to 35,000 tons in 1962. A small amount was probably used in ferroalloy production.

Imports of zirconium concentrate in 1963 increased by 3,600 tons, 48 percent more than in 1962. The material may have been mostly used for foundry sands or other refractory materials.

NONMETALS

Asbestos.—Although Italian production of asbestos is relatively small compared to the major producing countries, Italy ranks seventh in world production and first in Western Europe. Since 1960, annual production has been maintained at about 55,000 tons, slightly exceeding U.S. production until 1963. About two-thirds of the Italian product is made up of various short-fiber grades, about one-third is powder, and several hundred tons of long-fiber tremolite is usually produced. The bulk of 1963 production came from the Turin area and was concentrated by air-separation from an estimated 1,300,000 tons of crude ore. Long-fiber asbestos is mined near Sondrio and Aosta.

Exports in 1963 amounted to about 10 percent of production, mostly to West European countries, with the remainder consumed within the country. Imports, probably of long-fiber grades, are mostly obtained from South Africa and Canada; these imports increased from 14,000 tons in 1959 to 44,000 tons in 1961 but since then have gradually decreased.

Barite.—Production of barite in 1963 decreased by 15,000 tons and was 12 percent less than in 1962. The drop in production was accompanied by sharply reduced exports as well as decreased drilling for oil and gas in Italy during the year. Exports fell by 24,000 tons and were less than half the quantity exported during the previous year. The decline in exports was chiefly due to reduced shipments to Iran and Kuwait.

Bentonite.—Production of bentonite increased by 31,000 tons in 1963. The increased output was apparently due to higher domestic demand, although exports of this commodity increased by about 2,000 tons as compared with 1962.

Cement.—For several years, Italy has ranked fifth in world cement production and second in the EEC. In 1963 production increased 10 percent to more than 22 million tons. This was 40 percent of EEC output and an estimated 6 percent of world production. More than 99 percent of production was used within the country for construction of roads, buildings, dams, and industrial plants.

Cement production in 1963 was 40 percent greater than in 1960 and was twice the output of 1955. In 1960 there were 72 firms producing cement, with 115 plants and 224 kilns with a total rated capacity of 17,282,000 tons per year. Based on the increase in production, the industry's capacity had increased by 1963 to an estimated 24 million tons per year and plant employment had increased to about 20,000.

The cement industry is concentrated in northern Italy, particularly in the highly industrialized area between Genoa and Milan although there are numerous plants throughout the Po Valley and some large installations near Naples and Rome. In 1960, the largest plants were located at Bergamo (840,000 tons per year), Naples (800,000 tons), and Milan (580,000 tons). An estimated 50 percent of productive capacity was located in northern Italy, 20 percent each in central and southern Italy, and 10 percent in Sicily and Sardinia. It is unlikely that this distribution was radically changed in 1963 although the industrialization of southern Italy, including Sicily and Sardinia, has been a major objective of the Italian Government. The principal limestone quarries are also located in northern Italy close to the centers of cement production. The largest cement companies in 1960 were Italcementi Fabbriche Riunite Cemento (19 plants, total annual capacity of 4,345,000 tons); Unione Cementi Marchino (a subsidiary of Società Fiat) (10 plants; 1,700,000 tons); the Segni Co. (5 plants; 1,620,000 tons); and Cementerie del Tirreno (CEMENTIR) (2 plants; 1,300,000 tons). CEMENTIR is part of the government-controlled FINSIDER combine.

Construction Materials.—*Building and Ornamental Stone.*—Production of block marble in 1963 was slightly less than in 1962 and was 12 percent below the 1961 level. Data on other stone production was not available for 1962 or 1963, but total annual production (excluding

crushed stone) has averaged 20 million tons for the previous 4 years. Polished and block marble produced in 1963 was valued at an estimated US$37 million.

More than 80 types or grades of marble are produced in Italy, mostly from Tuscany, and numerous other varieties of metamorphic, igneous, or sedimentary rock are quarried in many parts of the country including Sicily and Sardinia. The most recent statistics available indicate that in 1959, the marble and building stone industry employed about 50,000 persons, including 23,600 in quarries, 23,400 in finishing shops, and 3,000 in sawing plants. At the end of that year there were 2,500 operating quarries with 676 sawing plants and 5,000 finishing shops.

In 1961 production of building and ornamental stone of all types (excluding crushed stone) was about 22 million tons, of which block marble constituted 4 percent, other dimension stone 14 percent, and rough stone 82 percent. Limestone accounted for 38 percent of total production, followed by diabase (14 percent), basalt and lava (10 percent), and marble (9 percent). The estimated value of this production was US$72 million, of which marble accounted for 44 percent, followed by limestone (10 percent), calcareous tufa (10 percent), and travertine (9 percent).

Exports of marble in blocks, slabs, and finished pieces in 1963 increased by 5 percent over those of 1962 and were valued at an estimated US$23 million. Exports of other dimension stone were valued at US$800,000. There is a substantial demand for chips, powder, and other stone waste, and exports of this material (principally marble and onyx) in 1963 were valued at US$3.7 million.

Imports of building stone have doubled since 1961, and the tonnage imported in 1963 was approximately equal to half of Italy's exports. Portuguese marble was the principal item and was valued at US$5.8 million. The only other building stone imported in appreciable quantity was granite or similar rock in unfinished blocks, mostly obtained from Norway and Sweden.

Miscellaneous Quarry Products.—In 1961 quarries produced an additional 40 million tons of crushed rock and rubble, of which more than 50 percent consisted of limestone and gypsum for industrial use. The quantity of other materials produced in quarries was 60 million tons, of which sand and gravel constituted 51 percent and clays 41 percent. The total value of crushed rock and other quarry products was estimated at US$82 million. Detailed production statistics for the quarrying industry are given in table 11.

Fertilizer Materials.—Italy's production of potash ore in 1963 increased by 20 percent as expansion of mine operations continued in the Caltanissetta and Enna areas of Sicily. With production beginning in 1957, annual output of potash ore has risen to more than 1.2 million tons. New mines under development or planned at both localities in 1963 were expected to increase annual production capacity to 2 million tons in 1966. The potash content of ore produced in 1963 was estimated at 190,000 tons.

TABLE 11.—Quarrying industry statistics

(Thousand metric tons unless otherwise specified)

Commodity	Production				Main producing centers, 1961 (in order of quantity produced)
	1958	1959	1960	1961 [1]	
Building and ornamental stone:					
Alabaster:					
Calcareous (onyx)	2	1	1	1	Trieste, Firenze, Siena.
Gypseous	5	4	8	6	Pisa.
Breccia and conglomerate:					
Cut and worked	13	12	14	14	Agrigento, Bergamo.
Other pieces	54	50	48	59	Syracuse, Messina, Genoa, Agrigento.
Calcareous tuff:					
Cut and worked	818	800	840	809	Lecce, Bari, Agrigento, Palermo.
Other pieces	867	867	1,096	882	Lecce, Taranto, Bari, Palermo, Foggia.
Diabase (pieces)	14	--------	700	3,172	Genoa.
Diorite:					
Cut and worked	8	10	8	6	Turin, Novara.
Other pieces	--------	4	5	295	Bolzano-Bozen.
Gneiss:					
Cut and worked	209	146	96	116	Novara, Cuneo, Turin.
Other pieces	3	2	2	1	Cosenza.
Granite:					
Cut and worked	77	63	67	80	Sondrio, Novara, Livorno.
Other pieces	129	105	121	27	Catanzaro, Sondrio. (Prior to 1961, Sardinia.)
Gypsum:					
Cut and worked	64	67	70	74	Agrigento, Caltanissetta, Enna.
Other pieces (for industrial use).	1,170	1,910	1,825	2,001	Ravenna, Asti, Bergamo, Bologna.
Lava:					
Cut and worked	427	454	433	413	Naples, Catania, Rome, Padua.
Other pieces	1,511	1,588	2,325	1,916	Padua, Rome, Catania, Naples.
Limestone:					
Cut and worked	678	708	816	728	Bari, Syracuse, Ragusa, Palermo, Agrigento.
Other pieces	7,190	7,806	9,705	7,845	Bergamo, Avellino, Alessandria, Bari, Rome.
For lime and cement	13,634	16,900	19,083	18,522	
Marly (for hydraulic lime)	1,275	916	860	949	Trento, Firenze, Piacenza, Como, Vicenza, Agrigento.
Crushed	9,432	11,463	15,382	13,407	[2].
Marble:					
White, in blocks	439	423	508	677	Massa-Carrara, Lucca, Brescia, Trieste, Vicenza, Verona.
Colored, in blocks	215	248	328	315	
White and colored, other pieces.	621	711	870	1,168	Bergamo, Verona, Brescia, Siena, Vicenza.
Peperino:					
Cut and worked	14	13	13	13	Rome, Viterbo.
Other pieces	92	86	81	82	
Porphyry:					
Cut and worked	112	209	183	159	Trento, Bolzano-Bozen, Varese.
Other pieces	24	28	30	30	Varese, Bolzano-Bozen, Trento, Livorno.
Quartz and quartzite:					
Cut and worked	9	8	9	11	Cuneo, Turin, Sondrio.
Other pieces	157	142	211	170	Bergamo, Grosseto, Trento, Savona.
Sandstone:					
Cut and worked	210	240	202	245	Firenze, Lecce, Livorno, Arezzo.
Other pieces	853	932	762	906	Firenze, Livorno, Arezzo, Palermo, Messina, Enna.
Schist:					
In slabs, worked	25	26	24	51	Sondrio, Valle d'Aosta.
Other pieces	5	5	1	6	Bergamo.
Serpentine:					
Cut and worked	10	--------	--------	--------	(1958: Parma 10 tons.)
In chunks and scraps	64	109	163	47	Genoa, Parma.
Slate, in sheets	51	53	58	61	Genoa, Sondrio, Bergamo.
Syenite, cut and worked	15	15	14	12	Vercelli.
Travertine:					
In blocks, worked	263	272	264	291	Siena, Rome, Ascoli-Piceno, Grosseto, Terni.
Other pieces	194	203	195	267	Rome, Viterbo, Siena, Grosseto, Terni.
Volcanic tuff:					
Cut and worked	80	101	122	117	Rome, Grosseto, Viterbo.
Other pieces	1,563	1,634	3,458	1,667	Rome, Naples, Viterbo, Latina.
Other crushed stone	4,449	4,382	7,225	5,783	Caserta, Genoa, Rome, Turin, Varese (all types).

See footnotes at end of table.

TABLE 11.—Quarrying industry statistics—Continued

(Thousand metric tons unless otherwise specified)

Commodity	Production				Main producing centers, 1961 (in order of quantity produced)
	1958	1959	1960	1961 [1]	
Other materials:					
Clays:					
For bricks and terracotta	16,659	18,241	18,752	22,448	Rome, Pavia, Turin, Alessandria, Bologna, Siena.
For cement	3,012	2,257	2,338	2,201	Rome, Terni, Pescara, Padua, Bari, Syracuse.
Bianchetto	10	11	--------	12	Naples.
Dolomite, for refractory and other uses.	407	434	490	651	Genoa, Brescia, Bergamo, Massa-Carrara.
Other refractory materials	69	70	73	66	Vercelli, Firenze.
Diatomite	45	52	47	57	Viterbo, Rome, Siena, Grosseto, Terni.
Earths:					
For coloring	7	8	9	7	Verona.
Foundry	299	284	343	350	Asti, Udine, Treviso, Lucca.
Marmorino	59	54	75	83	Udine, Treviso.
Potstone tons	8	1	15	30	Sondrio.
Pozzolan	2,715	2,772	3,170	2,915	Rome, Viterbo, Naples, Latina, Frosinone.
Pumice	132	234	313	257	Messina, Grosseto.
Pumiceous lapilli	125	133	113	146	Viterbo, Rome, Naples.
Sand and gravel	13,085	20,329	25,632	28,768	Milan, Rome, Firenze, Treviso, Como, Bergamo.
Volcanic sand	54	43	37	35	Naples.
Silica sand	1,514	1,648	1,903	2,097	Lucca, Cuneo, Grosseto, Rome, Latina.
Sharpening stone tons	2,461	2,428	805	621	Bergamo, Belluno.
Totals:					
Building and ornamental stone:					
Blocks, slabs, sheets; cut and worked.	3,734	3,873	4,078	4,199	
Other pieces	13,341	14,272	19,773	18,540	
Crushed stone	13,881	15,845	22,607	19,190	
Limestone and gypsum (industrial).	16,079	19,726	21,768	21,472	
Other materials	38,194	46,482	53,296	60,094	
Grand total	85,229	100,198	121,522	123,495	
Total value million lire	65,116	74,674	92,406	96,002	
Total value million U.S. dollars (625 lire=US$1)	104	119	148	154	
Employment	50,000	50,000	(2)	52,667	

[1] Not including Sardinia.
[2] Data not available.

Source: Istituto Centrale di Statistica (Rome), Annuario di Statistiche Industriali (1962). V. 7, 1963, pp. 38–51.

The major producing firms in 1963 were Società Montecatini and Società Industriale Catanese (SINCAT), the latter a member of the Società Edison group. Montecatini's San Cataldo mine at Caltanissetta accounted for about two-thirds of total production. This mine is a highly mechanized underground operation, producing 3,000 tons of kainite-carnallite ore per day. Mine run ore, with an average grade of 12 percent K_2O, is concentrated by flotation to a grade of 17 percent before shipment to the company's sulfate plant at Campofranco 18 kilometers distant. The Campofranco plant, with an annual capacity of 200,000 tons of potassium sulfate, ships its product down to the coast to a fertilizer plant at Porto Empedocle.

Mine development and plant construction at Montecatini's new Palo mine at Caltanissetta were nearing completion in 1963 and production was scheduled to begin in 1964. The Pasquasia mine near Enna, owned by Società Trinacria (an Edison affiliate), was also in an advanced stage of development and produced some sylvite-carnallite ore

in 1963. Società Edison was reportedly planning to open a second sylvite mine in 1965. In other activities in 1963, two subsidiaries of the ENI group were exploring for soda, potash, iodine, and bromine in the vicinity of Gela.

With increasing domestic supplies, exports of potassium fertilizers from Italy rose about 20 percent in 1963. Imports of potash ores from European countries have generally decreased but considerable quantities of potassium chloride continued to be imported from Israel, the U.S.S.R. and Spain.

Fluorspar.—Italian fluorspar production in 1963 was 31,000 tons less than in 1962 and was the lowest since 1956. Factors contributing to this decline were higher labor and transportation costs as well as decreasing exports to the United States. Labor costs were reportedly 25 percent higher in 1963 following negotiation of a new labor contract in the preceding November. Inland freight rates and port handling charges also increased. This weakened the competitive position of Italian fluorspar, particularly in relation to Spanish and Mexican producers. Italy's production was surpassed in 1963 by Spain, which became West Europe's second largest producer.

Italy's declining exports of fluorspar to the United States, from 108,000 tons in 1959 to 35,000 tons in 1963, were attributed partly to leveling off of American stockpile purchases and partly to increased imports of Mexican fluorspar by the United States. The Mexican product was reportedly delivered to U.S. east coast ports for US$33 per ton. In 1963 Italian producers were seeking the temporary exemption from EEC tariffs that has been granted to lead-zinc and sulfur producers in Italy. It was hoped that increased demands for acid-grade fluorspar, created by Europe's expanding chemical industry, would improve the market situation.

Some changes took place in the distribution of fluorspar production in Italy during 1963. Although the Torgola mine (near Brescia) of Società Mineraria Prealpina probably remained the nation's largest single producer, an increasing share of Italian production was reported from mines of the Giulini group in Sardinia. Also, Montecatini's production of fluorspar from the Prestavel mine (north of Bolzano) amounted to 20,000 tons (7,300 tons in 1962), or 16 percent of Italian production in 1963.

Pumice.—Italy has produced a superior grade of pumice for many years, mostly from the Lipari Islands and Sicily (Messina). Italy ranks third in world production after West Germany and the United States but exported pumice principally to these two countries in 1963. Total exports in 1963 increased by more than 200,000 tons as compared with 1962.

Pyrite.—The decline in pyrite production in 1963, the first in many years, was attributed to strikes at the mines early in the year and to the shorter workweek (44 hours) incorporated in new labor contracts. Productivity increased, however, at Montecatini's Niccioleta and Gavorrano mines north of Grosseto. These mines account for about 90 percent of Italian production and have a combined productive capacity of 5,000 tons of ore per day. Until 1963, all ore was treated at the mines by flotation to obtain a high-grade pyrite concentrate before roasting. During 1963, an increasing share of Niccioleta ore was being processed at the company's new roasting plant at Follonica.

The Follonica plant produces sulfuric acid and iron concentrates from mine-run ore. Montecatini's mines at Brasso and Calceranica were reducing output in 1963 and were scheduled for shutdown in the near future. The Elba mine ceased operation in June.

Exports of pyrite in 1963 decreased 35 percent as compared with 1962, continuing a trend which started in 1960. Exports of cinder, however, increased 44,000 tons. Imports of pyrite have steadily grown over the past 5 years and increased 11 percent in 1963. Cyprus and the U.S.S.R. remained the principal suppliers.

Sulphur.—Italian production of elemental sulfur again declined in 1963, as it has for the past 10 years. Production of sulfur concentrates, while nearly triple that of 1959, increased only 5 percent and appeared to be leveling off. Of total ore production, Sicilian mines accounted for 83 percent and the remainder came from the Bologna district.

Exports of sulfur in 1963 decreased by nearly 50 percent and were less than one fifth the quantity exported in 1961. Imports were negligible in 1963, but increased domestic consumption and depletion of producers' stocks were expected to result in substantial imports of sulfur in 1964.

In Sicily, where high production costs have virtually eliminated Italian sulfur from world markets, reorganization of the industry continued. From 1956 to 1962 the number of operating mines had been reduced from nearly 200 to 50; employment was reduced 50 percent; and processing efficiency had improved. Surveys of the industry by private consultants in 1962 recommended additional cuts of about 50 percent in the number of mines and personnel, and that the ore be used directly for production of sulfuric acid. The Italian Sulfur Agency and the Sicilian Mining Board agreed that such measures were necessary, and both agencies have submitted plans for their implementation to the EEC Commission. It was expected that EEC tariff protection, accorded to the industry since 1960, would be extended through 1964.

Talc and Steatite.—Production of talc and steatite in 1963 was about 25 percent greater than in 1959. Italy's production was about 5 percent of world output and was second to that of France in western Europe. The industry employed at least 900 persons at the end of the year.

Most of production came from the Turin area (principally the Fontane mine), but substantial quantities were also produced near Sondrio and in two districts of Sardinia. The products are generally of high quality. Società Talco e Grafite Val Chisone was the principal producing firm, with plants at Malanaggio and Livorno.

For the past 6 years, exports have amounted to 35 to 50 percent of production, with the principal buyers being the United States, United Kingdom, and West Germany. Imports, mostly from Austria, have risen from less than 2,000 tons in 1959 to more than 13,000 tons in 1963.

MINERAL FUELS

Italy's main domestic energy resources are hydroelectric power and natural gas. Other domestic energy resources include coal, lignite, petroleum, and volcanic steam; these are locally important but do not contribute substantially to the total energy supply. About two-thirds of all energy produced in Italy in 1963 was derived from solid and liquid fuels, most of which were imported. Eighty-five percent of Italy's solid fuel supplies and more than 97 percent of the petroleum were obtained from foreign sources. Total energy consumption in Italy has increased about 12 percent annually since 1950.

The proportion of total energy requirements supplied by petroleum has steadily increased and this trend was expected to continue. Petroleum fuels provided an estimated 56 percent of Italian energy requirements in 1963, followed in importance by hydroelectric power, solid fuels, and natural gas. Despite increased construction of hydroelectric plants and mounting consumption of solid and gaseous fuels, the relative proportions of total energy requirements supplied by these sources declined.

TABLE 12.—Energy supply

(Quantities in thousand metric tons of coal equivalent at 7,400 kcal/kg, including bunkers)

Source	1960		1961		1962	
	Quantity	Percent	Quantity	Percent	Quantity	Percent
Petroleum fuels	29,424	44.1	35,153	48.6	42,680	53.7
Coal and lignite	10,979	16.4	11,785	16.3	12,250	15.4
Natural gas	7,156	10.7	7,615	10.5	7,937	10.0
Hydro-geo-electricity	19,225	28.8	17,774	24.6	16,630	20.9
Total	66,784	100.0	72,327	100.0	79,497	100.0

Source: Unione Petrolifera (Rome). Il Petrolio in Italia (1962). August, 1963, 79 pp.

About 66 percent of Italy's electric power was of hydroelectric origin in 1963. Of the 34 percent of total supplied by thermal plants, almost six-tenths was derived from liquid fuel in 1963. Consumption of all mineral fuels was expected to increase, as the total generating capacity of thermoelectric plants under construction in 1963 was twice the capacity of the installations available in 1962.

Three nuclear powerplants were in advanced stages of construction in 1963. The Latina and Garigliano plants, located near Rome and Naples, respectively, were operated briefly during the year and produced over 300 million kilowatt-hours of electricity. The third plant, located on the Po River (Trino Vercellese) east of Turin, was scheduled for preliminary operation in 1964.

Coal.—Coal production in 1963 declined 15 percent as compared with 1962, apparently due to relatively high costs of domestic production as well as to increased imports of higher grade coal.

Most of Italy's coal deposits are of subbituminous grade and are in Sardinia. The small annual production of anthracite has come mostly from La Thuile near Aosta in the Western Piedmont. Sardinian (Sulcis) coal constitutes about 95 percent of Italian production

TABLE 13.—Electric power production

(Quantities in billions of kilowatt-hours)

Source	1961		1962		1963	
	Quantity	Percent	Quantity	Percent	Quantity	Percent
Hydroelectric	42.0	69.3	39.3	60.6	46.0	65.7
Thermoelectric:						
Fuel oil	8.8	14.5	14.3	22.0	14.2	20.3
Coal and lignite (domestic)	2.6	4.3	[1] 2.5	3.9	1.7	2.4
Coal (imported)	1.0	1.7	2.0	3.1	0.8	1.1
Geothermal	2.3	3.8	2.3	3.5	2.4	3.5
Nuclear					0.3	0.4
Other	3.9	6.4	[2] 4.5	6.9	4.6	6.6
Total thermal	18.6	30.7	25.6	39.4	24.0	34.3
Grand total	60.6	100.0	64.9	100.0	70.0	100.0

[1] Includes 1.9 from lignite and 0.6 from coal.
[2] Includes 2.6 from natural gas.

Sources: Ente per l'Energia Elettrica (ENEL) reports, through U.S. Department of State dispatches. Associazone Nazionale Imprese Produttrici e Distributrici di Energia Elettrica (ANIDEL) (Rome). L'Industria Elettrica Italiana nel 1962. 1963, 161 pp.

and is largely used for fuel in thermal powerplants. Italian coal reserves in 1963 were estimated to be 500 million tons of Sulcis coal and 2.5 million tons of anthracite.

Because of a relatively low-quality product and high production costs, the Sardinian coal industry has experienced difficulties similar to those of the sulfur industry in Sicily. With many small mines, rising labor cost and (until 1963) the lowest output per man-shift in EEC, the industry has not been able to compete with foreign producers. Production in 1963 was about 60 percent of the 1953 level and employment in mines and plants decreased from about 7,000 to about 2,200 during the same period. Under a modernization program begun several years ago, high-cost mines have been eliminated and mechanization has been increased so that the output of coal per man-shift in 1963 was more than tripled compared with 1953. In addition, Società Mineraria Carbonifera Sarda (CARBOSARDA), owned by the Italian National Power Agency (ENEL), was completing construction of a large thermoelectric plant at Porto Vesme. The plant will be fueled by mine-run coal from local mines. CARBOSARDA also announced that mechanization of the Seruci mine will be completed by mid-1964 and that new facilities at the Nuraxi Figus mine were also nearing completion. By the end of 1964, the government anticipates a total annual production of 2.4 million tons of coal from these mines. This quantity would be equivalent to more than four times the Sardinian production in 1963.

Exports of coal from Italy have been negligible compared to the total supply although there were increased shipments to France in 1963. Exports of coal were valued at US$480,000.

Imports of coal in 1963 exceeded 11 million tons for the first time and were valued at approximately US$160 million. The total tonnage was 4 percent more than in 1962, and the increase was mainly due to anthracite imports, which rose by 320,000 tons. Coking coal made up 53 percent of all coal imports, followed by steam coal (18 percent), gas

coal (17 percent), anthracite (11 percent), and coal agglomerates (1 percent). Imports from the United States increased 1.8 million tons and were 33 percent more than in 1962, whereas imports from ECSC countries (principally West Germany) fell by 1.1 million tons, or 36 percent. Imports from East European countries also declined, principally from Poland and Czechoslovakia, although imports from the U.S.S.R. (mostly anthracite) rose 140,000 tons. The United States supplied 60 percent of Italy's coal imports in 1963 as compared with 47 percent in the previous year.

More than 50 percent of Italy's coal supply in 1963 was used for making coke. An estimated 17 percent was used for domestic and commercial heating, 10 percent for gasworks, 6 percent for the transportation and construction materials industries, and 3 percent for thermoelectric power. Consumption of coking coal was expected to increase, whereas steam and gas coal were encountering increased competition from liquid and gaseous fuels.

Production of liquid coal-derivatives continued to increase in 1963 although at a reduced rate as compared with previous years. Production in 1963 was 30 percent more than in 1959. Apparent domestic consumption of these products increased as exports were negligible and imports rose by one-third.

Coke.—Total coke production in 1963 was about 2 percent higher than in 1962, with increased production of metallurgical coke being offset by lowered production in gasworks. All coking coal was imported, with the United States supplying 86 percent. Exports of coke, usually destined for Austria and Switzerland, dropped 14 percent while imports of coke more than doubled. Consumption of metallurgical coke in the iron and steel industry was about 2.6 million tons of which 90 percent was used for pig iron production and 5 percent in agglomerating plants.

Lignite.—Lignite production in 1963 declined by 23 percent because of reduced demand from thermoelectric plants. All lignite produced was of the xyloid or lower-grade type, having a calorific value of about 2,500 calories per gram. Production of "Picean" or high-grade lignite (calorific value about 4,300 calories per gram), became so uneconomical that none was produced in 1963.

Italy's principal lignite deposits are located near Perugia and Arezzo in central Italy (Umbria and Tuscany) and in southern Italy (Calabria and Basilicata). The Picean lignite mostly came from the Grosseto area in west Tuscany. Total proved reserves of lignite in 1963 were estimated to be about 150 million tons.

Prior to 1958 most lignite produced was used in manufacturing construction materials (mostly tiles), but since that year its principal use has been fuel for thermoelectric powerplants constructed near the deposits and production has greatly increased. More than 95 percent of the lignite produced in 1962 was used for power generation and accounted for about 9 percent of Italy's thermoelectric power. In 1963 a new powerplant was being constructed near lignite deposits at Laino Borgo (near the Calabria-Basilicata boundary) by Società Meridionale di Elettricità. At the end of the year a total of 700 workers were employed in lignite mines as compared with 2,200 in 1958.

No exports of lignite were reported during the past 2 years. Imports of lignite in 1963, mostly briquets obtained from West Germany, increased 52,000 tons, or 20 percent as compared with 1962.

Petroleum and Natural Gas.—The oil and gas industry ranks with the iron and steel industry as one of the major mineral industries of Italy. Although only about 12 percent of Italy's energy requirements are produced from domestic resources of oil and gas, the industry provides two-thirds of the total energy supply by importing and refining large quantities of crude petroleum. Italy processed more crude oil in 1963 than any other country in the EEC and was second only to the United Kingdom in Western Europe. Output of refinery products in 1962 amounted to 18 percent of West European production and 3.4 percent of world production.

The growth of the processing industry is comparable to that shown by iron and steel, and productive capacity has doubled during the past 5 years. Imports of crude petroleum, refinery production, and domestic consumption of petroleum products have shown annual increases of 10 to 20 percent. In 1963, investments in the oil and gas industry were estimated at US$350 million, and six petrochemical plants completed or under construction represented a total investment estimated at US$1 billion. In 1962 and 1963 the petroleum industry provided about 14 percent of all government revenue, largely from sales of petroleum products.

Although small by world standards, discoveries of oil in Sicily and of gas in northern Italy since 1953 have been important in the country's industrial development. Italy's production of natural gas, until recently the largest in Western Europe, is mostly used for industrial fuel and is distributed by some 6,000 kilometers of pipelines. The petroleum and gas deposits in Sicily will be further exploited by a large petrochemicals complex at Gela which was nearly completed in 1963.

Within the EEC, Italy's gas reserves rank third after The Netherlands and France, and its recoverable reserves of petroleum rank second after West Germany. Although small discoveries of oil and gas continued to be made in 1963 and there was increased interest in Adriatic marine areas, the limited success of exploration drilling and a decline of 25 percent in all drilling activity since 1960 suggests that major new discoveries of oil or gas are unlikely and that Italy's rising demand for energy will be met by increased imports of fuel.

Government Participation.—The largest firm in Italy's oil and gas industry is the government-owned Ente Nazionale Idrocarburi (ENI). ENI was established in 1953 with authorization to participate in all sectors of the oil and gas industry and was given exclusive oil and gas rights to most of the Po Valley. The Po Valley concession extends from the Adriatic Sea west to Rivoli and Cuneo in the Piedmont, and includes Adriatic coastal waters for a distance of 15 kilometers offshore between Rimini and Monfalcone. ENI also holds numerous concessions in the oil- and gas-producing areas of central and southern Italy as well as in Sicily.

The principal divisions of ENI are: Azienda Generale Italiana Petroli (AGIP) Mineraria (exploration and production); Società Nazionale Metanodotti (SNAM) (transport and distribution of nat-

ural gas); AGIP (transport, refining, and marketing of petroleum products); Azienda Nazionale Idrogenazione Combustibili (ANIC) (petrochemicals and refining); and AGIP Nucleare (nuclear energy). Through these divisions and about 80 other partly- or wholly-owned companies, ENI conducts its domestic operations and is heavily engaged in petroleum exploration, production, refining, engineering, or products distribution in many foreign countries. The organization's engineering and construction projects both in Italy and abroad are usually handled by Nuovo Pignone and SNAM Progetti. Total sales of the ENI Group in 1963 were about US$965 million, and Italian employees were estimated to be 35,000.

Exploration and Development.—Drilling activity in Italy continued to decline in 1963. Total depth of all wells drilled during the year (including gas wells) was about 316,000 meters as compared with 366,000 meters in 1962. Exploration drilling was only slightly less than in 1962 but development drilling decreased by nearly 40 percent. Oil was reportedly found in two exploration wells—one near Parma and the other near Foggia—but its commercial significance appeared to be slight. In development drilling, AGIP Mineraria completed six oil wells in the Gela field, four of which were drilled offshore from a fixed platform and one was deviated seaward from shore. Production from the Gela field was expected to increase substantially in 1964 as ANIC's petrochemical plant was scheduled to begin production early in the year. In central and southern Italy, oil was produced from several development wells which had been drilled for gas. Società Nazionale Industria Applicazioni Viscosa (SNIA Viscosa) found oil in two wells drilled to develop the Candela gasfield, and Società Ricerche Idrocarburi (SORI) reported 26° API gravity oil in two wells drilled to develop a gasfield discovered northwest of Foggia. In the San Cataldo oilfield, Società Ricerche Petrolifere Meridionale (RPM) completed one development well.

The area held under petroleum concessions in 1963 declined 10 percent as compared with 1962. Increased interest in offshore exploration in the Adriatic Sea was evident from a threefold increase in the total area covered by applications for offshore concessions. In contrast, the total area of land concessions applied for in 1963 decreased 45 percent from the previous year. Most of the interest in offshore exploration appeared to be in the regions of Veneto, Emilia-Romagna, and Marches.

In foreign operations, ENI continued its exploration and development activities, particularly in Iran and Egypt. In Iran, two development wells were completed in the offshore Bahrgansar field and another well was drilling at the end of the year. Six wells were producing by December 31. Production from this field in 1963 averaged about 14,800 barrels of oil per day, as compared with 6,200 barrels per day in 1962. The Bahrgansar field is operated by Société Irano-Italienne des Pétroles (SIRIP) in which ownership is shared equally by AGIP Mineraria and the National Iranian Oil Co. The company's export terminal was completed in 1963 and production was scheduled to increase during 1964.

The ENI affiliate in Egypt, Compagnie Orientale des Pétroles d'Egypte (COPE), increased production by more than 20 percent to

about 86,000 barrels per day. The rise in output was mainly due to a fivefold increase in production from the Marine Belayim field. COPE's output accounted for 75 percent of total Egyptian production during 1963. The company is owned 50 percent by ENI.

Unsuccessful exploration wells were drilled in Libya, Morocco, and the Sudan. AGIP Mineraria's explorations in Somalia were reportedly suspended, but surveys were continuing in Libya, Morocco, and the Sudan as well as in Iran, Nigeria, and Tunisia. In India, ENI began drilling an exploratory well in Bihar to explore Tertiary formations. The well was spudded in October and was still drilling at the end of the year.

Ausonia Mineraria, an affiliate of the Società Edison, reportedly drilled two exploratory wells in Lebanon in 1963 with negative results. The wells were drilled on concessions of Cie. Libanaise des Pétroles, one at Suhmur and the other at Tel Znoub. Ausonia Mineraria also has interests in concessions in Algeria and Libya.

The Genoa-Aigle segment of the Central European pipeline was completed in mid-1963 by SNAM Progetti and in September began supplying oil to the new Aigle refinery. The pipeline was to be extended to Ingolstadt where another refinery was under construction. SNAM Progetti was also engaged in construction of the 1,140-kilometer Barauni-Calcutta-New Delhi oil pipeline in India and a 270-kilometer pipeline in Spain.

In August 1963, a consortium of private oil companies and the Austrian National Oil Co. announced its decision to construct a 40-inch oil pipeline from a northern Adriatic port (possibly Trieste) to Austria and southern Germany. Completion of the pipeline was planned for 1967. Throughput capacity of the pipeline was expected to reach 800,000 barrels per day from an initial rate of about 350,000 barrels per day.

Crude Oil Production.—Production of crude petroleum in Italy in 1963 was slightly less than in 1962 and was about 9 percent below the 1961 level. Total production averaged about 33,000 barrels per day, or 3 percent of Italy's supply of crude during 1963. Of total production, 96 percent came from Sicily, 3 percent from the Po Valley, and 1 percent from central and southern Italy.

In Sicily, Gulf Italia's Ragusa field continued to provide most of Italian production and accounted for 63 percent of the total output, followed by ENI's Gela field with 33 percent. Po Valley production was mostly derived from the Piacenza area. Producing wells at the end of the year included 48 at Ragusa, 71 at Gela, and 356 in northern and central Italy of which more than 90 percent were located in the Piacenza-Parma area. At the beginning of 1963, Italy's petroleum reserves were estimated at approximately 300 million barrels.

Crude Oil Trade.—Italy imports large quantities of crude petroleum to supply the refining and petrochemical industries, and exports of crude are normally insignificant when compared to the total domestic supply. Exports in 1963 represented about 0.3 percent of the domestic supply and were valued at an estimated US$2.2 million. The quantity exported in 1963 was nearly 50 percent less than in 1962 and was more than 60 percent below the level of 1961.

Imports of crude petroleum in 1963 totaled more than 47 million metric tons and were valued at an estimated US$665 million. The quantity was 15 percent greater than in 1962 and 39 percent more than in 1961. The main regional sources of supply were the Middle East (69 percent), North Africa (14 percent), and the U.S.S.R. (14 percent). As in 1962, the principal supplying country was Kuwait with 29 percent of total imports, followed by Iraq (20 percent), Saudi Arabia (17 percent), the U.S.S.R. (14 percent). These proportions were not significantly changed from 1962, although Iraq provided 27 percent of Italy's crude in 1961. Imports from Libya have steadily increased, from less than 1 percent of Italy's imports in 1961 to 6 percent in 1963. About 20 percent of all crude petroleum imported by Italy is temporarily imported, probably for refining and re-export under Italian and foreign accounts.

The total supply of crude petroleum in Italy in 1963, as calculated from net imports, domestic production, and stocks reported at the beginning of the year, was approximately 50.5 million metric tons. Of this total, an estimated 94 percent was processed by refineries and 3 percent by petrochemical plants. An additional 3 percent remained in stocks at the end of the year.

In 1963, new supply agreements were negotiated by ENI with the Standard Oil Co. of New Jersey and with the U.S.S.R. Standard Oil will supply 12 million metric tons of crude over a period of 5 years, and the U.S.S.R. will supply about 25 million tons of crude over a 7-year period. The quantity of crude to be imported from the U.S.S.R. under the new ENI agreement represents an increase of about 30 percent on an annual basis from the previous agreement for 1961–65 which called for a total of 12 million tons.[5] The Soviet oil is to be exchanged for oil industry equipment, fertilizers, synthetic rubber, and other Italian products. A third supply agreement was being negotiated with the Gulf Oil Corp. at the end of the year.

For the past several years, about 75 to 80 percent of the currency requirements for the large imports of crude petroleum were reportedly obtained from exports of refinery products, processing on behalf of foreign companies, charter of Italian tankers (Italy had 4 percent of world tanker capacity in 1963), and purchase of Italian goods and services by international oil companies.

Refined products output, consumption and trade.—The quantity of crude petroleum processed by Italian refineries and petrochemical plants in 1963 was approximately 48.5 million metric tons and was the largest quantity processed among the EEC countries. Italy produced 27 percent of the refinery products produced by the Community in 1963 and has been the leading producer since 1962. Although total production of refinery products was exceeded by the United Kingdom, Italy's refinery capacity was the largest in Western Europe. An estimated 39 refineries and 31 petrochemical plants were operating in Italy at the end of 1963.

Most petroleum refining, petrochemicals manufacture, and distribution of petroleum products in Italy is conducted by private firms

[5] Annual imports of Soviet crude from 1961 through 1963 averaged about 6 million tons because of transactions by private firms, independent of the ENI agreement.

but about 25 percent of the industry is directly controlled by the government through the ANIC and AGIP divisions of ENI. ANIC and AGIP are the principal Italian firms engaged in refining and distribution of petroleum products in foreign countries and are particularly active in Africa and Western Europe. In Italy, the principal refining companies affiliated with ENI in 1962 were Industria Petrolifera (STANIC), owned 50 percent by the Standard Oil Co. of New Jersey, and Industria Raffinazione Oli Minerali (IROM), owned 49 percent by British Petroleum.

Italian refinieries are required to maintain a reserve capacity of at least 30 percent of authorized capacity. The reserve capacity is not usually included in published data concerning productive capacity of Italian refineries, such as those listed in table 15; the capacities listed refer only to authorized capacity. The maximum refining capacity of the industry at the end of 1962 was thus 30 percent more than the table would indicate, or about 73 million tons. By the end of 1963, the maximum figure had risen to approximately 82 million tons.

An Italian law of 1961 requires that a 56-day supply of petroleum be kept in constant reserve. Four-fifths of the required reserve is stored at refineries and the remainder is stored in commercial storage installations. The quantity of required reserves is based on the average daily consumption in Italy during the previous year. Because of rapidly rising petroleum consumption, storage requirements are increasing at the rate of several million barrels per year.

In early 1961, the Government's Interministerial Price Committee lowered the ceiling price of regular gasoline to 96 lire per liter. This ceiling has been maintained as an anti-inflationary measure. The refining industry contends that the ceiling should be either removed or readjusted to compensate for increased costs of production and marketing, but no such action appeared to be likely and the ceiling was still in effect at the end of 1963.

Output of refinery products in 1963 increased by 48 million barrels, 16 percent more than in 1962. This continued the trend of the past 5 years, during which annual refinery production has increased by an average of 19 percent. The main refinery products continued to be fuel oils and gasoline, with the former accounting for 68 percent of the total Italian production and 24 percent of EEC output. Total Italian production in 1963 was estimated to be about 80 percent of authorized refinery capacity.

Consumption of petroleum products in 1963 also increased 16 percent as compared with the previous year. Domestic consumption was estimated at 32.3 million metric tons. Consumption of motor gasoline increased by 21 percent (800,000 tons), fuel oil (excluding bunkers) by 16 percent (2.7 million tons), and gas oil by 12 percent (400,000 tons).

In 1963 the Montecatini Co. formed a partnership with the Royal Dutch Shell Group. The new company (Monteshell) took over Montecatini's large petrochemical plants at Ferrara and Brindisi. Crude oil processed by these two plants totaled about 1.5 million tons annually.

TABLE 14.—Operating petroleum refineries, December 31, 1962

(Thousand metric tons)

Location	Company	Authorized annual capacity	Plant facilities [1]							
			Distillation	Cracking	Reforming	Desulfurizing	Polymerization	Lubricants	Solvent	Bitumen
Northern Italy:										
Genoa	E. Garrone	6,515	X		X	X			X	
Do	Purfina	806	X		X	X				X
Do	San Quirico	500	X		X	X				
Busalla (Genoa)	IPLOM [2]	600	X		X	X	X			
Cremona	Amoco Italia	900	X		X	X	X			
Cortemaggiore	ENI (AGIP)	139	X	X						
Como (Valmadrera)	ILSEA [3]	390	X		X	X				
Fiorenzuola	Petroli d'Italia	400	X	X	X				X	
Viguzzolo	ROL [4]	65	X					X		
Fornovo Taro	SPI [5]	260	X		X	X				
La Spezia	INPET [6]	2,980	X		X					X
Rho	Condor	2,700	X	X	X	X				
Mantova	ICIP [7]	1,300	X		X	X				
Villasanta	Lombarda Petroli	290	X		X	X				
Milan	Nuova Nilo	400	X		X	X				
Do	Purfina	286	X			X		X		X
Trecate	SARPOM [8]	1,400	X	X	X		X			
Ferrara	Montecatini	230	X	X						
Mantova	SICEDISON [9]	250	X	X						
Porto Marghera	IROM	2,500	X		X	X				
Trieste	Aquila	1,945	X	X	X	X	X			
Do	Esso	316	X		X			X		
Total		25,172								
Peninsular Italy:										
Ravenna	SAROM [10]	4,170	X		X	X				
Falconara	API [11]	3,000	X	X	X					
Livorno	STANIC	2,800	X		X	X		X		X
Bari	STANIC	2,500	X		X	X				
Naples	Mobil Oil	5,400	X	X	X	X	X	X		X
Brindisi	Montecatini	1,000	X	X						
Gaeta	Getty Oil	2,000	X		X	X				
Rome	Purfina	520	X	X	X	X				X
Total		21,390								

Sicily:										
Augusta	RASIOM [12]	5,360	X		X	X				
Milazzo	Mediterranea	2,600	X	X	X					
Syracuse	SINCAT	2,450	X	X			X			
Ragusa	ABCD [13]	250	X	X						X
Gela	ENI (AGIP)	165	X							
Total		10,825								
Grand total		57,387								

[1] X=facilities available.
[2] Industria Piemontese Lavorazione Olii Minerali.
[3] Industria Leganti Stradali ed Affini.
[4] Raffinerie Olii Lubrificanti.
[5] Società Petrolifera Italiana.
[6] Società per l'Industria Italiana del Petrolio.
[7] Industrie Chimiche Italiane del Petrolio.
[8] Società Anonima Raffineria Padana Olii Minerali.
[9] Società Industriale Chimiche (a subsidiary of Edison S.p.A.)
[10] Società Anonima Raffinazione Olii Minerali.
[11] Anonima Petroli Italiana.
[12] Raffinerie Siciliane Olii Minerali.
[13] Asfalti Bitumi Cementi e Derivati.

Source: Ministero dell'Industria e del Commercio (Rome). Industria del Petrolio in Italia (1962). 1963, pp. 22-23.

TABLE 15.—Production and stocks of petroleum products

(Thousand barrels)

Commodity	Production					Stocks	
	1959	1960	1961	1962	1963	Dec. 31, 1962	Dec. 31, 1963
Gasoline [1]	31,903	37,719	40,536	50,397	55,849	5,731	6,434
Jet fuel	4,501	4,102	5,559	5,199	5,650	876	767
Kerosine	3,459	4,121	5,349	5,646	6,290	910	1,089
Distillate fuel oil [2]	49,426	59,741	64,605	78,053	94,120	[3] 13,400	6,909
Residual fuel oil	77,310	88,459	102,219	125,061	143,594		13,221
Liquefied petroleum gas	6,451	7,252	8,002	9,210	11,166	244	294
Bitumen	3,841	4,224	5,105	5,452	6,396	305	268
Lubricants [4]	1,131	1,216	1,218	1,246	1,261	797	810
Other	3,729	5,174	[5] 20,638	[5] 21,497	[6] 25,468	(7)	7,514
Total	181,751	212,008	253,231	301,761	349,794	----------	----------
Refinery fuel and loss	10,178	14,024	16,022	19,802	22,785	----------	----------
Grand total	191,929	226,032	269,253	321,563	372,579	----------	----------

[1] Includes aviation gasoline, solvents, and white spirit.
[2] Includes light fuel oil ranging up to 5° E.
[3] Estimate.
[4] Includes white oil and transformer oil.
[5] Includes 14 million barrels of semirefined product.
[6] Includes 17 million barrels of semirefined product.
[7] Data not available.

Sources: Ministero dell' Industria e del Commercio (Rome). Bollettino Petrolifero. 6th year, No. 12, December 1963, 68 pp.
Bureau of Mines. World Petroleum Statistics. Annual summaries for 1959–62.

In the distribution of petroleum products, the principal development in 1963 was the acquisition of APIR (Azienda Petroli Italiana Roma), a subsidiary of Società Fiat, by the Gulf Oil Corp. The APIR facilities, now under the name of Gulf Italiana, included 636 filling stations, coastal terminals at Livorno and Porto Marghera, and 4 inland bulk plants. Gulf has no refinery in Italy and was not previously engaged in the marketing field although the company's other Italian subsidiary, Gulf Italia, has produced most of Italy's crude petroleum from the Ragusa field in Sicily.

Exports of petroleum products from Italy in 1963 increased 7 million barrels, 12 percent more than in 1962. The exports amounted to about 20 percent of Italy's refinery production and were valued at US$270 million. Exports of distillate fuel oil increased by 5 million barrels and made up 44 percent of all product exports, followed by residual fuel oil (25 percent) and gasoline (22 percent).

Imports of petroleum products in 1963 increased 11 percent and were valued at US$75 million. Residual fuel oil made up 80 percent of the total. Imports of lubricants, principally obtained from the United States, increased by 25 percent.

Refinery Construction in Italy.—Three new refineries were under construction in Italy in 1963 and the capacity of several others was being increased. ANIC's San Nazzaro refinery at Pavia in northern Italy was scheduled for completion in 1964. The refinery will have a capacity of 80,000 barrels per day and will be fed from the Central European pipeline. Also, construction of ANIC's Gela refinery (capacity 55,000 barrels per day) was nearing completion at the end of the year. In Sardinia, a refinery at Sarroch, with a capacity of 75,000 barrels per day, was scheduled for completion in late 1964. Major extensions to present refineries at Trieste, La Spezia, and Trecate in

northern Italy and at Milazzo and Augusta in Sicily were also underway.

Refinery Construction in Foreign Countries.—ENI completed construction of three refineries in 1963 and four others were planned or under construction. The Aigle refinery in Switzerland, owned by Raffineries du Rhone, S.A., was completed by SNAM Progetti. The plant has a capacity of 45,000 barrels per day and is partly owned by ENI.

In Ghana, ENI completed the Tema refinery. This plant, which has a capacity of 25,000 barrels per day and cost an estimated US$20 million, is operated by the Ghanaian Italian Petroleum Co., Ltd. The operation is owned 100 percent by ENI but a 50 percent share will be acquired by the Ghanaian Government after 10 years.

Tunisia's first refinery was completed at Bizerte by SNAM Progetti. The plant has a capacity of 20,000 barrels per day and cost an estimated US$22 million. It is operated by Société Tuniso-Italienne de Raffinage (STIR), which is owned 50 percent by ENI and 50 percent by the Tunisian Government.

In West Germany, SNAM Progetti continued construction of a refinery at Ingolstadt for Südpetrol A.G., für Erdölwirtschaft (owned 74 percent by ENI). The refinery will have a capacity of 40,000 barrels per day and is scheduled for completion in 1964. The plant, to be operated by Erdölraffinerie Ingolstadt A.G., will be fed by the Central European pipeline.

In the Congo, Société Congo-Italienne de Raffinage (SOCIR), owned jointly by the Congolese Government and ANIC, was constructing a 12,000-barrel-per-day refinery at Léopoldville.

In Tanganyika, ENI planned to construct a refinery at Dar-es-Salaam with a capacity of 12,000 barrels per day. The Tanganyika Government will have option on a 50-percent share in the operation.

In Yugoslavia, SNAM Progetti was awarded a contract to build a 20,000-barrel-per-day refinery near Belgrade.

In Morocco, Société Anonyme Marocaine Italienne de Raffinage (SAMIR), owned 50 percent by ENI, was operating the Mohammedia refinery which was completed late in 1961. The refinery has a capacity of 25,000 barrels per day.

Natural Gas.—Production of natural gas in 1963 increased 1.6 percent as compared with 1962. Ninety-eight percent of total production came from the Po Valley region, principally from the provinces of Emilia-Romagna and Lombardy. The main producing centers were Ravenna, Bologna, Piacenza, and Cremona. Gasfields in the Abruzzo-Molise region of the Adriatic coast accounted for an additional 1.2 percent and the remainder came mostly from the Gagliano field in Sicily.

Italy's gas production in 1963 came from 1,565 wells, of which more than half were located in Emilia-Romagna. About 44 percent of the producing wells yielded wet gas. The relatively large number of producing wells (2,679 in 1960) reflects the scattered pattern of gas pools in northern Italy. In 1963 there were 53 gasfields in the Po Basin (including offshore fields in the Adriatic Sea), of which 22 were classed as important fields. Total proved reserves of natural gas in 1963 were estimated to be 140 billion cubic meters.

Exploration drilling in 1963 brought in an estimated 11 new gas wells, of which one was in the offshore region of the Po Basin, eight were in peninsular Italy in Abruzzo-Molise and Puglia Provinces, and two were in Sicily. Seven of the wells were drilled by AGIP Mineraria and four by private concerns.

In the Po Basin an offshore well drilled by AGIP Mineraria near Ravenna found gas in Pliocene strata in five zones at depths of 2,250 to 2,600 meters. The field was discovered a few kilometers south of the Ravenna Mare gasfield but appeared to be of minor importance. A second offshore well, drilled about 20 kilometers farther south, was unsuccessful as were 19 land exploration wells drilled in the Po Valley between Ravenna and Turin. AGIP Mineraria also completed two development wells in the Ravenna Mare gasfield which was discovered in 1962.

In peninsular Italy, most of the gas discoveries in 1963 were made in the San Salvo-Guglionese area northwest of Foggia. Several discoveries had been made in the Foggia region in 1962 by AGIP Mineraria (Guglionese field), Società Montecatini (Ascoli Satriano field), and by SNIA Viscosa (Candela field). All of the 1963 discoveries were made in Miocene or Pliocene strata at depths between 960 and 2,200 meters. AGIP Mineraria drilled one discovery well only 4 kilometers from Foggia and other wells in the vicinity of Ascoli Satriano. Both Montecatini and Ausonia Mineraria drilled discovery wells within 4 kilometers of AGIP Mineraria's Guglionese field, and SORI found gas 50 kilometers northwest of Foggia. Of about 30 unsuccessful exploration wells drilled between Marches and the Gulf of Taranto, five were drilled to depths between 3,400 and 5,000 meters. In development drilling, SNIA Viscosa successfully completed nine wells in the Candela field and the company estimated recoverable reserves of gas to be approximately 10 billion cubic meters. Montecatini completed two development wells in the Lentella field; Ausonia Mineraria and SORI each drilled two successful wells near their 1963 discoveries and AGIP Mineraria continued to develop the Guglionese field.

In Sicily, two of four wells drilled by ENI companies yielded dry gas and condensate. The wells were drilled to test extensions of the Gagliano reservoir formation. In the Gagliano field, 5 development wells were also completed, increasing the number of producing wells to 13.

A 270-kilometer gas pipeline from AGIP Mineraria's San Salvo field in Abruzzo-Molise to Pescara, Terni, and Rome was nearly completed by the end of 1963. The pipeline will supply gas to industrial consumers in Pescara, Rieti, and Terni, as well as to domestic consumers in Rome. The delivery rate of gas to Rome was scheduled to be 100,000 cubic meters daily by early 1964, increasing to 250,000 cubic meters in late 1964 and to 500,000 cubic meters in 1965. The pipeline was constructed by ENI's affiliate, SNAM Progetti. Two other gas pipelines were under construction by the same company in 1962 and may have been completed in 1963. These were the Ferrandini-Bari-Monopoli pipeline in Puglia and the Gagliano-Gela pipeline in Sicily. Completion of these projects was expected to increase the total length of ENI pipelines in Italy to approximately 5,000

kilometers. In Argentina, SNAM Progetti was also constructing a 1,700-kilometer gas pipeline from Santa Cruz to Buenos Aires.

In 1963 Westates-Italia Co., a subsidiary of Westates Petroleum of California, purchased a 49-percent interest in the permits and concessions of Ausonia Mineraria. Westates will furnish US$9.3 million for exploitation and development costs in connection with Ausonia Mineraria's recently discovered gas deposits northeast of Foggia. The agreement also gave Westates a share in other Ausonia concessions in Italy as well as in Libya and Algeria.

The proportion of total natural gas production consumed in various industrial sectors in 1963 was not appreciably changed from previous years although statistics were available only for the first 8 months of the year. The proportion used for heating and domestic purposes, however, appeared to have increased from 13 percent in 1961 to 23 percent in 1963. This was probably due to improved distribution facilities as well as to increased production.

The use of natural gas for petrochemical conversion was being encouraged by ENI which was offering gas for this purpose at one-third of its price for fuel. At least four petrochemical plants were using gas as raw materials in 1963.

Natural gasoline.—Production of natural gasoline condensate has remained relatively constant for the last 5 years. Production in 1963 amounted to 55,067 metric tons and was almost unchanged from 1962. Approximately 90 percent of production came from the Po Valley, mainly from Piacenza and Modena in the Province of Emilia-Romagna, and the remainder was produced in Sicily.

TABLE 16.—Utilization of natural gas
(Million cubic meters)

Consumer	1959	1960	1961
Mining industry	34	29	19
Manufacturing industries:			
Metallurgical:			
Production and first processing of ferrous metals	630	673	664
Secondary processing of iron and steel	218	258	269
Production and processing of nonferrous metals	59	59	59
Processing of nonmetallic minerals:			
Cement, lime, and gypsum	242	305	376
Brickmaking	48	62	78
Ceramic and refractory materials	121	138	172
Glassmaking	165	164	179
Other mineral processing	8	10	11
Chemical industry:			
As fuel	752	726	701
As raw material	922	1,090	1,183
Gas and electrical industry:			
Production of thermoelectric energy	328	205	351
Heating and domestic uses	695	819	910
Other	1,868	1,895	1,871
Total gas utilized	6,090	6,433	6,843
Losses	28	14	20
Total gas available (national production)	6,118	6,447	6,863

Source: Istituto Centrale di Statistica (Rome). Annuario di Statistiche Industriali [1962]. V. 7, 1963, p. 93.

The Mineral Industry of Luxembourg

By Anton W. T. Wei[1]

MINERAL significance of Luxembourg lies solely in the iron and steel industry. Luxembourg, one of the smallest countries in the world, is by far the smallest member State of the European Economic Community both in population (325,000) and in area (2,590 square kilometers). Nevertheless, its steel production represents more than 1 percent of the world total and about 5.5 percent of that of the European Coal and Steel Community (ECSC). In 1963, per capita output was 12.6 tons, highest in the world. A large part of the world significance of Luxembourg derives from the country's position as an exporter of iron and steel. In this connection, the Belgium-Luxembourg Economic Union has held the leading position in the world for years, and 28 percent of the Union exports originated in Luxembourg in 1963.

Despite recent attempts to diversify the industrial base, the iron and steel industry continues to remain the preponderant element of economic life. The comment by a Luxembourg economist that "Luxembourg is a gift of iron as Egypt is a gift of the Nile" summarizes the dominant position of the industry in the economy of the country. In 1963 the iron and steel industry was responsible for nearly 75 percent of the value of industrial production, provided 65 percent of the industrial salaries, absorbed more than 80 percent of industrial investments, employed nearly 50 percent of the labor force, and furnished nearly 80 percent of the value of total exports. If the personal income taxes of employees are included, it is estimated that nearly 50 percent of the national tax revenue is derived from iron and steel activity.

SOURCE MATERIAL

Production data for the mineral industry have been obtained from foreign service dispatches of the U.S. Embassy in Luxembourg. Salient statistics about the iron and steel industry were taken from Siderurgie of the Office Statistique of des Communautés Européennes. Data and information about energy sources are derived from Charbon et Autres Sources D'energie, a publication from the same office. Information on significant developments in the industry was provided almost entirely by the iron and steel report from the U.S. Embassy in Luxembourg.

PRODUCTION

In 1963, the mineral and metal production of Luxembourg increased slightly from that of 1962. The estimated total value of output was

[1] Physical scientist, Division of International Activities.

approximately the equivalent of US$400 million, with more than 95 percent being derived from 4 million tons of iron and steel, the only metallic mineral commodities produced in the country. Other than iron and steel, 1963 mineral output consisted, as in the past, almost entirely of construction materials. Luxembourg does not produce or process any mineral fuels.

TABLE 1.—Production of metals and minerals

(Thousand metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Iron ore	6,509	6,978	7,458	6,507	6,990
Pig iron	3,411	3,713	3,775	3,585	3,563
Ingots and castings	3,663	4,084	4,113	4,010	4,032
Rolled steel	2,750	3,013	3,084	3,016	3,031
Nonmetals:					
Cement	192	210	231	230	[1] 230
Building stone, thousand cubic meters	116	120	118	689	489
Cut stone, rough, do	3	1	1	[1] 1	1
Dolomite, roasted	10	8	[2]		[2]
Limestone	175	161	[1] 100		
Molding sand	38	34	32	32	30
Sand and gravel, thousand cubic meters	552	548	681	633	543

[1] Estimate.
[2] Data not available.

TRADE

All foreign trade statistics of Luxembourg are integrated with those of Belgium under the Belgium-Luxembourg Economic Union (see Belgium). Except for steel exports, the Luxembourg share of total trade is minor.

Following the pattern of previous years, nearly 94 percent of the finished steel output was exported. The steel trade is highly ECSC-oriented; in 1963, 66 percent of the exports went to this market.

Both imports and exports of iron ore decreased. The decline in imports from 7.3 million tons in 1962 to 6.5 million tons in 1963 was the result of strikes in French mines which normally supply practically all of the Luxembourg foreign iron ore requirements. Iron ore exports dropped below the 1 million ton mark (919,000 tons) for the first time since 1950. The Belgium market, which normally receives more than 80 percent of the iron ore exports of Luxembourg, was looking more and more to oversea sources for the supply of richer iron ores.

COMMODITY REVIEW

METALS

The Luxembourg iron and steel industry entered a period of resurgence in 1963, operating at 92 percent of capacity after undergoing a period of stagnation in 1962. New investments during 1963 were the equivalent of nearly US$44 million, compared with US$39 million in 1962 and US$36 million in 1961. The industry continued to emphasize technological improvements to raise efficiency. Production of crude steel exceeded the 4 million ton level for the 4th consecutive year but remained below the record 4.1 million tons produced in 1961.

Iron ore production showed a 7.4 percent increase, and domestic output again exceeded imports after the temporary reversal of 1962.

As of 1963, the Luxembourg steel complex, comprising three companies, consisted of 33 blast furnaces, 7 steel works, and 7 rolling mills. About 59 percent of the steel output was provided by the Aciéries Réunies de Burbach-Eich-Dudelange (Arbed) S.A., 31 percent by Hadir Hauts Fourneaux et Aciéries de Differdange-St. Ingbert-Rumelange Société Anonyme, and 10 percent by Société Minière et Metallurgique de Rodange.

TABLE 2.—Salient iron and steel statistics

(Thousand metric tons unless otherwise specified)

	1961	1962	1963
Number of blast furnaces:			
Available—number of units	32	33	33
In operation—do	30	29	26
Pig iron production, (Thomas)	3,775	3,585	3,563
Raw material consumption for pig iron production:			
Iron ore directly in blast furnaces	9,980	8,968	7,157
Iron ore in sinter plants	3,033	3,571	5,336
Total	13,013	12,539	12,493
Manganese ore	60	52	34
Scrap	214	109	89
Coke	4,053	3,792	3,433
Number of steel furnaces: [1]			
Thomas converters:			
Available—number of units	24	24	
In operation—do	24	24	
Electric furnaces:			
Available—do	5	5	5
In operation—do	5	5	5
Crude steel production:			
Thomas	4,037	3,881	3,847
Electric	75	64	66
LD-AC		65	121
Total [2]	4,113	4,010	4,032
Total ingots	4,107	4,005	4,029
Total castings	5	5	3
Raw material consumption for steel production:			
Pig iron	3,980	3,756	3,744
Scrap	612	698	732
Ore	8	27	32
Semifinished rolled steel production:			
Rails and accessories	82	75	57
Profiles	647	649	626
Bars and rods	1,143	1,001	1,031
Wire rods	221	235	225
Hot rolled coils	537	593	593
Hot strips	44	52	57
Plates, wide	2	3	3
Hot rolled sheets, 4.76 millimeters or more	59	56	65
Hot rolled sheets, 3–4.76 millimeters	69	64	86
Cold rolled sheets, less than 3 millimeters	281	288	288
Total [2]	3,084	3,016	3,031
Miscellaneous production: [3]			
Steel pipes	83	84	83
Cold strips	18	19	21
Galvanized sheets			26
Employment in steel industry—persons	22,259	21,839	[4] 22,000

[1] Data on Linz-Donawitz converters not available.
[2] Data do not add to total shown because of rounding.
[3] Output in part may consist of further processing of Luxembourg-produced semifinished products.
[4] Estimate.

Arbed completed in 1963 the construction of a 16,000 kilowatt powerplant, a sheet steel soaking pit, and a 12-ton electric furnace. Sched-

uled for completion in 1964 were three soaking pits; a 70-ton LD–AC converter; a new rolling mill; and a 7.2 meter, 700-ton capacity blast furnace. Orders were placed for a new LD–AC complex at a reported cost of US$16 million, which included two 120-ton LD–AC converters, a 1,800-ton hot metal mixer, and a new rolling mill. LD–AC refers to a two-slag process using powdered lime injected with the stream of oxygen for high-phosphorus application in the regular LD (Linz-Donawitz) converter. The OCP (Oxygène Chaux Pulvérisée) process was developed by a Belgium metallurgical research body and brought to commercial success at the Dudelange works of Arbed and has since been styled LD–AC process. In addition to these new installations, replacement of a pre-World War I blast furnace was underway at Belval. The new furnace, scheduled for completion in 1965, will have an 8-meter diameter and a capacity of 1,000 tons of pig iron a day.

Hadir completed construction of a new blooming mill. Scheduled for completion in 1964 were an 8-meter blast furnace (1,000 tons of pig iron per day) to replace an older unit, and installation of stands and motors in the new Grey mill. The long term program of Hadir's contemplates systematic replacement of all the blast furnaces of the company. During 1963 the company converted fully to the use of sintered ore for blast-furnace feed.

Rodange continued construction of the direct oxygen line from the Oxylor plant in France during 1963. The company also scheduled modest investments for 1964–65 as part of a 10-year plan to reorient its production to specialized steels based on small (25 ton) LD–AC converters.

Despite an overall increase of employment in the iron and steel industry, employment at the mines dropped about 5 percent to roughly 1,800 workers; two mines were closed during the year. In the meantime, investments continued in conveyor belts, precrushing equipment, and other facilities. Reserves in the mines were estimated to total 242 million tons of ore with about 27 percent Fe. At the existing exploitation rate, these reserves (2.6 percent of the ECSC known total) were expected to last more than 30 years.

While heartened by improvements in 1963, steel industry officials expressed concern over the prospect of adapting to conditions of ECSC on capacity. Recognizing no quick solution to the problem, the firms were following an investment policy of rationalization. Emphasis was being placed on specialization to enable the industry to remain competitive. The industry has suffered from lack of a domestic market and consequent reliance on export sales, gradual depletion of easily accessible domestic ores, and need to import all coke and high-grade ore requirements. However, it has enjoyed the advantages of being located in the center of the ECSC, possessing relatively modern and efficient plants, operating a worldwide sales organization, holding a faithful clientele, and employing an unusually stable and experienced work force. The wage level in the Luxembourg steel industry is the highest in the ECSC.

MINERAL FUELS

Except for moderate quantities of hydropower, all energy consumed in Luxembourg is derived from imported mineral fuels. As in prior

years, about 70 percent of 1963 coal requirements were supplied by West Germany, the balance largely by Belgium and France. More than 85 percent of the coke, which has constituted the major item of mineral fuel imports, was supplied by West Germany, the balance originating in Netherlands and Belgium. At least some of the coke from Belgium was processed from U.S. coal shipped to that country under contracts with the Luxembourg steel firms of Hadir and Rodange. Imports of coal briquets and lignite showed moderate increases. Almost all the lignite is for household use. Imports of petroleum products continued to increase rapidly. As a result of the Vianden hydroplant going on stream in late 1962, hydropower output increased markedly from 110 million kilowatt-hours in 1962 to 486 million in 1963, raising the ratio of hydropower to total generation from 7 to more than 27 percent during this period. The Vianden

TABLE 3.—Deliveries of mineral fuels by type and user

(Thousand metric tons unless otherwise specified)

Commodity and consumer	1961	1962	1963
Coal:			
Iron and steel	18	20	20
Other industry	32	29	26
Gas plants	46	42	42
Transportation	23	18	20
Home use [1]	93	96	108
Total [2]	211	204	217
Coke:			
Coke and semicoke from coal:			
Iron and steel	4,116	3,919	3,627
Independent foundries	2	2	3
Other industry	6	6	7
Transportation	1	1	1
Home use [1]	26	32	41
Total [2]	4,149	3,958	3,677
Gas plant coke	33	32	32
Total, all coke	4,182	3,990	3,709
Coal briquets:			
Iron and steel	3	4	2
Other industry		1	
Home use [1]	5	5	7
Total [2]	9	9	11
Lignite	137	142	152
Petroleum products:			
Motor gasoline	64	66	70
Aviation gasoline	2	3	3
Kerosine	1	1	1
White spirit	2	2	2
Diesel oil	126	164	205
Fuel oil	49	146	270
LP gases	10	12	13
Lubricants	8	8	8
Bitumen	5	10	5
Total	267	412	577
Manufactured gas 10^9 kilocalories	15,832	14,850	13,476

[1] Includes some small industries.
[2] Data do not add to total shown because of rounding.

plant has a first stage capacity of 320,000 kilowatts (4 turbines), eventually to be increased to 640,000 kilowatts. Available statistics also show that imports of electric power increased from 242 million kilowatt-hours in 1962 to 970 million in 1963, while exports rose from 88 million to 492 million kilowatt-hours during the same period. Imports in 1963 were roughly two-thirds from West Germany and one-third from Belgium; about 90 percent of the electric power exports went to West Germany.

The Mineral Industry of the Netherlands

By Walter C. Woodmansee[1]

THE NETHERLANDS output of minerals and mineral products advanced considerably during 1963. As in previous years, metals and mineral raw materials (except natural gas and salt) were at least in part derived from foreign sources of supply; for several commodities, the country was entirely dependent upon imports for raw materials.

The year was one of continuing expansion in the principal mineral industries—petroleum, natural gas, and iron and steel. Construction continued on port and distribution facilities for crude oil and petroleum products. Natural gas exploration was extensive, and development of new fields proceeded through the year. The iron and steel industry was in the midst of an expansion program that would increase crude steel capacity by 30 percent during 1964.

Continuing seismic and drilling activity for natural gas was the most publicized news of the Netherlands minerals industry during 1963. Many companies joined the search, which has extended from the northern provinces to the offshore islands, estuaries, continental shelf, and the North Sea. Important discoveries were reported, and by yearend, reserves appeared to rank with the largest known fields in the world. As exploration continued, the government, in conjunction with private industry, proceeded with construction of pipelines and storage facilities for distribution of natural gas throughout the country.

The Netherlands led Western Europe in petroleum-products trade during the year. Four oil refineries in the Rotterdam area, having total capacity of more than 500,000 barrels per day, represented the largest concentration of this type in Western Europe. The country ranked fourth in Western Europe in crude oil output and fifth in refinery capacity and output of refined products. The Royal Dutch Shell refinery at Pernis, near Rotterdam, was the largest in Western Europe.

Large bunkers for residual and distillate fuel oils were maintained at Netherlands ports. Nearly half the cargo traffic of Rotterdam was in petroleum and petroleum products. Construction at Europoort continued as piers, storage tanks, pipelines, and a pumping station were completed. This development was only the beginning of a vast

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program in which Rotterdam and the national government planned to spend f700–800 million [2] and private industry f1.8 billion.

GOVERNMENT POLICIES AND PROGRAMS

The government has encouraged both domestic and foreign private investment in mineral industries of the country. Prospecting and exploration have been permitted throughout most of the country with permission of landowners, except in certain coal-mining districts. The government through the Council of State, however, owns all subsurface natural resources and has reserved the right to grant or withhold mining concessions after discovery.

The government has participated in the coal, oil, and natural gas industries through several organizations. State Mines (Staatsmijnen), under the jurisdiction of the Ministry of Economic Affairs, continued to operate the largest coal mines, coke plants, coal- and oil-based chemical plants, fertilizer works, and other industrial and commerical enterprises. Private coal-mining operations have been limited to concession areas established many years ago. However, State Mines and the private companies have worked in close cooperation. Both have been subject to regulations imposed by the Ministry and the High Authority of the European Coal and Steel Community.

NAM (N.V. Nederlandsche Aardolie Mij.—Netherlands Oil Co.), a joint subsidiary of Shell and Esso, held large oil and gas concessions including the highly productive Groningen Province, and had exclusive rights to crude oil and natural gas production in the country. Petroleum distribution companies maintain mandatory stock levels equal to 20 percent of previous year sales. More recently, the government has participated in the Netherlands Gas Union (N.V. Nederlandsche Gasunie), which coordinated natural gas production, distribution, and sales.

No definite policy was established regarding exploration for oil and gas on the continental shelf. NAM has explored offshore with consent of the Ministry of Economic Affairs. Within the 3-mile limit, exploration has been permitted as on land. However, the government did not ratify the policy adopted by the 1958 Geneva Convention on the Continental Shelf, which established the 3-mile zone of territorial waters. An announcement late in the year indicated a new mining law was being drafted.

SOURCE MATERIAL

The Statistical Yearbook of the Netherlands (Jaarcijfers voor Nederland), published by the Central Bureau of Statistics (Centraal Bureau voor de Statistiek), was the source of most production statistics through 1962. The Monthly Statistics of Imports, Exports and Transit, by Commodity (Maandstatistiek van de In- Uit- and Doorvoer per Goenderensoort) of that agency was the basis for import and export tables. Other sources of information were the publications of the European Economic Community, particularly for iron and steel, coal, and petroleum. Mineral and metal published periodicals and

[2] The monetary unit of the Netherlands is the guilder (f). One guilder is equal to US$0.276.

U.S. Embassy dispatches provided much of the information on recent developments in minerals.

PRODUCTION

Output of most metals and minerals was improved during the year of review. Although exact values were not available, the petroleum, coal, and iron and steel industries were the principal sources of income within the minerals sector of the Netherlands economy. Production of crude oil, most petroleum refinery products, and natural gas was higher than in 1962, and coal and manufactured gas output showed little change. Output of nearly all phases of the iron and steel industry from the sintering of imported ores to rolled steel products increased during 1963. The diamond industry, highly developed and employing a large labor force, has not publicized its processing activities and the extent of its output.

Production of lead and tin increased slightly during the year, but output of zinc has been gradually declining since 1960, owing to a continuing shortage of ore supply. Copper output, entirely secondary, has remained fairly uniform for several years.

Among the nonmetals, output of cement, salt, and sulfur was higher than in 1962. The fertilizer industry was involved in company mergers and plant expansions, and fertilizer output was expected to show continued improvement, although there was little change during the year.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Aluminum [2] thousand tons	3	4	4	4	4
Cadmium [3]	40	40	40	40	40
Copper [2] thousand tons	13	14	14	[3] 14	[3] 14
Iron and steel:					
Sinter do	808	968	1,805	1,995	2,355
Pig iron do	1,142	1,347	1,457	1,571	1,709
Steel ingots and other primary forms [4] do	1,670	1,942	1,971	2,087	2,342
Castings:					
Iron do	191	225	230	230	216
Steel do	9	8	9	9	9
Rolled steel do	1,197	1,429	1,442	1,555	1,759
Lead:					
Pig lead	12,006	12,691	10,817	9,577	11,864
Semimanufactures, including alloys thousand tons	16	17	17	18	16
Tin long tons	9,592	6,393	2,729	4,282	5,762
Zinc	32,155	36,080	39,592	37,049	35,762
Other nonferrous [2]	1	2	1	1	1
Nonmetals:					
Cement thousand tons	1,600	1,798	1,903	2,015	2,081
Fertilizers: [5]					
Nitrogenous, N content do	400	412	410	417	421
Phosphatic, P_2O_5 content do	182	207	200	187	174
Potassic, K_2O content	1,200	1,300	1,600	2,600	2,600
Salt thousand tons	986	1,096	1,114	1,262	1,479
Sulfur do	31	31	29	29	34
Mineral fuels:					
Coal and coal products:					
Anthracite and bituminous thousand tons	11,978	12,498	12,621	11,573	11,509
Coal briquets do	1,063	1,177	1,282	1,369	1,561
Coke and semicoke, including gas coke thousand tons	4,518	4,809	4,787	4,474	4,447
Lignite do	199	4			
Lignite briquets do	64	63	74	71	63
Tar do	153	158	161	144	[3] 140
Benzol do	46	50	54	52	[3] 52
Gas, manufactured million cubic feet	148,534	158,610	155,326	154,281	[3] 154,000
Petroleum and refinery products:					
Crude thousand tons	1,773	1,918	2,046	2,157	2,215
Aviation jet fuels do	641	805	1,171	965	857
Motor gasoline do	2,608	3,215	2,944	3,501	3,827
Kerosine do	850	836	722	950	970
Turpentine and solvents do	63	120	132	158	[3] 160
Liquefied petroleum gas do	249	267	295	332	337
Residual fuel oil do	6,555	8,045	8,484	9,636	10,155
Distillate fuel oil do	3,435	4,456	4,743	5,465	5,164
Lubricants do	192	206	259	246	[3] 250
Bitumens do	265	385	469	469	[3] 470
Gas, natural:					
Direct from field million cubic feet	8,434	12,316	16,757	18,623	[6]
Refinery do	10,860	15,749	21,383	22,691	[6]

[1] In addition to commodities listed, the Netherlands also produced the following, but quantity of output is not reported: Unconsolidated construction materials, building stone, byproduct and secondary precious and nonferrous metals, and carbon black.
[2] Secondary production, including alloys, in foundries.
[3] Estimate.
[4] Includes liquid steel for castings.
[5] Production for year ended June 30 of the year stated.
[6] Data not available.

TRADE

Both exports and imports of most mineral commodities were notably higher in 1963. Petroleum trade, by far the most important element of mineral trade in both tonnage and value, attained a record high as the industry prospered and expanded. Exports of rolled steel increased 47 percent while imports also advanced to new highs.

Total value of metal and mineral imports exceeded exports by f1.6 billion during the year. Imports were valued at f4.8 billion, while exports totaled f3.2 billion. These values, however, do not include

crude oil and petroleum product receipts by and deliveries from storage in bonded warehouses.

The metal and mineral exports were distributed, in terms of value, as follows: Petroleum products, chiefly gasoline and the fuel oils, 45 percent; metals, mainly iron and steel, 28 percent; coal and coal products, 16 percent; and nonmetals, chiefly fertilizers and diamonds, 11 percent. Corresponding percentages for imports were: Petroleum, predominantly crude oil, 41 percent; metals, largely iron and steel, 35 percent; coal and coal products, 14 percent; and nonmetals, 10 percent.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963
Metals:				
Aluminum:				
Bauxite	228	645	843	France 312; United Kingdom 296.
Alumina	27	33	44	West Germany 5; Belgium-Luxembourg 3.
Scrap	2,202	4,854	7,396	West Germany 6,279; Belgium-Luxembourg 963.
Ingot [1]	2,431	784	91	United Kingdom 41; Belgium-Luxembourg 36.
Semimanufactures	7,370	8,058	8,814	West Germany 2,483; Belgium-Luxembourg 1,212.
Bismuth, scrap and semimanufactures.	150	151	181	France 84; West Germany 60.
Cadmium, all forms	120	177	246	West Germany 123; France 60.
Chromite	419	1,121	1,476	United Kingdom 508; Belgium-Luxembourg 342; France 332.
Copper:				
Ore	6,913	267	-------	
Scrap	14,605	17,616	20,000	West Germany 11,593; Belgium-Luxembourg 8,128.
Unwrought [1]	6,378	5,645	5,572	West Germany 4,804; France 444.
Semimanufactures [1]	6,315	7,758	9,006	West Germany 3,318; Belgium-Luxembourg 2,429; France 1,512.
Iron and steel:				
Ore	872	70	37	Not available.
Pyrite cinder thousand tons	229	122	120	United Kingdom 80; West Germany 34.
Scrap do	344	234	282	West Germany 200; France 47; Belgium-Luxembourg 23.
Pig iron and blast-furnace ferroalloys. [2] do	166	204	145	West Germany 41; France 35; Belgium-Luxembourg 26; Italy 13; Switzerland 11.
Ingots and other primary forms. do	5	8	35	United Kingdom 19; Belgium-Luxembourg 8.
Rolled steel do	947	916	1,350	West Germany 272; Belgium-Luxembourg 180; Italy 174; United Kingdom 167; U.S.S.R. 102; Norway 91; France 89.
Forged and drawn products. [3] do	43	39	42	
Tubes and fittings [3] do	89	147	117	
Lead:				
Scrap	3,229	2,726	3,247	Mainly to Belgium-Luxembourg.
Pig [1]	7,523	6,042	5,629	Mainly to West Germany.
Antimonial and other alloys	1,183	1,279	1,797	France 612; West Germany 462; Austria 325.
Semimanufactures	2,734	2,368	2,836	United States 1,234; Belgium-Luxembourg 495.
Magnesium, all forms	188	257	373	France 192; United Kingdom 83.
Manganese ore	5,651	5,680	7,095	Belgium-Luxembourg 1,328; West Germany 1,197; Italy 1,055.
Mercury 76-pound flasks	210	18	4	Mainly to Belgium-Luxembourg and West Germany.
Nickel:				
Scrap	810	992	1,548	West Germany 656; United Kingdom 414.
Ingots, anodes, and semimanufactures. [1]	171	254	305	Spain 80; West Germany 75.

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963
Metals—Continued				
Platinum and platinum group: Unwrought and semimanufactures.[1] troy ounces	68,095	41,539	47,551	West Germany 15,112; United States 12,411; Switzerland 10,224.
Silver:				
Scrap and waste.[4] thousand troy ounces	3,036	2,164	1,433	United Kingdom 661; West Germany 629; Belgium-Luxembourg 135.
Unwrought [1] do	793	2,799	1,724	West Germany 582; Switzerland 324.
Semimanufactures do	446	511	353	Denmark 205; West Germany 80.
Tin:				
Ore long tons			44	All to Brazil.
Ingots [1] do	12,572	4,661	4,853	West Germany 2,671; France 485; Austria 297.
Scrap and semimanufactures do	544	586	807	West Germany 388; United Kingdom 107; Belgium-Luxembourg 89.
Zinc:				
Ore	4,795	3,880	3,870	Mainly to France.
Scrap	4,630	7,804	7,955	Do.
Slab [1]	20,793	21,276	23,481	West Germany 14,043; Italy 2,000; France 1,357.
Semimanufactures	1,301	1,192	1,300	Turkey 432; West Germany 314; Denmark 201.
Other nonferrous ores	244	252	666	West Germany 300; United Kingdom 174.
Other nonferrous metals and scrap [1]	683	249	271	Belgium-Luxembourg 65; West Germany 64; United States 41.
Nonmetals:				
Abrasives, natural	4,154	4,272	4,273	France 689; West Germany 455; Belgium-Luxembourg 400.
Asbestos	263	58	122	Belgium-Luxembourg 100.
Cement	14,553	4,851	7,894	West Germany 2,830; Netherlands Antilles 2,120.
Chalk	11,150	13,305	14,709	Mainly to Belgium-Luxembourg.
Clays:				
Refractory	1,439	2,120	1,355	Sweden 529; Belgium-Luxembourg 452.
Other thousand tons	98	102	102	West Germany 83; Belgium-Luxembourg 12.
Diamonds and other gem stones:				
Diamonds, unworked and worked. thousand carats	1,875	959	1,464	Not available.
Diamond powder do	721	651	671	France 203; West Germany 103; Belgium-Luxembourg 66; Japan 63.
Other gem stones, unworked and worked. kilograms	255	103	94	Belgium-Luxembourg 15; West Germany 3; others not reported.
Diatomaceous earth	79	109	113	West Germany 63; Belgium-Luxembourg 33.
Feldspar and leucite	2,287	2,327	4,268	Mainly to Belgium-Luxembourg.
Fertilizers:				
Nitrogenous:				
Natural thousand tons	6	14	11	Do.
Manufactured do	601	671	565	Mainland China 146; United Kingdom 94; Sweden 37; Ireland 32; Republic of South Africa 29.
Phosphate:				
Phosphate rock	5,137	3,654	3,505	West Germany 2,040; Thailand 500.
Superphosphate and other. thousand tons	429	370	376	France 145; West Germany 16.
Potassic	936	1,161	1,374	Ceylon 300; Morocco 248; United Kingdom 201.
Other thousand tons	237	277	260	France 23; West Indies 12; Belgium-Luxembourg 10; Colombia 9.
Kyanite and andalusite	8,432	7,462	1,426	West Germany 768; France 240.
Lime and limestone	1,987	1,709	1,412	Belgium-Luxembourg 975; Surinam 143.
Magnesite	25,060	31,370	36,614	West Germany 7,979; Belgium-Luxembourg 1,201; France 804; others not reported.
Mica	53	112	157	Belgium-Luxembourg 95; West Germany 43.
Pyrites		2,683		
Quartz and quartzite	1,851	2,419	2,036	Belgium-Luxembourg 1,309; West Germany 473.
Salt thousand tons	663	736	863	Sweden 278; Belgium-Luxembourg 274; Finland 109; Norway 107.
Sand:				
Industrial do	415	400	343	West Germany 105; Italy 105.
Construction do	4,606	4,767	5,173	Belgium-Luxembourg 4,953; West Germany 147.
Slate	1,055	1,662	1,984	Mainly to Belgium-Luxembourg.

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963
Metals—Continued				
Stone, other:				
Dimension	3,040	1,878	2,812	Mainly to Belgium-Luxembourg.
Crushed rock..thousand tons..	1,985	1,934	1,796	Belgium-Luxembourg 1,115; West Germany 679.
Sulfur	5,098	5,153	6,949	Belgium-Luxembourg 5,901; Switzerland 1,042.
Talc and steatite	148	196	162	Belgium-Luxembourg 18; others not reported.
Other	733	807	382	Belgium-Luxembourg 180.
Mineral fuels:				
Coal:				
Anthracite thousand tons.. and bituminous.	2,357	2,332	2,572	France 1,062; Belgium-Luxembourg 1,022; West Germany 400.
Coal briquets.....do....	542	620	769	West Germany 382; France 216; Belgium-Luxembourg 128.
Lignite briquets.....do....	38	39	34	West Germany 21; France 8.
Peat.....do....	38	56	51	West Germany 23; Belgium-Luxembourg 18.
Coke and semicoke.....do....	2,477	2,223	2,118	France 993; Belgium-Luxembourg 446; West Germany 281; Sweden 122; Switzerland 110.
Gas, manufactured..thousand cubic feet..	1,269	11,308	26,646	All to West Germany.
Distilled products	81	77	77	Belgium-Luxembourg 35; West Germany 20; United States 13.
Petroleum: [5]				
Crude.....thousand tons..	6,569	7,623	8,797	West Germany 8,471.
Gasoline [6].....do....	3,491	4,820	4,290	United Kingdom 1,114; Sweden 713; West Germany 622; Belgium-Luxembourg 315; Denmark 237.
Kerosine, including jet fuel.[6] do....	760	788	769	United Kingdom 305; Sweden 145; West Germany 84.
Distillate fuel oils.....do....	7,153	10,259	10,377	West Germany 4,613; Sweden 1,437; Denmark 417; Norway 373.
Residual fuel oils.....do....	7,809	12,170	13,778	United Kingdom 1,487; Belgium-Luxembourg 1,340; West Germany 1,101; Sweden 740; Denmark 727.
Lubricants.....do....	291	314	292	Sweden 37; Belgium-Luxembourg 34; United Kingdom 27; Italy 17.
Liquefied petroleum gas..do....	150	174	181	Belgium-Luxembourg 137; West Germany 22.
Paraffin, jelly, etc.....do....	23	16	18	West Germany 6; United Kingdom 2.
Petroleum coke.....do....	37	55	56	United Kingdom 28; Italy 13; France 12.
Bitumen, bituminous mixture, and other derivatives. do....	266	261	413	West Germany 295; Switzerland 38; Sweden 18; United States 17.

[1] Includes alloys.
[2] Includes sponge iron, shot, grits, pellets, and powder.
[3] Non-EEC treaty items; destinations are not given for these products.
[4] Includes all precious metals.
[5] Includes reexports and also petroleum from bunkers and bonded warehouses.
[6] Converted from liters given in official trade statistics. Conversion factors employed: 1 liter equal to .00629 barrel; 8.5 barrels gasoline per ton; 7.75 barrels kerosine per ton.

Sources: Netherlands Central Bureau of Statistics, Monthly Statistics of Imports, Exports and Transit, by Commodity; iron and steel statistics are principally from European Economic Community publications.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963
Metals:				
Aluminum:				
Bauxite	4,917	1,701	10,368	Mainly from Greece.
Alumina	7,716	7,967	7,810	Mainly from West Germany.
Scrap	2,840	2,077	2,180	Belgium-Luxembourg 922; France 368; Norway 203.
Ingots	11,992	11,225	14,129	France 6,565; U.S.S.R. 2,227; Canada 1,606.
Alloys	1,813	3,534	5,685	West Germany 2,166; United Kingdom 1,120; France 736.
Semimanufactures [1]	17,224	17,011	22,682	Belgium-Luxembourg 8,627; West Germany 5,140; France 2,472.
Antimony, unwrought and semimanufactures.	444	341	386	Mainland China 136; West Germany 96; U.S.S.R. 88.
Bismuth, unwrought and scrap	--------	93	105	United States 25; West Germany 24; mainland China 21; United Kingdom 21.
Cadmium, unwrought and semimanufactures.	135	216	189	Belgium-Luxembourg 54; U.S.S.R. 53; United States 21.
Chromium:				
Ore	858	2,339	2,700	Republic of South Africa 2,068; Philippines 406.
Unwrought and semimanufactures.	10	14	16	United Kingdom 7; West Germany 5; France 4.
Cobalt, unwrought and semimanufactures.	216	142	122	France 46; West Germany 34; Belgium-Luxembourg 33.
Copper:				
Scrap	4,936	4,924	8,386	West Germany 4,622; Belgium-Luxembourg 3,169.
Unwrought [1]	31,320	23,245	27,898	Belgium-Luxembourg 17,701; United States 4,688; United Kingdom 2,618.
Semimanufactures [1]	45,826	40,072	39,924	Belgium-Luxembourg 23,165; West Germany 11,474; United Kingdom 2,826.
Iron and steel:				
Ore—thousand tons	2,255	2,317	2,522	Sierra Leone 810; Liberia 684; Sweden 674; Spain 176.
Pyrite cinder	4,435	2,966	14,423	Mainly from Belgium-Luxembourg.
Scrap—thousand tons	38	83	90	United Kingdom 39; Belgium-Luxembourg 32; West Germany 14.
Pig iron and blast-furnace ferroalloys.[2] do	33	27	51	United Kingdom 23; Sweden 9; France 5.
Other ferroalloys—do	9	8	7	Norway 3; U.S.S.R. 1.
Ingots and other primary forms. do	117	59	98	Norway 55; West Germany 35.
Rolled steel—do	1,621	1,561	1,773	Belgium-Luxembourg 692; West Germany 657; U.S.S.R. 142; France 105.
Forged and drawn products.[3] do	146	134	136	----------
Tubes and fittings [3]—do	186	202	216	----------
Lead:				
Scrap	1,308	1,197	3,708	West Germany 2,803; Belgium-Luxembourg 512.
Pig [1]	44,892	42,521	33,372	Belgium-Luxembourg 11,602; U.S.S.R. 6,076; Mexico 4,166.
Antimonial and other alloys	11,566	8,027	7,204	Mexico 5,790; Belgium-Luxembourg 819.
Semimanufactures	2,615	2,350	2,708	Mainly from Belgium-Luxembourg.
Mangesium:				
Scrap	28	20	94	West Germany 51; United Kingdom 15.
Unwrought	156	314	393	United States 268; Norway 110.
Semimanufactures	55	64	76	West Germany 26; Austria 20.
Manganese ore	84,512	37,238	12,927	Ghana 2,726; Republic of South Africa 2,327; U.S.S.R. 2,316.
Mercury—76-pound flasks	262	50	63	Italy 27; Spain 17; West Germany 8.
Nickel:				
Scrap	309	453	876	Belgium-Luxembourg 304; West Germany 167; France 113.
Ingots and anodes [1]	849	719	775	United Kingdom 253; Norway 244; Finland 132.
Semimanufactures [1]	1,269	1,273	1,362	West Germany 686; United Kingdom 242; Belgium-Luxembourg 117.
Platinum and platinum group:				
Unwrought and troy ounces semimanufactures.[1]	78,158	60,990	77,998	U.S.S.R. 35,655; Czechoslovakia 9,227; United Kingdom 8,231.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963
Metals—Continued				
Silver:				
Scrap thousand troy ounces and waste.[4]	199	240	431	Greece 280; Denmark 90; Canada 48.
Unwrought[1] ---do---	1,850	4,726	3,895	United States 1,301; United Kingdom 1,239; Belgium-Luxembourg 625.
Semimanufactures ---do---	3,464	2,209	2,242	West Germany 992; United Kingdom 564; France 517.
Tin:				
Ore ---long tons---	4,221	7,648	7,929	Thailand 3,533; Chile 974; Indonesia 968; Bolivia 777.
Ingots[1] ---do---	14,094	2,710	3,083	Mainland China 1,469; United Kingdom 967; Hong Kong 259.
Scrap and semimanufactures ---do---	97	136	201	Belgium-Luxembourg 94; West Germany 41; United Kingdom 24.
Zinc:				
Ore	91,731	73,758	76,767	Finland 13,350; Peru 12,063; Spain 9,583.
Scrap	458	322	431	United States 198; Belgium-Luxembourg 113.
Slab[1]	16,212	16,767	15,907	Belgium-Luxembourg 3,833; U.S.S.R. 2,948; Poland 2,696.
Semimanufactures	6,071	4,938	6,562	Belgium-Luxembourg 4,534; West Germany 940; United Kingdom 843.
Other nonferrous ores	12,652	15,704	4,570	Mainly from Australia.
Other nonferrous metals and scrap[1]	24	29	31	Miscellaneous.
Nonmetals:				
Abrasives, natural ---thousand tons---	480	447	479	West Germany 458; Italy 16.
Asbestos	19,725	16,968	16,644	Mainly from Canada.
Barite	38,103	22,654	14,314	West Germany 12,748; France 1,010.
Borates, natural	2,111	3,831	3,500	Mainly from United States.
Cement ---thousand tons---	1,664	1,452	1,410	Belgium-Luxembourg 781; West Germany 591.
Chalk	53,081	57,090	53,624	Belgium-Luxembourg 25,821; France 20,377.
Clay:				
Refractory ---thousand tons---	174	167	187	United Kingdom 103; West Germany 61.
Other ---do---	302	319	345	Mainly from West Germany.
Cryolite and chiolite	209	272	386	All from Denmark.
Diamonds and other gem stones:				
Diamonds, thousand carats unworked and worked.	60	1,305	1,827	Not available.
Diamond powder ---do---	-------	507	539	United Kingdom 307; Belgium-Luxembourg 87; United States 78.
Other gem stones, kilograms unworked and worked.	129	20	52	West Germany 30; Brazil 22.
Diatomaceous earth	5,924	7,576	6,649	Hungary 1,907; United States 1,871; West Germany 764.
Dolomite ---thousand tons---	160	254	264	Belgium-Luxembourg 226; West Germany 30.
Feldspar and leucite	21,148	19,933	28,913	Norway 7,860; West Germany 7,244; Sweden 6,012.
Fertilizers:				
Nitrogenous:				
Natural ---thousand tons---	23	28	33	Mainly from Chile.
Manufactured ---do---	92	99	122	Mainly from West Germany.
Phosphatic:				
Phosphate rock ---do---	711	565	675	Morocco 391; Tunisia 80; United States 72.
Basic slag ---do---	134	146	155	Mainly from Belgium-Luxembourg.
Superphosphate and other. ---do---	40	78	62	United States 43; Tunisia 9.
Potassic ---do---	389	380	405	West Germany 162; France 74; Belgium-Luxembourg 59; East Germany 35; U.S.S.R. 23.
Other ---do---	33	65	50	Belgium-Luxembourg 29; United States 7; West Germany 7.
Fluorspar	7,263	11,113	8,842	Republic of South Africa 2,160; mainland China 1,878.
Graphite	405	396	392	West Germany 209; Austria 134.
Gypsum ---thousand tons---	132	140	153	West Germany 95; France 44; Belgium-Luxembourg 13.
Kyanite and andalusite	15,149	6,997	3,011	India 974; West Germany 701.
Lime ---thousand tons---	460	469	473	West Germany 230; Belgium-Luxembourg 228.
Limestone ---do---	756	655	709	Belgium-Luxembourg 678; United Kingdom 29.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963
Nonmetals—Continued				
Magnesite	34,272	36,678	40,368	Greece 27,104; India 6,952.
Mica	570	710	630	United Kingdom 259; Norway 195.
Pigments, natural	1,122	2,249	2,394	France 1,623; West Germany 320.
Pyrite thousand tons	294	249	226	Cyprus 148; Italy 57.
Quartz and quartzite	14,009	14,660	18,698	West Germany 6,855; Norway 6,035.
Salt	30,607	24,081	62,830	West Germany 40,512; France 13,017; Spain 9,250.
Sand thousand tons	649	928	1,348	West Germany 780; Belgium-Luxembourg 567.
Slate	26,328	19,378	22,157	West Germany 12,379; Norway 4,112; France 4,051.
Stone, other:				
Dimension thousand tons	945	1,264	1,128	Belgium-Luxembourg 852; West Germany 220.
Crushed rock do	3,692	4,287	5,821	West Germany 4,055; Belgium-Luxembourg 1,629.
Sulfur do	128	124	137	France 67; United States 53.
Talc and steatite	11,122	12,012	13,646	Norway 7,106; mainland China 2,220.
Mineral fuels:				
Coal:				
Anthracite and bituminous thousand tons	7,159	8,923	9,949	West Germany 4,047; United States 3,322; United Kingdom 1,490.
Coal briquets do	119	135	200	Mainly from West Germany.
Lignite do	240	215	191	All from West Germany.
Lignite briquets do	238	241	265	West Germany 227; East Germany 38.
Peat do	63	65	59	Mainly from West Germany.
Coke and semicoke do	312	361	524	West Germany 450; United Kingdom 67.
Gas, manufactured million cubic feet	703	784	1,062	Mainly from West Germany.
Distilled products thousand tons	141	114	174	U.S.S.R. 31; Belgium-Luxembourg 30; West Germany 25; United Kingdom 22; United States 16.
Petroleum: [3]				
Crude do	25,971	26,967	30,366	Kuwait 7,003; Syria 5,032; Lebanon 3,267; Iran 2,946; Venezuela 2,922; Saudi Arabia 2,287; Libya 2,342.
Gasoline [6] do	1,037	1,140	947	Netherlands Antilles 186; West Germany 164; Belgium-Luxembourg 132; United Kingdom 82.
Kerosine, including jet fuel [6] do	411	423	691	Belgium-Luxembourg 217; Netherlands Antilles 180; Italy 55; Iran 43; United Kingdom 42.
Distillate fuel oils do	5,279	7,031	8,478	Venezuela 2,068; Netherlands Antilles 1,184; Belgium-Luxembourg 731; Italy 669.
Residual fuel oils do	5,548	6,466	8,017	United Kingdom 2,220; Belgium-Luxembourg 879; Netherlands Antilles 793; Kuwait 752; West Germany 713; Venezuela 624.
Lubricants do	311	295	269	United States 93; Belgium-Luxembourg 47; Netherlands Antilles 45; United Kingdom 36; West Germany 26.
Liquefied petroleum gas do	69	77	82	West Germany 62; Belgium-Luxembourg 20.
Paraffin, jelly, etc do	26	21	20	West Germany 7; United States 6.
Petroleum coke do	11	14	40	Mainly from United States.
Bitumen, bituminous mixtures, and other derivatives do	103	187	217	United States 101; Belgium-Luxembourg 70; West Germany 28.

[1] Includes alloys.
[2] Includes sponge iron, shot, grits, pellets, and powder.
[3] Non-EEC treaty item; sources of these products are not given.
[4] Includes all precious metals.
[5] Includes bunker and bonded warehouse supplies.
[6] Converted from liters given in official trade statistics. Conversion factors employed: 1 liter equal to .00629 barrel; 8.5 barrels gasoline per ton; 7.75 barrels kerosine per ton.

Source: Netherlands Central Bureau of Statistics, Monthly Statistics of Imports, Exports and Transit, by Commodity; iron and steel statistics are principally from European Economic Community publications.

COMMODITY REVIEW

METALS

Primary base metal production in the Netherlands is limited to two major companies. Crude metals produced include lead, zinc, tin, and a variety of other nonferrous metals in small quantities. There is no primary copper production; the entire output is secondary copper, produced largely by one company. Several secondary nonferrous metals and alloys also are produced in small quantities at numerous foundries, many of which also have milling facilities. Aluminum output also has been entirely by secondary smelters, but arrangements have been completed for an electrolytic reduction plant in the country.

The iron and steel industry, most important of the metals in both tonnage and value of output, is comprised essentially of one main company, Hoogovens, which operates in close association with the Government, and numerous foundries and mills.

Aluminum and Bauxite.—During 1963 the Netherlands aluminum output remained limited to a few thousand tons of secondary ingot by several foundries and nonferrous scrap processors. Imports of ingot and semimanufactured aluminum products, the principal supplies, were notably higher than in the previous year.

TABLE 4.—Principal producers of nonferrous metals and alloys

Company	Location		Facilities	Remarks
	City	Province		
N.V. Hollandsche Metallurgische Industrie Billiton.	Arnhem	Gelderland	Ore roasting and leaching plants, 4 large reverberatory furnaces, rotary furnaces; recovery from flue gases by electric filters. Metallic ores and metals processed include tin, lead, antimony, tungsten, vanadium, bismuth, molybdenum, chromite, silver, cadmium, about 80 alloys of these metals. Research and ore-dressing laboratory; pilot-plant facilities.	Subsidiary of N.V. Billiton Maatschappij, which has large foreign bauxite and tin holdings. Capacity: 40,000 tons various metal products annually.
N.V. Kempensche Zinkmaatschappij.	Budel	Noordbrabant	23 zinc furnaces; concentrates, scrap and ashes are treated; rolling mill.	Netherlands only zinc smelter; capacity 40,000 tons slab zinc, 10,000 tons zinc sheet, 100 tons cadmium.
Lips, N.V. Metaalbedrijf.	Drunen Brunsum	Noordbrabant Limburg	Refinery, foundry, rolling and extrusion mills; 5 rotary furnaces, 2 electric furnaces, 1 special reverberatory furnace, rolling mills with copper extrusion press; aluminum continuous casting unit and extrusion press, research and development laboratories.	Products include secondary copper, lead and zinc alloy ingots and mill products; nickel, brass and other alloy strip and bars; secondary aluminum ingot. Copper capacity 14,400 tons; aluminum capacity 3,600 tons. Total output: about 25,000 tons annually.

TABLE 5.—Selected ferrous and nonferrous rolling and extrusion mills, 1962[1]

Company	Location		Plant, products, remarks
	City	Province	
Hollandsche Draad-en Kabelfabriek, N.V.	Amsterdam	Noordholland	Steel and copper wire drawing and cable works at Amsterdam and Delft; nonferrous wire plant and cable works at other locations.
	Delft	Zuidholland	
	Enkhuisen	Nordholland	
	Delfzijl	Groningen	
Bleriksche Buizenfabriek, N.V.	Blerik	Limburg	Welded steel pipe and tube works.
Industrie v/h Van Lohuizen en Company, N.V.	Vasen	Gelderland	Rolling mill and foundry for iron, aluminum and copper; also tin, lead foil, solder. Aluminum powder metallurgical plant. Subsidiary plant at Nunspeet (Gelderland).
Rouppe van der Voort's Industrie en Metaalmaatschappij, N.V.	Hertogenbosch	Noordbrabant	Wire mill, foundry; lead and tin. Produces solders, tin-lined tubes, other manufactured articles.
Nederlandsche Aluminum Maatschappij, N.V.	Utrecht	Utrecht	Rolling and extrusion mills, foundry; aluminum sheet, foil, strip, other semifabricated; largest aluminum mills in country. Aluminium, Ltd., Canada, holds 40 percent interest.
Zuid-Hollandsche Pletterijen.	Delft	Zuidholland	Formerly D.A. Hamburg, N.V. Rolling mill and foundry; lead, zinc and copper. Variety of lead shapes, zinc ingots, copper tubes, solder. Capacity: 15,000 tons lead product, 5,000 tons remelted zinc.
Koperpletterijen en Metaalhandel.	Apeldoorn	Gelderland	Rolling mill and foundry; copper and tin. Solder, semifabricated products.
Koninklijke Nederlandsche Lood en Zinkpletterijen, N.V.	Utrecht	Utrecht	Rolling and extrusion mills; foundry. Various semifabricated products of lead and zinc; tin solder and alloys.
Fabrieken van Klinknagels en Schroefbouten, P. van Thiel en Zonen, N.V.	Beek en Donk	Noordbrabant	Iron, copper, bronze and aluminum wire mill.
Philips Draadtrekkerij	Geldrop	Noordbrabant	Copper, tungsten and molybdenum wire mill; more than 20 metal and alloy wires for electronic and electrical products of parent company, N.V. Philips Gloeilampenfabrieken.
Meta-Gelria, N.V.	Arnhem	Gelderland	Aluminum, brass and bronze wire mill.
Aluminum Extruders Holland, N.V.	Harderwijk	Gelderland	Extrusion plant completed by Aluminium Extruders International, Canadian firm, in 1960. Expansion agreement in 1962 with Reynolds Aluminum Co.

[1] In addition, there are 25 to 30 iron, steel, and nonferrous metal foundries and secondary metal producers in the country.

TABLE 6.—Principal iron and steel plants

Company	Location		Facilities	Remarks
	City	Province		
Koninklijke Nederlandsche Hoogovens en Staalfabrieken, N.V.	Ijmuiden	Ijmuiden	Seven coke-oven batteries, byproduct recovery plant; 3 sinter plants; three 235-ton and two 500-ton blast furnaces; pig iron desiliconization plant; six 200-ton open hearth furnaces; three100-ton LD stee converters and 2 oxygen-generating plants; slabbing, blooming, and plate mill; cast iron pipe foundry.	Ownership: Netherlands Government about 27 percent; Amsterdam about 10 percent; remainder private. Additional rolling capacity under construction. Capacity: 2.5 million tons ingots in 1964.
Breedband, N.V.	do	do	Rolling mills for Hoogovens steel; blooming mill; hot and cold strip mills; cold reduction temper mill; tandem mill; batch annealing plant; 8 automatic hot-dip tinning lines; 2 electrolytic tinning lines.	Ownership: Netherlands Government 92 percent; Hoogovens, 8 percent. Tinplate capacity 250,000 tons 1962; 400,000 tons 1965.
Koninklijke Demka Staalfabrieken, N.V.	Utrecht	Utrecht	Plant No. 1: two 60-ton open hearth furnaces; 5 electric furnaces: blooming mill; high-speed wire and rod mill; ferroalloys and special steels. Plant No. 2: Foundry, forge, cold drawing mill.	Hoogovens owns 51 percent of capital stock. Capacity 200,000 tons forging-grade steel; 150,000 tons rolled products.
	Blerik	Limburg	Wire-drawing and wire products plant.	
Nederlandsche Kabelfabrieken, N.V.	Ablasserdam	Zuidholland.	Three 35-ton open hearth furnaces; 3 electric furnaces; continuous bloom, billet, rod, and strip mill; cold-strip mill; plate mill; galvanizing plant.	Merged with Hollandsche Draad-en Kabelfabriek, N.V., in 1958. Largest producer of wire and cable. Capacity 200,000 tons.
	Delft	do	Steel cable works.	

Considerable progress was made toward completing the first alumina and aluminum reduction plants. Alusuisse, large aluminum producer in Switzerland, planned an extensive aluminum complex at Botlek (Zuidholland), along the New Waterway (Nieuwe Waterweg) to Rotterdam. Alusuisse formed a subsidiary, Aluchemie, N.V., headquartered at Rotterdam, which commenced construction of an f80-million carbon electrode plant and continued planning for a 200,000-ton alumina plant and a 100,000-ton rolling mill. Hoogovens, the Dutch steel concern, and Billiton, the Dutch tin producer and also a major producer of bauxite, are associated with Alusuisse in the rolling-mill venture. Reportedly, f800 million will be expended on this project over a period of 10 years. Alumina produced is to be shipped to Alusuisse electrolytic plants in Norway, West Germany, Switzerland, and Italy for conversion to aluminum. Alusuisse apparently selected the Rotterdam area plant site because of its central location in relation to the European aluminum reduction facilities, and also because of the excellent marine and inland waterway transportation from Rotterdam.

Hoogovens, Billiton, and Alusuisse agreed to proceed jointly with construction of the Netherlands first electrolytic aluminum reduction plant near Delfzijl (Groningen) on the north coast. Initial plant capacity, 30,000 tons annually is expected to be doubled at a later

date. Total investment was estimated at approximately f200 million. Share capital was distributed as follows: Hoogovens 50 percent, Alusuisse 33⅓ percent, and Billiton 16⅔ percent. The Delfzijl site was selected because of its proximity to the large natural gas resources of Groningen Province, which will provide fuel for electric power generation.

Greece and Surinam are expected to be the principal sources of bauxite for the Botlek alumina plant. Billiton, one of the largest nonintegrated bauxite mining companies in the world, has completed arrangements with Suralco (Surinam Aluminum Co., a subsidiary of Aluminum Company of America) for bauxite processing in Surinam. Bauxite mined by Billiton in this country is to be processed in a new Suralco alumina plant, the alumina product to be exported to the Netherlands and the United States by N. V. Billiton Mij. Suriname, the Surinam subsidiary of Billiton. Suralco agreed to produce a maximum of 130,000 tons alumina per year from the Billiton bauxite. This arrangement depended on Dutch natural gas prices in Groningen Province and the decision to construct the new aluminum reduction plant at Delfzijl. The Dutch Government reserved a certain quantity of natural gas on special terms for new industries, including the Delfzijl aluminum venture.

During 1963 officials of Kaiser Aluminum Co. (United States) and Pechiney (France), continued investigation of the possibilities for another reduction plant in the Netherlands, but at year end no definite decision had been reached. A site near Amsterdam was considered favorable.

Copper.—Production of unwrought copper remained limited to several thousand tons annually of secondary ingot, which provided for only a small part of annual demand of industry. The main supplies continued to be from imported semimanufactures, receipts from which during 1963 were approximately the same as in 1962. Imports of unwrought copper increased slightly in 1963, and exports of scrap to West Germany and Belgium continued high.

Electrical product manufacturers, shipbuilders, and the automotive industry have been the principal users of copper in recent years. Demand continued high during 1963, as consumption ranged from 40,000 to 50,000 tons per year.

A new institution, The Netherlands Copper Institute (Nederlands Koper-institut), was founded at The Hague to promote production and use of copper and copper alloys throughout industry. This institute was to provide information and technical advice on these subjects.

Iron and Steel.—Output of crude, semifinished, and finished steel increased further during 1963, while the ambitious modernization and expansion programs were under way. However, only part of the steel requirements were met by domestic production, and imports of iron ore, pig iron, scrap, and all forms of steel were higher during the year.

TABLE 7.—Salient iron and steel industry statistics

(Thousand metric tons unless otherwise specified)

	1961	1962	1963
Number of blast furnaces:			
Available	5	5	5
In operation	4	4	4
Pig iron production:			
Martin	1,199	1,258	1,502
Foundry	257	313	207
Total	1,456	1,571	1,709
Pig iron capacity	1,490	1,725	1,825
Raw material consumption for pig iron production:			
Iron ore directly in blast furnaces	473	522	370
Iron ore in sintering plants	1,598	1,782	2,205
Total	2,071	2,304	2,575
Sinter in blast furnaces	1,804	1,987	2,341
Manganese ore in blast furnaces	56	42	23
Manganese ore in sintering plants	8		
Total	64	42	23
Scrap (in independent foundries)	7	7	7
Coke in blast furnaces	1,060	1,101	1,123
Coke in sintering plants	72	43	104
Raw material consumption per ton of pig iron produced:			
Coke—kilograms	729	700	657
Sinter—do	1,240	1,265	1,370
Number of steel works:			
Martin:			
Available	11	10	10
In operation	7	6	6
Electric:			
Available	8	8	8
In operation	8	8	8
Crude steel production:			
Martin	1,025	806	698
Electric	198	205	211
Oxygen	748	1,076	1,438
Total	1,971	2,087	2,347
Crude steel capacity	2,185	2,538	2,927
Raw material consumption of steel works:			
Pig iron, spiegeleisen, and ferroalloys	1,186	1,232	1,509
Scrap	987	1,061	1,078
Iron ore	28	12	12
Consumption per ton of crude steel produced:			
Pig iron—kilograms	602	591	644
Scrap—do	505	517	470
Rolled steel production:			
Strip	67	64	76
Sheet and plate	1,072	1,274	1,387
Coil	133	63	118
Wirebar	129	127	132
Other	41	27	46
Total	1,442	1,555	1,759
Tinplate and other coated steel production	174	212	249
Tube production	128	141	145
Wire production	134	133	136
Steel consumption:			
Total quantity	2,866	2,855	2,835
Per capita—kilograms	246	242	237
Average total employment workers and staff—persons	9,750	9,875	10,149

Source: Statistical Office of the European Communities, Iron and Steel, 1964, No. 3.

Output of pig iron and crude steel was about 10 percent higher than in 1962, and output of rolled and finished steel increased at a slightly greater rate. Hoogovens (Koninklijke Nederlandsche Hoogovens en Staalfabrieken, N.V.—Royal Netherlands Blast Furnaces and Steelworks), the dominant iron and steel company in the country, accounted for all of the pig iron, 87 percent of the crude steel, and (largely

through its affiliate, Breedband, N.V.) about 80 percent of the steel products.

During 1954–62 more than f1 billion was invested in industry improvement programs. All four steelmaking companies continued new construction and plant renovation during 1963. Overall planned capacity for the end of 1964 was 2.15 million tons pig iron, 3 million tons ingot steel, 2.2 million tons rolled steel, and 250,000 tons castings. Expansion to capacity of 5 to 7 million tons ingot steel has been planned over the next several years.

Hoogovens has undergone a marked change from open hearth to oxygen converter steel since 1962. In 1963 about 70 percent of the company crude-steel output of more than 2 million tons was oxygen steel, and future steelmaking will include a higher proportion of oxygen steel. Hoogovens alone planned for crude-steel capacity of 3.4 million tons and production of 3 million tons by 1965.

TABLE 8.—Iron and steel production of Royal Netherlands Blast Furnaces and Steelworks (Koninklijke Nederlandsche Hoogovens en Staalfabrieken, N.V.) and its affiliated company, Breedband, N.V.

(Metric tons)

Product by company	1961	1962	1963
Hoogovens:			
Pig iron	1,457,313	1,571,085	1,709,334
Steel ingots:			
Oxygen	748,279	1,073,371	1,434,068
Open hearth	917,835	702,315	594,566
Total	1,666,114	1,775,686	2,028,634
Plates	402,488	383,816	368,774
Cast iron pipes	28,671	26,203	18,344
Breedband:			
Coils, hot-rolled	905,804	1,046,231	1,283,320
Coils, cold-reduced	108,055	150,546	170,619
Sheets, hot-rolled	80,130	68,969	83,742
Sheets, cold-reduced	393,346	463,529	431,189
Coils and sheet, rolled on commission	68,611	42,874	165,566

Source: Royal Netherlands Blast Furnaces and Steelworks, Ijmuiden; Annual Report, 1963.

During the year Hoogovens commenced construction of a new blast furnace, which would be fired during 1964, at Ijmuiden, the center of company steelmaking activities on the North Sea coast. A second slabbing and blooming mill went into operation in late 1963; raising slab and bloom capacity 1.5 millions tons to a total of 3.4 million tons. Construction on a second rolling mill continued during the year and is scheduled for 1964 completion. This rolling mill for merchant bars and rods will further diversify Hoogovens range of steel products, which formerly was limited to flat-rolled products.

Demka (Koninklijke Demka Staalfabrieken, N.V.—Royal Demka Steelworks), the Netherlands producer of special steels and ferroalloys, experienced some difficulty in getting a new rod and wire mill into production during the year, because of both technical difficulties and a shortage of trained and experienced personnel. The company also has initiated an improvement plan for its blooming and other rolling mills. An agreement continued with Carpenter Steel Co. (Reading Pa.), which provided technical and commercial assistance to Demka on spe-

cial steelmaking. As result, Demka introduced new types of stainless and tool steels during 1963.

NKF (Nederlandsche Kabelfabrieken, N.V.—Netherlands Cable Works) reportedly invested f80 million in expansion of steel capacity during the year, including oxygen steel, and in a new rolling mill at Ablasserdam (Zuidholland). The planned production target was 600,000 tons ingot and 500,000 tons finished steel by 1964. During 1963 the company issued new shares to increase capitalization for financing this continuing project, which also includes a new blast furnace and sintering plant. The mill is to be specially equipped to handle 5- to 8-ton ingots.

The General Scandinavian Import Steel Co. (Algemene Scandinavische Import Staal Mij., N.V.), Zwijndrecht (Zuidholland), made plans to establish an industry for the rolling and drawing of stainless steel in the vicinity of Terneuzen (Zeeland). The crude steel would be imported from Sweden. Many aspects regarding this project, however, were uncertain at yearend.

No decision was made concerning a new steel complex in the Rotterdam Europoort development project during the year. The proposed site on Rozenburg Island along the New Waterway had been held for several years, pending a decision by Rotterdam officials, the Government, and the iron and steel industry on feasibility of such a project. This land was sought by other industry during the year, and late in the year it appeared that interests other than the steel industry would proceed with Europoort development and that iron and steel development would be considered further in 1964.

Lead and Zinc.—Billiton (N.V. Hollandsche Metallurgische Industrie Billiton), the Netherlands only primary lead producer, increased production of pig lead nearly to the 1959–60 level. The main raw material supplies were domestic scrap and imported bullion and scrap. Imports of pig lead were lowered considerably during the year, as compared with 1962.

Output of slab zinc at the Budel (Noordbrabant) smelter of N.V. Kempensche Zink Mij., which accounted for the entire domestic production of slab zinc, dropped slightly during the year, owing to a continuing shortage of ore supply. Ore imports were higher than in 1962 but remained well below tonnages received in previous years. Zinc consumption was at an approximate annual rate of 30,000 tons during the year.

Nickel.—Small secondary production of nickel and nickel alloy ingots for ferrous and nonferrous uses continued at the Amsterdam plant of Nederlandsche Nikkel Mij., N.V. This plant has capacity for 2,000 tons of these ingots annually.

Precious Metals.—Small quantities of the precious metals have been derived as byproducts at the Arnhem (Gelderland) and Budel (Noordbrabant) nonferrous smelters, but essentially all of the Netherlands supply of gold, silver and platinum continued to come from imports of these metals in all forms, There was no significant change in trade patterns for silver and platinum during 1963; sources and quantities of gold supply are not known.

Tantalum and Columbium.—Kawecki Chemical Co. (New York) joined with Billiton on a 50–50 basis in a new company, KBM (N.V.

Kawecki-Billiton Metallindustrie), having a plant at Arnhem (Gelderland) that will produce columbium-tantalum sheet and foil, tantalum anodes, high-purity indium, and other rare metals in a variety of industrial forms.

Tin.—The Billiton Arnhem smelter received the first shipment of Indonesian tin concentrate since 1958. Domestic output has slowly recovered but has not reached pre-1960 production rates. During the years of loss of Indonesian concentrate, a shortage of world supply, and rising tin prices, greater quantities of the metal were imported from U.S.S.R. and mainland China. With resumption of raw materials supply from Indonesia, Billiton planned to process 12,000 tons of concentrate annually.

Early in 1963, Billiton concluded an agreement with the French CFE (Compagnie Française de L'Etain), under which Billiton acquired half of the share capital of CFE. These two companies have therefore become closely associated in the tin technical and commercial fields.

Titanium.—Billiton, Royal Salt Ketjen, and Cyprus Mines (United States) have joined in N.V. Titaandioxydefabriek (Titanium Dioxide Works) in the Botlek (Zuidholland) area. This company will produce 10,000 tons TiO_2 annually when full production is reached. During 1963, output was gradually increased after initial chemical difficulties were overcome. The highly competitive world market for titanium white, falling prices, and increased construction and operational costs introduced problems which were alleviated as productivity increased.

NONMETALS

Cement.—Domestic output of cement, which surpassed 2 million tons in 1962, continued an upward trend during 1963. Imports of large quantities also continued from Belgium and West Germany. The Netherlands cement industry produced about 60 percent of estimated consumption of 3.5 million tons during the year. An increased consumptive rate is anticipated, owing not only to high demand throughout industry but also to the Delta Plan, under which the estuaries of the Zeeland coast are to be closed off, and to the continuing reclamation projects in the Ijsselmeer.

Cemij (Cementfabriek Ijmuiden), a Hoogovens-ENCI (N.V. Eerste Nederlandsche Cementindustrie—First Netherlands Cement Industry) partnership, produced 812,000 tons of cement, an 8-percent increase over that of 1962. Construction began on a new plant, sponsored by the same partnership, on Rozenburg Island. Cement production from this plant was expected during 1965.

ENCI continued production at its Maastricht (Limburg) plants. Blast-furnace slag as well as imported limestone have been used at both Ijmuiden and Maastricht, the former utilizing slag from the Hoogovens steelworks and the latter from Liège, Belgium.

Diamond.—Imports of crude, worked, and powdered diamond increased from 1962. Total value of imports for gem stones and abrasives was nearly f90 million. Six major companies in Amsterdam and 40 others in the country were involved in trading, sorting, grading,

cutting, and polishing diamonds. The processed products have largely entered the export market, valued at nearly f100 million in 1963.

Fertilizers.—Output of phosphatic fertilizers continued to decline during the year, whereas output of nitrogenous types increased slightly. Production of potassic varieties remained small. With an increase in overall fertilizer consumption of 2 to 3 percent, imports of natural nitrates, phosphate rock, basic slag, and all manufactured fertilizers were higher in 1963.

Three large companies, the Royal Dutch/Shell, Hoogovens, and KNZ (the latter N.V. Koninklijke Nederlandsche Zoutindustrie—Royal Netherlands Salt Industry), have cooperated closely, through subsidiaries, for improved efficiency in production and sales of fertilizers. They have formed a new holding company, VKF (Verenigde Kunstmestfabrieken Mekog-Albatros, N.V.—United Fertilizer Works Mekog-Albatros) with ownership as follows: Royal Dutch/Shell, 40 percent, and Hoogovens, 20 percent, through their subsidiary Mekog (N.V. Mij. tot Exploitatie van Kooksovengasse—Company for Exploitation of Coke Oven Gas), and KNZ, 40 percent, through its subsidiary Albatros Superfosfaatfabrieken, N.V.—Albatros Superphosphate Works). VKF has coordinated the continuing expansion of operations of these companies in the fertilizer field. Older plants have been improved and enlarged, and several large new works have been built or are planned.

State Mines, the government coal-mining agency, which also has entered the chemical and fertilizer fields, produced 948,000 tons of nitrogenous fertilizers during the year, a significant increase over 1962. Another large producer of standard and double superphosphate has been ENCK (Eerste Nederlandsche Cooperatieve Kunstmestfabriek—First Netherlands Cooperative Fertilizer Works), which has a 225,000-ton works at Vlaardingen (Zuidholland) along the New Waterway to Rotterdam.

Salt.—Production of salt has shown a steady growth, which was 13 percent in 1962 and 18 percent in 1963. Imports of salt more than doubled during the year but still remained small relative to production and exports. About 60 percent of the annual salt supply has been exported in recent years; 40 percent, or about 600,000 tons, has been absorbed in domestic consumption.

The main deposits and installations at Hengel (Overijssel), near the West German border, have capacity for 800,000 tons of salt annually. Reserves here were reported to be 500 million tons in the Triassic Bund sandstone. Similar but smaller scale operations continued on a salt dome at Winschoten (Groningen) in the northeast and at Spijkenisse (Zuidholland), near Rotterdam. All are owned and operated by the Royal Netherlands Salt Industry (Koninkijke Nederlandsche Zoutindustrie). Brine salt from depths of 1,000 to 1,200 feet is precipitated by evaporation and is purified by electrolysis at Hengelo. Winschoten brine has been fed by pipeline to the company 350,000-ton plant at Delfzijl (Groningen), where salt was processed principally for the export market.

KNZ has diversified its activities in recent years. The company, through subsidiaries, has participated in several fertilizer and chemical industry ventures, both domestic and foreign.

Sand and Gravel.—A large quarrying industry for unconsolidated construction materials was active during the year but production is not known. Deliveries to the consuming sectors reportedly totaled 46.7 million tons in 1961 and 45.3 million tons in 1962. Large quantities of construction sand and crushed rock have been involved in trade.

Sulfur.—The Netherlands sulfur supply continued to be provided largely by imports, which have gradually increased in recent years. Limited, uniform domestic output of liquid sulfur accounted for about 20 percent of consumption during the year. The use of pyrite as a source of sulfur for sulfuric acid has decreased as the use of native and recovered sulfur has increased. The principal consumer of pyrite was Albacid, a subsidiary of the Albatros superphosphate works.

Sulexco, an American export organization, was constructing the first European installation for transhipping liquid sulfur in the Botlek (Zuidholland) industrial area. Plant throughput capacity was reported to be 200,000 tons per year; construction costs were from f7 to f8 million. Facilities for loading and transhipping solid sulfur also were to be built. The operating company was reported to be the Netherlands Sulfur Storage Business (Nederlandsche Swavel Opslagbedrijf).

Liquid and solid sulfur also are to be recovered as byproducts of Europoort oil refining. About 30 tons per day were anticipated.

MINERAL FUELS

Coal.—Output of Netherlands coal mines was approximately the same as in 1962. There was a substantial gain in demand for coal, necessitating imports of anthracite and bituminous coals more than 1 million tons higher than in 1962. Imports were the highest since World War II. The United States provided 3.3 million tons during the year, approximately 50 percent above the previous year and the highest since 1958.

A large part of the coal output of the Netherlands was good-quality coking coal. About 40 percent was anthracite and semianthracite; 50 percent was medium-volatile bituminous; and 10 percent was low-volatile bituminous.

The Government-owned State Mines (Staatsmijnen) continued to operate 4 of 12 producing mines and was responsible for about 60 percent of the 1963 coal and coke production. State Mines profits fell during 1962–63 owing to a labor shortage and lower productivity.

The company has produced coal-based chemical products at Beek (Limburg) in the coal-mining region for many years and, more recently, has entered the field of petrochemicals with a new plant at Rotterdam, using oil refinery byproducts. State Mines also has entered the fertilizer field, making ammonia for nitrogenous fertilizers from enormous company supplies of coke-oven gas. A synthetic hydrogen plant and a methane-cracking plant also have provided hydrogen for ammonia production.

The four State Mines coal mines remaining active in 1963 and their approximate optimum annual production were the Emma, 2.5 million tons; Maurits, 2.5 million tons; Hendrik, 1.5 million tons; and Wilhelmina, 1 million tons. The company had developed another mine, the Beatrix, during 1954–62. This mine, however, was closed by the

TABLE 9.—Salient coal and coal products statistics

(Thousand metric tons unless otherwise specified)

	1961	1962	1963
Coal:			
Production:			
Anthracite	5,113	5,056	5,572
Bituminous, medium to high volatile	7,508	6,517	5,937
Per work day—tons	47,400	44,900	44,800
Per man shift—kilograms	2,055	2,070	2,087
Received from EEC	3,932	4,583	4,089
Delivered to EEC	2,278	2,245	2,276
Stocks at mines, end of year	541	537	378
Consumption, deliveries:			
Coking plants	5,928	5,723	5,173
Public utility plants	4,312	4,752	4,905
Domestic, commercial	3,329	3,994	4,862
Briquet plants	1,131	1,186	1,484
Mines, electricity generation	1,111	1,110	1,039
Industry	1,167	1,046	889
Coal mines, actual consumption	452	435	477
Gas plants	273	231	188
Transportation	87	45	37
Other	67	37	99
Total internal deliveries	17,857	18,559	19,153
Employment:			
Mines, underground	26,700	26,400	25,300
Mines, surface	14,800	14,900	14,800
Related installations	7,700	8,000	7,900
Technical personnel	4,900	5,100	5,100
Other	2,800	2,900	2,800
Total	56,900	57,300	55,900
Coa briquets:			
Received from EEC	113	126	146
Delivered to EEC	505	587	728
Total internal deliveries	700	774	954
Lignite:			
Deliveries to thermal plants, after briquetting	178	169	151
Consumption at briquet plants	55	50	44
Received from EEC	215	221	227
Total internal deliveries [1]	257	283	302
Coke, coke oven:			
Received from EEC	278	330	449
Delivered to EEC	1,955	1,766	1,668
Internal deliveries:			
Iron and steel	1,139	1,151	1,174
Domestic, commercial	887	1,022	1,006
Other	435	538	544
Total	2,461	2,711	2,724
Coke, gas plant:			
Production	223	201	178
Stocks at gas plants	56	48	64
Total internal deliveries	207	190	144
Consumption, at gas plants	171	148	126

[1] Nearly all for domestic and commercial use.

Source: Statistical Office of the European Communities, Coal and Other Energy Sources, 1964, No. 2.

Ministry of Economic Affairs, principally because of the growing importance of the natural gas fuels in Groningen Province. Other company operations during the year included two coking plants, briquet plants, several chemical works, gas distribution, power stations, research, a railroad system, shipping and port facilities, and sales offices.

Seventy to eighty percent of State Mines coal output was mechanized in 1963; only steeply inclined seams were mined by hand longwall methods. Hydraulic roof-support props have been gradually replacing existing friction props.

TABLE 10.—Production and employment of State Mines (Staatsmijnen) coal mines

	1961	1962	1963
Coal thousand tons	7,769	6,998	6,924
Coke do	2,994	2,682	2,725
Gross output per man shift kilograms	3,462	3,490	3,657
Labor force:			
At mines, underground	17,992	17,639	16,402
At mines, surface	6,377	6,175	5,885
At coke and chemical plants	8,551	8,901	8,892
Other	6,150	6,431	6,276
Total	39,070	39,146	37,455

Source: Annual Reports, Staatsmijnen in Limburg, 1962 and 1963.

Coal resources, mostly in Limburg Province, were reported to total 4.6 billion tons, of which 1.7 billion tons were reserves workable under 1963 economic conditions. The gross resources were distributed, by quality, as follows: Bituminous 64 percent, semibituminous 20 percent, and anthracite-semianthracite 7 percent.

Petroleum.—*Crude Oil.*—Domestic output of crude oil continued to gradually expand, although still providing only a small part of annual requirements. Imports, including bunkering and bonded warehouses, increased nearly 10 percent from 1962 while crude oil from bonded storage was shipped to West Germany in larger quantities.

Production remained under the exclusive control of NAM (N.V. Nederlandsche Aardolie Mij.—Netherlands Petroleum Co.), which was formed by Shell Netherlands and Esso Netherlands in 1947. Numerous companies continued exploration, encouraged more by natural gas prospects but still hopeful of locating new oil fields. During 1962 there were 412 producing oil wells in 13 productive fields of the Northeast Basin, near the West German border, and in the Western Basin. Total oil reserves reported during the year were 250 million barrels.

Large companies and small independents were involved in expansion of storage, refining, distribution, and marketing facilities. Storage capacity in 1961 was estimated to be 55 million barrels at ports, refineries, storage depots, inland distribution centers, oilfields, and pumping stations. A further 4.6 million barrels of tankage capacity was either planned during 1962 or construction was underway. Pipelines consisted of relatively short lines from oilfields and from Europoort to the refineries. As new storage facilities were built at Europoort, new lines were extended to the refineries.

Refinery Products.—Production of most petroleum refinery products was greater than in 1962; only for jet fuels and distillate fuel oils was output known to be less. Imports of most products also were higher, especially of the fuel oils. Exports also increased during the year, as the Netherlands remained a net exporter of gasoline, fuel oils, lubricants, liquefied petroleum gas, and other products through bunkering and bonded warehouse sales.

Three operational refineries in the Rotterdam area have been actively engaged in expansion of capacity, storage, or distribution facilities. A fourth, a 30,000-barrel per-day plant under construction for Gulf Oil Corp. at Europoort, neared completion during 1963. Late in the year, Gulf announced plans to double the plant capacity. The Shell refinery at Pernis, largest in western Europe, had about 60 percent of total refinery capacity late in 1963, including the new Gulf

TABLE 11.—Activities of major oil and gas companies in 1962–63

Company	Affiliation	Recent developments
BPHM (Benzine en Petroleum Handel Mij., N.V.)	British Petroleum Co., Ltd.	Exploration team on Schiermonnikoog Island. Started drilling offshore islands and Waddenzee. Expanded storage capacity at Amsterdam.
Caltex (Caltex Petroleum Mij., N.V.)	California Oil Co. and Texas Oil Co.	Continued drilling in Zeeland and Brabant provinces, and offshore; subsidiary Amoseas discovered gas, depth 6,200 feet on Ameland Island. Associated with Gulf and Mobil in North Sea exploration; further seismic activity in shallow sea between mainland and offshore islands. Opened new unloading and storage facilities at Europoort. Expansion of refinery at Pernis completed to 80,000 barrels per day. Two gas storage tanks constructed 1962; capacity, 1.8 million cubic feet each; 12 more planned. Participated with Esso in pipeline from storage to Pernis and Botlek and on to the Rhine.
Esso (Esso Nederlandsche, N.V.)	Standard Oil Co. of New Jersey.	Exploration activities through NAM. Also holds 25-percent interest in N.V. Nederlandsche Gasunie, new government-controlled company for natural gas distribution and marketing. Storage capacity at Botlek (Europoort) enlarged. Continued production at Botlek refinery, capacity 100,000 barrels per day; construction of lube oil blending and packaging plant, capacity 750 barrels per day; aromatics plant; and new tankage of 550,000 barrels capacity. Continued construction of Esso-Rhine pipeline for direct oil shipments to Ruhr.
Gulf (Gulf Oil Nederlandsche, N.V.)	Gulf Oil Corp.	Associated with Mobil and Caltex in North Sea exploration. Continued construction of 30,000 barrels per day refinery at Europoort; builder is Kellogg International Corp., cost in excess of fl00 million; will process a variety of crude oils.
NAM (N.V. Nederlandsche Aardolie Mij).	Shell Nederlandsche 50 percent; Standard Oil of New Jersey 50 percent (Esso).	Offshore exploration since 1956; completed 4 unsuccessful drill holes 1961–62 outside territorial waters; depths to 7,000 feet. Exploration continued 1963, including Ameland Island and Waddenzee, near mouth of Eems River. No exploration in 1963 beyond territorial waters. Made new gas discoveries, north coast Friesland Province and in Drenthe Province. Used helicopters in seismic surveys off Dutch coast; explosive charge fired from one helicopter; reflections measured in another. Controls largest concession areas, including Groningen Province. Oil and gas discoveries continued in numerous concessions; oil yield 38,000 barrels per day, 2 million tons per year, from 5 concessions. Numerous gas discoveries in northeast basin during 1962–63. Late in year, NAM and Brigitta, German subsidiary of Shell and Esso, announced gas reserve of 320 billion cubic feet in the Eems-Dollard estuary area between the 2 countries. Participated in N.V. Nederlandsche Gasunie, new gas distribution agency, on 50-50 basis with government, through Staatsmijnen (State Mines).
Royal Dutch—Shell Group (N.V. Koninklijke Nederlandsche Petroleum Mij. and N.V. Shell Nederlandsche).	With companies mainly in Netherlands, United States, France, Switzerland and United Kingdom.	Leading petroleum company in country; operates largest refinery and participates in exploration through NAM. Began work on largest crude oil storage tanks in the world at Europoort; tank diameter, 250 feet; height, 72 feet; capacity 630,000 barrels. Refinery at Pernis, 320,000 barrels per day, or 16 million tons annually. Storage at Amsterdam enlarged.

plant. Esso at Botlek had 19 percent; Caltex at Pernis had 15 percent; and Gulf at Europoort had 6 percent. A small asphalt refinery at Amsterdam, Smid en Hollander, continued production with a daily throughput of 4,300 barrels.

Natural Gas.—Data on the 1963 output of natural gas are not yet available. However, the total was probably greater than that in 1962 of approximately 41,000 million cubic feet of associated and nonassociated gas. Exploration was intensified on the mainland, offshore islands, territorial waters, and beyond the 3-mile limit in the North Sea. With approximately 90 percent of the country considered to be favorable for oil and gas, prospects for future discoveries remained

good. Gas reserves increased steadily during the year as discoveries or successful development wells were reported. Early in the year, reserve estimates were approximately 15 trillion cubic feet; at yearend a report by NAM, which has sole rights for natural gas production, showed reserves of about 40 trillion cubic feet.

TABLE 12.—Petroleum throughput, output and deliveries

(Thousand tons)

	1961	1962	1963
Throughput	21,492	24,237	24,955
Output	19,508	22,357	22,909
Internal deliveries:			
Jet fuels	295	308	330
Motor gasoline	1,315	1,427	1,612
Kerosine	545	676	827
Distillate fuel oils	2,576	3,088	3,600
Residual fuel oils	4,024	4,825	5,887
Turpentine and solvents	52	56	[1] 58
Liquefied petroleum gas	194	215	[1] 224
Lubricants	122	135	[1] 140
Bitumens and other	232	247	[1] 255

[1] Estimate.

Source: Statistical Office of the European Communities, Coal and Other Energy Sources, 1964, No. 2.

Twenty gasfields were productive in 1962, 14 in the Northeast Basin and 6 in the Western Basin. The immense Slochteren field in Groningen Province was shut in during 1962 but was scheduled for limited production in 1963. Production from this province was about 22 billion cubic feet in 1962. The gas was reported to occur in anticlinal structures, some fault zones, and a salt dome (Delfzijl) in Upper Permian and Lower Cretaceous strata at maximum depths of 10,000 feet. Depths to productive zones are reportedly much shallower in the Western Basin.

Government authorities and private operating companies directed their efforts toward preparation of marketing facilities as well as exploration during the year. The first pipeline deliveries were made, and plans continued on a countrywide pipeline network linking the gasfields, refineries, and municipal and industrial consumers. Schedules called for gas supply in Groningen Province during 1963 and throughout the country by 1967. A 300-mile pipeline network under construction was scheduled for completion in 1964. A U.S. engineering firm reportedly supervised the pipeline construction, while Dutch firms built the measuring and other ancillary installations.

Natural gas exploitation is governed by NAM, 60 percent, and State Mines, 40 percent. A new organization, N.V. Nederlandsche Gasunie (Netherlands Gas Union), was formally established on a 50–50 basis between the government (State Mines, 40 percent, State, 10 percent) and NAM, to coordinate gas policy on purchasing, distribution, and marketing. Plans were made for investment of f700 million on distribution facilities during 1963–70.

Plans to market natural gas in foreign countries also were advanced. Long-term contracts were concluded with West German firms during the year, and discussions also were held with French interests. The possibility of a gas pipeline under the North Sea to the United King-

dom was proposed. Royal Dutch/Shell and Esso, partners in NAM, formed NAM Gas Export, to promote the sale of natural gas abroad, and International Gas Transport Co., to arrange for future transportation of natural gas by pipeline to Western Europe.

Natural gas prices, which are subject to approval of the Ministry of Economic Affairs, were of much concern to potential domestic and foreign consumers. Late in the year, the Gas Union announced domestic wholesale prices charged to local distributors would be 6 cents (Dutch) per cubic meter. Export prices were not given but were expected to be slightly lower. In establishing natural gas prices, the government attempted to keep rates in line with other energy fuels and to lessen any disruptive effects of a large cheap fuel supply on the energy market.

The Mineral Industry of Norway

By Charles D. Hoyt[1]

ALTHOUGH Norway has limited mineral resources, it possesses a large and valuable resource in hydroelectric energy potential, which in 1961 was officially estimated at 110 billion to 128 billion kilowatt-hours annually. In 1963, hydropower production totaled 40.2 billion kilowatt-hours. Intensive use of hydropower, combined with a high level of technology, has made Norway a significant world producer of metals and alloys, as indicated by the approximate percentages of world production in 1962: Aluminum, 4 percent; ferroalloys, 7 percent (estimated); nickel, 8 percent; electrolytic zinc, 4 percent (estimated); and cobalt, 4 percent.

The output of these commodities is almost completely based on the processing of imported raw materials. Domestic mineral production contributes partially to ferroalloy raw material supplies (iron ore and silica) and to electrolytic zinc production.

In addition to this group of import-based metal products, Norway has developed its own mineral resources, particularly since World War II, and the country in 1963 continued to contribute significant quantities to the world output of a number of commodities. On the basis of 1962 data, Norway provided the following shares of world output: Magnesium, 11.3 percent; ilmenite, 14.4 percent; columbium-tantalum, 8.0 percent; feldspar, 3.6 percent; pyrites, 3.9 percent; and talc and soapstone, 4.9 percent.

Large quantities of most of Norway's mineral products are exported and do not enter the domestic economy as consumption items. Therefore, in viewing Norway's role in the world mineral economy, it is meaningful to mention that the country ranked first in the world as an exporter of ferroalloys, magnesium, and feldspar; second in exports of aluminum, titania, nickel ingots, electrolytic zinc, columbium-tantalum, and talc and soapstone; third as a molybdenum exporter; and fourth in exports of pyrites, cobalt, and mica.

The processing and production of these items continued to be important to the economy of the country. It is estimated that the total contribution of mineral and metal output to the gross national product in 1963 was 4 to 4.5 percent. The industry employed 31,000 workers (3 percent of the country's 1 million wage earners), of whom 23,000 worked in metal production and 8,000 in mining and quarrying. Mineral commodities in 1963 remained the most important export group and represented an estimated 31 percent of total export value (18 per-

[1] Staff engineer, Office of Program Coordination.

cent of import values), a slight increase over that of 1962, in spite of lower average unit prices.

The role of U.S. capital in the mineral development and economy of Norway has been appreciable but by no means dominant. The most important U.S. ownership within the mineral and metal industry has been in ferroalloy and titania output. The U.S. firm Union Carbide operates one of Europe's largest ferroalloy plants, and another U.S. firm, National Lead, owns the Norwegian titania operations, which are among the largest in the world.

The outstanding development during 1963 was the entry of two major U.S. aluminum producers, Alcoa and Harvey, into the country's aluminum industry. Alcoa entered joint ownership with one of the existing major aluminum producers, which is expanding its plant capacity. Harvey joined with one of the major Norwegian chemical (and magnesium) producers, Norsk Hydro, in a joint venture to build a 60,000-ton-per-year aluminum plant in western Norway. Capital investment projections for these and other increases in the country's aluminum capacity during the next few years total nearly one-quarter of a billion dollars. This estimate includes all costs for building additional power facilities, which have been approved by the Norwegian Government. Scheduled completion date for these new plants is 1965–67.

Investment in the Norwegian aluminum industry by such important aluminum producers portends well for the future of Norway's aluminum industry, which has been expanding very rapidly in recent years. Since 1950 output has more than quadrupled, reaching 211,000 tons during 1963. Developments within the Common Market are of particular interest to Norway since the common market countries are in short supply of aluminum.

GOVERNMENT POLICIES AND PROGRAMS

During 1963 there were no actual changes in the Government's policies toward the mineral industry or its extensive ownership within it. However, there was a substantial reassessment of these investments following a series of political events which were interwoven with problems concerning Government mineral operations and related to the philosophy of Government ownership of mineral industries. The Norwegian Government retained outright ownership or control of the major portion of the iron ore output, iron and steel production, aluminum output and several other mineral commodities of lesser importance. The economic results of these various Government enterprises during 1963 were sharply different. The iron ore and aluminum industries continued to be operated at a considerable profit. Profits for 1963 from the State-owned aluminum complex were officially estimated at nearly $5 million.

In contrast, the Government-owned steel plant at Mo i Rana continued to operate at a considerable deficit; the loss for 1963 was about $4 million, according to a Government report released in April 1964. This same report stated that the net total operating loss from the start of operations in 1955 to June 30, 1963, was more than $11 million. It further projected losses for 1964 and 1965, to total another $8.4

million. The Government also proceeded with the building of a coke and ammonia plant to be used in conjunction with the steel plant. This coke complex, which reportedly is to begin operation in mid-1964, has been a considerable source of dissatisfaction within the Government and the country because the original cost estimates of $20 million have been exceeded by an estimated 75 percent and the expected startup date has been delayed a number of times.

A third problem area within the Government mineral operations resulted in the fall of the Labor Government in August 1963. In November 1962, a serious explosion which cost 21 miners' lives occurred at the State-owned coal-mining operations at Kings Bay on the arctic island of West Spitsbergen. The operation was shut down following this disaster, and a no-confidence vote over the Government's conduct and responsibility for these operations resulted in the fall of the Government. Within less than 1 month, the opposition coalition government that took over was forced to resign and the Labor party returned to power. Subsequently, the Kings Bay coal-mining operation was closed indefinitely and was being liquidated at yearend.

These events have caused the Norwegian Labor Government to be cautious in making further major industrial investments. For example, a careful study is now being made by the Government to determine what should be done about the operations and intended expansion of the Mo i Rana steel plant.

PRODUCTION

During the year the country's mineral industries registered a mixed pattern of production changes. The light metals industries all showed increases in output, as well as significant activity in planning for and building additional production capacity to be available within a few years. There were small production increases within the ferrous industries, but the economic results, particularly at the major iron and steel producer, continued to be disappointing and of concern to the Government, which owns the operation. One major metal processor (nickel) encountered unusual marketing difficulties early in 1963 and had to reduce both its output and its work force temporarily. However, market conditions improved considerably by yearend.

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TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963 [1]
Metals:					
Aluminum:					
Primary:					
Unalloyed	148,385	167,984	174,909	205,892	219,161
Alloyed	5,354	8,448	5,614	[2] 9,400	
Secondary	2,436	3,183	3,000	3,400	4,700
Semimanufactures	[3] 12,000	17,132	17,697	[3] 18,000	[3] 19,000
Cadmium—kilograms	128,782	110,000	105,000	115,000	110,000
Cobalt [4]	390	478	555	600	625
Columbium concentrate—kilograms	289,898	345,997	321,197	[5] 300,504	355,000
Copper:					
Metal, content of concentrate	14,359	15,391	13,952	15,535	11,009
Smelter [4]	19,249	21,614	21,970	19,097	17,902
Iron and steel:					
Iron ore—thousand tons	1,547	1,658	1,673	1,950	1,966
Pig iron—do	338	374	378	399	415
Ferroalloys—do	246	289	313	265	[3] 279
Steel ingots and castings—do	426	489	499	489	593
Semimanufactures	292	277	303	([6])	([6])
Lead, metal content of ore	2,256	2,522	2,290	3,100	3,500
Magnesium metal	9,586	10,317	14,531	14,900	[5] 20,600
Molybdenum, metal content of concentrate	226	246	241	261	[5] 242
Nickel metal	25,998	30,428	32,215	29,202	[5] 26,420
Tin, secondary—long tons	606	721	71	76	([6])
Titanium concentrate	226,138	231,916	307,408	251,100	[5] 252,337
Zinc:					
Metal, content of concentrate	9,895	10,337	9,330	11,400	12,428
Smelter	48,777	43,962	46,527	44,976	[5] 46,647
Nonmetals:					
Cement—thousand tons	1,131	1,151	1,274	1,412	[5] 1,409
Dolomite	117,700	160,700	145,000	160,000	[3] 205,800
Feldspar	39,882	54,193	70,000	55,000	[5] 66,000
Graphite	4,895	5,840	5,700	6,400	[5] 7,600
Lime	122,543	123,330	([6])	([6])	([6])
Limestone—thousand tons	3,005	3,220	3,400	3,500	[3] 3,900
Mica	5,470	2,900	3,500	[2] [5] 3,200	[2] [5] 3,600
Nepheline syenite			8,149	19,940	23,000
Pyrites	744,163	832,714	733,391	793,000	[5] 710,737
Quartz	255,000	346,000	370,000	410,000	[3] 400,000
Sands (olivine and foundry)	28,600	40,736	43,200	50,900	56,900
Sulfur, elemental	78,348	72,399	62,138	45,927	
Talc and soapstone, ground	62,600	64,000	65,000	65,000	[2] 67,000
Mineral fuels:					
Solid:					
Coal	251,679	403,615	369,053	444,498	[5] 393,000
Coke, low-temperature	49,000	47,000	45,000	45,000	[5] 36,300
Peat:					
Agricultural use	50,000	38,000	45,000	36,000	40,000
Fuel	213,000	180,000	163,000	146,000	104,000
Liquid:					
Motor gasoline—thousand 42-gallon barrels	112	185	2,100	2,700	[3] 2,800
Kerosine—do		5	30	200	100
Distillate fuel oil—do	167	264	4,500	6,800	5,700
Residual fuel oil—do	18	141	4,500	6,200	7,800
Lubricants—do	127	179	40	200	200
Others—do	239	240	600	700	600

[1] Officially reported preliminary data, subject to revision.
[2] Estimate based on exports.
[3] Estimate.
[4] Totally recovered from an imported nickel-copper matte.
[5] Final figure; supersedes that given in Commodity Chapters, Volume I and II.
[6] Data not available.

TRADE

With few exceptions, Norwegian mineral and metal-processing output is exported; hence, comments on production, as well as the production changes, reflect what happened to the export markets.

Preliminary pricing information for the first three-quarters of 1963 indicated that export sale prices for nearly all the traditional export mineral commodities decreased, except for zinc. Nevertheless, total

value of mineral exports for 1963 will probably remain the same or increase slightly owing to moderate increases in production and exports, principally in aluminum and magnesium and, to a lesser degree, ferroalloys. It is the considered opinion of some Government officials that lower world prices for many export commodities and services (that is, shipping) are not merely short-range phenomena, but long-range, economic facts of life. This condition has developed principally through new techniques of production and transport throughout the world, and to compete with these expected permanent lower export prices, Norway will have to make similar advances in technology.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Ingot, unalloyed and alloyed	146,295	171,690	United Kingdom 50,408; United States 49,867; West Germany 29,298.
Semimanufactures	5,665	5,907	Denmark 2,257; Sweden 1,407; Finland 677.
Cadmium, ingot	93	87	(1).
Cobalt, unwrought	636	645	(1).
Columbium-tantalum ore	195	268	(1).
Copper:			
Ore	10,606	11,385	West Germany 5,908; Sweden 5,477.
Matte	19,882	15,759	Sweden 10,442; West Germany 5,317.
Ingot:			
Unrefined and refined	19,057	17,957	West Germany 10,606; France 4,277; Switzerland 816.
Alloy (including all copper scrap).	3,407	2,811	West Germany 1,463; Sweden 772; Italy 436.
Semimanufactures	2,472	2,232	United States 682; Denmark 630; Netherlands 453.
Iron and steel:			
Iron ore	1,138	1,269	West Germany 810; United Kingdom 302; Poland 113.
Pig iron	119,850	135,119	United Kingdom 48,620; West Germany 31,255; Belgium-Luxembourg 10,718.
Ferroalloys:			
Ferromanganese	48,120	46,580	Belgium-Luxembourg 11,447; West Germany 9,470; Netherlands 6,526.
Ferrosilicon	161,930	135,909	United Kingdom 54,892; West Germany 41,872; Belgium-Luxembourg 14,076.
Ferrosilicomanganese	86,254	71,702	West Germany 23,234; United Kingdom 17,059; United States 9,025.
Ferrochrome	21,593	17,067	United Kingdom 4,359; United States 3,677; West Germany 2,659.
Ferrosilicochrome	3,209	2,673	United Kingdom 1,537; Sweden 446; West Germany 342.
Others	1,208	924	United Kingdom 463; West Germany 147.
Steel ingots and equivalent primary forms.	27,365	48,891	Netherlands 20,433; Denmark 11,808; Greece 5,999.
Semimanufactures	121,800	133,347	Sweden 33,727; U.S.S.R. 14,521; Denmark 14,453.
Lead:			
Ore	3,440	5,151	All to West Germany.
Ingot, unalloyed and alloyed	489	255	Sweden 122; Finland 34.
Scrap	2,394	2,407	Denmark 1,430; Italy 609; Sweden 287.
Semimanufactures	229	424	Sweden 341; Iceland 46.
Magnesium:			
Unwrought	12,352	14,759	(1).
Scrap and semimanufactures	220	152	Italy 92; West Germany 54.
Manganese ore	406	203	United Kingdom 203.
Molybdenum concentrate	400	488	(1).
Nickel:			
Ingot	29,676	27,680	United States 13,960; West Germany 5,091; Sweden 3,933.
Semimanufactures and scrap	1,000	860	Sweden 266; West Germany 187; Italy 112.
Platinum metal—troy ounces	10,706	15,786	United States 12,956; Netherlands 1,608; United Kingdom 1,157.

See footnote at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals—Continued			
Silver in all forms.....troy ounces	15,014	19,226	West Germany 14,950.
Tin in all forms.....long tons	458	327	Sweden 251; Denmark 31.
Titanium concentrate	303,340	233,786	(1).
Zinc:			
Concentrate	9,687	15,201	West Germany 14,078; France 1,123.
Ingot, unalloyed and alloyed	32,556	33,518	Sweden 10,568; West Germany 9,412; Denmark 5,649.
Scrap and semimanufactures	797	1,402	Japan 362; West Germany 286; Sweden 204.
Nonmetals:			
Cement	121,124	212,303	United States 177,579; Sweden 20,673; Spain 6,203.
Dolomite	46,518	59,778	Sweden 11,821; West Germany 11,505; France 8,115.
Feldspar	67,588	71,411	United Kingdom 33,364; West Germany 10,069; Netherlands 7,766.
Graphite	6,178	6,655	West Germany 2,096; United States 1,907; United Kingdom 1,120.
Lime	1,413	124	Sweden 108.
Limestone	28,812	25,592	Sweden 22,255; West Germany 669.
Mica	2,932	3,020	France 593; Sweden 510; Netherlands 195.
Pyrites:			
Unroasted	438,728	559,720	West Germany 380,215; Sweden 90,481; Denmark 49,645.
Roasted	71,682	79,320	West Germany 72,220; Sweden 7,100.
Quartz	26,872	21,040	West Germany 11,710; United Kingdom 6,568.
Salt	6,583	3,048	Sweden 1,408; Denmark 833; Iceland 775.
Sands (foundry)	17,502	335	(1).
Sulfur	34,821	32,769	Sweden 31,940; Denmark 789.
Talc and soapstone	61,855	64,176	United Kingdom 17,339; West Germany 9,367; Netherlands 6,726.
Mineral fuels:			
Solid: Coal	162,515	179,989	West Germany 142,629; Denmark 37,263.
Liquid: Petroleum products	651,532	1,215,668	Denmark 813,285; Sweden 363,270.

[1] Data not available.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Bauxite	29,975	38,404	Greece 38,097.
Alumina	302,149	411,807	Jamaica 219,382; Guinea 91,540; British Guinea 51,631; United States 49,205.
Ingot, unalloyed and alloyed	2,408	1,376	United States 1,087; United Kingdom 144; Canada 65.
Rolled and scrap	7,138	8,984	Sweden 2,639; United Kingdom 2,464; Belgium-Luxembourg 1,724.
Chromite ore	101,538	50,747	Northern Rhodesia and Nyasaland 19,104; Turkey 11,276; Greece 8,309.
Copper:			
Refined, ingot	4,315	5,192	United States 2,463; Sweden 1,602; United Kingdom 989.
Alloys and scrap	577	485	United Kingdom 403.
Semimanufactures	18,011	18,835	Sweden 10,667; Canada 4,640; United Kingdom 1,509.
Gold.....troy ounces	22,505	23,148	
Iron and steel:			
Iron ore	13,702	21,503	Sweden 21,118.
Pig iron	17,083	8,486	Sweden 5,301; West Germany 1,975; Netherlands 987.
Ferroalloys	4,893	322	Sweden 142; Republic of South Africa 51; West Germany 45.
Steel, ingots and equivalent primary forms.	11,967	8,576	Sweden 5,678; Denmark 2,332.
Semimanufactures	580,300	627,857	United Kingdom 270,292; West Germany 127,486; Belgium-Luxembourg 122,107.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals—Continued			
Lead:			
Ingot:			
Unalloyed	8,590	8,119	Sweden 3,564; Mexico 1,346; Peru 1,345.
Alloyed	1,563	1,473	Denmark 1,188; Sweden 162.
Scrap	319	45	All from Sweden.
Semimanufactures	1,166	1,391	Belgium-Luxembourg 375; Netherlands 261; West Germany 250.
Magnesium in all forms	78	9	Italy 7.
Manganese ore	228,964	284,116	Ghana 90,018; British Guiana 51,396; Republic of South Africa 44,458.
Mercury	46	29	Spain 18.
Nickel:			
Matte	64,344	60,857	All from Canada.
Scrap	4,001	532	United States 246; Netherlands 117; United Kingdom 114.
Semimanufactures	409	398	United Kingdom 235; Sweden 99; Belgium-Luxembourg 24.
Platinum in all forms—troy ounces	3,601	3,504	United Kingdom 3,022.
Silver in all forms—thousand troy ounces	2,850	2,735	United Kingdom 1,492; West Germany 1,096.
Tin in all forms—long tons	771	706	United Kingdom 313; West Germany 139; Netherlands 89.
Titanium concentrate	306	163	Australia 112.
Zinc:			
Ore	66,931	69,465	Sweden 24,661; Belgium-Luxembourg 17,000; Canada 10,778.
Ingot, unalloyed and alloyed	1,084	2,301	U.S.S.R. 2,039.
Scrap and semimanufactures	3,362	3,404	France 1,575; Belgium-Luxembourg 719; Sweden 489.
Others [1]	249	273	(2).
Nonmetals:			
Abrasives, natural	338	282	Denmark 277.
Asbestos	6,077	5,231	Federation of Rhodesia-Nyasaland 2,083; Canada 1,340; U.S.S.R. 500.
Barium compounds	589	360	West Germany 223; Algeria 100.
Cement	38,998	7,021	Denmark 3,748; United Kingdom 1,714; Sweden 694.
Chalk	5,932	5,593	France 3,793; Sweden 543; Denmark 487.
Clays:			
Kaolin	57,156	49,160	United Kingdom 48,030.
Others	33,567	32,763	United Kingdom 21,647; Sweden 2,682; Czechoslovakia, 2,280.
Cryolite, natural	2,807	1,892	All from Denmark (Greenland).
Diatomaceous earths	5,237	5,928	Denmark 4,433; United States 1,220.
Dolomite, burned	3,421	3,754	West Germany 1,643; Sweden 954; Belgium-Luxembourg 555.
Fluorspar	2,768	1,536	Republic of South Africa 795; United Kingdom 403; West Germany 302.
Graphite	612	420	United Kingdom 222; West Germany 124; Sweden 59.
Gypsum	58,508	54,575	Poland 36,848; France 13,837; West Germany 2,150.
Lime	9,608	13,776	Sweden 9,426; Denmark 4,299.
Limestone	85,889	106,588	United Kingdom 87,900; Sweden 9,598; Denmark 5,192.
Magnesite	4,942	7,668	Netherlands 5,252; Yugoslavia 2,050.
Mica	2,975	4,212	India 4,187.
Phosphate rock	152,922	168,367	U.S.S.R. 95,384; Morocco 67,920; Tunisia 5,062.
Potash fertilizers	89,247	86,792	Spain 55,032; France 11,765; U.S.S.R. 5,020.
Quartz	5,026	3,754	Sweden 3,526.
Salt	227,694	246,708	Netherlands 66,562; West Germany 60,324; Spain 32,419.
Sands:			
Glass	48,918	56,173	Belgium-Luxembourg 37,807; Netherlands 14,260.
Foundry	21,896	23,100	Sweden 9,018; France 7,024; Denmark 3,644.
Talc and soapstone	1,595	2,762	India 1,896; mainland China 220.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Mineral fuels:			
Solid:			
Coal in all forms	289,419	251,936	United Kingdom 91,296; Belgium-Luxembourg 64,835; Poland 62,386.
Coke in all forms	701,232	674,767	United Kingdom 550,163; West Germany 41,188; Netherlands 33,285.
Liquid:			
Crude oil thousand tons	1,739	2,355	Venezuela 2,355.
Petroleum products do	2,859	2,983	United Kingdom 1,017; Netherlands 954; U.S.S.R. 191.

[1] Tungsten, molybdenum, tantalum, cadmium, cobalt, antimony, and uranium.
[2] Data not available.

COMMODITY REVIEW

METALS

Aluminum.—Output for 1963 increased slightly over that of 1962, reaching a new high for the industry. This increased production continued the rapid growth by the industry over the past decade, during which Norway has become one of world's major sources of primary aluminum. Among the nation's four producers in 1963, the State-owned A/S Årdal og Sunndal Verk remained dominant and produced almost 70 percent of the total.

Extensive expansion plans for the export industry were finalized during 1963. Contracts were signed for the building of three large-scale aluminum plants during the next 2 to 4 years (total reported combined annual capacity 160,000 tons). Two of these new plants will be jointly financed by U.S.-Norwegian interests, and the third will be financed by a consortium of Swiss-French-Norwegian capital. In addition, three of the four existing domestic producers are expanding plant facilities. The total ingot capacity of the industry at the end of 1963 was about 240,000 tons. A projected aluminum capacity of 400,000 tons by 1970 has been mentioned by officials in industry. The Norwegian Government has approved the building of the power facilities for this expansion, and financing is being arranged.

During 1963, as in previous years, most of the aluminum output was exported (85 percent), principally to other European countries and the United States. Over the past decade Norway's most important customers have been the United Kingdom (26 percent), the United States (18 percent), Sweden (14 percent), and West Germany (10 percent). The remaining 32 percent was shipped to a wide variety of countries throughout the world. All aluminum raw materials must be imported since Norway has none. Jamaica and Guinea continued to be the most important alumina suppliers; Greece provided the bauxite.

Consumption within Norway during 1963 increased to almost 30,000 tons. Over half of this domestic consumption was by the country's only aluminum fabricating plant, A/S Nordisk Aluminium Industri, which is a subsidiary of one of the private aluminum producers, A/S

Norsk Aluminum Company. Both the fabricating plant and the parent company are doubling their original plant capacities and expect to complete this expansion during 1965 when their ingot and processing capacity will be 28,000 to 30,000 tons annually. The remainder of the domestically consumed aluminum is used by Norway's foundry, alloy, and metalworking industries.

Cadmium.—Cadmium metal is a byproduct of the refining of zinc at the Det Norske Zinkkompani A/S plant. Slightly over 90 percent of the cadmium output is exported, primarily to Sweden. The balance is consumed domestically.

Cobalt.—The nation's total cobalt output is derived as a byproduct of the processing of imported nickel-copper matte. Practically all of this production has been exported, with roughly three-fourths going to the United States. Small quantities of cobalt are contained in some of the country's pyritic ores, but these are not sufficient to justify domestic recovery.

Columbium-Tantalum.—All production comes from a small Government-owned mining operation that was started in 1953 based on markets and favorable price incentives provided by the U.S. stockpiling program. Declining world prices since 1955, when stockpiling was completed, have made the Norwegian operations a losing or near-marginal operation.

An increasing portion of the concentrate have been converted to ferrocolumbium since 1957. Nearly all the exports of both the ferrocolumbium and the concentrate have been to the United States.

It has been reported that further consideration was being given to closing this operation because of the continued operating losses. The Government has reportedly offered this property for sale and will discontinue operations by July 1, 1964, whether or not a buyer is found.

Copper.—The metallic copper output in Norway has been derived mainly from processing nickel-copper matte imported from Canada. This matte is processed at the Falconbridge Nikkelverk A/S, the only significant copper processor in the country. The remainder is blister copper recovered from the processing of domestically mined ores at the largest base-metal-mining operation.

In 1963 there were 12 underground operations, most of them relatively small, mining pyritic ores. Ten of these mines contained copper-bearing ores. Some of the copper was recovered as concentrates within the country, and the balance was exported as copper pyrites and recovered at foreign smelters. Total contained copper eventually recovered from Norwegian ores was almost 14,000 tons in 1963, about the same as in 1962.

Among the operations based on domestic ores, A/S Sulitjelma remained the largest producer. In 1963 their electric smelter and air-blown converter produced over 4,000 tons of 99 percent blister copper. All the remaining mine copper producers process the ores to concentrates, primarily by flotation.

In 1963 the country's entire domestic output of copper and the refined copper recovered from imported matte was exported in the form of concentrate, copper-bearing pyrite, and blister copper. The actual total export of copper in all forms for 1963 was 28,600 tons,

of which the electrolytically refined copper amounted to slightly over half. Nearly all the exports were to Western European countries and the United Kingdom; no one country received a particularly large quantity.

Norway's domestic needs are satisfied entirely by imports. In 1963 these imports originated principally in Western Europe and the United Kingdom; Canada and the United States each provided small amounts of copper and copper alloy products.

Iron Ore.—The 1963 output of iron ore increased slightly to a record level. One large, Government-owned open-pit mining operation, A/S Sydvaranger, in northern Norway near the Soviet border, continued to dominate the iron ore picture. During 1963 it produced about three-fourths of the country's output; two underground operations, one of these also Government-owned, provided most of the remaining output. There are some smaller producers whose output was very limited.

As in the past, nearly the entire output of the country's iron ore was in concentrate form. The grade of the ores (32 to 40 percent) was such that they required beneficiation. It was necessary to mine over 3.4 million tons of low-grade ores to produce about 2 million tons of 65 to 66 percent iron ore concentrate.

As in previous years, Norway's export of iron ore concentrate went principally to West Germany and the United Kingdom. Nearly all the exports came from the Sydvaranger taconite operations. No significant changes are anticipated in the trade patterns for 1964, since nearly all these exports are sold in advance to traditional customers on an annual contract basis. The entire 1964 output (estimated at 1.5 million tons) of iron ore from Sydvaranger reportedly had been sold in advance to customers in West Germany, the United Kingdom, Austria, and Norway, at the same price levels as in 1963.

During 1963 Norway's consumption of iron ore held firm at slightly over 700,000 tons. The principal customers for these ores are the domestic steel producers, two of which produce almost all of the country's iron and steel output. The Government-owned steel plant at Mo i Rana continued to obtain its annual needs of about 500,000 tons from Sydvaranger and the Fosdalen iron mine. The private steel producer Christiania Spigerverk, has two mines which supply its entire iron ore requirements of about 120,000 tons annually. The remainder of the domestic iron ore consumption is by the ferroalloy industry.

Ferroalloys.—In 1963 Norway maintained its position as one of the world's largest producers of ferroalloys, with particular emphasis on the silicon-bearing alloys. Ferrosilicon production provided about 40 percent of total output, with the balance divided among ferrochrome, ferromanganese, and silicomanganese, which has shown the greatest increase in use in recent years.

A new ferrosilicon producer, Orkla Metal A/S, began operations in late 1963. Its plant was converted from a pyrite smelter to a ferroalloy production works for economic reasons at the end of 1962. Annual capacity of the new producer will be 25,000 tons. The new plant was Norway's ninth ferrosilicon producer. During the year there were no plant or capacity changes among the four producers of ferrochrome and ferromanganese alloys. The Union Carbide subsidiary,

Electric Furnace Products, Ltd., produced over 100,000 tons of chromium and manganese-base alloys and continued to dominate the industry.

The only other ferroalloy producer was a small State-owned facility which converts part of its concentrate output to ferrocolumbium. This operation may be discontinued in mid-1964.

In 1963 the country remained one of the world's leading exporters of ferroalloys. Normally 85 to 90 percent of the ferroalloy production is exported, principally to other European countries, and this market position was maintained in 1963. As in the past, the United Kingdom, West Germany, and Belgium-Luxembourg received the bulk of these exports. Shipments to the United States, which in recent years have averaged about 16,000 tons dropped 54 percent to 7,410 tons in 1963.

Of the raw materials for ferroalloy production, Norwegian mines supply silica and iron ore; all the manganese and chrome ores have to be imported. Ghana continued to be the principal source of manganese ores, with the Soviet Union and the Republic of South Africa as secondary suppliers. The Federation of Rhodesia and Nyasaland and Turkey continued to provide most of the chrome ores.

Iron and Steel.—In spite of the nation's 1963 record level of crude steel output, Norway's major steel producer, the State-owned Mo i Rana steel complex (which provides roughly three-quarters of the country's output) experienced losses estimated at about US$4 million in 1963. Moreover, lesser but still significant losses were projected for the next 2 years. The complex has been in the process of expanding its capacity to about 750,000 tons annually and becoming fully integrated by developing its own iron ore source at the nearby Dunderland deposits. In early 1964 the Government appointed an advisory committee of three experts, two Norwegians and one American to evaluate all aspects of the Government iron and steel operations. All three members of the committee are from private enterprise.

Christiania Spigerverk, the privately operated second major producer whose output is almost totally for domestic consumption, had another successful year of operation. Both crude and rolled steel production reached new highs at or near present capacity levels. Total sales for the firm were also at a new peak of almost US$34 million. Spigerverk, a fully integrated producer, began as a nailworks but by 1963 was operating a complex of divisions and subsidiaries that produced a wide variety of finished products ranging from farm implements to tin cans. It also operated a ferroalloy plant and the largest wire-drawing plant (35,000 to 40,000 tons annually) in Scandinavia. The total number employees of the corporation in 1963 increased to almost 3,200, which is about the same number employed by the Mo i Rana complex.

Output at Norway's other steel plant, Stavanger Electro-Staalverk A/S, a specialty alloy steel producer, increased slightly in 1963 to 26,000 tons.

In 1963 Norway continued to be dependent on imports for most of its iron and steel requirements. Imports for the year were equivalent to about two-thirds of the estimated domestic consumption. Over half the imports in 1963 were as plates and sheets; structural steels

made up the second largest import group, and the balance was distributed among the other steel categories. The bulk of these steel imports maintained the country's traditional trade pattern and originated largely in Belgium-Luxembourg, West Germany, and the United Kingdom.

Exports of both pig iron and steel increased. Pig iron shipments expanded to 140,000 tons and steel shipments to almost 190,000 tons. Structural steel and ingots were the largest export categories; the principal customers were Sweden and the United Kingdom.

Lead.—No primary refined lead was recovered in Norway. Output of concentrates came from two mining operations, Bleikvassli Gruber A/S and Bergverkselskapet Nord-Norges A/S, both of which also produced other base metals and pyrites. Over 90 percent of the concentrate output came from the Bleikvassli mine which opened in the early 1950's.

All lead concentrate produced in 1963 was shipped to West Germany for smelting under an arrangement in effect since 1954. The country's needs for lead and lead products were met through imports, except for small tonnages of secondary lead recovered domestically. In 1963 the imports were 11,500 tons of lead and lead products, of which the major portion was lead ingots. Sweden continued to be the principal supplier.

Magnesium.—During 1963 the country strengthened its position as the world's largest exporter of magnesium, increasing its sales almost 16 percent over the 1962 level. All production continued to come from a single plant southwest of Oslo, operated by the major chemical and fertilizer producer, Norsk Hydro-Elektrisk Kvalstofaktieselskabet. The plant, which began operation in 1951 under the impetus of the U.S. stockpiling program, has had a history of continuous growth. Plant capacity at the end of 1963 had been increased to over 19,000 tons, and plans have been made to further expand capacity in 5,000-ton stages. Reports indicate that expansion of plant capacity will continue during 1964.

No basic changes appeared in the modified electrolytic process used in magnesium recovery, so the raw material base of sea water, dolomite mined in Norway, and coal from privately owned West Spitsbergen mines appears more than sufficient to support any foreseeable market demands.

Most of the exports in 1963 continued to go to West Germany for use in the manufacture of components for Volkswagen automobiles. The small remaining exports have gone to other European countries.

Molybdenum.—Norway's entire molybdenum production came from A/S Knaben Molybdaengruber's mine and mill in southern Norway, Western Europe's only significant molybdenum producer. Swedish interests (Avesta Jernverk) control this operation, and nearly all the output was exported to Sweden.

Nickel.—A refinery operated by Falconbridge Nikkelverk A/S accounted for all of Norway's nickel output. This firm is a subsidiary of the Canadian company Falconbridge Mines, Ltd. The Canadian parent company ships its entire smelter output to the Norwegian plant for final processing. The smelter product imported was a matte containing 48 to 50 percent nickel, 28 percent copper, and small amounts of cobalt, selenium, and various precious metals.

World markets for nickel during the year declined so much that in late 1963 the Norwegian nickel plant reportedly had an unsold inventory of 8,000 tons. It therefore became necessary to lay off temporarily 140 of its workers, roughly 10 percent of the total labor force. When market conditions improved near yearend, these workers presumably were reemployed.

Nearly all the refined nickel was exported. The United States was the primary customer (about half of the shipments), and the United Kingdom, West Germany, and Sweden received most of the balance. Imports of nickel-copper matte from Canada in 1963 were about 50,000 tons, compared with 60,857 tons in 1962.

Precious Metals.—In 1963, no precious metals were derived in Norway from Norwegian ores. Small amounts of gold, silver, platinum, and selenium were recovered at the nickel refinery of Falconbridge Nikkelverk A/S, which processes nickel-copper matte imported from Canada. Exact amounts of these metals recovered have not been reported, but platinum exports of 13,000 troy ounces were reported in 1962. These are assumed to have originated at the nickel refinery. All platinum exports were in crude form and were destined primarily for the United States and West Germany.

The country traditionally imports both silver and platinum for use of its extensive metalworking industry. Imports of silver in 1963 were almost 2.8 million ounces and originated mainly in the United Kingdom and West Germany. A small export trade in silver has been conducted with Denmark.

Some of the country's pyrite concentrates contain minor amounts of precious metals; these were not recovered in the country.

Tin.—Output of tin in 1963 was derived totally from the processing of scrap, primarily tinplate, at the A/S Stavanger Tinfabrik in southern Norway. This plant can process 20,000 tons of scrap annually. Nearly all scrap treated has been of domestic origin.

Imports of tin and tin alloys for 1963 were mainly as crude tin, while exports were nearly all in the form of solder destined for Sweden. This solder was produced by the Stavanger tin plant, which also produces a variety of aluminum and base metal alloys.

The country's estimated annual domestic consumption of tin and tin alloys is 900 to 1,100 tons, most of which is used in making tinplate for the country's large canning industry.

Titanium.—Norway's titania concentrate output for 1963 was estimated to have increased nearly 10 percent over the 1962 level, but was considerably below the peak output in 1961. Nevertheless, Norway still holds a very important position within the world titanium industry. All titania production continued to come from a single producer, A/S Titania, a subsidiary of the National Lead Company, a U.S. firm. Original mining at this operation was by underground methods, but the development and exploitation of a new, very large ore body (300 to 350 million tons of 17 percent titanium dioxide and 20 percent iron) near the original deposit permitted mining by low-cost open-pit methods. Cost results at this new operation have been so favorable that the underground operations are scheduled to be shut down within the near future, after which all output will come from the new deposit. This changeover was being accomplished in 1963.

During the year a 15,000-ton-per-year pigment plant was being constructed at Fredrikstad, adjacent to a small existing plant. This had not come into full-scale operation at yearend. The plant output is to be marketed domestically and within Scandinavia.

During 1963, as in the past, nearly all of the titania concentrates except those consumed domestically, went to the National Lead Company pigment plant at Leverkusen in West Germany. No change is foreseen in this pattern unless a titanium slag plant is built in Norway. Over the past year there have been discussions, full-scale amenability tests, and pilot plant operations for a proposed titanium slag smelter able to treat 600,000 tons of concentrates annually. This plant is to be built in Norway near the present operation. Total capital investment required for such a smelter is U.S.$35 million. Approval of the required power facilities for this smelter was given by the Norwegian Government in June 1963. Owing to the large investment required and the depressed condition of world markets for titanium, no definite action on this smelter proposal was taken by the end of 1963.

Zinc.—Zinc output for 1963 showed a slight increase over that of 1962 but was well below the peak years of 1956 and 1959. The entire zinc production continued to be processed at one of Europe's largest electrolytic zinc plants; this facility is operated by Det Norske Zinkkompani A/S, in which the Belgian firm Royale Asturienne des Mines holds a controlling interest. About 75 percent of the ores treated at the Eitrheim plant were imported, and the remaining 25 percent were from domestic mines.

Seven domestic mining operations recovered zinc concentrates to be further processed at the Eitrheim refinery. The zinc content of domestic ores produced in 1963 was slightly over 10,000 tons. Two companies, A/S Bleikvassli Gruber and Folldal Verk A/S, produced over 60 percent of domestic mine output.

In 1963 a little over three-fourths of the refined zinc output was exported, almost totally to other European countries, Sweden, France, and West Germany continued to be the largest customers.

The import of ores in 1963 was slightly over 80,000 tons; as in the past, Sweden, Australia, Spain, Canada, and France provided the ores.

The country's imports of zinc and zinc products reached a new high in 1963, when 6,000 tons were brought in, primarily from Western Europe. Estimated consumption of zinc and zinc products for the year was 16,000 tons, a 6-percent increase over that of 1962.

NONMETALS

Cement.—The country's three cement plants, which produce almost totally for domestic consumption, had a combined output of 1.4 million tons during the year. This was almost identical with the production of 1962.

Clays.—Norway's clays are suitable for building uses, but the country lacks ceramic-quality clays. Imports of ceramic clays, primarily from the United Kingdom, exceeded 80,000 tons in 1963. Over half of these imports were china clay.

Dolomite.—Output of dolomite reached a new high in 1963. All this production was mined by Hammerfall Dolomitbrudd, which is owned and operated by the Norwegian Talc Co., A/S, the leading nonmetallics producer in the country. The major portion of Norway's dolomite consumption is used in the production of magnesium at the Norsk Hydro plant.

Dolomite exports also expanded in 1963; principal customers were Sweden, France, West Germany, and the Netherlands. Adequate dolomite reserves exist to supply the expansion taking place within the magnesium industry and any additional export markets that may be developed.

Feldspar.—The bulk of Norwegian feldspar output was exported, principally to the United Kingdom and other European countries for use in the ceramics industries. Domestic consumption, used primarily in glass and porcelain manufacture, is estimated at 3,000 to 5,000 tons annually. Output was obtained from the mining of pegmatite dikes from which mica, quartz, and other minerals also are recovered.

Fluorspar and Cryolite.—All fluorspar and cryolite used in Norway must be imported, since the country has no domestic sources. Fluorspar is used in the steel, ceramic, and aluminum industries; consumption in 1963 was almost 3,000 tons.

Domestic consumption of synthetic and natural cryolite, which totaled about 8,500 tons in 1963, was used in the country's extensive and growing aluminum industry. Over three-quarters of the cryolite consumed was in synthetic form and was imported from West Germany and Italy. All the natural cryolite has come from Denmark's operations in Greenland, which stopped production in 1962 but had sufficient ore stockpiled to supply present customers for an estimated 20 years at the present rate of consumption.

Graphite.—Output of processed graphite from the country's single producer was nearly 7,200 tons in 1963, a 11-percent increase over that of 1962 and an alltime high. The A/S Skaland Grafitverk quarried and processed about 28,000 tons of 25 to 30 percent ore in 1963 to produce the final product, nearly all of which is exported. The Ever-Ready Co. of London, a large battery manufacturer, owns a financial interest in the Skaland operations and conducts most of the company's export business. Small tonnages of specialty graphites were imported from the United Kingdom and Sweden.

Mica.—The output of mica was derived from the mining of pegmatites. Roughly three-fourths of this production was exported to West Germany, France, and Sweden to be used in the electrical industry.

Scrap mica imported in 1963 came primarily from India. The cheaper unit cost of the scrap mica is the reason for importing it, rather than consuming the domestic output.

Nepheline Syenite.—Production of nepheline syenite, which began in late 1959, expanded sharply in 1963. Output was obtained entirely from an underground mine and a plant operated by A/S Norsk Nefelin, a subsidiary of the major domestic steel producer, Christiania Spigerverk. Most of the nepheline syenite output is exported, but the country's largest porcelain manufacturer consumed some of the

output as a raw material for porcelain manufacture replacing feldspar, to which it has superior characteristics. It is anticipated that in 1964 output may reach the rated plant capacity of 40,000 to 50,000 tons.

Phosphate Rock and Other Mineral Fertilizers.—Norway is deficient in minerals from which the three basic fertilizer components(nitrogen, potassium, and phosphate) can be recovered. Thus, the country's requirements for fertilizers must be satisfied by either synthetically manufactured fertilizers or production based on imported fertilizer raw materials. Imports of phosphate ores in 1963 were almost 170,000 tons, a slight increase over those of 1962. Morocco was the primary source; the Soviet Union was the secondary supplier.

Pyrites and Sulfur.—The country's pyrite production in 1963 declined 10 percent, compared with 1962 output. This reduction was primarily due to the end of pyrite processing at the Orkla Metals A/S plant, effective December 31, 1962. This plant, which formerly treated about one-third of the domestic pyrite output, was the country's only source of elemental sulfur. In addition the plant recovered copper. It was converted to ferrosilicon production after its closure as a sulfur and copper operation.

Twelve domestic mines produced pyrites in 1963, all by underground operations. Among these, Orkla Gruber A/S continued to be the dominant factor in pyrite production, with about 40 percent of domestic production. One other operation, the Skoravas mine, was a fairly large producer with an annual output of about 140,000 tons of pyrite concentrates. Other producers were small and most of them also recovered base metal concentrates. One of these smaller mines, Bjorkasen Gruber A/S, totally owned by Swedish interests, reportedly shut down operations at the end of 1963 owing to insufficient reserves and continuing poor marketing conditions for pyrites.

Silica.—The major portion of Norway's quartz output was consumed by the country's extensive ferroalloy industry. High-purity quartz was also produced in small tonnages for use in the domestic ceramic and silicon carbide industries. In addition, about 25,000 tons of electronic-grade quartz was produced and shipped to West Germany, the United Kingdom, and the Netherlands. Small tonnages of semiprocessed, electronic-grade quartz were imported from Sweden and West Germany.

Norway has adequate construction material sands but has to import its entire supply of glass sands and some other specialty sands. Imports of these commodities totaled about 82,000 tons in 1963. Belgium-Luxembourg provided most of the glass sands, which amounted to about 70 percent of the total imports of special-purpose sands. The country exported small tonnages of foundry sands; these were presumably olivine sands, although export statistics do not identify them as such.

Talc and Soapstone.—The country's production of talc and soapstone in 1963 was slightly above that of 1962. Output is exported principally to the United Kingdom, Denmark, and West Germany with the remainder divided among some 20 other countries.

Most of the talc and soapstone is processed into ground form by A/S Norwegian Talc, which operates several quarries and a processing plant at Bergen. This firm specializes in extremely fine grinding

(micronizing) of nonmetals of all types. Annual output of all nonmetals from this plant is about 70,000 tons, of which an estimated 40,000 tons is ground talc and soapstone.

MINERAL FUELS

Coal and Coke.—All of Norway's coal output comes from one mining operation on the arctic possession of West Spitsbergen and owned by Store Norske Spitsbergen Kulkompani. Coal shipments from the island, which only has a 7-month shipping season because of ice conditions, amounted to 430,000 tons in 1963; about 100,000 tons was shipped for use at the new coke plant at Mo i Rana. It is expected that domestic consumption of coal will increase considerably when this new Government-operated plant begins operations in mid-1964. The plant will require about 300,000 tons annually of Spitsbergen coals when operating at full capacity.

The Government-operated Kings Bay coal mine on West Spitsbergen was shut down following the 1962 disaster and is not expected to reopen.

Coal and coke imports totaled almost 950,000 tons in 1963, of which 75 percent was coke of various types. The United Kingdom and Belgium-Luxembourg provided most of the coal imports, and the United Kingdom also supplied the bulk of the coke imports. Exports of Spitsbergen coal amounted to over 180,000 tons, or about half the domestic production for 1963. West Germany received 80 percent of these exports and Denmark received the remainder.

Petroleum.—Norway continued to be totally dependent on imports for its requirements of crude oil and petroleum products. Imports in 1962 exceeded those of 1961 by almost 17 percent. This does not represent a similarly high increase in consumption because exports of refined products for this same period were almost doubled. Actual domestic consumption increased 5 percent, comparing 1962 with 1961, and private estimates indicate that 1963 consumption increased almost 8 percent over 1962 levels.

Norway's two refineries, both totally owned subsidiaries of Standard Oil of New Jersey, had a combined annual crude oil throughput of over 17 million barrels in both 1962 and 1963. The refinery at Slagen, completed in late 1960 at a cost of US$30 million, is rated at 40,000 barrels per day and is the largest in Scandinavia. This new refinery processes about 93 percent of the crude oil refined in Norway.

Over half of the current output of domestically refined products, principally diesel fuels and residual oils, is exported to Denmark and Sweden. In 1962 and 1963 this amounted to an estimated 9 million barrels of products. This large export trade has developed since the Slagen refinery came into full-scale operation in 1962.

In the past few years there has been a flurry of exploration activity on the arctic island of Spitsbergen, which is a Norwegian possession. U.S., Soviet, and private Norwegian interests have been conducting independent exploration, but no discoveries have been announced. Plans for oil and gas exploration programs on the Continental Shelf off the west coast of Norway were anounced in mid-1963. This exploration was to be conducted by major U.S., British, and French petroleum concerns.

Plans were also reported for a new major refinery to be built in southwest Norway by the Royal Dutch Shell Co. Proposed capacity was 40,000 barrels per day, and estimated completion date was 1967–68. Official Government announcement of its approval has not been reported.

The Mineral Industry of Poland

By Bernadette C. Michalski [1]

POLAND's two leading mineral products are high-rank coals and zinc; output of each accounted for 4 to 4.5 percent of the world's total in 1963. The country also produced 2.2 to 2.6 percent of the world's cadmium, cement, salt, and sulfur during 1963. The significant aluminum, iron and steel, and petroleum-refining industries are based upon imported raw materials, primarily from the Soviet Union.

The mineral industry, including metallurgical and cement operations, contributed about 12 percent to the gross national product and employed 18 percent of the total labor force. Poland's overall industrial growth rate has declined steadily since 1960, when it was 10.9 percent greater than in 1959; in 1963 the rate was only 4.9 percent higher than in 1962.

Factors contributing to the decline of the industrial growth rate were overemployment, low productivity, and inefficient methods of operation. In 1963 employment rose 3.4 percent and gross wages rose 8 percent. In a July resolution, the Council of Ministers attempted to restrict employment, particularly in the construction industries. It was reported that fuels, iron and steel, and sulfur production met the goals for 1963. However, aluminum, electric power, pig iron, rolled products, and zinc failed to meet the 1963 targets.[2]

The leading mineral developments occurred in the fuel industries with discovery of natural gas and possibly petroleum in western Poland, construction of refining and other facilities at Plock, completion of the Friendship pipeline through Poland to the Schwedt refinery in East Germany, development of seven new mines and expansion of nine mines in the Rybnik coal basin, and expanded use of hydraulic coal transportation.

The shortage of iron and steel products, particularly pipe and sheet metal strips, continued through 1963. To alleviate the import burden, construction began on a new cold-rolled strip mill at the Warszawa metallurgical plant and a rolled and drawn pipe unit at the Zawadski plant. A tinning line was completed at Nowa Huta during the year.

Increased electrolytic copper production was attributed to the new electrolytic unit at Legnice. Construction of the new integrated lead-zinc smelter at Miasteczko in Upper Silesia was in progress. Enlargement of sulfur-refining facilities at Tarnobrzeg and operations of a new sulfuric acid plant at Machow contributed to Poland's expanding sulfur-chemical industry.

[1] Commodity research assistant, Division of International Activities.
[2] Trybuna Ludu (People's Tribune) (Warsaw, Poland). V. 17, Feb. 11, 1964, p. 5.

The mineral industry's share of total industrial investments in 1963 was estimated at 23 percent, or $12,000 million.[3] Long-term investments in fuels and iron and steel, which consume the bulk of Poland's mineral foreign exchange expenditure, continued to receive most of the outlays.

PRODUCTION

The output of sulfur, coke, electrolytic copper, and petroleum increased significantly. Petroleum emerged from its slump of 1962, probably through use of better recovery methods. While nearly all reported figures were slightly higher than in 1962, many basic industries did not meet their targets. The zinc industry failed by 4 percent, aluminum by 3 percent, and electric power, pig iron, rolled steel, and pipe by 2 percent or less.

TABLE 1.—Production of selected metals and minerals[1]

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum	22,800	26,000	47,600	48,100	48,800
Copper:					
Ore—thousand tons	1,538	1,760	1,944	2,162	2,162
Smelter	17,500	21,700	22,200	24,100	29,633
Iron and steel:					
Iron ore—thousand tons	2,014	2,182	2,386	2,436	2,609
Pig iron—do	4,374	4,563	4,770	5,311	5,395
Steel, ingots—do	6,160	6,881	7,234	7,684	8,004
Rolled products—do	4,061	4,422	4,824	5,238	5,457
Lead:					
Lead-zinc ore—do	2,156	2,461	2,365	2,497	2,556
Smelter	38,700	39,700	39,800	40,680	38,914
Zinc:					
Refined	168,100	175,500	182,000	180,900	181,200
Electrolytic[2]	70,600	73,800	78,900	82,100	[3] 82,200
Nonmetals:					
Barite	[3] 11,200	[3] 11,200	37,341	45,215	[3] 45,000
Cement—thousand tons	5,317	6,599	7,364	7,544	7,670
Fertilizers:					
Nitrogenous—do	1,064	1,113	1,191	1,269	1,330
Phosphatic—do	877	1,045	1,191	1,368	1,389
Gypsum, calcined	93,500	104,000	95,800	116,000	117,000
Lime, construction and industrial—thousand tons	2,045	2,166	2,181	2,384	2,433
Phosphate rock	41,000	41,000	46,675	55,904	64,800
Salt:					
Rock—thousand tons	508	521	608	609	645
Other—do	1,320	1,425	1,443	1,466	1,486
Sulfur:					
Ore—do	41	147	1,150	1,740	1,791
Elemental	17,200	26,300	133,000	210,800	235,200
Sulfuric acid (100 percent)	610,000	685,000	794,700	852,400	888,100
Mineral fuels:					
Coal:					
Bituminous—thousand tons	99,106	104,438	106,606	109,604	113,200
Brown—do	9,258	9,327	10,338	11,091	15,300
Briquets—do	1,003	1,031	1,013	999	996
Coke—do	11,600	11,900	12,600	13,100	13,900
Natural gas—million cubic feet	15,589	20,205	26,956	29,531	36,692
Petroleum:					
Crude—thousand tons	175	194	203	202	213
Refinery products—do	829	876	930	1,292	1,442
Gasoline—do	111	121	139	248	305
Kerosine—do	115	101	81	28	[3] 30

[1] In addition to commodities reported in official Polish statistics, Poland produces (estimated 1963 production in metric tons, except silver) cadmium 420; nickel (content of ore) 1,300; silver 130,000 troy ounces; barite 45,000; magnesite 34,000.
[2] Included in refined zinc.
[3] Estimate.

[3] Official exchange rate is 4 zloty to US$1.00; however, the zloty is generally overvalued.

TRADE

Mineral industry products and raw materials accounted for a quarter of all exports, or Zl1,700 million and a quarter of all imports, or Zl1,800 million, in 1962. While 68 percent of Polish mineral exports were destined for the Soviet bloc and 74 percent of mineral imports were from the Soviet bloc, Polish mineral trade with the free world was significant when compared with that of other bloc nations. The free world in 1962 supplied the following percentages of Polish mineral imports: Tin, 83; alumina, 45; zinc concentrates, 33; copper, 25; and iron ore, 21. In return, the free world received 96 percent of Poland's exports of fuel oil, 55 percent of the aluminum, 50 percent of the hard coal, 28 percent of the metal products, 22 percent of the zinc metal, and 6 percent of the coke.[4] Foreign trade aggravated the balance of payments problem. Exports, particularly of machinery, manufactured consumer goods, coal, and cement, dropped below plan goals. Imports, on the other hand, especially of Western grain, Soviet bloc machinery, coking coal, crude petroleum, petroleum products, and iron ore, exceeded the plan levels.

TABLE 2.—Exports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum	------	4,810	United Kingdom 1,960; Czechoslovakia 1,733; Netherlands 728.
Cadmium	346	350	U.S.S.R. 280 ; West Germany 45.
Iron and steel:			
Iron ore thousand tons	8	26	Mainly to the Netherlands.
Steel do	55	184	United Arab Republic (Egypt) 38; U.S.S.R. 37; Syria 29.
Rolled do	------	10	U.S.S.R. 4; Denmark 4.
Other do	651	740	Czechoslovakia 180; Sweden 72; U.S.S.R. 50; Yugoslavia 43; West Germany 35.
Lead, concentrate	165	9,228	West Germany 8,700.
Zinc:			
Metal	76,700	67,600	U.S.S.R. 27,000; Czechoslovakia 9,700; Hungary 6,200; United Kingdom 5,800; Sweden 5,700.
Rolled products	10,268	12,367	U.S.S.R. 4,041; Denmark 2,181; East Germany 1,457; Hungary 708; Switzerland 567; Turkey 560; Thailand 559.
Nonmetals:			
Refractory clays	48,800	89,800	Italy 42,000; Hungary 14,600; Yugoslavia 13,000; West Germany 11,500.
Sulfur:			
Elemental	41,500	103,200	Czechoslovakia 50,300; Austria 17,800; Sweden 16,300.
Sulfuric acid	298	420	All to Denmark.
Mineral fuels:			
Coal:			
Hard coal thousand tons	17,053	17,306	U.S.S.R. 4,686; Denmark 2,316; Finland 1,907; East Germany 1,650.
Brown coal including briquets do	5,872	5,660	All to East Germany.
Coke do	2,138	2,145	East Germany 846; U.S.S.R. 597; Hungary 259; United Arab Republic 126.
Petroleum:			
Refined products:			
Gasoline do	------	3	France 1; Belgium 1.
Kerosine do	7	5	Sweden 4.
Fuel oil do	274	555	West Germany 180; Sweden 141; Austria 62.
Lubricants do	3	3	Mainly to Yugoslavia.
Asphalt do	1	1	All to West Germany.
Paraffin do	6	5	Yugoslavia 1; Denmark 1; United Kingdom 1; Austria 1.

[4] Glowny Urzad Statystyczny (Central Statistical Committee) Statystika Handlu Zagranicznego (Foreign Trade Statistics) Warsaw, Poland, June 1963. 80 pp.

TABLE 3.—Imports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Bauxite—thousand tons	60	43	Hungary 42.
Alumina—do	87	109	Hungary 55; United Kingdom 35; Guinea 15.
Aluminum—do	6	6	U.S.S.R. 3; Hungary 2; Czechoslovakia 1.
Antimony	2,452	1,051	Mainland China 1,000; U.S.S.R. 51.
Bismuth	20	69	All from United Kingdom.
Cadmium	-------	2	All from mainland China.
Chrome ore	125,000	98,000	Albania 57,400; U.S.S.R. 40,500.
Copper:			
Concentrate	10,855	7,500	Cuba 6,500; Chile 1,000.
Metal including wire	32,850	36,538	United Kingdom 23,913; U.S.S.R. 6,594; Finland 3,556.
Iron and steel:			
Iron ore—thousand tons	7,670	8,104	U.S.S.R. 6,336; Sweden 560; Guinea 444.
Steel—do	143	117	Czechoslovakia 63; Hungary 34; Italy 9.
Rolled products—do	108	150	Czechoslovakia 132; Austria 6.
Other semimanufactured products—do	234	271	Czechoslovakia 50; Austria 30; United Kingdom 30; West Germany 18; U.S.S.R. 12.
Lead	15,038	15,813	Yugoslavia 4,950; Bulgaria 4,765; United Kingdom 2,650.
Magnesium	213	385	Italy 170; Norway 103.
Manganese:			
Ore—thousand tons	266	299	U.S.S.R. 238; Cuba 31; India 23.
Peroxide—do	2	4	U.S.S.R. 1; mainland China 1, Cuba 1.
Mercury—76-pound flasks	5,307	5,017	United Kingdom 1,625; U.S.S.R. 1,335; mainland China 790.
Molybdenum, concentrate	-------	357	Mainland China 241; United States 100.
Pyrites, concentrate	60,700	42,700	Yugoslavia 42, 700.
Tin	3,147	2,204	United Kingdom 1,722; mainland China 230; Netherlands 122.
Tungsten, concentrate	-------	3,400	Mainland China 3,400.
Zinc:			
Concentrate	148,000	124,000	United Kingdom 23,000; U.S.S.R. 22,000; Bulgaria 21,000; United States 18,000; Yugoslavia 16,000.
Metal	1,600	2,400	North Korea 1,900; Bulgaria 500.
onmetals:			
Asbestos	19,923	23,924	U.S.S.R. 11,798; mainland China 4,383; Canada 4,208.
Barite	9,456	13,971	Mainland China 7,737; Yugoslavia 5,760.
Bentonite	6,641	7,178	Yugoslavia 6,316; Hungary 862.
Diatomaceous earth	550	1,199	United States 665; United Kingdom 464.
Fluorite	26,500	25,900	Mainland China 14,300; East Germany 11,600.
Graphite	8,153	9,674	Czechoslovakia 7,663; U.S.S.R. 873.
Ilmenite	-------	1,383	Finland 1,383.
Kaolin	73,800	81,300	Czechoslovakia 47,000; East Germany 16,800.
Cryolite	1,842	674	U.S.S.R. 659; East Germany 15.
Magnesite	79,500	92,000	Czecholsovakia 31,500; North Korea 30,300; Yugoslavia 18,600.
Mica	600	673	India 420; Rumania 252.
Refractory clays	3,800	3,800	U.S.S.R. 2,000; West Germany 1,200.
Sulfur:			
Elemental	11,100	20,300	Mainland China 20,000.
Sulfuric acid	-------	13,970	All from East Germany.
Talc, powder	31,400	22,700	Austria 14,700; North Korea 6,300.
Mineral fuels:			
Coal:			
Anthracite—thousand tons	19	20	All from U.S.S.R.
Anthracite briquets—do	-------	26	All from Czechoslovakia.
Brown coal including briquets—do	592	510	All from East Germany.
Hard coal [1]—do	910	1,042	U.S.S.R. 678; East Germany 299.
Coke—do	53	103	All from Czechoslovakia.
Natural gas—million cubic feet	7,846	10,184	All from U.S.S.R.
Petroleum:			
Crude—thousand tons	740	1,102	U.S.S.R. 1,094; Bulgaria 8.
Refined products:			
Gasoline—do	1,046	1,067	U.S.S.R. 735; Rumania 196.
Kerosine—do	46	58	All from U.S.S.R.
Fuel oil—do	988	1,289	U.S.S.R. 1,103.
Lubricants—do	68	75	Rumania 55; U.S.S.R. 12.
Asphalt—do	87	69	Albania 40; Hungary 15.
Paraffin—do	15	17	U.S.S.R. 10; East Germany 7.
Others—do	46	27	U.S.S.R. 13; East Germany 13.

[1] As reported, apparently lower rank than anthracite.

Coal production did not increase as rapidly as domestic consumption, and coal exports to the free world fell 1 million tons in 1963. However, total trade with nonbloc countries increased because better prices were offered outside the bloc. During 1963 Polish representatives showed increased interest in obtaining greater participation in the General Agreements on Trade and Tariffs. By November 1963, the United States restored Poland to most-favored-nation status. However, no appreciable increase in Polish exports to the United States was anticipated in 1964.

COMMODITY REVIEW

METALS

Aluminum.—The Skawina plant, operating near capacity, supplied Poland's total 1963 aluminum production. Construction of a second plant at Konin fell behind schedule and it was doubtful that it would operate in 1964 as planned.

The industry depended on imported bauxite and alumina for its raw material. To ease the import burden, extensive research was conducted for an economically feasible means of alumina extraction from coal ash such as that produced by the Konin thermal power plant, and clays.

Cadmium.—Polish cadmium production was a byproduct of zinc-lead ore mining and processing operations. Production for 1963 was estimated at 420 metric tons, 80 percent of which was exported.

Copper.—The development of the Legnica-Glogow area, to include copper mining and processing facilities as well as electric power, continued through 1963 and represented one of Poland's largest investment outlays. When the area is fully exploited it should provide Poland with sufficient copper for domestic requirements and an exportable surplus. In view of the copper shortage in the Soviet bloc, intensive efforts were being made to meet the scheduled plan. At yearend, two mines were under development in the area, Lubin and Polkowice I. Both were scheduled to begin production in 1966, reaching full capacity by 1970.

The increase of electrolytic copper output to 29,600 metric tons in 1963 was attributed to an additional refining unit placed in operation at the Legnica copper plant.

Iron and Steel.—Domestic iron ore production satisfied only a quarter of industrial demand. Dependence upon iron ore imports, which amounted to 8.8 million metric tons in 1963, was expected to increase because of expanding steel facilities. In 1963, Zl5,600 million was invested in the iron and steel industry, of which Zl3,600 million was slated for new construction and Zl2,000 million for modernization and reconstruction of plants in Silesia.[5]

In 1963 a new electrolytic tin plating division of the Lenin metallurgical plant in Nowa Huta, with an annual capacity of 20,000 tons, was put into operation. Its 1963 output was 10,000 tons. The 9th

[5] "Inwestycie W Hutnictwie W 1963 Roku" (Investment in the Metallurgical Industry in 1963). Wiadomosci Hutnicze (Metallurgical News), (Katowice, Poland). No. 3, March 1963, p. 83.

and 10th batteries of ovens for producing coke opened at the Lenin plant.[6] Other new installations included a cold-rolled strip mill at the Warszawa metallurgical plant, a 200-ton-capacity open-hearth furnace at the Labedy metallurgical plant, a wire mill of 180,000-ton capacity (location unreported), and two open-hearth furnaces at the Zawiercie metallurgical plant. The first stage of a rolled and drawn pip unit was completed at the Gen. Swierczewski plant in Zawadzki; the unit was to have a rated capacity of 50,000 tons of drawn and 25,000 tons of rolled pipe when completed at the close of 1964.

During 1963 the following metallurgical plants were reportedly under some degree of modernization: Batory, Pokoj, Jednosc, and Bierut. Measures taken by the Polish iron and steel industry to alleviate the chronic shortage of iron and steel products were expected to be reflected by lower imports in 1964.

Lead and Zinc.—Poland operated at least seven zinc-lead mines in 1963, yielding 2.5 million metric tons of ore. An exporter of lead concentrate and importer of lead metal, the nation appeared to lack adequate smelting facilities; total annual capacity was estimated at less than 45,000 tons.

Production of zinc-lead ores was inadequate to supply Poland's zinc smelters and refineries; hence large quantities of concentrates were imported. Zinc output in 1963 increased by only 300 tons and failed to meet the planned goal by 4 percent. Zinc exports for 1963, totaling 89,000 tons, were nearly a third greater than in 1962.

A rectification column for obtaining zinc dust of high purity (95 to 98 percent) was put into operation in the Silesia zinc plant in Katowice-Welnowiec in early 1963.

Construction continued on the new integrated lead-zinc smelter at Miasteczko in Upper Silesia. Started in 1962, the plant is expected to begin production in 1966. Plant capacity is not known, but the Imperial smelting process will be employed. Facilities will include a sintering unit, an acid plant, and Waelz kilns. Cowper-Siemens stoves will be used to preheat the blast air.

NONMETALS

Bentonite.—Large commercial deposits were reported near the Radzionkow coal mine. Construction of a processing center near the deposit was being considered in 1963.

Cement.—Production in 1963 increased slightly over that of 1962, but failed to meet the planned goal. A cement plant at Dzialoszyn neared completion at the close of the year. By 1964, it should reach capacity of 1 million tons annually; 700,000 tons would be portland cement.

Kaolin.—Poland's first kaolin mining and processing installation at Nowogradziec near Boleslaw opened in 1963.

Lime.—In spite of abundant limestone reserves, the Poles reported a shortage of agricultural and metallurgical lime in 1963. At the close of the year, five new lime kilns went into operation at the Gorozdzach plant where capacity totaled 180,000 tons of lime yearly.

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[6] The amount of coke used per 1 ton of pig iron for Poland as a whole decreased from 932 kilograms in 1962 to 918 kilograms in 1963.

Sulfur.—Expansion of sulfur mining and processing facilities at the Tarnobrzeg deposit included work on a second plant for processing sulfur ore. The first stage was to be completed and produce 100,000 metric tons of pure sulfur in 1964. In mid-1963 a new sulfuric acid plant went into operation at Machow. The plant is expected to raise Poland's total sulfuric acid production to 1 million tons in 1964.

MINERAL FUELS

Coal.—Although Poland's coal output target for 1963 was reportedly overfulfilled, a shortage occurred late in the year. Apparently, coal consumption increased more rapidly than production. The additional fuel necessitated by a severe winter, growth of coal-consuming industries, and continued inefficient coal burning were contributing factors to the shortage. The imbalance was corrected by a cut of 1 million metric tons of hard coal exports to the free world. Extensive mine development and expansion activities were undertaken in attempt to balance future output with consumption and export programs.

Development began on the Pniowek coal mine, which will be Poland's largest. According to plan the mine will produce 20,000 tons of coking coal per day.[7] Coal waste was cut by construction of a waste processing plant at the Makoszowy coal mine and a similar plant, to be operational in 1964, at the Dymitrow mine. In 1963 seven new mines were under development and nine were expanded in the Rybnik coal basin. A 50-unit coking battery with a rated capacity of 950 tons of coke per day went into operation at the Walenty coke plant in Rudzie.[8]

Polish coal transportation difficulties shall be slightly eased by the introduction of hydraulic coal pipelines. The pipeline connecting Boleslaw Smialy mine with the Laziska power station began operation in 1963. About 1,700 tons of coal flows daily through this pipeline. Another larger pipeline, in the planning stage at year end, will transport coal about 200 miles from Silesia to Nowy Korczyn.

Petroleum and Natural Gas.—With 1963 crude output only 200,000 metric tons, Poland was an insignificant producer of petroleum. Oil developments in 1963 included the discovery of a potential field in Zielona Gora, western Poland, expansion of refinery capacities to process imported crudes, and extension of the Friendship (Druzba) pipeline about 500 miles from the U.S.S.R. through Poland. Expanding refinery capacity failed to keep pace with increasing product consumption, and imports continued to rise, reaching 2.8 million metric tons in 1963. With the Czechowice refinery operating at increased capacity of 450,000 metric tons in 1963 and opening of the Plock refinery in 1964, Poland will produce a greater percentage of its requirements; however, it is doubtful that domestic refinery production will reach the planned 75 percent of product requirements by 1965.

Poland processed nearly 35,300 million cubic feet of natural gas in 1963. Growth in gas output may continue as the result of discovery

[7] "Wegiel" (Coal), Wiadomosci Gornicze (Mining News) (Katowice, Poland). No. 5, May 1963, p. 160.
[8] "Nowa Bateria Koksownicza" (New Coking Battery), Trybuna Luda (People's Tribune) (Warsaw, Poland). Nov. 12, 1963, p. 1.

of new commercial deposits in Nowa Sol. Construction began on a gas refinery in Poznan; upon completion, it should have a capacity of about 8.5 million cubic feet per day.

A 65-mile gas pipeline connecting Przemysl to Jaroslaw was completed in 1963. The entire pipeline (390 miles), scheduled for completion in 1965, will supply nitrogen plants in Pulawy with natural gas from the U.S.S.R. and from domestic deposits in Przemysl.

ELECTRIC POWER

Although it reportedly failed to fulfill its production goal for 1963, the electric power sector made notable gains over the previous year, attaining 37 billion kilowatt hours. The use of brown coal in producing electric energy increased from 9 percent in 1962 to 15 percent in 1963. Two additional turbine generators, of 200-megawatt capacity each, were put in operation at Turow, raising the total capacity to 800 megawatts by the close of 1963. The Konin coal-burning powerplant, also under expansion, attained a capacity of 590 megawatts in 1963.

The Mineral Industry of Portugal

By Anton W. T. Wei[1]

THE MINING and mineral processing industry apparently accounted for about 5 percent of the gross national product in 1963. The mining sector has been relatively stagnant showing little change during the past decade. Mining provides employment to less than 1 percent of the total labor force of 3 million. In 1962 the Portuguese Government formed a commission to study the mining industry and to make recommendations for its reorganization and improvement; the commission continued the investigation in 1963.

Considerable progress, however, has been made in the mineral-processing sector. Output of refined petroleum, pig iron, steel ingots, ferroalloys, and chemical fertilizers all increased in 1963 from the levels of the previous year. The production of ferroalloys, begun in significant quantities in 1962 to supplement the operations of the first integrated steel plant in the country, reportedly increased 67 percent. Production of chemical fertilizer increased about 22 percent in 1963. In prior years, Portugal had exported about a quarter to a third of its annual chemical fertilizer output.

SOURCE MATERIAL

Production data for Portugal are obtained from the official Portuguese Estatística Industrial of the Instituto Nacional de Estatística and foreign service despatches from the U.S. Embassy in Lisbon. Trade data are derived from official Portuguese trade publications. Information on pertinent developments in the minerals industry also comes from foreign service dispatches of the U.S. Embassy.

PRODUCTION

Mine output in 1963 totaled roughly the equivalent of US$40 to US$45 million, based on preliminary and incomplete data. About two-thirds of this mine output was nonmetallic minerals and construction materials. Pyrites, coal, tin, and tungsten continued to be the ranking minerals produced in Portugal. Inclusion of the processing sector raised the 1963 mineral output value considerably above US$100 million. The most important of the processed mineral commodities were cement, iron and steel, and refined petroleum, each of which accounted for more than US$20 million in production value in 1963.

[1] Physical scientist, Division of International Activities.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1958	1959	1960	1961	1962	1963 [1]
Metals:						
Aluminum and alloys, secondary	285	247	288	399	303	(2)
Arsenic, white	105	541	735	300	575	[4] 700
Beryl, 10 percent BeO	47	37	29	35	17	(2)
Columbite-tantalite, 70 percent $Cb_2O_5+Ta_2O_5$	24	18	25	19	15	(2)
Copper:						
Mine, metal content [3]	2,332	2,007	3,417	3,040	3,395	(2)
Refinery	4,350	4,931	5,274	5,846	4,766	4,548
Alloys, secondary	1,051	941	1,191	1,295	1,199	(2)
Gold:						
Mine, troy ounces	17,747	20,769	21,927	22,377	21,927	22,379
Refinery, do	(2)	418	2,508	3,858	2,572	(2)
Iron ore, roughly 50 percent Fe, thousand tons	232	246	302	249	262	[4] 255
Iron and steel:						
Pig iron, do	(2) (5)	(2) (5)	(2) (5)	86	222	236
Ferroalloys:						
Ferromanganese	-------	-------	-------	(2)	399	5,511
Ferrosilicon	-------	-------	-------	(2)	2,832	
Crude steel, thousand tons	-------	-------	-------	92	167	211
Rolled products, do	(2) (5)	(2) (5)	(2) (5)	15	150	197
Lead:						
Mine (metal content of ore)	902	32	31	25	44	(2)
Metal:						
Primary	1,670	795	905	1,509	2,020	(2)
Secondary	2,886	2,053	1,970	2,690	1,038	(2)
Manganese ore, 40–42 percent Mn	4,975	6,988	7,436	11,333	11,490	[4] 18,600
Silver:						
Mine	45,782	54,141	52,919	48,257	52,919	54,002
Refinery	(2)	52,244	332,817	30,317	17,782	(2)
Tin:						
Mine, metal content of concentrate [6]	1,249	1,129	772	729	679	634
Refinery	1,259	1,167	601	784	766	630
Titanium ore, ilmenite—50 percent TiO_2	459	1,917	909	99	68	[4] 60
Tungsten concentrate:						
Scheelite, WO_3 content	55	35	41	45	35	8
Wolframite, WO_3 content	1,093	1,314	1,709	1,737	1,467	953
Other, secondary	1,785	2,835	1,770	2,768	2,901	(2)
Nonmetals:						
Barite	1,226	3,411	3,910	2,073	1,351	[4] 1,300
Basalt	15,220	29,580	15,400	27,048	19,810	(2)
Cement, thousand tons	1,024	1,031	1,202	1,244	1,401	1,433
Clays, do	344	368	397	549	273	(2)
Diatomaceous earth	(2)	1,882	1,063	768	1,450	[4] 1,500
Dolomite	2,120	2,400	2,600	2,750	3,800	(2)
Feldspar	553	850	1,726	2,938	3,733	[4] 3,700
Gabbro	6,780	4,463	6,356	5,294	5,795	(2)
Gypsum	63,369	54,263	61,637	71,949	72,259	[4] 73,000
Kaolin:						
Washed, 98 percent	25,132	27,301	28,871	29,765	30,715	(2)
Impure, 30 percent	34,613	17,028	17,915	19,834	12,775	(2)
Limestone, noncrystalline, thousand tons	1,866	2,235	1,216	1,680	1,877	(2)
Marl, do	357	387	418	454	463	(2)
Marl and limestone, do	431	368	435	521	604	(2)
Ophite	20,675	18,447	28,239	25,524	22,987	(2)
Porphyroids and schists	68,637	87,453	167,033	117,919	93,461	(2)
Pyrites, cupriferous	598,166	631,546	654,922	652,921	641,293	604,724
Quartz	890	1,408	8,072	18,844	11,292	(2)
Quartzite	1,850	3,320	7,365	1,700	9,022	(2)
Salt:						
Evaporated, thousand tons	343	236	236	267	315	[4] 315
Refined	786	762	953	1,664	2,714	(2)
Sand and gravel, thousand tons	321	465	330	315	420	(2)
Schists, do	59	101	65	55	71	(2)
Slate, do	63	85	57	83	86	(2)
Stone:						
Marble, do	35	34	28	19	23	(2)
Granite, do	341	348	322	426	540	(2)
Sulfur, refined	17,652	16,143	11,090	8,954	6,784	[4] 3,000
Talc	(2)	220	680	720	326	[4] 326

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1958	1959	1960	1961	1962	1963 [1]
Mineral fuels:						
Solid:						
Anthracite—thousand tons	567	527	435	470	405	416
Lignite—do	156	159	156	158	153	142
Coke, gas—do	(2)	34	39	40	31	25
Briquets—do	60	[7] 45	[7] 41	[7] 38	[7] 45	42
Liquid:						
Refined petroleum products:						
Gasoline—thousand 42-gallon barrels	2,437	2,613	2,545	2,774	2,693	3,227
Kerosine—do	1,850	1,152	1,598	1,323	1,186	1,285
Jet fuel—do	(2)	156	138	73	95	254
Gas oil—do	1,266	1,816	1,575	1,930	1,899	2,160
Residual fuel oil—do	2,839	2,769	3,023	3,034	3,035	3,400
Other—do	(2)	1,173	1,028	1,012	1,149	1,145
Total—do	(2)	9,679	9,907	10,146	10,057	11,471

[1] Preliminary.
[2] Data not available.
[3] Officially reported mine output, including copper contained in some cupriferous pyrites produced.
[4] Estimate.
[5] Quantity believed to be limited.
[6] Excludes mixed concentrates.
[7] Revised figure; supersedes that given in commodity chapter, volume 1.

TRADE

Overall trade statistics for 1963 are not yet available, but in 1962 mineral exports totaled the equivalent of US$28 million and imports amounted to roughly US$130 million. These figures represented about 8 percent of the total exports of Portugal for the year and 22 percent of its total imports. More than 40 percent of the value of 1962 mineral imports was accounted for by petroleum and its products, and iron and steel accounted for about a third of the total.

The mineral export position was considerably strengthened towards the end of 1963 when world prices of tungsten and tin showed a marked improvement, and the outlook for pyrites became more encouraging. These three commodities account for an important share of the total mineral exports of the country.

Signing of a contract by the United States Steel Corp. to deliver 200,000 metric tons of metallurgical coke to the Portuguese National Steel Mill (Siderurgia Nacional) was reported in early 1963. The first shipment under this contract was reported to have arrived in April. According to the latest trade information, the United Kingdom, as in prior years, supplied the major part of coke imports in 1963 which totaled about 210,000 tons. Imports from the United States during the year amounted to only 9,000 tons and did not arrive until May. Presumably, the United States Steel contract represented a triangular agreement whereby metallurgical coke was to be delivered to Portugal by United Kingdom suppliers in return for steel shipments from the United States. The total contract represented roughly the annual coke requirement of Siderurgia Nacional. Siderurgia Nacional requirements for foreign iron ore were covered by an agreement signed in April with the Companhia Vale do Rio Doce of Brazil. While the immediate contract called for the supply of only 10,000 tons of Brazilian iron ore, a protocol signed at the same time provided that

the Brazilian company would furnish all imported iron ore needs of Portugal. It was estimated that roughly 80,000 to 100,000 tons of imported ore would be needed to supplement the 250,000 tons of domestic output in 1963.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum, unwrought and wrought	55	66	Italy 31; United Kingdom 21; Angola 9.
Arsenic, white	78	1,117	United Kingdom 300; Spain 215; Federation of Rhodesia and Nyasaland 180; Italy 171.
Beryl	(1)	44	All to United States.
Copper:			
Ore and concentrate	2,277	2,136	West Germany 1,543; United States 593.
All other forms	635	565	Italy 497.
Iron and steel:			
Iron ore	95,041	99,508	United Kingdom 66,227; Belgium-Luxembourg 28,161.
Pyrites, roasted	104,323	29,373	West Germany 25,353; Netherlands 3,600.
Scrap	16,656	15,019	Japan 8,580; Italy 4,039; Spain 1,220.
Pig iron and rough castings	15,032	10,177	Italy 9,444; Israel 600.
Ferroalloys:			
Ferrosilicon	1,002	2,411	Belgium-Luxembourg 1,194; West Germany 910.
Other		26	All to West Germany.
Steel ingots and equivalent primary forms.	161	48,598	Spain 33,796; Israel 12,497.
Tubes, pipes and accessories	1,668	3,473	Mozambique 2,253; Angola 472; West Germany 226.
Other semimanufactures	4,348	1,936	Angola 903; Mozambique 244; Turkey 134; Sweden 105; Portuguese Guinea 104.
Lead, unwrought and wrought	29	27	Angola 11; Mozambique 9.
Manganese, ore and concentrate	2,008	880	All to Netherlands.
Nickel in all forms	5	2	All to Italy.
Platinum and platinum-group metals, unwrought and wrought. grams		10,467	United Kingdom 10,437.
Silver, unwrought and wrought. grams	10,000	25,000	Angola 20,000.
Tantalum, ore and concentrate	41	43	All to United States.
Tin in all forms long tons	987	910	United States 709; Netherlands 69; West Germany 50; Angola 24.
Titanium, vanadium and zirconium, ore and concentrate.	(1)	50	Mainly to Netherlands.
Tungsten, ore and concentrate	2,626	2,041	United Kingdom 792; United States 671 Netherlands 224; Japan 180.
Zinc, unwrought and wrought	113	5	Cape Verde 3; Mozambique 2.
Nonmetals:			
Barite	611	5	All to United Kingdom.
Cement, hydraulic	40,108	179,430	Spain 158,223; Gibraltar 11,536; Cape Verde 4,117.
Clays:			
Kaolin	19,478	15,739	Italy 10,950; France 4,400.
Other	191	297	Angola 153; United Kingdom 100.
Diatomaceous earth	310	288	United Kingdom 160; Netherlands 89.
Fertilizers and fertilizer raw materials:			
Nitrogenous	215	491	United Kingdom 448.
Phosphatic:			
Superphosphates	83,359	56,216	South Korea 32,700; Indonesia 10,825 Cyprus 7,381.
Other	4,630	9,645	New Zeland 9,568.
Potassic	208	130	Mozambique 43; St. Thomas and Principe Islands 37; Angola 36.
Flint	1,930	2,767	Belgium-Luxembourg 1,208; Mozambique 1,056; Angola 264.
Gypsum	433	228	Angola 124; Mozambique 79.
Lime, hydraulic	1,232	1,168	Mozambique 725; St. Thomas and Principe Islands 258.
Natural pigments	42	64	Angola 33; Mozambique 16.
Pyrites, unroasted	265,168	292,082	Belgium-Luxembourg 180,572; France 38,550; West Germany 36,425; Netherlands 35,135.
Quartz and quartzite	(2)	3,455	Mainly to Italy.
Salt	416	2,306	Bunkers 2,280.

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Nonmetals—Continued			
Shale	8,887	8,634	United Kingdom 2,893; Belgium-Luxembourg 2,821; Denmark 713.
Stone, building and monumental	42,252	77,910	Italy 61,796; Belgium-Luxembourg 6,760; United Kingdom 1,625
Sulfur	462	323	Mozambique 210; Angola 62.
Other	172	276	Mozambique 62; Angola 49; St. Thomas and Principe Islands 46; Italy 45; United States 34.
Mineral fuels:			
Coal in all forms	3,106	1,663	Bunkers 1,550.
Petroleum, refined products:			
Gasoline	77,214	47,483	Nigeria 9,470; Western Equatorial Africa 8,366; United Kingdom 6,315; Mozambique 5,706; Republic of Cameroon 3,800.
Kerosine	41,638	28,698	Netherlands 6,873; Nigeria 6,816; United Kingdom 5,912; Angola 3,891.
Distillate fuel	104 255	41,887	Former French Equatorial Africa 12,511; Nigeria 9,595; Morocco 4,026; Ivory Coast 3,881.
Residual fuel		34,189	Morocco 11,348; Algeria 11,282; United Kingdom 11,012.
Lubricants	1,689	1,618	Mozambique 828; Angola 402; Portuguese Guinea 140.
Other products	656	97	Cape Verde 66; Angola 24.
Carbon black	8	11	Mozambique 8; Angola 1.

[1] Not listed separately.
[2] Less than 0.5 metric ton.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Bauxite	(1)	2,115	France 1,099.
Metal, alloys and scrap, unwrought.	1,930	1,474	Canada 724; France 458; United Kingdom 169.
Wrought	3,711	3,696	Austria 903; West Germany 745; United Kingdom 600; Belgium-Luxembourg 370.
Arsenic, white	8	5	Mainly from Sweden.
Copper:			
Matte	60	120	All from Angola.
Ore and concentrate	4,198	9,205	Canada 6,093; Haiti 3,112.
Blister	4,808	2,640	Federation of Rhodesia and Nyasaland 1,218; Angola 915; Republic of South Africa 507.
Refined	4,705	3,243	Belgium-Luxembourg 2,202; Canada 356; West Germany 356.
Scrap	315	909	United Kingdom 559; Mozambique 88; Angola 86.
Metal and alloys, wrought	4,422	3,531	United Kingdom 1,204; West Germany 638; Italy 571; Belgium-Luxembourg 459.
Gold, crude and semi-wrought. grams	292,596	14,472	All from Belgium-Luxembourg.
Iron and steel:			
Scrap	1,195	1,126	United Kingdom 353; Cape Verde 265; United States 245; St. Thomas and Principe Islands 105.
Pig iron and rough castings	1,130	1,242	Netherlands 970; United Kingdom 255.
Ferroalloys	422	391	West Germany 94; Sweden 79; France 72; Norway 50; Belgium-Luxembourg 20.
Steel ingots and equivalent primary forms.	4	152	United Kingdom 78; Sweden 24; Switzerland 16.
Bars, rods, angles, shapes and sections.	241,846	83,355	Belgium-Luxembourg 34,234; West Germany 19,705; France 15,606.
Plates and sheets, uncoated	6,392	2,477	West Germany 609; United States 416; Sweden 409; France 389.
Tin plate and galvanized plate	109,254	102,311	France 27,153; West Germany 24,360; Belgium-Luxembourg 20,842; United Kingdom 20,779.
Hoop and strip	37,873	34,583	France 12,666; Belgium-Luxembourg 10,705; West Germany 7,390.
Wire	26,345	7,184	Belgium-Luxembourg 2,969; United Kingdom 1,661; West Germany 1,442.
Other semimanufactures	14,344	17,833	United Kingdom 5,301; West Germany 4,297; France 4,077; Belgium-Luxembourg 1,848.
Lead:			
Ore and concentrate	(1)	447	All from Nigeria.
Unwrought and scrap	6,787	6,539	Mexico 3,280; Spain 2,465; Belgium-Luxembourg 409; West Germany 200.
Magnesium, unwrought and wrought.	21	9	United Kingdom 7; Italy 1.
Manganese ore and concentrate	168	195	Netherlands 60; West Germany 55; France 40; United Kingdom 30.
Mercury 76-pound flasks	380	438	Spain 426; United Kingdom 12.
Nickel, unwrought and wrought	114	204	United Kingdom 83; Finland 62; West Germany 30.
Platinum and platinum-group metals, unwrought and wrought. grams	1,280	4,050	United Kingdom 2,085; West Germany 1,609; Belgium-Luxembourg 221.
Silver, unwrought and wrought. grams	53,050,239	42,688,211	United Kingdom 30,011,118; West Germany 11,903,210; Belgium-Luxembourg 367,238; China 299,175.
Tin:			
Ore and concentrate, long tons	(1)	265	All from Nigeria.
Scrap and wrought do	18	17	United Kingdom 13; Netherlands 1; West Germany 1.
Titanium, vanadium, molybdenum, tantalum, and zirconium ore and concentrate.	259	548	Australia 392; Nigeria 81; United Kingdom 65.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals—Continued			
Zinc:			
Unwrought and scrap	4,944	4,625	Spain 2,030; Belgium-Luxembourg 1,538; West Germany 461.
Wrought	196	245	West Germany 186; United Kingdom 25; Spain 14; Belgium-Luxembourg 13.
Other ores and concentrates	73,203	40	Australia 34; United States 6.
Other metals	107	115	West Germany 46; China 40; Netherlands 18.
Nonmetals:			
Asbestos	2,602	2,719	Canada 1,164; Republic of South Africa 878; Federation of Rhodesia and Nyasaland 250; West Germany 171.
Barite	102	89	West Germany 71; Austria 15; United Kingdom 3.
Cement, hydraulic	647	1,083	France 427; Cape Verde 300; United Kingdom 208.
Chalk, including ground	1,312	1,234	France 805; Belgium-Luxembourg 359; Norway 70.
Clays:			
Bentonite	1,067	1,370	Algeria 485; West Germany 270; Morocco 254; United States 250.
Kaolin	815	225	United Kingdom 129; United States 80; West Germany 11.
Other refractory	1,456	964	United Kingdom 646; Spain 310.
Other	1,648	1,493	United Kingdom 1,304; West Germany 117.
Corundum, natural	535	450	Italy 258; Netherlands 119.
Diatomaceous earth	1,379	652	United States 318; France 181; West Germany 67.
Dolomite	578	662	Norway 369; Sweden 107; Italy 101.
Feldspar	745	486	West Germany 214; United Kingdom 183; Spain 49.
Fertilizer and fertilizer raw materials:			
Nitrogenous:			
Sodium nitrate	8,415	4,768	Chile 4,500; West Germany 109; Angola 100.
Ammonium nitrate	6,012	1,600	Belgium-Luxembourg 900; France 670.
Phosphatic:			
Phosphate rock	275,413	242,213	Mainly from Morocco.
Thomas slag	11,600	9,501	Belgium-Luxembourg 9,501.
Other	6,890	11,688	Senegal 11,390.
Potassic:			
Potassium chloride	14,228	14,113	Mainly from Spain.
Other	1,620	1,150	All from Spain.
Flint	112	115	West Germany 37; Denmark 35; Belgium-Luxembourg 18.
Graphite, natural	119	114	West Germany 75; Norway 12; France 8.
Gypsum	10,324	12,805	Morocco 12,300; Spain 480.
Magnesite, natural	634	1,084	Austria 886; Netherlands 168.
Mica	103	129	Norway 73; France 20; Federation of Rhodesia and Nyasaland 18.
Natural pigments	130	88	Spain 50; France 11; West Germany 11; Austria 10.
Salt	3,077	5,869	West Germany 2,134; France 132; Belgium-Luxembourg 120.
Sand	964	1,196	Mainly from Belgium-Luxembourg.
Stone, building and monumental	579	476	Norway 176; Sweden 100; Italy 66; Angola 61; Spain 53.
Sulfur	12,145	20,944	France 18,562; West Germany 2,208.
Talc and steatite	1,006	1,207	France 491; Norway 359; Italy 192.
Other	174	75	West Germany 30; Denmark 22; United Kingdom 10.
Mineral fuels:			
Coal, all types	375,835	372,002	United States 112,498; Poland 91,868; United Kingdom 80,021.
Coke and coke briquets	190,294	176,261	United Kingdom 118,728; West Germany 46,234; United States 9,777.
Coal tar and mineral tar	2,115	2,976	Mainly from Italy.

See footnote at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1963
Mineral fuels—Continued			
Petroleum:			
Crude	1,306,168	1,333,952	Iraq 1,019,104; Angola 114,045; Algeria 97,815.
Refined products:			
Gasoline	22,569	23,671	Aruba 17,858; Curacao 4,714.
Kerosine	27,642	43,417	Aruba 16,015; Curacao 10,852; Bahrain 5,325; Venezuela 4,562; Iran 3,517.
Distillate fuel	553,419	430,207	Aruba 122,275; Venezuela 66,131; Curacao 55,668; Iran 39,927; Rumania 38,545; Italy 33,520; Aden 27,767; France 22,058.
Residual fuel		148,418	Iran 32,962; Aruba 29,871; Curacao 29,604; Venezuela 24,559; Netherlands 16,500.
Liquefied petroleum gas	10,914	18,910	France 17,769.
Lubricants	35,307	33,738	United States 14,292; United Kingdom 10,080; Netherlands 5,703; Sweden 1,793.
Other products	51,302	59,249	United States 23,202; Spain 13,668; Curacao 10,940; Aruba 4,978.
Carbon black	3,241	2,299	United Kingdom 882; United States 842; Netherlands 493.

[1] Not listed separately.

COMMODITY REVIEW

METALS

Iron and Steel.—Siderurgia Nacional is the only integrated steel mill in Portugal and possibly its only crude-steel producer. Siderurgia Nacional was completed in August 1961 with a reported annual capacity of 250,000 to 300,000 metric tons of steel; it employs the Linz-Donawitz (L-D) process of steelmaking. Output continued to increase in 1963 as production at the plant approached designed capacity. The Portugal steel brokers had anticipated the significant increase in tariff, which was applied when Siderurgia Nacional began operations, and had accumulated a sizable inventory of imported steel. As stocks held by brokers were drawn down, the orders placed with Siderurgia Nacional began to increase; yearend inventories showed a gain in orders placed from 118,000 tons in 1962 to 154,000 tons in 1963. Nevertheless, while income in excess of normal operating expenses, including interest charges, returned a net of approximately US$3 million, the annual report of the company for 1963 shows that after amortization charges the deficit for the year amounted to nearly US$8 million.

The first cold-rolled strip-steel mill in Portugal, designed and equipped by the United Kingdom firm of Bromford Iron and Steel Co., Ltd., was being built in 1963 for F. Ramada Acos e Industrious, S.A.R.L., at Ovar near Oporto. Schedule for completion was the end of 1964; the £385,000 plant was to produce about 15,000 metric tons of cold strip and a similar quantity of bright drawn bar annually.

Tin and Tungsten.—By curtailing output and by retrenchment, Beralt Tin and Wolfram, Ltd., the major tungsten producer in Portugal, was able to achieve a marked reduction in its wolfram-production cost and to partially compensate for the low demand in the world

tungsten market. Meanwhile, the United States firm, Metallium Corp., maintained a limited but regular production of tungsten concentrates. In the early part of the year it had plans to acquire additional wolfram deposits and to place itself in a position to greatly increase output, should a more active demand develop at higher prices.

Despite rising world prices, the tin output in 1963 showed a marked decline from the 1962 level. The Beralt firm, also a small tin producer in the country, was reported to be actively engaged in exploring new tin areas during the year.

MINERAL FUELS

Coal and Coke.—Portugal coal and coke consumption in 1963 totaled 886,000 and 258,000 metric tons, respectively, compared with 847,000 and 223,000 tons in 1962. Except about 34,000 tons of domestically produced gas plant coke, all the coke consumed consisted of imported metallurgical grade material. The market for coal in the electric-power-generating industry is unusually small, as the major part of the facilities consist of hydroelectric plants, and many of the thermal plants are oil fired. In 1963 the estimated consumption of 100,000 tons of coal probably provided only about 5 percent of the total quantity of power generated.

Petroleum.—As in prior years Portugal did not produce crude petroleum. Output from the only refinery, the SACOR plant at Lisbon—operating on imported crude oil—continued to increase during the year. Construction of a second refinery and petrochemical adjunct, planned for the northern coastal region of Oporto, had not yet begun nor had it been announced which foreign firms would participate in the capitalization. Portuguese firms selected to participate in this project, according to the Minister of Economy, were SACOR, the principal domestic participant; Sociedade Nacional de Petroleos SONAP, a prominent distributor of petroleum products; and the Companhia União Fabril, the leading industrial concern in Portugal. A large part of the production from this refinery would be for export.

A new storage area of Shell Portuguesa at Matosinhos was completed in April 1963. The new installation comprised 2 warehouses and 11 storage tanks, having a combined capacity of about 283,000 barrels; it cost 46 million escudos and is 1.5 kilometers from the Port of Leixões. It is connected to the port by a double pipeline.

Portuguese official statistics indicate that domestic consumption of petroleum products in 1963 totaled approximately 1.4 million tons. In the meantime, imports of crude, fuel, and other petroleum products continued to be a major drain on the financial resources of the country, totaling 1.12 billion escudos through November.

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The Mineral Industry of Rumania

By Roman V. Sondermayer [1] and K. P. Wang [2]

RUMANIA's industrial status is characterized by a well-established petroleum industry and a new large steel complex in process of construction. In 1963, crude oil output ranked second in Europe, to that of the U.S.S.R., although it was equivalent to only about 6 percent of Soviet production. The Rumanians were aiming at an additional 5-million-ton annual steel capacity by 1970, nearly twice the 1963 output. The metallurgical and manufacturing base was being expanded, but the domestic raw-material position did not show great improvement. Rumania's leading mineral products, with output in percentages of 1963 world totals, were as follows: Manganese, petroleum, salt, and cement, 1 to 1.5; and lead, iron ore, pig iron and steel, mercury, and coal, 0.3 to 1.

Rumania does not report industrial product and gross national product (GNP), except by way of indices. Mineral and metal output value in 1963 was about 15 percent more than in 1962. The share of the mineral industry in the 1963 GNP was roughly 18 percent. The 223,000 workers employed in the mineral industry during the year represented about one-sixth the total for all industry. Minerals were important in Rumania's international trade, particularly refined petroleum exports.

During 1963, special efforts were made to raise the efficiency of established mineral operations, both by improving productivity and reducing consumption of materials and supplies, two areas which presented numerous problems to the industry in the past. Considerable funds were also spent in capital construction. Mineral industry investments in 1963 amounted to 8,394 million lei [3] as compared with 7,567 million lei in 1962. The bulk of the investments went into the fuels industry (particularly petroleum) and iron and steel industry.

No major event occurred in the oil industry, Rumania's premium industry, or in the natural gas and coal industries. The main activity in the fuels area during 1963 was centered on improvement and development of existing facilities.

The most important developments in the mineral field took place in the ferrous and nonferrous industries. Highlights in 1963 included the opening of a sizable iron mine and commencement in construction of a large steel mill in the Danube Delta port of Galati, commissioning of new blast furnaces in Resitza and Hunedoara, continued construction of the Copsa Mica lead-zinc smelter in Transylvania, discovery

[1] Foreign mineral specialist, Division of International Activities.
[2] Chief specialist, East Europe-Far East, Division of International Activities.
[3] 6 lei equal US$1.00.

of the Sommova lead-zinc deposit in Dobrugea, and ground breaking in building a new aluminum plant at Slatina.

PRODUCTION

Output of most mineral and metal products in Rumania has increased every year from 1959–63. However, increases in production of petroleum, the country's leading mineral product, have been relatively modest.

During 1959–63, output of iron and steel products roughly doubled, with important gains made in 1963, particularly for iron ore. No official statistics are available for nonferrous base metals, but apparently copper output remained nominal and lead-zinc output rose only slightly. Construction of lead-zinc facilities indicates that more refined metals will be produced in the future.

In the same 5-year span, a whole new nitrogenous fertilizer industry was created, presumably based primarily on natural gas. The phosphatic fertilizer industry doubled in size, using Soviet apatite. Salt output also nearly doubled. Cement production in 1963 was about one-fifth more than in 1959. The coal industry expanded about one-fourth.

TABLE 1.—Production of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Bauxite	71,000	88,000	69,000	30,000	30,000
Iron and steel:					
Iron ore—thousand tons	1,064	1,460	1,737	1,738	2,286
Pig iron—do	846	1,014	1,099	1,511	1,706
Steel—do	1,420	1,806	2,126	2,451	2,704
Rolled products—do	822	1,254	1,518	1,665	1,921
Pipe—do	275	338	401	456	478
Mercury—76-pound flasks	387	413	349	223	[2] 230
Nonmetals:					
Cement—thousand tons	2,851	3,054	3,308	3,489	4,369
Fertilizers:					
Nitrogenous (Nitrogen content)	8,469	18,940	29,934	43,950	85,000
Phosphatic (P_2O_5 content)	43,608	52,081	56,510	86,597	100,000
Lime—thousand tons	575	597	657	677	[3]
Salt—do	840	1,045	1,330	1,477	[4] 1,637
Sulfuric acid—do	199	226	248	326	343
Mineral fuels:					
Coal:					
Bituminous including anthracite—do	4,148	4,481	4,902	5,319	} 10,267
Brown—do	549	537	554	587	
Lignite—do	3,280	3,145	3,247	3,683	
Coke—do	609	820	940	1,119	1,141
Petroleum:					
Crude—do	11,438	11,500	11,582	11,864	12,233
Refined products:					
Gasoline—do	2,698	2,792	2,667	2,400	2,434
Kerosine—do	1,279	1,289	1,234	1,234	1,084
Gas oil—do	2,277	2,376	2,653	2,910	3,110
Fuel oil—do	3,947	3,824	3,681	3,952	4,059
Carbon black	22,333	25,032	28,390	29,521	33,177
Natural gas—million cubic feet	215,797	243,304	268,603	329,805	376,970

[1] In addition to reported commodities, Rumania is a known producer of the following (figures where given represent 1963 production estimates in metric tons, unless otherwise specified) asbestos, antimony, copper, chromite 13,500, feldspar, gold 390,000 troy ounces, gypsum 100,000, lead smelter 12,500, manganese 200,000, molybdenum, mica 350, silver 645,000 troy ounces, zinc, pyrites 305,000.

[2] Estimate.

[3] Data not available.

[4] Final figure; differs from that given in commodity chapter, volume I.

TABLE 2.—Export of selected metals and minerals[1]

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963
Metals:			
Bauxite	33,000	15,000	8,000
Manganese ore	74,800	72,100	72,000
Steel:			
Rolled metal	381,600	356,000	521,300
Metal tubing	198,200	205,100	213,500
Nonmetals:			
Cement	1,109,100	986,500	1,264,400
Salt	285,200	291,800	309,200
Mineral fuels:			
Natural gas, million cubic feet	761	763	761
Petroleum refinery products:			
Gasoline	2,076,900	1,871,100	1,792,800
Kerosine	616,800	601,500	419,200
Diesel oil	1,767,900	1,647,800	1,608,800
Fuel oil	1,304,300	1,467,800	1,644,500
Paraffin	30,700	23,400	25,100
Petroleum coke	26,500	28,300	55,200
Bitumen (including natural)	86,300	99,300	100,900
Carbon black	22,000	18,300	17,900

[1] Distribution by destination not available.

Source: Rumanian Statistical Pocketbook, 1964, Bucharest 1964, pp. 217–220.

TRADE

General information is available on the overall mineral trade of Rumania; however, no breakdown on destination or origin is reported. During 1963, exports of refined petroleum constituted about 60 percent of output. Import statistics of the U.S.S.R. indicate that about one-third of Rumania's exports went to that country.

Rumanian-Soviet trade, derived from official figures of the U.S.S.R., shows some trends regarding Rumania's overall international trade. Aside from petroleum, the country exported some cement, certain steel products, and refined lead.

TABLE 3.—Export of selected metals and minerals to the Soviet Union

(Metric tons)

Commodity	1961	1962
Metals:		
Lead, metal	1,500	1,400
Iron and steel:		
Steel ingots	81,600	123,800
Pipes	183,300	199,700
Nonmetals:		
Cement	583,000	555,000
Minerals fuels:		
Petroleum:		
Refined products:		
Gasoline	1,556,000	1,326,500
Kerosine	271,700	242,900
Diesel fuel	238,700	199,700
Heating oil	47,200	43,600
Lubricants	131,600	101,500
Bitumen	60,100	61,500

Source: Vneshyaya Torgovlya S.S.S.R. za 1962 god (Foreign Trade of the U.S.S.R. for 1962), Moscow, 1963, 235 pp.

Imports reveal interesting facets of the Rumanian mineral economy. There has been a shortage of domestic iron ore, ferroalloys, some rolled steel products, aluminum, and copper. The country has been totally dependent upon imports for phosphatic raw materials and has been somewhat deficient in coking coals and coke. Mineral and metal products as a whole have been very significant in Rumania's overall trade.

TABLE 4.—Import of selected metals and minerals[1]

(Metric tons)

Commodity	1961	1962	1963
Metals:			
Iron and steel:			
Iron ore	1,258,200	1,920,000	2,236,500
Ferroalloys	27,700	35,400	36,900
Rolled metals	860,800	986,200	945,200
Metal tubing	112,100	101,900	108,500
Nonmetals:			
Fertilizers:			
Apatite concentrate (P_2O_5 content)	79,800	102,800	150,300
Potassium fertilizers (K_2O content)	12,000	10,300	6,900
Nitrogenous fertilizers (Nitrogen content)	4,500	1,200	3,500
Mineral fuels:			
Coking coal	440,700	749,900	697,900
Coke	479,700	718,700	918,000

[1] Distribution by origin not available.

Source: Rumanian Statistical Pocketbook, 1964, Bucharest 1964, pp. 222–223.

TABLE 5.—Import of selected metals and minerals from the Soviet Union

(Metric tons)

Commodity	1961	1962
Metals:		
Aluminum:		
Ingots	8,800	9,900
Semimanufactured products	985	605
Copper:		
Copper, metal	4,600	5,100
Semimanufactured products	2,269	1,769
Iron and steel:		
Iron ore	1,068,000	1,386,000
Pig iron	9,800	8,400
Ferroalloys	25,100	30,700
Rolled products	584,600	723,800
Pipes	30,700	31,400
Other semimanufactured products	468,900	527,000
Tin:		
Metal	259	42
Semimanufactured products	158	20
Nonmetals:		
Asbestos	2,500	4,000
Apatite concentrate	94,800	97,800
Cryolite	10,000	11,500
Refractories	300	200
Sulfur	400	370
Mineral fuels:		
Bituminous coal	149,000	395,000
Coke metallurgical	239,000	431,000
Petroleum:		
Refined products:		
Lubricants	600	800

Source: Vneshnyaya Torgovlya S.S.S.R. za 1962 god (Foreign Trade of the U.S.S.R. for 1962), Moscow, 1963, 235 pp.

COMMODITY REVIEW

METALS

Iron and Steel.—A billion-dollar 5-million-ton steel complex at Galati, scheduled for completion in 1970 after installing six key projects, was still under construction toward the end of 1963, with most of the infrastructure like office buildings, workshops, roads, and rail sidings already completed. Many Western firms were competing for contracts to build different parts of the plants. A Franco-British firm was at work on a 2-million-ton hot-rolling mill. The Soviet Union made commitments to furnish certain equipment for a hot-rolling mill and a blooming and slabbing mill. They also promised future supplies of iron and coal, but Rumanian officials were looking into alternate raw material sources, such as iron ore from Brazil and India and coking coal from the United Kingdom and the United States. Plans call for the use of oxygen converters, but these apparently will not be supplied by the U.S.S.R.

During 1963 the iron mine at Galati started production. The increase of Rumania's iron ore output of 32 percent over that in 1962 can be attributed to this development.

Hunedoara and Resitza retained their positions as Rumania's leading iron and steel centers. Both plants were being reconstructed during 1963. Hunedoara was rated at about 1-million-ton annual capacity, with a sinter plant, two 700-cubic-meter blast furnaces, six 180-ton open-hearth furnaces, blooming mill, heavy and medium section mill, and pipe mill.

Resitza also produced ferroalloys from the manganiferrous iron ore mined at Banat. Rumania produced enough manganese ore not only for internal iron and steelmaking use but also for export.

Nonferrous Metals.—Rumania's leading nonferrous mining centers, with mostly complex ores containing mainly precious metals and lesser values in base metals, are in Maramures and northern and southern Transylvania. Little is known about specific details. For the country as a whole in 1963, it is estimated that about 390,000 ounces of gold, 650,000 ounces of silver, 12,000 tons of mine lead, 5,000 tons of mine zinc, and a few thousand tons of mine copper were produced. At Baia Mare, a copper plant of 40,000 tons annual capacity is under construction. The electrolytic unit capacity will be 20,000 tons per year. In recent years, the Sasar, Baia de Cris, and Baia Sprie mines in Maramures have been mentioned as prominent producers of precious and base metal ores. The discovery of the Sommova deposit in Dobruja during 1963 may lead to greatly increased production of lead-zinc. A plant to produce 27,000 tons of lead and 23,000 tons of zinc annually was scheduled for completion in 1964.

Apparently, no zinc smelter exists in the country as yet, and the zinc concentrate produced is presumably exported. Two lead smelters were operating in 1963, providing even a little surplus for export. The Baia Mare lead smelter and refinery at Firija and Baia Sprie is about 5,000 tons in annual capacity. The Phoenix sulfuric acid and lead smelter at Baia Mare near Lucaci has about the same capacity.

The most interesting news about lead-zinc smelting, however, con-

cerns the Copsa Mica integrated lead-zinc smelter being constructed in Transylvania with British help using the Imperial Smelting Process. Although capacity is not known, the plant is expected to begin production in 1965. The Power-Gas Corp. and Huntington Herberlein Co. have been awarded a contract by Masinimport Rumania. The British contract covers equipment and services valued at 2 million British pounds, about two-fifths of the entire cost. There will be sinter, acid, and twin-condenser furnace plants. A copper matte will be separated from the crude lead, which will be sent as ingots to the refining plant.

Bauxite was being produced at declining rates, mainly from the Lorau mines in western Rumania; part of the output was consumed as filter medium by the oil industry and possibly some was exported. The 50,000-ton new aluminum plant at Slatina in the Arges region, built with French help by the firm Pechiney, was being readied for production by 1965. Also under construction is a plant at Oradea, which is expected to produce 120,000 tons of aluminum annually.

The mercury production center in 1963 was Dosului in western Rumania, which probably had ore reserve difficulties. Chromite output, roughly 13,500 tons in 1963 and largely from deposits near Dubova, fulfilled most of Rumania's needs.

NONMETALS

Few details are known about the many nonmetals produced in Rumania, but output was of little importance by world standards. The cement industry operating about 15 plants produced at a relatively stable level in 1963. Salt output, from at least seven rock salt deposits in various parts of the country, continued to rise. Pyrite recovered from nonferrous ores provided most of the sulfur for the country's sulfuric acid production during 1963. Fertilizer production rose markedly, with Soviet apatite as the main imported raw material. A magnesite mine was opened for the Hunedoara steel plant in recent years. Possibly 100,000 tons of gypsum was produced. Talc mines were operating at Lelese and Cerisor in western Rumania. Other products include mica, graphite, diatomite, bentonite, and kaolin.

MINERAL FUELS

Rumania stressed oil development during 1963, in contrast to few undertakings in coal. Exploratory oil drilling was stressed, although some development of existing fields also took place. Between 300 and 400 wells were drilled during the year, more than twice as much by rotary drills as compared with turbodrills. The trend in exploration was to tap deeper reservoirs of more than 9,000 feet.

About 5,000 wells were operating in 1963; daily well output from old fields like Baicoi was below 2 tons, whereas that from the new field of Ciuresti was around 22 tons. The new oil fields in the pre-Carpathian depression located west of the old Ploesti and Moldavian fields and the areas south of this depression accounted for about two-thirds of Rumania's oil output. Most discoveries were made in the early 1950's, and finding new oil fields has become more difficult in recent years.

The Rumanians stressed both water injection and gas repressuring to maintain underground pressure. Lenticular sands and complicated tectonic conditions limited the effectiveness of such measures. Electronic devices for controlling oil production were introduced with centralized instruments already reportedly installed for about 100 wells.

Rumania's crude oil was processed in 10 refineries, the 6 larger ones having a combined annual capacity of nearly 12 million tons. The country exported slightly more than half of the refined petroleum produced. Ploesti was the main refining center with eight plants. A new center was being developed at Onesti-Borzesti. Recently, a new catalytic cracking plant and an aromatic plant were completed.

Several petrochemical plants were operating in the country. Fagars and Victoria were producing nitrogenous fertilizers and plastics. The Turda Rizanov Onesti, Borzesti, and Savinesti are expected to be completed or expanded shortly. Part of the equipment for petrochemical plants was made locally and part imported from Soviet Ekonomicheskoy Vzayimopomoshchi (SEV) [4] countries.

[4] Council of Mutual Aid, set up under an intercountry agreement that includes the U.S.S.R., Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and Mongolia.

The Mineral Industry of Spain

By Taber de Polo[1]

VALUE of mine production in Spain suffered a small decline in 1963 from the US$264.7 million recorded for 1962; however, preliminary information is not sufficiently complete to determine the magnitude of this decline. Complete information on the value of production from metallurgical plants and other mineral processing facilities are not available, but in recent years the mineral industry as a whole has contributed progressively smaller shares of the gross national product (GNP) each year; in 1961 its contribution was about 1.6 percent, and this apparently declined to not over 1.5 percent in 1962.

Spain has appreciable reserves of iron ore, pyrites, potassium salts, zinc, lead, and mercury, and each of these commodities has been produced in sufficient quantity to contribute significantly to Spain's export trade. In spite of these exports, however, Spain's balance of trade in mineral commodities has not been favorable; the value of mineral imports exceeded that of exports by US$63 million in 1963.

Other mineral products produced in quantity of significance to the national economy include iron and steel, aluminum metal, refined copper, silver, cement, limestone, coal, and petroleum refinery products.

The Government's 4-year economic and social development plan scheduled to go into effect on January 1, 1964, will be of significance to the mining industry with a potential long-range impact. The overall objective of the plan is a 6 percent annual rise in GNP. Public investments totaling US$5.6 billion are planned, some of which will help modernize certain sectors of the mining industry. The plan encourages the consolidation of the numerous small firms engaged in the production of some commodities such as coal and iron ore. Continued liberalizing of control over foreign investments is expected to help finance modernization of some mineral industry operations.

Some specific objectives for improvement in the minerals industry are—

1. Increased production of coking coal.
2. Consolidation of some of the 222 small companies engaged in iron extraction.
3. Introduction of up-to-date techniques in iron and steel metallurgy.
4. Consolidation and modernization of the numerous small steel mills.
5. Reduction of production costs of iron pyrites and consolidation of small companies.

[1] Foreign mineral specialist, Division of International Activities.

6. Local consumption and export of fertilizers based on sulfuric acid (from pyrites).
7. Consolidation of some of the more than 200 lead and zinc mines in operation.
8. Increased exports and decreased imports of aluminum.
9. Association with large foreign aluminum companies.
10. Enlargement of existing copper smelting operations.
11. Promotion of national production of lead concentrates.
12. Renewal of equipment in mercury mining industry.
13. Replacement of 50 percent of cement production equipment.

PRODUCTION

In 1963, although there was a further slight decline in total value of mineral production, some commodities important to the economy registered gains. Zinc production increased by almost 18 percent compared with 1962 figures; potassium salts showed a slight increase and production of most of the metallics showed a decline.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite	7,659	2,573	5,594	6,047	(1)
Aluminum metal	22,642	28,740	37,648	41,688	43,529
Aluminum alloys	8,898	3,536	10,698	7,155	(1)
Antimony:					
Content of ore mined	160	220	172	159	84
Smelter production	295	504	531	552	(1)
Arsenic:					
As_2O_3 content of concentrate	291	419	321	216	----------
Smelter production (As_2O_3)	795	394	311	212	149
Bismuth:					
Content of concentrate produced, kilograms	27,000	15,000	9,436	2,308	1,132
Smelter production, do	24,117	13,551	9,719	8,527	(1)
Cadmium, do	6,500	11,848	34,318	60,228	(1)
Copper:					
Ore and concentrate	8,904	8,176	9,585	7,894	6,640
Blister	6,949	13,089	18,812	20,247	17,747
Refined (fire and electrolytic)	42,912	41,804	50,848	49,313	44,776
Copper sulfate	4,509	4,413	10,671	8,803	(1)
Gold:					
Content of ores mined for gold, troy ounces	15,239	13,986	8,231	6,687	14,090
Byproduct recovery, do	7,861	13,471	20,737	45,826	(1)
Total, do	23,100	27,457	28,968	52,513	(1)
Iron and steel:					
Iron ore (iron content), thousand tons	2,284	2,798	2,848	2,857	2,640
Pig iron, do	1,672	1,886	2,077	2,100	2,309
Ferroalloys:					
Ferromanganese	30,457	26,098	22,289	28,013	38,336
Ferrosilicon	19,869	14,933	22,541	25,169	20,641
Other	1,154	886	1,398	977	(1)
Steel ingots, thousand tons	1,810	1,957	2,340	2,311	2,364
Steel shapes and plates, do	802	1,787	1,652	1,625	(1)
Other iron and steel products, do	(1)	(1)	1,519	1,703	(1)
Lead:					
Content of ore and concentrate	70,099	72,895	79,708	70,998	60,850
Smelter	68,490	71,181	77,726	72,272	[2] 59,952
Manganese ore	40,754	22,304	15,506	12,792	[2] 14,763
Mercury:					
Content of ore mined, 76-pound flasks	69,532	55,902	20,217	52,446	(1)
Smelter production, do	51,680	53,369	51,202	52,794	(1)
Silver, troy ounces	2,181	1,740	4,527	5,684	(1)

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals—Continued					
Tin:					
Content of ore and concentrates—long tons	326	196	230	231	167
Smelter—do	328	464	731	905	1,613
Solder—do	(1)	462	639	577	(1)
Titanium, TiO_2 content of ore and concentrate	3,663	5,454	14,255	20,593	32,069
Tungsten, WO_3 content of ore and concentrate	465	560	648	423	87
Zinc:					
Content of ore and concentrate	85,861	86,110	87,982	78,521	89,617
Smelter production	24,529	44,965	52,494	62,579	64,209
Nonmetals:					
Asbestos	17	4	10		(1)
Barite	25,570	25,942	33,973	38,939	(1)
Calcite	605	1,485	440		(1)
Cement, hydraulic:					
Natural—thousand tons	506	498	560	556	(1)
Artificial—do	5,221	5,234	6,068	6,738	7,150
Chalk—cubic meters	24,539	44,428	54,307	35,401	(1)
Clays:					
Bentonite	6,585	4,837	7,338	12,165	(1)
Kaolin (china clay):					
Crude	115,964	112,364	126,893	167,793	(1)
Content of pure kaolin, washed	47,797	43,122	50,995	67,879	(1)
Others—thousand cubic meters	1,319	1,165	1,605	1,832	(1)
Dolomite—cubic meters	80,985	88,059	94,104	91,278	(1)
Feldspar	10,894	12,115	8,325	[2] 10,900	(1)
Fluorspar:					
Acid grade	70,026	79,907	97,195	100,130	[2] 104,954
CaF_2 content	67,701	77,204	94,909	93,874	101,165
Metallurgical grade	19,167	31,112	49,727	49,878	[2] 50,030
CaF_2 content	14,597	23,826	35,916	35,530	31,729
Garnet	219	183	188	167	(1)
Graphite	415	261	275		
Gravel—cubic meters	208,587	253,051	283,853	237,979	(1)
Gypsum, alabaster and anhydrite:					
Alabaster—cubic meters	3,660	5,539	7,213	8,767	(1)
Anhydrite—do	55,093	112,411	13,561	16,283	(1)
Gypsum—thousand cubic meters	1,052	1,025	1,260	1,468	(1)
Industrial earths not elsewhere specified	7,314	9,993	7,368	6,709	(1)
Lime:					
Hydraulic	211,239	196,824	223,642	299,961	(1)
Quicklime	65,685	114,339	145,523	183,737	(1)
Limestone—thousand cubic meters	10,468	10,658	11,099	10,316	(1)
Lithium minerals (amblygonite)		26	17		
Magnesite	40,432	48,298	83,191	71,387	(1)
Marl—thousand cubic meters	1,957	1,750	1,958	1,996	(1)
Marble—cubic meters	34,704	37,022	40,921	35,392	(1)
Ochre	15,667	17,692	19,125	18,664	(1)
Phosphate fertilizers, superphosphate	(1)	(1)	(1)	(1)	325,354
Potassium salt, natural (sylvite), K_2O equivalent	244,750	264,314	262,210	235,103	249,353
Pumice	1,666	1,464	1,438	1,740	(1)
Quartz	150,001	80,575	68,087	99,617	(1)
Quartzite—cubic meters	233,375	212,684	218,127	191,669	(1)
Salt:					
Rock—thousand tons	559	537	614	626	(1)
From springs—do	18	14	18	18	(1)
Sea salt—do	774	840	967	995	(1)
Sand, industrial—cubic meters	291,257	231,890	285,225	433,420	(1)
Sandstone—do	333,176	290,537	371,928	405,492	(1)
Sepiolite, content of pure sepiolite	4,851	2,146	4,172	3,847	(1)
Serpentine—cubic meters	469	517	565	482	(1)
Silica and silica sand—do	203,639	130,632	177,293	238,022	(1)
Slate:					
Graphitic—cubic meters	2,817	1,234	1,530	1,500	(1)
Other—do	16,795	44,762	68,066	60,519	(1)
Sodium compounds, natural (Na_2SO_4) content:					
Glauberite (sodium-calcium sulfate)	1,596	1,501	1,254	1,928	(1)
Thenardite (sodium sulfate)	15,745	17,135	18,079	20,700	(1)
Stone, crushed and dimension [3]—cubic meters	410,492	569,237	724,266	851,141	(1)
Sulfur:					
Content if iron pyrites	862,278	917,113	777,161	799,012	778,719
Content of cupriferous iron pyrite	114,163	153,091	244,270	214,193	179,986
Elemental	26,132	40,839	49,098	42,507	[2] 27,061
Talc (steatite)	27,815	27,989	27,667	27,725	(1)
Tripoli	10,488	12,555	17,550	12,113	(1)
Tufa—cubic meters	137,216	147,546	173,272	181,810	(1)

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Mineral fuels:					
Coal:					
Anthracite—thousand tons	2,620	2,514	2,597	2,643	2,807
Bituminous—do	10,921	11,269	11,199	10,052	10,170
Lignite—do	2,102	1,762	2,089	2,488	2,568
Coke:					
High temperature—do	2,407	2,574	2,609	2,738	2,740
Low temperature—do	272	248	253	232	194
Natural asphalt	1,513	993	1,047	988	(1)
Products of coal distillation:					
Coal treated—thousand tons	3,347	3,584	3,681	3,826	(1)
Liquid tar and pitches	113,492	121,514	131,784	204,376	(1)
Other tar and pitch	34,048	34,703	26,652	28,567	(1)
Oils, not otherwise specified	19,912	24,660	18,599	15,537	(1)
Gas—million cubic feet	(1)	(1)	(1)	32,267	(1)
Products of bituminous shale distillation:					
Material treated	817,475	806,594	773,543	739,148	811,433
Gas-oil	(4)	35,823	44,917	40,799	45,271
Lubricants	(4)	36,477	50,122	51,559	49,636
Nonlubricating oils and greases	(4)	2,034	3,696	5,499	4,939
Paraffin	(4)	7,150	5,352	1,730	3,109
Dry gas	(4)	9,294	(1)	(1)	(1)
Products of petroleum distillation:					
Crude oil treated—thousand tons	(4)	6,275	7,028	8,615	(1)
Output:					
Dry gases—do	(4)	134	164	255	328
Gasoline—do	(4)	794	864	1,023	1,068
Jet fuel—do	(4)	65	81	180	183
Kerosine—do	(4)	342	321	343	358
Gas oil—do	(4)	1,043	1,412	1,691	1,973
Diesel oil—do	(4)	307	301	342	254
Residual fuel oil—do	(4)	3,143	3,388	4,105	4,754
Lubricants—do	(4)	36	47	49	34
Asphalt—do	(4)	158	185	249	264
Other—do	(4)	20	19	19	21

[1] Data not available.
[2] Revised figure; supersedes that given in commodity chapter, volume 1.
[3] Includes basalt, diabase, fonolite, granite, ophite, porphyry, and trachyte.
[4] Comparable data not available.

TRADE

Preliminary statistics indicate that the value of mineral and mineral product exports in 1963 was slightly over US$27 million, about US$1 million less than in 1962. In terms of value mineral exports consisted largely of iron ore, pyrites, potassium salts, zinc, lead, and mercury. Other export commodities included salt, marble, and barite. The value of mineral imports was about US$90 million, or roughly US$15 million higher than in 1962. Significant imports include phosphates, cement, asbestos, manganese, copper ores, concentrates and scrap, tin ore, and bituminous and anthracite coal.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Unwrought and scrap	3,998	10,720	United States 5,500; Yugoslavia 1,650; Poland 1,600.
Wrought	4,269	3,561	South Viet-Nam 1,336; United States 1,284; Bulgaria 500.
Copper, all forms	456	[1] 122	Belgium 72; Colombia 30.
Gold, semiwrought and troy ounces wrought.	----------	(2)	All to West Germany.
Ilmenite	19,270	24,636	France 9,550; Italy 9,100; Netherlands 5,869.
Iron and steel:			
Iron ore	1,067,127	1,188,441	West Germany 619,245; United Kingdom 216,030; France 141,960.
Roasted pyrites and sinter	1,801,134	777,356	United Kingdom 347,510; West Germany 316,541; Netherlands 51,385; Belgium 47,736.
Scrap	13,474	132	Italy 100; South Viet-Nam 29; France 3
Pig iron and castings	287,679	144,613	Japan 38,719; United States 36,148; Italy 27,680.
Ferroalloys:			
Ferrosilicon	11,852	9,856	United Kingdom 5,047; West Germany 3,084; Japan 1,500.
Other	5,877	5,792	United States 2,600; West Germany 1,545; United Kingdom 1,336.
Steel:			
Ingots and semimanufactures	[3] 239,360	[3] 63,424	West Germany 18,428; France 12,057; Japan 11,626; Turkey 7,693.
Semimanufactures	5,762	8,644	Turkey 2,240; Chile 1,378; France 911; Brazil 779.
Lead:			
Ore and concentrate	1,184	542	United Kingdom 292; West Germany 200; France 50.
Lead and lead alloys, unwrought	36,369	29,233	United Kingdom 9,400; United States 6,406; Italy 4,671; Switzerland 3,000.
Lead, wrought	40	154	Italy 89; Andorra 30; Finland 15; Turkey 11.
Manganese:			
Ore and concentrate	22,802	6,728	West Germany 4,978; France 1,000; Italy 750.
Mercury—76-pound flasks	48,095	45,891	United States 11,139; West Germany 9,747; United Kingdom 6,875; India 6,788; France 4,148.
Zinc:			
Ore and concentrate	30,129	29,590	Belgium 9,581; Netherlands 8,586; France 7,472.
Unwrought and scrap	22,218	23,846	West Germany 5,600; France 4,800; United States 2,870; Portugal 2,245; Italy 2,119.
Wrought	80	132	Colombia 100; Portugal 14.
Other metallic ore minerals [4]	782	296	Canada 89; United Kingdom 69; Japan 45.
Other metals [5]	[6] 137	217	United States 200; Belgium 5; France 5.
Nonmetals:			
Barite	36,514	40,095	United States 15,306; Italy 13,601; France 5,180; Cyprus 3,000.
Cement, hydraulic	9,579	10,900	Andorra 9,645; Gibraltar 1,048.
Clays:			
Kaolin	13,937	9,265	West Germany 6,851; Netherlands 2,096.
Bentonite	1,650	2,434	France 1,916; West Germany 331; Italy 180.
Other	1,009	7,290	Italy 6,523; Portugal 300; West Germany 200.
Diatomite and other siliceous earths	631	365	West Germany 165; United Kingdom 140; Netherlands 51.
Diamond, value, thousand pesetas [7] industrial.	----------	503	All to Cuba.
Dolomite	7,496	6,483	Mainly to France.
Feldspar, lucite, nepheline and nepheline-syenite.	----------	600	All to United Kingdom.
Flint	102	1,367	Gibraltar 1,065; Andorra 280.
Fluorspar	101,503	88,001	United States 75,117; West Germany 6,124; Italy 4,794.
Gypsum	4,625	4,769	Andorra 2,969; West Germany 750; Portugal 482; France 300.
Lime, hydraulic	483	486	Andorra 471; Gibraltar 15.
Magnesite, natural	14,951	7,857	West Germany 7,696.
Natural pigments	690	199	Netherlands 95; West Germany 60; Yugoslavia 16.

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1692	Principal destinations, 1962
Nonmetals—Continued			
Potassium chloride	292,976	228,725	Norway 55,968; United Kingdom 55,392; United States 42,600; Belgium 27,150.
Potassium sulfate	2,700	19,360	United States 13,860; Greece 3,000; Portugal 2,300.
Pyrites thousand tons	1,034	1,022	West Germany 571; France 221; Denmark 100; Belgium 71.
Salt	434,656	511,281	Japan 150,233; United States 65,438; Italy 49,080; Iceland 43,399; Denmark 42,815.
Sand	53,150	63,786	Gibraltar 33,694; Andorra 30,017.
Shale	284	495	Andorra 373; Netherlands 99; West Germany 23.
Stone, dimension:			
Calcareous	11,034	11,956	West Germany 4,507; Italy 3,768; France 1,779; United States 548.
Other	7,228	10,030	Gibraltar 6,341; France 2,296; Italy 1,268.
Talc and steatite	41	212	Mainly to Italy.
Others [8]	350	74	Portugal 39; Sweden 30; West Germany 5.
Mineral fuels:			
Coal, bituminous and lignite	[9] 36,582	15,599	Portugal 14,454; Andorra 1,145.
Coke and coke briquets	27,596	----------	
Petroleum refinery products:			
Gasoline	64,739	54,752	United Kingdom 38,281; Netherlands 16,459.
Aviation gas (jet)	4,023	49,110	Bunkers.
Residual fuel oils	42,088	21,011	United Kingdom 10,742; Netherlands 10,269.
Lubrication oils	1	26	Italy 18; Belgium 7.
Liquefied petroleum gases. cubic meters	8,915	5,940	Algeria 3,358; France 2,582.
Paraffin	567	768	Italy 200; United Kingdom 150; France 148; Netherlands 141.
Other bitumens	430	44	Andorra 21; Portugal 13; United Kindom 10.
Carbon black	1	9	All to Portugal.

[1] Includes 72 tons of matte exported to Belgium.
[2] Less than 15 troy ounces.
[3] Includes 37 tons of coils for rerolling, of which 22 tons went to West Germany.
[4] Includes bauxite (1961), tin, tungsten, titanium, vanadium, molybdenum, tantalum, zirconium and unspecified.
[5] Includes antimony, columbium, cadmium, tantalum, selenium and tellurium, tungsten, and unspecified.
[6] Includes 18.8 tons columbium.
[7] 60 pesetas=US$1.00.
[8] Includes chalk, natural and artificial corundum, and quartz and quartzite.
[9] Includes 15,489 tons anthracite.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Bauxite	40,222	46,828	Greece 34,355; Jamaica 7,797; Surinam 2,000.
Aluminum and aluminum hydroxide.	83,961	91,117	France 90,922; West Germany 171.
Aluminum scrap	310	981	United States 223; United Kingdom 190; Canada 155.
Metal and alloys, unwrought	3,955	7,459	Canada 7,077; United States 196; Norway 151.
Wrought	1,131	1,880	United States 767; France 350; West Germany 258; Switzerland 178.
Antimony:			
Ore and concentrate	250	589	All from Morocco.
Metal unwrought	43	61	Netherlands 30; West Germany 20; mainland China 11.
Arsenic, white	664	663	France 456; Portugal 200.
Bismuth	23	17	United Kingdom 16.
Cadmium	6	21	United Kingdom 10; West Germany 5; France 5.
Chromium:			
Chromite	16,541	19,658	Republic of South Africa 7,965; Iran 6,259; Turkey 3,179; Federation of Rhodesia and Nyasaland 2,230.
Unwrought	10	6	All from United Kingdom.
Copper:			
Ore and concentrate	50,410	22,909	Cyprus 11,340; Canada 6,408; Italy 3,338.
Matte	2,163	3,204	Cyprus 1,672; Israel 1,477; France 55.
Blister	9,815	18,846	British East Africa 9,220; Turkey 9,131; Mexico 495.
Refined, unwrought	653	4,914	Belgium 2,249; United Kingdom 800; Norway 610; West Germany 584; Federation of Rhodesia and Nyasaland 439.
Copper and alloys, wrought	477	3,870	United Kingdom 2,057; Belgium 600; West Germany 541.
Scrap	10,383	15,719	United States 5,772; West Germany 1,612; United Kingdom 1,596; Canada 1,516.
Gold, semi wrought and wrought. troy ounces	17,812	26,685	West Germany 13,503; France 12,507.
Iron and steel:			
Iron ore	214,303	252,860	Morocco 202,585; Portuguese Asia 17,665; Brazil 11,913; India 10,351; Liberia 10,221.
Scrap	246,880	306,594	United Kingdom 220,270; United States 66,919; Belgium 11,494.
Pig iron and castings	1,493	3,729	West Germany 1,580; Belgium 1,086; Norway 884; Australia 124.
Shot, grit, pellets, powder, sponge	1,188	853	Sweden 643; France 146; West Germany 32.
Ferroalloys:			
Ferrochromium	1,335	1,683	Norway 683; France 538; Sweden 215; West Germany 111.
Ferromanganese	1,444	1,419	Norway 888; France 415; United States 47; West Germany 45.
Ferrosilicon	145	159	United Kingdom 99; West Germany 47; Switzerland 10.
Ferrotungsten	----------	41	Portugal 22; Czechoslovakia 5; Norway 5; Sweden 5.
Other	461	871	Norway 374; France 136; West Germany 129; Netherlands 76.
Steel:			
Ingots and other primary forms.	366	175,691	West Germany 84,756; Portugal 35,212; Belgium 21,002; France 12,987; Italy 108.
Coils for rerolling	35,389	130,924	West Germany 67,761; Japan 59,121; Belgium 3,936.
Wire rod	397	27,523	West Germany 10,938; France 10,749; Belgium 4,776.
Bars and rods	2,223	25,922	Belgium 9,333; United Kingdom 9,041; West Germany 3,689; France 2,110.
Angles, shapes, sections	8,441	21,621	Belgium 7,653; West Germany 6,446; France 4,616; United Kingdom 2,491.
Plates and sheets, uncoated	44,388	70,625	France 19,129; Belgium 14,662; West Germany 12,077; United Kingdom 9,125.
Plates and sheets, coated	52,026	73,981	United Kingdom 27,309; France 20,604; West Germany 9,185; Italy 7,365.

See footnotes at end of table.

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TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals—Continued			
Iron and steel—Continued			
Steel—Continued			
Hoops and strips	22,349	10,002	West Germany 4,511; France 4,330; Sweden 610.
Railway track material	270	6,996	United Kingdom 4,142; Gibraltar 2,500; West Germany 279.
Tubes, pipes and fittings	4,376	10,820	West Germany 5,212; France 1,713; Italy 1,125; Sweden 977.
Castings and forgings	164	63	Belgium 19; France 15; United Kingdom 10; West Germany 5.
Lead, all forms	83	34	West Germany 20; United States 10.
Magnesium, all forms	143	242	United States 177.
Manganese:			
Ore and concentrate	67,434	61,737	Ghana 34,819; Morocco 7,493; India 5,065; Republic of the Congo 3,694; Republic of South Africa 3,261.
Metal, unwrought	24	86	Japan 25; Republic of South Africa 16; West Germany 13; United States 12.
Molybdenum, wrought	2	3	Netherlands 1; West Germany 1.
Nickel:			
Matte, speiss, etc	832	380	France 190; Canada 85; United Kingdom 83.
Unwrought including scrap	250	791	United Kingdom 534; Canada 136; France 25.
Semimanufactures, including anodes.	338	572	France 155; United Kingdom 137; West Germany 131.
Platinum-group metals troy ounces unwrought and semiwrought.	6,559	4,083	France 1,768; Switzerland 1,286; West Germany 804.
Selenium and tellurium	4	6	West Germany 4.
Silver, unwrought and troy ounces semiwrought.	1,794,476	2,464,374	Morocco 1,022,498; Mexico 489,145; United Kingdom 475,899; France 320,128.
Tin:			
Ore and concentrate—long tons	2,269	1,041	France 376; Republic of South Africa 311; Indonesia 196; Thailand 75.
Unwrought—do	207	27	Netherlands 10; West Germany 10; United Kingdom 4; Federation of Malaya 3.
Scrap		10	All from Portugal.
Wrought	(1)	1	Mainly from Netherlands.
Titanium, vanadium, molybdenum, tantalum, and zirconium ores.	850	1,353	Australia 597; United Kingdom 729; Italy 25.
Tungsten:			
Ore	54	227	Asia 75; Bolivia 59; Australia 38; Portugal 33; British East Africa 20.
Wrought and unwrought	5	7	West Germany 4; France 2.
Zinc:			
Ore and concentrate		2,208	All from Italy.
Metal and alloys, all forms	20	58	United Kingdom 28; West Germany 20.
Other base metals	74	86	Belgium 43; Republic of the Congo 28.
Nonmetals:			
Abrasives, natural, including pumice, emery and other.	30	1,242	Greece 925; Italy 279; Denmark 20.
Asbestos	23,303	27,852	Republic of South Africa 10,791; Canada 9,615; Federation of Rhodesia and Nyasaland 5,697; France 845.
Barium sulfate	134	4	France 3; West Germany 1.
Cement, hydraulic	26,719	508,840	Poland 211,035; Portugal 96,010; Rumania 74,610; Bulgaria 62,225; Czechoslovakia 20,134.
Chalk, including ground	1,550	2,376	France 2,360; Belgium 10; West Germany 6.
Clays:			
Kaolin	3,519	7,358	United Kingdom 6,940; France 263; United States 92.
Bentonite	2,327	4,111	Morocco 1,740; Algeria 1,100; United Kingdom 593.
Other	5,066	3,084	United Kingdom 1,757; France 824; Republic of South Africa 334; West Germany 101.
Cryolite and chiolite, natural	790	611	All fom Denmark.
Diatomite and other siliceous earths	414	1,536	United States 767; Belgium 500; West Germany 160.
Diamonds:			
Industrial value thousand pesetas	2,503	19,554	Belgium 5,886; United Kingdom 3,947; Netherlands 3,799; Ireland 3,662; France 1,918.
Other than industrial—do	(3)	53,046	Belgium 44,805; Switzerland 4,620; France 2,339.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued
(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Nonmetals—Continued			
Dolomite	264	1,242	France 740; Italy 231; Norway 230.
Flint	141	159	France 101; Belgium 28; United Kingdom 21.
Graphite natural	349	482	West Germany 233; Malagasy Republic 138; United Kingdom 50; France 31; United States 16.
Magnesite, natural	3,554	3,241	United Kingdom 2,540; Brazil 500; Norway 86.
Mica, including splittings and waste	153	359	India 184; Norway 44; United States 33; United Kingdom 30.
Pigments, natural	98	135	West Germany 114; France 21.
Phosphate rock	941,510	1,026,249	Morocco 628,579; United States 182,683; Algeria 175,422.
Sand	13,031	24,457	Belgium 22,228; Netherlands 2,165.
Stone, dimension	1,593	1,606	Italy 874; Norway 305; Belgium 273.
Sulfur	5,894	6,623	United States 2,328; Mexico 2,275; France 2,008.
Talc and steatite	220	409	Norway 284; France 115.
Other	552	3,651	Brazil 2,200; Republic of South Africa 904.
Mineral fuels:			
Coal, bituminous and anthracite	214,265	1,534,640	United States 690,021; West Germany 676,511; Poland 81,531; United Kingdom 71,891.
Coke and coke briquets	288,400	305,985	West Germany 210,961; United Kingdom 57,736; Netherlands 23,712.
Coal tar and mineral tar	26,434	95,403	United Kingdom 63,721; West Germany 14,525; Yugoslavia 11,753.
Petroleum:			
Crude, including shale oil	4,719,094	5,512,116	Bahrain 3,031,828; Iraq 1,381,896; Iran 1,098,392.
Refinery products:			
Partly refined including topped crudes.	9,100	----------	
Gasoline	81,446	84,498	Surinam and Netherlands Antilles 43,088; United Kingdom 31,402; Italy 4,536.
Kerosine	30,228	29,211	United Kingdom 24,862; France 2,418; Netherlands 1,550.
Jet fuel	6,438	19,124	United Kingdom 10,431; Italy 4,528; France 3,402.
Gas oil	117,626	46,079	U.S.S.R. 43,775; Italy 2,005.
Residual fuel oil	9,976	9,358	France 6,002; Surinam and Netherlands Antilles 3,264.
Lubricants	12,768	45,994	Bahrain 20,365; United States 19,756; United Kingdom 4,393.
Liquefied cubic meters petroleum gases.	----------	2,000	All from France.
Petroleum coke	14,493	21,379	United States 11,907; West Germany 9,471.
Other	3,280	2,697	United States 1,850; West Germany 243; France 240.
Carbon black	10,093	13,266	France 6,017; United States 2,468; West Germany 2,119; United Kingdom 1,427; Netherlands 1,122.

[1] Less than 0.5 metric ton.
[2] 60 pesetas equal US $1.00.
[3] None reported.

COMMODITY REVIEW

METALS

Copper.—The massive cupriferous pyrite deposits of southern Spain have been exploited for their copper content since ancient times, but output from these deposits has constituted only a small part of the raw material requirements of Spain's copper industry in recent years. In 1963 copper content of domestic ores was equivalent to only 37 percent of blister copper output and less than 15 percent of refined copper production; imports of ores and concentrates, matte, blister

copper, and scrap provided the remainder of smelter and refinery copper-bearing raw materials. Even these imports fell short of internal requirements and modest imports of copper and copper alloy semimanufactures contained to supply a part of domestic needs, these imports exceeding all copper exports.

The most important mining concern in 1963 was Compañias Españolas de Minar de Rio Tinto, S.A.; this firm has for a number of years produced over 90 percent of domestic output. Spanish reserves have been estimated to total several million tons of contained copper.

Iron Ore.—Spanish consumption of domestically produced iron ore declined in 1963, as output fell and export increased. An increasing share of domestic requirements was met through imports of higher grade ores than were available internally.

Some higher grade deposits have been depleted to a large extent, but remaining positive and probable reserves have been estimated to total 880 million tons, and inferred reserves are reportedly about 375 million tons. Principal deposits are in the Bilbao-Santander-Asturian area of northern Spain.

Iron and Steel.—The Central Siderurgica, an organization comprised of 21 of the leading private steel producing companies and the State-operated Empresa Nacional Siderurgica (ENSIDESA) dominates the iron and steel industry of Spain. ENSIDESA is part of the Government industries group controlled by the Instituto Nacional de Industria. ENSIDESA, Altos Hornos de Vizcaya, S.A., and Union Siderurgica, S.A. (UNINSA) were the three largest steel producers.

ENSIDESA complex accounted for approximately one-third of total Spanish production of pig iron and steel ingots in 1963. Major facilities of its plant at Ariles in 1962 were two blast furnaces with a total annual capacity of 1,140,000 tons and five acid open-hearth furnaces with an aggregate annual capacity of 900,000 tons. Pig iron production in 1963 was about 650,000 tons, a substantial reduction from 1962 production as a result of shutdowns for furnace repairs.

Altos Hornos de Vizcaya, S.A., with plants at Baracaldo and Sestao accounted for the largest tonnages of iron and steel, among the private companies. In 1963 this company accounted for about one-third of Spain's output of both pig iron and ingot steel. At the end of 1962 major production facilities in Vizcaya's plants consisted of six blast furnaces with an aggregate annual capacity of 650,000 tons, an open-hearth furnace with a capacity of 282,000 tons, four 15-ton Bessemer converters with a total capacity of 300,000 tons, and two electric furnaces with a combined capacity of 16,000 tons; in Sagunto there were three blast furnaces with a capacity of 438,000 tons, eight open-hearth furnaces with a capacity of 384,000 tons, and an electric furnace with a capacity of 1,200 tons.

The Union Siderurgica, S.A., complex consisting of Sociedad Metalurgica Dura Telguera, Fabrica de Mieres, S.A., and Sociedad Industrial Asturiana Santa Barbara, Fabrica Moreda, is Spain's second largest private industry producer of iron and steel. In 1963 its production was a little over 200,000 tons of both pig iron and steel, approximately 10 percent of total production. Company facilities at the end of 1962 included Mieres which has two blast furnaces with a capacity of 122,800 tons and seven open hearths with a capacity of 72,000 tons; Gijon which has two 250-ton blast furnaces with a capacity

of 150,000 tons, four basic 60-ton open hearths (160,000 tons), and one 25-ton electric arc furnace (30,000 tons); and La Telguera which has three blast furnaces (annual capacity 346,750 tons), three open hearths (150,000 tons), three Bessemer converters for duplexing (94,500), and a 12-ton electric furnace (21,600 tons).

Other plants with capacities upwards of 100,000 tons are—Echevarria, S.A., at Recalde and Santa Agueda with three blast furnaces (annual capacity 73,000 tons), three open hearths (33,000 tons), three electric furnaces (28,800 tons), and one 12-ton electric furnace (15,000 tons); Moreda y Gijon, at Gijon with two blast furnaces (146,000 tons), three open hearths (150,000 tons), and two electric furnaces (3,600 tons); Nueva Montaña Quijano, S.A., at Nueva Montaña, Santander with one blast furnace (100,000 tons), one 45-ton and one 65-ton basic open-hearth furnace 120,000 tons, three 10-ton Bessemer converters, and one 12-ton electric arc furnace (18,000 tons); Estaban Orbegozo, S.A., at Zumarraga with two 40-ton basic open-hearth furnaces (40,000 tons capacity each), one 50-ton open hearth (50,000 tons), one 6-ton electric arc furnace (7,700 tons), and one 3-ton electric arc furnace (3,000 tons).

Modernization and expansion of Spain's iron and steel industry continued. The impetus for this expansion was the Economic Development Plan which forecast that total demand for steel in Spain would be almost 6.5 million tons by 1972.

New installations entered on service in 1962 included one 20-ton electric steel furnace in Fabrica de Moreda, Factory of Industrias Asturianas "Santa Barbara," S.A., and a rolling mill for the same company, and rolling mills in Material y Construcciones, Duro Telguera, Nueva Montaña Quijano, and Jose Maria Aristrain, S.A.

Installations completed in 1963 included two Linz-Donawitz furnaces (250,000 tons each) by Altos Hornos de Vizcaya, S.A., a structural mill (200,000 tons) by Union Siderurgica, S.A., and a tin-plating mill (80,000 tons) and a Bliss skin-pass mill (100,000 tons) by Laminacion de Bandas, S.A.

Lead.—In 1963 Spain accounted for slightly under 2.4 percent of world output of lead, both at the mine and the smelter stages of production. In metal content of ore mined, this represented a 14.3 percent decline over 1962; in smelter output, a 17.0 percent decline. In spite of the lower level of output in 1963, Spain apparently continued to produce more lead than it consumed, and exports, which were equivalent to nearly 41 percent of smelter output in 1962, continued.

During 1962, lead was produced by 212 mines, including 137 lead mines, 51 lead-zinc mines, 5 lead-zinc-fluorspar mines, 4 lead-zinc-iron mines, and 15 lead-zinc-pyrite mines. Of these mines, 54 lead mines were in Jaén Province, and 37 lead-zinc mines, all lead-zinc-iron mines, and 14 lead-zinc-pyrite mines were in Murcia Province. Over half of the total production came from the lead mines.

The Mantos Ayuler deposit in Murcia Province reportedly has a known reserve of 4 million tons of 2 percent lead ore and an inferred reserve of 40 million tons of 1.5 percent ore. Old mine dumps have been estimated to contain 25 million tons of 1.5 percent lead material which may become economically recoverable. High-grade reserves,

which made possible Spain's rank as the world's second largest lead producer during the 1920's, have been largely exhausted.

The most important lead mining companies have been: Sociedad Minera y Metalurgica de Peñarrega, S.A., in the Province of Jaén; Sociedad Minero Metalurgica Zapata Portman, S.A., in Cartagena district, Province of Murcia; and Real Compañia Asturiana de Minas, Sociedad Anonima, in the Torrelaga district, Province of Santander.

The ownership, location, and capacities of primary lead smelters and refineries in Spain were:

Company	Plant location		Annual capacity (metric tons)
	City	Province	
Compañia La Cruz	Linares	Jaén	36,500
Compañia Minero Metalurgica Los Guindos, S.A.	Malaga	Malaga	20,000
Sociedad Minera y Metalurgica de Peñarroya, S.A.	Peñarroya and Santa Lucia.	Murcia	40,000
			30,000
Minas del Priorato, S.A.	Bellmunt de Ciurana	Tarragona	6,000
Real Compañia Asturiana de Minar, Sociedad Anonima.	Renteria	Guipuzicoa	14,000
Compañia Sopwith, S.A.	Linares	Jaén	25,000
Industrias Reunidas Minero-Metalurgicas	Asua	Vizcaya	12,000
Total			183,500

Mercury.—Spain contributed substantially to the world supply of mercury in 1963 producing an estimated 22 percent of world output. Virtually all the Spanish production came from the large Almaden mine in the Province of Ciudad Real. The mine was operated by the Spanish State through Minar de Almaden y Arraganes. This mine is considered to be the world's largest potential source of mercury. In the 20th century production from this mine has been over 2 million 76-pound flasks of mercury. Some mercury also was produced by Minar de la Soterraña in Oviedo Province in conjunction with arsenic mining.

Zinc.—Mine production of zinc in 1963 moved sharply upward, reaching a higher level than had been attained since 1955, and exceeding that of 1962 by over 11,000 tons. About 70 percent of metal in ores and concentrates was recovered by Spanish smelters, the balance presumably was exported as in the past. Mine output constituted 2.5 percent of estimated world production in 1963, and smelter output was about 1.8 percent of the world total. Except for the sharp decline in 1962, Spain's mine zinc production has been relatively stable, in the range of 80,000 to 90,000 tons for a number of years, fluctuating less as a result of world price and demand changes than many other significant producers, and generally edging upward. Smelter zinc output has increased 160 percent over that of 1959.

For years the Real Compañía de Minas, S.A., has been the foremost mine producer of zinc ore in Spain; its Recocin mine in Santander Province, accounted for about 70 percent of production in 1962. The Company plant at Recocin is completely modern.

Other important zinc mining companies included Compañía Sopwith and Española del Zinc. In 1962 there were 61 operating lead-zinc mines, of which 37 were in Murcia Province; 5 lead-zinc-fluorspar

mines; 4 lead-zinc-iron mines, all in Murcia Province; and 15 lead-zinc-pyrite mines, of which 14 are in Murcia Province. The one mine in Santander Province, however, accounted for 80 percent of the zinc from lead-zinc-pyrite ore. Seventy-eight percent of all zinc production came from lead-zinc-pyrite ore in 1962.

Real Compañía de Minas S.A. continued to operate a smelter at Aviles in Oviedo Province. This facility was Spain's only zinc smelter for a number of years. Beginning in 1959, however, Española del Zinc commenced operations in a new smelter at Cartagena. This plant was especially designed to handle the high-iron zinc concentrates from the mines of the Cortagena-Mazzaron area in Murcia Province.

NONMETALS

Cement.—Cement production has increased steadily; output of artificial cement, which accounts for over 90 percent of combined artificial and natural cement, increased 6 percent in 1963 with respect to 1962 and was 39 percent greater than in 1959. There were 56 plants producing artificial cement in 1962; the Provinces of Barcelona, Madrid, Oviedo, Toledo, and Valencia were the principal producing areas accounting for over half the output of the 28 producing provinces. In spite of increased production, Spain continued to import significant quantities of cement. Over 80 percent of 1962 output of natural cement came from the Provinces of Barcelona, Gerona, and Baleares.

Fluorspar.—In 1963 Spain accounted for 7.2 percent of the total world production of fluorspar. The principal mines were in the Provinces of Barcelona, Cordoba, Gerona, and Oviedo. Major producers were Minerales y Productor Derivados, S.A. and Fluoruros, S.A.

Exports of fluorspar in 1963 decreased 12 percent to 88,000 tons.

Potassium Salts.—After a sharp decline in production in 1962, the potash industry partially recovered with a 6 percent increase in 1963 registering an output of a quarter of a million tons of K_2O equivalent.

Spain's potash deposits are extensive and reserve estimates are upward of 500 million tons containing 15 percent K_2O. The bulk of production comes from Barcelona Province where deposits were first discovered in 1912 and first mined in 1926. Only recently has production commenced in Navarra Province, where deposits were discovered in 1950. Principal companies mining potash are Union Española de Explosives, S.A., Minas de Potosa de Surica, S.A., Potosas Ibericas, S.A., and Explotaciones Polasicor, S.A.

Potassium salts have constituted an important part of Spain's mineral export trade.

Pyrites and Sulfur.—Production of iron pyrites, including cupriferous iron pyrites, declined slightly from the 1962 production level. The largest share of the decline occurred in cupriferous iron pyrite output. Exports of pyrites remained at slightly over 1 million tons.

Elemental sulfur production declined by over one-third, while sulfur imports increased approximately 10 percent, with over one-third coming from the United States.

Spain's reserve of pyrites is among the largest in the world. Most of the deposits occur in Huelva Province in southern Spain. During

the last 90 years, over 60 million tons of pyrites have been produced. Reserves have been estimated to total about 250 million tons. The average sulfur content of these high-grade pyrites is about 50 percent. In 1962 Spain produced over 10 percent of the world's pyrites, and only a little over 1 percent of elemental sulfur.

In 1962 almost 95 percent of the pyrites produced was mined in Huelva Province. All the remainder came from Sevilla Province.

The principal mines are operated by Compañia Española de Minas de Rio Tinto S.A., and Compañia de Azufre y Cobre de Tharis. The Seville Sulfur and Copper Co., Ltd., is the principal operator in Sevilla Province.

Over 85 percent of the elemental sulfur is produced by Rio Tinto. Other important producers are Industrial Quimica de Zaragoza S.A., Sociedad Anonima Coto Minera de Hellin, and Romero Hermanos, S.A.

It has been reported that under the influence of the Spanish Economic Development Plan, there are plans to modernize the pyrites mines to increase production of sulfuric acid-based fertilizers.[2]

Other Nonmetallic Minerals.—Spain produces important quantities of limestone, gypsum, and lime, the latter two being minor export items. Crushed and dimension stone are also produced in sizable quantities. The large increase in production of construction materials, over the past 5 years reflects the increased tempo in building.

MINERAL FUELS

Coal.—Production of solid fuels in 1963 slightly exceeded the 1962 level of output. Domestic production, however, was insufficient to satisfy demands and over 1.5 million tons of coal was imported. During 1963 the Spanish coal industry suffered as a result of extensive labor strikes. The coal industry accounted for almost half the employment in the entire Spanish mineral industry.

Petroleum Refinery Products.—There has been a steady increase in refined petroleum products over the past 5 years. In 1963 there was a 21 percent increase in refinery input. Total value of products in 1963 amounted to US$13.5 million. Notable increases in output were gas-oil, up 17 percent, fuel-oil, up 16 percent; and dry gases, up 28 percent.

Spain's daily refinery capacity was rated at 220,000 barrels in 1963. Consumption of crude oil was 158,644 barrels daily. Exports were 24,736 barrels daily of products while imports were 214,400 barrels per day of crude oil and 11,562 barrels per day of products.

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[2] U.S. Embassy, Madrid, Spain. State Department Dispatch A–835, May 15, 1964, p. 4.

A 175 mile crude pipeline was under construction from Malaga Puertollono to the refinery petrochemical plant. Refineries and chemical plants expanded are:

Company	Location	Type	Capacity (barrels-per-day)
Compañia Española de Petroleos, S.A.	Tarragona	Asphalt	7,560
Do	Tenerife	Desalting	15,000
Do	do	Nerox	4,300
Do	do	Hydrodesulfurization	13,000
Do	do	SO_2 extraction	3,500
Compania Iberica Refinadora de Petroleos, S.A.	La Coruna	Refinery	40,000
Empresa Nacional Calvo Sotelo	Puertollano	do	40,000

The Mineral Industry of Sweden

By E. J. Gealy [1]

MINING and mineral processing continued to be leading industries in Sweden in 1963. Overall industrial production in the country had been consistently rising during the 1958–63 period and in 1963 was estimated to be 25 percent higher than in 1958. The contribution of mining and mineral processing, including iron and steel production, to Sweden's gross national product was approximately 6 percent through 1962; as a result of generally lower mineral commodity prices during 1963, it appears that the share of output value of mining and mineral processing may have decreased somewhat from the previous year in spite of generally higher levels of production quantitatively.

Sweden's total foreign trade, excluding precious metals in ores, bullion, coins, and issued currency, has been in fairly close balance but has continually recorded a net deficit for the past several years. In 1963 imports were valued at SKr17,542 million [2] and exports at SKr 16,573 million. Minerals and metals, including fuels, have been a consistently large item in Sweden foreign trade. Commodities of this type have accounted for almost 30 percent of the total value of imports, whereas they have represented less than 20 percent of the value of exports. These items, as a group, have thus been a major factor in Sweden's net trade imbalance. The dependence of the country upon imports of mineral fuels is exhibited by examining the value of these energy commodities as traded. In 1961 mineral fuels imports were valued at SKr2,045 million, exports at SKr40 million; in 1962 fuel imports were SKr2,150 million and exports SKr49 million. The net trade deficit in fuels alone has been larger than the total net trade deficit of the country. Although the remaining nonmineral and nonfuel mineral commodities have consistently returned a favorable net trade balance, the quantity has been relatively insignificant and the net deficit in mineral fuels is roughly equivalent to the net deficit of total minerals and metals, including fuels.

In recognition of this trade problem, as well as the implications to the country's self-sufficiency position, Sweden has capitalized heavily on its only significant energy resource, hydroelectric power. Sweden uses a high proportion of its energy as electricity, and, of approximately 40 million megawatt-hours of electricity generated in 1963, about 95 percent came from hydroelectric sources. The trade problem is also a factor in the intense Swedish interest in the development of nuclear-fueled powerplants. On July 17, 1963, the country's first

[1] Supervisory research specialist, Division of International Activities.
[2] One Krona (SKr) equals US$0.1933.

nuclear-energy powerplant became critical; the second plant was authorized in 1962 and the design was decided in 1963.

A decline in profit margins caused by rising production costs and stable export prices had the effect of reducing investment in the industrial sector, which includes several mineral processing industries.

GOVERNMENT POLICIES AND PROGRAMS

The Swedish Government has participated heavily in the mining and mineral processing industry through ownership of operating companies. Organizations so controlled function as private companies and compete with those in the private sector. There has been no great growth of Government ownership nor is the position of private industry under pressure from the Government. On the contrary, private investment is encouraged. Any person, by taking out a claim with the appropriate mining inspector, may obtain the right to exploit deposits of most of the metallic minerals and several of the nonmetallic minerals. Since 1938 the State is entitled to a half share of any mining concern, but this does not apply to concerns predating the Mining Act of 1938. Mineral fuels, salt, alum shales, and other commodities may also be exploited by private persons but require a concession granted by the Government. Deposits of any potential nuclear fuel material are more closely regulated.

No fundamental changes in these policies or laws were invoked in 1963 nor was new legislation introduced. During the year the Government granted some forms of direct financial relief to small mining companies faced with difficulty in the ore export market. Trade negotiations by the Government during 1963 reflected obvious concern for the export position of the country's mining industry, both public and private.

The Government program for nuclear energy development advanced with the authorization for construction on several new facilities and the formation of new research organizations. The Government's interest in the available stocks of mineral fuels continued through 1963.

SOURCE MATERIAL

Swedish trade data has been extracted from official Government publications; however, because of a changed pattern of reporting, designed to provide coincidence with reporting of other European countries, the release of official production data has been delayed. The material contained herein in regard to annual output has been gathered from several nonofficial sources, including the annual reports of several of the larger companies. Comparable data were not available for many of the construction materials and for a number of nonconstruction material mineral commodities produced in Sweden in minor quantities. The information presented covers all the major commodities produced and, although estimates have been made in several cases for 1962 and 1963, these are considered to be of the proper order of magnitude.

PRODUCTION

Mineral and metal production in Sweden was already at high levels in 1962 and, during 1963, increased moderately in most instances. The most significant gains were recorded in iron ore, iron and steel, mine and smelter lead, mine zinc, and aluminum. As a whole the mineral industry operated at near capacity levels, particularly in the metal smelting sector, with copper being a notable exception. Also prominent among the commodities of which output declined in 1963 were the precious metals. Production of these is a function of the metal values contained in base metal ores, and they are recovered as byproducts at copper, lead, and zinc operations and do not reflect the

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum	15,500	15,984	16,350	16,900	[1] 18,000
Arsenic, white	11,200	11,750	11,025	[1] 11,000	[1] 11,000
Beryllium ore (beryl)	37			24	
Bismuth, kilograms	[1] 30,000	[1] 36,000	[1] 36,000	[1] 70,000	[1] 70,000
Copper:					
Recoverable content of ore mined	17,308	17,477	18,186	19,100	19,051
Smelter	25,330	21,706	20,704	22,769	22,680
Gold, thousand troy ounces	103	94	83	129	121
Iron and steel:					
Iron ore, thousand tons	18,351	21,690	23,593	22,023	23,631
Pig iron and ferroalloys, do.	1,503	1,632	1,900	1,827	1,882
Steel ingots and castings, do.	2,862	3,218	3,558	3,612	3,898
Lead:					
Mine	48,373	55,305	63,973	67,800	69,900
Smelter	36,849	43,554	38,778	38,751	40,823
Silver, thousand troy ounces	3,098	2,756	2,825	3,459	2,874
Tungsten, 60 percent WO_3 basis	243	282	313	350	350
Uranium oxide (U_3O_8)	[1] 9	[1] 9	[1] 9	[1] 9	[1] 9
Zinc, recoverable content of ore and concentrate	78,516	74,230	79,431	63,372	66,900
Nonmetals:					
Cement, thousand tons	2,820	2,806	3,012	3,054	3,250
Diatomite, do.	693	411	710	[1] 700	[1] 700
Feldspar	46,900	55,392	56,900	[1] 57,000	[1] 59,000
Fluorspar	2,717	2,914	3,230	3,500	[1] 3,500
Kaolin	19,686	26,729	27,100	[2]	[2]
Lime (quick, hydraulic, and dead-burned dolomite)	816,294	936,720	[2]	[2]	[2]
Mica, ground	149	158			
Pyrites (including cupriferous pyrites, sulfur content)	171,356	206,000	223,482	191,811	[1] 190,000
Selenium, kilograms	60,400	80,200	96,828	[1] 102,000	[1] 102,000
Talc, soapstone, and pyrophyllite	14,433	15,845	15,700	[1] 16,000	[1] 16,000
Mineral fuels:					
Coal, bituminous, thousand tons	272	251	200	139	90
Peat:					
Agricultural, do.	63	70	[1] 65	[1] 65	[1] 65
Fuel, do.	242	210	[1] 250	[1] 250	250
Briquets and packaged fuel, do.	62	54	[1] 60	[1] 60	[1] 60
Coke (oven and beehive), do.	121	134	266	344	[1] 350
Carbon black	3,370	[2]	[2]	[2]	[2]
Petroleum refinery products:					
Gasoline	1,839	2,864	3,359	3,175	[2]
Jet fuel	1,025	1,051	1,247	367	[2]
Kerosine	144	110			
Distillate fuel oil	3,910	4,015	4,100	5,023	[2]
Residual fuel oil	9,150	9,261	7,793	8,102	[2]
Lubricants	72	114	314	327	[2]
Other	1,309	1,447	1,197	1,900	[2]
Total salable	17,449	18,862	18,010	18,894	[2]
Refinery fuel (includes losses)	246	1,348	878	844	[2]

[1] Estimate.
[2] Data not available.

general increased trend of the industry. These declines apparently stem from changes in the relative share of total nonferrous ore smelter feed contributed by the several Boliden Mining Co., Ltd. mines, some of which contain considerably higher precious metal values than others. The only other major mineral decline was registered in coal output; the reduction in the tonnage produced in 1963 was a continuation of a long, established trend.

TRADE

Sweden's trade picture changed relatively little in 1963 particularly in metals and minerals. Certain features of international company agreements tend to stabilize the direction and, to a lesser extent, the volume of the movement of some commodities. Sweden acts as a custom smelter of copper for factors in West Germany, and several countries import quantities of Swedish iron ore as part of traditional understandings.

The major problem of 1963, applicable to total trade but particularly to mineral commodities, was the fact that export prices changed little, in fact declined in some cases, while costs of production increased substantially. The Swedish market for iron ore was somewhat depressed during 1963 because of the generally sluggish activity in the European steel industry and because of the technological shift to oxygen steelmaking.

Sweden's major trading partners remained the United Kingdom, West Germany, and the United States. In minerals West Germany continued to rank high as an export market. Much of Sweden's mineral trade is with EFTA (European Free Trade Association) countries rather than EEC (European Economic Community) areas, but satisfactory negotiations were carried out with members of both groups. Sweden's iron and steel industry expressed the belief that the foreign market for high-quality alloy steels would probably improve, while the market for common steels would be more competitive. The increased output of Swedish automobiles raised the domestic demand for flat-rolled steel. While these products were imported fairly heavily during the first half of 1963, operation of the new flat-rolling equipment installed in domestic plants began to be effective in reducing the import demand in the last half of the year.

The value of 1962 metal and mineral exports listed in the tables of this chapter totaled about SKr2,431 million; in comparison, imports totaled about SKr3,993 million. Distribution of value of exports and imports in 1962 by major commodity groups was:

Commodity group	Exports (million kroner)	Imports (million kroner)
Metals:		
Iron, steel, and ferroalloys	1,979	853
Other	353	798
Nonmetals	50	192
Mineral fuels	49	2,150
Total	2,431	3,993

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Scrap	697	835	West Germany 399; Denmark 272.
Unwrought	83	245	Finland 74; West Germany 74; Denmark 37.
Wrought	6,014	7,499	Finland 2,761; Norway 2,144; Denmark 1,017.
Antimony, unwrought	7	10	Denmark 5; Finland 5.
Arsenic, white	10,393	7,843	United Kingdom 4,657; Australia 1,039; United States 714.
Cobalt	15	13	West Germany 12.
Copper:			
Scrap	731	554	West Germany 311; Netherlands 83; Norway 57.
Refined	16,209	16,139	U.S.S.R. 11,936; Norway 1,571; France 1,533.
Alloys	1,773	1,920	West Germany 1,365; Italy 335; Denmark 177.
Bars, rods, angles, sections, wire	18,925	16,849	Norway 8,012; Denmark 7,707.
Plates, sheets, and strip	4,716	4,243	Norway 1,682; Denmark 898; West Germany 800.
Foil	4,482	6,011	United States 2,981; West Germany 2,173; Italy 416.
Other wrought	2,589	2,041	Denmark 708; Norway 669; United States 443.
Gold bullion (approximate)	troy ounces 49,000	52,000	All to France.
Iron and steel:			
Ore and concentrate	thousand tons 20,250	19,396	West Germany 7,954; Belgium-Luxembourg 4,263; United Kingdom 4,247.
Roasted pyrites	do. 181	200	West Germany 189; United Kingdom 11.
Scrap	14,091	11,489	West Germany 7,139; Norway 1,866; Belgium-Luxembourg 1,338.
Pig iron	70,840	34,965	Denmark 10,360; Norway 5,274; East Germany 4,997; West Germany 4,590.
Shot, grit, and pellets	1,610	1,182	Poland 456; Czechoslovakia 302; Switzerland 132; Norway 112.
Powder and sponge	31,302	32,965	West Germany 6,653; United Kingdom 5,748; Japan 3,393; France 3,131.
Ferroalloys:			
Ferromanganese	2,581	2,578	West Germany 1,344; United Kingdom 547; Austria 183.
Ferrosilicon	5,878	4,658	West Germany 3,247; Austria 762; Rumania 238.
Ferrochrome	18,955	17,331	United States 7,685; United Kingdom 5,453; Austria 251.
Ferro-silico-chrome	1,205	2,416	United Kingdom 1,377; Italy 575; Austria 419.
Other	458	664	United States 144; Arabia Peninsula States 89; Switzerland 56.
Steel:			
Ingots	2,055	3,627	Norway 2,511; West Germany 846; Denmark 106.
Blooms, billets, slabs, etc	157,770	115,314	Finland 30,635; Argentina 20,776; India 9,492; France 8,022.
Bars and rods	104,520	109,721	United States 28,380; Denmark 11,668; Finland 9,505; West Germany 9,177.
Wire rod	65,529	59,425	West Germany 16,339; United States 14,232; United Kingdom 8,688.
Angles, shapes, and sections	23,904	27,554	West Germany 10,123; Denmark 4,979; Finland 4,879.
Heavy plates and sheets (uncoated)	105,149	125,010	West Germany 55,620; Norway 20,324; Italy 18,485; Finland 14,876.
Other uncoated plates and sheets	35,317	37,925	Denmark 8,593; Finland 6,225; West Germany 3,876; Norway 2,757.
Plates, sheets (coated), hoops, and strips	31,991	33,888	West Germany 5,784; United States 4,717; Italy 3,558; Norway 3,341.
Railway track material	5,020	29,536	India 14,996; Norway 11,162; Argentina 999.
Tubes, pipes, and fittings	86,449	113,035	U.S.S.R. 25,303; West Germany 17,518; Netherlands 9,341; France 8,544; Norway 8,058.
Castings and forgings	288	704	Denmark 279; Norway 130; West Germany 75.

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals—Continued			
Lead:			
Ore and concentrate	22,803	42,639	West Germany 35,682; Belgium-Luxembourg 6,955.
Lead and lead alloys, unwrought	16,136	14,462	Denmark 5,704; Norway 4,370; United Kingdom 2,863.
Scrap	170	53	All to Norway
Lead, wrought	199	237	Norway 99, Iran 70
Magnesium:			
Unwrought	(1)	28	West Germany 25.
Scrap	132	193	United States 69; West Germany 51 United Kingdom 45.
Semimanufactures	(1)	7	(2).
Manganese:			
Ore and concentrate	755	492	Norway 201; Czechoslovakia 95; East Germany 60.
Metal	30	17	Poland 15.
Mercury—76-pound flasks	174	87	Norway 58.
Molybdenum:			
Ore and concentrate	----------	102	All to Italy.
Metal, unwrought and semimanufactures	5	7	United States 1.
Nickel:			
Scrap	49	60	United Kingdom 34; Netherlands 15.
Metal and alloys:			
Unwrought	6	124	Netherlands 99; Italy 25.
Semimanufactures	594	597	Denmark 166; Norway 104; Netherlands 57.
Selenium	71	50	West Germany 19; Italy 9; France 8.
Silver:			
Bullion—thousand troy ounces	1,382	1,591	Mainly to West Germany.
Tin:			
Unwrought, including alloys	146	240	Italy 128; Finland 74; West Germany 14.
Scrap	35	17	Norway 12; United Kingdom 4.
Semimanufactures	3	1	Mainly to Denmark.
Titanium:			
Ore and concentrate	49	26	Finland 16.
Metal	4	1	Mainly to United Kingdom.
Tungsten:			
Ore and concentrate	48	----------	
Metal	46	26	West Germany 18.
Uranium: Metal	5	(1)	Mainly to Norway.
Vanadium, tantalum, zirconium: Ore and concentrate.	43	12	(2).
Zinc:			
Ore and concentrate	145,437	149,519	Belgium-Luxembourg 87,275; West Germany 27,487; Norway 27,049; Poland 6,846.
Unwrought	148	110	Norway 61; Netherlands 25.
Scrap	1,215	1,745	Italy 816; Norway 421; Belgium-Luxembourg 309.
Semimanufactures	(1)	50	West Germany 47.
Nonmetals:			
Asbestos	52	12	(2).
Barite and witherite	5	----------	
Cement hydraulic	232,908	134,937	(2).
Chalk, including ground	3,559	4,316	Finland 2,025; West Germany 1,105; Norway 528.
Clays:			
Kaolin	162	10	(2).
Fire clay	6,589	4,547	West Germany 3,938; Finland 566.
Bentonite	47	106	Denmark 70.
Other	3,202	2,097	Finland 1,999.
Corundum:			
Pumice, emery, and other natural abrasives.	44	42	Denmark 19.
Artificial	1,382	842	United States 185; France 153; Japan 135; United Kingdom 118.
Diatomite and other siliceous earths	71	26	(2).
Dolomite	5,371	5,803	Denmark 2,569; Venezuela 1,417; Norway 893.
Flint (crushed rock)	338,546	484,906	West Germany 434,193; Denmark 49,061.
Fluorspar	348	482	Finland 407; Netherlands 54.
Lucite, nepheline, nepheline-syenite.	39,066	31,071	Belgium-Luxembourg 15,300; United Kingdom 3,856; East Germany 2,822; Netherlands 2,500.

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Nonmetals—Continued			
Graphite (natural)	50	26	(2).
Gypsum	147	111	(2).
Lime (including slag)	4,048	5,204	Norway 5,119.
Limestone, industrial	277,832	282,166	West Germany 166,667; Finland 92,281; Denmark 16,707; Norway 6,216.
Magnesite, natural or ground	296	199	Denmark 184.
Mica, including splittings and waste	2	8	(2).
Natural pigments	54	11	(2).
Pyrites	40,814	23,888	United Kingdom 13,404; West Germany 10,484.
Quartz and quartzite	89,376	110,555	West Germany 56,500; Denmark 35,581; United Kingdom 6,265; Norway 5,705.
Salt, refined and other	54	297	Iceland 180.
Sand, natural (excluding metallurgical sand):			
Quartz sand	29,627	,249	Norway 7,940; Finland 7,524; Denmark 6,931; West Germany 5,720.
Other industrial	2,509	8,650	Norway 6,876; Denmark 899; Finland 874.
Shale	53	60	Denmark 58.
Stone dimension:			
Calcareous	11,843	12,199	Denmark 9,446; Netherlands 1,044; West Germany 843.
Other	176,374	204,260	West Germany 150,406; Netherlands 15,676; Denmark 11,836.
Sulfur:			
Natural	146	159	Denmark 110; India 33.
Elemental	145	176	Netherlands 126.
Talc and steatite	1,374	2,000	Denmark 1,046; Belgium-Luxembourg 435.
Thomas slag	5,431	8,149	Finland 8,143.
Mineral fuels:			
Coal:			
Anthracite	----------	849	Belgium-Luxembourg 800.
Bituminous and briquets	36,783	19,382	Denmark 19,073.
Peat	915	5,028	United States 3,078; Denmark 1,417.
Coke, including coke briquets	6,681	6,335	West Germany 4,711; Denmark 1,622.
Petroleum:			
Crude petroleum, including shale oil.	----------	8	(2).
Refinery products:			
Gasoline, 42-gallon barrels including white spirit.	27,028	111,779	Mainly to Norway.
Kerosine ---do	18,568	9,253	Do.
Distillate fuel oils ---do	195,210	306,248	Norway 184,196; Denmark 12,026.
Residual fuel oils ---do	160,546	180,158	Norway 71,555; Netherlands 52,364; Denmark 38,143.
Lubricating oils	37,178	41,195	Finland 16,890; Norway 8,717; United Kingdom 6,156; Denmark 5,851.
Liquefied petroleum gas	4,232	1,783	Denmark 1,160; Norway 589.
Petrolatum	(1)	7	(2).
Paraffin	35	25	Finland 7; Norway 7.
Other bitumens	32,573	37,755	Denmark 19,628; Norway 9,258; Finland 7,767.
Carbon black	47	20	(2).

[1] Less than 0.5 ton.
[2] Data not available.

TABLE 3.—Imports of major metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Bauxite	25,687	24,233	Greece 18,550; British Guiana 5,676.
Alumina	22,744	38,018	Jamaica 27,437; British Guiana 10,306.
Scrap	179	314	Finland 163; Denmark 98; Canada 20.
Metal and alloys unwrought	24,022	30,824	Norway 14,106; Canada 10,347; United Kingdom 1,363; U.S.S.R. 1,274; Denmark 1,232; Switzerland 1,063.
Semimanufactures:			
Plates and sheets	9,329	10,107	Belgium-Luxembourg 4,282; United Kingdom 1,849; Austria 746.
Other	4,009	4,099	West Germany 1,545; United Kingdom 631; Switzerland 516; France 323.
Antimony, unwrought	345	392	Mainland China 354.
Arsenic, white	2	3	(1).
Cadmium, unwrought	131	104	Norway 63; Poland 22; U.S.S.R. 10.
Chromium:			
Chromite	106,872	110,996	U.S.S.R. 51,325; Yugoslavia 23,008; Turkey 15,561; Federation of Rhodesia and Nyasaland 8,699.
Metal	76	33	United Kingdom 21; West Germany 7.
Cobalt, unwrought	313	152	Belgium-Luxembourg 120; Canada 8; Norway 7.
Copper:			
Ore and concentrate	18,696	21,635	Ireland 5,671; Norway 4,611; Chile 3,814; Cyprus 2,829; Morocco 2,169.
Matte	8,294	9,404	France 6,108; Denmark 3,061.
Scrap	1,503	1,522	France 372; Norway 362; Denmark 283.
Refined, unwrought	67,023	70,253	Chile 24,588; Federation of Rhodesia and Nyasaland 18,976; Belgium-Luxembourg 12,885; Canada 4,982.
Other, unwrought	5,352	1,906	Chile 1,358; France 547.
Alloys	4,531	3,053	United Kingdom 2,085; Norway 457; Belgium-Luxembourg 217.
Copper and copper alloy, semimanufactures.	10,113	9,496	West Germany 2,397; Finland 2,309; United Kingdom 1,294; Belgium-Luxembourg 1,014.
Gold:			
Ore and concentrate	496	1,012	Bulgaria 867; France 75; Upper Volta 68.
Bullion, troy ounces	52,000	354,000	Mainly from United States.
Iron and steel:			
Ore and concentrate, thousand tons	4	3	All from Denmark.
Roasted pyrites, do	19	20	Norway 19
Scrap	166,537	29,410	United States 12,316; United Kingdom 10,416; Denmark 2,836; West Germany 1,971.
Pig iron	130,497	182,885	Finland 70,746; U.S.S.R. 51,807; West Germany 18,331.
Spiegeleisen	141	102	All from West Germany.
Shot, grit, and pellets	3,082	2,909	United Kingdom 1,929; West Germany 401; United States 178.
Sponge and powder	4,560	548	United States 529; United Kingdom 13; West Germany 4.
Ferroalloys:			
Ferromanganese	10,979	10,142	Norway 4,506; U.S.S.R. 3,100; Republic of South Africa 884; France 800.
Ferrosilicon	6,316	6,141	Norway 5,171; East Germany 761; West Germany 149.
Ferro-silico-manganese	3,332	3,641	Norway 3,395; United States 240.
Ferrochrome and ferro-silico-chrome.	9,030	3,537	Norway 2,070; Yugoslavia 697; Poland 350; Japan 260.
Other	2,525	1,146	West Germany 224; Czechoslovakia 170; France 158; Austria 139; United Kingdom 128.
Ingots, and equivalent primary forms.	35,824	12,438	Norway 4,976; United States 4,305; West Germany 2,295.
Bars and rods	102,555	82,281	Belgium-Luxembourg 21,986; France 14,138; West Germany 11,716.
Angles, shapes, and sections	144,424	137,856	Belgium-Luxembourg 50,113; West Germany 46,042; Norway 14,439.
Plates and sheets	498,329	438,673	United Kingdom 84,434; West Germany 68,723; Belgium-Luxembourg 67,121; Poland 166,741.
Tinplate	51,774	56,757	France 24,063; United Kingdom 20,999; United States 5,367.

See footnotes at end of table.

TABLE 3.—Imports of major metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals—Continued			
Iron and steel—Continued			
Other coated sheets	30,849	35,443	Belgium-Luxembourg 21,740; United Kingdom 5,355; West Germany 5,326.
Hoops and strip	34,816	36,179	Belgium-Luxembourg 14,993; West Germany 7,762; United Kingdom 5,544; France 3,131.
Railway track material	3,152	4,563	West Germany 3,827; Austria 603; Belgium-Luxembourg 115.
Pipes, tubes, and fittings	132,878	146,925	West Germany 61,560; France 29,040; United Kingdom 17,520; Netherlands 10,782.
Castings and forgings	2,148	2,567	United Kingdom 368; Norway 279; Denmark 189; France 108.
Lead:			
Scrap	330	312	All from Norway.
Unwrought, including alloys	10,111	12,881	Peru 4,541; Mexico 3,755; United States 1,828; Belgium-Luxembourg 1,068.
Semimanufactures	1,645	2,369	Belgium-Luxembourg 1,159; West Germany 574; Norway 408.
Magnesium:			
Unwrought	418	475	Norway 309; United Kingdom 90; Italy 30.
Semimanufactures	----------	33	United States 14; West Germany 11.
Other	211	69	United Kingdom 21; Norway 19; West Germany 15; United States 11.
Manganese:			
Ore and concentrate	88,357	57,852	Republic of South Africa 23,156; India 20,637; U.S.S.R. 9,642; British Guiana 3,854.
Metal, unwrought	615	933	Republic of South Africa 556; Norway 200; Japan 118.
Mercury ----- 76-pound flasks	2,580	3,710	Italy 1,740; Spain 754; Yugoslavia 725.
Molybdenum:			
Ore and concentrate	2,795	1,948	United States 844; Chile 624; Norway 480.
Unwrought	11	22	West Germany 11; United States 9; Czechoslovakia 1.
Semimanufactures	1	1	All from United Kingdom.
Nickel:			
Matte, speiss, etc	912	364	All from Canada.
Scrap	229	96	United Kingdom 43; United States 21; Norway 19; Denmark 11.
Metal and nickel alloys, unwrought.	9,110	7,496	Norway 3,830; United Kingdom 2,364; Canada 1,234.
Metal and nickel alloys, semimanufactures.	928	972	United Kingdom 604; Norway 200.
Platinum-group metals:			
Unwrought ----- troy ounces	(2)	(2)	Mainly from West Germany.
Semiwrought and wrought. do	(2)	(2)	Mainly from United Kingdom.
Selenium	34	8	Italy 6; Japan 1.
Silver:			
Bullion ----- troy ounces	354,000	386,000	Mainly from United Kingdom.
Tantalum	(2)	(2)	Mainly from United States.
Tin:			
Scrap	----------	139	All from Italy.
Unwrought	860	904	United Kingdom 348; Federation of Malaya 200; Netherlands 149.
Semimanufactures	113	101	United Kingdom 49; West Germany 27.
Titanium:			
Ore and concentrate	3,473	4,494	Australia 4,424; India 50.
Metal	34	51	United Kingdom 36; Japan 11.
Tungsten:			
Ore and concentrate	1,087	1,333	China 469; U.S.S.R. 320; Republic of Korea 292; Spain 132.
Metal	83	78	West Germany 60; France 8; United Kingdom 5.
Vanadium, tantalum, zirconium:			
Ore and concentrate	419	432	Australia 302; British West Africa 121.

See footnotes at end of table.

TABLE 3.—Imports of major metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals—Continued			
Zinc:			
Unwrought	26,298	36,378	Norway 11,080; Poland 5,830; U.S.S.R. 5,388; United Kingdom 3,937; Federation of Rhodesia and Nyasaland 3,754.
Zinc dust	175	135	United Kingdom 57; Norway 43; Belgium-Luxembourg 28.
Other wrought	1,050	1,240	Poland 450; Belgium-Luxembourg 323; West Germany 275.
Scrap	51	----	
Nonmetals:			
Abrasives:			
Pumice, emery, and other natural abrasives.	1,012	1,134	Italy 324; United States 296; Netherlands 212.
Artificial	5,477	4,398	West Germany 1,786; United States 1,135; East Germany 841.
Asbestos	17,018	19,645	Canada 5,652; U.S.S.R. 4,863; Federation of Rhodesia and Nyasaland 3,818; Arabia Peninsula States 2,794: Finland 1,623.
Barite and witherite	2,071	1,684	West Germany 1,655.
Boron salts	211	605	United States 604.
Cement (hydraulic)	11,034	26,477	Norway 14,384; Denmark 10,011; West Germany 1,199.
Chalk (including ground)	9,097	8,950	Denmark 8,067; France 717; West Germany 39.
Clays:			
Kaolin	123,724	131,222	United Kingdom 121,309; East Germany 3,124; West Germany 2,203.
Fire clay	45,582	41,881	United Kingdom 17,864; Czechoslovokia 15,086; West Germany 8,224.
Bleaching earths	17	30	(1).
Bentonite	9,804	2,086	United States 1,591; Yugoslovia 460.
Other	7,575	11,045	India 4,264; West Germany 3,801 United Kingdom 1,848.
Cryolite and chiolite (natural)	770	944	All from Denmark.
Diatomite and other siliceous earths	5,457	5,181	Denmark 2,060; United States 1,657; Hungary 1,050.
Diamonds:			
Industrial	(1)	(1)	Mainly from United Kingdom and Netherlands.
Other	(1)	(1)	Mainly from Belgium-Luxembourg and Netherlands.
Dolomite	22,661	24,901	Belgium-Luxembourg 13,993; Norway 10,166: West Germany 612.
Flint	2,669	3,022	Denmark 2,321; France 662.
Crush rock	6,018	9,808	Denmark 3,252; Norway 1,528; West Germany 1,148.
Fluorspar	13,408	14,323	Republic of South Africa 12,165; France 1,308; Mainland China 405.
Lucite, nepheline, nepheline-syenite.	244	892	Norway 885.
Graphite (natural)	868	832	Norway 265; West Germany 246.
Gypsum and anhydrite	212,356	269,513	France 132,675; Poland 114,453.
Lime, including slag	3,317	5,144	Denmark 4,856; Norway 124; United States 106.
Limestone, industrial	43,825	38,683	Norway 20,673; Denmark 16,531.
Magnesite, natural or ground	5,455	4,531	Netherlands 2,913; Austria 1,236.
Mica, including splittings and waste	1,201	1,152	Norway 557; West Germany 200; India 153.
Natural pigments	364	303	France 121; West Germany 75; United Kingdom 54.
Phosphate rock	373,651	403,076	Morocco 264,437; United States 46,870; U.S.S.R. 46,825; Tunisia 30,098; Senegal 13,238.
Pyrites	93,670	83,438	Norway 83,338.
Quartz and quartzite	1,755	1,569	Norway 735; West Germany 492.
Salt:			
Refined	353,258	358,910	Netherlands 250,661; United Kingdom 84,532; West Germany 20,884.
Other	200,287	237,480	West Germany 168,882; Poland 25,792; East Germany 18,255; Spain 14,979.

See footnotes at end of table.

TABLE 3.—Imports of major metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Nonmetals—Continued			
Sand, natural (excluding metallurgical sand):			
Quartz sand	120,225	127,979	Belgium-Luxembourg 88,790; Denmark 28,922; Netherlands 5,333.
Other industrial	10,157	18,467	Denmark 11,557; Norway 3,031; United Kingdom 1,728; Belgium-Luxembourg 1,635.
Shale	5,810	8,905	West Germany 4,983; Norway 3,659.
Stone, dimension:			
Calcareous	5,110	4,764	Italy 3,498; Belgium-Luxembourg 1,234.
Other	3,008	3,064	Norway 2,989; United Kingdom 57.
Sulfur:			
Natural	97,326	82,553	Norway 34,886; France 22,221; Poland 18,757; United States 4,652.
Elemental	129	123	West Germany 67; United Kingdom 41.
Talc and steatite	11,800	10,799	Norway 7,216; United States 1,173; Australia 1,069.
Mineral fuels:			
Anthracite	52,527	52,546	U.S.S.R. 34,225; United Kingdom 10,835; Finland 7,476.
Bituminous and briquets	1,804,602	1,862,704	United States 696,532; Poland 612,451; West Germany 270,886; United Kingdom 193,891.
Lignite and lignite briquets	11,652	15,111	East Germany 14,421; Denmark 688.
Peat	14	24	(1).
Coke:			
High temperature (metallurgical).	57,837	44,746	West Germany 27,114; Belgium-Luxembourg 8,644; United Kingdom 4,698.
Other and coke briquets	1,535,704	1,478,661	West Germany 760,248; United Kingdom 263,642; U.S.S.R. 147,289; Netherlands 137,983.
Coal and mineral tar	6,190	5,073	United Kingdom 3,065; West Germany 1,939.
Petroleum:			
Crude, including shale oil	2,486,211	2,384,901	Saudi Arabia 1,028,740; Iran 743,554; Venezuela 446,142; Qatar 146,727.
Partly refined petroleum, including topped crudes.	150,872	82,581	All from Venezuela.
Refinery products:			
Gasoline—42-gallon barrels	13,421,841	15,937,602	Netherlands 5,679,511; United Kingdom 3,639,885; West Germany 2,472,115; Qatar 1,858,903.
Kerosine—do	2,273,388	2,556,067	Netherlands 747,214; United Kingdom 688,422; Qatar 434,928; Aruba 390,100.
White spirit—do	378,740	406,026	Mainly from Netherlands.
Distillate fuel oils—do	32,888,580	36,777,146	Netherlands 11,771,131; United Kingdom 6,381,004; U.S.S.R. 2,619,370; Qatar 2,600,877.
Residual fuel oils—do	27,613,295	31,895,395	U.S.S.R. 14,842,224; United Kingdom 6,253,292; Belgium-Luxembourg 5,075,357.
Lubricating oils	118,219	134,072	United States 68,236; Netherlands 26,322; United Kingdom 15,772.
Liquefied petroleum gases	5,041	7,497	Norway 5,038; West Germany 1,721.
Petrolatum	657	823	West Germany 472; Netherlands 203; United States 139.
Paraffin	9,138	9,915	West Germany 4,871; United States 1,503; East Germany 839; Netherlands 772.
Petroleum coke	13,055	10,107	United States 7,737; Netherlands 1,103; West Germany 932.
Other bitumens	14,128	16,147	United Kingdom 4,408; Netherlands 3,248; Belgium-Luxembourg 1,790; West Germany 1,744.
Carbon black	13,748	17,453	Netherlands 5,760; United Kingdom 5,276; United States 4,372.

[1] Data not available.
[2] Less than 0.5 ton.

COMMODITY REVIEW

METALS

Arsenic.—For many years, Boliden Mining Co., Ltd. (Boliden Gruvaktiebolag), has recovered crude arsenic oxide at its Rönnskär smelter, chiefly from the complex nonferrous ores of the soon-to-be-exhausted Boliden mine. The quantities recovered have been far in excess of the quantities the market has been able to absorb, and Boliden has stored the excess material in silo-type structures. Reportedly 300,000 tons or more of crude arsenic oxide are on hand. Thus, in spite of the impending closure of the foremost mine source of arsenic, appreciable stocks of material are available for processing at Rönnskär. By 1963, Boliden had completed its new arsenic refinery, which doubled treatment capacity to 30,000 tons per year.

Copper-Lead-Zinc.—The Boliden Mining Co., Ltd. (Boliden Gruvaktiebolag), constituted almost all of the base metal industry of Sweden. In 1963 the company operations continued almost unchanged with only slight increases. Prospecting and development work increased. In the Långdal mine, which is scheduled to replace the nearly exhausted Boliden mine in the late 1960's, development was almost to the deepest communication level at 405 meters; at Kristineberg examination at depth commenced; at Laisvall the 1.6-kilometer-long access tunnel was completed, and the new concentrating plant was run in, resulting in production of over 1 million tons of ore.

In spite of the high level of production of mine copper, lead, and zinc, the company increased its reserves of ore during the year. Underground exploration costs of potential ore bodies and exploitation costs for small ore bodies were reduced in part through use of mobile mine plants and head frames. These installations can be shifted with reasonable ease from an unsuccessful exploration site or worked out ore body to a new site without the usual costs of dissembly and reassembly. The scheme has been pioneered by Boliden because of the numerous small ore bodies on which it holds leases. Mining operations were hampered somewhat by a shortage of labor in 1963.

Copper smelting at Rönnskär increased to a new high although mine copper output fell slightly. This was possible because of the greater treatment of purchased ores and secondary material which increased from about two-thirds of the total raw material in 1962 to about three-fourths in 1963. Improvements were made at the lead smelter which reduced costs and increased production. Boliden made an agreement to take over half the shares in the Norwegian Zinc Co. for which 125,000 Boliden shares would be transferred to Norwegian Zinc's parent company, Compagnie Royale Asturienne des Mines of Belguim. Boliden has no zinc smelter and the acquisition of the Norwegian company was considered a natural step. It was announced that Norwegian Zinc would increase its capacity by a third to 64,000 metric tons per year.

At Rönnskär, Boliden was investing the equivalent of US$7.2 million in a slag-fuming plant for the recovery of lead and zinc from copper slags. A mixture of pulverized coal and air will be blown through molten copper slag extracting the lead and zinc content as

metal fumes. These fumes will be oxidized into dust, collected and treated. The plant is designed to treat 200,000 tons of slag per year with an expected annual recovery of 20,000 to 25,000 tons of zinc clinkers and 6,000 to 7,000 tons of lead dust. The products will be exported for further processing.

Iron Ore.—Output of iron ore was pushed to highest levels of record primarily by the Government-owned Luossavaara-Kiirunavaara AB (LKAB), the country's largest producer. At Kiruna the 13.1 million metric tons mined during the year came largely (11 million tons) from underground extraction. During 1963 the shaft was enlarged and a crushing station was being installed at the 420-meter level to crush to 70 millimeters rather than to 100 millimeters as previously done. Construction of the new pelletizing plant was begun at Kiirunavaara just south of the present central plant. The facility was ordered from Head Wrightson Iron and Steel Works Engineering, Ltd. Upon completion in 1965 at an estimated cost of SKr90 million (almost US$18 million), the plant will have a capacity of 1.5 million tons of pelletized ore per year. This plant supplants the one planned earlier for the Svappovaara field and will handle much of the mined product from that area. Later a 900,000-ton plant is to be built at Svappavaara. LKAB had a capacity of 350,000 tons of pellets at Malmberget and was expanding that plant to a 500,000-ton-per-year capacity.

Swedish producers of iron ore for export experienced difficulties during the year as a result of declining prices (5 to 7 percent lower than in 1962) and because of the shrinking market for Sweden's high-phosphorus iron ore, particularly in West Germany, as new oxygen steel facilities put heavy competitive pressure on the Bessemer steelworks. Some of the smaller companies in Sweden were already in financial difficulty and one, the State-owned Statsgruvor AB, asked for SKr6 million from the Government to cover anticipated losses for the next few years.

Swedish companies have recognized the need to improve mining efficiency and a move by LKAB to establish a centralized traffic control (CTC) equipped for data processing is one example of the methods being used to cut costs. Information on positions of train sets, the level of filling in shafts and bunkers, and analysis data will be fed into the center which will control ore haulage and hoisting in the mines and will be tied into the surface lines of the Swedish State Railways serving the mines and beneficiating plants as well as those over which the product is shipped.

As of 1963, one of the smaller producers of iron ore, Stora Kopparbergs AB was producing high-grade iron concentrates at 300,000-ton-a-year rate in its new Risberg mill. The products supplied about a third of the feed for the company's Domnarfvets Jernwerk pig iron blast furnaces. The plant uses ore from the Grängesberg field in central Sweden; this material is a mixture of hematite and magnetite and is high in phosphorus. The Risberg mill uses fine grinding to −8 mesh and magnetic separation to produce a 65-percent iron concentrate. Tailings from the first separation are treated in 80-turn Humphreys spirals. The Humphreys concentrate is mixed with the

magnetic concentrate and the final tailing dewatered in top-feed filters of high efficiency.

The iron ore prospecting program of recent years was in its final stages in 1963. The work was being done by LKAB for the Swedish Geological Survey in the Svappavaara area and in the Kaunisvaara field in Pajala.

Iron and Steel.—Increased economic activity during the latter half of 1963 was reflected by the almost full use of Sweden's iron and steel capacity and resulted in the record high output for the year. The increased domestic capability for the production of flat-rolled products was indicated by decreased import demand for the items during the final semester. In general and in spite of the increased demand, steel prices were unsatisfactory from a producer's viewpoint during the year. Prices for some commodities were reduced to 10-year lows. Greater efficiency and plant rationalization were relied upon to combat the squeeze between rising costs and reduced per-unit income. The problem of the Swedish industry was complicated by the decision of EEC countries to raise tariffs on some steel products; however, Sweden's total steel exports were higher than in 1962.

Pig iron output increased relatively moderately in support of the larger steel output. The proportion of scrap used in steel furnaces increased. Sponge iron production was only slightly higher in 1963 than in 1962 as facilities operated at capacity both years. The Höganäs Group revamped its operation by installing a new iron-tunnel kiln, and total capacity of the company was increased by about 40,000 tons per year. It was planned that the old pit-kiln would be held in reserve.

The new Kaldo and LD furnaces took over a larger part of steelmaking production, and their output in 1963 increased 165 percent over the 1961 level.

Uranium.—Sweden's nuclear power program is in the hands of a Government company, Atomenergi AB, which functions as a profit and loss organization although its income is derived primarily from Government grants and subsidies. Some funds have been obtained from the sale of radioactive isotopes and from the charges for services to other Swedish companies. In 1963 Atomenergi reported good progress on the uranium mill at Ranstad and the beginning of the production of refueling elements and enriched uranium dioxide elements for testing. The major accomplishment of the year was the success of going critical at the Ågesta power station and district heating plant on July 17, 1963. This plant was a joint venture of Atomenergi, the State Power Board, and the Stockholm Electricity Authority. Also in 1963, the Government approved the design of the Marviken power station at Vikbolandet, Sweden's second such plant.

Although Sweden's early work in nuclear power was accomplished with imported fuel from the United States, domestic resources were being worked in 1963. Uranium shales at Mt. Billingen were being exploited, and the new Ranstad mill was expected to produce 120 tons of uranium concentrates per year from 850,000 tons of shale. It was planned that some type of breeder reactor eventually would be used with the consequent recovery of plutonium. When this is accom-

plished, Sweden will be virtually self-sufficient in terms of nuclear fuels.

MINERAL FUELS

Sweden remained almost completely without domestic sources of mineral fuels in 1963. Indigenous resources include bituminous coal and oil shales; however, Sweden's demand for mineral fuels continued to be supplied almost entirely by imports. Production of coal from domestic deposits, done solely by the Höganäs Group, appears to be dwindling to an insignificant point, and operation of the Kvarntorp shale oil plant at capacity provided only about 1 percent of the country's petroleum demand. In 1963 the ready availability of fuel oil at attractive prices, even though imported, was held responsible for the diminution of the coal requirements. Most of the gas used in Sweden was obtained from the conversion of coal in municipal gas plants. Water gas, butane, propane, and other sources made up the smaller part. The use of liquefied petroleum gas increased rapidly and has found application in industry for lead smelting.

Swedish oil shale production operations have been in economic difficulty for many years. The industry was begun to augment the sharply reduced imports of petroleum during World War II and has continued to operate since, although almost always at a deficit. Over the 15-year span ending in 1962, the total accumulated losses of the Kvarntorp plant exceeded SKr100 million in spite of the expenditure of over SKr180 million on improvements. In 1962 the Government authorized closing of the shale oil operation, and during 1963 the volume of retorting of shale was being reduced. Certain chemical byproduct operations of the plant were continued although the fundamental shift was away from shale oil toward crude petroleum for feedstocks.

An expansion program at the important Nynas Petroleum AB refinery of the Axel Johnson group at Nynashamn was completed, raising this refinery's daily capacity to 30,000 barrels and the daily national capacity to 67,900 barrels. The country's other major refinery, Shell's Gothenburg plant, apparently remained unchanged. British Petroleum announced plans for the erection of a major new refinery at Hisingen. This facility, with a planned daily capacity of 50,000 barrels, is expected to cost about US$800 million. The nearby port of Gothenburg reportedly will spend an additional US$12 million on harbor facilities to accommodate larger tankers than it can now handle.

The Mineral Industry of Switzerland

By Walter C. Woodmansee [1]

SWITZERLAND'S diversified industries remained heavily dependent on foreign supply for most mineral commodities during 1963. Despite the country's general lack of mineral resources and its small metal-producing industry, recent developments in mineral fuels have been significant. The trend continued toward greater emphasis on liquid fuels rather than solid fuels for production of energy. As consumption of refined petroleum products expanded further, Switzerland's first oil refinery went into production; others are planned for construction during 1964–65. Crude oil supply would probably come largely through Western Europe's new pipeline system, which was under construction during 1963. Several companies continued oil exploration and distribution activities in Switzerland.

Total value of metal and mineral output in Switzerland during 1963 is not known but would be less than 1 percent of the gross national product, which was SwF41.9 billion [2] in 1962 and continued an upward trend in 1963.

Only a small part of Switzerland's labor force has been involved in actual primary metal and mineral production, but metal goods manufacturing plants and other operations processing metal and mineral commodities were more significant employers. Of a total industrial employment of 750,500 in 1962, only 425 persons were engaged in mining and quarrying; a small but increasing number were employed in petroleum refining; about 100,000 were employed in the metallurgical industry including manufactured metal product plants; and 26,000 to 27,000 were engaged in the construction materials, nonmetals, and earthenware industries.

GOVERNMENT POLICIES AND PROGRAMS

Mineral resources have been explored and exploited by private industry under cantonal concessions, except for salt mining, which is in the hands of cantonal officials. The Rhine salt industry has been organized as a corporation controlled by Swiss cantons.

The Swiss Government continued to encourage private foreign investment in the country's new oil-refining and distribution industries. New companies engaged in exploration and refinery or pipeline construction in Switzerland must be at least 50 percent Swiss owned ac-

[1] Foreign mineral specialist, Division of International Activities.
[2] SwF1 = US$0.23.

cording to national law; other legislation governing exploration for or development of oil deposits is cantonal, and regulations have varied widely.

SOURCE MATERIAL

Most production and trade data are from official Swiss sources through 1962. Most production figures for 1963, however, are based on nonofficial sources or are estimates. Production of secondary nonferrous metals and a few nonmetals and fuels is not available, apparently because the producing companies do not release these data.

PRODUCTION

Aluminum and iron and steel remained the only major metals produced in quantity. The iron and steel industry showed little change during 1963, but production of aluminum ingots continued an upward trend. Among the few nonmetals and mineral fuels produced, little change took place during 1963. Cement output reached a peak in 1962 and declined slightly during 1963, owing to lower demand for cement in hydroelectric powersite construction. Output of manufactured gas and gas-plant coke continued at a high level, while output of asphalt, tar, and pitch remained small.

Production of refined petroleum products commenced during 1963 with completion of Switzerland's first oil refinery. Future production from this refinery and from others in the planning or construction stages during 1963 should improve the national income from minerals during the next few years.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Aluminum	34,370	39,730	42,210	49,570	[2] 61,180
Copper, smelter	----------	----------	1,800	[3] 800	----------
Iron and steel:					
Iron ore—thousand tons	60	125	86	104	96
Pig iron—do	40	50	50	50	42
Ferroalloys (ferrosilicon)—do	4	3	4	5	2
Ingots and other equivalent primary forms—thousand tons	244	249	270	290	295
Castings—do	14	15	16	16	15
Nonmetals:					
Cement	2,683,169	3,036,148	3,601,167	3,725,863	3,581,330
Lime, hydraulic	133,565	168,016	185,666	192,601	184,426
Salt	137,225	149,311	157,277	167,943	185,288
Slate [4]	905	737	751	450	458
Mineral fuels:					
Asphalt	[5] 15,000	15,414	13,229	[5] 13,000	[5] 13,000
Coke, gas plant	467,941	483,811	479,743	496,322	[5] 498,000
Tar and pitch	27,035	29,019	27,729	27,505	[5] 27,000
Gas, manufactured—million cubic feet	12,088	12,289	12,155	12,717	[5] 12,800

[1] In addition to the commodities listed, several metals were produced from scrap, including copper, magnesium, nickel, and zinc. Gypsum, coal briquets, and peat were produced, but output is not reported. Switzerland's first oil refinery went on stream in September 1963, but its output has not been reported.
[2] Includes superpurity aluminum.
[3] Production terminated May 1962.
[4] Estimate based on exports.
[5] Estimate.

TRADE

Switzerland's trade deficit in metals and minerals continued in 1963, probably differing little from that of 1962, the last year for which complete data are available. In 1962, exports of metals and minerals were valued at only SwF465.5 million, while value of imports was SwF2,647.5 million. Metal and mineral imports accounted for 20 percent of the value of Switzerland's total imports of all goods in 1962; the corresponding figure for exports was only 4 percent. Metals, including ores and scrap, were the highest valued group of mineral imports (SwF1,485.9 million) and consisted principally of iron and steel semimanufactures; imports of mineral fuels, chiefly petroleum products, were valued at SwF866.9 million; and the nonmetals, chiefly diamonds, were valued at SwF294.7 million.

Metals, metallic ores, and scrap also accounted for by far the greatest part of the value of metal and mineral exports, totaling SwF303.6 million in 1962, principally in aluminum, gold, and iron and steel products; exports of the nonmetals, largely diamonds, were valued at SwF157.2 million, and exports of mineral fuels, largely petroleum coke and lubricants, were valued at SwF4.7 million.

Tonnages of metals and minerals exported during 1962 showed little significance change from those of 1961. Imports of alumina, aluminum ingot, and aluminum semimanufactures increased appreciably during 1962, but imports of refined copper and slab zinc were down. Imports of gold bullion and of steel ingots and some semimanufactures were much higher in 1962. Among the nonmetals and mineral fuels, cement imports increased more than 60 percent, and imports of residual fuel oil, lubricants, and petroleum coke also were considerably higher than in 1961.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Bauxite	-------	40	Mainly to West Germany.
Alumina	32	59	Do.
Ingots, including scrap	6,079	8,563	West Germany 4,587; Italy 1,716; Sweden 1,099.
Semimanufactures	15,111	15,281	Netherlands 2,194; United States 1,395; Nigeria 1,002.
Antimony	[1] 19	12	Mainly to West Germany.
Copper and copper alloys:			
Scrap	535	1,830	Italy 793; West Germany 727; Belgium-Luxembourg 173.
Unwrought	1,652	2,063	West Germany 1,215; Italy 800.
Semimanufactures	8,762	7,851	United States 3,368; Italy 1,494; Israel 662.
Gold:			
Scrap—thousand troy ounces	4,311	3,274	West Germany 1,725; France 696; Belgium Luxembourg 607.
Bullion and other un- do wrought.	244	272	Mainly to West Germany.
Semimanufactures—do	39	34	Denmark 20; France 3; Italy 2.
Iron and steel:			
Iron ore	61,282	75,445	Mainly to West Germany.
Scrap	6,253	7,082	Italy 3,811; West Germany 2,160; France 687.
Pig iron [2]	1,127	999	Pig iron: 80 tons to Austria. Other: France 352; West Germany 296.
Ferroalloys	11,776	9,073	West Germany 6,015; Italy 2,435; Austria 539.
Steel:			
Ingots and equivalent primary forms.	131	435	Mainly to Italy.
Semimanufactures, low- and medium-carbon unalloyed steels:			
Rods, bars, angles, shapes, sections.	8,113	7,855	Italy 3,999; Austria 1,824; Belgium-Luxembourg 639.
Flat rolled	2,070	1,597	Italy 470; Denmark 346; West Germany 209.
Wire	1,350	1,156	Italy 316; West Germany 260; Belgium-Luxembourg 128.
Rails and railway track materials.	125	55	Austria 30; Canada 24.
Tubes, pipes, fittings	19,108	20,438	United States 5,342; Peru 2,908; France 2,742; Netherlands 1,961.
Castings and forgings	1,583	1,681	West Germany 809; Netherlands 232; Austria 107; France 100.
Semimanufactures, high-carbon and alloy steels.	1,018	1,032	Italy 594; West Germany 134; France 130.
Lead:			
Scrap	2,126	2,415	Mainly to Italy.
Unwrought	6	1	Mainly to United Arab Republic.
Semimanufactures	79	102	Belgium-Luxembourg 30; Sweden 22; Austria 18.
Magnesium, all forms	24	38	Various; semimanufactures, mainly to Netherlands.
Mercury—76-pound flasks	30	90	Mainly to West Germany.
Molybdenum	1	2	Do.
Nickel:			
Matte, speiss, scrap	475	525	Italy 221; France 153; West Germany 77.
Anodes	323	283	France 119; West Germany 86; Belgium-Luxembourg 26.
Semimanufactures	559	403	Italy 100; West Germany 92; France 64; Austria 58.
Platinum-group metals, all forms.	thousand troy ounces 29	38	Italy 14; Belgium-Luxembourg 6; Spain 3.
Silver:			
Ingots, bars, etc—do	107	422	Italy 258; West Germany 79; United Kingdom 65.
Semimanufactures—do	2,412	2,794	Italy 1,081; Denmark 461; West Germany 297; France 226.
Tantalum—kilograms	2,000	3,000	Mainly to West Germany.
Tin:			
Scrap—long tons	254	195	West Germany 75; France 63; Netherlands 57.
Unwrought and semimanu- do factures.	46	46	Unwrought mainly to West Germany; semimanufactures mainly to Austria and West Germany.
Tungsten, all forms	13	2	United Kingdom and West Germany.

See footnotes at end of table.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals—Continued			
Zinc:			
Scrap	709	1,012	Italy 984; France 28.
Slab	54	91	Mainly to Italy.
Semimanufactures	52	76	West Germany 36; Austria 14; Italy 10.
Other ore and concentrate	20	673	Mainly to West Germany.
Other base metals	[3] 24	15	Netherlands 6; West Germany 4.
Nonmetals:			
Abrasives, natural	2	26	Netherlands 10.
Asbestos	34	21	West Germany 9; France 4.
Cement	24,510	20,630	West Germany 18,100; France 2,440.
Chalk	22	18	Mainly to West Germany.
Clays	11,021	12,667	West Germany 11,073; Austria 1,537.
Diamond, industrial thousand carats and other.	13,530	15,130	West Germany 4,070; India 3,295; United Kingdom 2,280.
Diatomite and other siliceous earths	79	152	West Germany 73; Belguim-Luxembourg 33.
Dolomite	155	160	Denmark 75; Netherlands 75.
Feldspar, leucite, etc.	7	58	Austria 20; West Germany 12.
Gypsum	166	73	Italy 38; West Germany 16.
Lime	1,212	3,327	West Germany 1,343; Austria 980; France 949.
Limestone, industrial	3,115	2,291	Mainly to West Germany.
Magnesite	6	24	West Germany 5.
Mica	25	20	France 6; Italy 5; West Germany 5.
Quartz and quartzite	2,427	6,615	Italy 4,121; West Germany 1,132; Belgium-Luxembourg 530.
Sand, gravel, crushed thousand tons rock.	75	63	West Germany 30; Austria 27.
Shale	647	451	West Germany 398; France 52.
Stone, other	22,631	22,590	Mainly to West Germany.
Talc and steatite	123	1,108	Mainly to Italy.
Other	22	20	[4].
Mineral fuels:			
Coal:			
Anthracite and bituminous	3	1,774	France 1,000; Netherlands 757.
Lignite, including briquets	2,538	167	All to West Germany.
Peat	222	202	[4].
Coke	314	394	All to Italy.
Tar, coal and mineral	1	46	West Germany 24; France 11.
Petroleum refinery products:			
Gasoline [5]	47	5	[4].
Kerosine	8	7	Mainly to West Germany.
Distillate fuel oil	17	12	Italy 9; France 3.
Residual fuel oil	1	37	Mainly to Italy.
Lubricants	1,094	1,242	Italy 480; Burma 417; India 47.
Liquefied petroleum gases	80	1	[4].
Asphalt and bitumens	2,441	2,306	Asphalt: West Germany 119. Bitumens mainly to United Kingdom.
Petroleum coke	3,773	8,873	France 6,474; West Germany 1,766; Italy 633.
Other	137	64	[4].
Carbon black	511	628	Italy 438; West Germany 102.

[1] Includes other metals not specified.
[2] Includes sponge iron, shot, grit, and pellets.
[3] Includes antimony.
[4] No principal destination; distributed in small quantities to a number of countries.
[5] Includes white spirit.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Bauxite	2,720	1,369	Mainly from France.
Alumina	92,527	107,116	France 67,871; Italy 14,279; British Guiana 13,793.
Ingots, including scrap	10,502	11,113	United States 2,698; Austria 2,243; Canada 1,564.
Semimanufactures	7,058	7,744	Mainly from West Germany.
Antimony	[1] 801	546	Mainland China 388; U.S.S.R. 113.
Arsenic, white	249	100	West Germany 57; France 19.
Beryllium	2	1	Mainly from United States.
Copper and copper alloys:			
Scrap	501	432	Israel 173; United Kingdom 96; West Germany 91.
Unwrought	54,032	42,343	Belgium-Luxembourg 13,639; Federation of Rhodesia and Nyasaland 12,491; Chile 5,963; United States 4,058.
Semimanufactures	21,494	21,479	West Germany 6,762; Canada 5,195; United Kingdom 4,172.
Gold:			
Scrap—thousand troy ounces	160	193	Mainly from Denmark.
Bullion and other unwrought—do	58	80	Peru 38; West Germany 34.
Semimanufactures—do	149	132	West Germany 61; United States 41; United Kingdom 29.
Iron and steel:			
Iron ore	7,862	1,330	West Germany 847; Italy 252.
Scrap	18,285	38,508	West Germany 23,472; United Kingdom 11,089; Austria 2,496.
Pig iron [2]	79,033	87,128	West Germany 36,419; Netherlands 23,835; Canada 8,861.
Ferroalloys	10,891	9,264	West Germany 3,265; U.S.S.R. 1,118; France 1,112.
Steel:			
Ingots and equivalent primary forms.	220,575	282,708	West Germany 200,169; France 26,359; ingots (33,801 tons) mainly from Italy.
Semimanufactures, low- and medium-carbon unalloyed steels:			
Rods, bars, angles, shapes, sections.	365,804	401,596	West Germany 165,477; France 116,542; Belgium-Luxembourg 90,262.
Flat rolled	493,619	495,997	France 141,918; West Germany 139,254; Austria 86,732; Belgium-Luxembourg 64,097.
Wire	16,007	17,780	West Germany 11,232; Austria 2,368.
Rails and railway track materials.	48,395	66,294	Austria 22,600; West Germany 20,248; Belgium-Luxembourg 15,503.
Tubes, pipes, fittings	144,574	127,810	West Germany 76,737; France 21,947; Italy 12,356.
Castings and forgings	13,221	14,943	West Germany 9,807; France 1,837.
Semimanufactures, high-carbon and alloy steels.	72,057	71,679	West Germany 28,992; France 13,484; Austria 9,187; Sweden 8,451.
Lead:			
Pig	22,269	24,119	Mexico 6,428; France 3,579; Spain 2,950.
Semimanufactures	694	688	West Germany 370; France 227.
Magnesium, all forms	484	715	Ingots and scrap: Norway 197; United States 186. Semimanufactures mainly from United States.
Mercury—76-pound flasks	1,334	1,073	Italy 522; Spain 232; mainland China 203.
Molybdenum	11	13	Austria 3; United Kingdom 3; West Germany 3.
Nickel:			
Matte, speiss, etc	1,651	1,476	United Kingdom 917; Norway 400.
Scrap	11	141	Mainly from Israel.
Anodes	167	224	United Kingdom 94; Norway 62; Canada 21; France 21.
Semimanufactures	596	531	United Kingdom 242; West Germany 176.
Platinum-group metals, all forms.—thousand troy ounces	30	39	U.S.S.R. 18; West Germany 10; France 5.
Silver:			
Ingots, bars, etc—do	12,582	6,122	West Germany 1,613; mainland China 1,401; United Kingdom 1,347.
Semimanufactures—do	1,518	1,092	Mainly from West Germany.
Tantalum—kilograms	4,000	4,000	Do.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals—Continued:			
Tin:			
Ingots—long tons	1,167	1,091	Federation of Malaya 482; Netherlands 302; China 188.
Semimanufactures—do	111	88	Netherlands 31; Belgium-Luxembourg 23; West Germany 12.
Tungsten, all forms	36	29	West Germany 16; United States 5; France 3.
Zinc:			
Slab, including scrap	27,021	20,318	West Germany 8,898; Belgium-Luxembourg 3,644; Mexico 1,835.
Semimanufactures	3,561	3,066	Belgium-Luxembourg 1,638; West Germany 612; Yugoslavia 321.
Other ore and concentrate	6,093	4,639	Australia 2,445; Turkey 744; West Germany 325.
Other base metals	[3] 816	409	Republic of South Africa 122; Japan 117; West Germany 60.
Nonmetals:			
Abrasives, natural	21,075	18,769	Italy 11,353; West Germany 7,178.
Asbestos	9,281	12,122	Canada 9,272; Rhodesia 980; Italy 412.
Barite	2,979	2,509	France 1,341; West Germany 986; Italy 139.
Boron salts	88	137	Mainly from United States.
Cement	92,889	150,921	France 82,973; Austria 45,157; Italy 14,931.
Chalk	11,650	12,472	France 11,056; Italy 1,255.
Clays	149,930	158,059	West Germany 76,273; United Kingdom 34,469; France 20,860; Czechoslovakia 12,344.
Cryolite and chiolite	1,060	1,237	All from Denmark.
Diamonds—thousand carats	32,870	33,435	West Germany 8,830; Italy 6,995; India 625; Brazil 470.
Diatomite and other siliceous earths	2,835	3,127	United States 2,036; West Germany 457; France 255.
Dolomite	8,000	8,241	Italy 4,521; France 1,868; West Germany 1,200.
Feldspar, leucite, etc	11,277	11,116	West Germany 3,829; France 2,928; Italy 2,266.
Graphite, natural	695	657	Austria 398; West Germany 202.
Gypsum	23,477	22,577	West Germany 12,197; France 4,779; Austria 3,713.
Lime	2,897	3,342	Mainly from Italy.
Limestone, industrial	50,123	47,206	Mainly from France.
Magnesite	3,523	3,997	Mainly from Austria.
Mica	805	926	India 485; United Kingdom 190; West Germany 160.
Phosphate rock	35,084	31,132	Morocco 21,715; United States 3,192; Tunisia 2,932.
Pigments, natural	510	383	France 180; West Germany 93.
Potash	97,646	103,064	France 74,654; West Germany 27,209.
Pyrite	54,736	35,003	Mainly from Italy.
Quartz and quartzite	15,265	8,353	Mainly from West Germany.
Salt	1,192	787	Mainly from France.
Sand, gravel, crushed rock.—thousand tons	2,754	3,461	France 1,702; West Germany 839; Italy 562.
Shale	1,708	1,766	Mainly from West Germany.
Stone, other	54,966	58,595	Italy 38,251; France 12,989.
Sulfur	55,030	62,703	United States 32,933; France 27,390.
Talc and steatite	15,708	15,977	France 8,369; Austria 3,557; Italy 1,716.
Mineral fuels:			
Coal:			
Anthracite and bituminous.—thousand tons	1,707	1,731	West Germany 711; Belgium-Luxembourg 330; France 293.
Lignite, including briquets—do	213	186	Mainly from West Germany.
Peat—do	25	26	Do.
Coke—do	456	525	West Germany 351; Netherlands 122; France 27.
Tar, coal and mineral—do	11	10	Mainly from West Germany.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Mineral fuels—Continued			
Petroleum:			
Crude, including shale oil	(4)	4,269	Mainly from Venezuela.
Gasoline [5] thousand tons	1,162	1,058	Italy 476; West Germany 272; France 112.
Kerosine	15,672	16,688	Netherlands 6,526; Italy 4,970; Belgium-Luxembourg 2,350.
Distillate fuel oils thousand tons	454	303	Italy 141; France 46; Belgium-Luxembourg 21.
Residual fuel oils do	2,437	3,356	Italy 1,401; West Germany 513; France 437.
Lubricants	67,827	70,039	United States 19,729; United Kingdom 14,042; Netherlands 10,016; Italy 6,712.
Liquefied petroleum gases	2,213	891	France 352; West Germany 277; Italy 257.
Asphalt and bitumens	5,280	5,612	West Germany 1,499; United States 1,074; Italy 960.
Petroleum coke	27,486	36,531	West Germany 24,846; United States 10,729.
Other thousand tons	138	156	West German 41; France 31; Netherlands 30.
Carbon black	5,445	5,758	West Germany 1,300; United States 1,265; Netherlands 962.

[1] Includes other metals not specified.
[2] Includes sponge iron, shot, grit, and pellets.
[3] Includes antimony.
[4] Less than 0.5 ton.
[5] Includes white spirit.

COMMODITY REVIEW

METALS

Aluminum.—Production of aluminum has increased steadily with growing ingot capacity. The new plant of Alusuisse (Schweizerische Aluminum, G. m.b.H., formerly Aluminum Industrie, A.G.) at Steg (Canton Valais), which went into operation in 1962, raised domestic primary ingot capacity to 61,500 metric tons, distributed as follows: Alusuisse—35,000 tons ingot and 3,000 tons superpurity aluminum at Chippis (Canton Valais) and 18,000 tons ingot at Steg (Canton Valais); and Usine d'Aluminium Martigny—5,500 tons ingot at Martigny-Ville (Canton Valais). In addition, Metallwerke Refonda, Wiederkehr at Niederglatt (Canton Zurich) has annual capacity for 7,000 tons of secondary aluminum ingot. Twelve rolling and/or extrusion mills also operated in 1963. One was owned by Alusuisse, and several others were affiliated with Alusuisse.

Aluminum production has been based largely on alumina imported from Alusuisse operations in foreign countries. Bauxite and alumina came from Alusuisse's subsidiaries in France (S.A. des Bauxites de France), Greece, and West Africa. Through an agreement with the Government of Sierra Leone in 1962, Alusuisse established a subsidiary, Sierra Leone Ore and Metal Co., to mine bauxite in the southwest province of Sierra Leone. During 1962 Alusuisse also planned for an alumina plant, annual capacity 200,000 metric tons, near Rotterdam in the Netherlands at a reported cost of 200 million guilders. In 1963 the company participated in the financing of a new aluminum reduction plant, capacity 30,000 metric tons, in the Netherlands, with initial production anticipated for 1966. The Netherlands gasfields were to provide fuel for electric power requirements.

TABLE 4.—Aluminum semifabrication plants, 1963

Company	Plant location		Products, remarks
	City or town	Canton	
Aluminium Laufen, A.G	Laufen	Bern	Sheet, strip, rods, extruded products.
Aluminium, A. G. Menziken	Menziken	Aargau	Sheet, strip, extruded products. Affiliated with Alusuisse.
Aluminium, A. G. Rorschach	Rorschach	St. Gallen	Sheet, foil. Annual capacity: 15,000 tons. Affiliated with Aluminum Co. of Canada (Alcan).
Schweizerische Aluminium, G.m.b.H. (Alusuisse).	Sierre	Valais	Sheet, strip, extruded products, rods, wire, tubes. Annual capacity: 45,000 tons.
Aluminium Press und Walzwerk Munchenstein, A.G.	Munchenstein	Baselland	Sheet, extruded products.
Laminoirs Ed. Mathey Fils S.A.	Neuveville	Bern	Sheet, strip.
Robert Victor Neher, A.G	Kreuzlingen	Thurgau	Foil, thin sheet. Subsidiary of Alusuisse.
Nyffeler Corti et Cie	Kirchberg	Bern	Foil.
Presta, A.G	Kesswill	Thurgau	Tubes.
S. A. des Cableries et Tréfileries de Cossonay.	Cossonay	Vaud	Wire. Affiliated with Alusuisse.
Schupbach et Cie	Burgdorf	Bern	Foil.
Schweizerische Metallwerke Selve et Cie.	Thun	do	Sheet, strip, rods, wire.

Alcoa (Aluminum Co. of America) established Alcoa International, S.A. in Lausanne in 1962. This company will direct Alcoa's worldwide operations outside the United States.

Copper.—Switzerland's metallurgical production of copper has been limited to small quantities of secondary copper from Compagnie des Produits Électrochimiques et Électrométallurgiques at Bex (Canton Vaud) and Refonda at Niederglatt (Canton Zurich). Copper requirements during 1963 continued to be supplied largely by imported refined copper and semimanufactured products.

Iron and Steel.—Switzerland's small production of iron ore, pig iron, and crude steel remained relatively unchanged during 1963. Iron ore and pig iron output were reduced slightly, while output of ingots and other primary forms increased 1 to 2 percent. About half of the crude steel supply and a greater proportion of the semimanufactured steel supply continued to be provided by imports.

During 1963 four companies produced iron and steel: Ludwig von Roll'schen Eisenwerke, A.G. at Gerlafingen (Canton Solothurn) and Choindez (Canton Bern); Von Moos Eisenwerke, A.G. at Emmenbrücke (Canton Lucerne); La Fonte Électrique, S.A., at Bex (Canton Vaud); and Valfonte, S.A. Produits Électrométallurgiques at Martigny-Ville (Canton Valais). Products were mainly electric furnace pig iron, crude steel, and ferrosilicon. Mill products were made by Von Roll'schen and Von Moos. Steelmaking capacity has been entirely electric, based on domestic and imported scrap and pig iron and a small proportion of domestic ore. Electric furnace pig iron capacity has not been expanded in recent years and remained an estimated 60,000 to 70,000 metric tons per year. Crude steel capacity is not known but during 1963 was probably in excess of 300,000 metric tons per year. Total electric pig iron and steel facilities have not been utilized fully

on an annual basis because of a shortage of electricity during the winter.

Magnesium.—Imports of scrap, ingot, and semimanufactured magnesium increased considerably during 1962. Small quantities of magnesium also were produced by two companies in Switzerland during 1963, but output is not known. S.A. pour la Fabrication du Magnesium produced ingots, powder, alloys, and semiproducts at Martigny-Ville (Canton Valais), and Metallwerke Refonda, Wiederkehr, made secondary ingots.

Nickel.—Trade in nickel scrap, matte, and metal remained relatively unchanged during 1962; similar conditions apparently existed during 1963. Secondary nickel for alloying was produced by Compagnie des Produits Électrochimiques et Électrométallurgiques at Bex (Canton Vaud).

Uranium.—Several significant discoveries of uranium deposits were made during 1962–63, and Swiss companies planned mergers for exploration and development purposes. Deposits have been located in the central Alps and also in the lower ranges. At Blapbach (Canton Bern), reserves estimated to contain 800 to 1,000 metric tons of uranium have been reported. Other important uranium occurrences were reported at Tiraun (Canton Graubünden), in the Emmental Valley (Canton Valais), and near Isérables and Naters (Canton Valais). Average grade of samples indicated high-grade ores, but mining appeared unlikely because foreign sources of refined uranium apparently could supply the limited domestic requirements.

Zinc.—Imports of crude and semifabricated zinc were reduced during 1962 and remained at approximately the same level during 1963. A large part of the zinc supply was received as slab zinc. Small quantities of secondary zinc were produced by Metallwerke Refonda, Wiederkehr.

NONMETALS

Cement and Lime.—Output of cement in 1963 was slightly lower than the peak reached in 1962, owing to decreased deliveries to hydroelectric power station construction projects, the principal consuming sector, and lower demand for other building and construction. Consumption of cement for hydroelectric power construction increased 17 percent in 1961, 12 percent in 1962, and less in 1963. Although cement production capacity has increased, during seasonal peak demands consumption exceeded output, necessitating imports of cement and clinker. During 1962–63 about 3 percent of total cement consumption was supplied by imports.

Hydraulic lime production, which also reached a peak in 1962 and declined during 1963, continued to provide adequate supplies for domestic consumption.

Gypsum.—Plants operated at full capacity during 1963, but actual output is not known. Demand for building and construction uses continued high. Moderate imports supplemented domestic production, so that available supplies were adequate. Larger storage silos, recently constructed, provided continuing supplies during seasonal peak consumption. Gips Union, A.G. is the leading producer and supplier of gypsum in Switzerland.

Salt.—Production of table and industrial salts expanded further and provided sufficient supply for domestic consumption, which reached 168,000 metric tons in 1962 and an estimated 170,000 tons in 1963. Production remained centered in the Rhine district, near Basel, and near Bex (Canton Vaud).

Sulfur and Pyrite.—Imports of sulfur have increased in recent years, a trend which probably continued during 1963. The United States continued to be the principal source of sulfur, but France's Lacq gasfield also became an important source. As foreign supply of native and/or elemental sulfur grew, imports of pyrite from Italy were correspondingly curtailed during 1962. Sulfur, S.A., is a recently formed subsidiary of Continental Ore Corp., New York, with offices at Lausanne.

MINERAL FUELS

Coal.—Imported anthracite, bituminous coal, and lignite continued to be the sole source of coal supply in Switzerland. There has been no domestic production since 1957. Deposits of poor quality exist in and near the Alps, where mining has been difficult and expensive. Small quantities of peat were produced, but the great bulk of the supply also has been imported.

Output of manufactured gas and gas-plant coke reached new highs in 1962. Consumption of coal in gas plants totaled nearly 680,000 metric tons in 1962, slightly more than in 1961.

Petroleum.—Switzerland's supply of refined petroleum products was provided almost entirely by imports during 1963. The country's first oil refinery, that of Raffinerie dû Rhône at Collembey-Murraz (Canton Valais), went on stream in September 1963, but the quantity and types of refined petroleum products delivered in the country are not known.

Imports of most petroleum products increased during 1962. The rate of consumption continued to rise, with the trend toward greater use of liquid fuels rather than solid fuels for production of energy. Imported petroleum coke was used in the manufacture of carbon electrodes by Alusuisse at Chippis (Canton Valais), where about 18,000 metric tons was produced during 1963. CeCe Graphitwerk, A.G., Zurich, continued to manufacture graphite products at a rate of 5,000 metric tons per year.

Annual capacity of the Collembey refinery is 40,000 barrels per day. Crude oil was supplied by a branch at Ferrara Station, Italy, from the new pipeline between Genoa, Italy, and Ingolstadt, West Germany, construction of which continued in 1963. Oleduc, S.A. (Société de l'Oleduc de Rhône, S.A.), primarily a Swiss company, operated the Ferrara Station-Collembey line. The 415-mile line across Switzerland to West Germany will have a capacity of 230,000 barrels per day. The portion of this line in Switzerland was owned and operated by Oleodotto del Reno, S.A., a Swiss and Italian company.

Numerous oil concessions have been granted in the Molasse Basin, Jura Plain, and Alpine mountain areas in recent years. SEAG (Schweizerische Erdöl, A.G.), a joint stock company, held more than half of these concessions in 1962. During 1963 this company completed a deep borehole near Pfaffnau (Canton Lucerne) and planned

further deep drilling near the Boden See, where the South German Basin extends into northern Switzerland, and in Canton Zurich.

Other concession holders included LEAG (Luzernisches Erdöl, A.G.); Société des Hydrocarbures, S.A.; Société d'Intérêts Minières; Société d'Études et Récherches Minières et Petrolières; and others. SEAG, LEAG, and Hydrocarbures are Swiss-German and have a common operator, Gewerkschaft Elwerth, A.G., in Switzerland. Hydrocarbures discovered a noncommercial oil deposit at Essertines in 1963.

Shell Switzerland planned a new oil refinery, capacity 2 million tons per year, near Cornaux-Cressier (Canton Neuchâtel). Crude oil would be supplied by pipeline from Marseilles. A 4-million-ton refinery also was planned by eight companies jointly participating in Mittelland Raffinerie, A.G. at Mägenwil (Canton Aargau), at a reported cost of SwF300 million. Another refinery was planned by Rheintal, A.G., at Sennwald (Canton St. Gallen), with crude oil provided by the Genoa-Ingolstadt pipeline.

The Mineral Industry of the U.S.S.R.

By V. P. Sokoloff [1]

THE U.S.S.R., with a centrally planned economy, has been the world's second largest industrial power in terms of the size of its total industrial output and of the value of its gross national product (GNP) for many years. In 1963 the GNP apparently exceeded that of 1962, which was estimated at about US$256 billion.[2] As during 1959–62, approximately 8 percent of the Soviet GNP was provided by the country's mineral output.

All mineral reserves and industries of the Soviet Union are nationally owned and government operated. Production schedules are mutually coordinated and production targets predetermined, in principle, by the 1959–65 national plan for economic development. Through 1963 production targets for the country's mineral industries were met successfully despite some administrative discoordination, mismanagement of individual enterprises, occasional disruption of procurement and supplies, and crises in other sectors of the Soviet economy.

In contrast to the first 3 years of the plan when emphasis in the Soviet mineral economy was on exploration, 1962–63 were for development and increased production. In 1964–65, the last 2 years of the plan, development was to be essentially completed and greater production achieved. During these 2 years and on the basis of mineral reserves, known and proven, as of 1963, overall industrial output was to show a further 17.5-percent increase over the 1963 level; the chemical industry sector (including mineral fertilizers and petrochemicals) was to register an increase of 36 percent. As recently as 1962, the already substantial mineral reserves of the Soviet Union were significantly increased by the platiniferous copper-nickel high-grade ores at Talnakh in Noril'sk Territory, Siberia and the rich oilfields at Ust'-Balyk and elsewhere in Tyumen' Territory, Siberia.

The government is committed to complete industrialization of the country, and national planning is based on the inventory of the country's proved and available mineral reserves. Economically the country has been growing eastward while expanding politically towards the peripheries of its European center. The politically secure and relatively densely populated center has been extraordinarily poor in natural mineral reserves, including fertile soils. The problem of the increasing distances between the minerals-endowed peripheries and the consuming core of the country has been recognized and solutions sought since the 15th century. However, the unfavorable geographic distribution pattern of the minerals base continued to tax the already

[1] Physical scientist, Division of International Activities.

[2] U.S. Congress. Annual Economic Indicators for the U.S.S.R. Materials Prepared for the Joint Economic Committee, 88th Cong., 2d Sess., February 1964, 218 pp.

heavily burdened railways of the country. By 1963 more than 60 percent of rail transport, in terms of ton-kilometers, was committed to the haulage of low-unit cost but nonetheless essential mineral commodities. In some distant parts of the country, such as Yakutia and in northeast Siberia, some segments of the mining industry depended heavily on air freight.

In 1962–63 the planned modification of the economic-geographical distribution patterns on the Soviet industries was continued along the following lines—

1. Alleviation of regional shortages of fuels and water required by mining-metallurgical industries, mainly in Ural, Kazakhstan, Central Asia.
2. A more economic utilization of the available transportation and distribution systems, and a significant expansion of the trunk pipeline systems for the distribution of crude oil, oil refinery products, and natural gas.
3. A more efficient use of the available production capacities in ferrous and nonferrous metallurgy.
4. A gradual migration of ferrous industry eastward including a further expansion of the "Third Metallurgical Base of the U.S.S.R."[3] (in the Kuznetsk Territory, Siberia) and the beginning of the exploitation of vanadium-bearing phosphoripherous ironstones (previously regarded as uneconomic) in the Kustanay area, Kazakhstan.
5. Increased production of phosphate fertilizers from low-grade but easily enriched concretionary ores of the Russian Platform (previously regarded as uneconomic on account of the relatively small ore reserves of individual mines and pits).
6. A further increase in the relative share of opencast mining in the production of ferrous and nonferrous ores, phosphate ores, and coal.
7. A continuing increase in the number of persons employed in the national economy (68.3 million in 1962 as against 65.9 million in 1961) and a concurrently comparable increase in the numbers of the engineering-technological personnel of the Soviet mining-metallurgical industries.

The total employment figure includes 2.29 million technologists and engineers, 1.57 million of which are employed in industries and 217,000 in construction and maintenance.

Approximately 80 percent of the industrial engineering-technological force of the country is employed in heavy industries, as follows:

[3] The other two are Krivoy Rog, Ukraine and Ural, Russia.

Industry	Persons (thousands)
Metallurgy, metal fabrication, and machine-building	729
Ferrous	92
Coal	79
Electric power	46
Petroleum	24
Other	279

The distribution of specialists with university degrees in the Soviet industries, as of December 1, 1962, was as follows, in thousand persons:

Industry	Total specialists	Including engineers	Including engineers specialized in—				
			Mining-geology	Energetics, communications, radio-technology	Metallurgy and machine-building	Chemistry	Other
Iron-steel	35.4	30.1	4.0	3.6	17.0	2.6	2.9
Coal	22.0	19.8	15.6	3.5	.1	.1	.5
Petroleum	9.6	8.1	3.6	.5	1.0	2.6	.5
Electrical energy production	16.8	14.8	.1	11.7	.9	.3	1.8
Fabrication of metals and machine-building	266.6	207.0	1.9	22.7	142.7	10.1	29.6
Construction materials	20.8	16.1	2.1	.9	2.2	3.8	7.1
Other	198.1	134.7	8.4	6.8	24.2	20.0	75.2
Total	569.3	430.6	35.7	49.7	188.1	39.5	117.6

Wholesale prices of mineral raw materials and fuels in the Soviet heavy industry, last established in 1955, were partially revised in 1961–62, concurrently with the revision of the freight rates [4] following the July 1960 Plenum resolution and 1961 CPSU (Communist Party of the Soviet Union) Program. These revisions were made with attention to changes in the production costs, wages, the profit markup, and other variables and were to be implemented in 1963.

The following comparison is reproduced from Bornstein's study [5] based on the Soviet publications:

Branch of industry	Percentage change in the average branch price level
Coal	+30
Nonferrous ores	+15
Ferrous industry	+8.5
Construction materials	+2
Oil and products	−7
Gas	−10
Machine-building	−10
Chemicals	−14 to −15
Electrical power	−15
Railway freight	−20

[4] Ekonomicheskaya Gazeta, Mar. 9, 1963, p. 33.

[5] Bornstein, Morris. The 1963 Soviet Industrial Price Revision. Center for Russian Studies, University of Michigan, Soviet Studies, Ann Arbor Mich., 1963, v. 15, No. 1, pp. 43–52.

The revision did not affect the agricultural procurement prices (machinery, fertilizers, diesel fuel for tractors) and left the wholesale prices for the output of heavy industry practically unchanged (on the whole, 3 percent below their former levels). Thus the new price structure reflects increasing costs of primary products in extractive sectors of the Soviet economy (coal, ores) and decreasing costs in its processing sectors. However, the Soviet international trade prices are not to be influenced by the wholesale price revision within the country. The same applies to the Soviet domestic retail prices, which is to be regulated by the turnover tax, as formerly.

On the whole, the new price structure may be seen as a reallocation of the economic effort, particularly in the instance of the country's nonferrous and ferrous industries and in the instance of fuels, as a flexible provision for the uses of alternatives to coal. The 20-percent reduction in railway freight rates needs to be taken in relation to the modification in the country's transport structures already discussed.

SOURCE MATERIAL

Basic information on fuels, iron and steel, cement, sulfuric acid, refractories, and a number of other miscellaneous items are obtained from the Narodnoye Khozyastvo (National Economy of the U.S.S.R.), published annually by the Central Statistical Bureau at the Council of Ministers, U.S.S.R.; the 1963 data are derived from the quarterly reports of the Central Statistical Bureau published in Izvestiya, a daily newspaper. Estimated metal production data, except iron and steel and gold, are based on the U.S. Bureau of Mines open file materials. These estimates are interpretative extrapolations from often doubtful premises and represent, at best, an order of magnitude. Data on the production and sales of gold are quoted mainly from Samuel Montague's annual bullion reviews (London) and the Union Corporation, Ltd., reports (South Africa). Data on international trade of the Soviet Union came from the Vneshnyaya Torgovlya SSSR (Foreign Trade of the U.S.S.R.), a statistical review published annually by the VNESHTORGIZDAT (Press for Foreign Trade), Moscow.

Information on significant developments in 1963 are based upon or quoted from Soviet newspapers and magazines, including the following:

Newspapers: Izvestiya, Pravda, Eknomicheskaya Gazeta, and Stroyitel naya Gazeta.

Magazines: Gornyy Zhurnal (Mining Journal), Tsvetnyye Metally (Nonferrous Metals), Voprosy Ekonomiki (Eco-

nomic Problems), Planovoye Khozyaystvo (Planned Economy), Sovetskaya Geologiya (Soviet Geology), Vneshnyaya Torgovlya (Foreign Trade), and Ugol' (Coal).

Background information on the Soviet mineral industry was derived from a number of Soviet books, monographs, and symposia.

PRODUCTION

In 1962–63, about two-thirds of the increased output of Soviet mining and metallurgical industries was attained by a more efficient use of already available capacities rather than by commissioning of new. Inadequacies in the domestic supply of copper metal, power cable, large-diameter steel pipe, and several nonmetallic minerals were compensated by imports of these commodities as in previous years.

TABLE 1.—Estimated [1] production of metals and minerals

(Metric tons except where otherwise stated)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Ores and concentrates:					
Bauxite, 26 to 52 percent alumina thousand tons	3,000	3,500	4,000	4,200	4,300
Nepheline concentrates, 25 to 30 percent alumina thousand tons	100	200	350	375	400
Alunite ores, 16 to 18 percent Al_2O_3 do					30
Metal	625,000	675,000	900,000	910,000	960,000
Antimony metal	5,500	5,700	5,700	6,000	6,100
Arsenic (white arsenic, As_2O_3)	5,000	5,500	6,000	6,500	6,500
Beryl, cobbed only, 10 to 12 percent BeO	500	650	800	900	1,000
Bismuth metal	10	20	30	30	30
Cadmium metal	1,500	1,700	2,000	2,100	2,200
Chromite ore, 30 to 55 percent Cr_2O_3	850,000	915,000	920,000	1,150,000	1,230,000
Cobalt metal	700	800	1,000	1,100	1,200
Copper:					
Metal content of ore (ore grade: 0.5 to 2.0 percent copper)	460,000	550,000	600,000	720,000	740,000
Smelter	435,000	500,000	550,000	650,000	700,000
Gold (primary and secondary) thousand troy ounces	[2]	[2]	[2]	[2]	[2]
Iron and steel:					
Iron ore, mined, 25 to 55 percent iron [3] thousand tons	123,155	142,172	162,116	186,750	207,000
Marketable iron ore, 55 to 63 percent iron (including high-grade ore and concentrates derived from lower grade ores listed above) [3] thousand tons	94,015	105,857	117,633	128,111	137,100
Pig iron [3] do	42,972	46,757	50,893	55,265	58,700
Steel:					
Ingots and equivalent primary forms [3 4] do	59,971	65,293	70,775	76,306	80,200
Semimanufactures:					
Pipe, directly from ingots [3] do	1,104	1,124	1,139	1,105	[5]
Wrought products from ingots [3] do	631	686	727	776	[5]

See footnotes at end of table.

TABLE 1.—Estimated [1] production of metals and minerals—Continued

(Metric tons except where otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals—Continued					
Iron and steel—Continued					
Steel—Continued					
Semimanufactures—Continued					
Mill products:					
Structural shapes and sections thousand tons	[3] 15,618	[3] 16,816	[3] 18,066	[3] 19,949	54,000
Sheet and plate do	[3] 12,341	[3] 14,082	[3] 16,087	[3] 17,937	
Strip and coil do	[3] 3,186	[3] 3,547	[3] 3,902	[3] 4,047	
Bars, beams and rods do	[3] 2,594	[3] 2,489	[3] 2,427	[3] 2,409	
Steel pipe stock do	[3] 2,534	[3] 2,775	[3] 2,925	[3] 3,176	
Railway materials do	[3] 2,890	[3] 3,135	[3] 3,201	[3] 3,346	
Axles and smithy stock do	[3] 365	[3] 363	[3] 381	[3] 395	
Undifferentiated [6] do	[3] 455	[3] 473	[3] 471	[3] 144	
Total do	[3] 39,983	[3] 43,680	[3] 47,460	[3] 51,403	54,000
Industrial stock for rerolling and fabrication plants [7] thousand tons	[3] 5,332	[3] 5,467	[3] 5,959	[3] 6,065	(5)
Steel pipe, total [8] do	[3] 5,216	[3] 5,805	[3] 6,357	[3] 6,878	7,500
Total semimanufactures [9] do	47,050	50,957	55,265	59,349	62,400
Lead	320,000	325,000	360,000	360,000	360,000
Magnesium	20,000	25,000	31,000	32,000	32,000
Manganese ore thousand tons	[3] 5,516	[3] 5,872	[3] 5,972	[3] 6,402	6,700
Mercury 76-pound flasks	25,000	25,000	25,000	35,000	35,000
Molybdenum	4,500	5,000	5,400	5,700	6,000
Nickel:					
Recoverable content of domestic ores	55,000	58,000	75,000	80,000	80,000
Platinum-group metals (primary and secondary) thousand troy ounces	300	330	500	800	800
Silver (primary and secondary, 99.5-99.9 percent Ag.) thousand troy ounces	25,000	25,000	25,000	27,000	27,000
Tin, smelter long tons	15,000	16,000	17,000	17,000	20,000
Titanium, primary	1,000	1,000	3,000	4,000	5,000
Tungsten ore and concentrate, 60 percent WO_3 basis	9,000	9,500	10,000	10,500	11,000
Zinc:					
Recoverable content of domestic ores	335,000	345,000	400,000	410,000	410,000
Smelter	365,000	395,000	425,000	465,000	465,000
Nonmetals:					
Asbestos	545,000	600,000	800,000	1,000,000	1,050,000
Barite	120,000	130,000	150,000	180,000	200,000
Boron minerals and compounds, B_2O_3 content	60,000	60,000	62,000	63,000	63,000
Cement [3] thousand tons	38,781	45,520	50,864	57,328	60,000
China clay do	1,000	1,100	1,300	1,400	1,500
Diamond [10] thousand carats	800	950	1,500	2,500	3,000
Diatomite	250,000	275,000	300,000	300,000	315,000
Feldspar	190,000	200,000	210,000	210,000	215,000
Fertilizers, mineral (manufactured)					
Nitrogenous	4,408	4,892	5,664	6,905	8,575
Phosphatic	4,722	4,878	5,047	5,161	5,860
Potassic	2,474	2,606	2,753	3,198	3,365
Others [6]	1,311	1,491	1,858	1,994	2,135
Total	12,915	13,867	15,322	17,258	19,935
Fluorspar	175,000	190,000	210,000	210,000	2,00015
Graphite	45,000	45,000	50,000	55,000	55,000
Gypsum, dead burned [3] thousand tons	4,433	4,622	4,456	4,376	(5)
Lime do	[3] 15,226	[3] 16,140	[3] 17,259	[3] 16,546	17,000
Magnesite do	2,300	2,400	2,500	2,500	2,700
Refractories:					
Shamot ($3Al_2O_3 \cdot 2SiO_2$) do	4,640	4,940	5,174	5,427	(5)
Dinas (quartzite-lime) do	654	665	689	685	(5)
Magnesite and chrome magnesite do	958	1,050	1,115	1,195	(5)
Magnesite powder (metallurgical) do	952	1,062	1,102	1,172	(5)
Total do	7,204	7,717	8,118	8,469	(5)

See footnotes at end of table.

TABLE 1.—Estimated [1] production of metals and minerals—Continued

(Metric tons except where otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals—Continued					
Sulfur, total [11]—thousand tons	2,150	2,400	2,600	2,700	2,850
Talc, soapstone and pyrophyllite [3]	200,000	205,000	210,000	205,000	215,000
Vermiculite	(5)	(5)	50,000	150,000	(5)
Mineral fuels:					
Coal:					
Brown [12]—thousand tons	141,386	138,261	133,516	130,976	140,000
Hard: [13]					
Coking—do	100,805	110,198	112,247	117,462	127,000
Anthracite [14]—do	79,309	78,013	77,480	76,364	263,000
Undifferentiated [6]—do	185,106	186,714	187,292	192,606	
Total—do	365,220	374,925	377,019	386,432	390,000
Crude oil [15]—do	129,557	147,859	166,068	186,244	206,000
Oil shale [16]—do	13,682	14,147	15,174	16,370	18,308
Peat—do	60,500	53,600	51,600	34,700	35,000
Natural gas [17]—million cubic feet	1,388,304	1,754,040	2,201,182	2,743,953	3,414,780
Electric power—billion kilowatt hours	[18] 265	292	328	369	412

[1] Estimated, except where noted.
[2] Total estimated at 10 to 13 million troy ounces annually, data are insufficient to estimate annual fluctuations because of variations in placer output, which apparently account for 55 to 60 percent of total output.
[3] Reported in Soviet sources.
[4] Include steel produced from scrap. Soviet sources in 1963 stated that about half of all U.S.S.R. pig iron and steel are produced from scrap. For 1960, ferrous scrap consumption was reported as 35 million tons, not including 170,000 tons exported.
[5] Data not available.
[6] By difference between reported total and listed detail.
[7] Excludes stock for export; such stocks are included under separate items under semimanufactures.
[8] Includes pipe from ingots and pipe produced from steel pipe stock (both listed above) and additional pipe produced from unspecified materials. Data is also presented in terms of length of pipe in million meters, as follows: 1959, 802; 1960, 883; 1961, 991; 1962, 1,126; 1963, 1,240 (tonnage not reported in 1963).
[9] Detail above do not add to total because some items are listed twice in detail. This total excludes all duplication.
[10] Excludes synthetic diamond, produced on an industrial scale since 1959.
[11] Includes sulfur content of pyrite.
[12] Heat value 3,500 to 7,400 kilocalories per kilogram; specific gravity 1.1 to 1.2; 67 to 68 percent carbon; 41 to 50 percent volatile substance; 10 to 25 percent water.
[13] Heat value up to 8,200 kilocalories per kilogram; 75 to 97 percent carbon; 2 to 45 percent volatile substance; 3 to 12 percent water.
[14] Heat value 8,000 to 8,200 kilocalories per kilogram; 92 to 97 percent carbon, specific gravity 1.4 to 1.8; less than 6 percent volatile substance.
[15] Reportedly 45 to 55 percent by weight consists of light products.
[16] Estonian and Leningrad shales only.
[17] Including gas produced from oil wells, of which 5.5 billion cubic meters was produced in 1959. Also includes gas manufactured from coal and shale.
[18] Includes 18 percent from hydroelectric plants and 82 percent from thermal plants.

TRADE

By 1961–62, the Soviet Union had become the world's largest exporter of manganese ore, the second largest of coal, the fourth largest of iron ore and chromium ore, the fifth largest of aluminum and rolled ferrous metals,[6] one of the three largest of precious metals, the seventh largest of crude petroleum and petroleum refinery products.

Generally, about 60 percent of the Soviet mineral trade, as a whole, remains within the SEV (Soviet Ekonomicheskoy Vzayimopomoshchi) zone, very much like mineral (and total) trade of the other SEV member countries. The SEV, established in 1949, comprises Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and Mongolia, in addition to the U.S.S.R. This intramural character of the large share of the SEV trade makes it difficult to appraise

[6] Vneshnyaya Torgovlya SSSR (Foreign Trade), November 1963, pp. 8–17.

the influence of the Soviet Union's trade on world markets aside and apart from the collective influence of the SEV community.

Excluding proceeds from the Soviet sales of precious metals outside the SEV zone, the favorable balance of the total trade of the Soviet Union in 1961 and 1962 was 154 million rubles and 526 million rubles, respectively. The favorable balance of the Soviet mineral trade only, in the same years, was 1,054 and 1,346 million rubles, respectively.

TABLE 2.—Value of metal and mineral foreign trade distributed by geographical and political areas

(Million rubles)[1]

Area	Exports		Imports	
	1961	1962	1961	1962
Europe:				
SEV nations [2]	1,273	1,484	491	491
Common market	182	202	139	183
Other	209	223	105	102
Total	1,664	1,909	735	776
Asia:				
Communist	172	138	142	124
Other	102	110	20	34
Total	274	248	162	158
Africa (total)	39	33	12	18
Oceania (other)	(3)	(3)	(3)	(3)
Western Hemisphere:				
United States	1	2	3	(3)
Cuba	96	101	(4)	(4)
Other	10	3	3	7
Total	107	106	6	7
Undistributed [5]	37	110	152	101
Grand total	2,121	2,406	1,067	1,060

[1] One ruble = US$1.11 at the official rate of exchange.
[2] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, and Rumania in Europe, and Mongolia in Asia.
[3] Less than 500,000 rubles.
[4] Data not available.
[5] Calculated; difference between reported distribution and reported total.

The relative importance of the major mineral commodity groups within the favorable balance of the Soviet mineral trade may be illustrated by the following comparisons:

Commodity group	Percent of favorable balance	
	1961	1962
Crude petroleum and refinery products	52	50
Iron, manganese, chromium ores	19	18
Coal, coke, anthracite	17	18
Mineral fertilizers and nonmetals	8	8
Others	4	6

The ruble value of the Soviet net exports of crude petroleum and refinery products was about 571 million and 637 million rubles in 1961 and 1962, respectively (higher than the entire total all-trade favorable balance in both instances).

The Soviet Union, the world's second largest producer of crude petroleum and refinery products, was responsible only for 5 percent of the world's international trade in these commodities.[7] The Soviet net exports of petroleum crudes and products were small, by world standards, and smaller still, if the net exports to the SEV countries are excluded.[8]

Geographically, the Soviet crude oil and refinery products trade has been significantly oriented toward Europe. Moreover, this commodity group accounted for 65 percent of the Soviet mineral exports to Western Europe outside the SEV zone, both in 1961 and in 1962.

The relative dependence of various countries on crude oil and refinery product imports from the Soviet Union ranges widely as shown in the following tabulation.[9]

Country	Net imports of crude oil and refinery products in 1962	
	Thousand metric tons	Percent of net imports from the U.S.S.R.
Iceland	320	97
Finland	3,260	90
Greece	1,860	45
Austria	1,450	28
Italy	33,930	21
Sweden	14,480	18
West Germany	41,840	7
Norway	3,960	5
Belgium	8,690	4
Denmark	6,720	3
France	33,720	2
United Kingdom	58,180	.3
Ceylon	1,100	16
Japan	40,000	7
India	9,300	5
Africa, total	23,000	8

[7] Vneshnyaya Torgovlya (Foreign Trade), March 1964, p. 16.
[8] The Soviet exports of crudes and products cover 97 percent of the SEV zone's needs for crudes and 60 percent for refinery products.
[9] Vneshnyaya Torgovlya (Foreign Trade), March 1964, p. 16.

TABLE 3.—Value of metal and mineral trade distributed by major commodity groups

(Million rubles)

Commodity group	Exports		Imports	
	1961	1962	1961	1962
Metals:				
Ore and concentrate	227	246	264	270
Iron, ferroalloys, steel and steel mill products	640	713	364	384
Other	194	205	197	188
Total	1,061	1,164	825	842
Nonmetals:				
Construction materials	11	13	23	22
Mineral fertilizers	72	149	1	
Other	36	36	16	13
Total	119	198	40	35
Mineral fuels:				
Coal and coke	256	312	84	86
Petroleum:				
Crude	289	331	15	8
Refinery products	393	398	96	84
Natural gas and carbon black	3	3	7	5
Total	941	1,044	202	183
Grand total	2,121	2,406	1,067	1,060

Soviet trade statistics displayed the following consistent trends during 1958–62: (1) Decreasing imports of fuels and raw materials, including mineral raw materials; (2) increasing imports of rolled and semifabricated steel, mainly from Japan, Austria, West Germany, Italy, United Kingdom, Rumania, and Czechoslovakia; (3) heavy imports of large-diameter steel pipe, reaching a peak in 1962; (4) increasing trade in machinery, equipment, semifabricates, and finished products; (5) and increasing exports of all basic raw materials, with the exception of lead, zinc, tin and nonferrous alloys.

TABLE 4.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962	Value (thousand rubles) 1961	1962
Metals:					
Aluminum:					
Ingots and equivalent primary forms.	86,000	115,700	East Germany 41,600; United Kingdom 11,900; Czechoslovakia 11,500; Rumania 9,900; Belgium 9,800.	40,070	51,835
Semimanufactures, including those of duralumin.	13,500	21,400	East Germany 5,700; Cuba 4,900 Poland 2,100; Bulgaria 1,600; Czechoslovakia 1,600.	12,265	18,025
Antimony, primary forms	3,500	3,900	Netherlands 1,100; Belgium 500. (Unspecified 1,700.)	1,451	1,593
Cadmium, primary forms	1,100	1,100	Czechoslovakia 200; West Germany 200; Netherlands 200.	2,994	3,442
Chromium ores (48 to 56 percent Cr_2O_3, Cr to Fe ratio at least 3 : 1).	438,000	472,000	Japan 80,000; United States 69,000; Czechoslovakia 66,000; France 66,000; Sweden 53,000; West Germany 50,000; Poland 40,000.	12,324	11,914
Cobalt, primary forms	300	200	None specified	1,210	753
Copper:					
Ingots and equivalent primary forms:					
Unalloyed	60,400	71,300	East Germany 30,600; Czechoslovakia 19,400; Hungary 8,400; Poland 6,700.	34,482	40,958
Alloyed (bronze) [1]	2,300	2,300	East Germany 2,200	1,024	998
Semimanufactures:					
Unalloyed	7,300	5,500	Cuba 2,500; Rumania 1,000; Czechoslovakia 600.	6,188	5,223
Alloyed (copper-zinc) [2]	6,300	6,500	Rumania 1,900; Bulgaria 1,000; Cuba 800. (Unspecified 2,500.)	5,459	5,821
Iron and steel:					
Iron ore thousand tons	16,283	18,935	Poland 6,432; Czechoslovakia 5,988; East Germany 2,521; Hungary 1,999; Rumania 1,386.	169,035	194,134
Pig iron do	1,814	2,274	East Germany 624; West Germany 373; Japan 263; Italy 201; Czechoslovakia 185; Bulgaria 114.	92,361	112,933
Ferrous scrap do	223	225	Finland; 125; East Germany 99	8,438	7,743
Ferroalloys:					
Ferrosilicon	56,800	54,200	Rumania 30,700; Czechoslovakia 24,800; Other SEV countries 24,300; West Germany 13,600; Other Common Market countries 5,900; United Kingdom 12,400; Other Europe 18,800. (Unspecified 16,900.)	4,757	4,793
Ferromanganese	51,600	55,700		9,131	10,023
Ferrochromium	21,700	16,000		7,098	5,111
Ferromolybdenum	4,500	7,500		8,611	4,797
Not specified [3]	20,800	14,000		9,603	10,111
Total	155,400	147,400		39,200	34,835
Semimanufactures:					
Bars and rods thousand tons	1,138	1,238		135,576	145,112
Plates and sheets:					
Uncoated do	955	1,220		142,049	173,425
Tinplate and other coated do	94	106	East Germany 1,450; Rumania 724; Bulgaria 211; Cuba 186; Finland 161; India 148; Czechoslovakia 96; mainland China 73.	19,656	21,860
Wire, including nails do	33	32		6,400	6,087
Steel cable do	(4)	(4)		4,234	3,219
Railway track materials do	348	501		49,417	69,049
Custom special steel do	17	17		24,857	22,682
Steel pipe do	231	248	East Germany 120; Rumania 31; mainland China 27; Bulgaria 19; Cuba 15.	52,313	54,684
Total, classified semimanufactures do	2,816	3,362		434,502	496,118

See footnotes at end of table.

TABLE 4.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962	Value (thousand rubles) 1961	1962
Metals—Continued					
Iron and steel—Continued					
Semimanufactures—Con.					
Unidentified semimanufactures: [3]					
Value thousand and tonnage reported.	582	596	(5)	63,186	56,741
Value thousand only reported.	(5)	(5)	(5)	1,780	4,668
Total thousand semimanufactures. [6]	3,398	3,958	(5)	499,468	557,527
Unidentified thousand tons iron and steel. [3]	(4)	(4)	(5)	38	9
Total [6] do	(5)	(5)	(5)	808,540	907,181
Lead, ingots, and equivalent primary forms.	102,300	94,400	East Germany 29,700; Czechoslovakia 18,200; Finland 14,000; Hungary 8,500; United Kingdom 7,100.	20,575	19,012
Magnesium, primary forms	1,800	1,600	(5)	1,264	1,329
Manganese:					
Metallurgical grade ore	896,000	963,000	Poland 236,000; East Germany 216,000; Czechoslovakia 107,000; France 99,000; United Kingdom 99,000; Japan 74,000; West Germany 66,000.	30,368	29,993
Battery and chemical ore	9,200	11,500		847	853
Mercury 76-pound flasks	17,400	17,400	United Kingdom 1,247; Hungary 1,479; Netherlands 145. (Unspecified 14,533.)	3,294	3,502
Molybdenum, concentrate [7]	1,000	100	All to United Kingdom	1,207	88
Tin, primary forms long tons	5,600	490	(5)	11,008	972
Tungsten, concentrates [7]	4,800	4,200	West Germany 2,000; Austria 1,100; United Kingdom 600; France 200.	4,295	2,431
Zinc:					
Concentrate [7]	39,200	19,400	All to Poland	1,585	821
Ingot and equivalent primary forms.	116,200	108,000	Netherlands 27,700; East Germany 25,900; Czechoslovakia 10,600; United Kingdom 8,100; India 8,000; Belgium 7,900.	23,553	19,692
Unidentified nonferrous metals:					
Ingots and equivalent primary forms. [8]	25,900	11,500	(5)	17,061	14,956
Semimanufactures:					
Cable and conductance wire.	(4)	(4)	Rumania 3,730,000 rubles; North Korea 2,361,000 rubles; Bulgaria 1,728,000 rubles.	9,256	11,990
Bimetal plates [9]	1,600	2,900	(5)	769	1,348
Other	2,000	2,100	(5)	3,947	3,398
Unidentified metallic ores and concentrates.	(4)	(4)	(5)	14,761	10,368
Nonmetals:					
Abrasives:					
Hard alloys [10]	145	147	Rumania 76; Bulgaria 18; West Germany 6.	4,003	3,709
Other	(4)	(4)	(5)	624	524
Asbestos	158,600	176,800	West Germany 27,500; France 25,500; East Germany 14,000; Czecholslovakia 12,700; Bulgaria 12,000; Poland 11,300; Hungary 10,100; Japan 8,800.	22,124	23,766
Cement	408,000	540,000	Cuba 107,000; Ghana 87,000; Guinea 83,000; Indonesia 35,000.	3,649	4,990
Cryolite	3,200	2,800	Hungary 1,000; Rumania 200. (Unspecified 1,600.)	606	505

See footnotes at end of table.

TABLE 4.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962	Value (thousand rubles) 1961	1962
Nonmetals—Continued					
Fertilizers and fertilizer raw material minerals:					
Apatite ore	166,800	142,900	West Germany 67,800; Czechoslovakia 48,900; East Germany 26,000.	1,149	914
Apatite thousand tons concentrate, 84 to 86 percent $Ca_3P_2O_8$.	2,053	2,242	East Germany 594; Poland 313; West Germany 273; Czechoslovakia 226; Hungary 178.	32,817	35,599
Superphosphate, not less than 18.7 percent P_2O_5.	340,000	322,000	Cuba 104,400; Hungary 86,300; East Germany 72,600.	6,455	6,452
Ammonium nitrate	129,000	77,000	Cuba 33,600; Bulgaria 16,600; Afghanistan 10,300.	8,043	4,951
Ammonium sulfate	270,000	404,000	Cuba 208,000; North Vietnam 39,300. (Unspecified 142,400.)	7,794	11,343
Potassium salts, KCl, 58 to 62 percent K_2O equivalent.	762,000	878,000	Japan 286,000; Yugoslavia 118,400; Finland 80,500; Cuba 65,500.	15,385	18,457
Fluorspar [7]	8,400	5,000	All to Japan	(4)	(4)
Graphite	4,500	5,200	East Germany 1,700; Hungary 1,100; Poland 900; Bulgaria 700.	434	467
Gypsum	18,000	20,000	Finland 19,600	71	80
Kaolin	5,000	400	None specified	124	12
Mica	(5)			11	
Pyrite	663,000	781,000	Italy 236,000; East Germany 190,000. (Unspecified 355,000.)		
Refractories:					
Clay	2,600	2,800	Hungary 600. (Unspecified 2,200.)	33	34
Magnesite powder	8,700	13,400	Rumania 6,000; Bulgaria 5,200; Japan 2,200.	445	680
Other	81,000	74,000	Bulgaria 25,100; India 19,400; Rumania 11,500; Cuba 10,600.	7,020	6,851
Salt	115,000	134,000	(5)	636	741
Sulfur	218,100	169,100	Cuba 64,700; Netherlands 36,900; Hungary 26,100; Czechoslovakia 18,800.	5,200	4,118
Sulfuric acid	52,500	57,600	Czechoslovakia 31,700; Hungary 18,800.	1,567	1,723
Talc [7]	10,700	10,000	All to Japan	(5)	(5)
Other [3]	(4)	(4)	(4)	327	336
Mineral fuels:					
Coal:					
Anthracite thousand tons	2,207	3,265	France 949; East Germany 892; Italy 315; Finland 262; Czechoslovakia 208; Belgium 181.	34,448	50,137
Bituminous do	12,910	[11]15,893	East Germany 5,893; Czechoslovakia 2,494; Japan 1,063; Poland 991; Bulgaria 932; Yugoslavia 888; Austria 830.	157,469	189,059
Other [3] do		192			2,443
Total do	15,117	19,350		191,917	241,639
Coke do	3,016	3,322	East Germany 1,378; Hungary 523; Rumania 431; Finland 207; Denmark 194; Egypt 167.	64,485	70,121
Petroleum:					
Crude oil do	23,388	26,279	Italy 6,083; Czechoslovakia 3,673; Cuba 3,629; East Germany 2,437; Japan 2,136; West Germany 1,915.	289,389	331,253
Petroleum refinery products:					
Gasoline thousand tons	3,589	3,155	Mainland China 765; Poland 709; Bulgaria 386; East Germany 197; Cuba 186; North Korea 180.	120,282	102,528
Kerosine do	1,076	1,295	Mainland China 488; Czechoslovakia 224; India 230; Egypt 128.	31,684	36,535

See footnotes at end of table.

TABLE 4.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962	Value (thousand rubles)	
				1961	1962
Mineral fuels—Continued					
Petroleum—Continued					
Petroleum refinery products—Continued					
Gas/ diesel oil. thousand tons	5,698	6,387	Finland 1,036; West Germany 891; Poland 780; Bulgaria 446; mainland China 378; Japan 344.	131,675	141,685
Residual fuel oil.[12] do	6,857	7,737	Sweden 2,302; Italy 1,290; Finland 731; Bulgaria 653; Japan 499; Cuba 425; Poland 357.	63,592	71,461
Lubricants do	423	439	Mainland China 213; North Korea 49; Cuba 46; Bulgaria 38; United Kingdom 30.	35,052	36,153
Bitumen do	75	22	Bulgaria 16; Afghanistan 3	2,681	717
Paraffin do	24	30	Poland 10; mainland China 3; Bulgaria 2; Czechoslovakia 2; United Kingdom 2. (Unspecified 5.)	3,197	4,050
Unidentified[3] do	88	39		4,473	4,642
Total	17,830	19,104		392,636	397,771
Natural gas. million cubic feet	10,140	11,207	(5)	1,871	2,064
Carbon black	4,800	5,600	Czechoslovakia 1,800; Bulgaria 1,000. (Unspecified 2,800.)	691	850

[1] Reported as "metal"; defined as "copper base, zinc-free alloy"—bronze.
[2] Reported as "latten"; defined as copper-zinc alloys.
[3] Calculated, by difference between various reported totals and sum of listed detail under these totals.
[4] Value only reported.
[5] Not reported, and not reliably determinable.
[6] Total of listed detail only; no estimates included for unreported quantities.
[7] Total not reported; detail given are derived from listings of trade with individual countries and may represent only part of total.
[8] Partly reported as such and partly calculated, by difference between reported total and sum of listed detail.
[9] Firmly welded deformable plates of two metals such as copper-aluminum, nickel-steel, or lead-tin.
[10] Carbide base alloys of high-temperature metals.
[11] Reported total is 15,893 thousand tons, but detail by country adds to 15,911 thousand tons.
[12] Officially reported as "mazut"; a term applied to residual products of oil refining which are suited for cracking column feed for production of fuel oils, lubricants, and paraffins. Category presumably includes material which may be used directly as fuel oil.

TABLE 5.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962	Value (thousand rubles) 1961	Value (thousand rubles) 1962
Metals:					
Aluminum:					
Bauxite	[1]455,000	[1]308,300	All from Greece	[1] 2,215	[1] 1,670
Ingots and equivalent primary forms.	1,000			480	
Semimanufactures, including those of duralumin.	4,200	3,800	None specified	2,670	2,162
Cadmium, primary forms	330	330	Poland 280	1,104	1,095
Copper: Ingots and equivalent primary forms, unalloyed.	82,200	106,400	West Germany 34,700; Federation of Rhodesia and Nyasaland 20,200; United Kingdom 12,800; Sweden 12,200; Peru 8,900.	47,669	61,831
Iron and steel:					
Pig iron—thousand tons	134	141	Mainland China 94. (Unspecified 47.)	8,534	8,961
Ferroalloys—do	16	12	North Korea 2. (Unspecified 10.)	7,038	5,369
Semimanufactures:					
Bars thousand tons and rods.	215	531	Japan 188; Rumania 124; Austria 110; Czechoslovakia 87; West Germany 86; Italy 74; Netherlands 66; United Kingdom 56. (Unspecified 111.).	32,310	60,622
Plates and sheets uncoated. do	185	211		25,410	22,007
Steel cable do	13	6		3,853	1,838
Custom and special steel. do	287	251		44,842	53,109
Steel pipe do	631	962	West Germany 377; Rumania 200; Czechoslovakia 140; Italy 124; Poland 46.	189,967	187,981
Total classified semimanufactures. do	1,331	1,961		296,382	325,557
Unidentified semimanufactures.[2] do			(3)		
Value and tonnage reported. do	259	91	(3)	45,753	42,300
Value only reported. do	(3)	(3)	(3)	3,233	1,994
Total semimanufactures.[4] do	1,590	2,052	(3)	345,368	369,851
Unidentified iron and steel. do	(5)	(5)	(3)	2,581	369
Total [6] do	(3)	(3)	(3)	347,949	370,220
Lead:					
Ore	[1] 33,900	[1] 24,900	Iran 21,200; North Korea 3,700	[1] 2,350	[1] 1,871
Concentrate	[1] 4,200	(3)	All from mainland China	[1] 405	[1] 9
Ingots and equivalent primary forms.	39,500	26,100	North Korea 18,900; Bulgaria 2,000; Yugoslavia 2,000.	10,019	6,568
Nickel	[1] 5,900			(1)	
Tin, primary forms long tons	11,000	9,700	Mainland China 8,600; North Viet Nam 100.	[1] 20,241	18,419
Tungsten, concentrates	[1] 18,300	[1] 13,000	All from mainland China	[1] 32,370	[1] 22,494
Zinc:					
Ore	[1] 4,000	[1] 3,000	All from Iran	[1] 156	[1] 115
Concentrates	[1] 75,500	[1] 42,200	All from North Korea	[1] 4,459	[1] 2,190
Dust	[1] 1,400	[1] 1,500	All from Poland	[1] 296	[1] 314
Ingots and equivalent primary forms.	70,400	51,600	Poland 26,400; North Korea 24,200.	14,947	11,213
Semimanufactures	4,000	4,200	All from Poland	1,225	1,266

See footnotes at end of table.

TABLE 5.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962	Value (thousand rubles)	
				1961	1962
Metals—Continued					
Other nonferrous metals:					
Ingots and equivalent primary forms.	20,600	8,600	(3)	24,460	13,437
Semimanufactures:					
Cable and conductance wire.	(3)	(3)	East Germany 19,340,000 rubles; Czechoslovakia 15,044,000 rubles; Finland 7,520,000 rubles; Yugoslavia 7,426,000 rubles; Austria 5,245,000 rubles.	66,792	66,314
Other	7,200	5,500	(3)	7,138	4,957
Other metallic ores and concentrates.	(3)	(3)	Czechoslovakia 91,894 rubles; Bulgaria 22,335 rubles; unspecified 116,004 rubles.	222,533	241,379
Nonmetals:					
Abrasives, otherwise rubles unspecified.	(3)	(3)	East Germany 1,100,000; Czechoslovakia 548,000. (Unspecified 750.)	1,893	2,398
Barite	71,100	80,800	North Korea 57,900; Bulgaria 21,500.	1,710	1,871
Borax	[1] 14,400	[1] 6,400	All from mainland China	[1] 3,241	[1] 1,449
Cement thousand tons	1,740	1,575	Mainland China 689; Rumania 555; North Korea 161; Poland 100.	20,682	18,458
Diamond	(3)			1,947	
Fertilizers and fertilizer raw material minerals, ammonium sulfate.	[1] 15,000			[1] 656	
Fluorspar	76,000	80,200	Mainland China 42,700; Mongolia 37,500.	1,877	1,971
Mica	640	330	All from India	1,631	1,514
Quartz	[1] 500			[1] 744	
Refractories, magnesite powder.	56,000	70,300	North Korea 67,300. (Unspecified 3,000.)	2,817	3,358
Sulfur	44,500	32,100	Mainland China 20,100. (Unspecified 12,000).	1,604	1,082
Talc	50,400	74,800	Mainland China 57,700; North Korea 11,900.	1,153	1,671
Other	(3)	(3)	(3)	358	608
Mineral fuels:					
Coal, bituminous. thousand tons	4,733	4,887	Poland 4,686; mainland China 201.	68,805	71,266
Coke do	648	607	All from Poland	15,451	14,472
Petroleum:					
Crude do	888	496	All from Austria	14,643	8,367
Refinery products:					
Gasoline do	1,780	1,581	Rumania 1,327	58,431	52,140
Kerosine do	273	244	Rumania 243	8,388	7,479
Gas/diesel oil do	266	227	Rumania 200	7,583	6,461
Residual fuel oil do	48	44	All from Rumania	722	659
Lubricants do	146	117	Rumania 102; Hungary 13	9,654	8,698
Bitumen do	180	63	Rumania 62	5,177	1,453
Paraffin do	39	34	Rumania 12. (Unspecified 22.)	5,539	4,746
Unidentified do	4	6	(3)	902	2,724
Total do	2,736	2,316		96,396	84,360
Carbon black	37,700	25,500		7,199	5,069

[1] No total officially reported; data given are totals of detail reported for separate countries, and may be incomplete.
[2] Calculated, by difference between various reported totals and sum of listed detail under these totals.
[3] Not reported, and not reliably determinable.
[4] Total of listed detail only, no estimates included for unreported quantities.
[5] Value only reported.
[6] Total not reported; detail given are derived from listings of trade with individual countries and may represent only part of total.

TABLE 6.—Distribution of iron mines by mining method and size in 1961

Size group, by yearly capacity (thousand metric tons)	Number of open pits	Number of subsurface mines	Output of mined ore, annually	
			From open pits (thousand metric tons)	From subsurface mines (thousand metric tons)
Up to 200	20	22	1,861	1,335
201 to 500	18	14	5,589	4,693
501 to 1,000	9	7	5,900	4,925
1,001 to 2,000	3	7	4,253	10,907
2,001 to 4,000	8	10	21,164	25,868
4,001 to 10,000	4	2	24,991	10,557
10,001 to 19,000	2		35,403	
Total	64	62	99,161	58,285

COMMODITY REVIEW

METALS

Iron Ore.—By the beginning of 1963, the Soviet iron ore industry operated 62 subsurface mines and 64 open pits. Of these, 12 mines and 13 pits, with the combined total capacity of 70 million tons of mined ore, were commissioned in 1959–61. More than 10 percent of the 1962 total output of mined ore is credited to these newly commissioned enterprises.

In 1963, 66 percent of mined iron ore (and 43 percent of mined manganese ore) were produced from open pits.

The mean grade of iron ores mined in the Soviet Union declined from more than 45 percent iron in 1959 to about 43 percent iron in 1962; the regional mean grade of the ore, from 25 percent iron (Ural) to 51 percent iron (the Kursk Magnetic Anomaly) remained essentially the same during that period.

The share of total iron ore output supplied by subsurface mines declined from more than 46 percent in 1959 to 35 percent in 1962. According to the national plan, 70 percent of mined ore will be obtained from open pits by the end of 1965.

Production of commercial ore, including iron ore concentrates containing about 60 percent iron and subordinate quantities of 56 to 60 percent iron run-of-mine ores, increased from 94 million tons in 1959 to 128 million tons in 1962 and to 137 million tons in 1963.

Production costs of commercial ore, expressed in kopeks per ton-percent iron (1 kopek=US$0.011), varied from 10.0 (Transcaucasia) to 4.5 (The Kursk Magnetic Anomaly), compared with the national average of 5.8 in 1962.[10]

As of January 1, 1962, the proved reserve of economic iron ores was 46 billion tons compared with 43 billion tons at the end of 1959. The increase of 3 billion tons was obtained by upgrading the reliability rating of some of the known but insufficiently explored bodies of economic iron ores. However, the economic reserve of high-grade ores that require no enrichment (56 percent iron, on the average) declined

[10] Skobwikov, M. L. Gornyyi Zhurnal (Mining Journal), 1962, No. 8, pp. 3–6.

from 9.8 billion tons in 1960 to 9.0 billion tons in 1962, possibly as the result of a reappraisal of geographical and mining environments.

There was no reported change in the total reserve of economic iron ores, as of 1959: 93 billion tons averaging 39.8 percent iron. On the average, 74 percent of the total ore reserve is suited for open pit mining. Of the total open pit ore, the largest part consists of easily upgraded magnetite taconites and others, with a mean iron content of 34 percent; about one-third is hematite martites and other technologically difficult ores, and less than 4 percent are high-grade ores (56 percent iron) requiring no enrichment.

Of the subsurface reserve, a little more than 10 billion tons containing 45 percent iron, consists entirely of high-grade and of easily upgraded ores.

The U.S.S.R.'s total reserve of proved minable economic iron ore, 46 billion tons, is equivalent to 24 billion tons of commercial ore, calculated as 60 percent iron concentrate. The ultimate possible production peak is estimated at 479 million tons of commercial ore annually.

Geographical distribution of the iron ore reserve and of mining and milling productive capacities has been changing progressively since 1959.

TABLE 7.—Distribution of iron ore reserve and production of commercial ore by region or basin

(Percent)

Region or basin [1]	Mean grade of reserve (percent iron)	Share the U.S.S.R. total				
		Reserve	Production of commercial ore			
			1959	1960	1961	1962
Ural-Kazakhstan [2]	33	32	33	31	29	29
European Center (Kursk Magnetic Anomaly)	51	25	2	4	5	6
Dnepr-Donets (Krivoy Rog)	44	24	53	52	53	52
East-Siberia	39	9	1	2	2	2
Northwest (Kola-Karelia)	32	4	2	2	2	3
European South (Kerch)	37	3	4	4	4	3
West-Siberia	39	2	4	4	4	4
Transcaucasia (Dashkesan)	40	Small	1	1	1	1
Far East	39	1	Small	Small	Small	Small

[1] Districts within the region accounting for more than nine-tenths of the region's production are named in parentheses, except as noted.

[2] Including the ore base (the Kustanay District) and the output of the Sokolov-Sarbay Kombinat, Western Kazakhstan, and the ore base but not the output of the Karaganda District, Central Kazakhstan; the mining-milling developments in Karaganda began on an appreciable scale only in 1963–64. The Kachkanar pits, eventually the largest mines of the region, yielded their first ore only in 1962.

The continuing shift in the geography of mining and milling in 1963–64 may have already increased significantly the role of Ural and Western Kazakhstan in the Soviet iron ore industry.

It is possible that the planned increase in the production of commercial iron ore, from 137 million tons in 1963 to 142 million tons in 1964 and 154 million tons in 1965, may be accomplished primarily by increasing the output of the Ural-West Kazakhstan's mining and milling operations. The Kachkanar alone was expected to yield 3 million tons of commercial ore in 1963.

Iron and Steel.—In 1963 the iron and steel industry made a number of additions to and improvements in facilities. Newly commissioned capacities included two blast furnaces, six Martin (open-hearth) furnaces, and five electrical furnaces for steel.

The number of blast furnaces using natural gas was increased to 69 (out of the estimated total of 95). Combined output of pig iron from natural gas-fueled furnaces represented about 60 percent of the country's total output of pig iron. The number of blast furnaces operating at high-gas pressures up to 0.7 atmospheres and experimentally as high as 1.8 atmospheres over the charge at the end of 1963 was 91, corresponding to 88 percent of the country's total blast-furnace capacity. The number of Martin (open-hearth) furnaces using oxygen blast was increased to 83, compared with 80 in 1962; their combined total output of steel was 20 million tons (17.9 million tons in 1962). A high-capacity oxygen converter installation at the Nizhniy Tagil' Kombinat [11] produced its first steel. Three new plants for the production of large-diameter (1,020 millimeters) steel pipe, 5 oxygen installations, and 13 agglomeration systems went into operation.

In 1963, compared with production in 1962, the country produced 3.5 million tons more pig iron, 3.8 million tons more steel, 2.8 million tons more rolled ferrous metals, and 660,000 tons more steel pipe.

Additional planned capacities under 1964–65 targets were to include 4 blast furnaces, 9 open-hearth furnaces, 6 oxygen blast converters, 12 installations for continuous casting of steel, 12 steel-rolling installations, 6 steel pipe factories, 18 iron ore and manganese ore mining enterprises, 13 agglomeration belts, 2 agglomeration plants, and additional facilities for production of ferroalloys and of sulfuric acid.

However, the planned production increase in 1964–65 will be attained mainly by a better use of already available capacities. The indicated production targets are as follows:

Commodity	Target (million tons)	
	1964	1965
Pig iron:		
From oxygen furnaces using natural gas	6.0	10.0
Other	55.5	55.7
Total	61.5	65.7
Steel:		
Oxygen converter	4.2	5.1
Oxygen blast Martin furnace	29.5	35.8
Cast by continuous process	1.1	1.3
Iron ore concentrates containing 65 percent iron or more	14.5	26.7

The 1965 production goal for steel has been given as 84 million tons,[12] compared with a 97 million ton goal set previously.

[11] Construction was begun in 1962. The Kombinat is based on vanadiferous iron ores of Kachkanar and is scheduled to yield nine-tenths of the Ural's regional output of iron by 1965. The estimated capacity output of the Kachkanar pits and mines may be about 40 million tons of low grade magnetite mined ore.

[12] M. A. Pertsev and S. M. Filippov. Razvitiye Chernoy Metallurgiy 1963 godu i Yeyo Osnovniye Zadachi Na 1964–65 Gode. The Development of Ferrous Metallurgy in 1963 and the Basic Program for 1964 and 1965. Metallurg, v. 9, January 1964, pp. 1–3.

The more recently planned modification of the steel production structure involves, among other things, introduction of the Thomas process for beneficiation of the large reserve of phosphoriferous ironstones of the large and easily accessible Ayat-Lisakovka ore deposits, Western Kazakhstan, as well as for similar ores of the Kerch Peninsula, on the Black Sea, none of which has been mined so far on any appreciable scale. It also involves a general increase in Martin furnace capacity of the country (the yield of steel per square meter furnace floor per 24 hours is expected to reach 8.50 tons in 1965, compared with 8.04 tons in 1963, 8.02 tons in 1962, 7.92 tons in 1961, 7.69 tons in 1960, 7.48 tons in 1959) and a wide use of electrical furnaces and oxygen converters.

The widespread utilization of ferrous scrap made possible the production of almost 40 percent more steel than pig iron, as in 1959 and 1960. On the whole, about 48 percent of ferrous scrap available to the steel industry was steel plant scrap, about 22 percent was scrap from metal fabrication plants, and the remainder was old scrap.

Regional shortages of iron and steel in Siberia and the Soviet Far East continued through 1963 and were expected to continue beyond 1965. This regional shortage will be relieved only by the commissioning of the following enterprises, still under construction: Tayshet, in Irkutsk territory, which is to be based on Korshunikha and Rudnogorsk iron ores and on Kuznetsk coal supplemented by local coal; Nerchinsk, in Zabaykal'ye, which is to be based on the ores and coal of South Yakutia; and Svobodnyy, which is to be based on the Garino and Kimkan ores and South Yakutian coal.

Nonferrous and Rare Metals.—The 1963 production quotas for traditional nonferrous metals and the so-called rare metals (including beryllium, cobalt, columbium, molybdenum, rare earths, tantalum, tin, tungsten, and possible silver) were, on the whole, fulfilled, according to Soviet reports. The total value of output of these metals was reported to have risen by 59 percent during the first 5 years of the 1959–65 plan, compared with the planned increase of 51 percent.

However accession of additional reserves of copper, lead, zinc, and tin lagged seriously behind the planned annual quotas as did the development of known resources of these minerals. The construction progress of the Kirovobad and Pavlodar alumina plants, the Krasnoyarsk aluminum refinery, the Almalyk copper smelter and refinery, the Leninogorsk zinc plant, the Ust'-Kamenogorsk titanium-magnesium plant, and the Zhdanov ore-dressing kombinat was behind schedule. These plants were scheduled or rescheduled for completion during 1964–65, the last 2 years of the current 7-year plan. Other nonferrous and rare metal plants reportedly falling behind their construction schedules included the Berezniki titanium-magnesium plant, the Tyrny-Auz tungsten-molybdenum kombinat, the Mtsensk facilities for secondary metals, and the copper ore-dressing and flotation facilities at Uchaly, Sibay, and Gay.

The new Pikalëvo alumina plant reached its full capacity only after long delay. Modernization of the tungsten-molybdenum hydrometallurgical plant in North Caucasus failed to develop as planned. In the milling of copper, the long established but recently modernized

Agarak kombinat in Armenia failed to meet its production quota, and there were indications that the Almalyk plant in Uzbekistan was not functioning efficiently. The newly organized lead facilities at the Elecktrotsink zinc plant, believed to be in Ukraine, ran into difficulties immediately after commissioning.

Technologically, excessive losses of metals continued in slags, tailings, dusts, and gases. Mechanization of mining operations, especially in the lead and zinc industry, remained unsatisfactory.

On the other hand, in 1963 the lag in completion of new mineral production capacities was offset, to some extent, by more efficient use of existing facilities. The preparation of opencast and underground mines for ore production proceeded at a pace reportedly more than satisfactory, although results might not become apparent until 1964. Meanwhile, the use of progressively greater quantities of scrap (particularly aluminum and copper) and increased production of copper ores and of nepheline concentrates as a source of alumina compensated, to some extent, production deficiencies elsewhere. The regional fuels shortage in the Urals, one of the limiting factors in the expansion of the nonferrous industry in that area, began to be alleviated at the end of 1963 when the Bukhara-Ural gasline was opened for operation. Industrial research was sufficiently advanced to introduce 130,000-ampere and larger electrolysers into the aluminum refining industry on a large scale and to expand the production of secondary aluminum in vacuum-distillation furnaces. The newly introduced electrolytic batteries in aluminum, copper, zinc, and magnesium industries were equipped with silicon semiconductor rectifiers, assuring a more efficient use of the current and a greater uniformity of the production processes. The continuous refining of lead, the carbonyl process for nickel, and the electrothermal production of silumine were ready for assimilation by the industry.

Aluminum.—With operations presumably started in early 1963, the Zaglik alunite mine in Azerbaydzhan was reported at the beginning of May to have produced its first 100,000 tons of alunite. The Sumgayit alumina plant was designed and constructed to operate on the Zaglik ores. Every 6.6 tons of alunite yield 1 ton of alumina as well as 0.5 ton of potassium sulfate and 1.15 tons of sulfuric acid. The production of alumina from Siberian nepheline syenites was deemed impractical, especially since there were definite indications of bauxite ores in Central Siberia.

In the metal sector, the Kirovobad refinery, 8 years in construction, was reported in early 1963 to be finally going on stream sometime during the year. Output of the Irkutsk refinery increased in 1963, the 2d year of its operation.

Bismuth.—As in 1962, bismuth was produced in 1963 almost entirely from complex ores, such as the tungsten-molybdenum-bismuth ores of North Caucasus, by wet metallurgy involving flotation, leaching with strong mineral acids, and subsequent precipitation or by cementation of the bismuth on iron. Bismuth of 99.9 percent purity was produced by fire refining. Scheelite and cassiterite ores of Kazakhstan and Siberia are also processed for bismuth; in these ores, the metal ranks as a coproduct of tungsten and tin.

Copper.—The Soviet domestic supply of copper in 1963 was augmented by large imports of metal from abroad, and requirements were reduced by increasingly greater use of substitutes. Domestic mine output was increased at several locations in Kazakhstan (Balkhash, Dzhezkazgan, and Boshchekul'), Ural (Gay and Uchaly), Armenia, and Siberia. The regional shortage of water in Central Kazakhstan, one of the limiting factors for the full-scale exploitation of the Dzhezgazgan copper deposits, will be alleviated by a canal under construction to bring water from the Irtysh River, some 500 kilometers east of the area. Dzhezgazgan reportedly is the largest single reserve of copper in the country and is one of the world's largest deposits of cupriferous sandstone.

Precious Metals.—Several new and efficient processes for the recovery of gold, silver, and the six platinoids from anode slimes and from low-grade materials were reported in 1963 Soviet publications. These new processes, reported as having been "patented", involve ionic exchange, chelation, liquid-liquid extraction, and other hydrometallurgical concepts. The byproduct or coproduct precious metals extracted from polymetallic ores and residues are becoming increasingly more important in the Soviet mineral economy.

Titanium.—The Soviet titanium industry has been the second largest in the world since 1958, after that of the United States. Large deposits containing ilmenite with zircon and rutile were discovered in Ukraine and Siberia in 1955. A new process of flux-less smelting briquets composed of ilmenite concentrate with 5- to 8-percent anthracite and 3-percent lye was reported. Despite an output roughly equaling the combined production of Japan and the United Kingdom, the Soviet Union must import titanium to meet the rising demand within the country. Trade data for 1963 were not yet available, but some titanium was imported from Japan in 1962.

Tungsten.—The Nal'chik plan, based on the tungsten-molybdenum ores of Tyrny-Auz in North Caucasus and apparently reconditioned in 1962, continued operations but without the expected increase in tungsten metal output. The Nal' chik hydrometallurgical plant is reported to be the only one of its kind in the U.S.S.R. and Europe. According to the same report, only one plant of its kind exists in the United States.

Vanadium.—The principal source of Soviet vanadium in 1963 continued to be the 11 percent V_2O_5 slag from the smelting of the titaniferous magnetites of the Kachkanar pits in the Ural area. However, this source of supply appeared to have been supplemented during the year by ferrovanadium produced from the ironstones of the newly opened Ayat-Lisakovka pits in West Kazakhstan.

NONMETALS

Abrasives.—Despite its technological advancement and efficiency, Soviet Union's abrasives industry remained inadequate to meet domestic demands. As a result, the country continued to be a net importer of large quantities of abrasives in 1963. During the year, two corundum factories, at Zaporozhe and Leningrad, were in operation. A third one, reportedly at Kosulino, was being reconditioned while three

additional ones were being planned, at Roslavl', Chelyabinsk, and Yurga, the latter two in Siberia.

Asbestos.—The 1965 production target for asbestos was set at roughly 1.4 million tons, presumably for all grades including two standard hand-cobbed grades (to be produced in part for export) and six standard milled grades.

Construction Materials (Natural).—In 1963 Soviet output of natural construction materials continued essentially within the ranges of the 1959–65 production targets. However, operations were carried out under the handicaps of uneven distribution of reserves, the consequent regional shortages, and the long distances over which such materials as sand, gravel, and stone must be hauled from pits and quarries to the areas for their consumption. The rail haulage for cement, averaging about 650 kilometers, was roughly twice the distance for other materials. Meanwhile, despite a 6-percent increase in production over the 1962 level, the U.S.S.R. remained a large net importer of cement.

Cement Raw Materials.—Practically all the proven reserves of basic cement raw materials (over 12 billion tons of carbonates and clays and about 3 billion tons of gypsum) are in European Russia, Ukraine, and Kazakhstan. Little if any is found in other parts of the country.

Proved reserves of lime, including limestone, total about 4 billion tons. While estimated 1963 production of both construction and technological grades of lime increased over the 1962 levels, total output remained below the 1961 record level of over 17 million tons. The original production goal for 1965 was 17 million tons.

Gypsum production in 1963 remained at about the 1962 level. The 1965 goal was originally set at 13 million tons. No gypsum deposits are known to exist in West Siberia or the Soviet Far East.

Sand, Gravel, and Stone.—Detailed data on production of sand, gravel, and stone are not available. Total output in 1963 apparently was not far above the 1956 figure, reported as 190 million cubic meters, or much more than half of the original 1965 production goal of 400 million cubic meters. Reserves have been reported as deficient in many areas. There was no evidence that discovery of new sources of supply had eased regional shortages of dimension stones, one of the critical commodities at the beginning of the 1959–65 plan. Overall reserves, in cubic meters, were reported as over 8 billion for sand and gravel, 7 billion for rocks suitable for rubble and filling, and over 800 million for dimension stones.

Glass Sand.—Few of the large deposits of quartz sand in the Soviet Union could be used without upgrading; presumably the better grade materials in these deposits have been largely depleted. As a result, most glass factories in the country continued to depend on distant sources for the supply of sand (mostly transported by rail). Output of window glass in 1963 was 169 million square meters, compared with 140 million square meters in 1959, 166 million square meters in 1962, and the target of 220 million square meters in 1965.

Diamond (Natural).—Industrial research in the flotation of diamonds continued in the Soviet Union in 1963, reportedly with encouraging results. Technologic advances in this respect might find applications in the Yakutian diamond fields of Siberia.

Feldspar.—The pattern of feldspar consumption in 1963 in the Soviet Union, much different from that of the United States, was apparently the same as during 1958–62 when 60 percent was used for glass manufacture, 30 percent for ceramics, 4 percent for abrasives, and 6 percent for other purposes.

Fertilizers (Mineral).—The original Soviet 1959–65 production plan and targets for mineral fertilizers was not affected by the poor crop yields which led to large imports of wheat from abroad. However, the urgency of attaining the 1965 production target of 35.5 million tons was reemphasized at the December 1963 CPSU Plenum. At the same time, in Soviet technical publications it was reaffirmed that the earlier understanding that high and dependable crop yields, insofar as they are contingent on the use of mineral fertilizers and on irrigation, may not be attained until 1970 or later. The unfavorable geographical distribution of the mineral base for the Soviet fertilizer industry was reappraised. The known deposits of phosphates and potassium ores of Siberia remained to be further explored. For this exploration work, the appropriation for 1963 was 2.16 million rubles, to be raised to 7.3 million rubles in 1964 and 10.5 million rubles in 1965.

New projects placed on stream in 1963 raised Soviet Union's total mineral fertilizer capacity by about 7.4 million tons. These included the Grodno nitrogenous fertilizer plant, the Soligorsk I Potassium Kombinat, and the Kengisepp phosphorite mine.

Nevertheless, it appeared that the 1965 mineral fertilizer production goal would be difficult to reach without a large expansion of the Soviet copper, lead, zinc, and aluminum industries. The combined output of mineral fertilizers at the Krasnoural'sk and the Kirovograd copper kombinats in Ural and of the Alaverdy metallurgical-chemical kombinat in Armenia was more than 400,000 tons, primarily phosphatic. Construction of a double superphosphate plant at the Sredneural'sk copper smelting enterprise was started. The first section of the plant was to have an annual capacity of 700,000 tons; output of plant was to be doubled eventually. The production of potassium sulfate, as a coproduct of alumina, was scheduled for the Kirovobad and Achinsk alumina plants; actual construction of the potassium sulfate factories had already begun. Regional shortages of pyritic concentrates in Ural were not compensated in 1963, pending construction of additional ore-dressing and flotation plants at Uchaly, Sibay, Sredneural'sk, Gay, Urup, Nikolayevsk, and elsewhere. The 1965 goal for the base nonferrous industry was to increase the output of pyrite by 70 percent, to about 6 million tons.

Nitrogen.—The bulk of nitrogen consumption in the U.S.S.R. is in the form of ammonium sulfate and ammonium nitrate fertilizers; "NPK" (nitrogen-phosphate-potash) fertilizers are mostly used in the United States. In 1963, the U.S.S.R. had 28 known nitrogen plants and 6 byproduct ammonia plants in operation, with a total estimated capacity of 1.5 million tons of contained nitrogen (equivalent to about 7.3 million tons of standard Soviet nitrogenous fertilizers). At least 14 more plants were either in construction or projected. Of the total known 1963 nitrogen capacity, about 68 percent was in European Russia, 17 percent in Ukraine, 9 percent in Central Asia, and 6 percent in Siberia; Siberia is expected to rank second and

the Ukraine fourth in relative importance when the planned output of 4 million tons of contained nitrogen is reached, apparently by about 1967.

The planned conversion of the Soviet nitrogen industry to a different raw material base gained further momentum in 1963. The combined use of coke gas, natural gas, and petroleum byproduct gas continued to increase, while that of coal and coke showed a further decline.

Phosphate.—The estimated 1963 output of phosphate ore of the Karatau basin, with two pits and one mine, was 700,000 tons (16 to 32 percent P_2O_5), or only a small fraction of the basin's capability. The Kengisepp plant in the Leningrad area increased its output of phosphorite flour containing 19 percent P_2O_5 to about 400,000 tons; output was derived from shellstone phosphorite ores containing 5 to 15 percent P_2O_5 mined by open-cast methods.

The increase of output of phosphate fertilizers in the Soviet Union in 1963 was attained largely through a better use of available capacities rather than the commissioning of new ones. Single superphosphate continued to be the basic type of phosphate fertilizer produced. The P_2O_5 content of the Khibiny and the Karatau superphosphates remained at 19 to 20 percent and 14 to 15 percent, respectively. Soviet production of Thomas slag continued at its former level of 350,000 tons, pending the planned increase to 2 million tons in 1965.

About 95 percent of the 3 billion tons of proved reserve of economic phosphate ores are equally divided between the apatite deposits in the Khibiny District of the Kola Peninsula in the extreme northwest, the phosphate rocks in the Karatau Basin of Kazakhstan, and the low-grade concretionary ores scattered in a large number of relatively small deposits on the Russian Platform. Currently exploitable ores are not found east of the Ural Range. As a result, nearly all phosphate fertilizers consumed in Siberia and the Far East is brought in from the western part of the country by rail over distances of 1,500 to 7,000 kilometers and at costs of 4 to 19 rubles per ton compared with the cost of the fertilizer itself of 17 to 24 rubles per ton.

Potassium.—The bulk of the increased output of potassium fertilizers in 1963 may be credited to the greater capacity of the Solikamsk Kombinat and the commencement of production at Starobino in Belorussia. All Soviet potassium ore reserves and all of Soviet's potassium fertilizer output occur in the European part of the country. As a result, the transportation costs, up to 19 rubles a ton, often exceed the cost of the fertilizer of 7 to 11 rubles per ton.

Fluorspar.—Flourspar was mined from open pits in Transbaykalia and the Soviet Far East with lead as a coproduct. Ores in one location were reported as 40.5 percent CaF_2 and 1.32 percent lead. Soviet Union's domestic fluorspar output remained significantly inadequate to meet demand despite the considerable reserves in the country, and recorded exports of fluorspar to Japan and of cryolite to other countries. Soviet requirements were partly met through imports of which about 80,000 tons of fluorspar were recorded in 1962.

Graphite.—As in prior years, Soviet output of natural graphite in 1963 was supplemented by high-grade material recovered from metallurgical wastes of Krivoy Rog, Azovstal', and other iron and steel

enterprises. The Zhdanov plant in Ukraine processes annually about 3,000 tons of screened scrap containing 18 to 20 percent graphite.

Kaolin.—Output of kaolin in the Soviet Union in 1963 was at about the 1957 level. More than 80 percent of this output came from the high-grade Ukrainian deposits. The remainder, all low-grade material unsuited for the paper industry, was obtained almost entirely from the Ural region.

Mica.—As in prior years, muscovite was produced at Malinovaya Varaka and four other mines on the White sea and in two high-grade mines in the Mama District in Yakutia in Siberia. The Aldan phlogopite mica district, also in Yakutia, was reported by the Soviets to have the world's largest reserves of this type of mica. Strategic-grade mica continued to be imported to meet special demands.

Sulfur and Pyrite.—The Soviet Union's largest sulfur deposit, Razdol'skoye, is in the western part of the Ukraine. This deposit, with estimated reserves of 10 million to 30 million tons of elemental sulfur, was not mined on any significant scale until 1961. However, the Razdol'skoye Sulfur Kombinat probably attained an annual capacity of 600,000 tons of contained sulfur in 1963, 2 years ahead of schedule, and further expansion was underway.

The planned increase of sulfur output from the Gaurdak dome to five times the 1962 level may have been achieved in 1963. The total output from this relatively small deposit in Tadzhikistan and other even smaller deposits in European Russia and Central Asia probably amounted to less than 100,000 tons in 1963.

In the Soviet nonferrous smelters, sulfur is either entirely wasted or only partially recovered. In 1963 only five out of the total of nine copper smelters in the country used their sulfur gases for the production of sulfuric acid, and the sulfur recovery was only 32 percent. Zinc smelters were able to recover 72 percent of the sulfur from waste gases, but apparently recovery operations were undertaken in Eastern Kazakhstan only. Sulfur recovery at the lead smelters was negligible and at the three nickel smelters nil; the waste at the latter operations alone was equivalent to 1.5 million tons of sulfuric acid. Plans to reduce gas wastes in 1963 were not fulfilled reportedly because of poor management and lack of control and cooperation on the part of technologists and engineers.

In 1963 pyrites accounted for about 62 percent of Soviet Union's sulfuric acid production, elemental sulfur 20 percent, and waste gases 18 percent. Current plans call for the contribution of waste gases to increase to 39 percent of the total by 1965. In terms of production by facilities, only a quarter of the total sulfuric acid output was produced by the country's nonferrous metallurgical enterprises from their own pyrites and waste gases. The remainder of their pyrite supply was shipped to sulfuric acid plants elsewhere or discarded. The Ural alone shipped more than 4 million tons of pyrites in 1963 to sulfuric acid facilities in Ukraine and the industrialized center and northwest of European Russia.

Synthetic Crystal Industry.—The Soviet Union apparently continued research in the field of synthetic crystal production and use. Since the 1950's, metal crystals, metal-organic crystals, and organic crystals have been produced, although quantitative data are not available. Notable

TABLE 8.—Salient sulfur industry statistics [1]

(Thousand metric tons)

Commodity	1959	1960	1961	1962	1963
Sulfur:					
Produced from ore except pyrite	600	800	850	950	950
Content of pyrite	1,350	1,400	1,450	1,400	1,500
Recovered from gases	200	200	300	350	400
Total	2,150	2,400	2,600	2,700	2,850
Sulfuric acid production (as $H_2SO_4 \cdot H_2O$):					
From sulfur from ore	950	1,050	1,150	1,250	1,400
From pyrite	3,582	3,798	3,778	3,882	4,300
From sulfur from gases	550	550	800	1,000	1,200
Total	5,082	5,398	5,728	6,132	6,900

[1] Total sulfuric acid production is reported; all other data are estimates.

products of the industry include monocrysts of quartz, gemstone, fluorspar, Iceland spar, germanium, and others. At least one synthetic industrial diamond factory apparently has been in operation in Saratov for some time.

Talc.—The 1965 production goal for talc in the Soviet Union was set at 514,000 tons, nearly a 140-percent increase over the 1963 estimated output. About two-thirds of the talc consumed in the country is for insecticides, 9 percent for paper, 5 percent each for rubber manufacturing and roofing, and the balance for other miscellaneous uses. The country continued to import substantial quantities of high-grade talc.

Vermiculite.—The vermiculite reserve of Eno-Kovdor in Kola Peninsula, the largest in the country and apparently the only one exploited, was reported as 2.45 million tons. This figure included 1.2 million tons of top-grade material.

MINERAL FUELS AND ENERGY

The planned changes in the fuels production structure and the eastward shift of the production of fuels, particularly of coal continued in 1963.

TABLE 9.—Changes in fuels production structure (as percent of total production recalculated as standard fuel)

Fuel	1958	1960	1962	1963	1965 (planned)
Coal	58.8	53.9	48.8	46.0	43.4
Shale	.7	.7	.7	.8	.7
Peat	3.4	2.9	1.7	2.5	2.7
Wood	5.3	4.1	3.7	3.4	1.8
Oil	26.3	30.5	34.2	34.9	33.8
Natural gas (including byproduct gas)	5.3	7.9	10.9	12.4	17.5

While the share of coal in the fuels balance of the country was decreasing progressively, the tonnage output of coal continued to rise, particularly in the eastern coal basins. During 1958–63, the output of the Donets Basin increased by 6 percent, of the Kuznetsk by 19 percent,

of the Karaganda by 14 percent, of the Ekibastuz by 61 percent, of Central Asian mines and pits by 14 percent, of East Siberia by 15 percent, and of the Far East by 22 percent.

As the result the percentage output of coal basins east and south of the Ural Range rose to 38 of the U.S.S.R. total, compared with 34 in 1958.

The largest increase in the production of oil and gas occurred in Tataria, Bashkiria, and the Kuybyshev District. The 1963 output of gas in Uzbekistan (the Gazli fields representing 25 percent of the U.S.S.R. total reserve of natural gas) was 23 times as high in 1963 as in 1958.

Total production of hydroelectrical power increased by 55 percent (1958–62); however, production in Siberia, the Far East, Central Asia, and Kazakhstan increased by 68 percent. These regions contain 85 percent of the reserve of hydroelectrical power and 75 percent of total fuels reserve. The 1962–63 output of hydroelectrical power in these eastern areas rose from 19.7 percent of the U.S.S.R. total in 1958 to 21.3 percent in 1962; the estimated percentage for 1963 is close to 22.

However, the greater part of increased output of electrical power was credited mainly to the thermoelectrical power stations.

In 1962, 73 percent of the total power capacity and 83 percent of the power output was in regional high-capacity power stations; industrial power stations had 17 percent of the capacity and accounted for 14 percent of the output; while communal, transportation, agricultural and other unspecified plants provided the balance.

In 1962, and in 1963, by preliminary indications, 21 percent of the total fuel of all kinds expended in the U.S.S.R. was used for the production of electrical or motive energy including 7 percent in industrial power installations, 8 percent in railway locomotives and transport vessels, and 6 percent in other kinds and means of transportation.

TABLE 10.—Increase in the output of electrical power in 1958 and 1960–63, as percent of the output of 1958

Type of power station	1958	1960	1962	1963 [1]
Thermoelectric	100	128	157	178
Hydroelectric	100	110	155	163
All types	100	124	157	175

[1] Preliminary data.

Almost 44 percent of all natural fuels used in the U.S.S.R. required upgrading or refining. Specifically, such processing is applied to 20 percent coal, 41 percent shale, 12 percent peat, 99 percent petroleum, more than 5 percent natural gas.

The country's industries consume two-thirds of the country's total fuel and more than three-fourths of its total electrical and thermal energy. The industries consume 69 percent of all coal, 99 percent of shale, 83 percent of natural gas, and 70 percent of fuel oil.

While the rail freight turnover was 9 percent higher in 1962 than in 1960 and passenger traffic was 11 percent higher, the railroad consumption, as standard fuel, decreased by 18 percent. The saving of 23 million tons of coal was particularly important for the economy. The accompanying increase in the consumption of electrical power was equivalent to about 2.5 million tons standard fuel.

In 1962, 38 percent of all haulage by rail (including passengers) was by steam engines which consumed 80 percent of the total fuels allocated to the railways. In the same year, diesel engines hauled 32 percent of all freight (and passengers) and consumed only 9 percent of the total railways fuel, while the balances of haulage and fuel consumption were accounted for by electric engines.

TABLE 11.—Utilization of fuels by type and purpose (percent of total consumed)

Fuel	Production of electrical energy	Production of thermal energy	Production of mechanical energy	Conversion into other fuels and purposes other than fuel production [1]	Technology and miscellaneous
Coal	29	23	11	20	17
Shale	38	16		41	5
Peat	39	31	1	12	17
Wood	4	10	5	3	78
Oil	0.1	0.3		99.2	0.4
Natural gas (including byproduct gas)	23	32	2	5	38
Fuel oil (mazut)	11	32	26	1	30
Diesel fuel	16	1	71	1	11
Gas from coke	7	11	2	5	75
Gas from blast furnaces	10	16	4		70

[1] Including petrochemical production and similar uses.

TABLE 12.—Consumption of total fuels and energy by different sectors of the national economy in 1962

(Percent)

Sector	Fuels	Energy	
		Electrical	Thermal
Industries	67	77	77
Construction	2	3	4
Agriculture	6	4	1
Transportation	13	7	3
Household, communes, etc	7	6	9
Other	5	3	6

In 1962, the primary (natural) fuels-energy resources of the U.S.S.R. increased by 30 percent since the end of 1958 (including the 55-percent increase in the hydroelectrical power). Recalculated on the standard fuel basis, these resources represent the annual output of 906 million tons of fuels plus the 9 million tons equivalent of the hydroelectrical power (1 percent of the total).

The experience of 1962 shows, however, that about 34 million tons standard fuel were freed per every kilowatt-hour per year of hydroelectrical power consumed. Thus the share of the hydroelectrical power in the energy balance of the country may be reckoned as about 3.5 percent.

As it is the utilization of fuels by combustion, for the production of energy was only 40 to 45 percent efficient.

The first atomic power station, 5,000-kilowatt capacity, was put into operation in June 1954, at Obninsk, in the Kaluga area. The second one, in Siberia, was commissioned in 1958. In 1963, the first section of the Belyy Yar station (105,000 kilowatt), Sverdlovsk area, went into operation. At least two more stations were commissioned in 1962–63.

In 1963, the Novo-Voronezh station, 210,000-kilowatt capacity; the Melekess station, near Ul'yanovsk, 70,000-kilowatt capacity; and a certain number of smaller atomic power stations were in construction. In 1963, two motorized atomic power stations were built and commissioned for operation.

New energy developments in 1963 included the oilfields in the Tyumen' territory, in the West-Siberian Lowland, where the first oil was struck in 1960, were reportedly proved to contain economic reserves of billions of tons, large enough to call this region "the Third Baku." The known natural gas reserves in the same region were reported as trillions of cubic meters. The newly discovered and appraised fuel shales at Kenderlyk, Eastern Kazakhstan, whose tars yield 25 percent gasoline and 36 percent diesel oil, were rated the highest grade shales in the U.S.S.R., Europe, and United States. The geographically associated coal reserve is reported as at least 1.5 billion tons. The hydroelectric power resource of Siberia is now rated at 1,500 billion kilowatt-hours, 180 billion of which is in the Yenisey-Angara Basin. The resource of Central Asia exceeds 450 billion kilowatt-hours.

A new trunk gasline, Bukhara-Ural, 2,000 kilometers long was completed in 1963, and its first string (1,020 millimeter pipe) will deliver about 7 billion cubic meters of gas in 1964. The Ordzhonikidze-Tbilisi trunk gasline was commissioned in 1963.

The Mineral Industry of the United Kingdom

By Justin B. Gowen [1]

EARLY in 1963 the general economy of the United Kingdom took an upturn which by yearend had penetrated nearly all sectors of industry, including mineral producing and processing, and led some sectors to record rates of production. Contributing to the improvement were certain fiscal measures inaugurated by the Government to stimulate consumer demand in the basic industries. These included reduction in excise taxes, favorable changes in amortization allowances, and easement of credit regulations for shipbuilding and industrial development projects. Notable improvements in the mineral-based industries were the rises in production of iron and steel and the metal manufacturing industries after the prolonged depression which followed the peak year of 1960.

Except for domestic iron ores, which supplied about one-third of the iron-in-ore requirements of the iron and steel industry, Cornish tin ores which supplied 5 to 6 percent of the tin metal requirements, and a small tonnage of lead and zinc concentrates recovered from old dumps and from the beneficiation of barite and fluorspar, mineral production in 1963 was limited to the nonmetallic minerals, construction materials and fuels sectors.

In 1962 the United Kingdom was first in world output of strontium minerals (celestite), probably second in the production of china clay, and ranked high in the world production of salt, gypsum and anhydrite, diatomite, barite, fluorspar, cement and other construction materials, and coal.

The British nonferrous metal industries continued to be almost entirely dependent on imported raw materials and domestic scrap. On a world basis the United Kingdom ranked 3d in the production of tin metal, 6th in refined lead, 9th in refined copper, 10th in slab zinc, and was a leading producer of aluminum.

Celestite, the clays, salt, and coal were the only significant exports from dometsic resources.

Of the 1963 gross domestic product, reported to be nearly US$73 billion, industrial production contributed somewhat less than half, with mining and quarrying accounting for about 2.8 percent, the metals industries 3 percent, and other mineral-based industries including chemical elements and compounds and nonmetallic mineral

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products about 9 percent. Of the total employed population at year-end 1963 reported at about 25,109,000 persons, 670,000 or 2.7 percent were employed in the mining and quarrying industries and 607,000 (2.4 percent) in the metals industries.

Imports of all goods for consumption in 1963 increased by about 7.8 percent over imports in 1962 and were valued at US$13,066 million, of which US$3,329 million or 25.5 percent was in mineral and metal products. Exports of all produce and manufactures of the United Kingdom during 1963 were about 7.6 percent above 1962 exports and were valued at US$11,424 million of which US$2,312 million was in minerals and metals. Petroleum led the imports while iron and steel led the exports.

GOVERNMENT POLICIES AND PROGRAMS

In general, minerals are the property of the owner of the surface above them, and are subject to laws governing the surface. Excepted are coal, atomic energy materials, and petroleum. The extraction and working of minerals is also subject to regulation under provisions of the Town and Country Planning Act of 1947.

The ownership of coal and the right to work it are vested in the National Coal Board under provisions of the Coal Industry Nationalization Act, 1946. The Minister of Supply is responsible for the acquisition of atomic energy materials under provisions of the Atomic Energy Act of 1946.

Ownership of petroleum resources is vested in the Crown, and applications for their development are administered by the Ministry of Power. Rights can be held only by British subjects or companies organized in the United Kingdom, of which at least one director and a majority of the employees are British.

Under the Iron and Steel Bill (1949) all companies in the iron and steel industry having a minimum annual production of 50,000 tons of iron ore, or 20,000 tons of pig iron, crude steel, or rolled products, became subject to nationalization, and their assets were acquired by the Iron and Steel Corporation of Great Britain. Smaller companies, with a minimum production of 5,000 tons annually of any of the above products were made subject to regulation through license. The Iron and Steel Bill (1949) was repealed by the Iron and Steel Act, 1953, and assets of the nationalized companies, 71 major companies with 231 subsidiaries, were transferred to the Iron and Steel Holding and Realization Agency for return to private ownership. At the end of 1963 only one company, Richard Thomas and Baldwins, remained under control of the Government agency.

The Iron and Steel Act, 1953 (Part II, Sec. 3), also provided for the establishment of the Iron and Steel Board consisting of 9 to 14 members whose duties were—

> . . . to exercise a general supervision over the iron and steel industry, and to such extent as they may consider necessary the powers conferred on them by this Act, with a view to promoting the efficient, economic and adequate supply under competitive conditions of iron and steel products, and in particular to keep under review:

(a) The productive capacity of iron and steel producers;
(b) The arrangements for procuring and distributing raw materials and fuel for use in the iron and steel industry;
(c) The prices charged for iron and steel products;
(d) The arrangements for the promotion of research relating to the iron and steel industry and of the training and education of persons employed or to be employed in the industry;
(e) The arrangements for the promotion of the safety, health and welfare of persons employed in the iron and steel industry; and
(f) The arrangements for joint consultation between iron and steel producers and persons employed by them in the iron and steel industry or representatives of such persons on matters of mutual interest other than terms and conditions of employment.

In 1963 the board consisted of three full-time and eight part-time members drawn from trade unions and producers and consumers of iron and steel. The Board is consultative and advisory but also has specific duties, where the National interest is concerned, and the powers needed to carry them out. It is financed by levies which it is empowered to make on industry.

The nationalized industries, which include coal, electricity, gas, and the railroads, are administered by executive agencies. Although the Government has no direct control over prices in these industries, it exercises a considerable influence where the public interest is concerned.

In 1961 the responsibility for developing policies in certain spheres contributing to more rapid and sustained economic growth of the United Kingdom was given to the newly established National Economic Development Council (NEDC). The Council in turn established the National Economic Development Office (NEDO) to study the implications for the United Kingdom of a 4 percent annual growth rate between 1961 and 1966 based on the prospects of 17 industries including the mineral-based coal, gas, electricity, chemicals, construction, iron and steel, petroleum, heavy electrical machinery, machine tool, and motor vehicle industries. These studies were still in progress at yearend.

PRODUCTION

Preliminary figures show little variation in the gross value of production from mines and quarries in 1963 compared with that of 1962. Gross production of nonferrous metals also showed little change from that of 1962, but the output of refined aluminum, cadmium, lead, and slab zinc was higher than for any previous year, while copper output continued to decline from its 1961 high.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Primary	24,913	29,384	32,812	34,576	31,065
Secondary	109,020	111,390	119,050	131,780	148,970
Cadmium kilograms	140,611	106,909	98,557	107,610	165,860
Copper:					
Electrolytic	20,483	22,132	21,965	25,290	29,804
Fire refined	174,877	196,772	216,119	206,456	184,228
Total	195,360	218,904	238,084	231,746	214,032
Primary, all from imported blister (included in total)	97,070	112,706	131,080	118,862	91,429
Iron and steel:					
Iron ore, 27 percent Fe thousand tons	15,108	17,362	16,783	15,522	15,151
Pig iron and blast furnace ferroalloys do	12,784	16,016	14,984	13,912	14,825
Other ferroalloys do	(1)	183	186	175	120
Steel ingots and castings do	20,511	24,695	22,441	20,820	22,882
Finished steel deliveries from U.K. production new material thousand tons	14,931	17,924	16,623	15,256	16,574
Lead:					
Ore and concentrate, lead content	2,388	1,405	1,502	405	250
Refined lead [2]	88,116	92,560	87,663	90,026	96,584
Magnesium	2,165	2,737	5,280	3,800	1,745
Nickel, refined and ferronickel	25,300	34,340	38,000	38,300	[3] 38,000
Silver troy ounces	13,655	7,079	4,744	(1)	(1)
Tin:					
Ore and concentrate, tin content long tons	1,252	1,199	1,210	1,181	1,226
Refined:					
Primary do	26,614	26,286	24,449	18,749	17,441
Secondary do	971	1,386	1,903	1,198	1,331
Zinc, slab	74,137	75,496	94,375	98,837	100,617
Nonmetals:					
Barite and witherite	62,059	61,172	83,168	76,888	55,398
Calcite	27,400	24,400	27,400	28,400	[3] 28,000
Cement thousand tons	12,790	13,497	14,376	14,256	[3] 14,000
Chalk do	15,610	15,754	15,747	18,185	[3] 18,000
Chert and flint do	100	160	175	144	[3] 150
Clays:					
China clay do	1,333	1,664	1,746	1,724	[3] 1,730
Fire clay do	2,108	2,194	2,218	1,960	[3] 2,200
Potters and ball clays do	453	530	544	558	[3] 560
Other clays and shale do	10,950	16,300	10,060	[3] 9,900	[3] 10,000
Diatomite	17,300	15,017	22,607	[3] 22,600	[3] 22,600
Fluorspar	84,439	99,109	90,599	72,144	68,149
Gypsum and anhydrite thousand tons	3,442	3,653	3,791	4,063	4,186
Igneous rock [4] do	15,906	16,526	17,672	17,963	[3] 18,000
Limestone do	37,836	40,722	42,585	41,396	44,760
Magnesia from sea water	(1)	(1)	(1)	(1)	46,681
Pyrites	190	130	170	27,431	27,422
Salt:					
Rock thousand tons	145	152	290	485	764
Evaporated do	1,150	1,253	1,208	1,280	1,389
Other do	4,252	4,455	4,262	4,312	[3] 4,300
Sand:					
For glass making do	1,000	1,171	1,153	1,161	[3] 1,160
Other silica sand, including refractory do	789	731	703	572	[3] 700
Moulding and pig bed sand do	780	849	725	711	[3] 700
Other industrial sand and gravel do	66,454	72,652	81,164	82,799	[3] 83,000
Sandstone do	4,319	5,039	4,981	5,219	[3] 5,200
Slates do	95	94	99	94	[3] 95
Strontium minerals	6,096	6,710	8,818	6,657	[3] 6,650
Sulfur, recovered elemental	54,026	63,404	59,343	52,800	45,700
Mineral fuels:					
Coal:					
Anthracite thousand tons	3,664	3,653	3,604	3,965	4,226
Bituminous do	205,756	193,064	189,931	196,651	194,712
Coke and coke breeze:					
Coke oven do	18,415	20,367	19,356	16,995	16,973
Gas house do	12,639	12,498	12,396	12,324	12,314
Fuel briquets do	1,717	1,435	1,492	1,573	1,679
Oil shale do	720	680	484	159	----------
Shale oil do	420	420	308	112	----------
Crude petroleum thousand 42-gallon barrels	612	631	783	820	923
Carbon black thousand tons	123	146	137	128	140
Liquefied petroleum gases (well head) thousand 42-gallon barrels	1,484	1,821	2,368	3,400	5,907

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Mineral fuels—Continued					
Finished refinery products:					
Butane and other petroleum gases thousand 42-gallon barrels	3,127	4,640	5,417	7,453	10,933
Aviation gasoline do	12,442	11,618	11,868	13,278	7,507
Motor spirit do	53,177	57,294	60,829	60,684	58,776
Other white spirit do	1,223	1,441	1,358	1,296	1,348
Kerosine do	13,949	17,972	21,117	20,541	24,262
Gas-diesel oil do	54,885	57,969	65,318	75,542	81,773
Fuel oil do	105,604	125,467	143,186	148,685	143,129
Lubricating oils do	6,143	6,484	6,809	6,390	6,877
Bitumen do	5,921	6,387	6,985	7,517	8,042
All other products thousand tons	962	1,419	1,418	2,238	2,852

[1] Data not available.
[2] Does not include refined from imported bullion.
[3] Estimate.
[4] Includes feldspar and perlite.

TRADE

Distribution of the value of imports for consumption and exports of United Kingdom produce and manufactures in the various mineral and metal groups in 1963 were as follows:

Commodity group	Value (million U.S. dollars)			
	1962		1963	
	Imports[1]	Exports[2]	Imports[1]	Exports[2]
Metals:				
Metalliferous ores and scrap	388	56	400	46
Iron and steel	149	560	210	573
Nonferrous metals	632	369	623	348
Metal manufactures, not elsewhere specified	82	385	86	371
Nonmetals:				
Chemical elements and compounds[3]	180	232	211	259
Crude fertilizers and crude minerals (excluding fuels)	107	42	109	50
Fertilizers, manufactured	50	13	56	14
Nonmetallic mineral manufactures, not elsewhere specified	58	187	65	190
Fuels and energy:				
Coal, coke and briquets	2	87	2	134
Gas and electric energy	1	----	2	1
Petroleum and petroleum products	1,484	322	1,565	326
Total	3,133	2,253	3,329	2,312

[1] Does not include imports which were reexported.
[2] Does not include reexports.
[3] Includes some metals, generally those recovered by chemical methods.

Geographical and political distribution of imports to and exports from the United Kingdom of the listed commodities shows that the British Commonwealth led other country groups as a source of supply, accounting for US$894 million in value or 26.8 percent of the total. Next in importance were the European Economic Community countries (ECC) which supplied imports with a total value of US$500 million or about 15 percent of the total, and the European Free Trade

Area (EFTA) which accounted for US$213 million or 6.4 percent of the total. Individually, Kuwait, which supplied US$427 million in value, representing 27 percent of all petroleum products imported by the United Kingdom during 1963, led all other nations and was followed by Canada which supplied US$350 million in imports and the United States which supplied products valued at $214 million.

As a market for U.K. mineral and metal products the European Economic Community was first, receiving US$571 million in value of U.K. exports, and the European Free Trade Area was second with US$383 million. Individually, the United States was the U.K.'s best customer, receiving products valued at US$148 million, followed by Sweden with US$145 million and West Germany with US$135 million.

TABLE 2.—Value of mineral and metal trade by area and country in 1963

(Million U.S. dollars)

Area and country of origin and destination	Imports [1]			Exports		
	Minerals and metals	Fuels	Total	Minerals and metals	Fuels	Total
British Commonwealth:						
Australia	58	(2)	58	83	3	86
Canada	350	(3)	350	97	3	100
India	11	1	12	59	6	65
Nigeria	1	48	49	33	1	34
Rhodesia and Nyasaland	158	(2)	158	11	(2)	11
Trinidad	2	72	74	13	1	14
Other	70	123	193	242	15	257
Total	650	244	894	538	29	567
European Economic Community (EEC):						
Belgium-Luxembourg	58	14	72	51	20	71
France	63	25	88	69	38	107
Germany, West	108	18	126	99	36	135
Italy	19	24	43	94	7	101
Netherlands	71	100	171	85	72	157
Total	319	181	500	398	173	571
European Free Trade Area (EFTA):						
Austria	13	(2)	13	7	----	7
Denmark	4	(2)	4	38	68	106
Norway	74	(2)	74	41	40	81
Portugal	1	(2)	1	15	6	21
Sweden	99	(2)	99	77	68	145
Switzerland	22	(2)	22	22	1	23
Total	213	(2)	213	200	183	383
Other:						
Ireland	10	(2)	10	54	23	77
Iraq, Iran, Kuwait and Saudi Arabia	(2)	707	707	36	(2)	36
Algeria, Morocco, Libya and Tunisia	32	118	150	7	(2)	7
Republic of South Africa	53	(2)	53	61	4	65
United States	187	27	214	148	(2)	148
U.S.S.R.	45	4	49	56	(2)	56
Other East Europe Communist countries	12	(2)	12	29	(2)	29
Mainland China	5	(2)	5	11	(2)	11
All other countries	278	293	571	313	49	362
Grand total	1,804	1,574	3,378	1,851	461	2,312

[1] Includes imported merchandise valued at US$49 million which was reexported.
[2] Trade, if any, not reported separately.
[3] Less than US$500,000.

TABLE 3.—Exports [1] of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Alumina and aluminum hydroxide	24,211	16,079	(2).
Aluminum and aluminum alloys:			
Unwrought	5,495	5,465	
Semimanufactures:			
Bars, rods, angles, shapes and sections	4,008	3,566	Canada 11,038; United States 6,768; Ghana 5,216; Sweden 3,910; India 3,757; Australia 3,611.
Plates and sheets	42,211	48,080	
Foil	6,194	6,577	
Other	1,605	1,904	
Arsenic, white	6,883	8,297	(2).
Bismuth kilograms	388,320	519,215	(2).
Chromium do	319,921	275,460	(2).
Copper and copper alloys:			
Unwrought: Refined	79,465	123,341	Belgium 43,183; West Germany 13,808; Poland 13,274; East Germany 10,136; Netherlands 7,200.
Including reexports	7,115	12,609	
Brass and bronze ingots	38,169	41,287	(2).
Semimanufactures:			
H.C. wire rods	17,760	17,797	(2).
Other copper	20,428	17,334	(2).
Brass and bronze	33,319	25,660	(2).
Nickel silver and cupro-nickel	1,771	1,986	(2).
Gold:			
Bullion, fine gold troy ounces content	24,604,143	28,966,563	(2).
Gold coin do	948,866	761,037	(2).
Semimanufactures, 9 carats or better (excluding jewelry) do	23,591	20,285	(2).
Iron and steel:			
Scrap thousand tons	30.1	1,102.3	Italy 278.1; Spain 245.7; Japan 225.4; West Germany 118.1.
Pig iron do	147.4	222.9	West Germany 74.8; Japan 51.5; Switzerland 24.1.
Ferroalloys do	5.7	6.2	West Germany 1.2; Netherlands 0.8.
Steel ingots and other primary forms do	105.0	86.7	Venezuela 27.1; Argentina 15.5; Greece 9.8.
Finished steel:			
Bars, rods, angles, shapes and sections do	743.4	671.6	United States 75.5; U.S.S.R. 64.8; New Zealand 47.8; India 36.8 Canada 36.1; Netherlands 32.0.
Plates and sheets:			
Uncoated:			
3 mm thick and over do	423.7	398.9	Norway 56.0; France 41.2; Sweden 33.9.
Less than 3 mm do	416.2	559.1	U.S.S.R. 130.6; Sweden 64.9; West Germany 57.0; Italy 39.8.
Coated:			
Tinplate and tinned sheets do	434.5	465.1	Republic of South Africa 42.8; Argentina 37.3; United States 36.7.
Other do	112.1	111.4	Finland 16.2; British West Indies 7.2.
Hoop and strip do	107.6	98.0	India 11.6; Australia 5.6; Sweden 5.3.
Railway material:			
Wheels, tires, and axles do	40.9	48.3	Republic of South Africa 14.7; Mexico 4.7; Pakistan 4.1.
Rails and other track material do	182.9	124.8	Italy 12.5; Tanganyika 12.3; Iraq 11.0.
Wire, single strand not insulated do	131.0	113.6	United States 21.0; Canada 13.2; India 9.2; New Zealand 9.2.
Tubes, pipes and fittings:			
Wrought do	527.5	433.3	United States 88.4; British West Indies 30.5; Canada 27.0.
Cast do	116.2	103.5	Sweden 8.5; Canada 6.5; Iraq 5.5; British West Indies 5.4.
Rough forgings do	1.9	2.2	Sweden 1.0.
Total iron and steel (excluding scrap) do	3,496.0	3,445.6	

See footnotes at end of table.

TABLE 3.—Exports [1] of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals—Continued			
Lead:			
Bullion and refined	26,955	33,078	West Germany 19,969; Belgium 8,323; Egypt 1,942; U.S.S.R. 412.
Including reexports	626	489	
Lead alloys, including type metal	2,119	3,641	(2).
Semimanufactures, lead and alloys	2,892	2,093	(2).
Magnesium, and magnesium alloys, unwrought and semimanufactures.	1,836	2,045	(2).
Mercury, reexports, 76-pound flasks	8,385	5,774	Poland 1,082; Finland 649; India 570; Republic of South Africa 512.
Nickel and nickel alloys:			
Unwrought	22,269	20,452	(2).
Semimanufactures	5,879	5,636	(2).
Platinum and platinum group:			
Platinum:			
Ingots, bars, grains, powder, or sponge. troy ounces	307,461	253,320	(2).
Other, including alloys and semimanufactures. do	39,616	58,018	(2).
Other platinum group metals and alloys. do	360,471	259,998	(2).
Silver and silver alloys:			
Silver bullion do	11,394,246	19,794,688	(2).
Other unwrought and semimanufactures. do	6,409,464	7,474,272	(2).
Tin and tin alloys:			
Refined tin long tons	12,184	8,026	United States 1,407; Netherlands 544.
Including reexports do	2,385	870	(2).
Solder do	1,206	1,551	(2).
Antifriction metal do	553	653	(2).
Other unwrought or semimanufactured. do	301	468	(2).
Zinc and zinc alloys:			
Slab zinc	2,318	9,509	Sweden 3,749; Brazil 1,200; Italy 1,016; Turkey 698.
Including reexports	150	2,370	(2).
Semimanufactures	6,056	7,349	(2).
Nonmetals:			
Asbestos:			
Crude fiber and waste	7,127	7,173	(2).
Manufactures	32,980	30,160	Sweden 2,984; Netherlands 1,982; Norway 1,908; Italy 1,694; Belgium 1,612.
Clay and clay products:			
Ball clay thousand tons	222.0	246.4	(2).
China clay do	1,135.4	1,118.3	(2).
Other clays do	68.5	65.2	(2).
Refractory construction materials. do	147.8	128.9	(2).
Gypsum and anhydrite do	13.0	7.6	(2).
Pigments, earth	5,965	5,729	(2).
Salt:			
Evaporated thousand tons	250.6	253.2	(2).
Other do	78.4	71.8	(2).
Strontium minerals (celestite)	6,602	2,638	(2).

See footnotes at end of table.

TABLE 3.—Exports[1] of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Mineral fuels:			
Coal thousand tons	5,686.8	4,786.6	Netherlands 1,311.9; France 790.4; Denmark 686.4; Ireland 570.0; West Germany 442.7.
Hard coke do	504.8	695.3	Sweden 151.6; Finland 98.6; Portugal 91.6; Denmark 90.8; Venezuela 80.2.
Gas coke and coke breeze do	998.4	1,059.4	Norway 510.3; Denmark 234.0; Sweden 98.8.
Coal tar pitch do	172.3	213.4	(2).
Petroleum and petroleum products:			
Carbon black do	49.4	38.4	(2).
Crude thousand 42-gallon barrels or partly refined.	815	7,368	(2).
Gasoline, including blending agents. do	12,813	14,693	Sweden 3,788; Denmark 3,541; Norway 1,577; France 1,274; West Germany 559.
Other white spirit do	361	415	(2).
Kerosine do	6,468	6,555	(2).
Gas oil do	15,658	20,492	Sweden 12,161; Netherlands 8,220; Denmark 6,784; West Germany 6,094; Norway 5,408.
Diesel oil do	2,219	2,958	
Residual fuel oils do	15,735	21,743	
Lubricating and other heavy oils. do	3,519	3,666	Australia 319; India 224; Belgium 224; Republic of South Africa 214; West Germany 190.
Lubricating greases thousand tons	32.9	33.4	(2).
Asphalt do	63.6	69.0	(2).
Electric energy. thousand kilowatt hours	----------	15,204	(2).

[1] Products and manufactures of the United Kingdom except where otherwise noted.
[2] Data not available.

TABLE 4.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum and aluminum alloys:			
Bauxite and concentrates	401,355	432,705	(1).
Scrap	5,804	8,572	(1).
Unwrought	238,938	255,276	Canada 156,742; Norway 52,356; United States 32,130; U.S.S.R 8,827.
Semimanufactures	21,527	22,189	(1).
Antimony ore, concentrate, and crude antimony.	11,921	12,330	(1).
Arsenic, white	8,740	6,688	(1).
Bismuth:			
Metal kilograms	225,547	537,336	(1).
Alloys do	345,911	353,684	(1).
Cadmium do	1,172,467	1,195,839	(1).
Chromite	261,047	118,383	(1).
Cobalt kilograms	1,439,399	1,264,040	(1).
Columbium-tantalum ores	721	796	(1).
Copper and copper alloys:			
Copper and alloy scrap, and alloy ingots.	2,088	2,511	(1).
Blister	141,965	105,653	Chile 45,585; Northern Rhodesia 39,181; Peru 20,887.
Electrolytic	358,245	399,240	Northern Rhodesia 193,293; Canada 39,096; United States 48,331; Chile 33,150; West Germany 20,673.
Fire refined	36,084	30,891	Chile 26,503.
Semimanufactures	4,437	3,990	(1).

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals—Continued			
Gold:			
Ores, concentrates, troy ounces—jewellers sweepings, etc. estimated gold content.	49,900	59,600	(1).
Bullion, unrefined and refined, fine gold content. troy ounces	50,786,396	34,082,175	(1).
Gold coin troy ounces	10,999	554,929	(1).
Iron and steel:			
Iron ore and concentrate. thousand tons	15,206.3	13,120.0	Sweden 4,177.7; Canada 1,718.7; Algeria 1,428.3; Venezuela 1,247.1; Liberia 753.8.
Iron and steel scrap do	23.1	4.6	West Germany 2.9.
Sponge iron do	5.6	6.0	Sweden 5.9.
Pig iron do	33.1	135.6	U.S.S.R. 56.0; Norway 49.6; West Germany 10.9.
Ferroalloys:			
Ferrochromium do	43.2	25.1	Norway 62.0; Republic of South Africa 31.6; Canada 26.2.
Ferromanganese do	42.7	44.9	
Ferrosilicon do	86.6	76.8	
Silico-manganese do	26.9	25.8	
Other ferroalloys do	5.3	5.2	
Steel ingots and other primary forms. do	107.7	159.3	Canada 61.9; U.S.S.R. 54.0; Republic of South Africa 16.5.
Coils for rerolling do	90.7	269.8	U.S.S.R. 198.5; Netherlands 26.2; Canada 24.7.
Finished iron and steel products:			
Wire rod thousand tons	21.5	23.3	Sweden 9.0; Belgium 6.2; France 2.6.
Other bars and rods do	41.2	95.4	Belgium 32.7; France 18.6; Republic of South Africa 16.5.
Angles, shapes and sections. do	7.2	8.1	Belgium 1.7; Norway 1.2; United States 1.2.
Plates and sheets:			
Uncoated:			
8 mm thick and over. do	9.6	30.2	Republic of South Africa 21.0; Sweden 3.8.
Under 3 mm thick. do	143.2	153.6	Netherlands 113.8; Republic of South Africa 16.0; Belgium 6.5.
Coated do	8.5	10.3	Canada 4.3; Republic of South Africa 2.5; United States 1.8.
Hoop and strip do	6.6	10.8	Canada 4.2; United States 2.4; West Germany 1.5.
Wire, single strand not insulated. do	5.5	4.9	Sweden 2.0.
Tubes, pipes and fittings do	18.6	15.4	Sweden 7.8; West Germany 2.5; United States 1.9.
Other do	1.5	1.9	
Total iron and steel (excluding scrap).	705.2	1,102.3	
Lead:			
Ore and concentrate, lead content	23,307	27,075	Australia 20,219; Canada 3,361.
Scrap, lead and alloy	900	2,138	(1).
Bullion	49,050	47,237	Australia 113,360; Canada 40,391; Spain 11,563; U.S.S.R. 7,027; Mexico 4,778.
Refined	134,326	136,573	
Magnesium and magnesium alloys, unwrought.	5,973	5,651	(1).
Manganese ore	478,550	348,200	India 100,700; Republic of South Africa 96,630; U.S.S.R. 81,390; Ghana 26,720.
Mercury 76-pound flasks	27,047	20,725	(1).
Molybdenum ore and concentrate	8,100	5,604	(1).
Nickel:			
Mattes and speiss	63,980	54,574	(1).
Scrap	2,966	2,389	(1).
Nickel and nickel alloys unwrought	24,753	13,618	(1).
Semimanufactures	4,909	4,229	(1).
Platinum and platinum-group metals:			
Ore and concentrate	2,757	2,310	(1).
Metal and alloys, unwrought and semimanufactured. troy ounces	102,749	100,775	(1).

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals—Continued			
Silver:			
Ore and concentrate	146	109	(1).
Bullion:			
Unrefined—troy ounces	957,994	2,295,008	(1).
Refined—do	64,845,184	37,781,500	(1).
Selenium—kilograms	121,854	112,809	(1).
Silicon	7,098	8,161	(1).
Tin:			
Ore and concentrate, tin content—long tons	22,260	17,432	Bolivia 16,057; Republic of South Africa 530; Nigeria 150.
Refined tin—do	1,803	9,232	Nigeria 6,670; Malaya 1,064.
Titanium ore and concentrate:			
Ilmenite	277,751	280,328	(1).
Other	14,546	15,980	(1).
Tungsten ore and concentrate	6,733	5,755	(1).
Zinc:			
Ore and concentrate, zinc content	102,095	94,825	Australia 72,614; Canada 5,218; Peru 4,766; Burma 2,241.
Slab zinc	165,843	147,093	Canada 84,352; U.S.S.R. 12,863; Australia 12,717; Bulgaria 7,287.
Semimanufactures	1,806	1,021	(1).
Zirconium ore and concentrate	31,333	33,453	(1).
Nonmetals:			
Abrasives:			
Natural (pumice, emery, natural corundum, etc.)	13,987	11,160	(1).
Artificial:			
Corundum, unground, ground or graded	14,467	12,627	(1).
Silicon carbide	12,711	15,046	(1).
Asbestos—thousand tons	169.3	147.4	Canada 59.6; Rhodesia and Nyasaland 35.4; Republic of South Africa 28.4.
Barite	38,654	27,897	(1).
Boric acid	3,834	3,533	(1).
Borax	22,773	21,850	(1).
Cement, hydraulic—thousand tons	640.3	389.8	(1).
Clays:			
Andalusite, kyanite and sillimanite	36,383	31,823	(1).
Other	39,016	43,575	(1).
Diatomite	59,166	64,707	(1).
Feldspar and cryolite	42,550	59,155	(1).
Graphite, natural	9,618	8,943	(1).
Magnesite—thousand tons	154.1	47.6	(1).
Gypsum and anhydrite—do	149.8	135.0	(1).
Marble and other calcareous building stone	51,167	25,728	(1).
Mica, films, splittings and waste	7,561	6,082	(1).
Phosphate rock—thousand tons	1,377.4	1,421.7	Morocco 882.9; United States 273.7; Nauru 183.7.
Potash salts:			
Potassium chloride—do	705.3	677.6	France 204.5; East Germany 190.0; West Germany 169.6; Spain 57.6.
Potassium sulfate	22,205	24,551	(1).
Other fertilizer salts	53,848	----------	(1).
Pyrites—thousand tons	272.0	286.0	(1).
Sand, (excluding mineral bearing sand)—do	224.4	190.4	(1).
Sodium nitrate, natural	20,092	15,445	(1).
Sulfur—thousand tons	504.2	521.0	(1).
Talc and soapstone	41,407	44,286	(1).

See footnotes at end of table.

TABLE 4.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Mineral fuels:			
Coal, coke, and briquets. thousand tons	101	78	Commonwealth countries 73.3.
Petroleum and petroleum products:			
Asphalt and bitumen, bituminous shale, etc. thousand tons	84	88	(1).
Carbon black ---do---	296	291	(1).
Crude petroleum. thousand 42-gallon barrels	362,150	388,220	Kuwait 171,420; Iraq 54,131; Venezuela 51,698; Iran 24,028; Saudi Arabia 20,665.
Gasoline ---do---	23,060	23,401	Bahrain, Qatar, and Trucial States 4,032; Trinidad 3,967; Netherlands 3,486; Netherlands Antilles 2,560.
Kerosine ---do---	4,582	7,222	Aden 3,167; Netherlands 2,761; Netherlands Antilles 2,237; Bahrain, Qatar and Trucial States 1,559; Trinidad 436.
White Spirit ---do---	2,802	5,824	
Gas oil ---do---	15,937	16,925	Venezuela 14,234; Netherlands 10,990; Trinidad 5,770; Italy 3,920; Netherlands Antilles 3,590.
Diesel oil ---do---	916	1,282	
Residual fuel oils ---do---	35,989	50,157	
Lubricating oils ---do---	[2] 4,139	3,585	United States 1,243; Netherlands Antilles 1,120; Venezuela 394.
Petrolatum	4,918	4,685	(1).
Paraffin	32,330	29,620	(1).
Other mineral waxes	54,889	850,590	(1).
Petroleum coke	44,983	59,814	(1).
Other	(3)	(4)	(1).
Electric energy. thousand kilowatt hours	(1)	102,272.3	(1).

[1] Data not available.
[2] Includes other heavy oils 463,000 barrels.
[3] Includes products with a reported value of US$2,291,000.
[4] Includes products with a reported value of US$9,199,000.

COMMODITY REVIEW

METALS

The United Kingdom is a large processor and consumer of both ferrous and nonferrous metals. The ferrous metals industry is based partly on domestic raw materials and partly on imports. Details on raw material supplies for the ferrous industries are given subsequently under iron and steel. The domestic nonferrous metal smelting and refining industry is based almost exclusively on imported raw materials, but output is not sufficient to meet requirements of the metal manufacturing industry, making significant imports of most refined nonferrous metals necessary. Approximately 56 percent of total refined aluminum consumption, 58 percent of refined copper consumption, 29 percent of refined lead consumption, 36 percent of refined tin consumption, and 62 percent of refined zinc consumption was provided by imports of refined metal. The share of total consumption of these five major nonferrous metals derived from imported refined metals was nearly 53 percent.

Aluminum.—The United Kingdom's output of primary and secondary aluminum in 1963 was a record high, while the consumption (as measured by delivery to the fabricating and manufacturing industries) was second only to the peak year of 1960. At yearend the annual capacities of the major sectors of the British aluminum industry were—alumina 120,000 tons, primary aluminum 37,500 tons,

TABLE 5.—Consumption of principal nonferrous metals and scrap

(Metal content in metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Aluminum:					
Primary, despatches to consumers [1]	293,593	359,558	284,114	286,658	318,553
Secondary, despatches to consumers excluding exports [1]	108,217	105,360	111,498	125,647	140,780
Aluminum in scrap, direct use	15,044	17,140	11,720	9,187	10,028
Total	416,854	482,058	407,332	421,492	469,361
Scrap consumed in secondary smelters	145,951	150,629	146,725	160,118	182,341
Antimony:					
Metal	2,386	3,055	2,637	2,814	2,815
Oxides	5,154	2,698	2,321	2,110	1,948
Sulfides and crude	58	58	63	72	59
Antimony in scrap, direct use	4,747	6,444	6,215	6,979	7,363
Total	12,345	12,255	11,236	11,975	12,185
Cadmium kilograms	1,277,378	1,413,986	1,250,351	1,276,108	1,293,838
Copper:					
Primary	402,756	459,042	433,565	429,997	441,160
Secondary	83,748	101,252	95,235	96,067	116,808
Copper in scrap, direct use	156,824	173,896	163,610	133,660	130,865
Total	643,328	734,190	692,410	659,724	688,833
Lead:					
Refined lead	257,058	286,484	275,721	276,342	283,496
Scrap and remelted lead	94,400	98,997	97,793	108,957	109,809
Total	351,458	385,481	373,514	385,299	393,305
Nickel, including ferronickel	22,450	27,850	26,500	25,100	[2] 27,000
Tin:					
Primary long tons	20,604	21,790	20,242	21,439	[3]
Secondary do	792	997	1,381	995	[3]
Total do	21,396	22,787	21,623	22,434	21,770
Zinc:					
Primary:					
Slab zinc	251,235	275,904	258,675	246,344	261,626
Other	2,907	3,975	2,623	2,325	1,755
Remelted	5,968	6,733	5,930	5,290	7,070
Scrap, zinc content	81,533	85,077	77,316	68,340	74,990
Total	341,643	371,689	344,544	322,299	345,441

[1] Excludes primary content of secondary aluminum.
[2] Estimate.
[3] Data not available.

Source: British Bureau of Nonferrous Metal Statistics.

secondary aluminum 133,500 tons, and fabricated products about 512,000 tons. British Aluminium Company, Ltd., was the sole producer of alumina and primary metal and was the leading producer of semifabricated products.

Imports of bauxite in 1963 amounting to 336,755 tons were 22 percent below imports in 1962, while imports of aluminum metal in all forms showed an increase of 7 percent and consisted of scrap 9,368 tons, unwrought metal and alloys 296,233 tons, and semifabricated products 25,649 tons. The principal sources were—Canada 147,700 tons, United States 49,831 tons, Norway 45,737 tons, and U.S.S.R. 14,630 tons.

Exports amounted to 7,575 tons of unwrought metal and 56,722 tons of semifabricated products. The largest tonnages were consigned to Ghana (7,262 tons), Canada (5,915 tons) and Sweden (4,471 tons).

TABLE 6.—Principal aluminum industry companies and facilities in 1963

Company	Works	Product	Capacity (metric tons)
British Aluminium Company, Ltd.	Burntisland	Alumina	70,000
	Newport	do.	50,000
	Kinlochleven	Primary metal	10,000
	Lochaber	do.	25,000
	Foyer	Primary metal, super purity.	2,500
	Various plants	Semimanufactures	170,000
International Alloys, Ltd.	Aylesburg and Birmingham.	Secondary metal	50,000
Alcan Enfield Alloys, Ltd.	London Colney and Bradford.	do.	25,000
BKL Alloys, Ltd.	Kings Norton	do.	10,000
James Booth Aluminium, Ltd.	Birmingham	Semimanufactures	50,000
Imperial Aluminium Co.	Waunarlwydd	do.	40,000
British Insulated Callendars Cables, Ltd.	Prescott	do.	30,000
Aluminium Wire and Cable, Ltd.	Swansea	do.	20,000
Birmetals, Ltd.	Birmingham	do.	15,000
High Duty Alloys	Various plants	do.	15,000
Aluminium Corporation	Dolgarrog	do.	10,000

Copper.—Refined copper production during 1963 was 7.6 percent less than in 1962 and 10 percent below the 1961 high. Production was derived from blister, all of which was imported, and from scrap, most of which was of domestic origin. However, domestic refineries supplied only 38 percent of the 557,968 tons of refined copper consumed in semimanufactures and castings. An additional 130,865 tons of scrap was used in the production of semis, castings and copper sulfate. The total consumption of copper in industry represented an increase of 4 percent over 1962 but was 6 percent below 1960, the peak year for consumption.

The principal copper producer was British Copper Refiners, Ltd., which had a capacity nearly double that of second ranked Elkington Copper Refiners, Ltd.

TABLE 7.—Principal copper producers in 1963

Company	Location of works		Refining method	Capacity (metric tons)
	Town	County		
British Copper Refiners, Ltd.	Prescott	Lancashire	Fire and electrolytic.	120,000
Elkington Copper Refiners, Ltd.	Walsall	Staffordshire	do.	66,000
Enfield Copper Refining Co., Ltd.	Brimsdown	Middlesex	do.	25,000
Thomas Bolton and Son	Widnes	Lancashire	Fire	20,000
	Froghall	Staffordshire		
McKechnie Brothers	Widnes	Lancashire	Fire and electrolytic.	(1)
Wolverhampton Metal Co., Ltd.	Wolverhampton	Staffordshire	do.	(1)
Imperial Chemical Industries Actid, Ltd.	Glasgow	Lanarkshire	Electrolytic	3,000
		Glasgow		
International Refining Co., Ltd.	Stratford	London	Fire	(1)
Murex, Ltd.	Rainham	Essex	do.	12,000
Capper Pass and Son, Ltd.	Bristol	Gloucestershire	do.	(1)
	North Ferriby	Yorkshire	Electrolytic	(1)

[1] Data not available.

Iron and Steel.—*Iron Ore.*—Production in 1963 declined about 2 percent from the 1962 level and nearly 13 percent from the 1960 high.

Consumption of home ore showed a parallel decrease, reflecting an increase in the ratio of imported ore to home ore consumed, which was roughly 2:1 based on the iron content of all ores consumed in iron and steelmaking. As in recent years, the great bulk of the domestic production came from the Northampton Sand Ironstone bed (53 percent of the total) and the Frodingham Ironstone bed (35 percent of the total), the principal deposits of the Humber-Severn Belt. This iron ore belt, extending south from the River Humber, vicinity of Scunthorpe, to Banbury, Oxford includes the Frodingham, Claxby, Lincoln, South Lincolnshire, Rutland, Leicester, Northampton, and Oxford ore fields which together accounted for more than 96 percent of the total iron ore production.

With the exhaustion of the Cleveland and some other deposits which have been important in the past, expansion of iron ore capacity to help meet the increasing requirements of the iron and steel industry involves mainly the Northampton Sand bed and to a lesser extent the Frodingham Ore Bed. Although there are many factors that make steel produced locally from domestic ores competitive with steel made from high-grade imported ores, in spite of the low average grade of domestic output, there is a limit to the relative quantity which can be economically consumed in the industry and the rate at which the ores can be mined with consideration for conservation of resources and the welfare of the mining districts. While the Frodingham ore averages only about 20 percent iron, it is calcareous and can be used in blending to replace limestone flux in the furnace charge. On the other hand the Northampton sand ore contains about 31 percent iron, but is generally silicious and requires blending with limestone or the lower grade calcareous ores for fluxing. However, since these ores are basically carbonates, their iron content is increased by calcination or sintering and they make a self-fluxing sinter when properly blended. The marlstones, and some Frodingham ironstone therefore have been used extensively in sinter plants for blending with imported high-grade silicious ores.

The Iron and Steel Board has concluded [2] that consumption of 32 million tons (32.5 million metric tons equivalent) of domestic ore could be expected in 1970 based on capacity operation of the iron and steel industry, and that this would represent the maximum desirable rate of extraction with respect to the presently known reserves, quantitative estimates of which were reported as follows:

Area	Reserve (million metric tons)	
	Proved and probable	Possible
Frodingham	860	530
Northampton Sand:		
North of the River Welland	830	145
South of the River Welland	740	115
Oxfordshire and Southwest:		
Northampton Marlstone	220	110
South Lincolnshire and Leicester Marlstone	1	

[2] Iron and Steel Board, Development in the Iron and Steel Industry, Special Report, 1961, p. 74.

The larger part of the iron ore mining was conducted by the iron and steel companies which consumed the ore, the principal of which were (1) Stewarts and Lloyds with main operations concentrated in the Northampton Sand bed around Corby, south of the Welland, and other operations at Thistleton north of the Welland and in the Oxfordshire field, and (2) the United Steel Companies with operations in the Northampton sand at Colsterworth north of the Welland, in the Frodingham ore bed near Scunthorpe, and in the Cumberland hematite field near Workington. GKN Steel Company Ltd., Richard Thomas and Baldwins Ltd., and some foundry iron producers were also producers of iron ore.

Imports of iron ore during 1963 increased by 11 percent over imports in 1962 to 14.55 million tons of which 4.7 million tons were derived from Sweden, 2.4 million from Canada, and about 1 million tons each from Venezuela and Liberia. No exports of iron ore were reported.

TABLE 8.—Salient iron and steel statistics

(Thousand metric tons unless otherwise specified)

	1955	1959	1960	1961	1962	1963
IRON ORE						
Production by field and type:						
Lancashire, Cumberland and Glamorgan hematite, 49 percent Fe	456.9	455.1	441.9	420.7	384.3	401.5
Frodingham ironstone (including Claxby), 21 percent Fe	4,490.3	4,840.5	5,498.5	5,636.9	5,604.5	5,352.2
Cleveland oolite, 28 percent Fe	634.7	424.9	470.3	450.8	263.7	142.7
South Lincolnshire and Leicester marlstone 25 percent Fe	1,027.5	690.4	805.8	628.5	480.1	354.0
Oxford and S.W. Northamptonshire marlstone 22 percent Fe	1,617.5	1,056.9	1,349.7	1,014.7	788.1	919.3
Northampton sand ironstone, 31 percent Fe	8,207.7	7,640.4	8,795.4	8,631.5	8,001.6	7,983.3
Total,[1] 27 percent Fe	16,434.6	15,108.2	17,361.6	16,783.1	15,522.3	15,153.0
Consumption:						
In blast furnaces:						
Domestic iron ore	10,548.2	7,204.1	7,496.1	6,541.2	4,756.4	3,460.7
Imported iron ore, 58 percent Fe [2]	8,480.5	6,339.9	7,915.3	6,937.3	4,994.9	5,281.5
Imported manganese ore	421.6	314.9	479.1	354.1	387.0	(3)
Total	19,450.3	13,858.9	15,890.5	13,832.6	10,138.3	8,742.2
In sinter plants:						
Domestic iron ore	6,060.0	7,840.0	9,840.8	10,201.3	10,793.2	11,727.2
Imported iron ore, 58 percent Fe [2]	3,116.3	5,185.5	7,113.8	6,795.6	7,271.6	8,627.5
Imported manganese ore	.1			8.1	8.6	(3)
Total	9,176.4	13,025.5	16,954.6	17,005.0	18,073.4	20,354.7
In steelworks:						
Domestic iron ore	13.8	11.5	11.3	11.0	8.6	9.7
Imported iron ore, 64 percent Fe [2]	850.6	1,039.1	1,369.4	1,197.0	977.3	908.0
Imported manganese ore	1.0	.6	.1	.2	.6	(3)
Total	865.4	1,051.2	1,380.8	1,208.2	986.5	917.7
Total:						
Domestic iron ore, 27 percent Fe [1]	16,622.0	15,055.6	17,348.2	16,753.5	15,558.2	15,197.6
Imported iron ore, 58 percent Fe [2]	12,447.4	12,564.5	16,398.5	14,929.9	13,243.8	14,817.0
Imported manganese ore; 9 percent Fe, 44 percent Mn [2]	422.7	315.5	479.2	362.4	396.2	(2 3)
Grand total	29,492.1	27,935.6	34,225.9	32,045.8	29,198.2	30,014.6

See footnotes at end of table.

TABLE 8.—Salient iron and steel statistics—Continued

(Thousand metric tons unless otherwise specified)

	1955	1959	1960	1961	1962	1963
SCRAP						
Arisings from own works	7,142.1	7,724.9	8,888.9	8,216.4	7,896.9	(4)
Purchased (Home and Imported)	8,193.4	8,056.3	10,067.4	9,041.5	7,956.4	(4)
Consumption	15,607.4	15,644.8	18,349.4	16,993.1	15,912.2	17,232.0
Stocks at end of year	1,013.0	1,351.7	1,645.8	1,590.3	1,228.5	1,067.0
SINTER						
Production of sinter	7,892.5	11,643.0	15,023.8	14,840.6	15,940.7	18,053.6
Average materials consumed per ton of sinter produced:						
Domestic iron ore—kilograms	765.5	673.5	655.0	687.5	675.0	649.7
Imported iron ore—do	395.0	445.5	473.5	458.5	456.5	477.9
Pyrites residue and purple ore—do	47.0	56.0	56.0	49.0	43.0	33.4
Other iron-bearing materials [5]—do	100.5	90.5	83.0	84.0	82.0	81.9
Limestone and sandstone—do	11.0	36.5	47.5	53.0	57.5	52.1
Coke breeze and anthracite—do	105.0	101.0	96.5	100.5	103.0	101.6
Total—do	1,424.0	1,403.0	1,411.5	1,432.5	1,417.0	1,396.6
PIG IRON						
Production of pig iron by type:						
Hematite	1,437.4	1,037.4	1,206.2	1,155.1	889.8	830.9
Basic	9,444.7	10,449.7	13,281.9	12,452.4	11,754.0	12,846.9
Forge and foundry	1,591.0	1,146.7	1,319.1	1,215.4	1,070.9	1,021.6
Blast furnace ferroalloys	196.3	150.1	208.6	160.9	197.2	126.7
Total [6]	12,670.1	12,784.4	16,015.9	14,983.8	13,911.9	14,826.1
Average number of furnaces in blast—number of units	99	78	85	82	73	63
Average annual output per furnace	128.4	163.2	188.4	182.7	189.8	232.3
Average materials consumed per ton of pig iron produced:						
Domestic iron ore, as charged—kilograms	793.5	549.5	459.0	430.5	338.0	232.2
Average Fe content—percent	27	28	27	27	27	----------
Imported iron ore, as charged—kilograms	669.5	496.0	494.0	463.0	359.0	[7] 356.2
Average Fe content—percent	57	56	56	55	58	(5)
Imported manganese ore—kilograms	33.5	24.5	30.0	23.5	28.0	(5)
Average Fe content—percent	8	9	10	8	9	(5)
Sinter—kilograms	619.0	898.5	938.5	992.0	1,143.0	1,207.7
Scrap—do	67.0	88.0	92.5	93.5	103.5	104.7
Other Fe bearing materials [8]—do	93.5	103.5	106.0	111.5	102.5	89.3
Limestone and dolomite—do	220.0	156.5	154.0	139.5	114.0	96.4
Total—do	2,496.0	2,316.5	2,274.0	2,253.5	2,188.0	2,086.5
Consumption of pig iron:						
In ironworks and iron foundries	2,409.5	1,746.1	1,951.0	1,779.5	1,575.1	1,585.0
In steelworks and steel foundries	10,593.3	11,284.8	14,129.3	12,857.8	12,300.8	13,526.0
Total	13,002.8	13,030.9	16,080.3	14,637.3	13,875.9	15,111.0

See footnotes at end of table.

TABLE 8.—Salient iron and steel statistics—Continued

(Thousand metric tons unless otherwise specified)

	1955	1959	1960	1961	1962	1963
CRUDE STEEL						
Production by type:						
Open hearth:						
Acid	1,016.3	625.6	668.7	620.3	452.6	389.0
Basic	16,513.0	16,976.5	20,193.7	18,058.6	16,670.5	17,190.9
Bessemer:						
Acid	256.2	218.1	299.1	258.1	196.0	221.9
Basic (including Linz-Donawitz and Kaldo)	1,048.2	1,215.6	1,707.7	1,721.1	1,911.5	2,895.0
Electric:						
Arc	987.4	1,245.1	1,564.5	1,531.4	1,393.3	1,986.7
Induction	128.6	125.0	148.0	143.1	111.1	123.5
Stock converter	8.8	1.5	1.4	1.4	.8	----------
Tropenas	149.7	103.0	112.0	106.6	84.9	74.6
Total	20,108.2	20,510.4	24,695.1	22,440.6	20,820.7	22,881.6
Including:						
Ingots	19,531.9	20,000.9	24,101.1	21,845.4	20,320.0	22,385.9
Steel for castings	576.3	509.5	594.0	595.2	499.9	495.7
Average materials consumed per ton of crude ingots and castings produced:						
Pig iron:						
Molten kilograms	392.5	445.0	462.5	473.0	497.5	512.0
Cold do	134.5	105.0	109.5	100.0	93.0	78.2
Scrap:						
Cast iron do	20.5	26.0	24.5	22.0	21.5	21.0
Steel do	540.0	510.5	496.0	497.0	489.5	496.6
Oxides:						
Domestic iron ore do	.7	.6	.5	.5	.4	.4
Imported iron ore do	42.3	50.7	55.4	53.3	47.0	39.7
Fe content of imported ore percent	(1)	66	65	65	64	(8)
Scale and other oxides kilograms	17.7	16.0	14.6	15.9	16.5	17.5
Finishings do	16.0	16.5	16.5	17.5	16.6	16.2
Fluxes do	93.0	93.5	93.0	94.5	94.5	91.5
Fettling materials do	32.5	29.5	29.0	27.0	25.0	23.4
Total	1,289.7	1,293.3	1,301.5	1,300.7	1,301.5	1,296.5
FINISHED STEEL						
Production: [9]						
Heavy rails and accessories	(10)	431.0	570.9	519.5	342.1	290.6
Plates	(10)	2,479.6	2,927.2	2,824.5	2,317.7	2,594.2
Heavy bars and sections	(10)	2,260.7	2,840.9	2,601.5	2,203.4	2,414.5
Wire rods and other bars and rods in coils	(10)	1,262.1	1,543.4	1,388.6	1,409.6	1,495.2
Other light bars and sections	(10)	2,927.2	3,552.3	3,258.8	2,876.7	2,927.0
Hot rolled strip	(10)	1,463.9	1,766.1	1,446.2	1,487.8	1,693.3
Sheets	(10)	2,516.7	2,874.0	2,564.7	2,955.4	3,635.0
Tinplate, terneplate and blackplate	(10)	1,121.2	1,254.2	1,094.7	1,218.1	1,225.8
Tubes, pipes and fittings	(10)	1,199.1	1,363.2	1,263.8	1,221.3	1,252.2
Tires, wheels and axles	(10)	148.0	163.1	139.4	115.3	79.3
Forgings (other than drop forgings)	(10)	187.1	207.4	221.7	174.6	169.1
Steel castings	(10)	258.5	303.7	306.3	266.0	258.9
Consumption:						
Plates	(10)	(10)	2,351.0	2,340.8	2,128.5	2,250.2
Sheets	(10)	(10)	2,630.1	2,351.0	2,499.6	2,735.2
Tinplate, terneplate and blackplate	(10)	(10)	683.0	667.8	713.3	773.6
Other steel	(10)	(10)	9,489.7	9,119.3	8,553.7	8,776.5
Total	(10)	(10)	15,153.8	14,478.9	13,895.1	14,535.5

See footnotes at end of table.

TABLE 8.—Salient iron and steel statistics—Continued

(Thousand metric tons unless otherwise specified)

	1955	1959	1960	1961	1962	1963
FINISHED STEEL—continued						
Consumption—Continued						
Stocks of mill products at end of year:						
Held by producers:						
Ingots and semis	(10)	1,448.6	1,707.6	1,674.8	1,650.9	(10)
Finished steel	(10)	831.8	1,037.6	984.3	1,088.1	(10)
Held by consuming industries and stockholding merchants:						
Plates	(10)	740.2	822.5	859.8	614.5	631.3
Sheets	(10)	536.8	939.5	727.9	644.6	631.5
Tinplate, terneplate and blackplate	(10)	135.2	176.0	162.8	157.1	165.8
Other steel	(10)	2,745.0	3,232.8	3,054.6	2,525.6	2,387.9
Total consumer and merchant stocks	(10)	4,157.2	5,170.8	4,805.1	3,941.8	3,816.5
Consumption of finished steel by consuming industries:						
Coal mining	(10)	(10)	605.6	581.8	496.5	497.4
Food, drink and tobacco	(10)	(10)	87.0	90.2	101.0	95.8
Chemical and allied industries	(10)	(10)	136.9	148.0	131.3	125.2
Iron and steel	(10)	(10)	814.9	739.5	640.1	636.7
Machinery, machine tools and equipment	(10)	(10)	1,273.5	1,332.3	1,237.5	1,342.9
Ordnance, small arms and mechanical engineering n.e.s.	(10)	(10)	533.5	450.3	452.7	486.9
Industrial plant and steelwork	(10)	(10)	1,702.3	1,880.7	1,608.2	1,637.7
Tools, instruments and implements	(10)	(10)	87.1	90.4	88.4	87.8
Electrical industries	(10)	(10)	686.9	671.7	691.4	750.6
Shipbuilding	(10)	(10)	737.3	748.1	650.3	582.1
Motor vehicle manufacturing and servicing	(10)	(10)	2,298.8	1,752.1	1,942.4	2,225.3
Other vehicles, aircraft manufacture and repair	(10)	(10)	162.4	140.3	130.3	132.0
Railway equipment and other transportation services	(10)	(10)	715.3	737.3	533.4	457.4
Bolts, nuts, wire and wire manufactures	(10)	(10)	1,516.1	1,393.1	1,339.2	1,444.8
Other metal manufactures	(10)	(10)	2,416.8	2,379.5	2,451.2	2,614.6
Construction	(10)	(10)	948.8	961.1	939.1	927.5
Utilities	(10)	(10)	81.3	59.6	104.2	97.4
Other consumers	(10)	(10)	349.3	322.9	358.0	393.4
Total	(10)	(10)	15,153.8	14,478.9	13,895.2	14,535.5

[1] Weighted average, based on quantity of each grade consumed in 1962.
[2] Weighted average, based on quantities of each grade received in 1962.
[3] Included with imported iron ore.
[4] Data not available.
[5] Includes burnt spent and black oxides, flue dust, scale, slag, and other materials.
[6] Includes direct castings not shown in table.
[7] Includes manganese ore.
[8] Includes cinder, purple ore, scale, and slag.
[9] Includes some material for conversion into other products also listed in this table.
[10] Comparable figures not available.

Scrap.—During 1963, as in 1961 and 1962, domestic scrap was available in excess of steel industry requirements. Imports were insignificant, amounting to less than 5,000 tons. Under relaxation of restrictions on the export of ferrous scrap, 1.08 million tons were exported, of which 55 percent went to countries of the European Coal and Steel Community (ECSC), 17 percent to Japan, and 14 percent to Spain. These exports compared with 1.1 million tons in 1962 and 31,000 tons in 1961 when the relaxation took effect. With the tightening of supplies at the end of 1963, however, the Government was requested to reimpose the restrictions. They were to become effective in April 1964; under these restrictions, the only grades of scrap which can be exported are compressed baled iron and steel scrap, turnings and borings, not exceeding an f.o.b. value of f25 per long ton—equivalent to US$71 per metric ton. Consumption of scrap increased by 8.3 percent partially because of the overall increase in crude steel production, and partially because of the increase in the ratio of scrap to pig iron consumed in steelmaking, the latter a result of the increase in output of electric steel, which is made almost entirely from scrap.

Pig Iron.—Production increased by about 6.6 percent over that of 1962 but remained 7.4 percent below the 1960 output. Imports amounted to 201,000 tons, still less than 1 percent of the supply. Consumption in steelworks increased by about 10 percent to 13.5 million tons, while that in iron works and foundries showed only a slight increase over 1962 consumption.

Steel.—The output of 22.88 million tons of crude steel in 1963, while considerably short of the record 24.69 million tons produced in 1960, represented a substantial recovery from the recession which started in 1961 and continued into 1963. Actually, production during the fourth quarter approached the rate for the similar period of 1960, with indications for a record output of both pig iron and crude steel during 1964. Notable was the increase in the production of steel by the oxygen processes (basic bessemer, LD, LD–AC, Rotor and Kaldo) which represented 12.6 percent of the total output for an increase of more than 50 percent, and of steel by the electric processes which represented 9.2 percent of the total, for an increase of more than 40 percent. These high tonnages reflect the changing pattern of steelmaking and were made possible by the commissioning of new facilities under the Iron and Steel Industry Development Program. The output of finished steel showed a parallel trend with a record production of steel sheets, also made possible by recently completed facilities.

There was a general increase in the imports of all classes of iron and steel, the total increment amounting to about 527,000 tons, or 48 percent more than in 1962. Exports declined in most classes, but the increase in tonnage of flat rolled products exported (22 percent over that of 1962) more than offset the decreases.

New Developments in the Industry.—Postwar projects costing more than US$280,000 each carried out under the supervision of the Iron and Steel Board or its predecessors, and completed through 1963 represented a total capital investment of about US$4,250 million, and resulted in the expansion of pig iron capacity to about 22 million tons and crude steel capacity to more than 29 million tons. At the same time, old but still economic plants and equipment were modernized,

and obsolete plants representing a capacity of more than 6 million tons of pig iron and 7 million tons of crude steel were replaced or withdrawn. However, there was still in operation at the beginning of 1964 somewhat more than 1 million tons of obsolescent steelmaking capacity.

TABLE 9.—Iron and steel trade in 1963

(Thousand tons and thousand U.S. dollars)

Commodity	Imports		Exports	
	Quantity	Value	Quantity	Value
Iron ore	14,552	182,773		
Iron and steel scrap	5	235	1,082	35,742
Pig iron, including sponge iron, etc.	202	10,977	106	6,261
Ferroalloys	215	40,722	7	3,789
Crude steel: ingots and primary forms	262	20,937	44	5,245
Coils for rerolling	246	25,594		
Bars, rods, angles, shapes and sections	282	33,232	687	96,346
Plates and sheets uncoated	365	53,153	1,209	152,028
Plates and sheets coated	20	3,766	621	119,219
Hoop and strip	13	8,695	160	30,616
Railway track material	(1)	38	96	10,857
Wire, single strand	6	2,830	116	28,226
Tubes, pipes and fittings	16	9,052	513	115,237
Rough castings and forgings	2	1,230	15	4,990
Total iron and steel (excluding scrap)	1,629	210,226	3,574	572,814
Countries of origin and destination:				
Commonwealth countries	268	29,637	478	87,511
European Coal and Steel Community	583	71,530	683	88,253
European Free Trade Area	344	54,273	450	75,169
Spain	(2)	(2)	117	17,917
United States	16	8,972	317	51,324
U.S.S.R.	240	23,708	290	37,043
Other countries	178	22,106	1,239	215,597

[1] Less than 500 tons.
[2] Included with "other countries."

At the end of 1963 the British iron and steel industry consisted of some 350 companies with total employment of about 475,000 (including iron mines and quarries). Twenty-three of these were major companies which together with their subsidiaries accounted for about 96 percent of the pig iron and 94 percent of the crude steel produced in 1960, and which should control about the same proportions of the production potential scheduled for 1965.

The location of most of the iron and steel plants was determined primarily by the availability of coal, iron ore, scrap, labor, and markets; the latter also has determined the nature of the products. However, depletion of many local coal and iron ore deposits, changes in regional economy, and the pressures of competition from abroad have reduced or otherwise altered the relative importance of these factors, and the new works have been projected with consideration for national requirements as well as local. The result has been a broadening of the variety of products created in each district, a general expansion of capacity in all categories, and a substantial relative increase in wide strip and sheet mill capacity.

TABLE 10.—Principal iron and steel companies and works, production and capacities

(Thousand tons)

Company	Works and location by county	1960 Production		1965 Potential	
		Pig iron [1]	Crude steel	Pig iron [1]	Crude steel
Bairds Scottish Steel, Ltd	Gartsherrie, Coatbridge, Airdrie, (Lanarkshire).	242	(2)	284	100
Barrow Ironworks, Ltd	Barrow-in-Furness (Lancashire)	237	--------	508	--------
Briton Ferry Steel Co., Ltd	Briton Ferry, (Glamorganshire)	--------	254	--------	305
Colvilles, Ltd. group	Motherwell-Ravenscraig, Cambuslang, Coatbridge, Gartcosh and other works in Lanarkshire, and Glencarnock in Ayrshire.	1,043	2,194	2,083	3,485
Consett Iron Co., Ltd	Consett and Jarrow (Durham)	741	1,008	1,016	1,377
Dorman, Long and Co., Ltd	Acklam, Britannia, Cleveland, Lackenby and Redcar, near Middlesborough (North Riding, Yorkshire).	1,557	2,364	2,256	3,048
English Steel Corp., Ltd	River Don and Tinsley Park, Sheffield (Yorkshire).	--------	579	--------	970
Ford Motor Co., Ltd	Dagenham, (Essex)	234	--------	259	--------
G.K.N. Steel Co., Ltd.: Brymbo Steel Works	Brymbo near Wrexham (Denbighshire).	--------	200	--------	290
Guest Keen Iron and Steel Works. Lysaght's Scunthorpe Works	Cardiff (Glamorganshire)	684	810	869	1,016
	Normandy Park, Scunthorpe (Lincolnshire).	456	679	792	950
Lancashire Steel Manufacturing Co., Ltd.	Irlam (Lancashire)	373	613	732	889
Llanelly Steel Co. (1907), Ltd	Llanelly (Carmarthenshire)	--------	249	--------	356
Millom Hematite Ore and Iron Co., Ltd.	Millom (Cumberland)	282	--------	508	--------
The Park Gate Iron and Steel Co., Ltd.	Rotherham (Yorkshire)	--------	440	--------	803
The Patent Shaft Steel Works, Ltd	Wednesbury (Staffordshire)	--------	249	--------	386
Round Oak Steel Works, Ltd	Brierley Hill (Staffordshire)	--------	459	--------	513
Skiningrove Iron Co., Ltd	Skiningrove (North Riding, Yorkshire).	226	281	254	356
South Durham, Steel and Iron Co., Ltd.	Cargo Fleet and West Hartlepool (Durham).	823	1,095	1,524	2,032
The Steel Co. of Wales	Newport, Port Talbot, Trostre and Velindre (Glamorganshire).	1,922	2,859	2,590	3,708
Stewarts and Lloyds, Ltd	Bilston (Staffordshire)	230	495	305	560
	Clydesdale (Glascow)	--------	281	--------	305
	Corby (Northamptonshire)	845	1,163	1,372	1,575
The Stanton Ironworks Co., Ltd	Holwell and Stanton-by-Dale (Nottinghamshire).	718	--------	635	--------
The Stavely Iron and Chemical Co., Ltd.	Sheepbridge and Stavely (Derbyshire).	526	--------	559	--------
John Summers and Sons, Ltd	Shotton (Chester)	764	1,346	1,209	1,930
Shelton Iron and Steel, Ltd	Etruria, Stoke-on-Trent (Staffordshire).	279	259	330	356
Richard Thomas and Baldwins, Ltd.	Redbourn Works Scunthorpe (Lincolnshire).	353	541	549	700
	Ebbw Vale Works (Monmouthshire).	602	816	686	940
	Spencer Works do	--------	--------	1,367	1,422
	Other works: (England and Wales).	--------	602	--------	559
The United Steel Companies, Ltd.: Appleby-Frodingham Steel Co. branch.	Scunthorpe (Lincolnshire)	1,518	1,396	1,981	1,930
Samuel Fox and Co., Ltd	Stocksbridge (Yorkshire)	--------	430	--------	508
Steel Peech and Tozer branch	Sheffield (Yorkshire)	--------	1,177	--------	1,372
Workington Iron and Steel Co. branch.	Workington (Cumberland)	518	330	569	335
Other companies	----------	843	1,526	996	1,803
Total	----------	16,016	24,695	24,233	[3] 34,879

[1] Includes blast furnace ferroalloys.
[2] Data are not available.
[3] Includes about one million tons of obsolescent capacity.

Noteworthy among the technological developments were the adoption of high top pressures and oil injection in blast furnace practice, application of the oxygen or oxygen-steam blast to open hearth and bessemer steel furnaces, the replacement of open hearth capacity with electric melting facilities, adoption of the new oxygen steelmaking processes (LD, LD–AC, Kaldo, and Rotor), in steelworks, the installation of vacuum degassing and continuous casting equipment, the installation of gas cleaning equipment to inhibit air pollution, and the installation of automatic control systems.

General Data and New Developments in Specific Areas and Plants.—The iron and steel industry of Scotland (Lanarkshire) is based on local coal and scrap and imported iron ores. The principal products are heavy plate and sections for the shipbuilding and heavy engineering industries, and light plate, sheets and tubes; the district accounted for 18 percent of the 1960 output of heavy plates and sections. Colvilles' works completed in 1963, at Ravenscraig, near Motherwell, represents both an expansion and diversification. It is a completely new iron and steel works which produces open-hearth and LD steel for a 60-inch-wide hot strip mill and an associated cold reduction mill at Gartcosh 8 miles from Motherwell. The facility includes two blast furnaces, two 100-ton LD converters, and one 250-ton open-hearth furnace integrated with a slabbing and blooming mill and the hot strip mill. It is expected to produce 900,000 tons of pig iron, 1,260,000 tons of ingot steel, 500,000 tons of sheets, and 175,000 tons of light plates annually.

The industry of the Northeast coast district, site of the works of three major iron and steel companies, is based on local coal and scrap and imported iron ores. The district accounted for 41 percent of the 1960 output of heavy plates and sections for the shipbuilding and engineering construction industries and 11 percent of the 1960 output of light rolled products.

The Consett Iron Co., Ltd., with works at Consett, Durham, had completed, prior to 1963, an iron and steel works with an open-hearth melting shop to supply steel to an integrated 4-high 11-foot plate mill, designed to replace older mills. Nearly complete at yearend was an additional oxygen steelworks, consisting of two 100-ton LD and two 100-ton Kaldo converters, and designed to supply steel to a continuous strip and bar mill which was also under construction.

The Dorman Long (Steel), Ltd., with works on the east side of the River Tees near Middlesborough, North Riding, Yorkshire, completed a new slabbing and blooming mill at Lackenby in 1963. This completion was one of the last stages of a major modernization and expansion program undertaken by the company soon after World War II. Among the objects of the project were concentration of ore handling and iron making at Cleveland and the development at Lackenby of steelmaking and rolling mill facilities which could be more or less integrated with the nearby Cleveland and Redcar works. Completed at yearend were three new blast furnaces, a blooming mill and medium section mill at Cleveland, and an open-hearth melting shop with a capacity of about 900,000 ingot tons annually, rolling mills including a billet mill, a universal beam and heavy section mill, a rod, bar and narrow strip mill, and a slabbing and blooming mill at Lack-

enby. Still under construction were a wire rod mill, universal plate mill, and cold rolling equipment. The expected crude steel capacity of the combined works was reported as 2,600,000 tons annually.

Recent developments in the South Durham Steel and Iron Co., Ltd., works at Cargo Fleet, West Hartlepool, and Stockton-on-Tees, Durham, for the most part were commissioned prior to 1963. These included additional capacity at the Cargo Fleet and the West Hartlepool North Works for iron and steel making and the rolling of light, medium, and heavy plate, heavy sections, and universal beams. A new integrated works (South Works) designed for the production of heavy steel plate was constructed at Greatham, West Hartlepool. The works include coke ovens, a blast furnace, open-hearth melting shop, a slabbing mill, and a 2-stand 4-high 12½-foot plate mill. Reported steel capacity was 830,000 ingot tons annually.

The three major iron and steel works of the Lincolnshire district located at Scunthorpe are based on Yorkshire coal, regional scrap, and local (Frodingham and Northampton Sand) iron ores. The principal products are plate, heavy and light sections, and semis for finishing elsewhere. The United Steel Companies' Appleby-Frodingham branch developed the so-called Ajax equipment designed for the conversion of older open-hearth furnaces to utilize oxygen injection for increased productivity. Through 1963, six furnaces had been converted to the Ajax design and one was in progress. Replacements and additions increased capacity for the production of plates, heavy sections, and universal beams. New installations included a billet mill, a continuous rod and bar mill (capacity 300,000 to 350,000 tons annually) and a continuous casting plant for the casting of 9-inch-square blooms (capacity 250,000 tons annually).

Lysaght's Scunthorpe Works of the GKN Steel Co., Ltd., produces billets, blooms, sheet bar, and wire rod. A major expansion project completed in 1960 included new ore preparation, sinter, and blast furnace installations and additional billet and rod mill capacity. Partially completed in 1963 was a further expansion project scheduled for completion during 1964 including ironstone mine development, ore preparation, sinter plant, an oxygen steel melting shop comprising two 50-ton LDAC converters and a mixer. This plant, when completed, should increase Lysaght's crude steel capacity to more than 1 million ingot tons annually.

Richard Thomas and Baldwins' Redbourn Works produce billets, sheet bars, and slabs. The major modernization and expansion project, completed in 1962, included enlarging and relining of three blast furnaces, new ore preparation and sinter plants, the installation of two Rotor (oxygen process) furnaces, and the replacement of cogging and billet mills by new units including an 8-stand continuous-billet mill. Under construction at yearend was a new hot scarfing machine for billets. These projects bring the capacity of the Redbourn Works to 690,000 tons of ingot steel and 600,000 tons of billets annually.

The Northwest coal (Cumberland and north Lancashire) area's Workington Iron Company branch of United Steel Companies at Workington, Cumberland, comprises Britain's only major acid Bessemer steelworks. Originally based on local coal and scrap iron and the low-phosphorus hemetite ores of the Cumberland fields, the works

is now dependent to a large extent on imported ores. The products are predominantly steel rails and railway track material. Modernization and replacement of rolling mill equipment and generating plant was completed in 1962.

The Barrow Iron Works, Barrow-in-Furness, Lancashire, one of the last companies to be denationalized, was acquired in January 1963 by the Millom Hematite Ore and Iron Co. of Millom, Cumberland, which at the same time announced the intention of closing the works because the capacity is no longer needed. The Millom Co. completed a program of replacement and expansion at its Millom works which was initiated while the works was still under nationalized control.

The Barrow Steel Works, Ltd., Barrow-in-Furness, Cumberland, is owned by the United Steel Companies, Ltd., and is used as a research establishment for continuous casting. The works has a capacity of 50,000 tons of ingot steel annually and consists of one 7-ton electric arc furnace, one 20-ton electric arc furnace supplying steel to three twin-strand continuous casting machines and integrated rolling mills to produce billets, blooms, slabs, bars, sections, hoop, and strip.

At the beginning of 1963 the Sheffield district (Yorkshire other than North Riding) had one blast furnace plant, which utilized domestic ore from Lincolnshire and Northhamptonshire, and 43 steelworks and foundries with a total of 243 steel furnaces including 23 acid open-hearth, 37 basic open-hearth, 4 Tropenas, 57 electric arc and 122 electric-induction, dependent mainly on local scrap from the manufacturing industries and pig iron from other districts. During the peak year of 1960 the district accounted for 12.6 percent of the total crude steel output and 68 percent of the 1.65 million tons of alloy steel produced.

The Steel Peech and Tozer branch, United Steel Companies, Ltd., in the Sheffield district, had completed and put into operation at Templeborough 3 new 110-ton electric arc furnaces as part of a major project involving the replacement of 21 existing open-hearth furnaces at their Templeborough and Rotherham Works by a new electric melting shop at Templeborough. When completed, the new shop will consist of six 110-ton electric arc furnaces with vacuum casting facilities designed to produce 1,350,000 ingot tons of crude steel annually and is expected to be the world's largest electric melting shop. The project also included modernization of the bar mill and a new 4-stand cold reduction mill to operate in conjunction with a medium width hot strip mill at Brinsworth completed in 1960. In addition to billets, bars, sections, and strip, this company is a leading producer of railway rolling stock.

The English Steel Corp. completed in 1963, on a new site at Tinsley Park, Sheffield, a new melting shop and rolling mill consisting of two 100-ton electric arc furnaces with vacuum degassing equipment, a 42-inch blooming mill, two 32-inch billet mills, an 18-inch roughing bar mill and 18-inch, 14-inch, and 11-inch finishing mills. This facility will produce billets and bars of alloy and special carbon steel and will permit the closing of the obsolete works in Sheffield. In 1962 the company completed a vacuum melting plant at their River Don Works in Sheffield and a ladle degassing unit at their Openshaw Works in Manchester.

The Park Gate Iron and Steel Co., Ltd., subsidiary of Tube Investments, Ltd., had scheduled for completion in 1964 at Rotherham in the Sheffield area, a new steelworks comprising two 75-ton Kaldo oxygen converters, a 75-ton electric arc furnace, a rotary steel casting plant, a 42-inch blooming mill, a continuous billet mill, and a continuous narrow hot strip mill. This works was in addition to the existing works at Park Gate comprising 10 oxygen-equipped open-hearth furnaces which supply mills for the production of bars and sections; the Rotherham steelworks was designed to raise the output of crude steel by 375,000 ingot tons to 800,000 ingot tons annually and to provide the Tube Investments group with additional hot-rolled strip for tube-making as well as to increase its output of alloy and high-grade steel products.

Samuel Fox and Son, subsidiary of United Steel Companies, completed additional electric arc melting, billet, bar rod and plate production facilities to increase the output and range of these products at its Stocksbridge Works in Sheffield.

Thomas Firth and John Brown, Ltd., completed replacements and additions at their Atlas Works in Sheffield, including new electric arc furnaces, a vacuum melting plant, heat treatment facilities, and forging presses designed to increase capacity for the production of semis, plates, sheets, and medium sized forgings of carbon, alloy, tool, and special steels. Work continued on a ring rolling plant scheduled for completion in 1964. Output in 1960 amounted to about 180,000 tons of ingot steel.

Hadfields, Ltd., continued a major program of repairs and replacements at their East Hecla Works at Sheffield, including a vacuum melting plant installed in 1962 and replacements in the forging shop, still in progress at the end of 1963. Other facilities at East Hecla include basic open-hearth, acid Tropenas, electric arc, high frequency and vacuum furnaces, cogging billet and bar mills, heavy and light forges, and steel foundries, including a precision foundry. Output in 1960 amounted to approximately 130,000 tons of ingot alloy steel and 85,000 tons of billets, bars, castings, and forgings.

Steelworks in the Lancashire district (except its northern part), including Denbighshire, Flintshire, and Cheshire, are based on local or regional scrap, and imported iron ore. Principal products are billets, sections, rods plates, sheets, and tubes of alloy and nonalloy steel.

The Lancashire Steel Manufacturing Co., Ltd., had completed a major expansion project in 1962 at their Irlam Works including additional ore preparation, sinter plant, blast furnace, open-hearth steelmaking capacity, cogging, billet, rod, and bar mills to increase steel capacity to approximately 875,000 ingot tons and wire rod capacity to about 500,000 tons. Ladle degassing equipment was installed during 1963.

Scheduled for completion in 1964 at the Brymbo Works of the GKN Steel Co., Ltd., near Wrexham, Denbighshire, was a new inspection unit for its oxygen-electric alloy steelworks commissioned in 1959. Among unique features at this works is the oxygen prerefining unit of the company's own design that takes hot metal from the blast furnace and prerefines it for direct use in the electric arc furnaces, permit-

ting a high ratio of hot metal to scrap. The works comprises a blast furnace, oxygen prerefining vessel, three 20-ton electric arc furnaces, three 40-ton electric induction furnaces, a blooming mill, and billet mills and was designed to replace an existing open-hearth steelworks. Reported capacity was 75,000 tons of pig iron and 275,000 tons of crude steel, and 180,000 tons of alloy steel billets annually.

A modernization and expansion program started in 1954 and completed in 1961–62 at the John Summers and Sons, Ltd., Works in Shotton, Cheshire, included additions to ore preparation, sinter, blast furnace and open-hearth steelplants, improvements to the existing slabbing and hot strip mill, additional reheating furnaces, a third drum coiler and a universal roughing stand, and a 56-inch cold reduction mill. The new facilities were designed to increase sheet processing capacity to about 1,650,000 tons annually. Principal products were heavy and medium plates, hot rolled strip, hot rolled and cold reduced sheets including zinc coated, galvanized, and plastic coated sheets.

The principal iron and steel works of the Northamptonshire, Derbyshire, Nottinghamshire, and Leicestershire area is the Stewarts and Lloyds, Ltd., integrated works at Corby. It is based on regional coal and scrap and the relatively high phosphorous Northampton Sand Ironstone, and it produces strip, pipes, and tubes from basic bessemer steel. With works also in other districts, this company is the United Kingdom's leading producer of pipe and tube. A major modernization and development program completed in 1959 resulted in the modification of the five existing basic bessemer furnaces for oxygen or oxygen-steam blowing, the installation of a tonnage oxygen plant, and the modernization of the blooming and heavy rolling mills.

A further expansion project included the installation of an experimental LDAC oxygen converter of 100 tons capacity in 1961, an increase in the capacity for rolling billets and strip completed in 1963, and provides for an increase in crude steel capacity to 1,550,000 ingot tons annually. On the basis of results obtained from the experimental LDAC unit, work was in progress on a new LDAC steelmaking shop scheduled for completion in 1965, which will replace the existing basic bessemer shop and provide steel for the expanded works. An additional blast furnace was also foreseen in the project, but construction was temporarily deferred.

In the Staffordshire and Worcestershire district, the Shelton Iron and Steel, Ltd., a subsidiary of John Summers and Sons, Ltd., had in progress in 1963 and scheduled for completion in mid-1964 a major project including a completely new oxygen steelworks designed to replace the basic open-hearth melting shop at Stoke-on-Trent, Staffordshire. The works will be integrated with the existing blast furnace plant and comprises a 1,000-ton mixer, two 55-ton Kaldo converters, four continuous casting machines capable of casting blooms to a maximum of 24 inches by 17 inches and slabs to a maximum of 42 inches by 18 inches, and a structural and universal beam mill. Steelmaking capacity will be increased to about 350,000 ingot tons annually.

Patent Shaft Steel Works, Ltd., at its Wednesbury Works, Staffordshire, had completed new open-hearth steelmaking facilities, a new slabbing-blooming-billet mill, and a new heavy plate mill in 1959.

Round Oak Steel Works, Brierly Hill, Staffordshire, completed

in 1959 and 1961, two 65-ton electric arc furnaces and additional capacity for alloy tube rounds; in 1963 a pilot plant for continuous casting supplied by a 5-ton electric arc furnace was completed.

Stewarts and Lloyds, Ltd., Bilston Works completed improvements to their blast furnaces and open-hearth melting shop in 1958, and replacement of blooming, bar, and billet mills in 1961.

Operations in South Wales and Monmouthshire are based on local coal and scrap and imported iron ore. A large part of the country's sheet and all of the tinplate production is centered here. In 1960 the district accounted for 62 percent of the country's production of sheet, 14 percent of the light rolled products, and 7 percent of the heavy plates and sections.

In 1963 the Guest Keen Iron and Steel Works, at Cardiff, Glamorganshire (South Wales), completed a major modernization project which included equipment permitting the simultaneous operation of four blast furnaces, a new ore preparation and sinter plant, oxygen injection in the open-hearth steel furnaces, and additional roughing facilities ahead of the existing continuous billet mill. Crude steel capacity was raised to over 1 million ingot tons. The principal products are billets and heavy sections.

The Briton Ferry Steel Co., Ltd., Briton Ferry, Glamorganshire, commissioned a new 100-ton open-hearth furnace in 1959 which raised crude steel capacity to about 300,000 ingot tons annually. The principal product is billets.

The Steel Company of Wales' Margam and Abbey Works at Port Talbot, Glamorganshire, which were designed to improve the United Kingdom's supply of steel sheet and tin plate, represented the British iron and steel industry's largest postwar expansion project. The works consist of rail and dock terminals with coal and ore handling facilities; coking plant; ore preparation, sinter and blast furnace plants; open hearth and VLN (very low nitrogen) oxygen-steam converter steelmaking shops; and a continuous casting plant integrated with a universal slabbing mill, an 80-inch hot strip mill, and two cold reduction mills—one 3 stand, 80 inches wide and one 4 stand, 56 inches wide. As a part of the major project, tin plate mills were constructed at Trostre and Velindre, 22 and 15 miles, respectively, from Port Talbot. Works at Orb near Newport, Monmouthshire, were acquired and developed for the production of electrical sheet. New installations at Orb included a 48-inch cold reduction and a Sendzimer 14-inch cold reduction mill. The improvements completed in 1963 raised crude steel capacity at Port Talbot to about 3,650,000 ingot tons annually.

Included in the project were provisions for the processing of slabs from the Abbey Works into hot strip at the Spencer Works of Richard Thomas and Baldwins and returning the strip to the Steel Company of Wales for further processing.

Modernization of the Richard Thomas and Baldwins, Ltd., Ebbw Vale Works, Monmouthshire, included replacements and additions to blast furnace, steelmaking, rolling and tinning facilities, the conversion of the basic bessemer converters for oxygen-steam blowing, and the replacement in 1960 of one bessemer converter by an LD oxygen converter for experimental purposes. On the basis of results obtained, a new project was initiated in 1962 to convert the bessemer

steelmaking shop to LDAC practice. The conversion involved two remaining furnaces with fume cleaning equipment, one of which was commissioned in 1963. The other was scheduled for completion in 1964. The principal products at Ebbw Vale were plate, sheets, and tinplate.

The Spencer Works at Llanwern near Newport, Monmouthshire, is a new fully integrated iron and steel works designed to produce hot strip and cold reduced sheet from imported ore and local scrap. The works, commissioned in October 1962, includes coke ovens, ore preparation and sinter plants; two blast furnaces with 30-foot hearth diameter; an oxygen steelmaking shop with three LD converters; a universal slabbing mill; a 68-inch continuous hot strip mill; and a 66-inch continuous cold reduction mill. Initial crude steel capacity was rated at about 1,400,000 ingot tons, with provisions on the site for future expansion.

Lead and Zinc.—*Production and Trade.*—The production of refined lead from ores, concentrates and scrap rose 7 percent over that of 1962. Imports of concentrates and scrap declined somewhat, while those of lead bullion (58,936 tons) and refined lead (124,378 tons) combined were about equal to the imports of these commodities in 1961 and 1962. Australia and Canada continued to be the principal sources of supply; domestic ore and concentrate production has been limited to that derived as a byproduct of barite and fluorspar since the closure of the Greenside lead mine in the Lake district in Westmoreland in 1959. This was the last property in the United Kingdom to be operated primarily as a lead mine. Exports of refined lead in 1963 increased by nearly 12 percent to 40,065 tons, while exports of alloys and wrought metal remained about the same. West Germany with 28,662 tons was the leading customer, followed by the United States with 4,021 tons. Consumption of unwrought primary, secondary, and scrap lead rose to more than 393,000 tons and was believed to be higher than in any peacetime year.

The 1963 output of slab zinc was also a record high, continuing a trend toward increasing zinc metal production that received an added impetus with the commissioning in 1960 of a new standard size Imperial Smelting Furnace at the Swansea Vale Works of the Imperial Smelting Corp. This was the first standard size furnace using the Imperial Smelting Process developed at Avonmouth for the simultaneous recovery of slab zinc and lead bullion with associated metals from mixed concentrates and residues. The increased output since 1960 was due largely to improved efficiency. Imports of 104,729 tons of zinc in concentrates and 162,760 tons of slab zinc were each more than 10 percent above the level of imports in 1962, while exports of 10,160 tons of slab zinc and 4,400 tons of semimanufactures represented a modest decrease in total zinc exported. Consumption of zinc in all forms showed a substantial increase (7 percent) over that of 1962 but still remained below the high level of 1960.

Domestic Mines, Resources, and Processing Facilities.—Mining of lead and zinc ore in Great Britain historically predates the Roman occupation of that island and has included periods of more or less continuous mining operations which have extended over centuries. It is doubtful whether the remaining known reserves of lead and zinc

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ores are sufficient in quantity and grade either to play an important role in the mineral economy of the country except in the absence of other sources of supply, or to maintain an economic mining operation except under very favorable market conditions. However, the country's extensive mineralized areas and zones which have been important sources of past lead and zinc ore production, some of which were of considerable importance from a world standpoint, may still contain important deposits susceptible to discovery by conventional or improved modern methods of prospecting and economic extraction. Most productive of lead and zinc ores was the Northern Pennine orefield which is credited with a total production of about 4 million tons of lead concentrates (70 to 80 percent lead) and 267,000 tons of zinc concentrates (40 to 55 percent zinc) as well as large tonnages of fluorspar, barite and witherite.

Other favorable areas with substantial past production of nonferrous metals are the Leadhills Wanlockhead mining district in Scotland, the Lake district mining field in Cumberland and Westmoreland, the Derbyshire orefield, and mineralized areas on Anglesey (copper) and in north and central Wales.

Some limited exploration and development projects have been undertaken and others have been under consideration to resume development and mining in certain of the traditional mining districts, but the depressed state of the lead and zinc mining industries during 1954–63 was no doubt responsible for delaying further action on these projects.

The principal producers of refined lead, lead alloys, and slab zinc were as follows:

Company	Type of works	Location	Annual capacity where available
Associated Lead Manufacturers, Ltd.	Smelters and manufacturing plants.	Newcastle, Chester, Hull, and London.	Aggregate capacity 70,000 tons refined lead.
Britannia Lead Co., Ltd.	Lead-silver refinery	Northfleet, Kent	91,500 tons refined lead.
British Lead Mills, Ltd.	Refinery for scrap and residues.	Welwyn Garden City, Hertfordshire.	
H. J. Enthoven and Sons, Ltd.	Smelters, refineries and manufacturing plants.	Rotherhithe, London and Darley Dale, Derbyshire.	(16,000 tons refined lead). (30,000 tons refined lead).
Imperial Smelting Corp., Ltd.	Lead-zinc smelters	Avonmouth, Gloucestershire and Swansea, South Wales.	100,000 tons slab zinc.
	Other works	Seaton Carew and Newport, Monmouthshire; Bloxwich, Staffordshire; Widnes, Lancashire; Burry Port, South Wales.	
Lead and Alloys, Ltd.	Smelters and refineries	Abbey Wood, London; and Thorpe, near Wakefield, Yorkshire.	Aggregate capacity 10,000 tons refined lead.
Capper Pass and Son, Ltd.	Smelters and refineries	Bristol, Gloucestershire and North Ferriby, Yorkshire.	
Platt Metals, Ltd.	Smelter and refinery	Enfield, Middlesex	
Rhondda Metal Co., Ltd.	Refinery	Porth, South Wales.	
Sheffield Smelting Co., Ltd.	Nonferrous rare and precious metal smelter and refinery.	Sheffield	
	Rolling mills and machine shops.	Sheffield and Birmingham.	

Nickel.—Estimates on production and consumption of nickel in 1963 indicate little change from the output of 38,300 tons and consumption

of 25,100 tons recorded for 1962. Imports in 1963 consisted of matte and speiss 62,620 tons (up 15 percent); scrap 2,533 tons (up 6 percent); unwrought nickel and nickel alloys (down 2 percent); and semimanufactures 3,141 tons (down 26 percent). Exports in 1963 consisted of unwrought nickel and alloys 23,971 tons (up 16 percent) and semimanufactures 6,447 tons (up 14 percent).

The Mond Nickel Co., Ltd., a subsidiary of the International Nickel Co., with a nickel refinery at Clydach, South Wales, and a precious-metals refinery at Bashley Road, London, is the country's only producer of primary refined nickel; its subsidiary company, Henry Wiggin & Co., Ltd., with plants at Glasgow, Birmingham, and Hereford is a major producer of alloys.

Tin.—The output of primary and secondary tin in 1963 continued a more or less steady decline from the peak production of 34,500 tons in 1957. The tin content of domestic ore mined, however, showed little variation from the average annual output since 1957.

Imports in 1963 consisted of ores and concentrates 16,205 tons (down 7 percent); and refined tin 7,927 tons (down 14 percent). Exports of refined tin declined by 8 percent to 8,675 tons of which 219 tons were re-exports, while exports of solder increased by 30 percent to 2,033 tons.

South Crofty, Ltd., with operations at Redruth in Cornwall, and the Geevor Tin Mines, Ltd., at Pendeen in Cornwall accounted for the entire output of tin ores in the proportion of approximately 56 percent and 44 percent, respectively. Both of these mines appear to have adequate reserves and favorable development possibilities in adjacent areas including possible extensions under the sea to maintain operations at the present rate for a number of years under reasonably favorable conditions. Other possibilities associated with old abandoned workings or undiscovered extensions of the granite batholith are recognized. Tin smelting capacity in the United Kingdom was reported as 65,000 tons of refined tin annually. The principal producers were—Consolidated Tin Smelters, Ltd., a subsidiary of Williams, Harvey & Co., Ltd., with works at Bootle, Lancashire, which produced refined tin; Capper Pass & Son, Ltd., with works at Bristol and North Ferriby, Yorkshire, which produced tin, tin base alloys, solder, other nonferrous metals and alloys; and Batchelor, Robinson & Co., Ltd., with works at West Hartlepool, Durham, and Llanelly, Monmouthshire, which produced tin and solder.

NONMETALS

Barite and Witherite.—The drop in output of barite in 1963 was due principally to the closure of the Silverband Mine of Laport Industries, Ltd., at Dunfell, Westmoreland, and of the Gasswater Mine of Anglo Austral Mines, Ltd., at Cronberry, Ayrshire. Although, some new production may be expected as a byproduct from expanded fluorspar production facilities, the overall reduction in output was in accordance with barite market requirements in the United Kingdom. Imports were not affected because the requirement of certain industries for barite of certain qualities, including white barite for the paint industry, cannot be met from domestic crude barite. Imports in 1963 amounted to 28,448 tons, a rise of about 2 percent over imports in 1962.

The Settlingstones Mine of Settlingstones Mines, Ltd., at Fourstones, Hexham, Northumberland continued to be the country's only producer of witherite. The Muirshiels Mine of Muirshiels Barytes, Ltd., at Lockwinnock, Renfrewshire, was the principal producer of barite. The remaining output of barite was produced as a coproduct or by-product of fluorspar mining, or the processing of old lead-zinc dumps.

China Clay.—The United Kingdom continued to be the world's second largest producer and the world's largest exporter of china clay. While production in 1963 rose slightly to 1.73 million tons, exports increased nearly 14 percent to 1.271 million tons, reflecting the fruition of a program of progressive modernization of quarry operations which took place in the industry during 1959–63.

The entire output of china clay came from quarries in Cornwall and Devon, in the relative proportion of about 90 percent and 10 percent, respectively, where it occurs as an in-place hydrothermal alteration product in the granite batholith whose principal outcrops are identified as Dartmoor, Bodmin Moor, the St. Austel Mass, Carn Menellis, and Lands End Mass. The copper-tin-tungsten deposits of Cornwall and Devon are also associated with this batholith.

The principal producing company is English China Clays, Ltd., with operations in both Devon and Cornwall. This company and its subsidiaries are also principal producers of potters clay, which occurs in Devon, and of a variety of construction materials.

Other producers of china clay are S. W. Berk & Co., Ltd., Goonvean, Ltd., and certain paper and cement manufacturers who own china clay pits.

Fluorspar.—Production of fluorspar declined a further 6 percent in 1963, continuing a downward trend from the 1960 high, due partially to the depressed state of the steel industry which did not recover in time to affect fluorspar production, and partially to diminished demand in the chemical industries. Districts in Durham and North Derbyshire, formerly important for lead production, continued as the principal sources of fluorspar supply. Blanchland Fluor Mines, Ltd., a subsidiary of Colvilles, installed a heavy media seperation plant in 1963 at their Whiteheaps Mine at Blanchland, North Durham, to operate in conjunction with their flotation plant. The combined capacity will be 15,000 tons of acid-grade fluorspar and 25,000 tons of metallurgical-grade fluorspar anually. Among other operating companies in North Durham were Beckermet Mining Co., subsidiary of United Steel Companies, with a gravity-flotation plant at the Blackdene mine near Wearhead; Fluorspar, Ltd., with a flotation plant at the Stanhopeburn Mine near Stanhope; and the Weardale Lead Co., Ltd., with a gravity-flotation plant including heavy media separation at the Stotsfield Burn Mine near Rookhope.

Glebe Mines, Ltd., subsidiary of Laporte Industries, Ltd., completed in 1962 additions to the Glebe and Cupola mills near Eyam, North Derbyshire, bringing the combined capacity of the group to 45,000 tons acid-grade fluorspar, 18,000 tons of barite, and 2,000 tons of lead concentrates annually.

Gypsum and Anhydrite.—The United Kingdom's 1963 production of gypsum and anhydrite continued a trend which showed an average annual increase of more than 4.5 percent in the production of gypsum

and anhydrite during 1959–63. Official figures for 1963 were not yet available, but foreign trade during the preceding years has played only a small role in the United Kingdom gypsum supply position. During 1959–62 imports including alabaster averaged about 133,400 tons annually, while exports averaged only 10,300 tons. Apparent consumption in 1962 amounted to about 4.190 million tons of gypsum and anhydrite of which about 862,000 tons was anhydrite consumed in the manufacture of sulfuric acid.

Cumberland, Durham, Sussex, and Nottinghamshire continued to be the principal sources of supply. During recent years the most important operations have been modernized and brought to a high state of efficiency. The important producers include:

Company	Mines	Town or city	County
Imperial Chemical Industries (fertilizers and synthetic products), Ltd.	Billingham	Billingham	Durham.
Carlisle Plaster and Cement Co., Ltd.	Cocklakes	Carlisle	Cumberland.
	Long Meg	Langworthby	Do.
Solway Chemicals, Ltd	Sandwith	Whitehaven	Do.
Thomas McGhie & Sons	Birkshead	Long Marton	Do.
	New Stamphill	Kirby Thore	Do.
British Plaster Board, Ltd		Bunny	Nottinghamshire.
		East Lake	Do.
Gotham Co., Ltd		Cropwell Bishop	Do.
		Gotham	Do.
		Thrumpton	Do.
Gypsum Mines, Ltd	Kingston on-Soar		Do.
	Subwealden	Mountfield	Sussex.
J. C. Stratton & Co	Faulds	Hanbury	South Staffordshire.

Salt.—Increased demand for rock salt to keep British roads ice free was largely responsible for the nearly 58-percent increase in salt output in 1963. Through expansion and further mechanization of underground facilities at the United Kingdom's only rock salt mine, the Meadowbank Mine of Imperial Chemical Industries at Winsford, Cheshire, capacity was to be increased to 1 million tons of rock salt annually by 1964.

Production of evaporated salt increased by about 8.5 percent to 1.389 million tons, while estimates of brine output for purposes other than saltmaking indicated little change.

Exports of evaporated salt rose 8.5 percent to 253,200 tons, while exports of other salt rose by 30 percent to 93,500 tons.

The principal producer of salt in the United Kingdom was Imperial Chemical Industries, Ltd., salt works at Winsford and Weston Point, Cheshire; Stoke Prior, Worcestershire, Port Clarence, Staffordshire; and Carrickfergus, Northern Ireland.

It was reported that a geophysical survey conducted by the Department of Scientific Research in Northern Ireland disclosed the presence of extensive salt deposits at Larne in Antrim County.

Strontium Minerals (Celestite).—In the absence of official output and trade figures for 1963 it is presumed that production continued at about the same rate as in 1962. Exports averaged about 4,400 tons annually during 1959–62. Production came entirely from the vicinity of Yate, near Bristol in Gloucestershire, where the mineral occurs as

lenses and lenticular masses between the bedding planes of Keuper clays.

The Bristol Land & Mineral Co., Ltd., Bristol, is the principal producing company.

MINERAL FUELS

During 1963 the United Kingdom consumed the energy equivalent of 288 million tons of average salable British coal. Coal, however, of which the country has plentiful reserves, provided the raw material for somewhat less than 68 percent of the energy consumed, while petroleum, more than 99 percent of which must be imported, provided about 30 percent of the total; the remainder of total energy was supplied by gases associated with coal production, by nuclear energy plants, and by nuclear and hydroelectricity—a part of which is also imported.

From 1959 through 1963 total consumption of energy in terms of coal equivalent increased about 3.75 percent annually. Although there was a small annual increase in the tonnage of coal consumed, its share in the energy pattern decreased from 75 percent to 68 percent, while petroleum increased its share from 23 percent to 30 percent and supplied about 72 percent of the raw material for the increased energy consumed.

TABLE 11.—Energy balance

(Million tons coal or coal equivalent [1])

Energy source	1959	1960	1961	1962	1963
Coal, direct use	92.8	92.6	85.7	82.6	78.8
Oil, direct use	48.1	55.3	60.4	67.3	74.2
Coke and coke breeze	28.1	32.0	30.1	28.7	29.1
Other solid fuel	1.6	1.4	1.5	1.5	1.6
Coke oven gas	2.1	2.6	2.5	2.1	2.1
Electricity:					
Coal and coke	48.6	53.5	57.2	62.9	69.2
Oil	7.3	9.4	9.8	10.0	8.8
Nuclear electricity	.5	.9	1.1	1.5	2.6
Hydroelectricity	1.5	1.7	2.1	[2] 2.1	[2] 1.8
Total	57.9	65.5	70.2	76.5	82.4
Town gas:					
Coal	12.2	11.9	11.7	11.9	11.9
Oil and petroleum gases	1.6	1.9	2.0	2.7	3.7
Coke oven gas and colliery methane	2.5	2.6	2.7	2.4	2.3
Total	16.3	16.4	16.4	17.0	17.9
Liquid fuels derived from coal and methane at collieries	1.8	2.1	1.7	1.9	1.9
Grand total	248.7	267.9	268.5	277.6	288.0

[1] Conversion factors:
1 ton average salable coal=1 ton coal equivalent.
1 ton oil=1.7 tons coal.
300 therms colliery methane=1 L/T coal or 295 therms=1 metric ton coal.
40,000 cubic feet coke oven gas=1 L/T coal or 1,115 cubic meters=1 metric ton coal.
1 ton coke breeze=0.9 ton coal.
Coal equivalent of hard coke and gas coke is the coal used at coke ovens less coke, coke breeze, and coke oven gas supplied to consumers, to stocks or for export. Other solid fuels show coal used for production of briquets, etc.

[2] Includes imports.

Source: Ministry of Power Statistical Digest 1963.

Coal.—Deep mines under jurisdiction of the National Coal Board (NCB) had on their colliery books an average of about 523,800 wage earners and accounted for 96 percent of all of the coal produced in the United Kingdom during 1963. Employment and output were distributed among the nine National Coal Board Divisions as follows:

Division	Wage earners (thousands)	Output	
		Quantity (thousand metric tons)	Per man-shift (metric tons)
Scottish	55.8	16,832.9	1.395
Northern	33.7	12,173.3	1.596
Durham	75.0	22,389.7	1.333
Yorkshire	112.8	43,850.7	1.821
North Western	36.8	12,116.4	1.536
East Midlands	88.6	47,794.0	2.433
West Midlands	38.4	14,922.7	1.770
South Western	77.5	19,163.7	1.173
South Eastern	5.2	1,635.8	1.435
Total	523.8	190,879.2	1.674

This output was only slightly higher than in 1962 but was derived from fewer operating units with a considerably smaller operating force.

From January 1, 1947, through fiscal year 1963–64 (ending March 31, 1964), capital expenditures approximating US$3,508 million were made by the National Coal Board for the improvement of coal mining and preparation, ancillary plants, and housing for the labor force.

From 1958, when the improvements were beginning to show in operating results, the average increase in output per man-shift for all wage earners employed at NCB mines was slightly more than 5 percent annually and was effected principally through increased mechanization, concentration of productive operations, improvement in mining and cleaning methods, and modernization and replacement of obsolescent equipment.

In its annual report for fiscal year 1963–64 the National Coal Board recommended that efficient coal productive capacity be maintained at a minimum of 200 million tons annually to help meet expanding requirements which would rise from 283 million tons of coal equivalent in 1963 to about 450 million tons of coal equivalent in 1980 if the economy should grow 4 percent annually—as suggested by the National Economic Development Council.

TABLE 12.—Salient statistics of coal, coke, and gas industries

	1959	1960	1961	1962	1963
Deep-mined coal:					
National Coal Board Mines:					
Number in operation	798	737	698	669	(1)
Salable output—million tons	195.6	186.8	182.5	190.7	190.9
Net value of output million U.S. dollar equivalent	1,745.9	1,696.3	1,746.7	1,878.4	(1)
Employment:					
Underground—thousand wage earners	518.3	469.9	446.9	431.4	409.8
Surface at collieries—do	126.8	118.6	116.0	113.0	106.9
All other—thousand persons	70.6	68.3	69.0	66.1	(1)
Total	715.7	656.8	631.9	610.5	(1)
Output per man-shift:					
At face—tons	3.81	4.04	4.24	4.62	4.95
Underground—do	1.73	1.81	1.88	2.03	2.14
Total—do	1.37	1.42	1.47	1.58	1.67
Cost per ton at mine—U.S. dollar equivalent	11.54	11.82	12.38	12.20	(1)
Including labor—do	6.64	6.59	6.73	6.39	(1)
Average proceeds per ton salable coal—do	11.68	12.05	12.72	12.85	(1)
Average cash earnings per shift:					
Underground—do	9.07	9.33	9.86	10.22	(1)
Surface—do	6.18	6.32	6.78	7.01	(1)
Average allowances in kind, all workers U.S. dollar equivalent	.49	.53	.56	.62	(1)
Licensed mines:					
Number in operation	464	430	392	360	(1)
Salable output—million tons	2.8	2.2	2.3	1.7	1.8
Total operating deep mines	1,262	1,167	1,090	1,029	943
Total employment—thousand persons	723	672	637	616	(1)
Salable output	198.4	189.0	184.9	192.4	192.7
Opencast coal:					
Number of producing sites—NCB and licensed	73	50	41	29	26
Total employment—thousand persons	7.1	5.6	5.3	4.4	4.2
Salable output—million tons	11.0	7.7	8.7	8.2	6.2
Total coal production—do	209.4	196.7	193.5	200.6	198.9
Including anthracite—do	3.7	3.7	3.6	4.0	4.2
Consumption and shipment of coal:					
United Kingdom:					
Electrical supply industry—do	46.7	51.9	55.6	61.4	67.9
Gas supply industry—do	22.9	22.7	22.6	22.5	22.5
Coke ovens—do	26.1	29.0	27.2	23.9	23.9
Manufactured fuel plants—do	1.7	1.4	1.5	1.6	1.7
Railways—do	9.7	9.0	7.8	6.2	5.0
Collieries—do	5.7	5.1	4.6	4.3	4.0
Iron and steel industry—do	3.8	3.9	3.2	2.6	2.4
Engineering and metal trades—do	3.0	2.9	2.8	2.8	2.7
Other industry—do	25.4	25.0	23.6	22.3	21.1
Domestic—do	33.9	34.9	32.9	33.2	32.5
Miscellaneous—do	10.8	11.1	10.2	10.6	10.5
Subtotal—do	189.7	196.9	192.0	191.4	194.2
Shipments to Northern Ireland and the Channel Islands	2.7	2.9	2.8	2.8	2.9
Total	192.4	199.8	194.8	194.2	197.1
Foreign bunkers—million tons	.7	.3	.1	.1	(2)
Exports—do	3.7	5.3	5.7	4.8	8.0
Grand total—do	196.8	205.4	200.6	199.1	205.1
Stocks at end of year, total—do	50.8	43.3	37.7	41.0	36.7
Consumption and shipments of coke:					
Gas works—do	1.6	1.6	1.4	1.6	1.7
Blast furnaces—do	10.7	13.2	12.2	10.8	10.7
Domestic—do	3.0	3.5	3.6	4.1	4.4
Other inland—do	9.6	9.7	9.3	9.4	8.8
Total—do	24.9	28.0	26.5	25.9	25.6
Exports—do	1.0	1.1	1.1	1.4	1.7
Stocks at end of year—do	8.1	7.8	8.2	6.8	4.8

See footnotes at end of table.

TABLE 12.—Salient statistics of coal, coke, and gas industries—Continued

	1959	1960	1961	1962	1963
Consumption of coke breeze:					
Iron and steelworks—million tons	1.3	1.6	1.5	1.8	2.0
Power stations	1.2	.9	.9	.9	.7
Gas works	.8	.8	.7	.7	.7
Other	.7	.7	.8	.8	.9
Total	4.0	4.0	3.9	4.2	4.3
Exports of coke breeze	.4	.4	.3	.3	.3
Stocks at yearend	1.1	1.3	1.5	1.5	1.6
Gas supply:					
Production and imports:					
Gas supply industry—million therms [3]	2,260	2,276	2,227	2,356	2,413
Coke oven plants—do [3]	1,503	1,639	1,554	1,353	1,346
Blast furnaces—do [3]	1,426	1,720	1,595	1,385	1,339
Refineries:					
Liquefied petroleum gas—million therms [3]	60	73	96	137	239
Other petroleum gas—do [3]	848	909	932	937	935
Natural gas—do [3]	22	26	28	41	45
Total	6,119	6,643	6,432	6,209	6,317
Imports [4]—do [3]	4	1	3	4	7
Exports [5]—do [3]			1	1	11
Internal consumption—do [3]	1,799	1,981	1,892	1,734	1,722
Losses—do [3]	346	314	347	334	343
Consumption:					
Domestic use—do [3]	1,310	1,326	1,314	1,431	1,569
Iron and steel—do [3]	1,358	1,626	1,527	1,331	1,230
Other industries—do [3]	852	920	888	879	926
Other use (public administration, lighting, etc.)—million therms [3]	458	477	466	503	523
Total	3,978	4,349	4,195	4,144	4,248

[1] Data not available.
[2] Less than 50,000 tons.
[3] Therm equals 100,000 British thermal units (B.t.u.).
[4] Natural gas in 1959 and 1960; LPG in 1961, 1962, and 1963.
[5] All liquefied petroleum gas.

Trade.—Imports of solid fuels were insignificant, amounting to only 66,000 tons in 1963 compared with 78,000 tons in 1962. Exports of coal increased by about 67 percent, while those of briquets and coke increased by 18 percent and 35 percent, respectively. Exports in thousand metric tons, and principal countries or areas of destination are shown below:

Commodity	Total exports 1963	Principal destinations, 1963
Coal	8,002	France 2,119; Netherlands 1,884; other ECSC countries 1,604; Denmark 896; Irish Republic 533; other EFTA countries 436.
Coke and coke breeze	2,019	Norway 627; Denmark 323; ECSC countries 314; Sweden 235; other EFTA countries 178; Venezuela 132; Finland 106.
Briquets	137	ECSC countries 118.

Petroleum.—Although indigenous production of crude petroleum increased by more than 12 percent in 1963, the cessation of shale oil production in Scotland resulted in a net decrease in the output of crude oil. Throughput of crude and process oils and refinery output each increased less than 2 percent, reflecting capacity operations at refineries during 1962 and increasing production as new facilities came on stream in 1963. At the yearend, distillation capacity for crude and process oils had increased by more than 11 percent to about 57.8 mil-

lion tons, while expansion projects in progress were designed to add an additional 9.9 million tons capacity by the end of 1964. New proposals for completion by the end of 1967 would increase total capacity to about 89 million metric tons.

TABLE 13.—Petroleum [1] supply position

(Thousand metric tons)

Commodity	1962				1963			
	Production	Arrivals [1]	Deliveries into consumption	Shipments and bunkers [1]	Production	Arrivals [1]	Deliveries into consumption	Shipments and bunkers [1]
Crude and process oils	129	53,383	[1] 53,136	----------	125	[2] 54,375	[2] 54,173	----------
Products derived from coal	349	--------	[3]	[3]	355	--------	[3]	[3]
Petroleum refinery products:								
Gases	642	8	648	2	942	15	911	24
Light distillate feed stock for gasworks	819	37	726	88	1,037	121	914	124
Aviation spirit	198	199	226	196	145	207	244	122
Wide cut gasoline	1,294	102	820	406	699	59	523	290
Motor industrial and white spirit	7,289	2,517	9,044	1,008	7,071	3,063	9,535	889
Kerosine	2,652	850	2,766	737	3,132	1,007	8,899	703
Gas-diesel oil	10,126	2,381	7,783	4,119	10,961	2,959	3,395	4,761
Fuel oil	22,314	7,458	21,671	7,873	21,481	8,779	23,068	8,301
Lubricating oils	913	473	984	532	983	508	1,019	542
Bitumen	1,240	12	1,258	29	1,326	1	1,336	26
Paraffin wax	39	18	53	7	56	11	54	5
Feedstock for petrochemical plants	1,130	748	1,980	----------	1,502	1,200	2,749	----------
Miscellaneous	247	--------	----------	----------	258	--------	----------	----------
Total	48,903	14,803	47,959	14,997	49,593	17,930	52,647	15,787

[1] Differs from officially reported trade statistics.
[2] Refinery throughput.
[3] Petroleum products derived from coal and marketed by petroleum industry.

Source: Ministry of Power Statistical Digest 1963.

Imports of crude and process oils increased by about 4 percent from 53,189 million tons in 1962 to 55,377 million tons in 1963, while imports of refined products increased 17 percent from 15,087 million tons in 1962 to 17,695 million tons in 1963. The principal countries of origin were:

Commodity	Quantity (thousand tons)	Value (million U.S. dollars)
Crude and partly refined oils:		
Kuwait	22,032	403.2
Other Middle East	15,767	310.4
Venezuela	6,078	115.3
Libya	5,902	117.9
Nigeria	2,408	48.2
Other countries	3,190	75.0
Total	55,377	1,070.0
Refinery products:		
Netherlands	2,699	75.1
Other Europe	3,847	102.3
Bahrain, Kuwait, Qatar, and Trucial Oman	2,306	64.8
Other Middle East	1,500	40.2
Netherlands Antilles	1,794	51.4
Trinidad and Tobago	2,450	64.4
Venezuela	2,532	51.7
United States	397	22.8
All other countries	170	6.2
Total	17,695	478.9

Exports and re-exports of crude and partially refined oils increased from 1,007,000 metric tons to 1,444,000 tons, while those of refined products decreased from 9,859,000 tons to 9,791,000 tons. The principal countries of destination were:

Country	Quantity (thousand metric tons)	Value (million U.S. dollars)
Denmark and Faroes	2,032	54.0
Germany, West	1,175	31.0
Ireland	429	15.5
Netherlands	2,314	47.6
Norway	1,143	26.1
Sweden	2,604	60.9
Other countries	1,538	76.7
Total	11,235	311.8

Included in the above are crude and partially refined oils (in thousand tons)—West Germany 6, Netherlands 1,420, and others 18.

Developments.—Noteworthy among petroleum developments in the United Kingdom was the introduction to Parliament of the Continental Shelf Bill governing exploration of oil, gas, and coal underlying areas of the North Sea Continental Shelf subject to U.K. jurisdiction under provisions of the Geneva Convention on the High Seas of April 29, 1964. Under this act, rights to the natural resources underlying the seabed outside territorial waters are vested in the Crown. Licenses for exploration for oil and gas may be granted by the Minister of Power, and the National Coal Board will have the sole right to mine any coal which may be found.

Refineries in operation and their capacity at year end, together with reported completions of expansion projects during the year were:

Company and refinery	Location	Additions to capacity (thousand metric tons per year)	Total capacity at yearend (thousand metric tons per year)
British Petroleum Co.:			
Kent	Isle of Grain		9,653
Llandarcy	South Wales	2,235	5,588
Grangemouth	Stirlingshire, Scotland		3,302
Pumpherston	West Lothian, Scotland		183
Total		2,235	18,726
Esso Petroleum Co. Ltd.:			
Fawley	Hampshire		11,684
Milford Haven	South Wales	1,676	6,554
Total		1,676	18,238
The Shell Co. of the United Kingdom, Ltd.:			
Shellhaven	Essex	965	9,145
Stanlow	Cheshire		6,096
Heysham	Lancashire		1,829
Ardrossan	Ayrshire, Scotland		183
Total		965	17,253
Mobil Oil Co. Ltd.: Coryton	Essex	(1)	[1] 2,401
Imperial Chemical Industries, Ltd:. North Tees	Durham	1,016	1,016
Berry Wiggins & Co. Ltd.:			
Kingsworth	Kent	91	290
Weaste	Manchester, Lancashire		170
Total		91	460
Lobitos Oilfields, Ltd.: Ellesmere Port	Cheshire		406
Manchester Oil Refinery, Ltd.: Barton	Manchester, Lancashire		152
William Briggs & Sons, Ltd.: Dundee	Angus		61
Grand total			58,713

[1] The capacity of this plant reportedly was decreased by 10,000 tons per year in 1963.

The Mineral Industry of Yugoslavia

By Roman V. Sondermayer [1]

YUGOSLAVIA produced a large variety of mineral products in 1963, some of considerable significance by world standards. The more prominent minerals, with production expressed in approximate percentages of the 1963 world totals, were as follows: Mercury 6 to 7 percent; antimony, barite, bauxite, lead, and magnesite, 4 to 5 percent; and chromite, copper, feldspar, pyrite, silver, and zinc, 1 to 2 percent. Yugoslavia is one of the richest mineral countries in Europe, especially in terms of nonferrous metals.

The 1963 mineral and metal output value for the country was about US$550 million, roughly 10 percent above that of 1962. The contribution of the mineral industry to Yugoslavia's gross national product was on the order of 12 percent for 1963, and the 246,000 workers employed represented about one-fifth the total for all Yugoslav industry. International trade of mineral products, both imports and exports, was also of considerable significance.

The Yugoslav Government which controls the mineral industry made efforts in 1963 to increase the efficiency of existing facilities by integrating enterprises and cutting down on capital construction. Mineral industry investments amounted to 59,082 million dinars (US$1 equals 750 dinars) in 1962, representing 13 percent of all investments, as compared with 29 percent in 1961. The trend continued downward in 1963.

The most important mineral developments during 1963 were in the nonferrous industry. Highlights include the opening of Yugoslavia's first uranium mine and reduction plant at Kalna in eastern Serbia, commencement of operations at the Toranice-Sasi lead-zinc mine in Macedonia, discovery of new bauxite deposits in Dalmatia, and completion of the second phase of the "Boris Kidric" aluminum plant.

The steel shortage continued, with imports constituting a fourth of requirements. The Government implemented measures to develop domestic iron resources, to reduce imports, and to build new steel capacity. During 1963, work started on the construction of the Skopje steel plant in Macedonia.

Despite expanding petroleum output by Yugoslavia's youngest and most successful mineral industry, small net imports were still necessary in 1963. Construction of the Pancevo oil refinery was started during the year. As in the past, bituminous coal, coke, anthracite, and petroleum coke were imported in large quantities. To ease the import burden, the Government initiated various projects for the better utilization of available low-grade coal deposits.

[1] Foreign mineral specialist, Division of International Activities.

The growth of mineral output in recent years should not obscure the fact that an inefficient outmoded component remains, which has been neither modernized nor abandoned. In addition to inadequate mechanization and inexperienced management, the Yugoslav mineral industry of 1963 suffered from shortages of electric energy and railroad transport capacity.

PRODUCTION

Yugoslavia's expanding mineral economy, particularly in recent years, has been reflected in production increases in all five major branches of the mineral industry, namely coal, petroleum, iron and steel, nonferrous metals, and nonmetals. At present, nonferrous metals occupy the foremost position in terms of output value, followed closely, however, by the other four branches. During 1963 most of the major mineral commodities showed production increases over 1962, with the exception of manganese, bauxite, chromite, mercury, bismuth, and salt.

The overall trend of mine output during 1959–63 has been one of sizable increases of ore but only moderate increases in contained metal. This reflects the exhaustion of richer parts of mineral deposits and the transition to large-scale mining of low-grade ores. Metallurgical facilities have been built up steadily, and Yugoslavia smelts most of its base metal ores except bauxite and zinc.

TABLE 1.—Production of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite—thousand tons	815	1,025	1,232	1,331	1,285
Alumina	57,242	67,095	71,159	77,064	(1)
Ingots	19,245	25,070	27,407	27,980	35,895
Rolled products [2]	8,990	12,782	11,996	10,537	(1)
Antimony:					
Ore	96,138	109,508	108,013	116,654	123,327
Concentrate	6,885	7,262	7,735	7,064	(1)
Regulus	2,281	2,410	2,463	2,691	2,661
Arsenic concentrate		1,500	796	913	(1)
Bismuth, metal	91	105	98	91	88
Copper:					
Ore—thousand tons	2,228	2,370	3,236	5,070	5,629
Metal content of ore	34,601	33,270	37,909	51,717	62,093
Concentrate	102,566	109,658	148,622	221,471	(1)
Smelter	35,251	35,729	30,869	45,741	49,031
Electrolytic	31,567	35,053	30,108	45,520	49,032
Rolled products [3]	26,888	33,001	32,625	37,227	44,915
Chromium:					
Chromite	107,016	100,582	108,126	97,045	93,770
Chromite concentrate	42,620	41,641	43,481	44,088	(1)
Gold—troy ounces	59,780	63,979	67,195	70,506	74,041
Iron and steel:					
Iron ore—thousand tons	2,096	2,200	2,184	2,190	2,297
Pig iron—do	867	972	997	1,050	996
Ferroalloys	40,079	46,822	55,651	53,469	63,784
Steel—thousand tons	1,229	1,442	1,532	1,595	1,588
Rolled products [4]—do	861	972	1,009	1,057	1,146
Lead:					
Lead-zinc ore—do	1,832	1,920	2,063	2,239	2,287
Metal content of ore	92,450	91,221	96,681	101,995	101,575
Concentrate	115,804	117,370	123,502	132,804	135,804
Smelter	97,934	99,738	101,698	113,018	(1)
Refined	85,395	89,143	90,401	97,926	104,174
Rolled products	4,876	6,963	12,817	16,295	(1)

See footnotes at end of table.

TABLE 1.—Production of selected metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals—Continued					
Manganese ore	8,084	13,314	14,148	14,839	8,132
Mercury:					
Ore	168,876	150,900	180,210	192,083	192,200
Metal, 76-pound flasks	13,344	14,069	15,954	16,273	15,838
Pyrites	290,470	417,394	364,313	414,202	356,000
Silver, thousand troy ounces	2,827	3,025	3,454	3,750	3,792
Tungsten, concentrate	72	72	7	48	(1)
Zinc:					
Metal content of ore	60,674	56,382	59,882	61,114	51,266
Concentrate	100,581	97,003	113,899	118,889	(1)
Smelter	18,302	19,748	20,401	20,232	(1)
Electrolytic	13,659	16,187	16,467	19,072	(1)
Rolled products	4,065	5,255	5,957	6,948	(1)
Nonmetals:					
Asbestos:					
Ore	191,318	234,460	270,291	253,774	(1)
Fiber	4,307	5,416	6,086	6,714	8,232
Barite, crude	107,290	109,489	104,210	[5] 103,763	104,486
Cement:					
Portland, thousand tons	2,185	2,363	2,307	2,445	2,826
Other, do	36	35	29	74	
Gypsum:					
Raw	92,368	124,363	97,005	118,046	141,6
Calcined	24,760	26,934	32,113	30,553	(1)
Lime:					
Burned, thousand tons	618	697	725	768	860
Hydrated	6,642	6,879	25,051	48,110	(1)
Feldspar, crude	19,619	14,001	20,539	29,973	29,460
Fertilizers:					
Phosphatic	277,000	248,000	413,000	520,000	(1)
Others	197,000	175,000	250,000	400,000	(1)
Mica, kilograms	2,056	2,354	3,717	5,364	4,000
Refractories:					
Fire clay:					
Raw	120,618	132,777	152,264	144,707	(1)
Burned	27,060	30,070	34,282	35,937	(1)
Magnesite:					
Raw	244,805	251,847	273,065	373,362	411,959
Calcined	21,958	21,805	25,591	24,019	(1)
Sintered	86,788	90,891	97,885	131,626	155,016
Other [6]	151,177	174,156	171,538	193,509	(1)
Salt:					
Sea	21,662	35,687	45,193	86,522	19,000
Brine	114,745	115,745	115,754	128,331	147,580
Other nonmetals	197,605	250,536	301,668	355,032	(1)
Mineral fuels:					
Coal:					
Bituminous, thousand tons	1,298	1,283	1,313	1,188	1,286
Brown, do	9,122	9,628	9,494	9,319	9,945
Lignite, do	10,687	11,801	13,266	14,186	16,191
Briquets	16,216	8,963	4,732	[5] 3,244	[5] 5,600
Coke:					
Metallurgical, thousand tons	1,003	1,013	1,028	1,030	1,108
Breeze, do	67	70	71	77	(1)
Gaswork, do	21	20	17	18	18.5
Manufactured gas, thousand cubic feet	968,342	1,502,727	1,391,663	1,699,966	(1)
Natural gas, do	1,866,000	1,976,000	2,566,000	3,557,000	3,772,000
Petroleum:					
Crude, thousand tons	593	944	1,341	1,526	1,611
Refinery products:					
Gasoline, do	249	277	293	321	344
Kerosine, do	61	70	58	80	89
Diesel fuel, do	331	353	404	532	618
Lubricants, do	51	61	72	99	112
Heating oil, do	331	396	409	492	480
Carbon black	2,921	3,862	4,398	3,735	3,998
Bitumen	82,361	71,875	80,030	113,834	(1)

[1] Data not available.
[2] Includes aluminum alloys.
[3] Includes copper alloys.
[4] Includes pipes.
[5] Revised figure.
[6] Includes shamotte, magnetite, chrome-magnesite, other refinery material, and silica bricks.

The petroleum industry has made the most spectacular gains, with output in 1963 more than tripling that in 1959. In the same period, bauxite nearly doubled and lignite and copper rose by roughly half. The development of the Majdanpek mine and reconstruction of the Bor smelting complex around 1961 contributed heavily to the expanded production of both copper ore and refined copper.

TRADE

Minerals occupy an important position in Yugoslavia's overall trade, both in terms of exports and imports. During 1962, mineral exports of 37,851 million dinars were 18 percent of all exports and mineral imports of 50,220 million dinars were 19 percent of all imports. Although corresponding figures are not available for 1963, the trend is clearly upwards in volume for both mineral exports and imports.

Nonferrous metals occupy a special position in Yugoslavia's mineral export trade, their combined value in 1962 being 18,961 million dinars or roughly half the total. Nonferrous exports also registered a 22-percent increase over those of 1961. In recent years, bauxite was exported mainly to East Germany, copper to the U.S.S.R. and Indonesia, lead to the United States, and zinc to Poland. Yugoslavia is being gradually transformed from an exporter of mineral raw materials to an exporter of increasing quantities of refined products and semimanufactures. This significant change in export pattern is indicative of the progress in industrialization and reduces sensitivity of the economy to international market changes.

TABLE 2.—Exports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Bauxite	929,792	913,957	West Germany 679,023; Italy 183,840; East Germany 28,709.
Alumina	14,224	14,182	Austria 10,180; Poland 3,997.
Aluminum unwrought	6	----------	
Semimanufactured products	11,931	12,655	U.S.S.R. 3,828; India 2,890; United States 1,850; East Germany 730; Czechoslovakia 549.
Antimony regulus	2,071	2,280	All to United States.
Chrome concentrate	5,587	30,144	Sweden 30,062; Italy 82.
Copper:			
Scrap and filling	----------	11	All to Lebanon.
Alloys unwrought	101	856	Italy 769; West Germany 87.
Semimanufactured products	13,477	15,447	U.S.S.R. 4,567; Indonesia 4,428; United States 2,514; Hungary 773.
Iron and steel:			
Iron ore	123,705	101,943	All to Hungary.
Scrap	11,366	2,832	Italy 2,822; Austria 10.
Ferroalloys	26,868	26,435	West Germany 6,192; United States 4,723; Czechoslovakia 3,040; Austria 2,559; Italy 1,089; Egypt 1,071.
Cast iron	4,273	60	All to Netherlands.
Steel ingots and billets	----------	51,317	All to Italy.
Rolled products	92,503	164,698	India 48,085; Italy 27,402; East Germany 14,743; Bulgaria 13,552; Turkey 13,822; U.S.S.R. 12,585.
Other semimanufactured products.	79,832	68,526	East Germany 17,516; Italy 11,612; Czechoslovakia 9,216; West Germany 5,698; Egypt 5,805; Austria 3,131.

TABLE 2.—Exports of selected metals and minerals—Continued

(Metric tons unless otherwise specified

Commodity	1961	1962	Principal destinations, 1962
Metals—Continued			
Lead:			
Refined	50,932	52,073	United States 27,212; Poland 5,119; Italy 3,300; U.S.S.R. 3,000; Czechoslovakia 2,691; West Germany 2,485.
Alloys	1,280	877	All to West Germany.
Cable lead	2,976	6,421	West Germany 5,515; Austria 906.
Semimanufactured products		8,233	Italy 3,974; Austria 1,771; Indonesia 1,283.
Mercury—76-pound flasks	9,657	9,512	United States 3,973; Austria 1,479; Poland 899; Israel 696; Italy 580; Sweden 435.
Pyrite concentrate	275,830	293,988	Italy 78,102; Czechoslovakia 49,903; West Germany 48,569; Switzerland 38,620; Egypt 30,380.
Zinc:			
Concentrate	18,849	30,037	Poland 16,117; West Germany 5,744; France 5,650.
Electrolytic	7,955	7,146	West Germany 2,400; United States 2,150; Italy 1,445; Czechoslovakia 800.
Semimanufactured products		6,900	West Germany 2,333; Denmark 1,623; United States 712; France 600.
Nonmetals:			
Asbestos, fiber	4,293	5,380	United States 5,351; Austria 29.
Barites	83,065	87,959	United States 41,386; U.S.S.R. 27,532; Poland 5,762; Hungary 9,233.
Bentonite	9,556	8,707	Poland 6,215; Italy 1,132; Sweden 570; Egypt 523.
Cement:			
Portland	120,105	300,557	Libya 53,910; Kuwait 41,070; Malta 31,957; Liberia 33,380; Ghana 31,450; Spain 26,493; Saudi Arabia 19,660.
Other	13,770	36,039	Italy 8,131.
Feldspar	10,763	18,746	Poland 7,453; East Germany 5,508; Hungary 2,254; Italy 1303.
Fire clay:			
Raw	1,288	7,844	Italy 7,823; Austria 20.
Calcined	1,160		
Lime:			
Calcined	137	717	Italy 700.
Hydrated	30	10	All to Italy.
Magnesite:			
Raw	5,190	493	All to East Germany.
Calcined	17,505	16,950	Poland 6,195; Netherlands 4,745; West Germany 3,275; Rumania 1,755.
Sintered	36,587	45,827	United States 19,910; Poland 11,987; West Germany 5,146; Hungary 4,694; Argentina 1,050.
Mineral fuels:			
Coal:			
Bituminous	1,600	1,280	All to Italy.
Dust	98,728	83,097	Italy 11,742; Austria 5,258.
Brown	6,892	14,417	Austria 11,835; Italy 1,581; East Germany 1,000.
Dust	60	575	All to Italy.
Lignite	5,696	11,872	Italy 11,742; Austria 130.
Petroleum:			
Crude	178,510	560,722	Austria 284,092; Israel 276,629.
Refined products:			
Gasoline	16,342	25,664	Poland 14,999; Netherlands 9,171.
Diesel fuel	4,038	154,365	West Germany 107,997; Netherlands 42,386.
Heating oil	61,904	76,939	West Germany 49,428; Czechoslovakia 8,098; United Kingdom 6,172; Israel 3,390; United States 3,264.
Lubricants	10,313	25,329	India 21,387; Egypt 3,935.
Other products	170	192	All to Greece.

Ferrous products head the list of imports. Imports were valued at 24,527 million dinars in 1962, representing 9 percent of all imports. However, iron and steel exports in that year amounted to 8,162 million dinars. Main sources of iron ore were India and Brazil; of scrap, the United States; of pig and cast iron, the U.S.S.R.; and of rolled products, East Germany and Austria. The Yugoslavs were expanding their steel industry so as to cut these imports.

Traditionally an importer of high-quality and high-rank solid fuels, Yugoslavia spent 7,692 million dinars in 1962, representing 3 percent of all imports, for coal alone, which came mainly from the U.S.S.R. During the same year, the country's imports of petroleum totaled 7,255 million dinars, representing 3 percent of all imports, but in the same year exports of petroleum were valued at 4,611 million dinars and were 2 percent of all exports. Imports primarily from the Soviet Union were paid for in soft currency, whereas exports primarily to Austria and Israel brought in hard currency. The expanding Yugoslav petroleum industry is making the country more nearly self-sufficient in oil.

TABLE 3.—Imports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Bauxite	----------	2,724	All from British Guiana.
Unwrought, including alloys	10,676	10,717	United States 8,063; U.S.S.R. 2,276.
Semimanufactured products	572	588	Austria 311; Germany 33; Great Britain 43
Chromite	15,888	36,864	Albania 21,257; Turkey 15,607.
Cobalt unwrought	21	36	Belgium-Luxembourg 36.
Copper:			
Blister	----------	148	All from Turkey.
Electrolytic	10,448	7,111	United States 6,146; United Kingdom 965.
Scrap and fillings	4,305	4,948	United States 2,832; Indonesia 746.
Semimanufactured products	629	559	Italy 231; West Germany 171.
Iron and steel:			
Iron ore	358,828	353,143	India 182,996; Brazil 100,312; Morocco 39,250; Turkey 18,564; Spain 10,000.
Scrap	125,077	79,730	United States 51,347; Algeria 6,725; Tunisia 6,532; Lebanon 4,479; Syria 4,775; Ireland 3,678.
Cast iron	84,981	114,398	U.S.S.R. 80,868; India 14,353; East Germany 10,534; Hungary 4,654; West Germany 1,159.
Ferroalloys	1,054	1,047	U.S.S.R. 456; West Germany 233; Sweden 140; France 139; United Kingdom 38.
Ingots and billets	18,949	3,382	Rumania 1,824; Poland 503; Belgium-Luxembourg 499; West Germany 363; Austria 190.
Rolled products [1]	275,862	327,086	West Germany 121,881; Austria 87,723; Poland 42,023; Italy 40,060; Czechoslovakia 24,488; Hungary 23,522; U.S.S.R. 18,672.
Other semimanufactured products [2]	71,763	52,586	Poland, 9,962; Austria 8,111; Italy 5,531; West Germany 5,231; United States 4,971; Belgium-Luxembourg 4,076; Hungary 3,078; U.S.S.R. 2,810; United Kingdom 1,816; Sweden 1,573; France 1,422.
Lead, refined	----------	749	United Kingdom 477; Bulgaria 272.
Manganese:			
Ore	38,138	44,934	India 24,755; Morocco 14,126; U.S.S.R. 3,100; Turkey 2,820.
Unwrought	93	41	West Germany 22; United States 15.
Nickel:			
Unwrought	219	362	United Kingdom 234; U.S.S.R. 128.
Semimanufactured products	19	16	West Germany 8; Sweden 2; United Kingdom 2.
Tin:			
Unwrought	1,398	912	United Kingdom 610; Indonesia 251; United States 51.
Scrap	----------	6	Norway 2; United States 1; Netherlands 1.
Semimanufactured products	10	22	West Germany 12; United Kingdom 7.
Zinc:			
Unwrought, electrolytic	----------	499	All from Bulgaria.
Semimanufactured products	5	6	United Kingdom 4.

See footnotes at end of table.

TABLE 3.—Imports of selected metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Nonmetals:			
Asbestos	7,723	9,328	U.S.S.R. 7,122; Republic of South Africa 1,533; United States 528.
Barite	251	----	
Cement:			
Portland	153,603	13,702	Bulgaria 9,739; Rumania 3,882.
Others	327	3	All from Italy.
Chalk	47	180	United Kingdom 149; France 14.
Cryolite, natural	349	761	U.S.S.R. 761.
Fertilizers:			
Natural phosphates, raw	254,637	324,275	Tunisia 138,659; Jordan 115,831; Egypt 46,326.
Potash, raw	----	14,488	East Germany 10,575; U.S.S.R. 3,913.
Fire clay:			
Raw	7,831	9,028	Czechoslovakia 7,265.
Burned	18,522	28,746	Czechoslovakia 15,951; Poland 11,424.
Fluorite, natural	2,603	3,275	East Germany 1,968; Bulgaria 1,106; West Germany 155.
Fluorspar, raw	502	198	East Germany 120; Bulgaria 58.
Gypsum, raw	40	12	All from West Germany.
Graphite:			
Raw	1,172	1,227	Austria 801; West Germany 328.
Retort	----	114	All from East Germany.
Kaolin	8,520	17,216	Greece 5,782; Czechoslovakia 4,320; East Germany 3,668.
Magnesite, calcined	10	20	All from Austria.
Mica, in strips	----	6	All from India.
Refractory bricks:			
Shamotte	2,343	687	West Germany 458; U.S.S.R. 173.
Dinas	----	775	All from U.S.S.R.
Silica	779	341	West Germany 247; Belgium-Luxembourg 57.
Magnesite	5	10	All from Austria.
Chrome-magnesite	39	36	Do.
Salt	133,992	28,168	All from Rumania.
Sulfur	10,317	10,106	France 7,325; Italy 2,495; Bulgaria 225.
Talc, natural	406	353	Italy 290, Austria 52.
Mineral fuels:			
Coal:			
Anthracite	144,817	122,370	U.S.S.R. 117,906; Morocco 3,375; Bulgaria 1,069; United States 20.
Bituminous:			
Coking—thousand tons	1,303	1,222	U.S.S.R. 856; United States 366.
Gas	24,819	24,516	Poland 15,628; Czechoslovakia 8,888.
Forge	20	21	All from Czechoslovakia.
Coke:			
Metallurgical	196,099	243,983	Czechoslovakia 80,095.
Dust	2,979	3,065	All from Czechoslovakia.
Petroleum coke	15,950	13,878	United States 13,774.
Petroleum:			
Crude	287,192	746,864	U.S.S.R. 409,432; Iraq 279,937; Bulgaria 33,593; Venezuela 23,902.
Refinery products:			
Gasoline	10,640	16,829	U.S.S.R. 13,430; United Kingdom 2,040; Rumania 1,359.
Diesel oil	125,441	233,114	U.S.S.R. 154,994; Rumania 64,124; Italy 13,996.
Residual fuel oil	----	19,168	United Kingdom 12,079; U.S.S.R. 7,089.
Lubricants	12,223	8,223	Poland 3,117; United Kingdom 1,219; United States 1,010.
Other	24,235	17,161	United States 12,011; Rumania 4,706.

[1] Excludes pipes.
[2] Includes drawn products, all types of iron and steel pipes, castings, and forgings.

COMMODITY REVIEW

METALS

Aluminum.—According to reports, large high-quality bauxite deposits covering an area of 800 square kilometers were discovered at Obrovac near Zadar in Dalmatia. This discovery adds 38 million tons to the nation's 150-million-ton bauxite reserve, the bulk of which is in deposits near the Adriatic coast.

The second phase of reconstruction was completed on "Boris Kidric," Yugoslavia's largest aluminum plant, at Kidricevo near Ptuj in Slovenia. The so-called column process was replaced by the Bayer process, so that approximately 50 percent of the plant operations became mechanized. It was expected that about 95,000 tons of alumina and about 40,000 tons of aluminum per year will be produced.

The first Yugoslav powdered aluminum plant started production at Belgrade. The capacity of the plant was reported to be 600 tons of this type of aluminum per year. One-third of the production will be used domestically, and the remainder will be exported.

Iron and Steel.—Production was not adequate for consumption, and large quantities of iron and steel had to be imported. To relieve this shortage, the Government, with the help of Soviet experts, initiated certain projects such as expanding the Smederevo plant and reconstructing Zenica, the largest iron and steel plant in Yugoslavia.

A British concern started construction of an iron and steel plant at Skopje in Macedonia. According to present plans, the plant will produce 300,000 tons of steel per year by 1965 as the first stage of development.

Discovery of a magnetite deposit was reported in the region of Mount Kopaonik in Serbia. The initial plan was to produce 100,000 tons of ore per year in 1964. In the area of the Ljubija mine, which produced about 800,000 tons of ore in 1962, large new reserves were developed. Total reserves reached 160 million tons of ore. When new construction is completed, annual output is expected to be about 2 million tons.

Lead and Zinc.—The new Toranice Sasi mine in Macedonia started production in 1963. Annual capacity of the mine, when in full-scale operation, will be 150,000 tons of ore. Lead concentrate was shipped to Trepca, Yugoslavia's largest lead smelting center. Zinc concentrate was shipped to the electrolytic plant at Sabac.

Nickel.—A new deposit of nickel was discovered in the region of the Goles Mountain near Pristina in Serbia. The reserve was estimated to be about 3.5 million tons of 1.5 percent nickel ore. This discovery is significant, because it is the first nickel deposit of proven economic importance in the country.

Pyrrhotite.—The smelting and refining complex of Yugoslavia's largest lead-zinc enterprise, Trepca, acquired a new facility. A magnetic separator to recover about 1.2 million tons of pyrrhotite annually was commissioned in the lead and zinc concentrator plant.

Uranium.—Yugoslavia's first uranium mine and reduction plant went into production at Kalna in the fall of 1963, it was officially announced. Reported capacity of the mine was about 200 tons of ore

per day. The process in the reduction plant was described as very efficient but no details have been revealed. Meanwhile, scientists from the nuclear institute at Vinca produced the first bar of nuclear fuel from domestic raw material. The fuel will be used in the first Yugoslav nuclear power plant, which is planned for 1970.

NONMETALS

The most backward branch of the mineral industry was the one dealing with the production of nonmetals. Difficulties in supplying the market with adequate quantities of cement after the 1963 earthquake disaster in Skopje were solved by import.

Cement.—The central part of the country, Bosnia, had no cement plant. To lower transportation costs, plans were made to construct a new cement plant near Zenica.

Fertilizers.—The new fertilizer plant at Kosovska Mitrovica, Fabrika Superfosfata, started production, and its ultimate annual capacity reportedly will be 250,000 tons of superphosphates and 120,000 tons of sulfuric acid.

MINERAL FUELS

Coal.—Coal remained the backbone of Yugoslav energy production, although natural gas was emerging as a significant competitor. Because of large reserves of low-grade coals, efforts were concentrated on finding the most efficient way of converting coal energy to a form of energy which can be more economically delivered to the consumer.

A project for gasification of Velenje lignite was awaiting approval for funds from the National Bank in 1963. Construction of a gas plant and a 250-kilometer pipeline will start immediately following allocation of the funds.

The bituminous coal from Ibar Valley was found to be of good quality for coking. In an effort to reduce coking coal imports, the Government modernized the mines in the area. For example, a modern plant was built for coal separation. The facilities include units for grinding magnetite necessary for heavy media separation. Enough magnetite powder is made in this plant for the needs of all coal beneficiation plants in the country.

The second unit of the Kosovo thermal powerplant was in the last stage of construction. The plant will use lignite dust as fuel. Plant capacity was expected to be about 125,000 kilowatts.

Three large brown-coal mines (Kakanj, Breza, and Bilo) in the Bosna River Valley were merged into a single enterprise. This action was taken with the hope that overall efficiency will be improved in all aspects of brown-coal activities.

Unfavorable conditions within and outside the coal industry contributed to its unsatisfactory performance. Many of the 89 coal mines operating in the country during 1963 were small and unprofitable. One of the measures used to improve the weak financial position of Yugoslavia's coal industry was to merge the different enterprises.

Petroleum.—Production of crude oil and natural gas reached planned targets. However, the year was without any discoveries of major new fields. The gas found near Gospodjinci may be significant, be-

cause test holes proved for the first time the presence of hydrocarbons in Backa.

Completions of a gas pipeline from Mokrin to Pancevo and a gasoline plant at Elemir were the most significant developments in the petroliferous region of Banat. The Mokrin-Pancevo pipeline, which is 185 kilometers long, connects the major oil and gas fields in Banat with the fertilizer plant at Pancevo. The Elemir plant started production in early December 1963; reported annual capacity is about 20,000 tons of liquefied gas products.

Construction was started on a new refinery in Pancevo on a site embracing over 100 hectares. The capacity of this refinery is sizable—about 1.2 million tons of crude oil per year.

The Mineral Industry of Algeria

By Thomas G. Murdock[1]

ALTHOUGH the contribution of Algeria, including the Sahara, to the local economy and to world mineral supply was small for many years, the spectacular development of an important petroleum and natural-gas industry has changed the position of the country. In 1963 there were decreases in output of most mineral commodities, however oil and gas production forged ahead and established new records. The impact of adverse market conditions and especially the competition from lower cost producing areas was felt by both the metals and nonmetals industries. This and the general economic conditions related to the recovery of the country following the years of strife attending its emergence as an independent state combined to hold back production and development commensurate with resources.

The principal events of the year were in the petroleum sector and included the first commercial production from several new fields, some new discoveries, the virtual completion of the first petroleum refinery in the country, and installation of additional pipelines. Progress was made toward the further utilization of the vast resources of natural gas and the provision of additional transportation and refining facilities. In the mining domain the government took over two iron-mining operations, and progress was made towards expanding production of phosphate rock and determining methods of upgrading the Tindouf iron ores. Completion of the iron and steel plant near Bône was further delayed. The only coal mine reportedly closed down in late 1963.

Algeria has become a major crude-oil producing and exporting country, ranking 9th in production with 1.9 percent of the world total in 1963. Nowhere else in the world in the last few years have fields of the magnitude of those in the Algerian Sahara been discovered with such rapidity. The proven oil and condensate reserves of the Algerian Sahara at the end of 1963, totaling more than 1,400 million tons (approximately 108 billion barrels), are not yet on the same scale as those of the Middle East, but are comparable to those of the East Indies, are more than half those of Venezuela, and are more than twice those of Canada. In assessing the natural gas reserve, however, the magnitude is greater; the more than 2 billion million cubic meters proven is about the same as the reserve in the U.S.S.R. and second only to U.S. reserves.

Major U.S. oil companies have extensive holdings in the country; the total investment in oil and gas exploration at the end of 1963 was

[1] Mining engineer, Division of International Activities.

estimated at between US$75 million and $100 million, representing somewhat less than 10 percent of the total capital invested in Algeria for that purpose. U.S. companies had interests in about 31 percent of the 684,600 square kilometers open to exploration at yearend.

The 1962 mineral production is estimated to have been valued at about Fr2,296 million (US$470.68 million),[2] of this, crude petroleum accounted for Fr2,060 million. The 1962 gross national product (GNP) was Fr15,868 million; thus the extractive industry contributed about 14.5 percent of the GNP. Without its oil revenues the country could scarcely exist economically. Government income at the end of 1963 was reported at Fr246 million, being obtained from a 50–50 profit-sharing agreement based on realized prices. The oil revenues were estimated at about Fr188 million for 1962 and Fr215 for all of 1963.

At the end of June 1963, the labor force engaged in mining was down to 5,574 (7,153 average in 1961), slightly more than 0.1 percent of the total labor force of 4 million, half of whom were unemployed. In 1960 an additional 7,870 workers were employed in quarrying, including salt mining. Employment data for oil industry are not available; the total working force of the Sahara region was about 194,000, of which approximately 181,000 were nomads—indicating that about 13,000 are employed by the industry and supporting activities.

GOVERNMENT POLICIES AND PROGRAMS

The only recorded cases of nationalization of the mining industry in 1963 were two iron-mining operations and three stone quarries near Bône; nationalization in other sectors of the economy was established extensively. Matters relating to mines and minerals continued to come under the general control of the Directorate of Mines and Geology of Algeria; however, on September 6 the Ministry of Industrialization and Energy, which had formerly supervised the activities of this directorate, became a division of the new Ministry of National Economy. Under the new organization, construction materials were placed under the jurisdiction of the Directorate of Industrialization, a part of the Ministry of National Economy.

The petroleum code for Algeria remained essentially as it was under the French regime, except as modified by: (1) the Evian accords; (2) the Franco-Algerian agreement of August 28, 1962, putting into application the petroleum provisions; and (3) the agreement of June 26, 1963, establishing a Franco-Algerian petroleum arbitration commission. The present petroleum code, however, even as amended, applied only to permits granted before July 1, 1962, or to renewals of these. It was reported in the latter part of 1963 that the government had not announced any decisions as to regulations governing new exploration and exploitation permits, and it was not known whether the existing code would be simply extended, minor changes would be made, or a sweeping revision would follow. Reports issued in August indicate the granting of new permits had been suspended temporarily.

[2] The unit of currency used throughout this section is the new franc (Fr), roughly on par with the French new frac. (Fr1=US$0.205; US$1=Fr4.878).

On a visit to the United States in October, the Algerian Minister of National Economy reiterated that there was no thought at the time of nationalizing the oil industry. The oil resource has been recognized as the best potential source of income to put the economy on a sound basis and everything is to be gained from insuring the continued smooth operation of the industry. However, the government would like to see more diversification of foreign interest in the petroleum resources and has made the first moves towards pressure for a larger share of the oil revenues, calling for a revision of the Evian agreement which guaranteed the development of the oil industry after independence. Establishment of a national oil company, 51 percent owned by the Algerian Government and the remainder by private oil companies, particularly American and West European, has been suggested. Under the Evian agreement French companies must be given priority, or at least the right to match any rival offer for exploration rights for a 6-year period. The agreement gives also a similar priority for concerns whose capital is held by the Algerian Government or State organizations. Indications are, however, that Algeria is looking also to Japan for partners in an exploration and production venture and to the Ente Nazionale Indrocarburi of Italy for a refining-marketing tieup.[3]

The Franco-Algerian Organisme Technique de Mise en Valeur des Richesses du Sous-Sol Saharien continued its program of promoting development of the mineral and petroleum resources of the Sahara, carrying out geological mapping, exploration, and other activities.

On September 27, Algeria became a member of the International Monetary Fund, the World Bank, and the International Development Association.

SOURCE MATERIAL

Dispatches from the U.S. Embassy in Algiers have provided a partial coverage of 1963 activity. It has been necessary to supplement these with data from interim publications of the Algerian Government; often the latter cover only part of the year. In several cases, particularly the trade since 1961, it was necessary to resort to estimates. Value of production was estimated in the absence of any factual figures; this was also done for value of exports of crude petroleum, which is not reported on an annual or other regular basis by the source materials available. Information on other phases of the oil industry is adequate and the international journals have provided much of that used.

PRODUCTION

While the annual mine production has shown some temporary growth for intermediate years of the 1959–63 period, its overall trend has been generally downward, reflecting both market conditions and the impact of the troubled conditions existing in the country. Only copper has shown a steady year-by-year increase; antimony production ceased entirely with 1963. Phosphate rock production declined because of ore depletion at the active mine; new deposits were known but not yet fully developed. The spectacular growth in production

[3] Oil and Gas International. V. 4, No. 1, January 1964, p. 36.

of petroleum, resulting from the extensive exploration activities in the Sahara, was the outstanding performance during the period; barely affected by the strife in other parts of the country and limited only by pipeline capacity, the sixteenfold increase between 1959 and 1962 brought a considerable net gain to the extractive industries, amply compensating for declining mine activity.

TABLE 1.—Production of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity [2]	1959	1960	1961	1962	1963
Metals:					
Antimony, content of concentrate	1,030	712	653	136	
Copper, content of concentrate	85	138	609	779	1,036
Iron ore—thousand tons	1,927	3,438	2,867	2,062	1,976
Lead, content of concentrate	11,043	10,459	9,378	9,040	8,020
Silver [3]—troy ounces	400,000	300,000	300,000	275,000	250,000
Zinc, content of concentrate	38,804	40,134	42,137	41,926	36,287
Nonmetals:					
Barite [4]	21,807	55,850	26,969	15,985	29,100
Cement—thousand tons	957	1,062	1,072	650	884
Diatomite	34,552	22,014	31,130	27,728	17,600
Fuller's earth	119,300	102,000	116,426	38,437	85,000
Gypsum	171,800	176,563	[5] 175,000	[5] 175,000	[5] 175,000
Lime	88,500	85,600	60,200	[5] 31,200	[5] 15,600
Phosphate rock	571,763	563,047	439,609	389,866	248,000
Pyrites	29,050	38,500	48,857	43,000	37,700
Salt—thousand tons	131	[5] 143	131	[5] 131	130
Minerals fuels:					
Coal—thousand tons	122	119	78	53	40
Coke (low temperature)—do	89	93	[5] 85	[5] 70	[5] 65
Fuel briquets—do	49	45	40	[5] 27	[5] 25
Natural gas, marketed—million cubic meters	[6] 390	([7])	231	353	394
Natural gasoline			123,000	201,869	232,800
Petroleum, crude—thousand tons	1,232	8,598	15,664	20,497	23,636

[1] Includes the Sahara.
[2] In addition Algeria produces various construction materials, but annual data have not been available since 1960 when the following quantities were reported: clay (brick), 834,900 tons; clay (for cement), 297,900 tons; limestone (agricultural), 13,800 tons; limestone (for cement and lime), 1,145,200 tons; kaolin and quartz, 8,700 tons; sand and gravel, 1,382,900 tons; stone (building), 882,000 tons; stone (crushed), 4,331,300 tons; and stone (flagstone and paving), 225,000 tons.
[3] Estimated recoverable silver content of lead and zinc concentrates.
[4] Quantities for 1959–61 are mine production; comparable data for 1962–63 are not available, and quantities shown are for ground barite.
[5] Estimate.
[6] Total production including marketed.
[7] Data not available.

TRADE

Available official data on exports do not include crude petroleum. Other metal and mineral commodities were valued at Fr209 million (metals, Fr183 million, and nonmetals, Fr26 million) in 1961, having decreased from Fr233 million (metals, Fr200 million and nonmetals, Fr33 million) in 1960. Estimated value of exports of crude petroleum in 1961, including those from the Sahara the principal producing area, was about Fr1,508 million (Fr808 million in 1960). Including the crude petroleum, 1961 mineral export value was 52 percent of total export value (38 percent in 1960).

In 1961 the total value of metal and mineral imports was Fr647 million, 13 percent of all imports, compared with Fr824 million, also 13 percent, in 1960. The 1961 import value by categories was metals, Fr292 million; nonmetals, Fr58 million; and mineral fuels, Fr297 million.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	Destinations, 1961 [1]		
			France	Franc zone	Other
Metals: [2]					
Aluminum	1,128	1,612	337	87	1,188
Antimony ore	3,609	2,636	All		
Copper	4,663	5,761	5,115	635	11
Iron and steel:					
Iron ore thousand tons	3,574	2,781	122		2,659
Pig iron and ferroalloys	11				
Scrap	52,425	89,101	329		88,772
Ingots and blooms [3]	924	4,731	494	474	3,763
Rolled products	3,095	3,632	3,174	201	257
Lead:					
Ore and concentrate	5,821	5,461	4,323	652	486
Unwrought and semimanufactures [4]	3,838	3,318	2,410		908
Magnesium	16	23			All
Nickel	26	51	27		24
Precious metals troy ounces	25,721	643,015	643,015		
Tin [4] long tons	14	7	5	2	
Zinc:					
Ore and concentrate	65,821	76,124	75,395		729
Unwrought and semimanufactures [4]	589	434	232		202
Other metals		9			All
Ores, unspecified	[5] 10,920	6,059	1		6,058
Slags and residues	147	153	93	10	50
Nonmetals:					
Barite	3,185	1,432			All
Bentonite [6]	65,097	66,177	39,955	7,620	18,602
Diatomite	23,935	15,374	9,291	116	5,967
Fertilizers:					
Phosphatic	2,230	2,509		9	2,500
Other	67	25		25	
Phosphate rock	470,120	379,155	108,977	5,739	264,439
Pyrites, unroasted	17,119	23,948	17,968	5,980	
Salt	60,250	68,875	54,498	10,197	4,180
Other, unspecified	[7] 266	637	39	18	580
Mineral fuels:					
Coal		1,160	10		1,150
Other solid fuels	52	5		5	
Byproducts, coal	41	24	24		
Petroleum: [8] Refined:					
Liquefied petroleum gas		36		36	
Bitumens and asphalts	108				
Unspecified bunker	663	558	358	178	22

[1] More detailed distribution not available.
[2] Includes unwrought metal, semimanufactures, and scrap, unless otherwise specified.
[3] Includes bars and sections.
[4] Includes small quantity of manufactures.
[5] Consists of copper ores and concentrates, 417 tons, and pyrites (roasted), 10,503 tons.
[6] Includes fuller's earth and smectic clay.
[7] Consists of andalusite group minerals, 45 tons; graphite, 106 tons; gypsum, 2 tons; lime, 18 tons; sand (industrial), 54 tons; talc, 2 tons; and other, 39 tons.
[8] Crude petroleum from Sahara not included in Algerian official export statistics. Exports were (in thousand metric tons) 1960—8,054, and 1961—15,097 (France—11,172; other Common Market countries—3,472; and other countries, including Algeria—453).

Source: (1960) Service des Douanes. Commerce Extérieur et Navigation Maritime. 1961. (1961) Administration des Douanes. Bulletin Comparatif Trimestriel du Mouvement Commercial et Maritime, 1962.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	Source, 1961 [1]		
			France	Franc zone	Other
Metals: [2]					
Aluminum	3,047	2,250	2,173		77
Copper	5,653	4,232	920		3,312
Iron and steel:					
Pig iron and ferroalloys	1,321	886	886		
Scrap	1,554	73	73		
Ingots and blooms [3]	201,409	85,218	84,978	3	237
Rolled products	267,030	215,611	213,314		2,297
Lead:					
Ore and concentrate	55	1,502		1,502	
Unwrought and semimanufactures [4]	5,077	3,802	998	2,804	
Nickel	10	3	3		
Precious metals—troy ounces	19,612	15,432	14,146		1,286
Tin [4]—long tons	166	136	99	2	35
Zinc:					
Ore and concentrate	1,941	432		432	
Unwrought and semimanufactures [4]	1,184	1,032	1,029		3
Other metals	21	38	32		6
Ores, unspecified	[5] 4,715	2,972	2,502	67	403
Nonmetals:					
Barite	12,458	15,205	15,205		
Bentonite [6]	7,845	3,368	47	2,571	750
Cement	528,560	375,256	351,175	21,529	2,552
Diatomite	150	101	101		
Fertilizers:					
Natural	1,475	2,188	1,894	185	109
Nitrogenous	55,961	42,782	42,782		
Phosphatic	21,085	17,101	6,902	8,260	1,939
Potassic	22,344	14,928	11,910		3,018
Lime	6,256	4,641	4,641		
Pyrites, unroasted		1,538			1,538
Salt	376	347	345	2	
Sulfur:					
Crude	35,989	27,834	27,834		
Refined	375	487	487		
Construction materials	[7] 36,819	21,528	12,986	265	8,277
Other, unspecified	[8] 78,702	62,824	15,341	514	46,969
Mineral fuels:					
Coal	337,027	209,915	80,769	95,946	33,200
Other solid fuels	228	46	35		11
Byproducts, coal	17,139	12,532	10,697	322	1,513
Petroleum:					
Crude	11,295	18,848		[9] 18,848	
Refined:					
Gasoline [10]	322,558	323,502	304,243		19,259
Kerosine [10]	95,484	100,238	100,034		204
Other light oils [10]	3,560	3,804	2,407		1,397
Distillate fuel [10]	379,811	411,681	398,793		12,888
Residual fuel	562,716	458,708	368,486		90,222
Lubricants	29,763	28,996	28,496	14	486
Liquefied petroleum gas	51,166	60,471	57,229		3,242
Bitumens and asphalts	120,573	125,015	124,804		211
Other	628	927	899		28
Total	1,566,259	1,513,342	1,385,391	14	127,937

[1] More detailed distribution not available.
[2] Includes unwrought metal, semimanufactures, and scrap, unless otherwise stated.
[3] Includes bars and sections.
[4] Includes small quantities of manufactures.
[5] Consists of bauxite, 2,200 tons; manganese ore, 30 tons; pyrites (roasted), 2,313 tons; titanium minerals, 132 tons; and zirconium ores, 40 tons.
[6] Includes fuller's earth and smectic clay.
[7] Consists of crushed stone, 4,968 tons; dolomite, 2,529 tons; granite and other dimension stone, 41 tons; gypsum, 13,645 tons; limestone, 2,263 tons; marble, 8,892 tons; ornamental granules, 4,478 tons; and slate, 3 tons.
[8] Consists of abrasives (natural), 584 tons; andalusite group minerals, 5 tons; asbestos, 6,189 tons; clay (refractory), 408 tons; chalk, 9,569 tons; feldspar, 750 tons; fluorspar, 98 tons; graphite, 21 tons; kaolin, 3,759 tons; magnesite, 8 tons; mica, 70 tons; pigments (mineral), 725 tons; pumice, 46,204 tons; sand (industrial), 5,400 tons; talc, 4,387 tons; vermiculite, 480 tons; and, other, 45 tons.
[9] From Sahara.
[10] Approximate quantities for 1961 calculated from hectoliters, assuming same equivalence for conversion to metric tons as reported for 1960.

Source: (1960) Service des Douanes. Commerce Extérieur et Navigation Maritime. 1961.
(1961) Administration des Douanes. Bulletin Comparatif Trimestriel du Mouvement Commercial et Maritime. 1962.

France continued to be the principal partner in mineral and metal trade in 1961, supplying 90 percent of the imports and receiving 29 percent of the exports, exclusive of crude oil—74 percent going to France. Although exact data are not available, the other European Economic Community (EEC) countries, especially Italy, accounted for most of the remainder of this trade; these countries received 23 percent of the 1961 crude oil exports. Metal and mineral trade with the United States has remained small.

Only partial data on 1962 trade are available; that imports decreased appreciably below 1961 is evidenced by the decline in exports of iron and steel and solid mineral fuels from the EEC to Algeria to Fr83 million (Fr298 million in 1961). If these commodities and countries accounted for the same proportion of imports as in 1961, the 1962 imports would have been valued at only Fr182 million. The 1962 exports are estimated to have been valued at Fr189 million for metals and nonmetals and an additional Fr2,024 million for the crude petroleum.

COMMODITY REVIEW

METALS

Copper.—Copper production was 3,700 metric tons of 28 percent concentrate (2,900 tons at 27 percent in 1962), all from the Ain Barbar mine of Société des Mines de Sidi-Kamber, where copper occurs in association with lead and zinc. These are also recovered as concentrate. The improved security and economic conditions of the area, near Bône, are credited with the growing output of copper, however, the weak market position of coproduct lead and zinc held back copper production. The Ain Barbar reportedly has a capacity of 50,000 metric tons of ore per year and at full-scale operation could produce 4,500 tons of copper concentrate, 1,500 tons of copper-lead concentrate, and 2,000 tons of zinc concentrate. Data available do not indicate production of copper-lead concentrate for 1962 and 1963; in 1961, output reportedly was 216 tons of an unstated grade and was included with 451 tons of lead concentrate assaying 78 percent lead. In 1962, exports of copper concentrate were 3,572 tons; through the first 6 months of 1963 they declined to an annual rate of 2,070 tons.

The Algerian Government planned exploration of another copper deposit in the mountains near Blida south of Algiers, where a high-grade occurrence was known; this was scheduled to begin in the second 6 months.

Iron Ore.—The 1963 decline in iron-ore production followed the trend begun in 1960; it was due mainly to continuing difficulties in marketing the ore (average 1959–62 iron content, 53.9 percent) in competition with higher grade material readily available on the European markets from other countries. The decreased popularity of Algerian ores was reflected in the 32-percent drop in the f.o.b. selling price in the United Kingdom and West Germany between 1957 and 1962. The 1962 exports were 2,131,200 metric tons and distribution was approximately as follows: United Kingdom, 62 percent; Italy, 22 percent; West Germany, 9 percent; France, 5 percent; and Belgium-Luxembourg, 1 percent. Exports through June 1963 were at the

annual rate of 1,849,000 tons; receipts by European Common Market countries through September were at a rate of 7 percent below 1962. It was reported in September that a trade agreement had been signed with Bulgaria for delivery of an unstated quantity of ore from the Beni-Saf, Rouina, and Zaccar mines.

Because of marketing difficulties the Compagnie des Mines de Fer Mokta el Hadid gave up its concessions at the Beni-Saf mines near Tlemcen and the Algerian Government took over as of February 1, placing operations in charge of the Government Mining Service (Service des Mines) pending the creation of a public organism for mineral exploitation. In July the government also took over operation of the Zaccar mine near Miliana. Following a sharp drop in production in 1962 the managing company, Société Anonyme des Mines de Zaccar closed the mine in June, without abandoning its concession rights. The government reacted by placing the mine under the Bureau d'Etudes et de Recherches Industrielles et Minières (BERIM). The Rouina mine, idle since 1958, was also reopened with the aid of Bulgarian technicians, which was also extended to the Beni-Saf and Zaccar mines.

Production by mines for the latest years for which data are available was as follows:

Mine:	Metric tons	
	1961	1962
Beni-Saf	181,467	159,119
El-Maden	20,674	9,377
Khanguet	146,738	142,837
Ouenza	2,133,601	1,505,544
Timezrit	128,410	91,046
Zaccar	240,367	153,960
Other	15,970	---
Total	2,867,227	2,061,883

The Gara Djebilet iron-ore deposits, with a proven reserve of more than 1 billion metric tons containing about 58 percent iron, and situated about 130 kilometers southeast of Tindouf in the western Sahara, were in the news as an element in the Algerian-Moroccan border dispute in the fourth quarter. In April a pilot-plant installation set up by Société d'Etudes et de Realisations Minières et Industrielles (SERMI), the organization investigating these deposits, was completed and began an elaborate series of beneficiation tests to upgrade the ore by dry magnetic separation. A description of the deposits, earlier testing of the ore, and the new installation appeared in the technical press.[4] The deposits could be mined by open cut; however, their development would require a railway to the Atlantic, 380 air-kilometers away. Consequently the importance of improving the ore tenor is clearly a factor in their eventual possible development.

Iron and Steel.—In the absence of data on 1962 imports of iron and steel an approximate figure is reflected in the exports of the European Economic Community to Algeria. These exports consisted of 380 metric tons of pig iron and ferroalloys, 38 tons of scrap, and 98,136

[4] Annales des Mines (Paris), Station d'Essais pour Enrichissement du Mineral de Fer de Gara Djebilet (Pilot Plant for Beneficiation of the Gara Djebilet Iron Ore). April 1963, pp. 21–34.

tons of crude steel and rolled products, valued at Fr75 million (Fr280 million in 1961). The indicated decrease in imports was the result of decreased construction activity and curtailment of activity by Algerian metal-working establishments.

In 1960 the latter produced 7,500 metric tons of iron castings, 7,500 tons of steel castings, 40,400 tons of rolled steel, and 11,600 tons of wire products. In 1961 total apparent steel consumption expressed in terms of ingots was 402,000 tons, or 36 kilograms per capita (571,000 tons and 52 kilograms, respectively, in 1960). At the end of 1963 Aciéries et Laminoirs d'Oran (ACILOR) was turning out rolled products at the annual rate of 21,600 tons.

Although progress was made toward completion of the 400,000-ton-per-year steel plant 10 kilometers south of Bône, scheduled for late 1963, numerous difficulties intervened to delay this. Lack of an adequate water supply due to the noncompletion of the dam on the Oued Bounamoussa was reported in May as having held up completion of the plant, and subsequently, operations were rescheduled to begin only at the end of 1964.

This project, undertaken by Société Bônoise de Sidérurgie, partly financed by French public or semipublic sources, has been under construction since 1959; initially it is to consist of one blast furnace and two bessemer converters and would produce billets for export. Iron ore from the Ouenza mine would be smelted and expectations were that the annual demands of at least 800,000 metric tons would partly compensate for the loss of iron ore markets in Europe and permit iron mines to continue at the previous high production level.

Lead-Zinc.—The decreased production of lead and zinc (as well as recoverable silver contained in the concentrates) was essentially the result of low metal prices. The largest mines, situated along the Algerian-Moroccan frontier, were undoubtedly affected adversely by the boundary dispute and the labor difficulties which shut down the nearby lead smelter in Morocco, where a part of the Algerian production is smelted.

The 1963 output consisted of 11,800 metric tons of lead concentrates (12,917 tons in 1962) and 57,460 tons of zinc concentrates (70,057 tons in 1962). Tenors are believed to have averaged 68 percent and 63 percent, respectively. The zinc concentrates were mainly of sulfide minerals; however, the quantity of calamine included in the total rose from 470 to 1,660 tons. Indications are that five mines were in production, as in 1962 and 1961. Production by individual mines in 1961 was as follows:

		Concentrate production (metric tons)	
Mine	*Ownership*	*Lead*	*Zinc*
El Abed	Société Algérienne du Zinc	4,713	40,150
Oued Zounder	Société Nouvelle des Mines d'Ain-Arko.	3,546	27,013
Sidi-Kamber	Société des Mines de Sidi-Kamber	3,503	1,720
Ain Barbar	do	[1] 451	661
Ouarsenis	Société des Mines de l'Ouarsenis	859	1,363

[1] Includes an unspecified quantity of copper-lead concentrates.

In 1961, El Abed milled 130,322 metric tons of ore; Ain Arko, 140,198 tons. Mill recoveries were, respectively, 90 and 86 percent for the lead and 97 and 85 percent for the zinc.

In 1962, exports were 12,164 metric tons of lead concentrates and 68,992 tons of zinc concentrates; in the first 6 months of 1963, exports were at respective annual rates of 12,172 tons and 42,176 tons.

NONMETALS

Barite.—The appreciable increase in production of ground barite in 1963 was the result of efforts to increase domestic self-sufficiency. Lack of data on imports does not permit a reliable appraisal of results but 1963 production exceeded 1962 consumption (28,793 metric tons). In past years French barite was obtainable at a lower cost than the domestic product; however, reports are that the Algerian producers have been able to deliver barite of an average density of 4.3 at a competitive price. The principal producer continued to be Société Anonyme des Barytes Algériennes, having a modern plant at Oued Smar (Algiers). Exports through June were at the annual rate of 1,380 tons (about 1,200 tons in the year 1962).

Cement.—A new cement plant was entered in service at Bougie early in 1963, contributing to the increased 1963 production. Data on imports were available only for the first 6 months of 1962 when they were 186,000 tons for the year, considerably below the level of preceding years. The small production and imports of cement, in comparison with 1960–61 indicates that construction activity remained at a low level. In 1961, 31,554 housing units were started (37,596 units in 1960).

Phosphate Rock.—The 36-percent drop in phosphate rock production (29.8 percent P_2O_5) was mainly due to the declining reserves at the only mine in production, the Kouif operations of Compagnie des Phosphates de Constantine. At yearend the reserves were virtually exhausted, and mining was expected to cease in 1964. Work continued on preparations for mining the deposits at Djebel-Onk where Société de Djebel-Onk is installing mine and upgrading facilities expected to produce initially 600,000 metric tons per year, later to be expanded to 800,000 tons. The crude rock, containing 25.6–26.6 percent P_2O_5 is to be beneficiated to 34.4 percent in three stages. A pilot plant at Bône has developed the flowsheet for this. Originally scheduled for completion in late 1963, delays have postponed this until 1964. The new installations were estimated to cost Fr130 million, and the company was capitalized at Fr30 million.

In 1962 exports were 407,000 metric tons; local consumption, 26,423 tons. Through the first 6 months of 1963, exports were at the reduced annual rate of 340,00 tons. Local consumption is in manufacture of superphosphate; production of this declined sharply from 101,000 metric tons in 1958 to 59,700 tons in 1961 and 46,900 tons in 1962, result of conditions in the country. Output during April–July 1963 was at the annual rate of about 58,300 tons.

Sulfur and Pyrites.—Despite the completion of a program of equipment modernization by the only producer of pyrites (45 percent sulfur content), the El Halia mine near Philippeville, output decreased by 12 percent in 1963 to below the 1960 level. The reduced production

was reportedly the result of competitive market difficulties and, despite a 10-percent reduction in price, a greater volume could not be sold. Total (both roasted and unroasted) exports were 34,692 metric tons in 1962 and through June 1963, at the annual rate of 33,562 tons. In 1961 local manufacture of 30,000 metric tons of sulfuric acid utilized 14,269 tons of domestic pyrites; the 1962 consumption of pyrites was about 20,000 tons.

The Algerian Government announced plans to reopen the sulfur mine at Heliopolis, idle for some years following bomb damages during the hostilities.

MINERAL FUELS

Coal.—Following extensive substitution of Saharan oil and gas for domestic coal produced only by the nationalized colliery at Kenadsa in the Sahara, 1963 saw the further curtailment of coal output. In December 1961, it was decreed that production would be progressively reduced and cease completely by the end of October 1963. The mine operated for several years with an annual subsidy of about Fr10 million, and the 1961 operating deficit was estimated at Fr8 million.

Coal imports have also declined with the increased share of energy being supplied by oil and gas, particularly since 1960. Data on actual 1962 total imports were not available; they were reflected in the 153,866 metric tons exported to Algeria by the EEC and 45,609 tons by Morocco—a total of 199,475 tons, 41 percent below 1960 imports.

Petroleum and Natural Gas.[5] [6]—Although the crude oil production in the year did not show the spectacular rise characterizing past years, the 15-percent increase established a new record high and was about the maximum possible, considering that some major pipeline systems to the Mediterranean have become essentially full, and large output boosts could not be expected. Output of the Polignac basin of the Sahara, the principal producing area in 1962, was 11,379,000 tons (10,560,000 tons in 1962); however, with the increased output from the Triassic basin to the northwest, partly due to the new Rhourde el Baguel field there, this basin accounted for 51.8 percent of the country total (48.4 percent in 1962) and regained the first place it had in 1961. The small basins in northern Algeria continued to be of minor importance.

Exports of crude oil were 23,655,208 tons (20,350,000 in 1962). The 1963 exports were to France, 15,535,488 tons; other Common Market countries, 6,158,509 tons; and other countries, 1,961,211 tons. Of 1963 exports, 59 percent (52 percent in 1962) were shipped from Bougie, in Algeria, the terminus of the 638-kilometer pipeline from Haoud el Hamra (Hassi Messaoud), and 41 percent (48 percent in 1962) were shipped from La Skhirra, in Tunisia, the terminus of the 757-kilometer pipeline from In Amenas. Local sales in 1963 were 157,491 tons.

In 1963, market sales of natural gas amounted to 394 million cubic feet; based on data through August, 308 million were supplied by the Hassi R'Mel field of Société d'Exploitation des Hydrocarbures d'Hassi R'Mel (SEHR), 50 million came from the In Amenas North gasfield

[5] Institute of Petroleum Review (London). V. 17, No. 204, December 1963, pp. 449–60.
[6] World Oil. V. 157, No. 3, Aug. 15, 1963, pp. 158-E–158-H.

TABLE 4.—Algerian Sahara: Production of crude oil[1]

(Thousand metric tons)

Company and field	1962	1963[2]
Polignac basin:		
Compagnie Algérienne de Recherche et d'Exploitation de Pétrole au Sahara (CREPS):		
Edjeleh	1,882	1,832
El Adeb Larache	301	497
La Reculee		29
Ohanet South	119	179
Tan Emellel South	5	7
Tin Fouyé		718
Tiguentourine	326	452
Zarzaitine	7,307	6,771
Compagnie d'Exploration Pétrolière (CEP):		
Askarene	29	100
Guelta	3	88
In Adaoui	1	12
Ohanet North	550	656
Tamadanet	5	
Société de Recherche et d'Exploitation de Pétrole (EURAFREP): Tan Emellel	32	38
Triassic basin:		
Compagnie Française des Pétroles (Algéria)-(CFPA): Hassi Messaoud North	3,670	4,382
Société Nationale de Recherche et d'Exploitation des Pétroles en Algérie (SN REPAL): Hassi Messaoud South	5,507	6,556
Société Nationale des Pétroles d'Aquitaine (SNPA): El Gassi-El Agreb	750	1,116
Sinclair-Newmont Société Anonyme Française de Recherche et d'Exploitation de Pétrole (SAFREP):[3] Rhourde el Baguel		182
Compagnie des Pétroles France-Afrique (COPEFA): Gassi Touil		11
Constantinos basin (North Algeria): Société Nationale de Recherche et d'Exploitation des Pétroles en Algérie (SN REPAL): Djebel Onk	5	6
Hodna basin (North Algeria): Compagnie Algérienne de Recherche et d'Exploitation Pétrolieres (CAREP): Oued Gueterini	5	4
Total	20,497	23,636

[1] Including output from north Algeria.
[2] Estimate on basis of production of individual fields through August and total company production for the year.
[3] Operating company is Sinclair Mediterranean Petroleum Co. EURAFREP and Tidewater also hold interest in the concession.

of CREPS, and 36 million came from the Hassi Messaoud North oilfield of CFPA. In 1962 marketed gas production was 353 million cubic meters, all from Hassi R'Mel.

Gasoline condensate production in 1962 was 201,869 tons; 182,024 tons came from Hassi R'Mel; 11,002 tons, from In Amenas North; and 8,843 tons, from the Hassi Tourag field of Compagnie des Pétroles France-Afrique (COPEFA). Through August 1963, Hassi R'Mel produced at the annual rate of 220,800 tons and In Amenas North at a rate of 12,000 tons; Hassi Tourag was apparently idle.

The pace of exploration activity over the Sahara generally continued much as before although there was a decline in geophysical activity as a result of the completion of the general reconnaisance of many exploratory leases. Geophysical operations were mainly concentrated on areas of previously recognized interest where detailed studies were required, such as the Polignac basin, the western flank of the basin of the great Eastern Erg, and the borders of the Hassi R'Mel plateau. However, exploration was continued also in the newer areas of the Tindouf basin (part of which was the scene of the Algerian-Moroccan border strife in the fourth quarter) and the southwest corner of the great Eastern Erg.

Major discoveries made in the last half of 1962 and in 1963 include the location of a large oil reservoir at Rhourde el Baguel, which began

limited production in July, and at Gassi Touil, as well as important natural gas deposits at Rhoude Nouss and Rhoude Chouff on the Rhoude Hamra permit and at Alrar north of it. These finds on the western culmination of the basin of the great Eastern Erg in the El Biod plateau of the north Triassic province resulted in concentration of a considerable amount of exploration work in this area in the latter part of the year. In July a new deposit was discovered by SNPA, between the El Gassi and El Agreb fields, and the first tests showed 555 tons per day.

In the Polignac Basin the rate of discoveries remained outstandingly high (although most of the later ones were of natural gas), and a great deal of exploratory work continued to show the importance of this oil province. Exploratory drilling was concentrated, particularly in the southeast of the basin where CREPS was searching for the bevel of the Lower Devonian reservoirs on the culmination of the plateau adjoining the Libyan border and on the eastern region of the Tinhert plateau in the Ohanet area.

Well completions totaled 193 in 1963, an increase of 16 percent over the 167 in 1962 when 108 development wells totaling 181,000 meters and 59 exploratory wells totaling 135,000 meters were drilled. Development drilling activity declined because areas of several fields—for example Hassi Messaoud, Ohanet, Edjeleh, and Zarzaitine—were practically developed. At the beginning of the year, 519 oil wells were in production; of these 500 were flowing and 10 were artificial lift. Total oil wells drilled within the productive basins to January 1, 1963, were 793 of which 537 were capable of oil production.

In December the total proven reserves of oil and gas in the Algerian Sahara were reported to be as follows:

Field area:	*Oil and condensate (million tons)*	*Natural gas (million cubic meters)*
Polignac	450.6	498,400
Hassi Messaoud, El Gassi-El Agreb	480.0	-------
Hassi R'Mel	400.0	996,800
Ohanet Region	15.0	-------
El Biod Plateau	85.0	736,200
Ahnet-Mac Mahon Basin	-------	51,000
Total	1,430.6	2,282,400

Additional pipelines were completed and announcement of plans for others was made during the year. In March the 206-kilometer line from the Tin Fouyé field to In Amenasn was completed, followed a little later by the 108-kilometer line to permit evacuation of the new production from the Rhoude el Baguel to the Hassi Messaoud (Haoud el Hamra terminal). In July branch lines were finished to connect Algiers, Oran, and Arzew with the existing Hassi R'Mel-Relizane-Damesne lines; these new branches have a total length of 308 kilometers, and the old main line is 488 kilometers long. The new oil lines raised total length of these lines to 2,537 kilometers, including the 16-centimeter line from Hassi Messaoud to Touggourt, the terminus of the railway to the Port of Philippeville. This route was used before completion of the Haoud el Hamra-Bougie line, and is still available for use, if required. An additional 285 kilometers of line is used to move gasoline from Hassi R'Mel to Haoud el Hamra.

In 1963 plans were completed for construction of a new 60-centimeter line from the Haoud el Hamra terminal to Arzew, 766 kilometers away, paralleling the natural-gas and natural-gasoline pipelines already in existence on this route. Initial capacity will be 6 million tons per year, rising to 8.6 million by 1966 and to an eventual 14 million at a later time. At yearend, construction had not begun but was held up pending the outcome of discussions between representatives of the Algerian Government and the pipeline company representing the Saharan producers, Société pour le Transport des Hydrocarbures Sahariens au Littoral Algérie (TRAPAL), as to the percentage shareholding to be taken in TRAPAL by the former.

Announcement was made of plans to build a pipeline from Mostaganem to Cartagena, Spain, to transport Hassi R'Mel gas to Europe. Final tests on the technical feasibility of the project were scheduled for July. This 24.5-centimeter line would be 200 kilometers long and would be designed for pressures of 400 kilograms per square centimeter. The line may be built by a combination of companies, including Gaz de France; at yearend final decision had not been announced.

The serious fire damage suffered by the M'Sila pumping station (on the Bougie line) in October 1962 was repaired, and full capacity of the line was reestablished in the first half of 1963. On August 23, a fire in the SN REPAL pumping station at Hassi Messaoud resulted in some loss of production by that company.

SN REPAL continued operation of the 165,000-ton-per-year topping plant at Hassi Messaoud, producing fuels for local use. In 1962 this facility treated 83,340 tons of crude. Work on the construction of the Fr195 million Algiers refinery in suburban Maison Caree (renamed El Harrach) was intensified during the year and its completion scheduled for early 1964. This refinery is owned by Société de la Raffinerie d'Alger (SRA), a consortium of several French and other foreign major oil companies, including Mobil, ESSO, and Shell. Original plans were to treat 2.5 million tons of crude, but because of the reduction in the market capacity the figure was cut down to 1.5 million tons. Most basic facilities originally planned have been installed, and expansion to 2.5 million tons of capacity would be relatively simple. About 80 percent of the refinery production will be needed to supply the Algerian market, leaving a small amount for export. The SRA refinery is to be supplied by tanker from Bougie and delivery from Algiers port to the refinery is by a 65-centimeter pipeline, 16 kilometers long.

At yearend the methane liquefaction plant at Arzew, the small port 32 kilometers from Oran, and equipment of the port to accomodate methane tankers were nearing completion. This facility, estimated to cost Fr312 million, is to be operated by Compagnie Algérienne du Methane Liquide (CAMEL), formed by Shell, COMSTOCK, and three French companies; it will permit a tremendous increase in the use of the natural gas from Hassi R'Mel. Annual deliveries to the United Kingdom are expected to be 1.5 million cubic meters, and one-half that volume will go to France. In December announcement was made of a World Bank dollar loan of Fr97.6 million to CAMEL. The Algerian Government guaranteed this loan, and some press reports

indicated negotiations with CAMEL for an ownership participation of about 25 percent.

In September an agreement for a second refinery was concluded between the Algerian Government and Ente Nazionale Indrocarburi (ENI), the Italian oil enterprise. The refinery is to be built at Arzew and operated by Société Nationale de Raffinage (Algerian Government, 51 percent, and ENI, 49 percent), and an investment of Fr115 million is envisaged; no date for beginning of construction has been announced. Reportedly [7] ENI did not seem to show much enthusiasm for the project but was attracted by concessions for natural gas it hoped to obtain.

Consumption of petroleum products, still largely imported in 1963, was probably not in excess of that of 1962 when it showed an appreciable decline from 1961 as a result of the massive departure of Europeans during the year and the depressed condition of the economy. The 1962 consumption follows: Gasoline, 284,679 metric tons (323,762 tons in 1961); kerosine, 94,230 tons (106,308 tons in 1961); gas and light fuel oil, 223,432 tons (273,840 tons in 1961); heavy fuel oil, 101,865 tons (307,081 tons in 1961); and domestic fuel oil, 161,446 cubic meters (206,624 cubic meters in 1961).

[7] Industries et Travaux d'Outre-Mer (Paris). V. 11, N. 121, December 1963, p. 1037.

The Mineral Industry of Angola

By Thomas G. Murdock [1]

EXCEPT for an important increase in the production of crude petroleum and refined products, the extractive industries of the Province of Angola, Portugal's largest overseas dependency, showed little improvement in 1963. Angola has never been of great significance as a mineral supplier by world standards, and although production of a few minerals has expanded considerably over the last decade, the total value is still comparatively small. Its overall diamond production in 1963 was only 3 percent of the world total. However, Angola ranked eighth among producing countries and third in gem variety. Modest quantities of copper, iron, and manganese ores, as well as mica, have been contributed to world supply. However, the 1963 output was well below the average of recent years and was nil in some cases. The most important development was a record high petroleum production, the crude output being almost 16 times that of 1959, thus providing a surplus for export. Progress toward the provision of facilities for greatly expanded iron ore exports was also significant.

The 1962 mineral production exclusive of refined petroleum was officially valued at Esc1,243 million (US$43.46 million).[2] Crude petroleum comprised Esc254 million of this total. Refined petroleum production was valued at Esc384 million. Recent data on the gross national production (GNP) or the gross domestic production (GDP) of Angola are not available. For 1958, however, the GDP was approximately Esc11,428 million. The mineral production in 1958 was valued at Esc827 million or 7 percent of the GDP. If the 1962 GDP was 18 percent above that of 1958, as were all exports, the contribution of the extractive industries to the 1962 GDP would have been 9 percent.

Employment by the extractive industries in 1960, the latest year for which data are available, consisted of 1,300 European and 43,000 African personnel, or 2 percent and 13 percent, respectively, of the total labor force. Diamond mining was the largest employer in this sector, employing 558 Europeans and 27,052 Africans in 1962.

GOVERNMENT POLICIES AND PROGRAMS

No significant mining legislation was enacted in 1963, and the basic Portuguese Decree of September 20, 1906, providing that the State

[1] Mining engineer, Division of International Activities.

[2] The Angolan monetary unit is the escudo (Esc), roughly on a par with the Portuguese unit of the same name and equivalent to about US$0.035. Consular dispatches from Luanda show local exchange was Esc1=US$0.03496 (US$1=Esc28.60) prior to Nov. 13, 1963, and Esc1=US$0.0354 (US$1=Esc28.54) after that date.

owns all mineral deposits, has been continued with amendments that apply especially to Angola. Several 1963 legislative acts, however, did affect the Angolan mineral economy. A new interterritorial payments system went into effect in March. This was expected to alleviate the exchange shortage which had affected severely the Metropolitan Portugal-Angolan trade. A new defense tax was decreed on June 15, providing for a 10-percent tax (plus a stamp tax of approximately 3 percent), to be levied on all enterprises with profits equal to or above Esc1 million, except for new enterprises which have operated less than 5 years and those exempted by special contracts, such as the Companhia de Diamantes de Angola and the Benguela Railway. As part of the program of economic integration of the Portuguese National Space (Metropolitan and all overseas Portugal), customs duties on goods imported into Metropolitan Portugal from Portuguese Provinces were eliminated, effective January 1, 1964.

Provisions were made for a greater participation of foreign capital in some projects. The organization of an international consortium for iron ore exploitation was officially approved, and foreign association in a new company to prospect for gem stones was authorized. Arrangements were worked out for the large-scale use of Angolan crude petroleum by the refinery in Metropolitan Portugal.

Exploration was continued by several concerns, but no spectacular finds were reported. The work was essentially a search for extension of known mineralized areas and to prove areas for which prospecting permits had been issued. Budgetary limitations held back the Government's originally planned program of road construction and maintenance. However, expenditures amounted to Esc312 million.

SOURCE MATERIAL

Information on production and current developments has been supplied by the U.S. Consulate General, at Luanda and is supplemented by official publications of the Province of Angola. These data are reliable and reasonably complete. Data on 1960 and 1961 trade are from the Foreign Trade Statistics, published by Province's Directorate of Economic Services and General Statistics. For subsequent years trade data are from monthly bulletins of this organization. These are published as summaries covering only the most important commodities, and detailed information shown is not sufficient to permit the complete listing and analysis made for 1960–61. Data on diamond mining are from the 1962 report of the company engaged in that activity.

PRODUCTION

The year 1963 was characterized essentially by the continuation of trends evident in 1962. The emergence of petroleum as a major product was accentuated by a continuance in the growth of the output. Other salient developments were cessation of manganese mining, the severe decline in copper production, the continued lack of activity in mica (Angola formerly produced some of the finest quality material in the world), and the decrease in iron ore production to the pre-1960 level, a temporary situation pending completion of planned produc-

tion facilities. There was increased production of rock asphalt for local utilization in the Province's program of road improvement. Another significant development since 1959 was the continued increase in the percentage of gem variety diamonds in the total diamond production, reaching a record high in 1963, with consequently rising annual value regardless of the total quantity produced.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Copper:					
Mine	1,753	1,917	927	1,134	130
Smelter	1,617	1,582	850	783	101
Gold—troy ounces	42	42	48	77	37
Iron ore—thousand tons	349	659	812	754	638
Manganese ore	35,665	23,340	20,589	12,781	----
Vanadium	3	----	----	----	----
Nonmetals:					
Cement—thousand tons	155	161	157	163	194
Diamonds:					
Gem—carats	610,733	642,551	750,835	762,395	758,570
Industrial—do	404,954	414,276	396,704	318,709	325,000
Gypsum	13,387	[1] 13,000	[1] 13,000	[2] 16,305	[2] 14,208
Mica:					
Sheet	9	12	2	----	----
Scrap and splittings	174	327	23	----	----
Salt—thousand tons	69	58	67	60	69
Asphalt (rock)	27,900	25,783	22,783	36,237	54,741
Mineral fuels:					
Petroleum:					
Crude	50,519	66,850	104,429	471,236	799,657
Refined:					
Gasoline	9,087	27,855	34,083	55,235	59,775
Kerosine	1,058	----	2,553	1,706	4,331
Gas oil	14,366	48,199	53,224	83,359	113,949
Diesel oil	40,604	30,346	37,524	100,396	139,587
Bunker C		43,723	41,036	58,265	88,925
Heavy fuel oil		26,949	27,689	31,182	28,848
Jet fuel	----	----	----	1,919	8,263
Butane gas	----	416	1,596	3,035	4,149
Asphalt	----	----	----	2,130	6,071
Total	65,115	177,488	197,705	337,227	[3] 453,974

[1] Estimate.
[2] Final figure; supersedes figure given in commodity chapter, volume I.
[3] Includes 76 tons of cutbacks.

TRADE

Complete data on minerals and metals trade have not been available since 1961, when imports of these commodities were valued at Esc389 million (Esc361 million in 1960); exports were valued at Esc904 million (Esc738 million in 1960). The 1962 imports of major commodities, which constituted 92 percent of the total in 1961, amounted to Esc 221 million; in 1963, based on a projection of data through October, they were down to about Esc184 million. Exports were approximately Esc832 million in 1962, increasing to about Esc1,163 million in 1963.

In 1961 minerals and metals accounted for, by value, 12 percent of all imports and 23 percent of all exports. Fuels totaled Esc217 million, metals Esc161 million, and nonmetals Esc11 million of the 1961 imports. The values of 1961 exports follow: Diamond, Esc662 million; iron and manganese ores, Esc147 million; fuels,[3] Esc48 million; other

[3] Maritime bunkers are included in all export values.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	Principal destinations, 1961
Metals:			
Aluminum, scrap		7	All to Portugal.
Copper:			
Matte	1,980	82	Do.
Blister		825	Do.
Scrap	27	41	Do.
Other		68	Netherlands 60; Portugal 8.
Iron and steel:			
Iron ore	546,800	494,488	West Germany 288,635; France 74,275; Israel 61,041; Czechoslovakia 50,195.
Scrap	10	7,400	Japan 7,005; Spain 300; Italy 80.
Rolled products	9	132	Mozambique 81; United States 45.
Lead	30	40	All to West Germany.
Manganese ore	33,084	22,178	Norway 13,000; Italy 6,000; France 1,524; West Germany 1,000.
Zinc	[1] 308	5	All to Portugal.
Other		5	Do.
Nonmetals:			
Cement	6,450	8,948	São Tome 5,248; French Equatorial Africa 3,400.
Clay		209	All to Mozambique.
Diamond—carats	933,646	1,276,573	All to United Kingdom.
Gypsum	8,609	8,419	All to Mozambique.
Mica:			
Sheet	8	7	All to United States.
Scrap and splitting	597		
Stone, dimension	3,332	96	Mozambique 69; Republic of the Congo 27.
Salt	23,547	25,059	Republic of the Congo 17,454; Federation of Rhodesia and Nyasaland 3,422; Mozambique 2,669.
Other	338	35	Republic of the Congo 27; Portugal 7.
Mineral fuels:			
Coal	43	2,000	All to Republic of the Congo.
Petroleum, refined products:			
Gasoline	1	1	All to São Tome.
Kerosine		1	All to ships' stores.
Distillate fuel oil	1,773	2,989	Bunkers 2,988.
Residual fuel oil	45,913	72,840	Bunkers 72,793.
Lubricants	22	30	Bunkers 14; São Tome 10; Portugal 6.
Liquefied petroleum gas		65	Mozambique 52; Portugal 13.
Other	5	20	Republic of the Congo 10; bunkers 7; United States 2.

[1] Includes 284 tons identified as non-precious metal scrap.

Source: Repartição de Estatistica Geral. Commerce Exterieur. V. 1, 1960–61.

TABLE 3.—Imports of major metals and minerals

(Metric tons, unless otherwise specified)

Commodity	1960	1961	Principal sources, 1961
Metals:			
Aluminum	383	414	United Kingdom 101; United States 101; West Germany 66; Austria 30; Norway 28.
Copper, all forms	233	291	United Kingdom 128; West Germany 42; Belgium-Luxembourg 23; Republic of the Congo 20.
Gold [1]—troy ounces		100	Belgium-Luxembourg 64; Portugal 36.
Iron and steel:			
Pig iron		164	West Germany 132; United Kingdom 21.
Ferroalloys	330	7	Sweden 5; Portugal 1.
Scrap, ferrous		1	All from the United States.
Ingots, blooms, etc		48	Portugal 44; West Germany 4.
Rolled products	20,729	27,130	Belgium-Luxembourg 10,809; United Kingdom 5,248; France 4,221; West Germany 3,735.
Lead	43	80	Belgium-Luxembourg 28; Portugal 17; West Germany 11; Netherlands 10.
Silver [1]—troy ounces	1,190	2,107	Portugal 1,297; West Germany 739; United Kingdom 68.

See footnote at end of table.

TABLE 3.—Imports of major metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1960	1961	Principal sources, 1961
Metals—Continued			
Tin—long tons	3	29	Portugal 26; United Kingdom 2.
Zinc	101	64	Belgium-Luxembourg 46; Netherlands 6; United Kingdom 6.
Other:			
Ores, unspecified	15	113	All from South Africa.
Slag and residues, metallic	----	196	All from Cape Verde.
Unspecified	17	2	Netherlands 1; United Kingdom 1.
Nonmetals:			
Asbestos	819	713	South Africa 427; Canada 122; Federation of Rhodesia and Nyasaland 109.
Cement	1,751	1,135	Portugal 715; West Germany 130; Republic of the Congo 107; Belgium-Luxembourg 75.
Chalk	148	151	Portugal 112; France 20; Belgium-Luxembourg 19.
Clays	20	682	West Germany 198; United States 163; France 105; United Kingdom 76.
Diatomite	180	28	Portugal 15; United States 10; Italy 3.
Gypsum	702	262	Portugal 188; Belgium-Luxembourg 73.
Salt	75	40	Portugal 20; Mozambique 15; United Kingdom 5.
Stone, dimension	1,501	469	All from Portugal.
Sulfur	164	552	West Germany 389; Portugal 104; France 50.
Other	668	1,230	Cape Verde 650; French West Africa 198; Republic of South Africa 131; Portugal 82.
Mineral fuels:			
Coal	36,858	23,607	Republic of South Africa 23,599.
Coke and semicoke	1,619	1,542	West Germany 628; Federation of Rhodesia and Nyasaland 316; Netherlands 490.
Coal tar	3,054	1,898	Spain 1,672; United Kingdom 209; Portugal 17.
Coal tar oils		48	United Kingdom 34; Netherlands 6; Belgium-Luxembourg 3.
Pitch		1,054	Spain 1,000; United States 43.
Petroleum:			
Crude	118,617	121,612	Venezuela 78,118; Curacao 27,916; Portugal 15,578.
Refinery products:			
Gasoline	23,625	17,753	Curacao 6,508; Portugal 6,203; Saudi Arabia 1,818; Italy 1,497.
Kerosine	10,207	10,175	Portugal 4,227; Curacao 3,393; Venezuela 530; Iran 386.
Jet fuel	(2)	716	All from Curacao.
Distillate fuel oil	39,275	34,843	Portugal 10,593; Curacao 6,187; Venezuela 4,523; Italy 3,251.
Residual fuel oil	20,292	14,988	France 4,586; Kuwait 3,958; Spain 3,199.
Lubricating oils	7,630	7,476	United States 4,934; Netherlands 922; Belgium-Luxembourg 467; United Kingdom 441.
Liquefied petroleum gas	----	325	Portugal 306.
Asphalt and bitumen	1,004	922	Spain 623; United States 205; Portugal 67.
Other	36	669	United Kingdom 232; United States 153; Netherlands 117; Portugal 73.
Total	102,069	87,867	Portugal 21,834; Curacao 17,224; United States 6,549; Spain 5,726.

[1] Crude and semifinished; alloys included.
[2] Included with other categories.

Source: Repartição de Estatistica Geral. Commerce Exterieur. V. 1, 1960–61.

metals and nonmetals, Esc47 million. The lower value of the 1962 exports was due mainly to the decrease of diamond exports to Esc556 million; in 1963 these rose to Esc768 million. The increased exports of fuels, resulting from the greatly expanded production of both crude petroleum and refined products, accounted for much of the increased value of exports in 1963, offsetting the drastic decline in exports of manganese ore and copper and the lower value of iron ore exports

despite an increased tonnage. This spectacular gain in value of petroleum exports (from Esc47 million in 1961 to Esc238 million in 1963) has also been reflected in the abrupt decline in petroleum imports (from Esc202 million in 1961 to an estimated Esc90 million in 1963), thus altering appreciably the country's mineral trade pattern.

Angola's minerals and metals trade was diversified, with 34 suppliers and 25 recipients in 1961, including Portugal's other overseas territories. In that year Metropolitan Portugal was the chief supplier with 15 percent of the total. Other major suppliers were Belgium-Luxembourg (14 percent), Venezuela (13 percent), and the United States (10 percent). Imports from the European Economic Community were 30 percent of the total. Receipts from the United States amounted to Esc40 million; fuels comprised Esc29 million, metals, Esc10 million, and nonmetals, Esc1 million. These constituted 12 percent of all imports from the United States.

As the recipient of all diamond exports, the United Kingdom received 73 percent, by value, of the total 1961 exports. The European Economic Community (mainly West Germany) accounted for 13 percent; Portugal received only 1 percent, and the U.S. share was 0.1 percent. Portugal's share of the exports increased in 1963, when shipments of crude petroleum were expanded.

COMMODITY REVIEW

METALS

Aluminum.—No progress was reported towards the installation of the proposed aluminum rolling mill to utilize power from the Cambambe Dam. At the annual meeting of the company sponsoring the project, Aluminio Portugues (Angola), it was announced that the initial plan to roll 25,000 tons per year from ingots imported from France would have to be revised downward because the Cambambe installation could not provide the necessary power. No new production objective was announced.

Copper.—In January, Luanda newspapers stated that the ore reserve of the Mavoio mine of Empresa do Cobre de Angola (ECA), a subsidiary of the powerful Portuguese enterprise Companhia União do Febril, was nearing exhaustion. This mine, the Province's only copper producer, has been exploiting oxide ores since about 1942 and in 1949 began smelting these in a water jacket blast furnace at the mine, obtaining black copper for export to Portugal. The 1962 production consisted of 16,206 tons of 7 percent copper ore, part of which was processed to yield 779 tons of black copper containing 93 percent copper and 84 tons of matte with 70 percent copper. Mining and smelting continued through 1963, but at a greatly reduced rate, as was reflected by the low production. ECA continued its efforts to find new ore. However, there is no record that these efforts were successful. Exploration for copper has been in progress in northern Angola and elsewhere for over a decade. Despite a wide distribution of copper occurrences under a variety of conditions, only the Mavoio has become

an active mine, and with its exhaustion the small production apparently will cease.

Iron Ore.—Although 1963 iron ore production was below that of recent years, exports established a record high of 655,546 tons (445,987 tons in 1962). Companhia Mineira de Lobito (CML) accounted for most of the production with ore mainly from its Cuima and Cassinga mines. An estimated production of 200,000 tons came from mines of the Companhia do Manganes de Angola near Malange, and according to newspaper accounts Companhia Mineira da Mombassa shipped 34,000 tons to Czechoslovakia as part of a 40,000-ton barter deal, receiving mine equipment in exchange.

With the completion of the 70-kilometer rail connection between the Cuima and Vila Robert Williams on the Benguela railway in late 1962, ore shipments were stepped up, permitting a decrease of mine stocks and the increased exports. Shipments consisted of 63 percent iron direct-shipping ore and lower grade material upgraded in a 100-ton-per-hour sink-float plant.

Late in 1962 the Portuguese Government approved the contract of CML with an international consortium including Krupp, the Danish firm of Hojgaard and Schultz, and the Sociedade Portuguesa de Empreitadas e Trabalhos Hidraulicos. The contract called for expenditures of Ecs1.3 billion for equipping the Cassinga mine, building the 95-kilometer rail link northward to join the Moçâmedes Railway, and installing ore-loading facilities at Moçâmedes port. The mine has an ore reserve of about 67 million tons of 62-percent iron. An initial production of 1 million tons annually is planned, to be expanded to 4 million tons annually, the capacity of the railway. Production from the Cassinga in 1963 was only about 150,000 tons, and part of this was trucked to the railway at Vila Artur de Paiva for movement to Moçâmedes. Construction of the railway link began early in the year. In April the purchase of property for the ore-loading facilities at Moçâmedes began, and work started on the extension of roads and power lines into the area. CML also placed orders for the construction of two bulk ore carriers of 45,000- and 20,000-tons capacity to relieve congestion of ore held in Lobito awaiting shipment to Europe.

Iron and Steel.—In March, newspaper reports indicated plans for the establishment of facilities for remelting scrap iron and steel and converting it into reusable form. Investment in the plant and equipment was expected to be Esc15 million, and expected output was 14,000 tons per year. In expectation of the completion of the plant within 1 year, the new enterprise began building up stocks of scrap, beginning with Esc25 million worth of old steel railway ties which had been replaced by wooden ties in recent years.

In July plans were announced for the establishment of an electrometallurgical complex as an auxiliary project of the Cambambe hydroelectric development on the Dondo River. The annual production was to be 40,000 tons of pig iron, 22,000 tons of ferroalloys, and 4,300 tons of calcium carbide. Energy requirement was expected to be 200 million kilowatt-hours per year.

Manganese Ore.—Following a constant decline in production of manganese ore from the Quitoto mines of Companhia de Manganes de Angola since 1959, mining ceased altogether in 1963. Competition

from other more favorably situated producers in the markets formerly supplied by Angola caused this. Exports from stocks during the year were 203 tons through October (9,526 tons in all of 1962).

NONMETALS

Diamond.—In 1963 Companhia de Diamantes de Angola (DIAMANG) continued operations at its various mines in the Luanda area at approximately the same rate as in 1962. Exports, all to the United Kingdom, however, rose to 1,293,243 carats valued at Esc768 million (985,776 carats and Esc556 million in 1962). Sales were to the Diamond Corp. under the terms of the contract expiring in 1965.

Details of the 1963 operations are not available, but comparative data for 1961 and 1962 follow:

	1961	1962
Volume of overburden removed---thousand cubic meters--	10,470	11,180
Average thickness of overburden----------meters--	5.44	5.86
Overburden removed mechanically----------percent--	51.6	43.0
Volume of diamantiferous gravel treated thousand cubic meters--	2,369	2,546
Average tenor----------carats per cubic meter--	0.48	0.38
Gravel treated per worker-month----------cubic meters--	21.22	23.10
Gem diamonds in total production----------percent--	65.43	70.52
Industrial diamonds in total production----------do----	34.57	29.48

DIAMANG continued exploration, mainly for alluvial deposits along the streams of Luanda District, but some activities extended over to Malange District, and some drilling was done in search of primary deposits. In 1962 new discoveries slightly exceeded the year's production.

A new company, Sociedad Angolana das Pedras Preciosas e Diamantes, was formed to prospect for precious stones, including diamonds, in the area outside the concession held by DIAMANG and formerly reserved for the Government. Financing was to be provided by both the National and the Provincial Governments, and foreign participation in the venture was encouraged. Reportedly representatives of an important South African group visited Angola and discussed the project but decided not to participate.

MINERAL FUELS

Petroleum.—The year 1963 saw the establishment of record highs by Campanhia de Petroleos de Angola (Petroangol), operator and owner of the fields and the 350,000-ton-per-year refinery at Luanda, and by that company's Belgian founder and prospecting and producing contractor, Compagnie Financiere de Petroles (Petrofina). The 70-percent increase in the production of crude was made possible by the development of the new discoveries, made in 1962, in the Tobias field, 110 kilometers southeast of Luanda, where the producing formation is fractured limestone at about 800 meters. The installation of a pumping station and completion of a 20-centimeter pipeline to the refinery permitted delivery of the increased output from the field. Crude oil processed in the refinery was 475,110 tons (347,000 tons in 1962). Despite the increased refinery feed, exports were 317,719 tons valued at Esc126 million (114,951 tons and Esc57 million in 1962). Production of refined products showed an overall increase of 35 percent, and

except for residual fuel oil the increase was general. Metropolitan Portugal received the greater part of the export of crude, following the decision that the SACOR refinery there might import up to 600,000 tons annually of Angolan crude in excess of the needs of the Petroangol refinery.

Further drilling was done in the Tobias and other fields, particularly the Pitchi. Expectations were that 10 wells would be completed during 1963. In 1962 about 96 percent of the total output came from the Tobias field; the remainder came mainly from the Benfica and Luanda fields. Natural gas production in 1962 was 19,523 million cubic meters; none of which was marketed. Data on reserves of the Tobias field have not been announced, pending further exploration. At the beginning of 1963 the total reserve of Angola was placed at approximately 7 million tons.[4] Addition of the Tobias field reserve will increase the total appreciably.

Consumption of liquid fuels and lubricants for 1962 and 1963, as estimated on the basis of reported data for the January to September period of these years, follows:

		1962	1963
Gasoline, ordinary	thousand barrels	336	376
Gasoline, aviation	do	126	138
Kerosine	do	108	90
Diesel oil	do	744	827
Jet fuel	do	30	44
Heavy fuel oil	metric tons	60,082	66,290
Lubricating oil	do	7,433	7,060
Lubricating grease	do	831	812
Butane gas	do	2,873	3,041

[4] World Oil. V. 157, No. 3, Aug. 16, 1963, p. 164.

The Mineral Industries of the British High Commission Territories of Basutoland, Bechuanaland, and Swaziland

By Thomas C. Denton [1]

IN 1963 the British Territories of Bechuanaland and Swaziland in southern Africa produced several mineral commodities, of which asbestos was most important. Production in Basutoland was limited to diamond. The territories were under a High Commissioner, appointed by the Queen and responsible to the Secretary of State for Commonwealth Relations. Ultimately the Territories are to become self-governing and presumably independent. Considerable progress toward that end was made during the year.

Complete statistics of imports and exports are not kept in the Territories because for customs purposes they are treated as part of the Republic of South Africa, which collects duties for them. The unit of currency used in each of the Territories is the rand (R) [2] of the Republic of South Africa, which is divided into 100 cents.

SOURCE MATERIAL

Source material, besides dispatches of the U.S. Foreign Service, largely comprised publications of the Territories, articles appearing in the South African press, trade journals, and company reports. For Swaziland Bulletin 2, The Mineral Resources of Swaziland, published by the Territorial Geological Survey and Mines Department, was particularly useful.

BASUTOLAND

Mineral surveys conducted in recent years in this mountainous territory have resulted in discovery both of diamonds and of kimberlite rock from which diamonds derive. No other economic minerals have been found in workable deposits. Recorded exports of Basutoland diamonds were 5,110 carats, valued at R153,423.

Diamond prospecting jointly by De Beers Consolidated Mines, Ltd. (De Beers), and Jack Scott failed to reveal deposits profitably workable on a large scale. Mr. Scott therefore had relinquished his concession by the end of 1963. But it was agreed that further work would be done to assist Basutoland Factory Estates Development Ltd., a company nominated by the Basutoland Government to investigate and exploit diamond deposits profitably workable on a small scale.[3]

[1] Africa specialist, Division of International Activities.
[2] 1 rand equals US$1.40, or 10 British shillings.
[3] De Beers Annual Report. 1963, p. 10.

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BECHUANALAND

Considerable mineral exploration by large companies was in progress in Bechuanaland in 1963, but as for several previous years, production was limited to chrysotile asbestos, manganese ore, and gold with minor associated silver. Mineral exports were valued at R368,397, of which asbestos contributed 59.4 percent and manganese ore 39.6 percent. Gold and silver exports amounted to 142 ounces and 21 ounces. The 1963 export value compares with R616,129 in 1961, when minerals contributed about 10 percent of the total value of exports.

TABLE 1.—Bechuanaland: Production of metals and minerals

Commodity	1959	1960	1961	1962	1963
Metals:					
Gold—troy ounces	198	203	261	288	142
Manganese ore—metric tons	18,269	22,709	28,791	24,002	10,776
Silver—troy ounces	42	24	39	33	21
Nonmetals: Asbestos, chrysotile—metric tons	1,279	1,163	1,745	2,155	2,148

COMMODITY REVIEW

METALS

Copper.—In its report for the year ended June 30, 1963, Rhodesian Selection Trust, Ltd. (RST), reported copper discoveries in Bechuanaland, where RST has been exploring for some years. At one locality ore was found that could be significant if persistent. Exploration was proceeding, but it was clear that considerable work including diamond drilling would be necessary to determine the importance of the discovery. RST exploration in Bechuanaland was being concentrated on the copper area.

Manganese.—Early in 1963 the target output of Bamalete Manganese (Pty.), Ltd., about 18 kilometers (11 miles) north of Lobasti and about one-half mile from the Mafeking-Rhodesia railroad, was 5,000 tons of manganese ore per month. The capacity of the crushing and screening plant was about 15,000 tons per month. The ore is crushed to about 1½ inches, the size acceptable to Japanese buyers.[4]

NONMETALS

Asbestos.—The Bechuanaland production of chrysotile asbestos comes from the Moshaneng mine about 13 kilometers west of Kanye, operated by Marlime Chrysotile Asbestos Corp., Ltd., a subsidiary of Marble Lime and Associated Industries, Ltd., of Johannesburg. The ore contains about 2 percent asbestos. The mine has a large modern mill with capacity greater than present production.

Brines.—For more than 3 years Rhodesian Selection Trust, Ltd., has conducted, through a subsidiary, extensive investigations of brines found beneath the surface of Sua Salt Pan adjacent to the Bamang-

[4] South African Mining & Engineering Journal. Jan. 25, 1963, p. 192.

wato tribal area. The work was expected to be completed before the end of June 1964, when the economic possiblities of the salts would be assessed.

Diamonds.—Kimberlitic Searches, Ltd., prospected for diamond on behalf of De Beers Consolidated Mines, Ltd. A large area was covered but nothing of economic value was found, according to the Annual Report of De Beers for 1963. Interest in diamond possibilities in Bechuanaland was first aroused in 1959 when Consolidated African Selection Trust, Ltd., found small diamonds in rubble accumulations near Foley and elsewhere.

MINERAL FUELS

While Bechuanaland produces no coal, it has extensive favorably situated coalfields that probably will be exploited eventually. The known coals are low- to medium-rank bituminous coal with no coking properties. There are three fields of which Mamabule, between Debeeti and Mamabule, has the largest proven reserves. Mamabule has two seams; one investigated in an area of 66 square kilometers contains 163 million tons of coal; the other contains 245 million tons in an area of 50 square kilometers. The maximum depth from the surface to unweathered coal appears to be about 27 meters.

SWAZILAND

Mineral industry has had a major role in the Swaziland economy for many years and is becoming increasingly important. In 1961 the industry contributed 40 percent of the total value of exports, and by 1965 its contribution may be of the order of 50 percent. Mineral exports were valued at R4.1 million in 1963 and in 1959–63 averaged R4.8 million with no sharp fluctuations from year to year. While some 10 minerals generally were mined during the period, asbestos each year contributed more than 90 percent of total value. Large-scale iron mining to begin in 1964 is expected to increase the value of the Swaziland mineral exports by 100 percent or more. The new operation also will provide very substantial additional employment, statistics for which were as follows for Swaziland mining industry in 1962: [5]

	Skilled labor	*Unskilled labor*
Persons employed, monthly average	173	1,737
Earnings, year	R437,814	R342,202
Food furnished, value	--------	R116,019

[5] Swaziland. Annual Report of the Geological Survey and Mines Department. 1962, p. 43.

TABLE 2.—Swaziland: Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Beryl	2	5	6	----------	2
Gold, troy ounces	----------	806	1,325	2,214	2,092
Tin, in concentrates, long tons	5	6	5	5	3
Silver, troy ounces	----------	58	103	132	120
Nonmetals:					
Asbestos, chrysotile	22,504	29,054	27,934	29,783	30,255
Barite	418	181	412	62	84
Diaspore	388	750	446	203	58
Kaolin	----------	----------	53	2,488	2,007
Pyrophyllite	914	1,555	2,681	3,540	2,769
Mineral fuels: Coal:					
Anthracite	1,446	7,880	938	----------	----------
Bituminous	----------	3,774	42	----------	----------

COMMODITY REVIEW

METALS

Gold.—Prospecting by diamond drilling was in progress at the dormant Daisy mine in the Hoho area, Pigg's Peak District. Two holes had returned very encouraging results and three more holes were in progress. The mine, dormant since 1905, was abandoned when sulfide ore was encountered. At the surface the strike length of the vein is about 460 meters. If the ore persists in depth, it is possible that a large gold mine can be established.

Iron Ore.—Open-pit mining by Swaziland Iron Ore Development Co., Ltd. (SIOD), of the rich Ngwenya deposit at Bomvu Ridge north of Mbabane was expected to begin in 1964. SIOD is administered by Anglo American Corp. of South Africa, Ltd. Proven reserves of direct shipping ore in the deposit are about 42.6 million metric tons averaging about 62 percent iron. SIOD has undertaken to deliver about 813,000 metric tons in the 12 months immediately following completion of a railroad built specifically for the project and about 1.2 million metric tons annually thereafter for 9 years. The buyer is a Japanese consortium headed by Yawata Iron & Steel Co. and Fuji Iron & Steel Co., Ltd. The consortium agreed to take approximately 12 million tons of ore at R7 per ton or a little less, depending on iron content of each shipment. The price is free on board, port of Lourenco Marques, to which the ore will be shipped by rail. Actual shipments are expected to average about 1.2 million tons a year for 10 years, yielding around R84 million (US$117.6 million).

According to one source,[6] the cost of handling the ore at Lourenco Marques will be somewhat less than the cost of mining it. Rail freight will be about three times mining costs, and total cost to the buyers will be more than ten times mining costs, according to the source.

Besides preparation of the mine for production and construction of some 224 kilometers of railroad through rugged country to the Mozambique border, the SIOD project comprises railroad construc-

[6] Financial Mail, Johannesburg. Swaziland Supplement. Nov. 2, 1962, p. 31.

tion on the Mozambique side of the border, constructing ore loading facilities and deepening the harbor at Lourenco Marques, and building large ore carriers. In all, the capital involved reportedly was around the equivalent of US$70 million.[7]

Tin.—A mill was under construction to treat tin-bearing pegmatite near Mbabane. Proved ore reserves were reported as 50,000 tons, containing 185 long tons of tin and averaging 0.37 percent tin.[8]

NONMETALS

Asbestos.—The Havelock mine of New Amianthus Mines (Pty.), Ltd., controlled by Turner and Newall, Ltd. of the United Kingdom, furnishes the Swaziland chrysotile asbestos. Its mill was modernized in 1962 and early in 1963 a 1,200-foot vertical shaft was approaching completion. The shaft will make available many millions of tons of ore that is contained in a safety pillar of the old inclined shaft and therefore could not be extracted. Production from the mine can be sustained for many years at the present rate; 30,255 metric tons of asbestos, valued at R4,030,771, was produced in 1963.[9] In 1961 and 1962 Havelock explored its concession 41 in detail, and sank a shaft through which development was undertaken to test the western extension of the Havelock serpentine. Results were not divulged.

Havelock is one of the major sources of spinning grade chrysotile asbestos in the world. The ore body has a strike length of 1,372 meters and in width ranges from 18 to 107 meters, averaging about 45 meters. The asbestos occurs as a stock work of cross-fiber seams and comprises between 3 and 4 percent of the ore body. The average length of the fibers is between one-half and three-quarters inch.[10]

Barite.—Early in 1963 the barite reserves of Swaziland Barytes, Ltd., the only producer, were reported as 1,080,000 tons.[11] Output nevertheless has been small because of the limited market in the Republic of South Africa, where production also exists. It was hoped that completion of the Swaziland railroad to the port of Lourenco Marques would make possible sales to the Middle East oilfields.

Kaolin.—Bulk tests on kaolin from a large deposit in the south of Swaziland showed that the material was of top quality, being suitable for use both in all branches of ceramic industry and as a filler. The deposit was first exploited in 1961, and in 1963 output was 2,007 metric tons. The development is important to the Republic of South Africa, where no extensive deposits of high-grade kaolin are known.[12]

MINERAL FUELS

Central Mining and Finance was reported to be planning to open its Mpaka colliery on Crown Mineral area 9 late in 1964 to supply coal to the new railroad, two sugar mills, other Swaziland industries, and for household use. Swaziland has important reserves both of anthracite and bituminous coals.

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[7] Mining Journal. London. June 1964, p. 181.
[8] South African Mining and Engineering Journal. Feb. 8, 1963.
[9] Page 307 of work cited in footnote 9.
[10] Swaziland Geological Survey and Mines Department. Bulletin No. 2, Oct. 1962, p. 80.
[11] Page 307 of work cited in footnote 9.
[12] Mining Journal (London). June 1964, p. 180.

The Mineral Industry of Cameroon

By Thomas G. Murdock [1]

THE DOMESTIC MINING industry of the Federal Republic of Cameroon, is relatively small; mining during recent years has been limited to small quantities of gold and tin. The most important activity is aluminum production, using imported alumina; the country possesses the only facility of this kind in Africa. In 1963 aluminum output set a record high, with 1 percent of world production. This achievement was the most significant event of the year. Gold production was more than twice that of 1962, but it was still below that of a decade earlier. There was no revival of the former rutile and cement production. The extensive bauxite and iron ore deposits remained undeveloped, and petroleum exploration had not revealed economic occurrences.

In 1962 the gross national product (GNP) was CFAF91,140 million (US$372 million); [2] the mineral production, exclusive of building materials, had an estimated value of CFAF5,447 million, 6 percent of the GNP. For 1963 the estimated value rose to CFAF5,580 million, hardly sufficient to affect the share contributed to the GNP.

Data on employment in the mining industry in 1963 are not available. In 1960 the aluminum plant labor force consisted of 600 Cameroon workers and 100 European technicians, foremen, and training personnel. With the increased production since then, employment of workers undoubtedly has increased; however, it is believed that the Europeans force has declined appreciably as local personnel have advanced in technical ability. Regardless of the actual number employed in the minerals sector, those employed remained only a small part of the 4.4 million estimated 1963 total population.

GOVERNMENT POLICIES AND PROGRAMS

During 1963, Cameroon made slow progress under the 5-year plan covering 1961–65, which continued the work of two earlier plans. In the current plan, investment was projected to decline while per capita incomes were expected to rise. Expectations were that there would be a sharp decline in investment in the private sector of the economy. On the other hand, investment in economic infrastructure, such as railways, highways, and communications, was expected to increase substantially. Continuing increases in outlays for social equipment, such as schools and hospitals, were also expected.

[1] Mining engineer, Division of International Activities.

[2] African Financial Community (CFA) francs are used in Cameroon. The exchange rate for this country review is US$1=CFAF245 (CFAF1=US$0.0040816).

In view of its great need for investment funds, the Government of Cameroon continued to actively encourage the investment of foreign capital. The investment code, adopted June 11, 1960, provided substantial incentives for this purpose. No new legislation directly applicable to the mining industry was enacted; however, a new mining code was being drafted at yearend. A new agreement between the government and the aluminum producer was signed late in 1962.

The first Cameroonian Federal Chamber of Commerce, Industry and Mines was formally inaugurated on October 9, in Douala. The new chamber was to represent private enterprise, bring about close cooperation between all sectors of the economy, and fully exploit the economic and commercial agreements which Cameroon had signed with various countries.

On March 2, the president of the Cameroons ratified the various economic, technical, commercial, and cultural agreements signed with Poland, Yugoslavia, Greece, Taiwan, Lebanon, and Israel during the visits, late in 1962, of two Cameroonian missions to those countries and others in Europe, the Far East, and the Middle East. A Swedish company, Sueco-Camerunia Aktiebolag, announced that it would inaugurate a program of mineral exploration in west Cameroon near the end of 1963.

SOURCE MATERIAL

Data on production and 1963 developments are almost entirely from dispatches of the U.S. Embassy in Yaoundé. Some background information was provided by a French publication.[3] Foreign Trade statistics are inadequate for a complete, detailed analysis; some information has been provided by publications of the French Government and the European Economic Community (EEC).

PRODUCTION

The most pronounced trend for 1959–63 was a continual annual increase in aluminum output. Gold production fluctuated considerably; the 1963 level was considerably above that of 1959 but below that of the early 1950's. Tin showed little change, except for 1962 when the operations changed ownership. Cameroon apparently produced most of its requirements of construction materials; however, no quantitative data are available. Indications are that 1963 construction activities were slightly below those of 1962; building permits issued in Yaoundé, the capital, and Douala, the port city, declined from 56,800 to 50,000 square meters.

[3] Cédat, R. LActivité Minière du Cameroon en 1961 (Mining Activity in Cameroon in 1961). Industries et Travaux d'Outre-mer (Paris), v. 10, No. 106, September 1962, pp. 717–719.

TABLE 1.—Production of metals and minerals

Commodity [1]		1959	1960	1961	1962	1963
Metals:						
Aluminum	metric tons	42,315	43,940	47,578	52,250	52,920
Gold	troy ounces	971	416	537	775	1,874
Tin, content of concentrate	long tons	62	65	65	21	60
Nonmetals:						
Cement	thousand tons	[2] 11	---	---	---	---
Kyanite	metric tons	---	5	---	---	---

[1] In addition, building materials other than cement and lime were produced, but no quantitative data are available.
[2] Production ceased and plant closed.

TRADE

Data available on metals and minerals traded by Cameroon are limited to the major items. In 1962 the exports of primary metals of domestic origin were valued at CFAF5,300 million (aluminum, CFAF 5,294 million, and gold, CFAF6 million). In addition, exports of scrap metals were made; EEC recipient countries reported combined imports of these from Cameroon worth CFAF48 million (ferrous scrap, CFAF25 million and nonferrous scrap, CFAF23 million). The 1962 exports of aluminum and gold comprised 21 percent of all exports, on the basis of value (20 percent in 1961, when exports of these commodities were worth CFAF4,803 million). The 1962 major metal and mineral imports were valued at CFAF5,214, comprising 21 percent of all imports (CFAF4,645 and 20 percent in 1961). In 1962 the major metal and mineral imports, including manufactured metals not identified separately, were alumina, CFAF1,470 million; iron and steel, CFAF648 million; other nonferrous metals, CFAF1,179 million; cement and lime, CFAF324 million; salt, CFAF120 million; and petroleum refinery products, CFAF1,473 million. In addition there were small quantities of coal and coke; exports of these by EEC to Cameroon were valued by the exporting countries at CFAF2 million.

Information available does not identify adequately Cameroon's partners in the 1962 mineral trade. France undoubtedly ranked first, as reflected by that country's share in total trade (60 percent of all exports and 55 percent of all imports). Receipts of exports from Cameroon by EEC, of which Cameroon is an associate member, totaled CFAF5,173 million in 1962 for aluminum and scrap metal. Exports of metals and minerals (exclusive of metal manufactures) to Cameroon by EEC were worth CFAF1,178 million; Guinea supplied all of the alumina, and Netherland Antilles supplied CFAF650 million worth of petroleum refinery products. Trade in metals and minerals with the United States was small; this country supplied petroleum refinery products valued at CFAF100 million and metals and metal products worth CFAF37 million. U.S. imports of Cameroon aluminum were valued at CFAF9 million.

Through September the 1963 exports of major metal and mineral commodities enumerated for 1962 were at an annual rate of CFAF-4,715 million; the corresponding value of imports was CFAF5,051 million.

TABLE 2.—Exports of metals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Aluminum:			
Ingots	46,144	[1] 50,929	France [2] 45,870; Belgium-Luxembourg [2] 300; United States [2] 100.
Scrap	([3])	[4] 390	All to European Economic Community.
Copper, scrap	([3])	152	Do.
Gold, troy ounces	691	806	Mainly to France.
Iron and steel, scrap	[4] 409	2,544	All to European Economic Community.
Lead, scrap	([3])	[4] 91	Do.

[1] Some aluminum sheets may have been exported to neighboring countries.
[2] Figure from records of receiving country.
[3] Data not available.
[4] Only imports by the European Economic Community from Cameroon.

Source: Institut National de la Statistique et des Études Économiques. Données Statistiques. January-March 1964.
European Economic Community. Foreign Trade Statistics, 1962. August 1963.

TABLE 3.—Imports of metals and minerals

(Metric tons)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Alumina	104,402	84,681	All from Guinea.
Iron and steel [1]	16,208	14,633	European Economic Community [2] 14,133.
Other [1]	732	[3] 8,388	([4]).
Nonmetals:			
Cement and lime	53,721	67,137	European Economic Community [2] 58,937.
Salt	14,101	12,682	European Economic Comminuty [2] 3,662.
Mineral fuels:			
Coal	351	193	All from European Economic Community.
Coke	84	20	Do.
Petroleum refinery products	130,596	127,646	Netherlands Antilles 59,136; European Economic Community; [2 5] 33,057; United States 7,201.

[1] Includes manufactures.
[2] Exports from the European Economic Community.
[3] Includes the following semimanufactures exported by the European Economic Community: 962 tons of aluminum and 58 tons of copper.
[4] Data not available.
[5] EEC exports to Cameroon were (in metric tons): gasoline, 8,034; kerosine, 3,997; distillate fuel oil 1,143; lubricants, 4,021; petroleum coke, 14,629; bitumen, 700; and liquefied petroleum gas, 533.

Source: Institut National de la Statistique et des Études Économiques. Données Statistiques January-March 1964.
European Economic Community. Foreign Trade Statistics, 1962. August 1963.

COMMODITY REVIEW

METALS

Aluminum.—Compagnie Cameroonaise d'Aluminum Péchiney-Ugine (ALUCAM), a company owned and managed by a French aluminum and chemical interest with a 3-percent interest held by the Cameroon Government, continued the production in its plant at Edéa on the Sanaga River, at a level slightly above that of 1962. Operations began in February 1957, and the plant has gradually increased output; however, no significant rise above the 1962 level was possible because of the seasonal drop in the flow of the Sanaga, which requires cutting out a portion of the plant when available hydroelectric power declines. This situation resulted in a range of monthly production in 1963 of from 2,647 metric tons in April to 5,870 in August, and an average

of 4,410. To overcome this water shortage, the construction of a storage dam far up the river had been proposed; in September it was reported that the studies of the most suitable place to build this dam were nearing completion and construction would begin within a few months. Two years would be required to complete the facility.

Power for the aluminum plant was supplied by Société Énergie Électrique du Cameroon, operators of the Edéa hydroelectric plant; in the first half of the year 472 million kilowatt-hours was consumed, or 18,709 kilowatt-hours per ton of aluminum produced, and average cost per kilowatt-hour was CFAF0.50. The alumina again came entirely from Guinea, and imports were probably about 91,000 tons.

ALUCAM operated under the long-term agreement that had been decreed on November 29, 1962. This agreement provided for continuation of the previous favorable customs and tax provisions for 20 years, essentially without change. The company agreed to remit to the government 60 percent of the foreign exchange derived from aluminum sales outside the franc zone. This figure, however, was to be computed from the value added at Edéa to the alumina, imported duty-free, rather than the f.o.b. price of the aluminum at Douala. A new corporation (CAMAL) was formed to control these sales and this division of foreign exchange. It was further agreed that the government may commit up to one-third of ALUCAM's production in concluding agreements with other countries, and no aluminum is to be stockpiled while the government looks for buyers. Instead, the Government will exercise its right by requesting delivery from current production once all conditions of sale have been met. ALUCAM also agreed to increase the proportion of Cameroon citizens in the upper echelons of its management, to pay higher rates for the additional power expected to be available after completion of the storage dam on the Sanaga, and to take part in development studies of the feasibility of opening up domestic bauxite deposits.

In 1960, Société Cameroonaise de Transformation de l'Aluminum was founded by ALUCAM, other French interests, and several leading commercial firms of Cameroon. This company installed rolling facilities in a plant adjacent to the ALUCAM plant, for the production of corrugated sheets for roofing and siding. Plans were initially to use imported coils and later to start from Edéa ingots. In 1962 production began with 400 metric tons of corrugated sheets; while data on 1963 output are not available, it was expected that 800 tons would be produced. Neighboring franc zone countries were expected to provide the market.

Through September exports of aluminum were at the annual rate of 44,925 metric tons, 12 percent below the 1962 total. U.S. 1963 imports from Cameroon were 2,585 metric tons (100 tons in 1962).

Bauxite.—No new developments toward the economic utilization of Cameroon bauxites were reported other than further investigations of the economics involved. Latest figures on bauxite reserves are 40 million metric tons containing 45 percent alumina and 2 percent silica after screening for the Fongo-Tongo deposit in Menoua Department, and over 1 million tons with 43 percent alumina and 3.4 percent silica for the Minim-Martap and Ngaoundal deposits in Adamaoua. The location of the latter deposits, over 1,100 kilometers from the sea and

almost as far from Edéa, at least has held back their development pending the completion of the proposed Transcameroon Railway, bids for which were to be opened at yearend. With the comparatively small alumina requirements of the Edéa plant, over half the output of even a minimum-sized alumina plant would have to be exported; with the expected high production cost this alumina would not be competitive on the export markets. Early forecasts have been that only by 1975–80 could a development be economically feasible. ALUCAM is to participate in further investigations, with other interested parties, and reportedly is to purchase any alumina produced domestically, on a preferential basis.

Gold.—The gold production continued to come mainly from the Betare-Oya region, where tributers work within the permit of Compagnie Minière du Cameroon and sell the gold to the company. The substantial increase probably resulted from an improved control over the mining, although richer ground worked or more workers engaged could have been responsible. Exports through September were at the annual rate of 1,929 ounces.

Tin.—Following the 1962 takeover of operations at the Mayo Darle tin mine by a new operator, Société de Fibre et Mécanique of Douala, production rose to approximately the previous level. Indications are that the increased output came mainly from reworking old tailings. Production was 91 long tons of concentrates containing approximately 66 percent tin.

NONMETALS

Cement.—In September, plans were announced for the construction of two cement plants. These were to be established under the provisions of a technical cooperation agreement between the Cameroon Government and West Germany. Specific locations of the plants were not given, but a 75,000-ton-per-year plant is to be built in the north and one of 30,000-ton capacity in the south.

MINERAL FUELS

Petroleum.—Société de Recherches et d'Exploitation des Pétroles au Cameroon (SEREPCA), a predominantly French oil company capitalized at CFAF4,700 million in which the Cameroon Government holds 10.7 percent of capital, continued intermittent exploration. Since SEREPCA was created in 1951, it has put down 47 wells totaling approximately 58 kilometers in depth, within a 32-kilometer radius of Douala. Two small oil pools and two minor gas deposits were discovered, but no commercial production has resulted. Reportedly, 350 to 400 million cubic meters of gas could be used by the small industries in the area; however pending additional demand, production has not been started. Expectations at yearend were that an extensive series of seismic tests would be effected in 1964 and more drilling might follow in 1965.

During the year agreement in principle was reached for the Cameroon Government to participate with those of the Central African Republic, Chad, Congo (Brazzaville), and Gabon in the construction of a 700,000-metric-ton-per-year refinery at Port Gentil, Gabon.

On September 18, the Cameroon Investment Committee approved the application of Azienda Generale Italiana Petroli, the marketing agency of the Italian Government Ente Nazionale Idrocarburi, for benefits under the investment code. Approval was given for exemption from duties and taxes on plant, machinery, and raw materials imported into the country. Exemption from taxes on industrial and commercial profits during the first 5 years of operation was denied.

The Mineral Industry of the Central African Republic

By Thomas G. Murdock [1]

THE CENTRAL AFRICAN REPUBLIC, formerly the territory of Oubangui-Chari of French Equatorial Africa, has a relatively small mineral industry. Production in 1963 was limited to a small quantity of diamond (1.1 percent of the world total) and a few ounces of gold recovered as a byproduct of diamond mining. However, the industry is important to the economy of the landlocked country, and in 1963 diamond exports comprised about 42 percent of all exports on the basis of value. In 1962 the gross national product (GNP) was CFAF12,495 million (US$51 million); [2] the mineral production had an estimated value of CFAF1,084 million, 9 percent of the GNP. With the greatly expanded diamond production, the GNP increased to CFAF2,501 million in 1963, with a consequent rise in the share contributed by mining.

An alltime high in diamond production was reached in 1963. A new organization to increase further production of diamond through Government participation in mining and maintaining the output in the legitimate trade, through a closer control of the production and marketing, was established. Exploration of occurrences of other minerals also gave promise of some possible diversification of the industry.

Data on the total employment in mining are not available. An estimated 15,000 individual entrepreneurs were engaged in mining for sale to itinerant buyers at yearend. Employment by the established mining companies probably was down to about 5,000 following the decreased production since 1956, when 9,850 were working. Thus, indications are that about 20,000 workmen are engaged in mining. This is only a small part of the economically active labor force which was estimated in 1960 to be 35 percent of the total population; the population was estimated at 1.3 million in 1963.

A U.S. company continued its participation in two of the diamond-mining companies during 1963 and bought additional diamonds in the country. Announcement was made of its participation in setting up a cutting establishment.

GOVERNMENT POLICIES AND PROGRAMS

Following the adoption of a new mining code in 1961, no specific legislation relating to mining in general was recorded. Mining was,

[1] Mining engineer, Division of International Activities.

[2] African Financial Community (CFA) francs are used in the country. The exchange rate is US$1=CFAF245 (CFAF1=US$0.0040816).

however, encouraged by certain provisions of the new investment code, promulgated as law No. 62355 on February 19, 1963. New activities are to be exempted from income taxes for an initial period of 5 years; for a subsequent 3-year period, a reduced rate may be granted to certain enterprises. Several measures applying especially to diamond mining were taken during the year, to change the method of Government participation and to more effectively control the individual miners. The private mining companies' status was not altered.

Following a reorganization and the receipt of needed equipment, the Mining and Geological Service carried out the investigative program scheduled for 1963. Prospecting was undertaken by engineers placed at the Service's disposal through the Cooperation Française and assisted by Africans trained under a program instituted by the Service.

SOURCE MATERIAL

Data on production and 1963 developments are from dispatches of the U.S. Embassy in Bangui, effectively supplemented by a comprehensive coverage in the technical press.[3] Trade data are from the Union Douanière Équatoriale.

PRODUCTION

The production trend for 1959–63 reflected rather closely the changed structure of the industry. Gold output, limited to that recovered as a byproduct of diamond mining, has declined sharply since 1960 and reached a new low in 1963. Following the inauguration of diamond mining by individual miners to supplement the operations of the established companies and the activities of local buying offices established in early 1961, production rose sharply to the high in 1963 when the individual miners produced 82 percent of the total.

TABLE 1.—Production of metals and minerals

Commodity [1]	1959	1960	1961	1962	1963
Metals: Gold.....troy ounces..	495	291	80	100	76
Nonmetals:					
Diamonds:					
Gem.....carats..	25,980	20,892	41,484	80,417	120,714
Industrial.....do....	60,620	48,749	70,000	185,000	281,650
Total.....do....	86,600	69,641	111,484	265,417	402,364

[1] In addition, building materials are produced but no quantitative data are available.

TRADE

In 1962 the total value of metal and mineral imports was CFAF654 million, 11 percent of all imports, compared with CFAF633 million and 12 percent in 1961. The 1962 import value by categories follows: Metals, CFAF234 million; nonmetals, CFAF145 million; and mineral

[3] Mining Journal (London). Central African Republic-Record Diamond Output in 1963. V. 262, No. 6719, May 29, 1964, p. 423.

fuels, CFAF275 million. The exports were valued at CFAF790 million (CFAF371 million in 1961) and comprised 22 percent of all exports (11 percent in 1961); they consisted of diamonds (valued at about CFAF715 million), petroleum refinery products of nondomestic origin (valued at about CFAF75 million), and gold, lime, and unidentified materials (together valued at less than CFAF500,000).

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals: Gold—troy ounces	142	83	All to France.
Nonmetals:			
Diamond—carats	154,700	175,267	United States 71,020; France 45,700; Israel 18,930; United Kingdom 13,720; Netherlands 13,432.
Other [1]	46	7	All to Cameroon.
Mineral fuels:			
Petroleum refinery products:			
Gasoline, aviation	1	1,960	All to aviation bunkers.
Distillate fuel oil	2	----	
Lubricants	5	17	Bunkers 9; Cameroon 4.

[1] Includes lime (2 tons in 1962, natron (25 tons in 1961), salt (21 tons in 1961), and unspecified (5 tons in 1962).

Source: Union Douanière Équatoriale. Commerce Extérieur, 1961 and 1962.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum	139	167	All from France.
Copper	8	11	France 9.
Gold—troy ounces	12	104	All from France.
Iron and steel: Rolled products [1]	3,588	4,274	France 3,913; West Germany 226; Japan 72; Belgium-Luxembourg 40.
Other [2]	5	6	Unspecified (probably all from France).
Nonmetals:			
Cement	15,896	19,553	Republic of the Congo (Léopoldville) 7,629; Belgium-Luxembourg 7,022; France 4,373.
Fertilizers:			
Nitrogenous	702	1,116	Italy 591; France 505.
Phosphatic	316	4	All from France.
Potassic	379	89	Do.
Other	194	50	France 30; West Germany 20.
Lime	548	105	All from France.
Salt	4,199	2,329	Portugal 1,623; Portuguese Guinea 469; Senegal 139.
Other [3]	41	30	All from France.
Mineral fuels:			
Coal byproducts	4	14	Do.
Petroleum refinery products:			
Gasoline	15,785	[4] 11,805	Netherlands Antilles 6,019; Venezuela 3,682; United States 2,067.
Kerosine	4,004	3,135	Netherlands Antilles 1,657; Venezuela 1,055.
Distillate fuel oil	8,935	6,704	Netherlands Antilles 3,228; Venezuela 2,568; United States 901.
Lubricants	566	780	United States 434; France 317.
Liquefied petroleum gas	1	113	All from France.
Asphalts and bitumens	133	250	United States 194; Spanish Africa 48.
Other	10	9	Unspecified.
Total	29,434	22,796	Netherlands Antilles 10,906; Venezuela 7,314; United States 3,991.

[1] Includes 2 tons of ferroalloys in both 1961 and 1962.
[2] Includes lead (1 ton in 1961 and 2 tons in 1962), tin (3 tons in 1961 and 1 ton in 1962), and zinc (1 ton in 1961 and 3 tons in 1962.)
[3] Includes chalk (23 tons in 1961 and 3 tons in 1962), diatomite (6 tons in each year), gypsum (3 tons in 1961 and 2 tons in 1962), mineral pigments (4 tons in each year), sulfur (1 ton in 1962), and talc (5 tons in 1961 and 14 tons in 1962).
[4] Includes 279 tons identified as mixed motor fuels.

Source: Union Douanière Équatoriale. Commerce Extérieur, 1961 and 1962.

France continued to be the country's leading supplier of metals and minerals, with 40 percent of the total; the European Common Market, of which the Central African Republic is an associate member, supplied 51 percent in the aggregate. Netherlands Antilles and Venezuela, main suppliers of petroleum refinery products, ranked second and third, respectively, followed by the United States which also supplied these commodities and accounted for 9 percent of all metal and mineral imports. These items comprised 22 percent of all imports from the United States. The United States ranked first as a recipient of metal and mineral exports, with 36 percent, followed by France (18 percent) and Israel (17 percent). Mineral exports to the United States, exclusive of diamond, comprised 61 percent of total Central African Republic exports to that destination.

Assuming that in 1963 metal and mineral imports accounted for 11 percent of all imports, as they did in 1962, they would have had a value of CFAF717 million. Diamond exports in 1963 were valued by preliminary figures at CFAF2,258 million, or 216 percent above those of 1962.

COMMODITY REVIEW

METALS

Gold.—The small gold production continued to be obtained as a by-product of diamond mining, with the combined output of the companies amounting to 35 ounces and that of the individual miners to 41 ounces. The Mining and Geological Service continued investigations of gold deposits in the eastern part of the country, between Alindao and Kembe.

Iron Ore.—At Bogin, two beds of iron ore, grading 68 percent iron over a length of 500 meters, were explored by the Mining and Geological Service. The beds averaged 6 to 8.5 meters thick and 10 meters deep. Plans were made to exploit the deposits at the rate of 7,000 metric tons per year.

Tin.—Occurrences of cassiterite at Ippy, Bria, and Yalinga were scheduled for investigation, and arrangements were made for a West German expert to lend technical assistance in the project during 1964.

Uranium.—A permit for prospecting for uranium was granted in the Bengassou region to the French Atomic Energy Commission, which started work in December on an aerial scintillometer survey of 5,200 square kilometers.

NONMETALS

Diamond.—Of the 1963 record high diamond production, 73,960 carats were produced by the mining companies (61,379 carats in 1962); 58,331 carats came from the western region centered on Berberati and Carnot, and 15,629 carats came from the eastern region near Ouadda. Most of the output, however, was mined by individual African diggers and purchased by non-African buyers; of the 328,404 carats obtained in this way (265,417 carats in 1962), 64 percent was bought in Bangui, 33 percent in Carnot, and 3 percent in Bria. Indications were that, as in former years, the gem variety constituted 30 percent of the total on the basis of weight and 70 percent were industrials. On the basis

of value, however, these proportions were 60 percent and 40 percent, respectively.

Data on 1963 production of individual companies are not available. In 1961, when the output of the individual miners was 57 percent of the total, the leading company producer was Compagnie Centraficaine de Mines, an affiliate of Diamond Distributors, Inc., of New York, with 20 percent, from operations in the western region. Another affiliate of this U.S. organization, Compagnie Diamantifière du Dar Challa, active in the east, contributed 2 percent. Other producers, all controlled by French interests, in 1961 were Société Minière de l'Est Oubangui, at Yalinga (9 percent); Société Africaine de Mines, at Ouandjia (8 percent); Société Minière de Carnot, at Carnot (3 percent); and Société Anonyme de Recherches et d'Exploitations Minières, at Ouadda-Bria (1 percent).

Through November exports were at the annual rate of 364,000 carats. Preliminary data indicate that Israel was consigned 196,500 carats in the entire year; practically all of the remainder went to the United States. Total diamond exports of the country through 1963 were about 2.7 million carats; all were produced from alluvial deposits.

A number of important developments in the diamond industry took place towards the end of 1963. On December 19, the National Assembly passed a law to establish Société Nationale de Recherches et d'Exploitations Minières (SINAREX), a diamond-mining firm owned by the State. SINAREX was to establish several small diamond-mining centers in the southwestern region of the Republic within the next 2 years. It was expected that each center will cost CFAF40 million. Funds are to be provided by the National Development Bank and are to be repaid in 10 years. Prospecting will be undertaken by the Mining and Geological Service. Around each center, manned with 2 or 3 French mining engineers and 15 to 30 Central African laborers, the Government expects to build small villages with a minimum of public facilities, together with retail stores and licensed buying offices. It was hoped to attract to these centers most of the individual diggers, scattered throughout the region, whose operations were almost impossible to control. The diggers will be free to use the facilities provided and will be expected to sell their stones to the licensed buying offices, which, in turn will sell their lots to the major European- or U.S.-operated buying offices in Bangui. The Government will sell its own production directly to buying offices in Bangui.

Operations of privately owned diamond-mining companies were not affected by the establishment of SINAREX, which appeared to be motivated principally by the Government's desire to increase diamond production and to rid the country of the estimated 5,000 to 6,000 West African middlemen, of whom only about 150 are licensed.

The Israel-Central African Republic (ICAD) diamond export monopoly was dissolved on December 31. Henceforth each buying office will export its own lots directly, the full 10-percent export tax being remitted to the Government, which received slightly less than half this figure under the profit-sharing agreement with ICAD. Pituach Centrafricaine des Diamants, a subsidiary of Pituach-Israel, was formed on December 14 to engage in the buying, export, and sale

of rough diamonds. It will compete on equal terms with other privately owned diamond-buying offices in Bangui.

To combat the illicit trade in precious stones outside the Central African Republic, the Mining Brigade, attached to the Mining and Geological Service, was being organized. Recruitment of 40 agents was envisaged, when the necessary financial arrangements were completed. Announcement was made of plans for the establishment of a diamond-cutting industry in 1964; this will be by an association of the Government and Diamond Distributors, Inc.

Other.—Nonmetals exploration activities by the Mining and Geological Service included the exploration of brick clay deposits resulting in quantities sufficient for exploitation at the proposed rate of 12,000 tons per year, an investigation of granite deposits near Bouar and preparation of plans for setting up sawing and polishing facilities, and investigations of deposits of limestone at Bobassa, south of Bangui, where seasonal extraction is under consideration in connection with a project for the manufacture of 20,000 tons of cement per year.

MINERAL FUELS

The Central African Republic participated with its partners in the Equatorial Customs (Chad, Congo-Brazzaville, and Gabon) and nearby Cameroon in the successful negotiations for the establishment of the petroleum refinery at Port Gentil, Gabon, to be in operation by 1966 and to have an annual capacity of 700,000 metric tons.

The Mineral Industry of Chad

By Thomas G. Murdock [1]

THE REPUBLIC OF CHAD, formerly the territory of Chad of French Equatorial Africa, is a mineral-poor country dependent upon its agricultural resources for economic development. Mineral production has been limited to a small amount of natron and an unrecorded quantity of building materials. With the possible exception of oil, there seems to be little prospect of any significant investment in or exploitation of minerals in Chad. As an importer of minerals and metals in 1962, the country ranked high in comparison with its partners in the Equatorial Customs Union (ECU), accounting for 31 percent of the total value for these commodities; 180 percent and 40 percent more than the Central African Republic, and Gabon, respectively; and only 14 percent below the Republic of Congo (Brazzaville).

The 1962 gross national product (GNP) was CFAF29,616 million (US$120 million),[2] the highest of any ECU country. Natron production was valued at an estimated CFAF222 million, less than 1 percent of the GNP. The value of building-materials production, if data were available, would not alter significantly this small contribution.

Data on employment in natron extraction are not available. It is a tribal activity and is an intermittent operation following the annual rainy season (June to September); workers engaged are from the Bornou, Kanembou, Kotoko, and Boudouma tribes, probably numbering several hundred at the height of annual activity. They undoubtedly constitute an insignificant part of the economically active group, comprising less than 50 percent of the 3.1 million population, considering that more than 90 percent of this group is engaged in agricultural pursuits.

The year 1963 saw no changes in the mineral position of Chad other than the 23-percent increase in mineral imports. Natron mining continued at the level of the preceding year, and although in September rumors of a substantial oil find in northeastern Chad caused some optimism, later conclusions were that this was premature.

GOVERNMENT POLICIES AND PROGRAMS

No new mining legislation was reported in 1963. Likewise no amendments to the Chadian petroleum code adopted on February 3,

[1] Mining engineer, Division of International Activities.

[2] African Financial Community (CFA) francs are used in Chad. The official exchange rate used is US$1=CFAF246.8 (CFAF1=US$0.004052).

1962, were reported. A comprehensive investment law was promulgated in August 1963, which was liberal in content and aimed to encourage investment in industries beneficial to the development of Chad. Following the enactment of this law negotiations were begun on an investment guarantee agreement with the United States but at yearend this was still pending.

During the year an interim development plan for 1964–65 was under preparation. This plan placed emphasis on the construction and improvement of all-weather roads within Chad, expanding educational and technical-training facilities and personnel and improving agricultural production. Much of the development depended on aid from France and other members of the European Common Market, of which Chad is an associate member. In May, the French aid agency made a grant of CFAF78.6 million to the Cameroon-Chad Joint Railroad Commission for preliminary technical studies regarding extension of the Trans-Cameroonian Railroad from Ngaoundere, Cameroon, to Fort Archambault in southern Chad. The studies were to last 2 years and began previous to actual granting of funds. On July 10, 1963, Chad became a member of the International Bank for Reconstruction and Development and the International Monetary Fund. Plans for the participation of Chad in financing a cemet plant in northern Cameroon were announced; installation of this facility was scheduled for 1965, and expectations were that Chad would take 15,000 metric tons of the annual production.

SOURCE MATERIAL

Data are almost exclusively from dispatches of the U.S. Embassy in Fort Lamy, particularly an annual summary prepared especially for this review.[3] Trade data are from the Union Douanière Équatoriale.

PRODUCTION

Reported production of minerals in Chad has consisted only of natron; output in 1959 was only 3,000 metric tons, rising in 1960 to 6,000 tons, and again doubling to 12,000 tons in 1961. An increased local demand and expanded exports permitted substantial subsequent growth, and for 1962–63 production was placed at 25,000 tons. Production of building materials is not recorded; although no quantitative data are available, indications are that except for cement, some varieties of clays, and lime, Chad is self sufficient, and there has been some growth in production in the 1959–63 period.

TRADE

In 1962 the total value of metals and minerals exports was CFAF198 million, 4.7 percent of all exports, compared with CFAF65 million and 1.2 percent the previous year. The 1962 exports consisted of scrap copper (CFAF1 million), natron and other nonmetals (CFAF36 mil-

[3] Smith, M. B. Information on Chad for Minerals Yearbook. U.S. Embassy, Fort Lamy, Chad. State Dept. Airgram A–157, Feb. 29, 1964, 4 pp.

lion), and petroleum refinery products of nondomestic origin (CFAF 161 million). The 1962 metals and minerals imports were valued at CFAF1,833 million, 24 percent of all imports (CFAF1,488 and 24 percent in 1961). The import value by categories was: Metals, CFAF317 million; nonmetals, CFAF436 million; and mineral fuels, CFAF1,080 million).

Of the 1962 exports of metals and minerals, deliveries to aviation bunkers accounted for 78 percent; Nigeria with 15 percent and Cameroon with 6 percent received practically all of the remainder. As a supplier of petroleum refinery products, Netherlands Antilles was the principal source, with 39 percent of all metal and mineral imports, followed by France (27 percent) and the United States (9 percent). The European Common Market as a whole supplied 42 percent of these. Imports from the United States, almost all of petroleum refinery products, comprised 52 percent of all imports from that country.

In 1963 total exports rose to CFAF5,605 million and if metals and minerals comprised 4.7 percent as they did in 1962, their value would have been CFAF263 million. Natron exports, were at approximately the same level as in 1962, however, bunker sales of aviation fuels may have shown a substantial increase from 1962. Total imports in 1963 were approximately the same as in 1962, however, imports of refined petroleum products rose to CFAF1,129 million and if other mineral and metal imports rose in the same proportion the total for all would have been CFAF1,915 million.

TABLE 1.—Exports of metals and minerals

(Metric tons)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Copper, scrap	----------	16	All to France.
Nonmetals:			
Flint	----------	20	All to Cameroon.
Natron	2,456	4,050	Nigeria 3,484; Cameroon 540; Sudan 25.
Unspecified	488	----------	
Mineral fuels:			
Petroleum refinery products:			
Gasoline:			
Aviation	606	2,650	All to bunkers.
Other	40	62	All to Cameroon.
Kerosine	16	24	All to France.
Distillate fuel oil	2	56	Cameroon 51; Nigeria 5.
Other [1]	36	167	All to bunkers.
Total	700	2,959	Bunkers 2,817; Cameroon 113.

[1] Includes jet fuel.

Source: Union Douanière Équatoriale. Commerce Extérieur, 1961 and 1962.

TABLE 2.—Imports of metals and minerals

(Metric tons)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum	139	103	France 99.
Copper	6	6	All from France.
Iron and steel:			
Rolled products	4,458	[1] 5,314	France 4,661; West Germany 560; Belgium-Luxembourg 87.
Other [2]	3	2	All from France.
Nonmetals:			
Cement	11,509	19,901	France 9,963; Belgium-Luxembourg 4,196; West Germany 3,693; Republic of the Congo (Léopoldville) 1,400.
Chalk	9	2	All from France.
Clays	2	8	Algeria 7; France 1.
Fertilizers [3]	6	1	All from West Germany.
Lime	188	330	Cameroon 206; France 123.
Mineral fuels: [4]			
Petroleum refinery products:			
Gasoline:			
Aviation	8,059	9,095	Netherlands Antilles 8,120; Nigeria 594; United States 288.
Other	5,244	11,677	Netherlands Antilles 5,504; United States 3,669; Iraq 966; Venezuela 705; Portugal 361.
Kerosine	980	2,661	United States 837; Netherlands Antilles 688; Iraq 628; Venezuela 214.
Jet and other fuel	1,463	2,861	Netherlands Antilles 2,604; Nigeria 257.
Distillate fuel oil	3,925	8,859	Netherlands Antilles 5,958; West Indian Federation 1,868; Venezuela 256; Nigeria 222.
Lubricants	371	570	France 243; United States 239; Nigeria 38.
Liquefied petroleum gas	40	116	Nigeria 60; France 48.
Asphalt and bitumens	32	412	Netherlands 399.
Other	46	501	Netherlands Antilles 455; France 23; West Germany 22.
Total	20,160	36,752	Netherlands Antilles 23,337; United States 6,905; Iraq 1,720; Nigeria 1,456; Venezuela 1,203.

[1] Includes 3 tons of ferroalloys from France.
[2] Lead, 1 ton in 1961 and 1962; tin, 1 ton in 1961; and zinc, 1 ton in 1961 and 1962.
[3] 2 tons nitrogenous, 3 tons phosphatic, and 1 ton potassic in 1961; 1962, unspecified.
[4] Additional imports of 36 tons of crude petroleum in 1961 and 1 ton of coal byproducts (from France) in 1962 are recorded.

Source: Union Douanière Équatoriale. Commerce Extérieur, 1961 and 1962.

COMMODITY REVIEW

METALS

No new developments were reported for the only recorded metal occurrences in Chad of columbite, tin, and tungsten in the Tibesti region. Except for 22 tons of tungsten ore obtained during the 1957–58 exploration of the deposits, there has been no production and an economic exploitation has remained problematic.

NONMETALS

The Chadian natron, a mixture of sodium carbonates and chloride, is found in substantial quantity in and around Lake Chad, 110 kilometers north of Fort Lamy. Smaller quantities occur in Borkou and Ennedi but because of geographical considerations these latter sources remained unexploited. The center of the Chadian natron industry is Bol, on the northeastern shore of Lake Chad. When the lake waters

begin to dry up after the annual rainy seasons, tribal workers excavate along the still-wet shores to a depth of about 1.5 meters, where the natron is encountered and extracted in pieces averaging 60 kilograms in weight and 15 centimeters in thickness. After extraction the natron is placed on straw mats and dried in the sun for 2 or 3 days. When dry it is cut into rectangular or tombstone-shaped blocks of about 30 kilograms weight and carried to Bol by camels. There it is moved by barges across Lake Chad and up the Chari River to Fort Lamy for sale to local Moslem merchants. The natron is then retailed in the local markets or exported, mainly to Nigeria. The Chadian Customs in 1963 established a suboffice in Bol to permit exports of natron to move directly from Bol to northern Nigeria. Natron is widely used by Africans as a household seasoning, a remedy for minor ailments, and a flavoring for chewing tobacco. Chadian women mix natron with ashes of burnt wheat stalks to make soap; Chadian herders give it to their cattle as preventive medicine; and it is also used in tanning leather. Preliminary information placed the 1963 exports at 4,000 tons, about the 1962 level. In view of the relatively minor role in the total Chadian economy, the government has taken no major steps to encourage its production.

MINERAL FUELS

Petroleum exploration was continued in 1963 by a single company, the French Société de Participations Pétrolières (PETROPAR), holding exclusive exploration and exploitation rights in two areas. Following minor discoveries of noncommercial value in the late 1950's in the Tibesti Mountains near Baidai, PETROPAR gave up the search there but retained all rights, confining subsequent work to the Tekro area in northeastern Chad. Rumors of a major oil find in the Tekro area circulated around Fort Lamy in late 1963. It was known that PETROPAR had brought in European oil geologists to work in the Tekro region, and reports were that 4 drill rigs had been shipped from Douala, Cameroon, to Tekro. By yearend, however, nothing further had been heard regarding the discovery, and there was no confirmation of the discovery by French or Chadian officials. Even if substantial reserves of oil were found in northern Chad, there would remain the problem of transport; considering this and the present supply position, it is doubtful that a commercial exploitation would follow in the near future.

Total imports of petroleum refinery products in 1963 were 34,800 metric tons, 5 percent below those of 1962. The country continued to depend almost exclusively for energy on these imports. Preliminary general studies of possible hydroelectric development at Gauthiot Falls in the Mayo Kebbi area, were continued in 1963. Appreciably increased imports of distillate fuel oil in 1962 over those of 1961 reflected the greater generation of power by diesel plants in the country. Plans were announced for electrification of Fort Archambault in the near future; it would cost CFAF300 million and would increase fuel oil requirements.[4]

[4] Industries et Travaux d'Outremer (Paris). V. 12, No. 126, May 1964, p. 415.

Chad participated with Cameroon, the Central African Republic, Congo (Brazzaville), Gabon in successful negotiations for establishment of the 700,000-ton-per-year petroleum refinery at Port Gentil, Gabon, to be in operation by 1966.

The Mineral Industry of the Republic of Congo (Brazzaville)

By Thomas G. Murdock [1]

THE REPUBLIC OF CONGO, formerly the territory of Moyen Congo of French Equatorial Africa, has a mineral industry which thus far has been of little importance to the world mineral economy. Production in 1963 consisted of small quantities of gold and nonferrous metals and an insignificant volume of crude petroleum from a single field. However, the country's recorded metals and mineral exports continued to be enhanced by the inclusion of a large quantity of diamond believed to have originated in the adjacent Republic of the Congo (Léopoldville); the diamond exports reached a record high in 1963 and were 16 percent of estimated total world production.

In 1962 the estimated gross national product (GNP) was CFAF 9,065 million (US$37 million); [2] the domestic mineral production has an estimated value of CFAF691 million, 7 percent of the GNP. The latter decreased to CFAF520 million in 1963, with a consequent drop in the share contributed by mining.

The outstanding event of the year was the announcement of the assignment of rights to develop the country's potash deposits to a company comprising several foreign investors and the Congo Government. The potash deposits represent the only important discovery of any current significance. The 1963 inauguration of large-scale production of manganese ore in adjacent Gabon brought minor economic benefits to the Congo because the ore is exported through Pointe Noire, the Congo's only port, after a 485-kilometer rail haul through Congolese territory. In 1963 manganese ore shipments from the port totaled 575,000 tons.

Data on employment in the extractive industries are not available. In 1956 about 2,000 workers were engaged in mining, and with the decreased production since then, the mine labor force has probably declined. At any rate, only a small part of the estimated 40,000 Congolese salaried workers in the estimated 1 million population are employed in mines, quarries, and oilfield activities.

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[1] Mining engineer, Division of International Activities.

[2] African Financial Community (CFA) francs are used in the country. The exchange rate is US$1=CFAF245 (CFAF1=US$0.0040816.)

GOVERNMENT POLICIES AND PROGRAMS

Other than the agreement of the Government with the new company to exploit the potash deposits, no specific new mining legislation has been reported. Law No. 39–62 of December 28, 1962,[3] which set up a new general tax structure, became effective upon publication. This code brought up to date earlier legislation, and stipulated depletion allowances for the extractive industries.

Following the revolution of August 1963, there was a change in the business climate, and expectations of lower retail sales, depletion of inventories, increased fluidity, and the movement of capital to France affected the mineral economy. A rather remarkable increase in construction activity, however, was expected for 1964 and would include six new Embassies, and a CFAF613 million sports complex to be completed in 1965 in the capital, Brazzaville. The liberal investment and reinvestment codes formulated in 1961 remained applicable and were applied to several investment conventions. U.S. investors remained eligible for protection under the Agency for International Development's Investment Guarantee Program applicable to the Congo.

During 1963 a Congolese 5-year plan, which came into operation on January 1, 1964, was prepared. Calling for a total expenditure of CFAF50 billion, of which 44 percent was for development of industry and services, the program included about CFAF90 billion for foreign capital investment. No significant progress was reported on the plans for the construction of the cement plant near Loutete or for the hydroelectric development on the Kouilou River, around which an industrial complex has been proposed. The proposed complex would include a plant to produce aluminum from imported alumina and other electrometallurgical facilities.

First steps towards creating a Congolese Bureau of Mines in the Ministry of Industrial Production were taken in April. The bureau was formed both to administer mining matters and to undertake exploration; it was considered that exploration by the bureau would be more advantageous than concluding exploration agreements with foreign interests.

SOURCE MATERIAL

Data on production and 1963 developments are from dispatches of the U.S. Embassy in Brazzaville amplified by the coverage of technical journals. Trade data are from the Union Douanière Équatoriale.

PRODUCTION

The 1963 production of all commodities was below that of 1962. Gold and lead, the major items in 1959, have declined since then, owing to the economically marginal nature of the gold deposits and exhaustion of the principal lead mine. The beginning of zinc and petroleum production in 1960 partly compensated for this decline, but output of

[3] Journal Officiel de la Republique du Congo (Brazzaville, Republic of Congo). Dec. 31, 1962, pp. 1019–1095.

the new commodities has shown annual variations, marked by the sharp drop for zinc since 1961 and the 1963 decline for petroleum. Production data for building materials are not available; the country's requirements, other than those of cement and lime, are met mainly by domestic production. Output of building materials probably grew during 1959–63, and 1963 may have been comparatively high. However, output apparently did not attain the level established when the extensive port developments at Pointe Noire (to permit the evacuation of the Gabon manganese ore) were underway.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals: [2]					
Copper			160	840	290
Gold, troy ounces	3,665	2,628	3,376	3,718	2,951
Lead	4,942	4,301	875	334	330
Tin, long tons	32	34	46	46	[3] 43
Zinc		600	1,280	713	713
Mineral fuels: Petroleum, crude		51,847	102,939	123,393	109,217

[1] In addition, building materials are produced; but quantitative data are not available.
[2] Metal content of marketable ore or concentrate produced, except gold which is fine metal recovered in mining.
[3] Estimate.

TRADE

In 1962 the total value of metal and mineral imports was CFAF2,140 million, or 13 percent of all imports, compared with CFAF2,917 million and 15 percent in 1961. The 1962 distribution of import value by categories follows: Metals, CFAF830 million; nonmetals, CFAF347 million; and mineral fuels, CFAF963 million. Exports were valued at CFAF4,015 million (CFAF640 million in 1961) and comprised 47 percent of all exports (13 percent in 1961). The increase in 1962 was due to the greatly increased exports of diamonds, presumably originating in the Republic of the Congo (Léopoldville). In 1962 exports of these diamonds were valued at CFAF3,149 million (CFAF33 million in 1961), accounting for 78 percent of all mineral and metal exports and 37 percent of all exports. The 1962 exports of metals were valued at CFAF197 million, and exports of mineral fuels were valued at CFAF669 million.

France continued to be the country's leading supplier of metals and minerals, with 54 percent of the total; the European Economic Community, of which the Congo is an associate member, supplied 60 percent in the aggregate. The Netherlands Antilles and Venezuela, main suppliers of petroleum refinery products, ranked second and third, respectively, followed by the United States. The latter country supplied 4 percent of all mineral and metal imports; these commodities, mainly petroleum refinery products and rolled steel, comprised 14 percent of all the Congo's imports from that source. Belgium-Luxembourg was the chief recipient of mineral and metal exports, with 46 percent of the total, followed by France (13 percent) and the United States (12 percent). These exports, consisting solely of diamonds, comprised 92 percent of all exports to the latter country.

Preliminary data on 1963 metal and mineral trade place the total value at CFAF2,051 million for imports and CFAF5,113 million for exports; of the latter, diamonds amounted to CFAF4,759 million.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum	10	16	Italy 7; France 4; Cabinda 2; Senegal 2.
Copper:			
Ore and concentrate	336	1,524	Spain 800; Japan 724.
Scrap	35	95	Cameroon 55; France 24; Netherlands 16.
Gold, troy ounces	4,825	3,926	All to France.
Iron and steel:			
Ferrous scrap	2,348	1,281	Japan 1,274.
Rolled products	13	----	
Lead:			
Ore and concentrate [1]	2,645	----	
Crude and scrap	12	6	All to Italy.
Tin, ore and concentrate, long tons	55	70	Netherlands 45; Spain 25.
Zinc, ore and concentrate [2]	1,908	4,310	All to United Kingdom.
Nonmetals:			
Diamond [3], carats	33,168	2,629,070	Belgium-Luxembourg 1,821,937; Netherlands 197,461; United States 188,055; United Kingdom 170,602; Israel 162,133.
Fertilizers, potassic	68	68	All to France.
Mineral fuels:			
Petroleum:			
Crude	93,425	135,007	France 115,370; Morocco 19,637.
Refinery products:			
Gasoline	862	8,062	All to bunkers.
Kerosine	1,348	199	Do.
Distillate fuel oil	20	----	
Lubricants	75	162	Bunkers 152.
Liquefied petroleum gas	2	10	All to Republic of the Congo (Léopoldville).
Asphalts and bitumens	30	----	
Total	2,337	8,433	Bunkers 8,423.

[1] Believed to be straight lead concentrates from the Hapilo mine.
[2] Believed to be zinc-lead concentrates from the M'Passa mine.
[3] No imports of diamonds into the Congo (Brazzaville) are recorded, nor is there any domestic production. Exports shown originated in the Congo (Léopoldville).

Source: Union Douanirèe Équatoriale. Commerce Extérieur, 1961 and 1962.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum	360	394	All from France.
Copper	76	56	France 53; Algeria 1.
Gold—troy ounces	9	272	All from France.
Iron and steel: Rolled products	34,639	[1] 17,062	France 15,878; Belgium-Luxembourg 277; Japan 187; West Germany 96; United States 86.
Lead	19	34	All from France.
Silver—troy ounces	204	----	
Tin—long tons	2	4	Mainly from France.
Zinc	15	11	All from France.
Other	1	2	Do.
Nonmetals:			
Barite	----	200	All from Morocco.
Cement	53,308	60,860	France 49,475; Belgium-Luxembourg 6,089; Republic of the Congo (Léopoldville) 3,500; Spanish Guinea 1,358.
Chalk	55	30	All from France.
Clay	8	44	Morocco 42; Nigeria 1.
Fertilizers:			
Nitrogenous	742	801	All from France.
Phosphatic	37	43	Do.
Potassic	817	930	France 919; Portugal 9; West Germany 1.
Other	----	5	All from France.
Flint	508	380	Republic of the Congo (Léopoldville) 320; France 60.
Lime	492	301	All from France.
Magnesite	1,201	105	France 104; Belgium-Luxembourg 1.
Pigments, mineral	14	15	All from France.
Salt	2,398	2,504	Angola 1,385; Portugal 329; Senegal 319; Spain 267.
Sulfur	640	55	All from France.
Other [2]	53	44	France 41; Belgium-Luxembourg 2.
Mineral fuels:			
Coal	65	59	All from France.
Coke	32	32	Do.
Coal byproducts	17	12	Do.
Petroleum:			
Crude	224	----	
Refinery products:			
Gasoline:			
Aviation	16,604	13,086	Netherlands Antilles 12,141; ships' stores 775.
Other	20,754	19,390	Netherlands Antilles 12,817; Portugal 2,877; Venezuela 2,812.
Kerosine [3]	7,314	8,303	Venezuela 4,701; Netherlands Antilles 3,283; Portugal 133.
Distillate fuel oil	37,401	34,607	Venezuela 20,984; Netherlands Antilles 8,478; Portugal 2,251; Italy 1,674.
Residual fuel oil	5,859	6,427	Netherlands Antilles 2,820; Venezuela 2,454; France 752.
Lubricants	4,165	3,045	France 1,905; United States 899; Belgium-Luxembourg 166.
Liquefied petroleum gas	1,172	663	France 631; Belgium-Luxembourg 20.
Asphalt and bitumen	1,428	2,687	United States 2,508.
Other	56	68	Netherlands 62.
Total	94,753	88,276	Netherlands Antilles 39,563; Venezuela 31,109; Portugal 5,262; France 3,932.

[1] Includes 2 tons of pig iron and 4 tons of ferrous scrap in 1962.
[2] Includes diatomite (6 tons in 1961 and 11 tons in 1962), gypsum (5 tons in 1961 and 4 tons in 1962), marble (1 ton in 1962), sand (12 tons in 1961 and 2 tons in 1962), talc (5 tons in 1961 and 20 tons in 1962), and unspecified (25 tons in 1961 and 6 tons in 1962).
[3] Includes 757 tons of mixed fuels in 1961 and 4,808 tons in 1962.

Source: Union Douanière Équatoriale. Commerce Extérieur, 1961 and 1962.

COMMODITY REVIEW

METALS

Copper.—The small copper output, 65 percent below 1962, continued to come from the M'Passa mine in the Niari Valley, where Syndicat de M'Passa (SMM) began production in 1961. Copper was produced as a byproduct of mining lead-zinc; the principal economic mineralization of the lenses was estimated to contain about 55,000 metric tons of ore. The Syndicate is an association of the Bureau de Recherches Géologiques et Minières (BRGM), an agency of the French Government, and Compagnie Minière de Congo (CMC), formerly operators of the Mindouli copper mine and the lead mines at M'Fouati and Hapilo, which were worked out or uneconomic at prevailing prices. The 1963 production was 830 metric tons of concentrates estimated to contain 35 percent copper.

Gold.—Gold continued to be produced only by individual African miners using primitive hand methods and declined 20 percent below the 1962 output. Exports in 1963 were 2,765 troy ounces.

Lead and Zinc.—The M'Passa mine of SMM also accounted for the country's lead and zinc output, producing 2,229 metric tons of bimetal concentrates containing, as in 1962, an estimated 15 percent lead and 32 percent zinc. These grades are lower than the average for the ore reserved, estimated to be 21 percent lead and 35 percent zinc. No progress was reported toward the development of the new discoveries made by the Syndicat de la Loutete, another association of BRGM and CMC; these discoveries consist of 15,500 metric tons of 14 percent lead ore at Yanga-Koubenza and 40,000 metric tons of 13 percent lead ore at Palabanda.

Tin.—The 1963 tin production came from two small veins of cassiterite found in the Mayumbe. Output was maintained at the approximate level of the preceding year; production was 58 long tons of concentrates containing an estimated 75 percent tin. Other scattered cassiterite deposits in the area remained unexploited because of the high costs of mining and transport to Pointe Noire.

NONMETALS

Diamond.—Although a small diamond production was recorded in the past, it never exceeded 1,000 carats annually and ceased prior to 1959. Exploration by Diamant-Congo in the Lali-Bouenza area revealed extensive flats which might be exploited mechanically; however, no effort to undertake their development was reported in 1963. Additional promising finds in northern Congo were reported in the year. Diamond was the largest single item of Congolese exports. Almost all of the diamond arrived in Brazzaville from Congo (Léopoldville) but did not appear in the import figures. To regularize their trade, the government has licensed about 12 buyers for these stones and facilitated their export by levying only a 2-percent ad valorem export tax. The 1963 exports were 5,684,000 carats; estimates were that 341,000 carats were gem quality and 5,343,000 carats were industrial stones. Average value per carat was CFAF891 (CFAF1,198 in 1961). Dia-

mond exports to the United States declined appreciably from those of 1962.

Potash.[4]—In April 1963, potash-mining rights were assigned to Société des Potasse de Hollé (SPH) by the Government of the Congo. Discovered in 1960, the deposits near Hollé, 45 kilometers inland from Pointe Noire, were explored by a French group consisting of Société des Pétroles d'Afrique Équatoriale, Bureau de Recherches Géologiques et Minierès, and Les Mines de Potasse d'Alsace. The initial exploration included 7,645 meters of drilling within an area of 4,000 square kilometers, and by mid-1963 expenditures amounted to CFAF907 million. SPH was formed to exploit the deposits by the companies involved in the exploration, the Congolese Government, and reportedly Israeli, German, and possibly U.S. potash producers. World Bank financial assistance may be given. An annual production of 2 million metric tons is envisaged; of this 600,000 tons will be treated locally and will yield 350,000 tons of potassium oxide (K_2O), practically all for export. The remainder will be exported in untreated form. The projected total investment is about CFAF12 billion, and production is scheduled to begin in 1967. Employment is expected to be 700 to 800 personnel of all categories in mining, treatment, and transportation.

The potash occurs within the coastal sedimentary basin, as part of a thick salt series averaging 500 to 600 meters in thickness; the top appears at depths of 250 to more than 600 meters. This series contains several potash horizons, consisting essentially of carnalite which occurs as numerous beds up to 15 meters thick. Sylvanite is also present as beds or lenses, less frequent but thicker than those of carnalite.

MINERAL FUELS

Petroleum.—Congolese petroleum production dropped to approximately the 1961 level, 11 percent below that of 1962. The output came entirely from the Pointe Indienne field near Pointe Noire, where Société des Pétroles d'Afrique (SPAFE), partly owned by the French Government, began production in 1960. At the beginning of the year nine wells, all flowing, were producing. Previously announced plans for increasing the Pointe Indienne annual production to 150,000 metric tons were delayed in their implementation, probably because of the limited reserves of the field, placed at less than 1 million tons at the beginning of the year. The gas deposits, also in the Pointe Indienne field and containing an estimated 142 million cubic meters, remained unexploited. SPAFE continued exploration within the Pointe Indienne concession; exploration activities were begun within the offshore Pointe Noire and Nord Kouilou permits, covering respective areas of 3,950 and 3,564 square kilometers. In the offshore exploration, SPAFE is associated with Mobil Oil, Mobil West Africa, and Shell Oil. No discoveries resulting from the 1963 activities were reported.

In December it was reported that an affiliate of the Italian Ente Nazionale Indrocarburi (ENI), after 2 years of negotiations, had

[4] Canadian Mining Journal (Gardenvale, Quebec). V. 85, No. 2, February 1964, p. 164. Industries et Travaux d'Outremer (Paris, France). V. 10, No. 106, September 1962, p. 729.

received final permission to enter the retail market trade and immediately began the construction of at least six service stations. These stations were expected to be supplied by the ENI-affiliated refinery at Tema, Ghana.

The Republic of Congo participated with its partners in the Equatorial Customs Union (Central African Republic, Chad, and Gabon) and nearby Cameroon in the successful negotiations for the establishment of the 700,000-metric-ton petroleum refinery at Port Gentil, Gabon, to be in operation by 1966.

Preliminary 1963 data place the 1963 exports of crude petroleum at 101,100 metric tons with an average per-ton value of CFAF 3,314 (CFAF 3,322 in 1962). Imports of petroleum products included gasoline 28,700 tons; kerosine 6,600 tons; fuel oil (all types) 39,600 tons; and lubricants 3,400 tons.

The Mineral Industry of the Republic of the Congo (Léopoldville)

By Thomas G. Murdock [1]

DURING the first half of 1963 the mining and metallurgical industry of Katanga, the country's principal productive area, was recovering from damages caused by the hostilities attending reunification. Despite the loss of production while damaged productive, power, and transportation facilities were being reestablished, the year's performance for the country as a whole compared favorably with that of the preceding year as the output of some commodities improved. The extractive industries still occupy a preponderant place in the Congo economy; they produce currently about two-thirds of the country's revenue in hard currency and employ the largest single portion of the Congolese labor force.

Since World War II the Congo has shown an almost constant growth in its diversified mineral production and has maintained its rank as the leading world producer of cobalt and industrial diamond; it is the sixth world copper producer and an important supplier of manganese, columbium-tantalum minerals, and germanium. Because of its previous association with Belgium and extensive Belgian private investment, that country has been the principal customer for Congo metals and minerals. Most Western European countries rely on the Congo as a major source of minerals and crude metals. The Congo has also been an important supplier of minerals to the United States, particularly those items of which U.S. domestic supply is deficient. In 1961 the Congo's gross national product (GNP) was CF61 billion (US$1,220 million [2]); the 1962 value of mineral production was CF16.1 billion, or 26 percent of the 1961 GNP, exclusive of clandestinely mined diamonds and gold. In 1963 the total taxes and imposts paid by Union Minière du Haut-Katanga, the country's principal mining company, amounted to CF1,665 million (CF1,485 million in 1962).

The bulk of Congo ores were converted to metallic form in domestic smelting and refining facilities prior to export, thus insuring the maximum return to the local economy.

In addition to making important contributions to the country's budget, the mining industry also has made major contributions to the

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[2] In this and other references to values US$1=CF50. Actually the official exchange rate of the Congolese franc, formerly on par with the Belgian internal franc at this exchange, declined to US$1=CF65 following independence and market rates reached about 600 percent of the official rate. After the Congo became a member of the International Monetary Fund in September 1963, the franc was given a more realistic value, CF180 per US$1 for importers and CF150 for exporters.

development of rail, road, and river transport systems and to the establishment of extensive power generating facilities. It has pioneered the social development of the country and created a trained and stable labor force, constructing cities, schools, and hospitals for its employees and the general population of the mining areas.

Although 1963 saw important events in the political field, including the start of the reintegration of Katanga, the economy of the country evidenced little progress. The major event in the economic field was the monetary reform or devaluation, undertaken to prevent a further deterioration in the country's precarious economy. This measure was expected to benefit the mining industry at least temporarily, by easing the pressure on profit margins caused by rising wages and prices and an unrealistic rate of exchange. However, a 25-percent wage increase was expected to limit the benefits of devaluation. The greatest need of the mining industry was reported [3] to be a speedy restoration of secure and stable conditions. A major problem has been presented by the many resignations of European supervisors and other employees, who prematurely terminated their careers in the country, and of African employees, who have returned to their places of origin. Difficulties in obtaining replacement parts for equipment and shortages of skilled maintenance employees have created a certain hardship for mining companies. According to newspaper reports,[4] one cause of the economic difficulties in Katanga has been the inability to obtain the 50 percent of the hard currency earned by this province; this was to be returned to Katanga for its needs by the Central Government, in accordance with the national reconciliation plan. Rail communication from industrial centers in the Katanga to Lobito (Angola) and Beira (Mozambique) was reestablished, and exports were resumed in February. Reestablishment of transportation over the rail-river route, permitting movement of Katanga exports to Matadi via Léopoldville, was completed at the end of August with the rebuilding of the bridge over the Lualaba.

Despite the abnormal operating conditions which have prevailed in the Congo since mid-1960 and some recession in markets, the major producing companies have shown profit balances. However, these have declined steadily from year to year, and the 1963 profit of the largest company was 44 percent below that of 1962. The inability of the Congo Government to provide foreign exchange has prevented payment for dividends for 1961 and subsequent years.

The most outstanding 1963 development in the expansion of productive facilities in the Congo was the laying of the cornerstone for the new Société Congo-Italienne de Raffinage (SOCIR) oil refinery at Kinlao in the Bas Congo on September 26. SOCIR is owned on a 50–50 basis by the Congo Government and the Italian State-owned Ente Nazionale Idrocarburi (ENI). Half of the estimated cost of $12.7 million is to be raised by the Congo Government, which will share equally with ENI in the profits. The new refinery is to have

[3] Mining Journal (London). V. 261, No. 6691, Nov. 15, 1963, p. 459.
[4] L'Essor du Katanga (Élisabethville), Dec. 31, 1963.

a capacity of about 12,000 barrels of crude petroleum per day by 1965, at which time it should be able to supply all of the Congo's requirements for gasoline and fuel oils.

GOVERNMENT POLICIES AND PROGRAMS

Apart from the legislation covering licensing and exchange controls and endeavoring to curb illicit trade in diamonds and gold, no important laws directly pertinent to the mineral industry have been enacted since independence. In the absence of superseding legislation, the mining code prevailing under the Belgian Congo administration has been continued, and mineral resources constitute property distinct from that of the surface and belong to the State. The Central Government thus has been vested with the sole authority to fix the general conditions and terms under which prospecting and exploitation may be carried out. Mining rights have been granted by the Provincial governments since the dissolution of the "chartered" organizations formerly authorized to do this.

On December 6, 1963, the Congolese Minister of Lands, Mines and Energy issued a public letter warning concession holders that if they did not exploit their concessions, these would be forfeited under article 90 of the Mining Decree of September 24, 1937, which specified the maximum time permissible before exploitation must start and during which operations may be suspended. Expectations were that the determination of the government to enforce this article might lead to an increased activity.

An address by the Congolese Vice Prime Minister in June contained the first major statement of government policy toward economic development. This included several items of significance, particularly encouragement of existing investments, economic stimulation of the infrastructure inherited from the colonial economy, making a detailed inventory of natural resources actually being exploited and of others not yet in production, improving the technical educational level of the people, and organizing a national council to study the problems of conservation and utilization of renewable and nonrenewable natural resources.

SOURCE MATERIAL

Background information is from extensive files of U.S. Foreign Service dispatches, mining company annual reports, and other publications. Accounts of current development are meager and come chiefly from annual reports of the Union Minière du Haut-Katanga. The latter source has also provided the most reliable production data. For some products it has been necessary to resort to other sources and estimates have been used for some years because the normal transmission of these data by the U.S. Embassy in Léopoldville was interrupted by the lack of reliable statistics. The separation of parts of the country from the Central Government also made it impossible to obtain recent complete data on mineral trade; consequently, reliable detailed statistics for the country as a whole cannot be presented for years subsequent to 1959. Partial figures are available for 1960; for

later years an effort can only be made to show the general magnitude of the trade through resorting to several indicators of varied reliability.

PRODUCTION

Production trends reflect both world market conditions and local events in the Congo during recent years. The effect of additional productive capacity of the Katanga base-metal complex was evident in the increased output of some metals; if unfavorable operating conditions had not intervened following the completion of the new facilities, output could have been greater. Considering the magnitude of the disturbances throughout the country, the loss of production was the minimum possible. Individual commodities have shown different production trends; the declines in output were due, at least in part, to the prevailing chaotic conditions, with the possible exception of manganese, which comes from an area relatively free of political disturbances. Several producing facilities were centers of hostilities; particularly the Luena coalfields, the Manono tin mines and smelter, and more recently the various installations in the Katanga copper belt. Uranium production ceased in 1960 owing to exhaustion of ore. Copper output has been smaller than productive capacity, partly because of reductions in program in an effort to coordinate production with market demand and thus to stabilize price; cobalt demand has also declined in some years.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Beryl	254	335	167	277	[1] 463
Cadmium—kilograms	474,793	505,000	532,000	307,000	[2] 393,000
Cobalt (recoverable)	8,431	8,222	8,326	9,683	7,376
Columbium and tantalum concentrate [3] (including output of Rwanda and Burundi):					
Columbium—kilograms	237,000	[1] 103,295	[1] 51,295	[1] 25,331	[1] 74,133
Tantalum—do		[1] 150,787	[1] 74,516	[1] 103,502	[1] 66,794
Copper, smelter [4]	282,094	302,252	295,200	295,236	269,924
Germanium (recoverable)—kilograms	13,643	25,101	13,549	8,006	7,283
Gold—troy ounces	347,967	314,145	233,672	203,707	213,995
Manganese ore	386,184	373,900	316,240	316,197	270,033
Silver—troy ounces	4,768,180	3,962,836	3,457,877	1,595,513	1,097,176
Tin:					
Mine—long tons	9,194	8,636	6,314	6,875	[2] 6,488
Smelter—do	3,291	2,532	275	945	[2] 1,441
Tungsten ore and concentrate, 60 percent WO_3 basis [5]	942	575	582	370	202
Uranium oxide, U_3O_8	2,087	1,089	----------	----------	----------
Zinc:					
Mine	71,044	109,182	99,634	95,735	103,545
Smelter	54,810	53,358	56,960	56,027	52,724
Nonmetals:					
Cement—thousand tons	347	[6] 200	140	[6] 162	246
Diamonds:					
Gem—thousand carats	655	415	405	256	296
Industrial—do	14,200	13,040	17,738	14,400	14,468
Mineral fuels: Coal, bituminous—thousand tons	247	163	66	75	92

[1] U.S. imports.
[2] Final figure; supersedes figure given in commodity chapter of volume 1.
[3] In addition, tin-columbium-tantalum concentrate was produced as follows: 1959, 1,258,000 kilograms; 1960, estimated 680,396 kilograms; 1961–62, not available; 1963, 26,000 kilograms.
[4] Including recoverable copper in exports of cathodes, blister copper, cobalt-copper alloy, zinc concentrates, and other products.
[5] Including WO_3 in tin-tungsten concentrates.
[6] Estimate.

Although in 1962 the output of several commodities was below that of immediately preceding years, the total value (CF16.1 billion) reflects a growth of 18 percent over that in 1952 (CF13.7 billion).

TRADE

The value of mineral exports consistently has been several times that of the imports, and through 1959 showed an almost constant increase, despite sometimes fluctuating market values of the principal commodities. In 1959 mineral exports were valued at CF13,976 million, 56 percent of that of all exports. Exact value of 1960 mineral exports is not available; on the basis of available data it is estimated at CF13,000 million, 6 percent below that of 1959 and at about the 1953 level. Data are insufficient to estimate values of mineral exports in subsequent years. Indicative of these, however, are the value of aggregate 1961 imports of major mineral commodities from the Congo by Organization for Economic Cooperation and Development (OECD) countries, CF12,000 million, and of 1962 mineral exports from Katanga, CF9,445 million. Belgium has continued to be the principal recipient of Congo minerals; of the 1961 imports by OECD countries, 74 percent were by that country. The United States has been a steady customer for several Congo products, particularly cobalt, manganese ore, and zinc metal; total value of U.S. imports in 1962 was approximately CF660 million.

In August 1964 partial data on 1963 exports of metals became available. Exports identified as quantities shipped to final destinations from the ports of Lobito (Angola), Beira (Mozambique) and Mombasa (Kenya) were as follows: cadmium, 370,000 kilograms (all to Belgium), cobalt-copper alloy and electrolytic cobalt, 813 and 7,047 metric tons, respectively (all to Belgium); copper, 236,599 metric tons, (Belgium, 161,715 tons, France 27,445 tons, and Italy 21,124 tons), germanium concentrates, 9,000 kilograms (all to Belgium); zinc concentrates, 131,903 metric tons (Belgium, 123,772 tons and France, 8,131 tons); zinc in ingot form, 30,157 metric tons (United States, 9,017 tons; West Germany, 5,564 tons; United Kingdom, 4,295 tons; and Italy, 3,400 tons); and anode slimes, 8,000 kilograms (all to Belgium). The above exports from depots in neighboring countries had a total estimated value of CF10,980 million at an average exchange of CF69.43 per US$1. Shipments of metals to the depots were valued at CF11,345 million, 47 percent of the value of all exports.

Despite the extensive development of the Congo minerals industry, the country remained dependent upon imports of fuels, iron and steel, some nonferrous metals, and many nonmetallic minerals. In 1959 the total value of imports of these was CF2,560 million, compared with CF649 million 10 years earlier. The 1959 import value by categories follows:

	Francs, million	*Percent*
Metals	901	35
Nonmetals (except fuels)	194	8
Mineral fuels	1,465	57
Total	2,560	100

TABLE 2.—Exports of major metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1959	1960	Principal destinations, 1960 [2]
Metals:			
Beryl	454	419	United States 384; Japan 23.
Cadmium—kilograms	585,655	[3] 508,000	Belgium 113,798; France 106,000; United States 2,721.
Cobalt and alloys	11,871	7,362	Belgium 6,286; United States 1,074.
Columbium-tantalum minerals.—kilograms	370,000	203,000	United States 150,786.
Columbium-tantalum slag—do	153,302	819,000	Netherlands 510,000; United States 309,000.
Copper [5]	283,580	284,494	Belgium 208,523; Italy 33,655; France 32,927.
Germanium dusts	178	[4] 187	All to Belgium.
Gold—troy ounces	385,327	355,748	Do.
Manganese ore [5]	302,397	304,815	United States 128,113; Belgium 71,661; West Germany 35,036.
Tin:			
Concentrate—long tons	10,158	9,000	Belgium 8,508; United Kingdom 355; Tanganyika 111.
Metal [5]—do	2,820	2,529	Belgium 3,298; United States 336; West Germany 184.
Tungsten concentrate	1,016	1,177	Belgium 634; United States 182; Netherlands 120.
Zinc:			
Concentrate [5]	75,131	97,540	Belgium 90,263.
Metal	54,439	50,803	United Kingdom 14,335; United States 8,443; Republic of South Africa 609; West Germany 305.
Nonmetals (except fuels):			
Cement	43	[4] 406	Republic of Congo (Brazzaville) 400.
Diamond—thousand carats	15,954	10,356	United Kingdom 10,288; Belgium 68.
Lithium minerals	2,990	1,500	All to West Germany.

[1] Includes the trusteeship territories of Ruanda-Urundi through June 30, 1960.
[2] Exact data unavailable in most cases. Figures shown are estimated based on 1959 or partial 1960 deliveries, or receipts by known destinations.
[3] Estimate, from Overseas Geological Surveys, Statistical Summary of the Mineral Industry.
[4] January–June only.
[5] Receipts by countries in 1960 indicated by OECD trade statistics. Excess over exports are due to difference in quantities in transit at beginning and end of period.

Source: Bulletin de la Fédération des Associations Provincales des Entreprises du Congo, May 1962.

The 1959 mineral imports accounted for 17 percent of all imports on the basis of value. Belgium was the principal supplier with 30 percent of the total; the United States supplied 7 percent. Data on the value of mineral imports in subsequent years are so incomplete that they mean little. In 1960, exclusive of Katanga and South Kasai Provinces in the second semester, the total value was CF1,471 million. The 1962 value of mineral imports of Katanga Province, exclusive of fuels, has been reported at CF419 million. Since 1960, mineral imports have declined drastically owing to the precarious economic position of the country and particularly the need to allocate scarce foreign exchange to foodstuffs and other vital imports. The decrease in mineral imports was reflected in the decreased value of all imports, from CF15 billion in 1959 to CF8 billion, exclusive of Katanga, in 1962. The foreign exchange made available to importers in 1963 was reportedly equivalent to CF10 billion.

TABLE 3.—Imports of major metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1959	1960	Principal sources, 1960
Metals:			
Aluminum [2]	1,769	1,009	United Kingdom 331; Belgium 275; Kenya 83; France 77.
Copper [2]	211	95	Belgium 48; United States 20; Republic of Congo (Brazzaville) 10; United Kingdom 3.
Gold—troy ounces	209,141	———	
Iron and steel:			
Pig iron	96	160	Southern Rhodesia 120; Republic of South Africa 39.
Ferroalloys	291	271	Republic of South Africa 130; West Germany 103.
Scrap	285	725	Republic of Congo (Brazzaville) 718.
Ingots, blooms, slabs	116	64	Belgium 60.
Rolled steel	90,089	38,644	Belgium 27,190; Luxembourg 5,500; United States 1,788; West Germany 1,266.
Lead	232	793	Southern Rhodesia 404; Northern Rhodesia 298.
Nickel	25	2	All from Belgium.
Platinum [2]—troy ounces	161	32	All from France.
Silver [2]—do	72,757	73,971	Belgium 73,754.
Tin—long tons	27	13	Belgium 6; West Germany 3; United Kingdom 2.
Zinc	184	50	All from Belgium.
Slags and metallic residues	384	155	United States 100; Southern Rhodesia 22.
Nonmetals:			
Abrasives	12	6	West Germany 3; Belgium 2.
Asbestos (crude)	1,044	323	U.S.S.R. 198; Southern Rhodesia 72; Canada 45.
Cement—thousand tons	61	9	Belgium 6.
Chalk	2,299	1,338	France 1,006; Luxembourg 201; Belgium 94.
Clays	548	333	Algeria 110; France 98; Portugal 40.
Dolomite	162	73	West Germany 31; Austria 20; Southern Rhodesia 18.
Feldspar	196	23	All from Belgium.
Gypsum (calcined)	9,293	6,272	France 6,223; Belgium 30.
Lime	5,479	1,210	Belgium 919; Northern Rhodesia 111; West Germany 110.
Limestone	1,925	813	Northern Rhodesia 677; Southern Rhodesia 90; Angola 26.
Magnesium sulfate (natural)	208	360	West Germany 293; Netherlands 53; Belgium 14.
Magnesite	80	17	Republic of South Africa 9; Netherlands 4; West Germany 2.
Phosphate rock	39	51	Kenya 49; Belgium 2.
Quartz and quartzite	218	64	West Germany 36; Luxembourg 28.
Salt	50,608	31,574	Angola 11,286; Portugal 4,528; Kenya 3,991; Canary Islands 3,920; Tanganyika 3,731.
Sand	50	92	Angola 40; Belgium 40; United Kingdom 5.
Siliceous earths	614	311	United States 211; Switzerland 48; Southern Rhodesia 36.
Sodium carbonate (natural)	———	2,930	Kenya 2,633; Portugal 297.
Stone:			
Dimension	42	80	All from Southern Rhodesia.
Fluxing	240	204	All from Northern Rhodesia.
Paving	956	107	Angola 89; France 15.
Sulfur	7	138	United States 105; Belgium 28.
Talc	354	279	Norway 206; Italy 34; United Kingdom 14.
Mineral fuels:			
Coal [3]	140,862	97,007	Southern Rhodesia 76,017; South Africa 19,616.
Coke and semicoke	69,218	38,448	Southern Rhodesia 36,930; Belgium 1,124.
Tar, mineral	1,192	117	Belgium 57; Southern Rhodesia 40; Sweden 15.
Other byproducts	877	227	Belgium 108; Republic of South Africa 56; United States 39.
Petroleum, crude—thousand 42-gallon barrels	1	1	All from United States.

See footnotes at end of table.

TABLE 3.—Imports of major metals and minerals [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	Principal sources, 1960
Mineral fuels—Continued			
Petroleum products:			
Gas- oline. thousand 42-gallon barrels	1,630	1,197	Canary Islands 267; France 244; Netherlands Antilles 223; Iran 156; Venezuela 142.
Kerosine do	329	284	Canary Islands 62; Netherlands Antilles 59; Iran 52; France 50; Venezuela 30.
Distillate fuel oil do	1,158	832	Canary Islands 138; Netherlands Antilles 107; Venezuela 96; France 93; Iran 91.
Residual fuel oil do	209	112	Iran 65; Canary Islands 27; Netherlands Antilles 7.
Liquid petroleum gas do	24	13	Belgium 12; Netherlands 1.
Asphalt and bitumen do	58	41	Canary Islands 18; United States 10; Belgium 5.
Lubricants do	120	81	United States 59; Netherlands 17; Belgium 4.
Other do	48	17	Netherlands 5, Northern Rhodesia 4; Italy 1.
Total do	3,576	2,577	Canary Islands 512; Netherland Antilles 396; France 387; Iran 364; Venezuela 268.

[1] 1960 data are exclusive of the provinces of Katanga and South Kasai for the second semester. Includes the former trusteeship area of Ruanda-Urundi through June 30, 1960.
[2] Includes alloys.
[3] Includes briquets.

Source: Bulletin Mensuel du Commerce Extérieur du Congo Belge et du Ruanda-Urundi, December 1959 and June 1960; Bulletin Mensuel du Commerce Extérieur de la République du Congo, October-December 1960.

COMMODITY REVIEW

Unavailability of recent complete data on imports makes it difficult to estimate consumption. Undoubtedly the necessity of limiting imports during recent years has meant that consumption has been well below the 1959–60 imports and stocks have declined greatly. The suspension of most construction activities throughout the country meant that consumption of iron and steel products and building materials dropped to insignificant proportions. Cement consumption for the entire country dropped from 425,000 tons in 1959 to 135,000 tons in 1961 (133,107 tons exclusive of Katanga in 1962). U.N. statistics indicate 1961 energy consumption at 1.25 million tons of standard coal equivalent of which 0.39 million was of domestic origin, compared with 1.40 and 0.60 million in 1958. Except for small quantities of copper, tin, and zinc consumed locally, all metal production is for export, and thus 1959–60 imports of these probably closely approximate consumption.

METALS

Aluminum.[5]—Interest has been revived in the possibilities of hydroelectric power development at Inga on the Congo River upstream of Matadi and the establishment of aluminum production facilities there. In 1963 Italian consultants were asked to prepare a development plan, and the Congo Extraordinary Budget for 1964 contained an appropriation for preliminary work on the project.

Beryl.—The production of beryl, which began in 1954 and reached a high of 1,686 metric tons in 1956, has declined appreciably since.

[5] Mining Journal (London). Aluminum-Re-examination of the Inga Scheme. V. 262, No. 6699, Jan. 10, 1964, p. 23.

Beryl was extracted with cassiterite with which it is associated in certain pegmatite dikes. Thus the quantity recovered depends upon cassiterite output. The production has been entirely by Compagnie Minière des Grands Lacs from the Lusungu, Mapembe, and Kobokobo deposits in Kivu Province. The mineral is obtained by handsorting from the pegmatite; beryllium oxide content is 10 to 13 percent.

Cadmium.—Cadmium was recovered from the copper and zinc concentrates obtained from sulfide ores from the Prince Leopold (Kipushi) mine of the Union Minière du Haut-Katanga. Part of the cadmium content is volatilized when the copper concentrate is smelted at Lubumbashi and when the zinc concentrate is roasted at Jadotville. This part is recovered from flue dusts. The portion that is not volatilized during the roasting of the zinc concentrate is recovered as cadmium cement when the roasted concentrate is treated in the electrolytic zinc plant of Société Métallurgique du Katanga (METALKAT) at Kolwezi. The treatment of the cadmium-bearing flue dusts by METALKAT also yields cadmium cement. All the cements are delivered in solution, and this is treated by electrolysis. The cadmium cathodes thus obtained undergo a double refining in an electric furnace before being cast into rods for marketing.

Cobalt.—The Congo possesses extensive cobalt reserves and its single cobalt-producing company, the Union Miniére du Haut-Katanga, has accounted for over 63 percent of free world cobalt output during the past decade. The production is mainly as a coproduct of the hydrometallurgical treatment of copper concentrate from company mines near Kolwezi and Jadotville. Formerly the ores and concentrates especially rich in cobalt were reduced in the Panda electric furnace plant at Jadotville, to yield a copper-cobalt-iron alloy with 46 percent cobalt. They were exported to Belgium for refining into commercial forms. The Panda plant was closed down in September 1962, with the completion of facilities for the production of electrolytic cobalt at the Luilu plant near Kolwezi; subsequent production has been as electrolytic cobalt, most of which was refined into granules.

Cobalt is recovered from copper ores containing only a little of the element by leaching it at the same time as the copper, in the Shituru plant at Jadotville and the Luilu plant. The spent solution, after electrolysis for copper, is purified, and the cobalt is precipitated as a hydrate. This is put back into solution and recovered by electrolysis. The new Luilu plant has a rated capacity of 3,500 metric tons per year under normal conditions; the cathode cobalt produced there is refined in the electric furnace plant at Shituru. The hostilities in December 1962 demolished part of the Shituru cobalt plant. It became operative again only some months later, thus accounting for the decline in production in 1963 to a level only slightly above that of 1958. The 1963 output consisted of 4,827 metric tons of electrolytic cobalt in granules, 1,996 tons of recoverable cobalt in exported cathodes, and 553 tons of recoverable cobalt in exported cobalt-copper alloy.

Columbium-Tantalum.—The Congo has been an important producer of columbium and tantalum minerals and with the former trusteeship area of Ruanda-Urundi supplied 10 percent of free world production in 1953–57. As reflected in imports to the United States,

the principal customer, activity has declined drastically during recent years; actual output data are not available. This decrease has been mainly due to the troubled conditions which have existed in the producing areas, particularly at Manono, where Compagnie Géologique et Minière des Ingénieurs et Industriels Belges (GEOMINES) has been the largest producer. At Manono, as in several parts of Kivu Province, columbite-tantalite is produced; usually deposits are worked for cassiterite. The two minerals are normally intimately associated, and part of the production is of a mixture of the two with cassiterite. Congo columbite-tantalite assays 70 to 75 percent combined pentoxides. Separation of columbite-tantalite from cassiterite is by magnetic sorting in the last stage of the concentration. The tin ore smelted at Manono contains comparatively high percentages of columbium-tantalum minerals, and these go into the slag which is exported; production of this slag was curtailed by the inactivity at Manono during the height of the disturbances there. Activity in Kivu has likewise been on a reduced scale; exploration of the Luesche pyrochlore deposit continued during 1963, but production was not started. Compagnie Minière des Grands Lacs has been the principal producer of columbite-tantalite in Kivu.

Copper.—In 1963 the Union Minière du Haut-Katanga production of copper ore, together with accompanying quantities of cobalt ore from the western mines and of zinc ore from Kipushi, totaled 5,443,874 metric tons (9,147,869 tons in 1962). Except for Kipushi and a section of Kambove West, which are exploited by underground mining, all mines are worked by opencuts. Output of individual mines follows:

Sector and mine:	*Class of ore*	*Production (metric tons)*
Western:		
Kamoto	Siliceous oxides	1,369,039
Ruwe	Oxides in breccia	1,103,090
Musonoi	Mixed oxides-sulfides	1,339,666
Kolwezi	Oxides	276,608
Central:		
Kambove West	Mixed oxides-sulfides	252,858
Kakanda	Oxides	191,565
Southern:		
Prince Leopold (Kipushi)	Copper-zinc sulfides	896,679
Ruashi	Oxides	14,024
Other		345

Total feed to beneficiation plants, including ore withdrawn from stockpiles, was 7,363,365 metric tons; production data for individual plants follow:

Concentrator	Metric tons treated	Concentrates produced			
		Metric tons	Grades (percent)		
			Cu	Co	Zn
Kolwezi	3,839,160	600,533	25.33	1.70	
Kipushi	904,109	158,653	27.66		
		175,263			59.08
Kambove	793,115	107,738	31.29	1.63	
Kambove (washer)	109,666	[1] 53,074	7.18		
Kakanda	507,485	52,975	24.51	.85	
Ruwe (washer)	[2] 1,147,386	56,336	22.24		
		[1] 40,795	5.62		
Ruashi (washer)	62,444	9,848	18.87		
		6,620	7.30		

[1] Products retreated in concentrator.
[2] Includes 18,946 tons of intermediate products retreated.

Pyrometallurgical operations were carried out in the Lubumbashi smelter at Élisabethville, where matte production in water jacket furnaces was 110,318 metric tons; the converter plant produced 69,866 tons of blister for export. The Shituru electrolytic plant produced 107,424 metric tons of cathodes and 9,486 tons of starting sheets. The adjacent refinery, treating part of the cathodes and products from other plants, produced 131,484 metric tons of electrolytic quality and 24,895 tons of anodes for starting sheets. The Luilu electrolytic plant produced 91,282 tons of cathodes and 9,143 tons of starting sheets. The 1963 balance of copper in exportable products follows:

	Metric tons
Electrolytic copper in ingots	130,602
Recoverable copper in cathodes exported	67,726
Recoverable copper in blister exported	71,310
Recoverable copper in cobalt-copper alloy exported	178
Recoverable copper in zinc concentrates and other products	108
Total	269,924

The decreased 1963 production was mainly due to the shutdown early in the year when facilities were being reactivated, following the end of hostilities on January 14, when the Katanga Government terminated the secession and confirmed its adhesion to the Thant plan. The company announced [6] that in 1964 copper production will not be significantly greater than in 1963.

Germanium.—This metal is present in very small amounts in the copper-zinc ores of the Union Minière Prince Leopold mine as the sulfide mineral renierite. It accompanies the copper at the time of concentration at the mine. A first concentrate of germanium is obtained by passing the copper concentrate over magnetic separators. The rest is recovered from the cadmium-bearing dusts in the baghouse at the Lubumbashi smelter. These dusts are treated in the METALKAT

[6] Metal Bulletin (London). No. 4864, Jan. 17, 1964. p. 61.

plant at Kolwezi, where a germanium precipitate with 7 percent oxide is obtained and exported to Belgium, where the Hoboken plant of an associated company produces the oxide and metal in the extremely pure form required by the electronic industry. The interrupted operations at the Prince Leopold mine and the metallurgical plants account for the fact that production during recent years has been below the 1960 peak. The magnetic separators at the Kipushi concentrator were frequently shut down because of the low content of magnetic renierite in the copper concentrate.

Gold.—The gold deposits of the Congo are chiefly the eastern area stretching from the Congo River to the Sudan frontier and into Rwanda. In the small detrital deposits, the extraction is manual, while in the more important ones it is by mechanical shovel, dragline, dredge, and/or hydraulicking. The ore is concentrated by gravity in sluices or washers. Primary deposits yield about two-thirds of the normal production. The principal producers have been Société des Mines de Kilo-Moto, Compagnie Minière des Grands Lacs, Société Minière de la Tele, and Mines d'Or et d'Etain de Kindu (KINORETAIN). These producers accounted for 94 percent of the total production prior to the country's independence.

Gold production has diminished from year to year, due to political difficulties, the uncontrolled gold traffic, and the constant increase in working costs which has compelled many operators to curtail their activities or close their mines. The gold mines are mainly in Orientale and Kivu Provinces; these areas were involved in the 1961 struggle for power and by the end of 1963 had not wholly recovered from the damage.

Manganese.—Except for a few thousand metric tons annually from the Kasakalesa mine of Société de Recherche Minière du Sud-Katanga, a Union Minière affiliate idle in 1963, the Congo manganese production comes from the Kisenge mine of Société Minière de Kisenge. This operation, worked since 1950, is about 100 kilometers from Dilolo on the Angolan frontier and escaped the disorders which ravaged the rest of Katanga. However, the decreased 1963 output was partly due to inactivity early in the year when the power supply coming from Kolwezi was interrupted by military operations. The oxide ore mined at Kisenge, after crushing and washing or treatment in the sink-float plant, is exported via Lobito in Angola. Grade of marketable ore as reflected in U.S. imports of recent years has ranged from 48.1 to 50.0 percent manganese. Small quantities of manganese dioxide assaying 80 to 83 percent manganese oxide are mined.

The generally decreased production since 1960 has been the result of market conditions, particularly increasing competition. U.S. imports for consumption dropped 40 percent between 1961 and 1962 but improved substantially in 1963. Preliminary data indicate that shipments from the mine totaled 267,000 metric tons in 1963.

Silver.—Except for minor quantities of silver recovered during gold refining, all the silver of the Congo is recovered as a byproduct of the copper industry. Silver is present in the copper-zinc sulfide ores of the Prince Leopold mine; it accompanies the copper through its

various processes and is exported in the blister copper produced at Lubumbashi for subsequent recovery and refinement in Belgium.

Tin.—Although most of the Congo tin deposits are detrital, important primary deposits as pegmatites and quartz veins are exploited, usually by opencut mining. The production comes mainly from the Maniema region in Kivu and from Manono in northern Katanga. Mining methods include primitive panning, hydraulic mining, and mechanical mining by draglines and shovels. The major producers have been Syndicat Minière d'Etain and GEOMINES, and before independence they accounted for slightly less than one-half of the production. Other important producers in 1963 were Compagnie Minière des Grands Lacs, Compagnie Belge d'Entreprises Minières, KINORETAIN, and Société Minière de la Belgika. The tin-mining areas have been centers of political unrest, and conditions for the operators became extremely difficult, particularly in 1961. Improved conditions in 1962–63 permitted a partial return to normal operations, with the foreign exchange shortage proving a major handicap. The only smelter operation in the Congo is that of GEOMINES at Manono; production of tin metal continued there during 1963 and showed a remarkable increase over that of previous years, during which operations were completely stopped for over 7 months at one time and for shorter periods on other occasions.

Tungsten.—Tungsten from the Congo comes entirely from Kivu Province where it is normally associated with certain cassiterite deposits. Most of the tin companies also produced tungsten and export either a tungsten concentrate obtained by treating cassiterite concentrates by magnetic separation or a mixture of the two for separation in Belgium.

Zinc.—The Congo's zinc production comes entirely from the Prince Leopold mine of the Union Minière as zinc sulfide ore associated with copper sulfides. A subsidiary company, Société Générale Industrielle et Chimique du Katanga, treated 118,050 metric tons of Union Minière's zinc concentrate in its plant at Jadotville, obtaining 89,572 tons of roasted concentrate and 93,855 tons of sulfuric acid. Sales of 89,155 metric tons of roasted concentrate were made to METALKAT, which produced the Congo's entire output of electrolytic zinc at its Kolwezi plant. Crude and calcined concentrates delivered for export totaled 65,445 metric tons. The loss of production in early 1963, while normal activities at the mines and plants were being resumed, prevented zinc production from coming up to full capacity.

NONMETALS

Diamond.—Normal operations in the Tshikapa fields of Kasai Province, which formerly provided up to about 30 percent of the country's output of gem diamond, have not been possible since 1960. Tribal warfare, the absence of law and order, illicit diggings, and theft reportedly compelled the operators, Société Internationale Forestière et Minière du Congo and its affiliates, to suspend operations in February 1962; operations had not been resumed by the end of 1963.[7] A buying

[7] Mining Journal (London). Annual Review for 1963 (p. 183) May 1963, and for 1964 (p. 187), June 1964.

agency was maintained in the area to purchase diamonds from native miners, but was reported to be unsuccessful.

The problem of unauthorized exports continued to be serious. Unlicensed buyers operated on the frontiers, dispatching diamonds illegally to many destinations. Despite the heavy loss to the national revenue, the government had difficulties in effectively controlling illicit operations. The value of unreported diamond production in 1962 was estimated at between CF850 million and CF1,400 million.

The Lubilash diamond, 98 percent of which is industrial quality, is mined at Bakwanga in south Kasai by Société Minière de Bakwanga (MIBA). As contrasted with the Tshikapa area where weakly mineralized and scattered deposits have limited mechanization, at Bakwanga the concentration of the deposits and the large volumes to be treated have allowed complete mechanization of the operations. With an absence of disturbed conditions, MIBA had a reasonably satisfactory year in 1963 but was handicapped by difficulties in obtaining spare parts needed for the extensive equipment in service. Work continued on the construction of a new central sorting station and a new dam on the Lubilash; the cost of these and other improvements and new construction was CF280 million.

MINERAL FUELS

Coal.—Coal production by Charbonnages de la Luena, around Luena in north Katanga, has been greatly curtailed owing to heavy damage incurred in the various military operations. Of a high ash content and containing 34 percent volatile matter, the noncoking coal from Luena has never filled more than part of the country's needs. Mining difficulties in the Luena basin and exhaustion of the nearby Kisulu deposits necessitated the exploitation of the Kaluku where mining conditions are very unfavorable. This and the decreased output at the beginning of 1963, because of the destruction of railroad bridges over which the coal moves, combined to prevent production at a higher level.

The Mineral Industry of Ethiopia

By Thomas G. Murdock [1]

DESPITE a record of mineral activity that dates back to Biblical times, the occurrence of a wide variety of minerals, and continuing efforts to discover major ore deposits, the Empire of Ethiopia has remained of minor importance in the world mineral economy. In 1963, as in previous years, the productive activity consisted essentially of small-scale exploitation of gold and platinum deposits, recovery of marine salt at the principal Red Sea ports, and operation of a single small cement plant. However, the year was characterized by progress toward an expansion of the mineral economy through installation of mineral-processing facilities, development of the extensive potash deposits, and mechanization of the largest gold mines. Of significance also was the enactment of a new investment law, the granting of two petroleum concessions to U.S. companies, and further exploration.

The 1962 mineral production, exclusive of building materials other than cement and lime, had an estimated value of Eth$13.4 million (US$5.4 million); [2] of this, cement comprised Eth$8.2 million. The 1962 gross national product (GNP) was Eth$2,170 million; thus, the mineral industry contributed only 0.6 percent of the GNP.

Data on employment by the extractive industries are not available; however, including those engaged in quarrying, the total labor force presumably amounted to several thousand. These workers comprised only a small part of the 19.6-million population (1963 estimate), over 90 percent of whom were dependent upon farming or livestock raising.

GOVERNMENT POLICIES AND PROGRAMS

No new legislation specifically directed at mining was reported during the year; however, decree No. 51 of September 16, constituting a new investment law, effectively encourages private Ethiopian and foreign investment. Definitely stipulated as being applicable to mining and industrial enterprises, the law grants income tax exemption for 5 years to new enterprises investing not less than Eth$200,000 and to existing ones for 3 years upon expanding their activity through the investment of at least Eth$400,000. The law further grants exemptions from import and export duties and other taxes under certain conditions. It insures the provision of foreign exchange for remittance of profits, repatriation of net proceeds, and payment of interest and

[1] Mining engineer, Division of International Activities.
[2] The Ethiopian monetary unit is the Ethiopian dollar (Eth$). Exchange used in this section is Eth$1=US$0.4032 (US$1=Eth$2.40).

principal on approved foreign loan contracted by enterprises covered by the decree.

The year marked the beginning of the second 5-year plan, a program with emphasis on industrial development, following the completion of an earlier plan designed to provide for the development of transport and communications, which by and large fulfilled its principal objectives. Under the new plan, the extractive industries are scheduled to be allocated Eth$74 million in new investments and production is expected to grow at the annual rate of 53 percent. The establishment of several new mineral-processing enterprises during the year and progress towards setting up others indicate satisfactory progress on the plan; the new investment law is expected to encourage additional development.

Geological investigations completed in 1963 included the fieldwork involved in the survey of the resources of the Blue Nile Basin undertaken by the U.S. Bureau of Reclamation, in cooperation with other U.S. Government agencies and counterparts of the Imperial Ethiopian Government. The Ethiopian Ministry of Mines was scheduled to undertake investigations of asbestos deposits east of Harar and exploratory drilling of the Agametta iron deposits, 30 kilometers southwest of Massawa, where the new plan calls for a small production to start in 1964. The search for petroleum and further investigation of potash resources were continued by the foreign companies active in the country.

Following the successful completion of a 30-month program of training 30 young men from various parts of the country as prospectors and sending some of them abroad for further studies, plans to train a second group were announced.

Eritrea has been a fully integrated province of Ethiopia since late 1962, and it was expected that this will lead to the clarification of some Eritrean mining titles and to an eventual expansion of the mineral industry there.

SOURCE MATERIAL

Background data on the resources were published in 1949 [3] and have been updated by a paper [4] which became available in 1963. Additional information was contained in a recent official U.S. Government publication.[5] The dispatches of the U.S. Embassy at Addis Ababa supplied accounts of the principal events of 1963 and some information on production. Data on trade, production, and other subjects are from publications of the Imperial Ethiopian Government. Production quantities are not available for some minerals and those given by various sources often disagree, therefore, accepted figures may be erroneous in some cases. Value of production is a rough estimate, given only to show order of magnitude.

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[3] Murdock, T. G. Industrial Minerals of Ethiopia. Trans. AIME, v. 181, 1949, pp. 376–384.

[4] Quinn, H. A. The Mineral Industry of Ethiopia in 1962. Haile Selassie I Univ., Dept. Geol., unpub. manuscript, March 1963, 19 pp.

[5] U.S. Department of Commerce. Basic Data on the Economy of Ethiopia. Overseas Business Reports, No. OBR–117, August 1963, 19 pp.

PRODUCTION

Although official data on 1963 production are available for only two items, estimates based on authoritative forecasts indicate a definite decline in production. Output of gold, the principal commodity, has declined steadily since 1959; the other minerals have shown variable trends. Unfortunately data on the quarry production are not available; building materials are plentiful around the principal cities, and with the public works program carried out in 1959–63, large quantities of dimension and crushed stone were used. Prospects are good for an increased mineral production in the near future.

TABLE 1.—Production of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity [2]	1959	1960	1961	1962	1963
Metals:					
Gold—troy ounces	58,157	46,059	[3] 47,029	28,015	[3] 27,300
Manganese ore	1,320	9,255	7,000	6,000	[4] 3,496
Platinum—troy ounces	68	189	180	180	[3] 180
Nonmetals:					
Cement—thousand tons	25	28	30	41	34
Feldspar	1,500	1,000	3,000	432	[3] 500
Kaolin	6	2	4	1	
Lime [5]	2,515	2,507	4,538	6,894	4,888
Salt—thousand tons	141	157	151	173	[3] 255

[1] Includes Eritrea.
[2] In addition, small quantities of asbestos, barite, gypsum, iron ore, and sulfur have been produced in some years; however, production data are not available. Construction materials are produced extensively but no quantitative data are available.
[3] Estimate.
[4] U.S. imports.
[5] Year ended Sept. 10 of year stated.

TRADE

In 1962 the total value of metal and mineral imports was Eth$25.3 million, 10 percent of all imports, compared with Eth$25.4 million and 12 percent in 1961.[6] The 1962 import value was metals Eth$9.5 million; nonmetals Eth$1.1 million; and mineral fuels Eth$14.7 million. Recorded exports of minerals and metals were insignificant; in 1962 they were valued at only Eth$1.2 million, mainly salt, while in 1961 they totaled Eth$4.2 million and also included gold, manganese ore, and scrap metals. In 1962 they were only 0.6 percent of all exports, which was 2.3 percent less than in 1961. Reexports of metals and minerals were only Eth$47,954 in 1962 (Eth$33,600 in 1961).

[6] The official Ethiopian year ending September 10, 1961, the only base for which 1961 data are available.

Petroleum products constituted 58 percent of the 1962 metal and mineral imports, and Iran and Saudi Arabia were Ethiopia's principal suppliers with 26 percent and 16 percent, respectively. Japan, principal supplier of iron and steel, ranked third with 10 percent. The United States provided imports totaling Eth$1.8 million, and the European Common Market, Eth$5.9 million. Imports of metals and minerals from the United States were only 4 percent of all imports from that country. Japan was the principal customer for 1962 Ethiopian mineral exports, receiving 71 percent.

Based on trade in the most important items, through the first semester of 1963 the imports dropped to an annual rate of Eth$18.3 million; comparable data for exports are not available.

TABLE 2.—Exports [1] of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 [2]	1962	Principal destinations, 1962
Metals:			
Scrap:			
Ferrous	1,055	[3]	
Other	464	[3]	
Gold—troy ounces	31,898	[4]	
Manganese ore	11,000	[5]	
Nonmetals:			
Clay	[3]	6	Saudi Arabia 4; Sudan 2.
Fertilizers	[3]	20	All to Italy.
Marble	[3]	20	All to Sudan.
Salt	44,025	121,923	Japan 94,266; France 10,441; Kenya 9,751; Malaya 5,000.

[1] Reexports are reported as follows: 1961, coal 440 tons and steel wire valued at Eth$500; 1962, steel pipe valued at Eth$35,962 (Italy Eth$32,400, Yemen Eth$3,542) and petroleum products valued at Eth$12,002 (Kenya Eth$5,448, French Somaliland Eth$3,531, Aden Eth$3,023).

[2] Year ending Sept. 10, 1961.

[3] Statistics available do not show exports of these items.

[4] Gold exports have been indicated only for alternate years since 1957.

[5] None shown for 1962. U.S. receipts were (calendar years) 1961, 6,015 tons and 1962, 6,292 tons.

Source: 1961—Ethiopian Central Statistical Office. Statistical Abstracts, 1963; 1962—Ethiopian Ministry of Finance. Annual Import and Export Trade Statistics, 1962.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961 [1]	1962	Principal sources, 1962
Metals: [2]			
Aluminum	19	206	Italy 100; Kenya 58; Hungary 23; United States 12.
Copper and alloys	129	19	Italy 16; Poland 1; West Germany 1.
Iron and steel:			
Pig iron and ferroalloys	----	7	Yugoslavia 4.
Ferrous scrap	----	2	All from Yugoslavia.
Ingots	385	17	Belgium-Luxembourg 12; Italy 5.
Rolled products	18,169	16,331	Japan 6,141; Belgium-Luxembourg 2,663; Italy 2,323; West Germany 1,623; U.S.S.R. 1,307.
Lead	([3])	2	Denmark 1; United States 1.
Nickel	([3])	80	Aden 63; Kenya 16; Italy 1.
Silver and platinum----troy ounces	----	292,315	Unspecified 196,216; United Kingdom 81,148.
Tin----long tons	([3])	336	U.S.S.R. 310; West Germany 4.
Zinc	([3])	35	Canada 20; West Germany 3.
Other metals	[4] 174	91	Unspecified 54; Yugoslavia 29; Belgium-Luxembourg 6.
Ores, unspecified	----	15	All from U.S.S.R.
Nonmetals:			
Abrasives, natural	[4] 6	6	Czechoslovakia 2; Italy 2; West Germany 2.
Cement	21,627	9,627	Israel 6,170; Yugoslavia 1,551; United Arab Republic 1,000.
Fertilizers:			
Crude	3,134	101	Italy 73; West Germany 19; Aden 8.
Other	----	394	Italy 241; Netherlands 112; West Germany 41.
Salt	174	365	Sudan 225; unspecified 104; United Kingdom 29.
Stone, building	[4] 70	13	All from Italy.
Sulfur	([3])	67	Netherlands 64; Ceylon 3.
Other	[4] 121	593	Saudi Arabia 562; Belgium-Luxembourg 9; West Germany 9.
Mineral fuels:			
Coal and coke	9,738	24	Unspecified 17; France 7.
Coal byproducts	----	56	United States 30; Italy 10; West Germany 10.
Petroleum refinery products:			
Gasoline	37,525	64,148	Bahrein 18,196; Iran 13,365; Saudi Arabia 13,284; United States 4,677; Poland 4,064.
Kerosine	4,081	2,347	Saudi Arabia 688; Belgium-Luxembourg 556; Iran 479; Aden 273.
Distillate fuel oil	52,681	41,081	Iran 22,744; Saudi Arabia 11,035; United Arab Republic 1,773; Aden 1,663.
Residual fuel oil	29,104	1,956	Saudi Arabia 1,200; United Arab Republic 387; Iran 188; United States 79.
Lubricants	5,422	[5] 28,590	United States 22,606; Saudi Arabia 2,854; Italy 1,779.
Liquefied petroleum gas	----	340	Italy 188; French Somaliland 58; Netherlands 39; Aden 34.
Asphalt	[4] 4,089	3,577	Iran 2,466; Netherlands 501; Saudi Arabia 199; Israel 146.
Other	504	8,599	Poland 4,089; Iran 2,815; Saudi Arabia 630; Kuwait 428.
Total	133,406	150,638	Iran 42,191; Saudi Arabia 29,891; United States 28,287; Bahrein 18,196; Poland 8,153.

[1] Year ending Sept. 10, 1961.
[2] Believed to include manufactures in the case of the nonferrous metals. Not reported separately.
[3] Included with others in the same group.
[4] Only value shown in statistics; tonnage estimated on basis of value for quantities imported in 1962.
[5] Believed to consist mainly of residual fuel oil erroneously included.

Source: 1961—Ethiopian Central Statstical Office. Statistical Abstracts, 1963; 1962—Ethiopian Ministry of Finance. Annual Import and Export Trade Statistics, 1962.

COMMODITY REVIEW

METALS

Aluminum.—In May the local press reported that an aluminum-fabricating plant will be constructed and managed by the Chandarian Group (an Indian group with other industrial and commercial interests in East Africa), which will supply the initial capital of about Eth$278,000. The plant is to produce household utensils and light houseware from imported semimanufactures.

Gold.—The alluvial gold deposits at Adola in Sidamo Province, exploited by the Ethiopian Government, continued to supply most of the country's production. In 1962 these deposits, together with the small ground sluicing operations on the Kape River near Alghe, accounted for 25,721 ounces of the total. The remaining 2,315 ounces came from the two vein gold mines in Eritrea, which treat about 25 tons of ore per day each; these are the Ugaro mine of Eritrean Mining Co. and the Medrizien mine near Asmara. The production decline of recent years at Adola is reportedly due to the cessation of hand mining in certain areas while they are being prepared for mechanical mining. The government has an intensive program of mechanization underway at Adola for which Yugoslav credit of Eth$3 million was obtained. In April an order was placed with the Yugo-Inex Co. for equipment valued at Eth$793,600. This program is scheduled for completion in 1964.

Iron and Steel.—On February 13, the Emperor inaugurated the small plant of Ethiopian Iron and Steel Co., to remelt ferrous scrap in a 2,500-kilowatt electric arc furnace for casting ingots. The ingots are then reheated in an oil-fired universal heating furnace and rolled into round bars 6 to 24 millimeters in diameter. Situated at Akaki, 19 kilometers from Addis Ababa, the plant employed 170 people and daily production was 25 tons of bars. With no recorded exports of ferrous scrap in 1962, supplies were apparently stocked pending the completion of this facility.

Manganese.—The small production of manganese ore continued to come from the mine of Tigre Mining Concession at Enkafala, about 20 kilometers southwest of Dallol. The ore is trucked 140 kilometers from the mine to the port of Mersa Fatma and taken from there in small boats to Massawa for transshipment to market. Reserves of the area are believed not to exceed 75,000 metric tons; however, the high manganese content (51.3 percent for U.S. imports) have facilitated exploitation despite the remoteness from tidewater.

Platinum.—The operations of the Ethiopian Government at Yubdo in Wollega Province continued to produce placer platinum by hand washing. Production was at the approximate level of recent years. The mine has been in operation for over 30 years and major reserves are mined out. An extensive exploration with Banka drills was effected, and this outlined millions of cubic meters of low-grade platinum-bearing ground in the valley of the Birbir River below Yubdo. In 1963 the Ministry of Mines announced plans to mine this platinum at the rate of 6,000 to 8,000 ounces annually, using hydroelectric power to be produced on the Birbir, about 30 kilometers downstream from Yubdo. Geological investigations also revealed new bodies of plati-

num-bearing ultrabasic rocks extending northward from Yubdo to near Nejo.

NONMETALS

Cement.—In 1963 cement production continued to be supplied by the Dire Dawa plant of the Ethiopian Cement Corp., which operated at approximately full capacity. During the year construction was underway on a new 70,000-metric-ton-capacity plant at Nefas Selk on the outskirts of Addis Ababa. Limestone will come from the canyon of the Mugher River about 78 kilometers northwest of the plant, and a 10-kilometer aerial tramway will raise the rock 880 meters vertically from the quarry to the truck terminal. Clay will be obtained from an area near the plant and gypsum from Douanle, near the border of French Somaliland. Production is scheduled to begin in 1964.

In April agreement was reached with Friedrich Krupp of Rheinhauser, West Germany, for the construction of another 70,000-metric-ton-per-year plant at Massawa. Construction was scheduled to begin later in the year.

Potash.[7]—In 1963 the Ralph M. Parsons Co. of Los Angeles continued work in preparation for the development of the potash deposits near Dallol, in the northern part of the Danakil Depression inland from the Red Sea. Since 1958, exploration of the deposits has been in progress within the 90,000-square-kilometer concession, resulting in the discovery of at least 50 million metric tons of sylvite and other potassium-bearing minerals in a sedimentary zone about 3 meters thick and with an average dip of only 2°. The deposits are of Quarternary Age and are associated with substantial reserves of gypsum and rock salt. During the year drilling was continued to increase reserves, particularly to test formations for planning mining methods and development.

The Dallol deposits were worked on a small scale from 1915 to 1929 by an Italian concern. The new attempt to work them calls for an expenditure of Eth$37 million, in addition to the Eth$5 million invested since 1958. It involves the construction of a treatment plant at Dallol, including rodmills, flotation cells, large centrifuges, and a diesel-electric powerplant; a 100-kilometer standard gage railway from the plant to the Red Sea; a new deepwater port at Ras Andarge, just west of Thio on the Red Sea; and, a shallow inclined shaft to be driven to the beds from a point near the western edge of the Danakill Depression. Construction was planned to begin in the latter part of 1963, and production was scheduled to begin in 1965 with an initial annual output of 300,000 metric tons of exportable material expected to have a potash content equivalent to 25 percent potassium oxide.

In late 1963 the Parsons Co. began geological exploration of the Dallol concession for other minerals; all of these minerals, except oil and hydrocarbons, are included within the rights granted the company.

Salt.—The salt production comes mainly from the solar evaporation of the Red Sea waters by Società Saline di Massaua and Société des Salines d'Assab. Each installation has a capacity of about 100,000 metric tons. In 1963 the Massaua company expanded production; this accounts for the increased output. Of the total, about 20,000 tons

[7] Potash Developments in Ethiopia. Overseas Geology and Mineral Resources (London). V. 9, No. 3, 1964, p. 324.

was rock salt, quarried in the depression area near Dallol by Dedjazmach Menghesha Seyoum and sold in traditional local markets.

MINERAL FUELS

Petroleum.—Gewerkschaft Elwerath of Hanover, West Germany, continued geophysical work within its 90,000-square-kilometer concession, formerly held by Sinclair Oil Co. and granted to Elwerath for 50 years. Deep drilling of favorable structures began with the first well, started on June 28, at Abred in the Ogaden area near the Somaliland frontier. Total expenditures to June were estimated at Eth$12.9 million.

On February 14, the Ethiopian Government signed an agreement with Mobil Petroleum Co., Inc. This agreement provides for Mobil's exploration for crude oil, natural gas, and associated hydrocarbons in and on the coastline, coastal islands, and offshore area of the Red Sea north of Massawa. The concession, valid for 50 years, covers more than 27,000 square kilometers and will gradually be reduced to 7,000 square kilometers. If production results, the government will receive annual payments by way of rental, royalty, and taxes, equal to 50 percent of Mobil's profits from its production venture. A new subsidiary was established, Mobil Petroleum Ethiopia, Inc., and geophysical work was expected to commence later in 1963.

A petroleum agreement also was signed by the government on November 14 with the Gulf Oil Co. of Ethiopia, a subsidiary of Gulf Oil Corp. The agreement grants to Gulf rights to explore for petroleum in an area of approximately 28,00 square kilometers in the Red Sea and along the coast of Massawa, south and southeast of the Mobil concession area. The terms of the Gulf agreement were made public only in the most general sense.

On November 14, an agreement was signed between the government and Mobil Oil (East Africa), Ltd., for the construction of bunkering facilities at the port of Assab. Work was scheduled to begin immediately and to be completed about August 1964. Bunkering facilities will be available for six ships at a time.

In August 1962 the Ethiopian Government contracted with the U.S.S.R. for the erection of a refinery at the port of Assab, to be completed by 1966 and have an annual capacity of 500,000 metric tons of crude. The project was expected to cost Eth$37.5 million, of which Eth$20.5 million was to be loaned by the U.S.S.R. Construction for housing for the Soviet construction crews began in March, and erection of the refinery was scheduled to begin later in the year. According to September newspaper reports, the refinery is being designed for Kirkuk crude with flexibility to cover most Middle East crude. It reportedly will be supplied by crude from any country, depending upon all relevant factors such as competitive prices, marketing conditions, and suitability.

Data on consumption of fuel are not available; it undoubtedly approaches imports rather closely, and bunker deliveries to all flags are estimated to have comprised about 8 percent of total consumption. The virtual termination of imports of coal and coke in 1962 indicates replacement of these by oil and electric power; production of the later by public utility companies, exclusive of those in Eritrea, was 29 percent higher in 1962 than in 1961.

The Mineral Industry of Gabon

By Thomas G. Murdock [1]

THE MINERAL industry of the Republic of Gabon became considerably important with the spectacular 1963 increase in production and exports. Significant features of the year were the: Bringing into full production of new manganese mines; discovery of additional offshore petroleum deposits, resulting in a 100-percent increase in the known reserve; and doubling of gold production and exports over 1962 figures.

While only the 1963 manganese production was of world importance, corresponding to 4.5 percent of 1962 world output, increased quantities of other minerals greatly improved the national economy and uranium production again constituted an important source of supply for France.

The 1963 mineral production, exclusive of building materials, was valued at CFAF8,589 million (US$35.06 million);[2] of this manganese ore comprised CFAF3,500 million and crude petroleum CFAF2,700 million. The 1962 gross national product was CFAF22,050 million and in that year the mineral production, valued at approximately CFAF5,630 million, contributed 25.5 percent of the GNP. This rose in 1963 when timber exports, the most important source of Gabonese income, failed to maintain the steady upward growth necessary to support the expanding investment program of the country.

Latest available data on employment by the Gabon mining industry are for 1956 when 6,146 indigenous employees were engaged in this activity and comprised 5 percent of the available manpower. The extensive subsequent developments, particularly in the production of gold as an activity of numerous individual small-scale miners, have probably more than doubled employment in the extractive industries.

No new U.S. participations in Gabon mineral developments were recorded in 1963, and at yearend they consisted of the 49-percent interest of United States Steel Corp. in the manganese mining company, 50-percent share of Bethlehem Steel Co. in the company that explored the Mekambo iron-ore deposits, and an association of Mobil Oil affiliates with the French petroleum company active in the country. A New York firm was awarded the US$2.5 million contract for feasibility studies of the construction of a railway to serve the iron-ore field.

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[1] Mining engineer, Division of International Activities.

[2] African Financial Community (CFA) francs are used in Gabon. The exchange rate for this review is US$1=CFAF245 (CFAF1=US$0.0040816).

GOVERNMENT POLICIES AND PROGRAMS

In 1962 a new mining code was published. The only recorded 1963 change to this was the prohibition of alluvial gold and diamond mining to all persons except those of Gabonese origin who are working as registered artisans under the direct control of the Government company, Société Gabonaise de Recherche Minière (SOGAREM), established in 1962 to expand mineral production. This company achieved marked success in its first year, effectively doubling the gold output.

Exploration activities were carried out by SOGAREM, the oil companies, and the French Bureau de Recherches Géologiques et Minières (BRGM). The latter organization discovered a large body of argentiferous lead ore in the Mandji area, explored columbium-tantalum deposits near Tchibanga and near Eteke, and endeavored to develop a new technique of prospecting for diamonds in an area where they were formerly produced.

The Government of Gabon made progress carrying out the 3-year plan, covering the 1963–65 period, which was adopted by the national legislature at the end of 1962. This plan set forth major goals to be obtained before inauguration of a more comprehensive 5-year program of economic development. The Government continued its significant efforts to encourage the inflow of foreign private investment, having enacted a favorable Investment Code on November 8, 1961. An Investment Guarantee Agreement with the United States was signed in April 1963.

SOURCE MATERIAL

Background information on the country was provided by a comprehensive U.S. Government publication.[3] Production data and an account of 1963 developments are from the dispatches of the U.S. Embassy, Libreville, supplemented by the technical press.

PRODUCTION

The outstanding performance of the extractive industries is best indicated by comparing 1963 production with that of 1960. Apart from the establishment of significant production of two new commodities, manganese ore and uranium concentrate, the other items have shown a substantial overall growth, despite shortfalls in some individual years. The 1963 value of production of items recorded was 283 percent more than that of 1960. The quantities of building materials produced are not known, as data apparently are not collected; indications are that except for lime and cement requirements of the country are met by domestic production and while these needs have not shown phenomenal growth like the metals and fuels, output in 1963 was undoubtedly above that of the immediately preceding years.

[3] U.S. Department of Commerce. Basic Data on the Economy of Gabon. Overseas Business Reports. No. OBR 63–125, October 1963, 13 pp.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Gold.....troy ounces..	16,172	17,683	15,304	16,300	35,719
Manganese ore				203,244	636,587
Uranium concentrate			969	1,161	1,317
Minerals fuels:					
Natural gas, marketed.....million cubic feet..	258	278	249	328	321
Petroleum, crude.....thousand tons..	753	800	774	827	890

[1] In addition, building materials other than cement and lime are produced but no quantitative data are available.

TRADE

In 1962 the total value of metal and mineral imports was CFAFr1,313 million, 13 percent of all imports, compared with CFAFr1,037 million and 12 percent in 1961. The 1962 import value by categories was: Metals, CFAFr514 million; nonmetals, CFAFr263 million; and mineral fuels, CFAFr536 million. Exports were valued at CFAFr5,199 million (CFAFr3,565 million in 1961) and were composed almost entirely of crude petroleum (CFAFr2,527 million), uranium concentrates, (CFAFr2,193 million), manganese ore (CFAFr371 million), and gold (CFAFr93 million).

France continued to be the principal partner of Gabon in metal and mineral trade in 1962, supplying 62 percent of the imports and receiving 94 percent of the exports. The Netherlands Antilles and Venezuela, suppliers of most of the petroleum refinery products, ranked second and third, respectively, among the suppliers, with the United States ranking fourth with 4 percent of the imports. The European Common Market, of which Gabon is an associate member, supplied a total of 67 percent of all imports. The United States ranked second as a customer, receiving 2 percent of all metal and mineral exports. Imports of this category from the United States, mostly petroleum refinery products, comprised 5.8 percent of all imports from that country; mineral exports to the United States were exclusively of manganese ore and their value was 25 percent of all Gabon exports to that destination.

Based on the first quarter value of imports of principal commodities, 1963 imports may be roughly estimated at CFAFr1,297 million. Preliminary figures of value of exports for the year indicate that this rose to CFAFr7,718 million, with the greatly expanded shipments of manganese ore accounting for the increase.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destination, 1962
Metals:			
Copper [1]	6	5	West Germany 3; Cameroon 1.
Gold troy ounces	13,182	13,146	All to France.
Iron and steel:			
Ferrous scrap	2,322	1,141	All to Japan.
Rolled products	76	140	Japan 71; France 68.
Lead, scrap	2	-------	
Manganese ore	-------	54,532	France 20,496; United States 16,860; West Germany 15,000; Japan 2,235.
Uranium concentrate	776	1,263	All to France.
Nonmetals: Clays	30	-------	
Mineral fuels: Petroleum:			
Crude	737,808	817,671	France 788,272; Belgium-Luxembourg 17,087; Spanish Africa 12,312.
Refinery products:			
Gasoline	14	-------	
Distillate fuel oil	-------	421	All to maritime bunkers.
Lubricants	10	56	Maritime bunkers 42; Spanish Africa 13.

[1] Indicated as matte; probably was scrap.

Source: Union Douanière Équatoriale. Commerce Extérieur, 1961 and 1962.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum	63	105	All from France.
Cobalt ore	--	32	All from West Germany.
Copper	27	35	France 24; Cameroon 7.
Gold troy ounces	6	28	All from France.
Iron and steel:			
Pig iron, ferroalloys and scrap	1	2	Do.
Rolled products	6,355	9,713	France 8,979; Belgium-Luxembourg 264; Japan 187.
Lead	3	18	All from France.
Silver troy ounces	215	2,669	Do.
Tin long tons	--	1	Do.
Zinc	2	7	France 5; Spanish Africa 2.
Nonmetals:			
Barite	15	2,057	France 1,426; Morocco 630.
Cement	23,029	35,322	France 34,054.
Chalk	23	69	All from France.
Clay	476	568	France 388; Algeria 95; Morocco 85.
Diamond carats	--	2	All from France.
Fertilizers:			
Nitrogenous	37	35	Do.
Phosphatic	56	11	Do.
Potassic	3	26	Do.
Flint	4	10	Do.
Gypsum, calcined	43	185	Do.
Lime	294	235	Do.
Magnesite	100	982	Netherlands 500; France 482.
Mica	--	16	All from France.
Pigments, mineral	--	6	West Germany 4; France 2.
Salt	542	967	Senegal 324; France 313; West Germany 141.
Sulfur	400	805	All from France.
Talc	5	--	
Other, unspecified	15	1	Do.
Mineral fuels:			
Coal	15	25	Do.
Coke	--	5	Do.
Coal byproducts	34	21	France 20; Morocco 1.
Petroleum refinery products:			
Gasoline:			
Aviation	1,839	1,778	Netherlands Antilles 1,700; United States 73.
Other	9,590	9,184	Netherlands Antilles 6,345; Portugal 2,167; France 360; Italy 200.
Kerosine	2,714	3,174	Netherlands Antilles 1,862; Venezuela 798; France 307.
Distillate fuel oil	22,335	24,773	Venezuela 15,845; Netherlands Antilles 4,874; Portugal 2,939; Italy 1,049.
Residual fuel oil	22	40	West Germany 15; Netherlands 12.
Lubricants	2,517	2,401	France 2,195; United States 108.
Liquefied petroleum gas	303	256	France 159; Belgium-Luxembourg 82.
Asphalt and bitumen	1,192	1,723	United States 1,447; France 250.
Other	51	--	
Total	40,563	43,329	Venezuela 16,737; Netherlands Antilles 14,781; Portugal 6,120; France 3,331.

Source: Union Douanière Équatoriale, Commerce Extérieur, 1961 and 1962.

COMMODITY REVIEW

METALS

Gold.—The phenomenal increase in gold production was the result of efforts to expand exploitation of the alluvial and eluvial deposits on a small-worker basis, organized by the Government SOGAREM. This company, created in late 1962 and intended for the promotion of mineral exploration and production in general, concerned itself particularly with gold. It acquired the holdings and installation of the ORGABON-MICONZOU Group and made a lease agreement with

the Compagnie Minière du Nord-Gabon, thus obtaining an effective monopoly in gold production. The SOGAREM position was strengthened additionally by the decree of November 16, 1963, when the Government declared the country closed to further exploitation of its alluvial gold resources by all persons except those of Gabonese origin who are working as registered artisans under the direct control of the company. This decree was issued mainly to prevent non-Gabonese possessing gold-mining concessions from hiring local villagers at low wages to do the work and then reaping substantial profits by selling the metal to the Government, which purchases all gold found in the country at CFAF6,221 per ounce. Some of the artisans have found gold-mining quite lucrative, and individual monthly earnings as high as CFAF100,000 have been reported. Production mainly came from the Districts of M'Bigou, Koula-Moutou, N'Djole, and Lastourville; a new deposit discovered in the latter area was in part responsible for doubling production. SOGAREM concentrated on exploitation of alluvial and eluvial deposits but is scheduled to explore and exploit the lodes.[4]

Iron Ore.—Following the 1962 announcement that the overall iron ore reserves at the Mekambo property of Société des Mines de Fer de Mekambo (SOMIFER) in northeast Gabon amounted to 860 million metric tons, averaging 64 percent iron, a series of studies concerning the economic development was inaugurated during 1963. SOMIFER is a consortium of American and Common Market steel companies in which Bethlehem Steel has a 50-percent interest and has managed operations in Gabon. The 1963 studies were concerned with construction of about 700 kilometers of railroad, probably to the port of Owendo near Libreville, and with port equipment. These studies received financial and technical support from the United Nations Special Fund, the World Bank, and the European Development Fund. Foley Brothers of New York was engaged to conduct the railway study and began on-the-ground work in July. Expectations in late 1963 were that enough information should be available in 1965 for the economic feasibility of the whole Mekambo project to be assessed.

Exploration of other areas for iron ore was carried out during the year by the French Bureau de Recherches Géologiques et Minières (BRGM) in cooperation with the High Authority of the European Coal and Steel Community. This work included aerial magnetometer surveys, and encouraging anomalies were reported; however, these had not been fully investigated, and the program was scheduled to continue.

Manganese Ore.—October saw completion of the first year of full-scale operations at the Moanda manganese mine of Compagnie Minière de Igooúe (COMILOG), major economic asset of Gabon. Capitalized at CFAF25 billion, 49 percent subscribed to by United States Steel, COMILOG has invested Fr24 billion in opening the large deposits—having reserves of about 200 million metric tons of ore, containing an average of 50 percent manganese. Extraction and beneficiation of the ore presented no special problems. Mining continued to be carried out on the Bangombe plateau, where ore in beds

[4] Mining Journal (London). V. 261, No. 6687, Oct. 18, 1963, p. 354. Annales des Mines (Paris). April 1964, p. 61.

4 to 6 meters thick with only a thin waste capping was stripped and mined by conventional open-cut methods. After crushing, washing, and screening the marketable product had a typical analysis of 50 to 52 percent manganese, 3 to 4 percent ferric oxide, 2 to 3.5 percent silica, 6 to 7 percent alumina, and 0.10 to 0.13 percent phosphorous. Evacuation of the product is over the 76-kilometer aerial tramway to M'Binda on the Gabon-Congo frontier and thence through Congo (Brazzaville) to Point Noire on the Atlantic Ocean, 285 kilometers of newly constructed railway and 200 kilometers of the Chemin de Fer Congo-Ocean, which runs from Point Noire to Brazzaville.[5]

COMILOG continued work on installation of a concentration plant to produce an ore enriched to nearly 85 percent of dioxide or 56 percent manganese. This installation was scheduled for completion in July; capacity was to be 40 tons of concentrate per shift, or about 10,000 metric tons per year. It was planned with a view to possible further extension.

Despite the highly competitive situation of the world manganese market and a 32-percent drop in world market price since the inception of COMILOG in 1963, 1963 exports, based on preliminary figures, for shipments from Point Noire through December 13, were more than 90 percent of the production, totaling 575,000 metric tons consigned as follows: United States, 355,000 tons; France, 108,500 tons; West Germany, 77,500 tons; Japan, 29,000 tons; Spain, 3,000 tons; and Italy, 2,000 tons. The impact of the new supply on the world market has been reflected in the decreased output of other countries, particularly Morocco.

Uranium.—Expanding uranium production continued to come entirely from the Mounana deposits in remote southeastern Gabon. Founded in 1958, Compagnie des Mines d'Uranium de Franceville (CMUF), capitalized at CFAF2.5 billion, had an estimated reserve of 25 million metric tons of ore expected to yield about 5,000 tons of uranium metal. The capital is held by the French Atomic Energy Commission, several private French mining interests, and several French banks. Company production was guaranteed by special agreements between Gabon and France under which all sales of CMUF are to France. The Mounana mine has provided an estimated one-quarter of French needs in its first years of operation. Production of ore has been by open-pit methods at about 14,000 metric tons per month, but this will be replaced by underground working by 1966; during 1963 sinking of a 200-meter hoisting shaft continued. The treatment plant handled increased production; separation was effected by a sulfuric acid leach, followed by precipitation in a magnesia bath, filtration, and drying. Concentrate is shipped to Point Noire by rail; exports are reported at 1,300 tons of concentrate, containing 30 percent uranium oxide. A sulfuric acid plant was reported under construction at the beginning of the year and indications were that this was continued during 1963. The French Atomic Energy Commission proposed investigation of the Lastourville area, which had not previously been prospected for uranium.

[5] Vigier, R. L'Exploitation de la Mine de Manganese de Moanda. Annales des Mines (Paris), September 1963, pp. 529–548.

NONMETALS

Cement.—In December a contract was signed for construction of a cement plant near the port of Owendo, following discovery of commercially exploitable deposits of limestone on the Isle of Coniquet in the Gabon Estuary. The contract created Société des Ciments Portland Gabonais, capitalized at CFAF300 million, of which the Gabonese Government will hold 80 percent. The plant, which is expected to supply the local market of approximately 40,000 tons annually and eventually a small export market, is expected to cost about CFAF980 million.

MINERAL FUELS

Petroleum.[6]—Because the onshore Gabon structures are highly faulted, and wells have been of only a short life, the year saw a continuing emphasis on offshore exploration; significant new discoveries were reported from the Anguille region near Port Gentil. Anguille offshore production in 1962 accounted for about 9 percent of the total in that year; it contributed effectively to the 1963 increase, and in May two wells in the area were yielding together 350 tons per day. New discoveries raised the hopes of the Gabonese Government for a sustained growth in production. The total reserve, placed at about 10 million tons at the end of 1962, was reported to have doubled with the 1963 finds.

Société des Pétroles d'Afrique Équatoriale (SPAFE), controlled by the French Government but with small participation from the four States of ex-French Equatorial Africa (Gabon, Congo, Central African Republic, and Chad), continued exploration and production within its holdings totaling 105,934 square kilometers. This area includes four offshore permits. SPAFE continued its association in some permits with the Shell group as Compagnie Shell de Recherches et d'Exploitation au Gabon (COSREG) and with the Mobil Group as Mobile Exploration Equatorial Africa (MEEA). Participation of the latter companies varied for individual permits. For onshore associated holdings, one covered 5,275 square kilometers in which SPAFE and COSREG each had equal shares and COSREG was the operator; the other covered 12,045 square kilometers with SPAFE holding 50 percent and the remainder divided between MEEA and Mobilrex (another Mobil affiliate), in which SPAFE was the operator. Mobil and SPAFE share equally in the 4,335 square-kilometer-permit offshore of Port Gentil, Mobil being the operator; this arrangement was also applied within the 2,010 square-kilometer-permit offshore of Mayoumba, and the Sette Cama offshore permit was shared equally between SPAFE and COSREG with the latter carrying out the work. In October, Offshore International, an American company, was participating in exploratory drilling on a contractual basis on the offshore areas of the Mobil-shared concession of which the Anguille field is a part.

The Gabon producing fields extend 150 kilometers along the coastal zone south of Libreville to the south of Port Gentil. SPAFE is based

[6] Industries et Travaux d'Outremer (Paris). V. 11. No. 121, December 1963, p. 1031. World Oil. V. 157. No. 3, Aug. 15, 1963, pp. 162–164.

on the Cape Lopez field, near Port Gentil. Production by field is not available, but except for the increased output from Anguille it is estimated to have been about the same as in 1962, when the following distribution was reported for the four major fields: Tchengue, 203,695 tons; Pointe Clairette, 175,209 tons; M'Bega, 142,879 tons; and Cape Lopez, 121,267 tons. The 1962 production of the smaller fields was approximately as follows: Batanga, 91,127 tons; Ozouri, 46,501 tons; Animba, 14,876 tons; Rembo Kotto, 9,485 tons; Simany, 8,208 tons; Anguille (offshore), 7,693 tons; Alewana, 4,503 tons; and Illigoue, 1,487 tons. In 1963 drilling of 13 wells was completed, a decrease from 1962 when 27 wells were completed, including 17 dry ones, and their aggregate depth was 48,068 meters. At the beginning of 1963 production was from 64 wells, 21 of which were with artificial lift. Most of the fields continued to be served by the 90-kilometer pipeline between Cape Lopez and Ozouri; a 40-kilometer line connects the Rembo Kotto with Lake Odombo.

Expenditures of SPAFE for exploration, in 1962, including those in the Congo (Brazzaville) where this company has extensive holdings, were reported at CFAF2.5 billion. Cumulative sales of Gabon production through 1962, more than CFAF12 billion, were less than the total investments of SPAFE and its associates in the country.

At yearend agreement in principal for construction of a refinery to serve Gabon, its partners in the Equatorial Customs Union (Congo-Brazzaville, Central African Republic, and Chad) and nearby Cameroun had been reached by the respective governments, although the final decision as to location was still pending. A few weeks later it was announced that this facility, to have an annual capacity of 700,000 metric tons, would be built at Port Gentil.

Natural Gas.—The slight drop in natural gas marketed was the result of SPAFE's decreased deliveries to the only customer, Société d'Energie Electrique de Port Gentil, the company that provides the Port Gentil electric power. The latest data on gas reserves are for the end of 1961 when Gabon was credited with a total of 8,495 million cubic meters.

758-002—65——59

The Mineral Industry of the Republic of Ghana

By Thomas C. Denton [1]

FOLLOWING the pattern of many years, Ghana's significant mineral production in 1963 besides construction materials consisted of gold, diamond, manganese ore, and bauxite in that order for value. Rank in world production of these minerals in 1963, exclusive of Communist countries, was 5th after Australia for gold, 3d after the Republic of South Africa for diamond, 6th after Republic of Gabon for manganese ore, and 13th after Italy for bauxite. Available information indicates that bauxite outranks the others in quantity of reserves. Four areas in which it occurs contain deposits with an aggregate reserve of at least 200 million tons.

The minerals named were produced by Ghana for export, and generally account for nearly 99 percent of the total value of mineral exports. Their position in the domestic economy was important in contributing to badly needed exchange earnings, contribution to gross national product and employment, and for the training of Ghanaians for skilled and supervisory positions provided by all expatriate mining companies.

Mineral exports in 1962 contributed 22.4 percent of the total value of domestic exports and were about 4.7 percent of estimated gross national product (US$1.484 billion in 1962).[2] The mineral contribution to exports in 1961 was 21.8 percent. Gold bullion provided 44.7 percent of the mineral value in 1962; diamond 29.6 percent; manganese ore 21.6 percent; and bauxite 2.7 percent.

As for employment and training,[3] gold mines were employing 20,086 Africans and 555 non-Africans; manganese mining, 2,411 Africans and 40 non-Africans; diamond mining companies, 4,506 Africans and 120 non-Africans; African diamond industry, 5,250 Africans; bauxite mining, 447 Africans and 16 non-Africans as of March 31, 1962. In addition, there were 376 Africans and 22 non-Africans engaged in prospecting. Since the year covered by the report, the non-Africans employed has decreased significantly as the result of efforts by the Government and companies to Africanize industry to the maximum.

[1] Africa specialist, Division of International Activities.
[2] Agency for International Development. Statistics and Reports Division Estimates of Gross National Product Calendar Year 1962. May 5, 1964.
[3] Mines Department of Ghana. Report for the period Apr. 1, 1961–Mar. 31, 1962, p. 11.

Thus, mining companies in Ghana both operate well-equipped trade schools on their properties and finance technical education of Ghanaians abroad.

During the first half of 1962 Soviet technicians and equipment arrived to begin implementation of a geologic survey of northern Ghana. In addition, steps were taken to build 64 houses for Soviet technicians at Tamale, and the Ghana Government assigned 230 Ghanaians to the Soviet team.[4] This activity continued throughout 1963, and arrangements were made for Soviet mineral technicians to assist the Ghana Geological Survey upon its request.

In September 1963, when the Survey celebrated its 50th birthday, the Director announced plans for projects designed to evaluate and exploit iron ore and bauxite deposits. Development of the bauxite and subsequent domestic production of aluminum from it would be the most important project in the Ghanaian program for mineral development.[5]

GOVERNMENT POLICIES AND PROGRAMS

In October a substantial increase in the withholding tax on profits remitted home by foreign companies was announced. Also in October the budget for the fiscal year ending September 30, 1964, was introduced, which increased expenditures 12.5 percent and appeared to make another large budget deficit inevitable. Economic services, including fuels and power, and mining and manufacturing were allocated 29 percent of a total budget of 144 million Ghana pounds (G£).[6] On the Volta River Project G£7 million was to be spent.

New revenue measures introduced which directly and indirectly bear on mineral industry included: (1) increased taxes on gasoline, kerosine, diesel and fuel oil; (2) increases up to 25 percent on vehicle registration and driving licenses; (3) increased purchase taxes on commercial vehicles; (4) increased postal rates; (5) a new 5-percent excise tax on locally manufactured goods, including boots, paints, etc.; (6) users tax on all airline tickets; (7) an annual registration fee for importers of from 50 to 200 G£; (8) a fee of 1 percent of value on all import licenses.

In addition, income taxes would be collected by the employer, and the employer was to withhold tax on all wages and salaries of G£11 and over per month at rates ranging from 6 to 32.5 percent. Company income tax was increased. The compulsory savings scheme which had been in effect since 1961 was abolished. The Government, according to reports, expected to more than compensate for the loss resulting from the action by the increases in income tax.[7]

A bill to establish an Atomic Energy Commission was introduced in November. Provisions of the bill included: (1) That the Commission, whose members the President would appoint, would be solely responsible for all matters relating to the peaceful use of atomic energy in Ghana, including relations with the International Atomic Energy Agency and arrangements with other African countries for conduct-

[4] U.S. Embassy, Accra. Airgram A–94, Aug. 7, 1962.
U.S. Embassy, Accra. Economic Summary. April–June 1962, p. 9.
[5] U.S. Embassy, Accra. Airgram A–284, Dec. 1, 1963.
[6] 1G £ = US$2.80.
[7] U.S. Embassy, Accra. Airgram A–462. Mar. 12, 1964.

ing atomic energy research; (2) that the Commission would establish an institute to be called Kwame Nkrumah Nuclear Research Institute, which on behalf of the Commission would be responsible for the supervision, control, and operation of any nuclear installation in Ghana.[8]

SOURCE MATERIAL

The annual reports of companies operating in Ghana were particularly useful in preparing the chapter. Other source materials were articles appearing in trade journals, publications of the Government of Ghana and dispatches of the U.S. Embassy in Accra.

PRODUCTION

It seems unlikely at the present time that the existing pattern of Ghana mineral industry will change to an important degree in the immediate future insofar as raw mineral output is concerned. But the outlook for transforming industry is more encouraging. Besides an aluminum reduction facility, an iron and steel plant with rolling facilities is to be built for which at first the iron raw material will be scrap. In addition, semifabricating facilities for aluminum are being expanded, and cement and glass manufacture is to be undertaken.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Bauxite (exports)	150,206	228,075	199,219	291,401	210,752
Gold—troy ounces	913,141	893,113	852,619	888,038	921,255
Manganese ore (exports)	524,076	544,548	391,253	465,951	394,091
Silver (exports)—troy ounces	16,839	14,160	7,027	4,443	4,827
Nonmetals:					
Diamonds—thousand carats	3,076	3,273	2,214	3,208	2,678
Salt—thousand tons	[1] 22	12	18	19	[1] 20
Mineral fuels:					
Petroleum refinery products:					
Gasoline—thousand 42-gallon barrels	----------	----------	----------	----------	[1] 405
Kerosine—do	----------	----------	----------	----------	[1] 136
Light fuel oil—do	----------	----------	----------	----------	[1] 481
Heavy fuel oil—do	----------	----------	----------	----------	[1] 252
Miscellaneous—do	----------	----------	----------	----------	[1] 13

[1] Estimate.

TRADE

Despite its dependence on imports for energy, Ghana has a favorable balance of trade in minerals (including minerals, mineral fuels, metals, and semimanufactures of mineral origin). The position results from very substantial gold production. In 1962 the value of mineral imports was G£17.4 million, whereas exports were G£25.1 million, of which gold bullion was 44.7 percent. Bullion went to the United Kingdom for refining, and in 1962 the United Kingdom also received most of the diamond exported, thus being the major recipient of Ghana mineral exports by value that year.

[8] Source cited in footnote 7.

By value about 41 percent of imports in 1962 were refined petroleum products, and 29 percent were iron and steel semimanufactures. Establishment of a refinery in Ghana late in 1963 was expected to result in a sharp decline in imports of petroleum refinery products.

TABLE 2.—Exports of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Bauxite	199,219	291,401	United Kingdom 250,116; Netherlands 18,882; Canada 11,836.
Semimanufactures		4	Upper Volta 3.
Gold:			
Bullion, troy ounces	852,619	945,829	All to United Kingdom.
Ore	[2] 6,000		
Iron and steel:			
Scrap	146	11,620	Japan 11,606.
Semimanufactures	134	23	All to Upper Volta.
Manganese ore	391,253	[3] 472,287	United States 209,186; Norway 97,133; Netherlands 40,160.
Silver, unwrought and semimanufactures, troy ounces	7,027	4,443	All to United Kingdom.
Nonferrous metal scrap			
Slag, dross, scale, etc			
Nonmetals:			
Clays	[4]		
Diamonds, thousand carats	2,854	3,327	United Kingdom 2,397; Netherlands 703 Belgium-Luxembourg 223.
Salt	178	35	All to Upper Volta.

[1] Includes only domestic produce.
[2] Estimate.
[3] Includes 6,336 tons, containing not over 30 percent manganese.
[4] Less than 1 ton.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum and aluminum alloys:			
Unwrought	2,646	939	All from United Kingdom.
Semimanufactures	2,117	3,358	United Kingdom 3,286; Switzerland 62.
Copper: Semimanufactures	[1] 672	749	United Kingdom 667; Austria 22; Belgium-Luxembourg 20.
Gold:			
Bullion, troy ounces	160,190	1,425	All from United Kingdom.
Semiwrought, do	1,499		
Rolled, do	499		
Iron and steel:			
Pig iron	388	194	Do.
Ferroalloys:			
Ferromanganese	24		
Other		38	West Germany 29; United Kingdom 8.
Ingots and equivalent primary forms	18	27	United Kingdom 23; Italy 4.
Wire rods	73	345	
Bars, rods, angles, shapes, and sections	38,927	32,735	U.S.S.R. 11,066; West Germany 8,326; Belgium-Luxembourg 8,087.
Plates and sheets, uncoated	9,596	9,687	United Kingdom 4,857; Netherlands 2,526.
Plates and sheets, coated	1,489	3,211	United Kingdom 1,020; Belgium-Luxembourg 787; West Germany 448; Japan 407.
Hoops and strips	118	85	United Kingdom 73; Belgium-Luxembourg 3; Sweden 3; West Germany 3.
Rails and railway track material	4,986	2,001	United Kingdom 1,802; Belgium-Luxembourg 83; Italy 76.
Wire	1,730	772	Czechoslovakia 356; Netherlands 164; United Kingdom 125.
Tubes, pipes, and fittings	5,770	10,072	Italy 5,174; United Kingdom 3,710.
Castings and forgings	2,027	2,053	Italy 1,633; Southern Rhodesia 296; United Kingdom 116.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals—Continued			
Lead:			
Ore and concentrate	50	6	All from Nigeria.
Unwrought	53	41	United Kingdom 34; Belgium-Luxembourg 6.
Semimanufactures	296	239	Belgium-Luxembourg 119; United Kingdom 46; Netherlands 40.
Magnesium and beryllium	215	27	India 25; West Germany 1.
Nickel: Nickel and nickel alloys	22	(2)	United Kingdom; Togoland Republic.
Silver:			
Unwrought and semiwrought. troy ounces	12,325	(3)	West Germany G£37; United Kingdom G£17.
Rolled do	8,174	36	All from United Kingdom.
Tin:			
Unwrought	10	7	United Kingdom 5; Denmark 1; West Germany 1.
Semimanufactures long tons	112	521	Italy 476.
Zinc:			
Unwrought	19	47	United Kingdom 45; Belgium-Luxembourg 1; U.S.S.R. 1.
Semimanufactures	187	19	All from United Kingdom.
Nonferrous metals, including scrap, n.e.s.[4]	42	13	United Kingdom 12; West Germany 1.
Nonmetals:			
Cement thousand tons	504	455	Poland 163; U.S.S.R. 79; United Kingdom 59.
Clays	1,359	1,174	United Kingdom 823; Norway 196.
Corundum, natural	1	(3)	All from United Kingdom.
Diatomite	(3)	6	Do.
Flint	304	42	Do.
Gypsum	(2)	(2)	Do.
Lime:			
Industrial limestone	32	9	All from United Kingdom.
Lime	7,114	5,981	United Kingdom 5,593; Israel 338; West Germany 50.
Nitrogeneous fertilizers	9	----------	
Phosphate rock	51	21	United Kingdom 20; Japan 1.
Potash salts	406	437	United Kingdom 350; West Germany 67.
Salt	8,057	359	United Kingdom 270; West Germany 70; East Germany 17.
Sand	161	3	All from United Kingdom.
Shale	----------	1	Do.
Stone:			
Calcareous	1,297	691	Italy 690; United Kingdom 1.
Other	1	(2)	All from United Kingdom.
Other nonmetals, n.e.s.[4]	751	1,147	Italy 808; France 106; United Kingdom 90.
Mineral fuels:			
Coal, coke, and briquets	54,899	29,291	Nigeria 28,585; Poland 406; United Kingdom 300.
Petroleum:			
Crude petroleum. 42-gallon barrels	14	----------	
Refinery products:			
Gasoline do	921,573	1,193,245	Venezuela 318,350; Italy 281,936; United States 194,182.
Aviation turbine fuel do	36,102	115,531	Venezuela 36,320; Netherlands Antilles 29,253; Trinidad and Tobago 20,850.
Kerosine do	282,620	367,370	Italy 86,610; Venezuela 83,715; France 67,580; Netherlands Antilles 59,074.
White spirit do	8,254	259	United Kingdom 253; Sweden 3.
Distillate fuels do	1,661,804	1,418,177	Venezuela 477,360; Italy 387,606; Netherlands Antilles 292,122.
Residual fuel oils do	173,402	224,848	Venezuela 92,668; Netherlands Antilles 75,164; Netherlands 19,657.
Lubricants:			
Liquid do	89,440	110,386	United Kingdom 43,582; Netherlands 33,507; United States 29,215.
Solid	549	764	United Kingdom 374; West Germany 279; United States 68.
Other:			
Liquid 42-gallon barrels	----------	7	Netherlands 6; United Kingdom 1.
Solid	15,974	41,797	Netherlands 28,302; Netherlands Antilles 11,096.
Natural asphalt	----------	31	All from United Kingdom.

[1] Includes 1 ton of unwrought copper.
[2] Less than 1 metric ton.
[3] Not reported.
[4] Not elsewhere specified.

COMMODITY REVIEW

METALS

Aluminum.—The Volta River Authority announced at yearend that the dam and powerplant at Akosombo were half completed and that all phases of the project were on schedule. The main dam was expected to be constructed to an elevation of 260 feet by October 10, 1964, so as to avoid possible damage during the 1964 flood season. Behind the dam an 8,482-square-kilometer lake will form. It will be necessary to remove 80,000 people from the area.

Work on the power transmission grid was estimated to be 13 percent complete at yearend. Power was expected to be available by September 1965. About half the power generated at Akosombo at the outset will be consumed by a US$144 million aluminum reduction plant which Volta Aluminum Co. (VALCO) will build and operate at Tema, the new artificial port in Ghana. Work on the plant was expected to begin in June 1964. Alumina for the facility will be imported. VALCO is owned 90 percent by Kaiser Aluminum and Chemical Corp. and 10 percent by Reynolds Metals Co. Loans to VALCO were extended by the Agency for International Development and Export-Import Bank of the United States.[9]

Bauxite.—In 1963 British Aluminum Co., Ltd. (BAL), 47.7 percent owned by Reynolds Metals Co., was the only producer of bauxite and it has been since 1941, when it began exploiting Ghana bauxite at the instigation of the then British Ministry of Aircraft Production. Exports at 210,752 metric tons were lower than in 1962 by nearly 28 percent but only 2.4 percent lower than average annual exports for the period 1959–63. Most exports were to the United Kingdom. The BAL operation in Ghana has been for many years a major source of bauxite for the small primary aluminum industry of the United Kingdom. BAL is interested in a Canadian producer of primary aluminum, Canadian British Aluminium Co., Ltd., whose plant was opened officially in 1958. BAL exports in 1962 included nearly 12,000 tons to Canada, presumably for the Canadian British company.

The BAL output was from an open-pit operation at Kanayerebo in the Western Region, from which the bauxite was trucked to railhead at Awaso. Numerous additional deposits are known and the indicated aggregate reserve of four bauxite areas in Ghana is more than 200 million tons with average alumina content of about 47 percent.

Gold.—Ashanti Goldfields Corp., Ltd., continued to contribute nearly 50 percent of gold output. Ashanti expanded operations and was largely responsible for the increase in total Ghana production to a new record output for the country valued at US$32.2 million in 1963. The other contributors were the Government-owned Ghana State Mining Corp. and Konongo Gold Mines, Ltd. Konongo, which had expected to exhaust its ore reserve by September 1963, found additional ore while exploring the footwall by diamond drilling.[10]

In April the Ghana Geological Survey announced plans designed to increase the annual gold production of the country by 200,000 ounces by 1965. The scheme included prospecting the Tano, Offin, Pra, and

[9] Except for statement about source of alumina for the plant, source cited in footnote 7.
[10] Page 14 of source cited in footnote 7.

Ankobra Rivers and their tributaries and dredging many smaller rivers believed to contain rich alluvial deposits. The scheme also included: (1) Persuading existing underground mine operators to increase production by 25 percent; (2) increased dredging of gold from small alluvial flats; (3) using small mobile equipment to work small gold prospects.[11]

Ashanti Goldfields Corp., Ltd.—On a concession situated at Obuasi, this British-owned company incorporated in the United Kingdom in 1897 has one of the richest large gold mines in the world. Operating costs, however, are exceptionally high for a mine of its size, in part because of heavy ground—much of which must be square set.

The following information regarding the Ashanti operation is for the year ended September 30, 1963.

Gold production at 444,251 ounces recovered from 468,139 short tons of ore milled (0.9489 ounces or US$33.21 per ton) was again a record, and during August the 10-millionth ounce of gold was produced. Operating expense in Africa excluding development totaled £2,315,566, equivalent to £4 19s. or US$13.86 per short ton milled. Development expenditures were £291,477, equivalent to 12s. 5d. or US$1.74 per ton milled. Total costs per ton milled thus were £5 11s. 5d. or US$15.60. In terms of gold, these cost figures are equivalent to 0.446 ounce, which compares with 0.207 ounce reported by the Transvaal and Orange Free State Chamber of Mines as "the average working costs" of 55 gold mines of the South African Rand in 1962.

The ore reserve on September 30, 1963, was 2,990,000 short tons, averaging 1.0925 ounces gold per ton; the value represented also was a new record. In addition, development results during the year continued to be excellent.

Profits for the year before taxes exceeded £2 million for the first time in the history of the mine. Dividends nevertheless had to be reduced from 2s. per share paid the previous year, to 1s. 6d. or by 25 percent. The action was necessary because the Ghana budget, introduced in August 1963, sharply increased both taxes and operating costs. Total taxes, duties, and compulsory savings amounted to 77.3 percent of profits for the year. Beginning in October 1963 Ashanti officials discussed alleviation of the situation with Ghana authorities. If the tax burden were reduced, Ashanti could advance its plans for still larger production.

Ghana State Mining Corp. (GSMC).—GSMC was incorporated March 1, 1961, by an instrument signed by the President of the Republic on March 4, 1961. It was formed to purchase the outstanding shares of five companies in the United Kingdom operating gold mines in Ghana and to exercise overall management of the operations. After more than 90 percent of shareholders had accepted its offers, GSMC bought the shares for G£5,165,550, which was reported as reasonable. The purpose of GSMC was to save the jobs of some 14,000 workers after the companies had declared their intention of abandoning the mines as unprofitable.[12]

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[11] U.S. Embassy, Accra. Economic Summary. January–June 1963. Airgram A–166, Sept. 26, 1963.
[12] U.S. Embassy, Accra. Economic Summary, Aug. 13–26, 1962. D–148, Aug. 25, 1962.

The following companies were purchased:

Amalgamated Banket Areas, Ltd. (ABA).
Ariston Gold Mines (1929), Ltd. (Ariston).
Bibiani (1927), Ltd. (Bibiani).
Bremang Gold Dredging Co., Ltd. (Bremang).
Ghana Main Reef, Ltd. (GMR).

The most recent available information on ore reserves of these companies and their gold production during the first quarter of 1963 is as follows:

	Ore reserves			*Production 1st quarter of 1963, ounces*
	Short tons	*Average gold content, ounces/ton*	*Date of reserve calculation*	
ABA	491,569	0.2699	Sept. 30, 1961	27,789
Ariston	1,298,558	.3465	----do------	30,468
Bibiani	494,000	.2275	----do------	15,857
Bremang	[1] 77,148,900	[2] .266	Dec. 31, 1961	16,242
GMR	235,895	.4295	June 30, 1961	13,527
Total	----------	------	----------	103,883

[1] Cubic yards.
[2] Grains per cubic yard.

During 1963 GSMC amalgamated Ariston and Ghana Main Reef, improving financial results somewhat.[13] For the fourth quarter of 1963 the corporation reported slight declines in output from all its mines except Bremang, where production and profits continued to increase. Purchase by the corporation of the privately owned Konongo gold properties reportedly was still under consideration.[14]

Manganese Ore.—The only producer of manganese ore in Ghana was the British company, African Manganese Co., Ltd. (AMC), owned by Union Carbide Corp. of the United States. This has been the situation for many years, except that nominal tonnages have been produced sporadically by others.

Besides metallurgical ore AMC produces manganese ore used for dry cell battery manufacture and by chemical industry, which is widely accepted. In recent years ore identified as containing not more than 30 percent manganese has also been produced.

Ghanaian exports of manganese ore in 1963 were 394,091 metric tons valued at G£4,015,808, compared with 472,287 tons valued at G£5,419,760 in 1962. The 1962 tonnage by grades and value was as follows:

	Metric tons	*Value G£*
Battery grade	28,513	925,166
Containing more than 30 percent Mn	437,438	4,438,121
Containing not more than 30 percent Mn	6,336	56,473

Most of the battery-grade ore went to the United Kingdom and the United States, the former taking about 40 percent; the latter, 39 percent. There were four additional recipients.

NONMETALS

Diamond.—Of the order of 80 percent of the diamond produced in Ghana is industrial diamond; mostly the stones are small, few weigh-

[13] Mining Journal (London). Annual Review. June 1964, p. 199.
[14] Source cited in footnote 7.

ing more than 1 carat. The industry is principally in the hands of many individuals and small groups called diggers and one company, the United Kingdom company, Consolidated African Selection Trust, Ltd. (CAST). Company operations are highly mechanized, while diggers largely use primitive methods. Nevertheless, until recently, aggregate digger production has exceeded CAST production. The combined output of diggers and organized operations in 1963 was 2,677,820 carats—530,238 carats less than in 1962.

All Ghana diamond must be sold to the Ghana Diamond Marketing Board, established by the Government on January 1, 1963, as the sole legal purchaser, valuer, exporter, and seller of diamonds mined in the country. Sales by the Board in 1963 continued at a level substantially below that of previous years with consequent major losses of foreign exchange. Exports by the Board during the period January–November 1963 were 1,434,518 carats, valued at G£3.11 million, compared to 3,067,716 carats, valued at G£6.64 million in the same period of 1962. Observers attributed the decline to inconsistent pricing policies of the Board that tended to inhibit producers from selling to the Board.[15]

Toward the end of the year the Board took measures to improve the situation. The measures included establishment of two diamond buying centers in the country besides Accra. It was hoped that the Board actions would attract a greater proportion of diamond production into legitimate channels of the diamond trade.[16]

Digger Operations.—Digger operations are supervised by the Department of Mines of Ghana, which in its annual reports totals exports of diamond by holders of digging licenses and prospecting licenses. The report for 1962 shows that during the period 1956–59 such exports increased steadily, reaching 1,844,282 carats, valued at G£4,990,000, in 1959. Thereafter, exports of diamond won by diggers decreased to 1,187,548 carats, valued at G£3,124,315, in 1962. A further decline was indicated for 1963.

The Mines Department also reported that 236 digging licenses were issued in 1962, of which 91 were issued to Ghanaians and 145 to non-Ghanaians. The majority of the latter were Yorubas from the Western Region of Nigeria.

Consolidated African Selection Trust, Ltd. (CAST).—The company announced plans to invest G£3 million during the next few years. A new large plant was to be built, existing plant and equipment were to be modernized, and additional welfare facilities were to be provided for employees.[17]

For the year ended June 30, 1963, CAST reported in part as follows regarding its operations in Ghana:

	1963	*1962*
Diamond produced, carats:		
From gravel	1,739,574	1,776,621
From sundry residues	73,163	134,373
Totals	1,812,737	1,910,994
Gravel treated, cubic yards	1,010,450	907,650
Overburden removed, cubic yards	567,660	467,145

[15] Source cited in footnote 7.
[16] Mining Journal (London). Dec. 20, 1963, p. 599.
[17] U.S. Embassy, Accra. Economic Summary, January–June 1963, p. 4. Airgram A–166, Sept. 26, 1963

The increase in quantity of gravel treated resulted from the start of production at No. 8 plant in January together with additions to throughput at Nos. 10 and 11 plants. Design and ordering of equipment for the new treatment plant (No. 12) to be erected adjacent to Nos. 10 and 11 plants were well advanced. Construction of the plant was scheduled to begin in March 1964 with completion expected early in 1965.

Prospecting and development continued to yield satisfactory results. Major emphasis was on full development of deposits indicated by reconnaissance prospecting conducted in previous years.

Total overall cost per cubic yard treated again declined slightly in spite of continuation in the general upward trend in cost of supplies.

Profit for the year at £1,310,000 was £310,000 less than in the previous year. Although a larger volume of diamond was sold, the average price fell, partly due to market conditions, partly to the commission or profit retained by the Government Marketing Board, and partly to inclusion of the smaller, less valuable diamond recovered by treatment of concentrator house residues. At the end of the year a satisfactory method of determining prices to be paid CAST by the Diamond Marketing Board had not been determined.

CAST operations continued to benefit from personnel training programs introduced earlier. Three plants were being supervised by Ghanaian engineers.

MINERAL FUELS

On September 28, 1963, President Kwame Nkrumah of Ghana formally opened the first oil refinery in West Africa, at Tema about 27 kilometers east of Accra, the Capital. Ghana-Italian Petroleum Co., Ltd. (GHAIP), a subsidiary of the Italian State-owned Ente Nazionale Idrocarburi (ENI) will operate the refinery. It has an annual processing capacity of 1,250,000 tons and can produce premium and regular grade gasoline, fuel oil, and liquefied petroleum gas.

GHAIP will transfer free 50 percent of its authorized equity capital of the equivalent of US$9,520,000 to the Ghana Government on the 11th anniversary of the beginning of production. The Government also will receive 50 percent of profits, will appoint the chairman of the board of directors of GHAIP and one-half of its membership, and will have the final say in determining prices at which products will be sold.

The refinery, which went on stream in July, was processing about 4,000 tons of Nigeria crude per day. Under an agreement signed in September, the oil companies already marketing petroleum products in Ghana were to supply crude oil to GHAIP in proportion to their market requirements and withdraw an equivalent amount of refined products.[18]

Soviet equipment and instruments for oil exploration were included among material which Ghana would purchase from the U.S.S.R. as a result of the technical assistance agreement of August 1960 and a credit of the equivalent of US$40 million provided by the U.S.S.R. In March 1962, 25 Soviet geologists arrived in Accra for a 2-year geological survey of the country.[19]

[18] Africa Report. December 1963, p. 20.
[19] World Petroleum. V. 34, No. 10, September 1963, p. 50.

The Mineral Industry of Guinea

By Thomas G. Murdock [1]

GUINEA'S 1963 mineral production showed a slight decline over that of 1962. This decline was indicated by export data; complete 1963 mineral production data are not available. The achievement of full-capacity plant production of alumina from local bauxite was an important event for the only facility of this kind on the African Continent and Guinea's principal industrial establishment. The year was also noted by progress toward an expansion of production of the few minerals mined there: An agreement was signed with an American company for the development of the extensive bauxite deposits, prospects improved for the sale of Guinean iron ore and the opening up of new iron ore deposits, and diamond mining by private companies and entrepreneurs was encouraged in a part of the country.

Guinea is important in the world mineral economy only as a producer of bauxite and alumina. In bauxite production the country ranked seventh and contributed about 5 percent of the world total. With at least 16 percent of world bauxite reserves, its standing is greatly enhanced.

The 1962 mineral and metal production, exclusive of building materials, had an estimated value of GFr8,342 million (US$33.77 million).[2] The 1962 gross national product (GNP) was GFr48,412 million, thus in that year minerals and metals contributed about 17 percent of the GNP.

Few data on employment by the industry are available. At the beginning of 1963, bauxite mining and processing employed 936 Africans and 412 European expatriates. Employment in iron mining probably did not exceed 300 Africans and 40 Europeans. A larger labor force was believed engaged in diamond prospecting and mining, and this may have been in the order of several thousands. Regardless of actual number employed in mining and processing, the proportion of the total labor force is small; about 90 percent of the estimated 3.4 million inhabitants are engaged in agriculture.

U.S. investments in the Guinean industry consisted of the participation of Olin Mathieson Chemical Corp. as the largest shareholder in the existing bauxite to alumina complex, an association of Harvey Aluminum Inc., and the Guinean Government in the development of additional bauxite deposits, and one of United States Steel Corp. and Jones & Laughlin Steel Corp. in an international consortium for opening up large iron ore deposits.

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[1] Mining engineer, Division of International Activities.

[2] The exchange rate used in this chapter is US$1=247 Guinean francs or GFr1=US$0.0040486.

GOVERNMENT POLICIES AND PROGRAMS

The year 1963 saw a continuation of the 1962 trend toward an orientation of Guinea's commercial relations back toward the West and a demonstration of the recognition of the role that private capital could play in the development of the economy. Along with this shift of commercial policy, its international political stance continued as one of more genuine nonalinement. Following the enactment of an investment code on April 4, 1962, providing incentives to industries considered of special importance to the development of Guinea, and signing of an Investment Guarantee Agreement with the United States on May 9, 1962, the Ministry of Economic Development was established in January 1963, to promote industrialization.

In 1961 Guinea expropriated the properties of the Aluminum Co. of Canada, Ltd., local subsidiary engaged in mining bauxite and opening up larger deposits. With the serious decline in the 1962 foreign trade, the country's economic situation became very acute; serious shortages of spare parts and vital commodities existed and developmental projects, programed in the 3-year plan, were far behind schedule, or, in some cases, not even started. Thus the new agreement for bauxite development negotiated in 1963, and the encouragement given iron and diamond mining became of considerable importance for the future, particularly in view of the slow decline in agricultural production. The opening of diamond fields to private exploitation was described as another step toward liberalization of the economy and was designed primarily to provide mining opportunities for individual Guinean initiative.

On June 30, 1963, Guinea's first 3-year plan officially came to an end. The budget of the plan called for a total investment of GFr45,154 million. Despite substantial foreign assistance (most of it from the Communist countries), several of the plan projects had miscarried, many remained incomplete, and some were abandoned. Progress was made in resolving the many difficulties between Guinea and France, and in May an agreement was reached to set up a mixed commission to adjudicate the claims of private French firms whose assets had been taken over by the Guinean Government and to secure hard currency transfers for firms whose Guinean franc earnings had been blocked. On September 28, Guinea became a member of the International Monetary Fund and the World Bank.

SOURCE MATERIAL

Information on the industry in 1963 is meager and comes mainly from the U.S. Embassy in Conakry. Production and export data are mainly estimates, and, in the case of diamonds, they are open to question. Production of diamonds undoubtedly was much greater than shown, and additional output is quite apparently reflected in the large exports from adjacent Liberia, a nonproducer. Background data are from the technical press and brochures of the principal mining companies.

PRODUCTION

The constantly growing increase for alumina is the most salient feature of production during the 1959–63 period. Bauxite output did not parallel this growth because of the significant local events adversely affecting the industry. The fluctuations in iron ore production have reflected world market conditions and the special characteristics of the ore rather than mine productive capability. The unreliability of the data available on diamonds handicaps any interpretation of their significance; however, regardless of absolute quantities the trend was probably downward.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite	300,973	1,190,000	1,766,677	[2] 1,440,000	[2] 1,500,000
Alumina		185,289	390,336	458,432	480,035
Iron ore—thousand tons	342	776	542	700	[3] 370
Nonmetals:					
Diamonds:					
Gem—carats	[2] [3] 257,200	[2] [3] 446,500	[2] [3] 490,000	[2] [3] 140,000	[4] 22,000
Industrial—do	[2] [3] 385,800	[2] [3] 670,000	[2] [3] 730,000	[2] [3] 210,000	[4] 32,000

[1] In addition, gold, cement, and various construction materials have been produced in some years but no quantitative data are available.
[2] Estimate.
[3] Exports.
[4] Sales on tender only. Some additional stones were probably sold abroad by the Guinean Government and much local production is believed to have been diverted to Liberia. Moreover, some of the stones sold by tender were stones originating in adjoining countries, other than Liberia.

TRADE

Data available on quantities of metals and minerals traded by Guinea are limited to the major export items. In 1962 the unofficial total valuation of the major import items was GFr2,622 million, 16 percent of all imports (GFr2,134 million and 12 percent in 1961). The 1962 imports reportedly consisted of metals, GFr887 million; cement, GFr420 million; fertilizers, GFr127 million; and petroleum refinery products, GFr1,188 million. The corresponding 1962 value for exports totaled GFr8,352 million (GFr10,062 million in 1961), comprising about two-thirds of all exports in both years. Alumina exports were valued at GFr7,000 million in 1962, followed by those of iron ore (GFr833 million), diamonds (GFr497 million), and bauxite (GFr22 million).

Available data do not indicate source of the imports of metals and minerals. The contribution of the European Economic Community countries is reflected in their exports to Guinea, totaling GFr492 million in 1962, and 10 percent of all Common Market exports to that country. The Communist countries apparently were major suppliers, and metals and minerals undoubtedly constituted an important part of Guinea's total 1962 imports from these countries, valued at GFr5,754 million (36 percent of imports from all sources). All imports from Morocco, Netherlands Antilles, Venezuela, and the United Arab Republic amounted to GFr927 million and probably would reflect a

part of the imports of petroleum refinery products. Exports from the Common Market included petroleum products valued at GFr118 million. Some petroleum imports also came from the Communist countries, and a part of the total imports from the United States valued at GFr1,814 million were petroleum products. Estimates indicate that France was the leading recipient of 1962 exports of metals and minerals, with 22 percent of the total, followed by Cameroon (18 percent), Norway (16 percent), and the United States (14 percent). Those to the United States (alumina and diamonds) comprised 94 percent of all exports to that destination. In 1962, in an attempt to hold down her growing indebtedness to Communist countries, Guinea increased shipment of iron ore to those areas and began to divert a part of her alumina production there.

TABLE 2.—Major exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Alumina	462,901	457,653	France 118,215; Cameroon 99,780; Norway 88,537; United States 71,641.
Bauxite	378,412	[2] 44,389	Czechoslovakia 18,396; Hungary 10,334; Poland 493.
Iron ore	534,936	719,495	Poland 450,864; United Kingdom 118,400; West Germany 79,950.
Nonmetals: Diamond—carats	[3] 1,220,000	[4] 350,000	Belgium-Luxembourg 180,242; Switzerland 73,930; Israel 54,228.

[1] Data on other commodities not available.
[2] January–September only.
[3] Estimate.
[4] On basis of values of exports for January–September.

Source: U.S. Embassy, Conakry.

COMMODITY REVIEW

METALS

Aluminum—*Bauxite.*—The greater part of the 1963 bauxite production was by Compagnie Internationale pour la Production de l'Alumine (FRIA), to meet the demands of its plant, approximately 1.4 million metric tons. This output came from the company's opencut mines situated in the immediate vicinity of the plant. The proven reserve of bauxite in the area was reported to be 140 million metric tons. The bauxite contains about 42 percent alumina; the silica content is remarkably low, but the iron oxide content is comparatively high.

The small remainder of the production came from the island of Kassa, one of the Los group, off the coast from Conakry, where a Polish-Hungarian force attempted to operate the mines formerly exploited by Société des Bauxites du Midi (BAMIDI), a fully owned subsidiary of Aluminum, Ltd., of Canada (ALCAN), exporting to European Communist countries as in 1962. Opened up since 1952, the Kassa mines exported washed and dried bauxite containing about 50 percent alumina mainly to Canada and West Germany, and

annual shipments reached a maximum of 540,000 metric tons in 1960. Activities were suspended in August 1961, and the installations were taken over by the Government of Guinea, following BAMIDI's nationalization effective November 23, 1961. This resulted from the company's previous notification to the government that due to its inability to solve the problems of long-term finance, the Boké project could not be completed by July 1964, as provided for in the convention of May 17, 1958; an alternative proposal was rejected by the government, and subsequently all company assets were expropriated without compensation.

BAMIDI's project, expected to include eventually United States and European aluminum producers, called for the exploitation of the bauxite deposits at Boké, 350 kilometers northwest of Conakry, with the annual production of 1.5 million metric tons of bauxite and 220,000 tons of aluminum. The reserves of the Boké area have been estimated to total 700 million metric tons containing 55 percent alumina. BAMIDI's investment was reported at the dollar equivalent of about GFr4,940 million, and completion of the project as planned would have required about GFr32 billion more.[3]

After 15 months of negotiations, the Government of Guinea signed a 75-year agreement on October 1, 1963, with the U.S. firm of Harvey Aluminum which set up a joint company, Compagnie des Bauxites de Guinea (CBG), to exploit the Boké deposits. Under the terms of the accord, Harvey and the Government of Guinea will share jointly in the profits according to a formula which was worked out during the negotiations. Total projected investment by all parties has been set at GFr12.35 billion. The first stage of development includes a planned annual production of about 1 million metric tons of bauxite and the construction of a chemical ore processing plant with an annual capacity of 10,000 tons. The next stage envisages the preparation of studies regarding an alumina refinery and an aluminum smelter, to be submitted within 3 years. Auxiliary projects, including the construction of a 137-kilometer railway, new roads, housing, and a port for shipping products, will be undertaken by the Government of Guinea and leased to the American firm. Guinea purchased a 15,000-ton ore carrier from the United Kingdom and will provide ocean transport for a substantial portion of the Boké production. The Kassa deposits are not a part of the Harvey agreement. As part of this agreement, CBG reserves the right to supply other countries or companies with bauxite, and so long as this is done, no further concessions will be granted within the Boké area.[4]

Alumina.—In 1963, FRIA reached the full capacity of its Kimbo alumina plant at Fria, 150 kilometers by rail north of Conakry, with a 5-percent increase over 1962. The company, capitalized at GFr8.4 billion, continued to be managed by the French partners, Pechiney-Ugine, holders of 26.5 percent of the stock, for the other members of the consortium consisting of the U.S. firm of Olin Mathieson Chemical Corp. (48.5 percent); British Aluminium Co., Ltd. (10 percent); Aluminum Industrie A.G. of Swiss domicile (10 percent); and the Vereinigte Aluminium-Werke, A.G. of West Germany (5 percent).

[3] Industries et Travaux d'Outremer (Paris). V. 10, No. 106, September 1962, p. 705.
[4] Africa Report (Washington). V. 8, No. 12, December 1963, p. 21.

Total investment, nearly one-half of it in infrastructure, was reported in late 1963 as the equivalent of GFr37 billion. No progress was reported on original plans for the extension of annual plant capacity to 1,440,000 metric tons, nor on plans for the eventual production of aluminum; alumina output was entirely for conversion to metal, mainly at the stockholders' oversea plants.

Exports through June were 244,370 metric tons, and they reportedly continued to account for more than 50 percent of Guinea's exports to hard currency areas. By the end of 1963, FRIA had made considerable progress in the replacement of expatriate administrators and technicians by indigenous personnel, made possible through a successful training program inaugurated nearly 2 years before the alumina plant came on stream in mid–1960. The company has spent approximately GFr124 million a year since that time in developing skilled Guinean personnel for its operations.[5]

Iron Ore.—Compagnie Minière de Conakry, founded in 1947 by a combination of British and French interests, continued the production of lateritic iron ore from its mines on the Kaloum Peninsula, which is linked with the port of Conakry by a 12-kilometer railway. However, competition from other producing countries and the prejudice of some blast furnace operators against the comparatively low iron content (about 51.5 percent average) and high chromium content (about 1.25 percent average) again held down exports to far below the 1957 peak of 1,019,000 metric tons. Mined by opencut, the brown ore deposits are estimated to contain reserves of about 200 million tons of ore exceeding 50 percent iron content; production began in 1953, and although the installation has an annual productive capacity of 1,200,000 tons of marketable ore per year, this has never been achieved. Poland continued to be the principal recipient of the ore (245,714 tons), followed by United Kingdom (86,430 tons), East Germany (21,120 tons), Czechoslovakia (14,597 tons), and United Arab Republic (2,000 tons). In an endeavor to develop a technique which would overcome the high chrome content, the Austrian firm of Vereinigte Oesterreichische Eisen- und Stahlwerke, A.G. continued investigations and at year's end expectations were that these would prove successful and result in increased exports.

Some progress was reported toward the possible development of the iron ore deposits in the Nimba and Simandou mountains in southern Guinea, near the Liberian border north of the new mine of Liberian American Swedish Mining Co. (LAMCO) where production began in 1963. The project was being undertaken by an international consortium, the CONSAFRIQUE Group, originally established by a Swiss banking group and associated with European and American steelmakers (U.S. Steel and Jones & Laughlin). Japanese participation of 10 leading steelmakers, investing a total equivalent to GFr247 million, was announced in early 1963. Reserves for Nimba were reported at 250 million metric tons and for Simandou, 700–1,000 million tons. During the year the group sent in several small groups of engineers and steel company officers to study the problems attending the exploitation of the deposits. A larger team was scheduled to

[5] Hovey, J. A., Jr. Industrial Africanization: A Case History. Africa Report (Washington), v. 8, No. 12, December 1963, pp. 12–14.

arrive in the fall to prepare for the inauguration of surveys for roads, housing, and the railroad through the rough terrain to join the 266-kilometer LAMCO railroad in Liberia, about 50 kilometers away and connecting with Port Buchanan. Expectations were that ore might be moved out by 1967 or 1968, though world market conditions at that time will determine just when and in what quantities.

NONMETALS

Cement.—Limestone and clay suitable for the production of cement were discovered in an area about 45 kilometers west of Siguiri near the Mali border. Announcement was made of plans to utilize these raw materials in a plant to produce 100,000 tons per year, to supply most demands of Upper Guinea and the Forest Region. Reportedly the small plant built by the U.S.S.R. during the construction of a jet runway at the Conakry airport continued in operation; annual output was believed to be small.

Diamond.—Diamond production, in the hands of the Soviets since the 1960 nationalization of the two French companies working the Kerouane field, apparently fell to a new low, as reflected in the limited 1963 sales reported. Unconfirmed reports indicated that the Soviets found several new kimberlite pipes in the Kerouane area. In August several Western companies were making concerted efforts to form mixed companies (private and Guinean Government participation) to exploit either the old or the new fields; however, no announcement has been made of results. In a decree dated October 14, the government declared that deposits of alluvial diamonds, estimated by the Minister of Economic Development to contain about 200,000 carats, would be opened for private exploitation in an area bounded on the north and south by the parallels passing through Mazano and Sommansenia, respectively, on the east by the meridian of Femarodou, and on the west by the right bank of the Baule River. Diamond mined in this sector will be sold exclusively to the National Diamond Bourse, and operations are to be suspended for the period of May to July 31, corresponding to the farming season.

The Mineral Industry of the Ivory Coast

By Thomas G. Murdock[1]

THE IVORY COAST is one of the richest and most modern countries of French-speaking West Africa; however, its economy has continued to be essentially agricultural and its contribution to world mineral supply has been of little significance. Although other minerals are known, recorded production during recent years has been limited to small quantities of manganese ore and diamond and a few hundred kilograms of columbium-tantalum minerals. The only significant events in the mineral industry in 1963 were the establishment of a record high in manganese production and the beginning of construction of a refinery to treat imported crude petroleum.

In 1962 the country's gross national product (GNP) was US$624 million (CFAF154 billion).[2] In that year the value of the mineral production, estimated on the basis of unit value of exports as indicated by official foreign trade statistics, was CFAF965 million, exclusive of building materials, and only 0.6 percent of the GNP. The comparable value of production declined to CFAF848 million in 1963; consequently, the contribution to the GNP decreased.

Data on employment by the mining industry are not available; the labor force engaged in nonagricultural activities comprised approximately 70,000 of the 3.5 million inhabitants. Mine workers probably did not exceed 2,000 following the prohibition of diamond mining by individuals.

U.S. participation in the industry consisted of an affiliate of a New York diamond concern, which engaged in prospecting for diamonds, and of several oil companies, which held shares in the Ivory Coast petroleum refinery being constructed.

Mineral exploration was continued on an appreciable scale, and by yearend indications were that gold, manganese, diamonds, and lithium had primary potentialities for development. Beryllium, chromium, cobalt, rare earths, titanium, tin, and graphite were thought to have secondary potentialities. Copper, nickel, and platinum, although known to occur, did not appear to have much promise because of small deposits and lack of transportation facilities.

GOVERNMENT POLICIES AND PROGRAMS

No specific new mining legislation was reported for 1963. The Ivory Coast continued to encourage foreign investment and to indicate

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[1] Mining engineer, Division of International Activities.

[2] African Financial Community (CFA) francs are used in the Ivory Coast. The exchange rate is US$1=CFAF246.8 (CFAF1=US$0.004052).

that it wishes to receive foreign capital from all Western countries, especially from the United States. Important steps taken by the Ivory Coast Government in this regard have included the enactment of a liberal investment code and the conclusion of an Investment Guaranty Agreement with the United States in 1961. The investment code has made it possible for companies undertaking investments of particular importance to the development of the country to be given priority status. Enterprises which are granted priority status benefit from measures for fiscal exemption or relief. The Official Journal of January 24, 1963, published Law 62/460 guaranteeing the Compagnie Mokta el Hadid, the French company engaged in manganese mining, that taxes would not be increased while it continues operations, to a maximum of 18 years.

During 1963 the government operated along the lines of a development plan originally intended to cover the period 1960–70 and altered to cover the period 1963–70. The plan has undergone constant revision. As part of its efforts to develop every sector of the country's economy, the government continued to explore the mineral resources of the country through a national corporation established for this purpose, Société d'État pour le Développement Minier (SODEMI). In 1963 this organization followed the program of geological exploration and minerals development for 1962–64 prepared by the Development and Resources Corporation of New York.

SOURCE MATERIAL

Background data are from a 1963 publication of the U.S. Government.[3] Data on production and some information on developments are from the dispatches of the U.S. Embassy at Abidjan. Most of the Commodity Review section has been abstracted from an article in the French press.[4] Foreign trade data are from official French and Ivory Coast publications. These sources report values for diamond exports at roughly one-third those shown by other official sources; however, the former are believed to be more reliable.

PRODUCTION

Manganese ore production in the Ivory Coast during recent years has been characterized by annual fluctuations; production for 1963 achieved a record high. Columbium-tantalum production more than tripled between 1959 and 1961 and then declined to below the 1959 level in 1963. Diamond output rose sharply to an alltime peak in 1961 because of large-scale uncontrolled mining by individuals; upon the suspension of this activity in 1963, output dropped below the 1959 level. Data were not available on the production of building materials; import statistics indicated that except for cement, dolomite, and lime, most requirements were met by domestic production.

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[3] Sabatini, Omero. Basic Data on the Economy of the Republic of Ivory Coast. U.S. Dept. of Commerce, Overseas Business Report. OBR–63–32, January 1963, 20 pp.
[4] Industries et Travaux d'Outremer (Paris, France). Côte d'Ivoire. V. 12, No. 125, April 1964, pp. 370–371.

TABLE 1.—Production of metals and minerals

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Columbium-tantalum concentrate---kilograms	1,024	2,600	3,800	2,618	1,000
Manganese ore---metric tons	----------	61,613	124,740	106,983	139,063
Nonmetals:					
Diamonds:					
Gem---carats	75,180	79,648	219,330	102,208	62,659
Industrial---do	112,769	119,472	330,000	181,703	117,000
Total---do	187,949	199,120	549,330	283,911	179,659

[1] In addition, building materials were produced, but no quantitative data are available.

TRADE

In 1962 the total value of metal and mineral imports was CFAF4,443 million; they consisted of metals, CFAF1,413 million; nonmetals, CFAF1,012 million; and mineral fuels, CFAF2,018 million. The 1962 exports were worth CFAF1,211 million. Diamonds valued at CFAF555 million [5] and manganese ore valued at CFAF548 million accounted for most of the exports; the remainder was essentially scrap metals and reexported petroleum refinery products. In 1962, metals and minerals comprised 12 percent of all imports on the basis of value; however, exports of these commodities were only 3 percent of all exports.

France continued to be the leading supplier of metals and minerals, with 59 percent of the total; the European Common Market, of which the Ivory Coast is an associate member, supplied 70 percent in the aggregate. Venezuela, the main supplier of petroleum refinery products, accounted for most of the remainder, with 21 percent. Imports from the United States valued at CFAF17,941, were insignificant, and consisted mainly of petroleum refinery products. Although there was a comparatively small volume of metals and mineral exports, they were made to 21 countries. West Germany ranked first as a recipient with 37 percent, followed by France (27 percent) and the United States (9 percent). The European Common Market countries as a whole received 72 percent. Metals and minerals comprised 1 percent of all imports from the United States and 2 percent of all exports to that country.

On the basis of the value of all imports through November and assuming that metals and minerals again accounted for 12 percent, the value for these commodities for 1963 was CFAF4,872 million. Preliminary data indicate that exports of diamonds and manganese ore had respective approximate values of CFAF315 million [6] and CFAF478 million in 1963.

[5] Value indicated by official foreign trade statistics. The monthly bulletin of the Ivory Coast Chamber of Commerce and other sources place this at CFAF1,712 million; the reason for the disagreement is not known.

[6] Estimated value based on 9-month French Government data. Alternative sources place the value at CFAF932 million.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum	(1)	2	All to France.
Copper, scrap	(1)	301	Italy 111; France 63; West Germany 47.
Iron and steel:			
Scrap	(1)	7,805	Japan 6,072; Italy 1,733.
Rolled products	(1)	22	Cameroon 16; Gabon 3.
Lead:			
Scrap	(1)	68	Italy 67; Gabon 1.
Other	(1)	32	All to Somalia.
Manganese ore	113,730	97,559	West Germany 79,459; United States 11,045; Canada 5,093; Spain 1,950.
Ores, unspecified	(1)	141	Sweden 102; France 31; West Germany 8.
Tin—long tons	(1)	7	All to France.
Nonmetals:			
Diamonds:			
Gem—carats	[2] 191,341	147,530	France 98,925; United Kingdom 22,075; United States 10,705; Belgium-Luxembourg 10,625.
Industrial—do	[2] 348,079	268,380	United Kingdom 81,125; France 64,910; Belgium-Luxembourg 64,385; United States 36,845; Israel 20,275.
Total—do	539,420	415,910	France 163,835; United Kingdom 103,200; Belgium-Luxembourg 75,010; United States 47,550; Israel 24,865.
Fertilizers	(1)	2	All to Togo.
Sand, industrial	(1)	2	All to France.
Mineral fuels:			
Petroleum refinery products:			
Lubricants	(1)	4	All to bunkers.
Asphalt and bitumens	(1)	30	All to Gabon.

[1] Data not available.
[2] Estimate.

Source: Ministère des Finances et des Affaires Économiques. (Ministry of Finance and Economic Affairs) (Paris, France). Données Statistiques, Janvier-Mars 1964 (1961). Ministère des Finances des Affaires Économiques et du Plan (Ministry of Finances, Economic Affairs and Planning) (Abidjan, Ivory Coast). Statistiques du Commerce Exterieur de la Côte d'Ivoire en 1962 (1962).

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum	(1)	289	France 280; Israel 6.
Copper	(1)	142	France 138.
Gold, troy ounces	(1)	8	All from France.
Iron and steel:			
Pig iron and ferroalloys	[2] 30	34	Do.
Scrap	[2] 41	46	France 29; Ghana 10; Cameroon 7.
Rolled products	[2] 27,495	[3] 30,710	France 26,721; Belgium-Luxembourg 2,752; Netherlands 220; Italy 134.
Lead:			
Ore	(1)	6	All from France.
Semimanufactured	(1)	66	France 28; Belgium-Luxembourg 24; Denmark 14.
Silver, troy ounces	(1)	518	All from France.
Tin, long tons	(1)	12	Do.
Zinc	(1)	23	France 18; Belgium-Luxembourg 4; U.S.S.R. 1.
Nonmetals:			
Cement	136,248	168,592	France 109,988; Belgium-Luxembourg 57,524; United Kingdom 990.
Chalk	(1)	93	All from France.
Dolomite	(1)	1,908	France 1,124; Belgium-Luxembourg 784.
Fertilizers:			
Nitrogenous	(1)	39	All from France.
Phosphatic	(1)	2,681	Belgium-Luxembourg 2,407; France 259.
Potassic	(1)	6,834	France 6,220; West Germany 441; Belgium-Luxembourg 173.
Mixed and unspecified	(1)	6,263	France 5,587; Netherlands 397; Italy 204; West Germany 75.
Gypsum, calcined	(1)	198	France 178; Morocco 20.
Lime	(1)	1,248	France 1,177; United Kingdom 41; Israel 30.
Pigments, mineral	(1)	114	All from France.
Salt	17,783	5,719	France 2,490; Algeria 1,535; Portugal 1,373.
Stone, crushed	(1)	238	All from France.
Talc	(1)	403	France 319; Norway 64; Italy 20.
Other	(1)	[4] 89	France 71; Morocco 6; Algeria 4.
Mineral fuels:			
Coal	(1)	31	All from France.
Coke	(1)	171	France 151; West Germany 20.
Coal byproducts	(1)	149	France 139; United States 4; Israel 3.
Petroleum refinery products:			
Gasoline:			
Aviation	[5] 634	664	Venezuela 600; France 29; West Indian Federation 19.
Other	[5] 85,654	89,736	Venezuela 49,771; France 22,871; Iraq 10,587; Kuwait 1,571; West Indian Federation 1,340.
Kerosine	[5] 27,330	28,632	Venezuela 12,987; France 6,354; Iraq 3,443; Kuwait 3,255; West Indian Federation 1,527.
Distillate fuel oil	[5] 58,455	61,241	Venezuela 36,284; France 8,432; Iraq 6,667; Kuwait 4,171; West Indian Federation 2,927.
Residual fuel oil	[5] 9,498	9,951	Venezuela 6,053; France 3,898.
Lubricants	[5] 6,659	6,976	France 6,711; United States 213.
Liquefied petroleum gas	[5] 1,497	1,568	France 1,231; Chile 275; Italy 62.
Asphalt and bitumen	[5] 3,210	3,363	Venezuela 2,855; France 400; Chile 108.
Other	[5] 211	221	France 134; United States 62; West Germany 22.
Total	193,148	202,352	Venezuela 108,556; France 50,060; Iraq 20,697; Kuwait 8,997; West Indian Federation 5,814.

[1] Data not available.
[2] Estimate.
[3] Includes 2 tons of ingots and blooms.
[4] Includes abrasives (natural) 1; barite 14; borates 5; clay 15; diatomite 18; graphite 7; magnesite 5; quartz 5; sands (industrial) 3; stone (dimension) 8; sulfur 3; and, unspecified 5.
[5] Calculated from reported total, assuming same breakdown of individual items as in 1962.

Source: Ministère des Finances et des Affaires Économiques (Ministry of Finances and Economic Affairs) (Paris, France). Données Statistiques, Janvier-Mars 1964 (1961). Ministère des Finances, des Affaires Économiques et du Plan (Ministry of Finances, Economic Affairs and Planning) (Abidjan, Ivory Coast). Statistiques du Commerce Exterieur de la Côte d'Ivoire en 1962 (1962).

COMMODITY REVIEW

METALS

Columbium-Tantalum.—The small production of columbium-tantalite was again by a single operator, Société Anonyme de Recherches et d'Exploitations Minières de Côte d'Ivoire (SAREMCI), from the deposit 3 kilometers west of Bouake. The ore is recovered from quartz gravel which is mined as a building material. Exploration at depth has indicated that the deposit is strictly alluvial. The Société d'Etat pour le Developpement Minier (SODEMI) began exploration for the pentoxide minerals in the Issia region and discovered several small tantalite placers which can be worked by individual small-scale miners.

Gold.—The French Bureau de Recherches Géologiques et Minières continued exploration of the gold deposits at Ity, between Toulepleu and Danané, where work started in 1958; excellent results were reported. Following a discovery on Mont Flotouo, where gold had been found in the superficial lateritic clay, exploration indicated about 5 tons of gold in ore averaging 0.32 ounce per ton. In 1963 this occurrence was explored at depth; a mineralized formation 8 meters wide, 40 meters long, and 65 meters deep with an average gold content of 1.18 ounces per ton was found. At yearend work was continuing at this deposit to evaluate the mineralization within the zone of alteration where opencut mining would be possible. SODEMI began exploration work in the Lobo basin, between Issia and Soubré, and by yearend two areas containing an aggregate of several tons of gold had been proved.

Manganese.—The 1963 production consisted of 109,222 metric tons of lump ore containing 46 percent manganese and 29,841 tons of fines with 38 percent. The entire output came from the mines of Compagnie Mokta el Hadid in the Grand Lahou region; the increased production was attributed to the inauguration of a washing plant. Exports in 1963 were 104,843 metric tons, all of lump material and mostly to European Common Market countries. Exploration of manganese occurrences continued; the Mokta company prospected an area southwest of the producing mines, and a reserve of 80,000 tons of 45 percent ore were reported. In 1962, Direction de la Geologie et de la Prospection Minière (DGPM) had investigated the Ziemougoula deposit north of Odienne and the manganiferous outcrops east of Toumodi. In 1963 SODEMI was engaged in preparation of an economic study of the DGPM findings. The Grand Lahou manganese is transported from the mines to Abidjan through the net of coastal lagoons. In 1963 work was underway to improve transportation through the lagoons.

Titanium.—SAREMCI continued laboratory investigations of the ilmenite-bearing beach sands from Grand Lahou and Addah. Studies of beneficiation equipment for these sands were carried out in France in preparation for the early installation of a pilot plant. Estimates place the ilmenite reserve at 500,000 metric tons with a titanium content above 50 percent; the sands also contain small quantities of rutile and zircon.

NONMETALS

Building Materials.—SODEMI continued a search for building materials and discovered a large deposit of brick clay in Basse Comoé, near Grand Bassam, and extensive gravel deposits less than 30 kilometers from Abidjan. This company also investigated deposits of clay for ceramic use and glass sand.

Diamond.—The 37-percent decline in diamond production was largely due to the successful military closure of the Séquéla region to the wasteful mining by individual African diggers. In 1962 these diggers sold about 100,000 carats to the buying offices, accounting for 35 percent of the production. In 1963 the buying offices bought only 2,100 carats of production by individuals. The remainder of the production came from the three companies that also were active in 1962.

SAREMCI produced 155,614 carats (169,239 in 1962) from its Tortiya deposit. The slight decrease was due to declining richness of the deposit, which has been worked since 1948. The company installations include modern mining equipment and a treatment plant designed to work satisfactorily on low-grade feed. Exploration was continued, and deposits containing 110,000 carats were found. The 1964 production target was announced at 160,000 carats, treating gravel which would be still lower in grade than that of 1963.

Société Diamantifère de Côte d'Ivoire produced 21,275 carats (11,386 in 1962) from its mines about 30 kilometers north of Séguéla and continued a program of improvement of mining and treatment equipment. Expectations were 40,000 carats could be produced in 1964.

Société Minière des Bandamas, an affiliate of SAREMCI created in 1961 to exploit the deposits discovered within the old general permit of SAREMCI, produced only 670 carats (3,286 in 1962). This small recovery was the result of experimentation on the treatment of gravels coming from different deposits. Prospecting continued along the Maraboué River south of the Séquéla-Bouaké road, and deposits in the present bed of the river and in adjacent terraces were discovered. The first unit of a washing plant was to be installed in 1964.

Société Waston, an affiliate of Diamond Distributors, Inc., of New York and founded on March 6, 1963, carried out an exploration program within the Séquéla diamond area, under the agreement of association with SODEMI. At yearend alluvial reserves had been discovered and mining operations were being planned. Exploration of kimberlite pipe deposits reportedly had given encouraging results.

The Diamond Corporation Côte d'Ivoire, Limited, an affiliate of the South African De Beers Interests, continued prospecting, both for its own interest and for that of Société Israel Corporation Diamond, in the central and southwestern parts of the country, areas granted the firms in 1962. Diamond indications were found in the Maradiassa region in the central area, and detailed exploration was scheduled for 1964.

The 1963 exports were 213,507 carats, of which 186,182 came from the output of the companies. The remaining 27,325 carats was exports by the Ivory Coast Government purchasing offices, which bought diamonds brought from other African countries that apparently were

not listed as Ivory Coast imports. Exports in excess of production came from existing stocks.

MINERAL FUELS

Petroleum.—The French-controlled Société Africaine des Pétroles continued to hold its partly offshore 5,784-square-kilometer permit, where unsuccessful drilling was carried out in 1960 and 1962. Subsequent activity consisted of seismic work complementing earlier investigations, and at yearend an interpretation of results was underway. Expectations were that this would be completed by April 1964, and two wells were to be put down if the results of the seismic work were favorable.

Work began on the construction of the 700,000-metric-ton-per-year Abidjan refinery of Société Ivorienne de Raffinage (SIR); this installation was scheduled for completion in 1965 and will cost CFAF3,000 million. SIR was formally established in October 1962; its stockholders comprise Bureau de Recherche Pétroliere (25 percent), Ivory Coast Government (10 percent), Socony Mobil Oil Co. (18.2 percent), Shell Oil (14.7 percent), Compagnie Français de Pétrole (13 percent), British Petroleum Co., Ltd. (10.2 percent), Texaco Inc. (7.9 percent), and Esso (1 percent).

During the year, Société Générale Italienne des Pétroles completed their storage facilities in the Vridi industrial area of Abidjan and retail outlets in and around that city, following the granting of their operating authority by the Ministry of Finance, Economic Affairs and Planning in May.

The Mineral Industries of Kenya, Tanganyika and Uganda

By Thomas C. Denton [1]

THE CONTIGUOUS former British territories of Kenya, Tanganyika, and Uganda in East Africa have become fully independent countries within the British Commonwealth of Nations. This status was officially established on, respectively, December 12, 1963, December 9, 1961, and October 9, 1962. Investment guarantees through the U.S. Agency for International Development of the Department of State were available to U.S. citizens and corporations for Kenya and Tanganyika by July 15, 1964. For each of these countries guarantees were available with respect to convertibility, expropriation, and war risk, including guarantees against loss due to revolution and insurrection; also extended risk.

As a group the new countries were known as British East Africa (BEA). Such facilities as railways and harbors, collection of customs and excise revenue, postal and telecommunications services and civil aviation were operated for BEA as a whole. As of December 31, 1963, the scheme was being continued. The services as a whole are known as the East African Common Services Organization for which the top Authority consists of the Heads of the three East African Governments. The agency for collection of customs and excise revenue is known as the East African Customs and Excise Department, which also issues annual trade reports for the three countries. In addition, the countries have established a common market known as the East African Common Market (EACM), within which freedom of trade is insured by tripartite agreements providing for interterritorial movement of commodities under a system of consignor declarations. Nevertheless, the great bulk of the trade of the three countries still is with countries outside the EACM. With respect to metals and minerals, the net exports of Kenya within the market in 1962 comprised principally iron and steel semimanufactures, cement, gypsum, lime, and salt. Imports were negligible. Tanganyikan exports were negligible. The principal import was cement from Kenya. The largest export of Uganda is electric power generated at Owen Falls, which is transmitted both to Kenya and Tanganyika.

Before independence the currency of the new countries was a decimal currency the standard unit of which was the East African shilling, controlled by the East African Currency Board, which maintained a stable rate of sterling exchange. As of December 31, 1963, this was

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still the situation with respect to the currency of each of the three countries. One East Africa Shilling (EAsh) equals US$0.14, and 20 EAsh are equivalent to 1 pound sterling or US$2.80.[2] Pounds sterling are used in the chapter.

KENYA

The major event in the mineral field was the beginning of petroleum refining at Mombasa late in the year. No important changes occurred either in the pattern or value of production of other commodities. As for many years past, cement and soda ash contributed the great bulk of value—about 76 percent in 1963. Exclusive of construction materials and materials of cement manufacture, some 15 additional minerals were produced.

While not a significant supplier to world mineral markets Kenya mineral industry is important in the domestic economy. Its contribution to gross national product (GNP) in 1962 was about 1.9 percent, mineral production that year having been valued at £5.1 million (approximately US$14.3 million) and GNP estimated at US$735 million.[3]

The total persons employed in 1962 was 1,566 of whom 1,394 were Africans, 90 Asians, and 82 European (Whites). Expenditures in 1962 totaled £1,370,947—66.2 percent went into prospecting and 33.4 percent into mining and milling; the remaining 0.4 percent went into development. Basic cash wages paid were £160,354 to Europeans, £154,189 to Africans, and £66,086 to Asians. There were 258 registered holders of prospecting and/or mining titles at the beginning of 1963.

GOVERNMENT POLICIES AND PROGRAMS

The stated policy of the Kenya Government toward mining is to encourage the industry. Royalties are levied at low rates and mining machinery enters the country free. In addition the Mines and Geological Department in Nairobi maintains assaying and mineral dressing laboratories. Minerals are identified; Geiger counters are rented to prospectors; advice on geology, prospecting, and mining is furnished; and elementary prospecting courses are conducted twice a year.

In mid-December 1963 the government took action that weakened seriously the outlook for the important soda ash and cement industries of Kenya. A trade embargo was placed on South Africa, which has been the principal customer for soda ash and the supplier of anthracite for the cement industry. The Kenya Government at once began strenuous efforts to offset its elimination of the South African market by seeking to expand other markets and to find new outlets. Solution of the anthracite problem has been difficult because alternative cheap sources are not available.

SOURCE MATERIAL

The principal sources of information on Kenya were professional trade journals (Annual Review issue of Mining Journal (London),

[2] Union-Castle Mail Steamship Company, Ltd., Yearbook and Guide to East Africa. 1964. U.S. Embassy Dispatch Kampala A–325, Mar. 28, 1964.
[3] U.S. Agency for International Development. Estimate of Gross National Product, Statistics and Reports Division. May 5, 1964.

particularly), reports of the Mines and Geological Department of Kenya, reports of other departments of the Kenya Government, and U.S. Bureau of Mines Mineral Production Questionnaires, returned from Kenya by the U.S. Foreign Service. Dispatches of U.S. Foreign Service posts in former British East Africa also were consulted.

PRODUCTION

During 1959–63 fluctuations in the value of Kenya mineral output were minor, value ranging between £5 million in 1963 and £5.4 million in 1961. Throughout the period the combined contribution of cement and soda ash was 76 percent or more, with cement generally providing about three-quarters of the total contribution. In 1963 the three next largest contributors were copper, salt, and gold in that order. If markets for soda ash large enough to replace that of South Africa are not found, a substantial drop in the value of Kenya mineral production appears probable.

TABLE 1.—Kenya: Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Columbite—kilograms	635	175		[1] 375	
Copper, concentrate	2,014	1,784	2,564	2,225	[2] 2,244
Gold—troy ounces	9,145	8,646	12,299	9,327	[2] 9,070
Silver—do	46,420	35,797	40,731	50,160	[2] 50,072
Nonmetals:					
Asbestos	39	106	137	192	70
Beryl	2	1	1		
Carbon dioxide, natural—million cubic feet	13	15	12	8	9
Cement [3]—thousand tons	314	353	330	346	340
Coral		15,842	6,108	2,154	
Diatomite	3,666	3,439	3,209	2,909	3,336
Feldspar			1		
Gem stones, sapphire—carats			1,000		[4] 800
Graphite	576	1,010			
Gypsum, other than for cement [3]	1,218	439	20,085	26,844	
Kaolin	1,161	1,053	741	1,174	6,558
Kyanite	719	936			
Limestone, other than for cement	17,001	25,293	20,038	18,284	16,448
Magnesite	2,853	30	1,751		261
Meerschaum	19	22	1		6
Mica	9	0.6	0.1	1	0.8
Mullite	767	349			
Pumice	2,282	2,459	708	1,128	1,129
Quartz	1,782		10		259
Salt—thousand tons	20	22	23	19	16
Sand, diatomaceous		146			
Sandstone		35,406	4,355	49,177	
Soda, raw crushed	1,886	2,511	2,295	2,924	2,342
Soda ash	153,487	126,510	144,717	124,081	103,506
Vermiculite	102	257		20	92

[1] Includes oxides of rare earths.
[2] Provisional.
[3] Cement materials were reported for 1963 as follows: Limestone, 495,587 metric tons; clays, 73,680; volcanic ash, 845; gypsum, 20,729. For 1961 and 1962 no distinction was made between gypsum used for cement and for noncement.
[4] In 1963 semiprecious and ornamental stones were reported as follows: Augite, 113 kilograms; rose quartz, 21 tons; corundum and apatite, 4 kilograms; zoizite, 714 kilograms.

TRADE

Compared with 1961, mineral exports in 1962 fell by 14.8 percent to £2.3 million. The drop largely resulted from a decline in soda ash exports of more than 22 percent to £1.2 million. In 1962 more than 41

percent of soda ash exports went to South Africa, with India and Pakistan the next largest customers. It is noteworthy that in 1962 exports of 4,070 metric tons of copper concentrates valued at £480,796 went to Japan. Earlier the concentrates generally had gone to the smelter at Jinja, Uganda, to which the haul is short and mostly by water.

In 1962 mineral and metal imports, including metal semimanufactures, totaled £14.7—approximately 21 percent of the value of all imports from outside the East African market. Refined petroleum products accounted for about 54 percent of the total and iron and steel semimanufactures nearly 36 percent. Imports of mineral fertilizers were more than £1 million.

TABLE 2.—Kenya: Exports of metals and minerals, to countries outside the East Africa Common Market

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Copper, concentrate	3,726	4,070	All to Japan.
Gold, troy ounces	12,100	8,917	West Germany 8,371; United Kingdom 546.
Silver, do	37,836	46,303	West Germany 46,158; United Kingdom 146.
Nonmetals:			
Asbestos	32	18	All to Denmark.
Cement	95,114	105,548	Mauritius 43,482; Aden 24,046; Reunion 10,086; Somalia 7,698; Bahrain 5,691.
Diatomite	1,204	1,230	United Kingdom 990; South Africa 180.
Gem stones, other than diamond, £ sterling	1,115	--------	
Graphite	143	82	India 41; United Kingdom, 41.
Gravel and crushed stone, £ sterling	663	495	Zanzibar 480.
Lime	(1)	27	Zanzibar 25.
Mica, kilograms	--------	227	All to United Kingdom.
Minerals, crude, not elsewhere classified, £ sterling	1,232	1,183	Ships' stores 1,168.
Salt	765	692	Congo 678.
Sand, £ sterling	280	18	All to ships' stores.
Soda ash, sodium carbonate	144,962	112,987	South Africa 46,542; India 18,968; Pakistan 11,768; New Zealand 5,899; Siam 5,574; Singapore 4,826.

[1] Less than 1 ton.

Source: Same as for Uganda.

TABLE 3.—Kenya, Tanganyika, and Uganda: Imports of metals and minerals in 1962

(Metric tons unless otherwise specified)

Commodity	Total	Distribution of total [1]			Principal sources of total
		Kenya	Tanganyika	Uganda	
Metals:					
Aluminum:					
Unwrought	1,254	1,254			France 955.
Semifabricated	1,000	644	159	197	Belgium 372; Switzerland 226; United Kingdom 222.
Copper:					
Unwrought	33				
Semifabricated	325	73	183	69	United Kingdom 194; West Germany 60; South Africa 26.
Gold, troy ounces	398	398			All from United Kingdom.
Iron ore	3,521	2,825	670	25	Rhodesia and Nyasaland 2,322; Norway 670.
Iron and steel:					
Pig iron	642	501	95	46	United Kingdom 607; Republic of South Africa 25; West Germany 10.
Ferroalloys	924	2	735	187	Republic of South Africa 710; Norway 177; West Germany 26.
Ingot steel	2,069	1,559	165	345	Republic of South Africa 596; Belgium 590; United Kingdom 290; Japan 191.
Semimanufactures	130,453	79,498	36,841	14,114	United Kingdom 53,321; Japan 34,757; Belgium 12,288; West Germany 7,227; Republic of South Africa 6,456.
Lead:					
Unwrought	167	121	21	24	Denmark 57; West Germany 40; Netherlands 33.
Semimanufactures	36	18	10	9	United Kingdom 20; Netherlands 7.
Nickel	7	7			All from United Kingdom.
Silver, troy ounces	479	479			Austria 371; United Kingdom 108.
Tin, unwrought, long tons	207	124	47	36	United Kingdom 190; Malaya 10.
Zinc:					
Unwrought	233	228	5		Rhodesia and Nyasaland 134; Australia 51.
Semimanufactures	42	(2)	26	16	Republic of South Africa 22; United Kingdom 19.
Nonmetals:					
Asbestos:					
Crude	662			662	Rhodesia and Nyasaland 336; Canada and Newfoundland, 326.
Building material and pipe	2,769	1,357	1,005	408	Belgium 1,049; Republic of South Africa 830; France 227.
Manufactures, other than building material.	64	42	16	7	United Kingdom 57.
Cement	13,420	905	12,384	130	Israel 6,279; Japan 5,027.
Feldspar	3,248	1,878		1,370	All from Republic of South Africa.
Fertilizers:					
Nitrogenous	26,440	17,406	5,346	3,687	West Germany 19,581; Belgium 3,438; United Kingdom 1,557.
Phosphatic	14,215	11,853	622	1,740	Netherlands 6,139; Belgium 3,818; Italy 1,814; West Germany 1,341.
Potassic	3,587	29	678	2,880	West Germany 2,833; Israel 705.
Other, manufactured, including mixed.	7,255	4,356	2,095	804	Netherlands 4,492; Belgium 844; United Kingdom 808; Italy 651.
Gypsum	388	242	13	133	Republic of South Africa 154; Italy 121; United Kingdom 79.

See footnotes at end of table.

TABLE 3.—Kenya, Tanganyika, and Uganda: Imports of metals and minerals in 1962—Continued

(Metric tons unless otherwise specified)

Commodity	Total	Distribution of total [1]			Principal sources of total
		Kenya	Tanganyika	Uganda	
Nonmetals—Continued					
Lime	4,446	184	3,907	356	Zanzibar 3,422; United Kingdom 751; West Germany 219.
Mica, crude	18	--------	--------	--------	United Kingdom 15; Norway 3.
Salt	41,402	7,036	7,176	27,190	Aden 22,091; Ethiopia 13,730; Netherlands 1,721; West Germany 1,696.
Sulfur	3,333	292	323	2,718	United States 2,024; West Germany 842; Belgium 467.
Mineral fuels:					
Solid:					
Coal	43,690	43,289	320	81	All from South Africa.
Coke	2,161	1,594	430	137	United Kingdom 1,281; West Germany 502; South Africa 351.
Petroleum products:					
Gaso- thousand 42-gallon bbls	2,743	1,234	855	654	Iran 2,108; Bahrain 293; Netherlands West Indies 157.
line, motor and aviation.					
Kerosine, including jet do	1,402	790	338	274	Iran 1,037; Bahrain 174; Netherlands West Indies 90; Saudi Arabia 58.
fuel.					
Residual fuel oil do	3,837	3,232	567	39	Iran 3,210; Bahrain 443.
Distillate fuel oil do	2,116	1,009	773	334	Iran 1,601; Bahrain 218; Netherlands West Indies 90; Saudi Arabia 73.
Lubricants, including do	235	140	64	32	United States 112; United Kingdom 96; South Africa 7.
greases.					
Other do	19	13	3	2	Iran 7; United Kingdom 6; West Germany 2.

[1] Data may not add to total shown due to rounding.
[2] Less than 1 ton.

Source: Same as for Uganda exports.

COMMODITY REVIEW

METALS

Copper.—Copper was produced in the Macalder Nyanza mines, a short distance inland from Lake Victoria. The report for 1962 of the Mines and Geological Department of Kenya stated that no new sources of copper were developed that year. Available information indicated the same situation for 1963.

Gold and Silver.—In 1963 output of both gold and silver improved slightly from 1962. The combined value was £137,000. Most of the gold and silver was a byproduct from copper ores of the Macalder mine. In 1962 Macalder provided 94 percent of gold output and nearly 100 percent of silver. There were seven other contributors.

NONMETALS

Cement.—Two plants accounted for the cement output: One is near Mombasa and uses coral, limestone, and clay quarried locally; the other is near Nairobi and uses crystalline limestone from Sultan Hamad.

Both plants must import coal which South Africa used to supply. The combined output of the plants in 1963 was valued at £2.5 million. Local raw materials consumed included 495,869 metric tons of Kun Kar limestone, 73,679 tons of clay, 845 tons of volcanic ash, and 21,144 tons of gypsum.

Soda Ash.—Magadi Soda Co., a subsidiary of Imperial Chemical Industries, Ltd., of Great Britain, is the source of an important output of soda ash. The company exploits an unusual deposit situated about 118 kilometers southwest of Nairobi at about 610 meters above sea level, where temperatures rarely are lower than 70° F, and 100° F is not unusual. The deposit consists of trona ($Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O \cdot$) fairly evenly distributed over about 60 square kilometers of Lake Magadi. The deposit is from 2.4 to 3.0 meters thick toward the center of the lake, where the trona rests on mud. The deposit is continually replenished by many surrounding springs from which great quantities of hot saline waters flow into the lake. It has been estimated that 65 million tons of solid trona exist on the lake, and that soda in solution amounts to 20 million tons.

The trona is collected by a dredge floating on the lake. Solid lumps of trona mixed with liquor are crushed on the dredge and pumped as a slurry through a floating pipeline to a beneficiation plant on shore. The plant turns out soda ash with a guaranteed minimum sodium carbonate content of 97 percent. Byproducts consist of salt for local consumption and minor quantities of other alkali products, including household soda (recrystallized sesquicarbonate of soda), bicarbonate of soda, and sodium fluoride.

Production of soda ash at Magadi began shortly before World War I and since has continued without interruption. By the end of the war output had reached 12,193 metric tons annually and 46,738 tons by 1922, the increase in the interim being largely based on sales to Japan. During 1959–63 annual output ranged from 103,506 tons (1963) to 153,487 tons (1959).

As indicated earlier, South Africa has been the major market for Magadi soda; it has also been a market for Magadi salt. The loss of the South African market probably will be permanent inasmuch as South Africa proposes to establish production at home on a scale at least large enough to meet domestic requirements.

MINERAL FUELS

Petroleum.—BP-Shell Petroleum Development Co. of Kenya, Ltd., continued its search for oil. The company had permission from the Kenya and Tanganyika Governments to explore for oil along the coastal strip from the Somalia border to southernmost Tanganyika, including the islands of Pemba and Mathia. In 10 years of work along the coastal area the company focused drilling at Walu and Pandangua. In January 1963, it was prepared to drill a hole at Walu for stratigraphic information to 14,000 feet if necessary.[4]

[4] U.S. Consulate General, Nairobi. Airgram 466. Jan. 14, 1963.

East African Oil Refineries, Ltd., at Mombasa began production from imported crude oil in November 1963. Performance to the end of the year was as follows: [5]

	U.S. barrels
Crude, processed	989,970
Liquefied petroleum gas	1,017
Premium gasoline	5,232
Regular gasoline	167,242
Kerosine	75,696
Gas oil	135,524
Diesel fuel oil	20,323
Heavy fuel oil	502,849

The company expects to process 2 million long tons of imported crude petroleum annually.[6]

TANGANYIKA

Diamonds provide about 70 percent of the value of mineral production and gold about 16 percent. The value of these and other minerals produced in 1962 was £7.5 million (US$21 million) and 3.5 percent of Tanganyika's estimated GNP of US$600 million. The volume of diamond produced was 2 percent of total African production and about 1.9 percent of world production, including an estimated 2.5 million carats for U.S.S.R. Gold output in 1962 amounted to about 0.4 percent of African production.

In 1962, the most recent year for which information is available, the average number of persons employed by mineral industry was 13,534. Of the 12,857 Africans recorded, about 25 percent were self-employed, either as members of the Mica Mining Cooperative Societies or in other small mining and prospecting groups. More than £3.5 million was paid in wages and salaries, of which nearly £1 million was African wages.

During 1963, developments bearing on the mining industry included prohibition of imports from South Africa, resulting in some hardship. Professional and technical personnel were not readily obtainable. Training schemes for Africans were operating, but some years will elapse before benefits begin to be felt.

Foreign technical and trade missions were active. Interest was shown in coal, iron, phosphates and base metal deposits. Limited transportation and communication facilities are a principal hindrance to development of known occurrences, and for some minerals local demand must first increase.

GOVERNMENT POLICIES AND PROGRAMS

During 1963 the position of three marginal gold mines remained weak. The government was considering a program to subsidize the mines so as to prevent closure.[7]

The Tanganyikan National Assembly enacted a bill providing certain statutory guarantees to foreign investors. The bill empowered

[5] U.S. Embassy, Nairobi, Kenya. Airgram 644, June 2, 1964.
[6] Mining Journal (London), Mining Annual Review. June 1964.
[7] Source cited in footnote 6, p. 191.

the Minister of Finance to grant certificates to foreign nationals who invest assets or reinvest profits in Tanganyika, providing he believes the investment will benefit the country. When approved status is granted, the investor is guaranteed the right to repatriate capital and profits and full compensation in the event of nationalization or expropriation of the relevant enterprise.[8]

The government established the Tanganyika Development Corp., to encourage investment and industry and to promote economic development generally. A similar corporation in Uganda has succeeded in these fields, including mining.

SOURCE MATERIAL

The principal source of information on Tanganyika was a review of the mining industry in 1963 issued early in 1964 by the Mines Division of the Ministry of Commerce and Industry. Other sources included other publications of the Tanganyikan Government, trade journals (particularly the Mining Journal (London)) and dispatches of the Foreign Service of the United States.

PRODUCTION

The value of mineral production in 1963 as measured by local sales and exports was £7.2 million, £300,000 lower than in 1962. The decline was mainly due to lower diamond output. Gold output was 4,490 ounces lower than in 1960, when peak production for the period 1959–63 occurred.

In 1960–62 local sales of minerals produced in Tanganyika were, respectively, £428,052, £459,362, and £390,847, mostly comprising construction materials and salt.

[8] International Commerce. Nov. 25, 1963, p. 48.

TABLE 4.—Tanganyika: Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Copper,[1] content of lead concentrate	1,098	1,274	101		
Gold [2] troy ounces	95,794	107,009	102,502	101,972	[3] 102,519
Lead, content of ore, (exports)	5,807	6,284	351		
Silver, exports troy ounces	536,407	614,279	64,144	23,959	[3] 22,521
Tin, content of ore, exports long tons	65	138	163	206	236
Tungsten, ore and concentrate, 60 percent WO_3, exports			3		
Nonmetals:					
Artstone			8	5	[4] 502
Bentonite	36	100	249		
Construction materials:[5]					
Clays	41,352	51,714	([6])	([6])	43,307
Gravel	110,501	145,990	([6])	([6])	88,312
Sand	185,486	209,202	([6])	([6])	136,059
Stone	260,331	281,746	([6])	([6])	186,361
Total	597,670	688,652	710,375	680,396	454,039
Diamonds:					
Gem carats	274,291	286,668	339,982	323,177	275,958
Industrial do	350,000	250,000	344,873	324,000	312,753
Gem stones, exclusive of diamonds kilograms			[7] 52.89	20.75	23.26
Graphite	25	24			
Gypsum	6,866	4,728	640	2,007	1,895
Kaolin	78	223	155	91	182
Lime	3,691	3,694	3,524	2,323	1,261
Magnesite, export	107	114	43		85
Meerschaum	14	11	18	1.2	16
Mica:					
Sheet	53	81	89	99	107
Scrap	86				
Salt thousand tons	37	35	33	30	34
Vermiculite	113	18	142	65	27
Mineral fuels: Coal, bituminous thousand tons	2	2	2	3	2

[1] Copper content of exports and local sales.
[2] Including gold in lead concentrates exported amounting to: 10,391 ounces in 1959; 8,963 ounces in 1960; and 521 ounces in 1961.
[3] Provisional.
[4] Includes corundum.
[5] Reported in cubic feet; conversion factors were: clay, 105 pounds per cubic foot; gravel, 100; sand, 90; stone, 100; and for 1961 and 1962 all 4 combined, 100.
[6] Data not available.
[7] Includes 42.2 kilograms crude ruby; 6.35, rough ruby and sapphire; 4.33, ruby bearing corundum ore. In addition, there were 1,079 kilograms of chrysoprase reported in 1961, and 363 kilograms of miscellaneous gem stones (including chrysoprase and zircon) reported in 1963.

TRADE

Provisional figures for the value of exports in 1961 and 1962 are, respectively, £7.5 million and £7.1 million,[9] the decline in 1962 being largely due to a decrease in diamond exports; likewise exports declined further in 1963, to £6.7 million.[10]

Following the usual pattern, exports of diamonds, gold, and silver in 1962 went to the United Kingdom, which thus received by far the largest share of mineral exports by value.

Mineral and metal imports in 1962 at £6.3 million were about 16 percent of the value of all imports. Refined petroleum products accounted for 59 percent of the total; iron and steel manufactures, 31 percent. Imports of cement from outside the East Africa Common Market were valued at £83,337. For more detailed information on imports see table 3.

[9] Tanganyika, Ministry of Commerce and Industry. Annual Report of the Mines Division. 1962, appendix 1(a).
[10] Source cited in footnote 7, p. 954.

TABLE 5.—Tanganyika: Exports of metals and minerals, to countries outside the East Africa Common Market

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Copper, content of concentrate	101	-------	All to Japan in 1961.
Gold, troy ounces	99,574	101,597	All to United Kingdom.
Lead, content of ore	351	-------	All to Belgium in 1961.
Silver, troy ounces	64,144	23,725	All to United Kingdom.
Tin, content of concentrate, long tons	163	206	Malaya 140; United Kingdom 66.
Tungsten, concentrate, 60 percent WO_3	3	-------	All to United Kingdom in 1961.
Nonmetals:			
Cement	15	10	All to Federation of Rhodesia and Nyasaland.
Clays, including chamotte and dinas earth.	-------	(1)	All to Zanzibar.
Diamonds:			
Gem, carats	339,982	323,464	All to United Kingdom.
Industrial, do	344,873	324,000	Do.
Gem stones (exclusive of diamonds). £ sterling	-------	6,250	United Kingdom 4,000; West Germany 2,250.
Lime	230	118	All to Federation of Rhodesia and Nyasaland.
Magnesite	43	-------	
Mica	89	99	United Kingdom 73; Netherlands 13; United States 8.
Salt:			
Curing and agricultural	586	-------	
Other, including salt for retail sale	11,857	9,809	Rwanda Urundi 7,077; Congo 2,381; Zanzibar 228; Federation of Rhodesia and Nyasaland 122.
Stone, dimension, not worked	-------	2	All to Zanzibar.
Crude minerals, not elsewhere specified. £ sterling	90	191	Do.

[1] Data not available.

Source: Same as Uganda.

COMMODITY REVIEW

METALS

Gold.—Rhodesia-Katanga Co., Ltd., which controls Geita Gold Mining Co., Ltd., decided to abandon the Geita mine because it had become difficult to operate profitably. Extraction of the remaining ore was expected to be complete by the end of 1965. Closure of the Geita, largest gold mine in Tanganyika, would be severely felt in the district. The government explored with the company possibilities of subsidizing the operation to extend the life of the mine.

At the Kiabakari mine, of Tangold Mining Co., Ltd., ore was being drawn from the 850-foot level. Development was concentrated between the 1,150-foot level and the 1,550-foot level. The future of the mine largely depends on the grade of the reserves between the levels. The company prospected outside its lease but by the end of the year had indicated that it would allow its exclusive prospecting licenses to expire.

At the Buhemba mine of Buhemba Mines, Ltd., nearly wholly owned by Williamson Diamonds, Ltd., underground work was concentrated in workings at the ends of the ore body, to maintain uniform tonnage and grade of ore going to the mill. Advice and loaned equipment from Williamson helped to improve workings and to overhaul the mill and powerplant. In time costs should be improved. Two

1,000-kilowatt generating sets had been received by the end of the year, and a new 75-horsepower hoist had been ordered. While mill recovery improved, total results for the year indicated a loss would be incurred. Plans were to mine the Hospital vein by open pit, to provide cheap ore near the mill.

In Lupa goldfield in Chunya District the last vein mine, Ntumbi Reefs, Ltd., was abandoned, and the leasers emigrated to South Africa. Working placers and buying gold is now nearly entirely in the hands of Africans, who have organized the Lupa Gold Mining Co-Operative Society, headquartered at Chunya.

In North Mara District the owners of the Mara mine also emigrated to South Africa, but a partner-leaser continued to produce successfully from small occurrences. Other companies attempted unsuccessfully to open small mines in the field. Failure in part was due to lack of understanding of the problems of the area, some of which illegal mining and gold buying complicate, due to the proximity of the Kenya border.

There was steady production of coarse alluvial gold in Nzego District, following opening of the Mpanda Closed Area to prospecting. Possibilities of establishing another cooperative society for African miners were being considered.

Tin.—Steady improvement in the price of tin during the year encouraged operators in the Karagwe tinfield, but there were local difficulties resulting from flooding of the Kagera River and from troubles in Rwanda. Tin smuggling across the border increased; it was clear that not all of the concentrate allegedly produced by small operators came from claims in Tanganyika. In addition, attempts were made to mine illegally on the lease held by Kyerwa Syndicate, Ltd. At the Kaborishoke mine of the Syndicate tonnage treated increased substantially, but sales of tin concentrate declined. It was necessary to remove low-grade material to reach richer ore below. The nearby Rwabashoga occurrence was leased to two contractors, which may discourage illegal miners in the area. No attempt was made to solve the problem of tailings disposal; compensation to local cultivators for crop damage continued. Small producers had disputes about prices and assays with the tin buyer at Kikagati; possibilities of establishing a cooperative export society were discussed but no action was taken.

NONMETALS

Cement.—Tanganyika Portland Cement Co., Ltd., began construction of a plant near Dar es Salaam and applied for a lease for limestone and clay.[11]

Diamond.—Williamson Diamonds, Ltd., the only diamond producer, is owned equally by the Tanganyika Government and De Beers Consolidated Mines, Ltd. (De Beers), the operator. Williamson has two mines, the principal Mwadui mine and adjacent Alamąsi mine of New Alamasi (1963), Ltd., which as of January 1, 1963, became a wholly owned subsidiary of Williamson.

The main treatment plant at Mwadui operated at capacity during 1963. Ground treated totaled 2,643,638 tons, and 185,088 tons was

[11] Source cited in footnote 6, p. 193.

handled by the prospect plant, of which 46,776 tons was from Alamąsi. Total recovery was 571,632 carats, equivalent to 20.55 carats per 100 tons. The corresponding figures for 1962 were 636,856 carats, equivalent to 22.77 carats per 100 tons. Summarized financial results for the year ended December 31, 1963, were as follows:

	Value in Rands [1]
Diamond account	R8,031,000
Sundry revenue	117,000
	8,148,000
Deduct: Mining and general expenses and sundry charges	3,955,000
Profit for the year	4,193,000
Deduct: Provision for taxation	916,000
Surplus brought forward and adjustments for previous year	3,277,000
	153,000
Total credit to appropriation account	3,430,000
Transfer to reserves R1,148,000; dividends R2,000,000	3,148,000
Profit unappropriated	282,000

[1] 1 Rand (Republic of South Africa) equals US$1.40.

At Mwadui mine the policy of working lower grade ground, together with heavy rainfall and difficulties with a new primary crusher resulted in treatment of a greater proportion of kimberlitic material than of clayey but rich superficial gravels. Some difficulty developed in attracting and retaining experienced technical personnel. Africans were being trained at company expense for posts in all departments but some time would elapse before they would be able to take over. Breakdowns leading to lost time and production occurred that were partly from lack of skilled supervision. Underground work in the kimberlite pipe itself was hampered by heavy inflow of water, and pumping station capacity had to be increased by 50 percent.

Acquisition of the Alamąsi Co. by Williamson made available to Alamąsi mine substantial financial, technical, and administrative facilities of the parent company. By the middle of 1963 Alamąsi was yielding an operating profit. The plant was running on three shifts with a smaller staff than previously; most were Africans. Labor relations were greatly improved.

During the year Williamson surrendered two-thirds of the lands over which it held exclusive prospecting rights; but elsewhere the company continued to prospect for kimberlite pipes. Possibilities for finding another large diamond mine thus have not been completely exhausted according to the Mines Division of Tanganyika.[12]

The Belgian diamond prospecting company known as INTERFOR ceased operations in Tanganyika on December 31, 1963. An extensive prospecting campaign in the Mara and Dodoma areas had disclosed nothing to warrant further expenditures.

[12] Tanganyika, Ministry of Commerce and Industry. A Review of the Mining Industry in 1963. Mines Division, mimeographed paper, 1963, p. 5.

During the year individuals were granted authority to prospect for diamonds outside areas reserved to Williamson, but little or no significant work was done.

Mica.—The Uluguru and Kikeo Mica Mining Co-Operative Societies hold mining leases in the Uluguru Mountains. Much of Tanganyika mica production in 1963 came from the operations. Most of the miners are also cultivators, so that as usual output fluctuated seasonally. Once during the year the miners clearly indicated that they wished to bypass the buying firms in Morogoro and to sell the mica directly overseas. Wiser counsels prevailed when they became aware of financial and other problems involved.

Salt.—During the year improvements to the Uvinza Salt Works by Nyanza Salt Mines, Ltd., resulted in brine being drawn from drill holes with a density higher than that of natural springs. Brine reservoirs were roofed so that the rainy season could no longer adversely affect production. Potential demand for salt in Central Africa is very large, and the Uvinza Salt Works can now meet any foreseeable increased demand, according to the Mines Division.

At Utondwe and Bagamoyo, H. J. Stanley and Sons, Ltd., were the largest producers of salt by solar evaporation of sea water. The company has pioneered mechanical methods of salt cropping in Tanganyika. The processes have not yet been perfected due to the corrosive conditions under which the machines work.

At most other coastal saltworks, production was normal, but at times was reduced by unseasonable rains. The recently completed Ruvu-Mnyusi rail link would help these other producers to cut transportation costs and improve inland distribution of salt, according to the Mines Division.

MINERAL FUELS

Coal.—A new inclined shaft at Ilima Colliery in the Rungwe district improved coal extraction. The market for Ilima coal was restricted to local tea estates.

Petroleum.—While BP-Shell Petroleum Co. of Tanganyika, Ltd., did no fieldwork during 1963, studies were made of previous geophysical and geological investigations for planning a field program to prove structures suitable for drilling in 1964.[13] The company renewed its exploration license but over an area reduced to 137,270 square kilometers compared with the large area originally held along the coastal belt.

Ente Nazionale Idrocarburi (ENI), controlled by the Italian Government, concluded an agreement with the Tanganyika Government for construction at Dar es Salaam of a petroleum refinery, having initial annual crude capacity of 600,000 tons. The company organized to own and operate the refinery was Tanganyikan Italian Petroleum Refining Co. (TIPER). ENI was to furnish the capital to build the refinery but the Tanganyikan Government was holding an option to acquire a 50 percent interest in it.[14]

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[13] Source cited in footnote 12.
[14] Industries et Travaux D'Outremer. 11e Année. No. 121, December 1963.

UGANDA

Since 1958 the principal product by value of the small mineral industry has been blister copper, which reached a record peak in 1963. Besides cement, and rock quarried for road and other construction (about 95,000 tons in 1963), important quantities of beryl and small quantities of some 10 additional minerals and metals generally are also produced. Beryl resources are reported to be important;[15] this beryl and a large deposit of apatite and accessory pyrochlore appear to be the most significant mineral resources known in Uganda. The apatite is particularly important if export markets for the mineral are developed.

The value of Uganda mineral production in 1963 registered little change from 1962, respective values being £4.5 million[16] and £4.4 million. The value in 1962 was approximately 2.2 percent of the gross national product estimated for that year (US$475 million).[17]

In 1962 blister copper contributed more than 78 percent of the total value of mineral production and cement more than 14 percent. Mineral exports in 1962 at £3.8 million were about 9.7 percent of total domestic exports of £39.2 million, and 97 percent was copper. In 1961, the most recent year for which information is available, the average number of persons employed in mineral industry in Uganda was 5,546 Africans, 178 Asians, and 193 Europeans.

In 1961 Hunting Surveys, Ltd., of Great Britain, under contract to the Uganda Government, began an airborne geophysical survey of three regions in Uganda, totaling about 31,080 square kilometers, which was completed in 1963. Eighty-five percent of the cost of the survey was met by the U.N. Special Fund.

The agreement with the Special Fund provided that results of the survey would be published by the Uganda Government to insure maximum benefit to the economy of the country by making the results widely available. The first of several reports to be issued was published in December 1962.

The agreement also committed the Geological Survey of Uganda to a ground-followup program of work for at least 3 years, consisting of detailed ground geochemistry and geophysics. Results are available in Uganda for inspection. The followup in area C/D was completed in 1963 and was to be open to prospecting in 1964. Followup work elsewhere continued under the supervision of the Geological Survey.

GOVERNMENT POLICIES AND PROGRAMS

In 1963 the new Uganda Government encouraged foreign investors to participate and assist in the economic growth of the country. With that objective, Uganda offers several special tax and tariff concessions. The main government instrument to attract foreign investment is Uganda Development Corp., Ltd. (UDC). The Development Divi-

[15] Uganda Protectorate. Annual Report of the Mines Department. 1961. Government Printer, Entebbe.
[16] Mining Journal (London). Mining, Annual Review. June 1964, p. 193.
[17] Statistics and Reports Division. Agency for International Development. Estimate of Gross National Product. May 5, 1964.

sion of UDC explores opportunities for new investments of all kinds and joins with private capital in new ventures. The largest foreign private investment in Uganda at yearend was in Kilembe Mines, Ltd. (copper), which UDC materially helped to establish.

Despite the favorable attitude of the government, relatively little new investment has occurred in Uganda since October 1962 when the country became independent. The reason frequently given was uncertainty resulting from the approaching independence of contiguous Kenya because Uganda is landlocked and most of its exports are through the Kenya port, Mombasa.

SOURCE MATERIAL

Source material on Uganda comprised mainly trade journals, reports of various departments of the Uganda Government, and dispatches of the U.S. Embassy at Kampala—particularly the airgrams. For commodity reviews the annual review for 1963 of the Mining Journal (London), was particularly useful. The annual review was the source of production figures for 1963.

PRODUCTION

During 1959–63 the value of Uganda mineral production, exclusive of rock quarried for road and other construction, ranged from £4.0 million in 1959 to the peak for the period of £4.5 million in 1963. Eleven minerals were produced in 1963 virtually unchanged in kind since 1959, except that no lead was produced after 1959 and no mica in 1963. Small-scale mining in the Kigezi district, suspended in 1954, was resumed on trial in 1961 and suspended again in 1962.

TABLE 6.—Uganda: Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963[1]
Metals:					
Beryl	213	426	1,031	920	380
Bismuth ore, metal content—kilograms	8,680	1,650	650	50	18
Columbium-tantalum concentrates—do	2,388	2,370	7,366	13,087	9,150
Copper, blister	12,135	14,748	13,374	15,577	16,218
Gold—troy ounces	344	642	355	232	48
Lead, content of concentrate	54				
Lithium minerals (amblygonite)			23	20	48
Silver (exports)—troy ounces	54	109	70	39	[2] 40
Tin, content of concentrate—long tons	36	32	33	67	168
Tungsten concentrate, 60 percent WO_3 basis	[3] 13	[3] 76	[3] 220	[3] 95	2
Nonmetals:					
Cement	81,621	72,187	62,920	55,936	55,161
Lime	9,776	15,410	14,111	16,431	10,777
Mica, splittings—kilograms			386	83	
Phosphate (apatite)	3,171	4,073	401	616	7,072
Salt—thousand tons	9	5	7	3	3

[1] Mining Journal (London). Annual Review 1963. June 1964, p. 193.
[2] Estimate.
[3] Exports.

TRADE

Exports.—The value of mineral exports in 1961 and 1962 was, respectively, £3,215,256 and £3,810,510, contributing, respectively, 8.2 and 10.1 percent to total domestic exports of £39.2 and £37.6 million. In 1962 copper, which comprised nearly 95 percent of mineral exports, went principally to Spain (11,757 tons out of 15,799 tons exported). By November 1963, it was evident that exports to South Africa had sharply declined.

Imports.—Mineral imports in 1962 were valued at £3.4 million, nearly 13 percent of the value of all imports from outside the East African Common Market. Refined petroleum products and iron and steel semimanufactures accounted for, respectively, 65 percent and 17 percent of mineral imports. For greater detail on imports, see table 3. No figures were available to determine the effect of the Uganda ban on imports of South African products.

TABLE 7.—Uganda: Exports of metals and minerals, to countries outside the East Africa Common Market

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Copper, blister	13,137	15,788	Spain 11,757; Belgium 1,829; Italy 1,219; India 983.
Gold, troy ounces	453	412	All to United Kingdom.
Tin, concentrate, long tons	42	87	Do.
Tungsten, concentrate	192	--	
Other ores and concentrates of base metals, not elsewhere classified	901	996	United States 871; Japan 71; France 50.
Nonmetals:			
Cement	345	737	Sudan 660; Republic of the Congo 77.
Lime	6	4	All to Republic of the Congo.
Salt	1,145	671	Rwanda-Urundi 338; Republic of the Congo 333.
Minerals, crude, n.e.c. £sterling	150	1,379	West Germany 1,089; United Kingdom 290.
Building material, asbestos	53	89	Zanzibar 80.

Source: East African Common Services Organization; East African Customs and Excise; and Annual Trade Report of Kenya, Uganda, and Tanganyika. For years ended December 31, 1961 and 1962.

COMMODITY REVIEW

METALS

Beryl.—Production of beryl declined for the third year in succession because of low prices. Output in 1963 was less than 37 percent of that attained in 1961, when Uganda was the second largest beryl producer in the world after Brazil, contributing more than 9 percent of output.

Uganda beryl, containing about 11.5 percent BeO, comes principally from the Kigezi and Ankole Districts, from which total output during the 10-year period 1952–61 was 2,122 metric tons, of which Kigezi contributed 37 percent; Ankole, 63 percent.[18] Insofar as adequacy of resources are concerned, the future for beryl in Uganda appears good. The Annual Report of the Mines Department of Ugnada for 1961 stated in effect that production at the rate achieved in 1961 should be possible for some time.

[18] Mines Department, Uganda Protectorate. Annual Report. 1961, p. 3.

Columbium.—Tororo Industrial Chemicals & Fertilizers, Ltd., was expected to begin production of pyrochlore from apatite tailings late in 1964. The development is discussed under phosphate.

Copper.—Kilembe Mines, Ltd., financed largely in Canada, came into production in 1956, and has since accounted for virtually all Uganda copper production. At Kilembe the mine and concentrator are situated in a steep-walled valley in the foothills of the snow-capped Ruwenzori Mountains. The company generates its own hydroelectric power. Concentrates are conveyed by pipeline, largely by gravity, about 13 kilometers to Kasese, the railway terminus. From Kasese the concentrates are shipped by rail 435 kilometers to the company electric smelter at Jinga, power for which is supplied from the Owen Falls Station of the Uganda Electricity Board situated on the Victoria Nile a short distance downstream from Lake Victoria, the source of the Victoria Nile.

Kilembe was the sole copper producer in 1963. The company established a new record output, producing 16,216 metric tons of blister copper, having an estimated value of £3,630,256. From the mine, 1,004,170 tons of ore was sent to the mill, and a further 5,023 tons of ore from the oxide zone was sent directly to the smelter. The oxide opencut was exhausted during the year. Development totaled 16,297 meters. Development in the Bukangama section was mainly to prepare a large stope block and to explore on the 6,600-foot level. The 2,050 crosscut on the 4,500-foot level intersected ore. It was announced that an ore body containing at least 2.5 million tons had been discovered. The development insures continuation of the operation at least until 1973 or 1974.

Kilembe carried out considerable surface exploration in two areas. Results were negative.

Tin.—Production of tin ore increased to 233 long tons from 104 tons in 1962. Production was by small operators in Southwest Uganda, where vein and detrital tin deposits are widespread. In some areas water shortage hampers operations.

Tungsten.—Only one small hydraulic mine operated during the year. The government set up a commission to investigate measures to aid Ugandan tungsten miners, and a report was submitted.

NONMETALS

Cement.—Uganda Development Corp., Ltd., reported that the downward trend in cement sales caused by the building recession appeared to have halted in 1963. Any upward trend that might develop was not expected to be rapid. Production in 1963 by Uganda Cement Industry, Ltd., controlled by Uganda Development Corp. and the only cement manufacturer in Uganda, was 55,161 metric tons, compared with 81,621 tons in 1959.

Phosphates.—In the Sukulu Hills near Tororo in Eastern Uganda are large deposits of apatite with accessory pyrochlore. The deposits consist of apatite-pyrochlore-bearing soil, derived from underlying carbonatite. Reserves of the ore have been estimated at more than 200 million tons. The apatite is nearly pure theoretically and can be

concentrated into a product containing from 40 to 42 percent P_2O_5.[19] The deposits perhaps are the most important mineral resource presently known for Uganda. Interest in their possibilities dates back to 1945 or earlier.

Sukulu Mines, Ltd., and Tororo Industrial Chemicals & Fertilizers, Ltd., both subsidiaries of Uganda Development Corp., exploited the Sukulu deposits and manufactured superphosphate. Production of apatite concentrates and superphosphate in 1963 was, respectively, 7,072 metric tons and 7,288 tons, both figures representing substantial increase from 1962. It was expected that output would expand further in 1964. Planned annual production was to be 25,401 tons of superphosphate and 88,904 tons of soil, from which 14,123 tons of apatite would be produced. The sulfuric acid plant has a capacity of 10,669 tons per year. It was also expected that pyrochlore would be produced from apatite tailings in 1964.

Busumbu Mines, Ltd., continued to produce on a small scale. The ore was screened and shipped to Kenya for conversion to superphosphate.

MINERAL FUELS

Uganda lacks fuel resources other than wood, and the outlook for improvement of the deficiency in mineral fuels is not encouraging. All requirements therefore must be met by imports. However, the Owen Falls hydroelectric development on the Victoria Nile can supply more than sufficient electric power for present needs, and virgin water powers suitable for development exist elsewhere on the Nile.

[19] Ministry of Economic Affairs, Uganda. Uganda, the Background to Investment. Brochure, 1962, p. 38.

The Mineral Industry of Liberia

By Thomas C. Denton [1]

THE outstanding event in the Liberian mineral industry in 1963 was the formal opening of the iron ore mine and harbor facilities of Liberian American-Swedish Minerals Co. on November 15. President Tubman officiated, and there were present Prince Bertil of Sweden and business and financial leaders from Sweden, West Germany, and the United States.

Iron ore mining has become the foundation of the domestic mineral economy and a significant contributor to world iron ore supply. Production has increased each year since 1957 and in 1963 reached over 6.5 million metric tons, about 2 percent of world output that year exclusive of production from Communist countries. Production ultimately may reach the order of 20 million tons annually insofar as adequacy of ore reserves is concerned. Besides the iron ore and substantial quantities of construction materials, additional mineral output in 1963 was limited to small quantities of diamonds and gold; however, exports of diamonds produced outside Liberia were large.

As a result of expansion in iron mining, in 1961 Liberian mining industry ranked first, ahead of rubber, in foreign exchange earnings. It ranked second after the rubber industry in employment; however, employment data are incomplete. In 1961, the most recent year for which complete trade statistics are available, iron ore exports of US$29.4 million [2] were nearly 50 percent of the value of all domestic exports and nearly 22 percent of the estimated gross national product of Liberia in 1962 (US$136 million). In 1963 the share of iron ore in the value of exports presumably was much larger inasmuch as the volume of ore exports increased nearly 125 percent over the volume in 1961. It is estimated that in 1963 around 20,000 unskilled laborers were employed by mines and by construction companies working on projects for mining companies.

West African Explosives and Chemicals Ltd. (EXCHEM) plans to manufacture explosives in Liberia early in 1964. EXCHEM will be the first company to produce explosives in West Africa. Its new type of explosive could reduce blasting costs significantly.[3]

Persistent rumors that iron ore exploration in the Putu range would be renewed were given fresh impetus when President Tubman announced the Government hoped to aid the project. Reportedly, an option was granted late in 1962 to Martin Hofer, a Swiss citizen who

[1] Africa specialist, Division of International Activities.

[2] The practice of the Bureau of Statistics of Liberia is to value iron ore exports uniformly at US$10.60 per long ton. U.S. Embassy, Monrovia, Liberia. Minerals Production Statistics Questionnaire. Airgram A-280, May 2, 1962.

[3] International Commerce Business Bulletin. May 11, 1964.

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obtained financial backing from the H. L. Hunt Co., which owns the Hunt Oil Co. (U.S.). The Putu area was explored to some extent by Liberian American-Swedish Minerals Co. (LAMCO) but was abandoned when LAMCO prospectors discovered the Nimba deposit.

In November 1963 the Free Port of Monrovia berthed the largest ship ever to call at the port. The motorship *Strassburg*, an ore carrier of 38,300 tons and 720 feet long, spent 3 days at the German-Liberian Mining Co. pier loading LMC ore for West Germany. It was announced that a US$200,000 dredging project would be undertaken to permit the port to handle even larger ore carriers.[4]

GOVERNMENT POLICIES AND PROGRAMS

The climate for investment in Liberia remained good. The Government has indicated that it intends to maintain its traditional open-door policy to foreign investment. At the same time the Government has made clear that it will press demands for additional training and employment of Liberians at all levels by foreign enterprises operating in Liberia.[5]

The Bureau of Natural Resources and Surveys includes the Mining Service, the Geological Survey, and the Cartographic Service. The following are some activities of these departments during the Liberian fiscal year ended August 31, 1963. The Chief of the Mining Service and his staff were mostly engaged in surveying mining claims and issuing various classes of licenses. Insufficient funds and staff prevented the Service from providing hundreds of gold and diamond miners the technical advice they needed. No drilling was done because funds were lacking for maintenance and replacement of equipment.

The Geological Survey was mainly engaged in mapping an area extending about 40 kilometers (25 miles) on either side of the Monrovia-Veinjama highway. The Survey also periodically checked the weightometers of Liberia Mining Co. and National Iron Ore Co.

Under the general agreement of October 6, 1955, a project agreement was executed between the Governments of Liberia and the United States for a Technical Assistance program under which modern topographic map coverage of Liberia will be undertaken; later geologic mapping will be done. The program includes on-the-job training of Liberians in the United States. The program will require 4 to 5 years to complete and will cost an estimated US$4.2 million, according to the Liberian Bureau of Natural Resources and Surveys.

SOURCE MATERIAL

Besides information gained by the author during visits, this chapter is mainly based on dispatches of the U.S. Embassy in Monrovia, articles in trade journals, and information supplied by official publications of the Government of Liberia, particularly the annual report of the Bureau of Natural Resources and Surveys for the year which ended August 31, 1963.

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[4] U.S Embassy, Monrovia, Liberia. Economic Summary for Liberia for the Fourth Quarter of 1963. Airgram A–197, Jan. 27. 1964.
[5] International Commerce. V. 70, No. 27, July 4, 1964, p. 58.

PRODUCTION

The outstanding aspect of Liberian mineral industry in recent years has been the steady increase in iron ore production. At the end of 1963 the boom seemed certain to continue for some years. Of significance also was the start in 1963 of mechanized diamond mining. Liberia's neighbors on all sides are important diamond producers, and it may be that Liberia will join their ranks in due course.

TABLE 1.—Metal and mineral production

Commodity	1959	1960	1961	1962	1963
Metals:					
Gold [1] ---troy ounces	1,401	1,036	2,088	2,184	2,100
Iron ore ---thousand metric tons	2,689	3,051	3,251	3,607	[2] 6,557
Nonmetals:					
Diamonds: [2]					
Gem ---carats	470,000	577,000	596,000	224,715	[3] 239,556
Industrial ---do	500,000	400,000	500,000	680,000	[3] 507,865
Total ---do	970,000	977,000	1,096,000	904,715	[3] 747,421

[1] Estimate.
[2] Exports. Breakdown of total by quality estimated, except for 1963.
[3] Year ended Aug. 31, 1963.

TRADE

In 1960 and 1961, the value of exports of domestic merchandise was US$79.5 million and US$59.2 million, respectively. Exports of iron ore in 1960 of US$34.6 million contributed 44 percent of the total and nearly 50 percent at US$29.4 million in 1961. In 1960 diamond accounted for a further contribution by minerals of 3 percent, and in 1961, 4 percent. More recent data on diamond are not available, but information on company exports of iron ore is given under commodity review.

Imports in 1960 and 1961 were valued at US$69.2 million and US$90.7 million, respectively. Imports of metals, minerals, and mineral fuels in those years totaled, respectively, US$8.0 million and US$11.5 million, of which US$3.1 million comprised petroleum products. Imports in 1962 of iron and steel semimanufactures were US$5.5 million, and 65 percent of metal and mineral imports exclusive of petroleum products. The United States in 1961 was Liberia's major supplier of iron and steel semimanufactures and of petroleum products except gas-diesel oil of which Iraq furnished 59 percent.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	Principal destinations, 1961
Metals:			
Copper, ore and concentrate	----------	127	All to Italy.
Iron and steel:			
Iron ore and concentrate. thousand tons	2,962	2,837	Netherlands 1,146; United States 481; United Kingdom 412; Italy 329; West Germany 231.
Semimanufactures	34	----------	
Zinc, semimanufactures	41	10	All to Republic of Guinea.
Nonmetals:			
Cement	1	130	Mainly to Republic of Guinea.
Diamond carats	976,497	1,095,632	Belgium 959,500; Israel 26,233; Switzerland 24,706.
Mineral fuels:			
Petroleum and petroleum products:			
Gasoline 42-gallon barrels	5,119	78	Ghana 48; Sudan 30.
Kerosine do	101	10	All to Republic of Guinea.
Gas-diesel oil do	1,010	24	Do.
Lubricating oils do	----------	16	All to Sierra Leone.

Note: Items listed are foreign merchandise except iron ore and concentrate, and copper ore and concentrate.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	Principal sources, 1961
Metals:			
Aluminum and aluminum alloys:			
Unwrought	2	1	All from United States.
Semimanufactures	337	462	Sweden 262; United States 124; United Kingdom 42.
Copper, unwrought and semimanufactures.	437	459	United States 442; Netherlands 13.
Iron and steel:			
Pig and sponge iron	----------	11	All from West Germany.
Ferroalloys	1	----------	
Bars, rods, angles, and shapes	4,287	7,816	United States 1,834; United Kingdom 1,433; Netherlands 1,324.
Plates and sheets:			
Uncoated	1,422	5,380	United States 2,959; United Kingdom 1,332; West Germany 443.
Coated	1,539	4,263	United Kingdom 2,084; United States 1,075; Netherlands 675.
Hoops and strips	269	706	United Kingdom 273; United States 250; West Germany 135.
Rails and railway track material.	5,430	1,783	United States 811; United Kingdom 433; Sweden 290.
Wire rods	2	11	United States 8; West Germany 2; United Kingdom 1.
Tubes, pipes, and fittings	3,005	6,815	United States 3,519; United Kingdom 1,329; Sweden 718.
Castings and forgings	337	350	Mainly from United States.
Lead and lead alloys:			
Unwrought	113	2	Mainly from Sweden.
Semimanufactures	113	331	United Kingdom 106; United States 83; Sweden 78.
Nickel and nickel alloys:			
Unwrought	103	(1)	All from United States.
Semimanufactures	----------	14	Mainly from Japan.
Silver, unwrought and semiwrought	----------	(2)	Mainly from Switzerland (based on value).
Tin:			
Unwrought ---------long tons	20	(1)	All from West Germany.
Semimanufactures ---------do	22	13	Mainly from West Germany.
Zinc and zinc alloys:			
Unwrought	2	9	Mainly from Belgium.
Semimanufactures	2,025	2,944	United Kingdom 944; Belgium 570; United States 553.
Other nonferrous metals and alloys	392	174	West Germany 120; Italy 33.
Nonmetals:			
Cement	50,981	57,488	Sweden 8,954; Belgium 7,503; Israel 7,135; West Germany 6,819; Italy 5,674.
Clays	5	161	All from United States.
Lime	341	340	United States 97; Italy 94; United Kingdom 54; Sweden 46.
Salt	1,539	755	West Germany 408; United Kingdom 170; United States 58.
Sand and gravel	10	----------	
Slate	(1)	12	All from Sweden.
Stone:			
Dimension	5	2	All from West Germany.
Other	----------	(1)	All from Netherlands.
Mineral fuels:			
Coal, coke and briquets	55	88	Mainly from Italy.
Petroleum and petroleum products:			
Asphalt, etc	130	45	United States 23; West Germany 6; United Kingdom 5.
Gasoline ------42-gallon barrels	174,391	217,970	United States 130,317; Iraq 84,671.
Kerosine ----------do	50,281	32,550	United States 22,443; Iraq 8,687.
Gas-diesel oil ----------do	255,781	192,179	Iraq 113,988; United States 77,394.
Lubricating oils ----------do	10,442	16,645	United States 8,500; Netherlands 7,110.
Other oils ----------do	14	7	Mainly from United States.
Petrolatum ----------do	5	12	United States 8; United Kingdom 4.

[1] Less than 1 metric ton.
[2] Data not available.

COMMODITY REVIEW

METALS

Gold.—Up to August 31, 1963 no improvement in gold mining had occurred. A diamond rush occupied most gold prospectors and miners, who are familiar with hand placer mining methods applicable to primitive diamond mining in Liberia. Gold sales to the Bank of Monrovia amounted to 1,960 ounces. The figure is the only one available with respect to production, much of which goes to local goldsmiths and is not recorded.[6]

Iron Ore.—As indicated previously, iron ore production in Liberia in a few years may well be around 20 million tons of marketable product annually. In that event Liberia would rank about fifth after France among iron ore producers exclusive of Communist countries on the basis of relative country positions in 1963. At the end of 1963 three companies were producing ore and a fourth was preparing for production. All of the mines are open pit operations.

Liberia Mining Co., Ltd. (LMC).—The company operation is some 64 kilometers north of the Free Port of Monrovia to which it is connected by 3 foot 6 inch-gage railroad and through which the ore is exported. LMC, controlled by Republic Steel Corp., began shipments in 1951 and since has produced steadily and in generally rising volume. Exports in 1963 were as follows:

	Metric tons
Lump	1,203,420
Concentrates	1,139,795
Fines	251,787
Total	2,595,002

National Iron Ore Co., Ltd. (NIOC).—The company is owned 50 percent by the Liberian Government and 35 percent by Liberian citizens. The remaining 15 percent LMC controls.[7]

The NIOC mine is some 80 kilometers by rail easterly from LMC's mine. Concentrates comprise the great bulk of production. The first shipment was made in December 1961, through the port of Monrovia. Exports in 1963 totaled 2,105,207 metric tons. When fully equipped, the annual production capacity of the operation will be about 4 million tons of marketable ore.[8]

Liberian American-Swedish Minerals Co. (LAMCO).—The LAMCO iron ore concession at Nimba in the Nimba Mountains on the Guinea border is exploited jointly by LAMCO (75 percent) and Bethlehem Steel Corp. (25 percent), through the LAMCO Joint Venture Operating Co. LAMCO in turn is owned equally by the Liberian Government and Liberian Iron Ore, Ltd. (LIO), a Canadian holding company controlled by a Swedish syndicate in which are a group of Swedish companies. Under a special agreement, management of

[6] Republic of Liberia Bureau of Natural Resources and Surveys. Annual Report for the period Sept. 1, 1962–Aug. 31, 1963, p. 11.
[7] U.S. Embassy, Monrovia, Liberia. Economic Summary for the First Quarter of 1961. Dispatch 349, May 3, 1961.
[8] U.S. Embassy, Monrovia, Liberia. Dispatch 141, Dec. 11, 1961.

LAMCO Joint Venture Operating Co. is in the hands of the Grangesburg Co. of Stockholm.[9]

LAMCO made its first commercial ore shipment in August of 1963 and by yearend had exported 1,797,445 tons. The targets for 1964 and 1965 are 7 million tons and 7.5 million tons, respectively. Reportedly, by 1970 exports could be stepped up to 12 million tons annually insofar as capacities of facilities involved are concerned.

The ore is shipped through the artificial port of Buchanan, to which the mine at Nimba is connected by 265 kilometers of U.S. standard gage (4 feet 8½ inches) railroad, the widest gage railroad in Africa south of the Sahara. (Gages elsewhere are 3 feet 6 inches and 1 meter.) Equipment and grades on the line are such that 9,000-ton-ore trains can be run to the port. At the port ships can load 45,000 tons of ore, and the harbor is being deepened to handle larger carriers.

The LAMCO project was carried out as a unit, comprising equipping the mine for production and constructing the railroad and the artificial port, where a breakwater was run out into open ocean 1.9 kilometers. The start of ore exports through the port represented the successful conclusion of the largest industrial project undertaken in Africa to the present time. The project is expected to yield some 300 million tons of direct shipping ore. The cost was some US$220 million. The U.S. company, Raymond International, built the railroad and harbor.

German-Liberian Mining Co. (DELIMCO).—The company is owned equally by the Liberian Government and Gewerkschaft Exploration, largely controlled by the Thyssen interests.[10] Through Bong Mining Co., which will manage the operations, DELIMCO is preparing to mine and concentrate low-grade iron ore situated some 80 kilometers easterly from Monrovia. Besides preparing the mine for production and building a concentrator, the project includes constructing an 80-kilometer railroad to Monrovia and a finger pier at the port. Production of 3 million tons of concentrate per year is expected to begin by the end of 1964 and eventually be increased to 5 million tons.[11]

Liberians are being trained for skilled work both on the job and in West Germany.

Representatives of the West German steel industry who visited Liberia in 1963 stated that when the DELIMCO project is operating, West Germany will become Liberia's largest customer for iron ore. West German firms already have made long-term contracts for Liberian ore.[12]

NONMETALS

Diamonds.—While not recorded, it is known that the diamond production of Liberia has been very small. The substantial exports recorded in recent years have been nearly exclusively diamonds which enter Liberia from adjacent countries (mainly Sierra Leone and Guinea) for sale to buyers in Monrovia. The following official data are for exports by Monrovia diamond buyers (15 in all) during the

[9] Work cited in footnote 4.
[10] U.S. Embassy, Monrovia, Liberia. Dispatch 208, Feb. 23, 1962.
[11] Engineering and Mining Journal. V. 165, No. 1, January 1964, p. 63.
[12] Canadian Mining Journal. V. 85, No. 2, February 1964, p. 164.

year ended August 31, 1963, which by value were 13 percent higher than in the previous year:

	Carats	Value, U.S. dollars
Exports:		
Gem diamond	239,555.92	2,976,775.24
Industrial diamond	507,865.15	1,270,603.89
Total	747,421.07	4,247,379.13
Government revenue:		
Royalty collected		637,122.08
License fees		27,708.34
Total		664,830.42

The official values shown, on which royalty is computed, are one-fifth of the price paid by buyers, according to the Bureau of Natural Resources and Surveys of Liberia.[13]

The Director of the Bureau of Natural Resources and Surveys announced that effective January 1, 1964, the President had approved an increase in the price of the diamond-buying license from US$2,500 to US$10,000 per year.

In February 1963 President Tubman dedicated the diamond mine of Liberian Swiss Mining Corp. at Williamstown. It is Liberia's first fully mechanized diamond mine. Swiss capital is largely involved in the venture. The British provided the planning, engineering, management, technicians, and equipment.[14]

[13] Work cited in footnote 6, appended table.
[14] U.S. Embassy, Monrovia, Liberia. Economic Summary for Liberia for the Fourth Quarter of 1963. Airgram A–328, June 30, 1963, p. 24.

The Mineral Industry of Libya

By Taber de Polo[1]

CRUDE oil production has become the backbone of the Libyan economy and is likely to hold that position for many years to come. It accounted for more than 98 percent of foreign exchange earnings to the country in 1963. Libya has become a major source of petroleum supply and has the advantages of relatively low production costs and of accessibility to Western European markets. The reserve was estimated to be from 4 to 8 billion barrels in 1963; new fields were being discovered regularly, and existing fields were being extended. Throughout 1963, the major oil boom continued in this country where 8 years ago there was no positive indication of oil. During the first half of 1963, Libya produced 1.6 percent of the free world crude petroleum and supplied 3.5 percent of total petroleum export trade. This compares with 0.08 percent of total production and 1.9 percent of export trade in 1961—a remarkable expansion considering that the first oil was discovered in June 1959 and that exports did not commence until September 1961.

Employment of Libyans directly related to oil company activity is estimated to have been around 12,500, approximately 4 percent of the paid labor force.

Other mineral activities in Libya included production of minor amounts of lime and salt. Deposits of iron ore, gypsum, magnesite and potash are known.

GOVERNMENT POLICIES AND PROGRAMS

In 1953, the Government of Libya enacted special mineral legislation (Minerals Law No. 9 of 1953) to deal with the few known exploitable mineral resources, primarily petroleum, iron ore, and potash. Separate legislation (Petroleum Law No. 25 of 1955 and subsequent amendments) was enacted for petroleum.

The lowering of tariffs early in 1963 on foodstuffs, industrial machinery, plant equipment, and parts was evidence of the Libyan Government efforts to stimulate foreign trade and business participation—one aspect of the 5-year plan for economic development initiated during the year. Also, in connection with its development plans the Libyan Government adopted a system for registering consulting engineering firms qualified to assist with development projects.

On July 28, amendments to the basic petroleum law were adopted abolishing the Petroleum Commission. Functions formerly exercised

[1] Foreign mineral specialist, Division of International Activities.

by the Commission will now be handled by the Ministry of Petroleum Affairs, advised by an interministerial Supreme Council for Petroleum Affairs.

PRODUCTION

Complete and fully reliable data on mineral production in Libya are not available. No production of metalliferous ores or metals has been reported and none has occurred so far as can be determined. Recorded output of nonmetals excludes production of construction materials and salt by local inhabitants for their own use. There has been no production of mineral fuels aside from crude petroleum.

TABLE 1.—Production[1] of minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Brick---thousand bricks	9,000	10,800	11,000	11,000	(2)
Lime	15,000	17,000	18,000	19,800	(2)
Natron	100	100	1,000	1,000	(2)
Salt---thousand tons	16	14	11	16	19
Stone, crushed[3]---do	200	250	250	250	(2)
Mineral fuels: Petroleum, crude thousand 42-gallon barrels	----------	----------	6,642	67,052	167,015

[1] Data are approximate except for petroleum.
[2] Data not available.
[3] Rock for concrete and road construction; apparently includes gravel.

TRADE

In 1963 Libya achieved a surplus in its balance of trade for the first time. For the first 9 months this was more than L£25 million, and oil was almost 99 percent. The total value of imports into Libya in 1962 was L£73,444,000. Total value of exports was L£49,016,000; crude petroleum was L£46,966,000 or 96 percent.[2] [3]

The value of Libya's imports has kept pace with the increasing surplus in balance of trade stemming from oil exports. Oil companies were largely responsible; they imported goods in the amount of L£24,837,000, 34 percent of all imports in 1962.

In 1963 Italy just maintained first place as a supplier to Libya with 20.5 percent of the market. The United States was second with 19.9 percent. Corresponding figures for 1962 are Italy, 24 percent; United States, 19.4 percent.

In May Libya signed a trade agreement with the Communist countries in east Europe that involves, primarily, exporting foodstuffs in return for machinery and textiles.

Early in 1963, Libya, being assured of revenues from oil, substantially cut tariff rates on several items, predominately foodstuffs. High tariffs were continued on luxury goods. Exemption from all duties was granted to agricultural equipment and certain supplies used in agriculture, to petroleum and petroleum development equipment, and to capital equipment for new industries.

[2] Ministry of National Economy, Census and Statistical Department, Tripoli. External trade statistics 1962, 401 pp.
[3] L£1=US$2.80.

TABLE 2.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum	186	228	Italy 219.
Copper	47	61	Italy 45; Belgium 7.
Iron and steel: Tubes, pipes, and fittings.	54,278	98,077	Germany (not further specified) 38,044; Italy 26,823; United Kingdom 16,437 United States 6,714; Japan 3,933.
Lead	11	40	Netherlands 33; Germany 5.
Nickel	15	1	All from United Kingdom.
Silver, platinum, and other platinum group metals. troy ounces	(1)	[1]86,776	United Kingdom 58,354; Germany 22,538.
Tin long tons	9	6	United Kingdom 4; Netherlands 1.
Zinc	187	259	Belgium 113; Germany 87; Italy 58.
Miscellaneous nonferrous base metals	2	129	United States 48; United Kingdom 30; Italy 29.
Nonmetals:			
Cement	157,124	241,055	Rumania 56,722; Yugoslavia 43,249; Bulgaria 23,203; Belgium 18,714; Greece 17,636.
Fertilizers	13,461	17,166	Italy 7,321; Netherlands 4,858; Germany 3,759.
Lime	5,960	9,743	Italy 9,378.
Marble and other calcareous building stone.	3,984	12,390	Italy 3,976.
Salt	36	20	All from United Kingdom.
Other crude minerals	3,974	15,392	Italy 6,194; Greece 5,610; United Kingdom 1,026.
Mineral fuels:			
Coal and coal products	38,369	6,180	United States 5,860.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	455	567	United States 264; France 186.
Kerosine do	143	180	United States 84; France 63.
Gas oil do	655	672	United Kingdom 375; France 237; Italy 88.
Fuel oil do	46	49	United States 32.
Lubricants do	43	49	United States 25; France 11; United Kingdom 10.
Asphalt do	125	90	Italy 78.
LP gases do	--------	19	All from Italy.
Total do	1,467	1,626	

[1] Quantity not available for 1961; imports were valued at US$407,539 in 1961, compared to US$86,976 in 1962.

COMMODITY REVIEW

METALS

Iron Ore.—In August 1962 a mineral concession was granted for exploration and exploitation of iron-ore deposits of the Shatti Valley, Fezzan. No iron ore has been produced and estimates of potential reserves have not been published.

NONMETALS

Cement.—Raw materials for cement occur in Libya in sufficient quantity for its present needs, but these resources have not been exploited. During the third quarter of 1963, the Industrial Development Organization agreed on a L£100,000-Government contribution towards financing a cement plant in Tripoli. The construction boom in Libya stimulated importation of cement; 1962 imports were valued at L£1,373,605. The completion and operation of this proposed plant should prove a stimulus to Libyan economy.

Gypsum.—During the first half of 1962, the Tripolitanian Provincial Government began construction of a gypsum kiln and fabricating

plant a few miles south of Tripoli. It is planned that the facility will use gypsum quarried in the foothills of Tripolitanian western Jebel, and production will be 20,000 tons per year of block and slab for the construction industry. The plant was almost ready to commence production by the end of 1963.

Lime.—Lime production has been slowly but steadily increasing, and the amount in 1962 was almost 20,000 metric tons. During the same period almost half that quantity was imported to meet domestic requirements. With the 5-year plan stimulating local development, and with reserves available, it is to be expected that requirements might be fulfilled locally within 2 to 3 years.

Potash.—In November 1962, the Cyrenaica Government granted permission to a U.S.-backed firm for exploration and exploitation of potash deposits near Marada. These deposits were worked by the Italians during their occupation of Libya before World War II. A successful venture in this field would be an asset to Libya with her present dependence on imported fertilizers.

Salt.—Salt was produced from sea water by a Government monopoly. Operation has been intermitten and large stockpiles frequently have built up. Average annual production is about 15,000 metric tons. Local consumption is 5,000 metric tons. Libya can easily produce enough salt for domestic needs.

MINERAL FUELS

Petroleum.—Production of petroleum during 1963 continued its recordbreaking increase and enabled the 10-year-old country of Libya to achieve a surplus in the merchandise account in its balance of payments. Actually this was accomplished during the first quarter, during which imports totaled L£19.68 million (US$55.1 million), and exports (primarily crude oil), L£23.88 million (US$66.86 million). This occurred despite the import rate having reached a record level.

For the first time in 1963, the merchandise account showed a L£48 million surplus (US$135 million). The value of exports reached L£133,535,000 (US$374 million), while imports stood at L£85,277,000 (US$239 million). Crude oil accounted for almost 99 percent of the value of all exports.

The economic importance of the petroleum industry to Libya lies not only in the Government share of the monies realized from crude oil sales, but also in the large sums spent on exploration and development; a significant part of which accrues to the Libyan Government and her people in wages and other benefits. Expenditures during 1962 by petroleum companies operating in Libya amounted to more than US$200 million, making an accumulated total since 1956 of more than US$800 million. During 1963 the figure went well over the $1 billion mark.[4] Of the 1962 expenditure, about US$80 million was expended for purchases in Libya.

Exports of crude oil in 1963 were two and one-half times the 1962 figure. Continued increases in rates of production and exports are expected before a leveling off is reached.

[4] Ministry of Petroleum Affairs. Petroleum Development in Libya, 1954 through mid-1963. Libya, p. 16.

Exploration and Development.—Drilling operations continued at a record pace during 1963, with from 40 to 45 rotary rigs being active throughout the year. The continued high rate of activity was partially spurred on because concession areas are subject to relinquishment at the rate of 25 percent at the end of 5 years, another 25 percent of original concession area by the end of 8 years, and a third surrender at the expiration of 10 years from the date of grant. Many of these turnback dates occurred in 1963, and companies had to decide what areas they were to relinquish.

During 1963 there were 379 wells drilled, making a total of 983 since drilling commenced in early 1956. Of these 379 completions, 173 were oil producers (overall total, 429) and 206 were dry holes (overall total, 552). Two gas wells have been brought in to date.

The rated daily capacity of producing wells completed in 1963 is 237,532 barrels, raising the figure for all producing oil wells in Libya to 612,280 barrels per day.

The majority of new producers were development or outpost wells in established fields, but 11 of them were listed as discovery wells. The breakdown of discovery wells by companies was: Mobil, four; Oasis, three; CPTL, two; and Amoseas and Phillips, one each.

Geologic and seismic parties continued to be very active, and preparations were underway for offshore drilling to commence.

Areas of Production.—Oil has been found in widely scattered locations in Libya. In each of the four zones into which the country was divided for concession-granting purposes oil has been discovered (Zone 1, Tripolitania; Zone 2, north Cyrenaica; Zone 3, southern Cyrenaica; Zone 4, Fezzan). The 429 producing wells at the end of 1963 were in 25 of the 95 concession areas. Initially, the concession areas amounted to 65 percent of the total land area of Libya, but owing to the surrender procedure the land area covered by concessions was reduced by mid-1963 to a little more than 51 percent—871,152 square kilometers. Marine concessions account for an additional 28,138 square kilometers. The most prolific producing area at present is in the north-central part of the country.

Estimates of reserves range from 4 to 8 billion barrels of oil, and it is likely that discovery of new fields will add to the higher estimated figure.

TABLE 3.—Status of drilled wells

	Zone 1	Zone 2	Zone 3	Zone 4	Total
Dec. 31, 1962:					
Wells completed	283	258	22	41	603
Producers	134	114	4	4	256
Gas wells	1			1	2
Dry holes	148	144	18	36	346
Tested rate of production—barrels per day	145,261	212,387	16,500	1,600	375,748
Dec. 31, 1963:					
Wells completed	416	473	49	45	983
Producers	199	208	17	5	429
Gas wells	1			1	2
Dry holes	216	265	32	39	552
Tested rate of production—barrels per day	180,287	398,896	31,417	1,680	612,280

Source: Petroleum Development in Libya. Published by the Ministry of Petroleum Affairs. Tripoli, 1964.

Production and Processing Facilities.—There were 25 concession-holding companies and 95 concession areas. Twelve of these companies have developed producing wells. Only three, Esso Libya/Esso Sirte, Oasis, and Mobil/Gelsenberg, had reached the production and exporting stage by the end of 1963. Esso, the first company to export oil from Libya (Sept. 12, 1961), was the producer of the largest volume of oil in 1963. Oasis, the second producing company in Libya (first shipment in May 1962), ranked second in production. The only other company to export oil was Mobil, and it did so through the Oasis pipeline and port facilities.

Refineries.—Esso Sirte completed a refinery at Marsa el-Brega, having a daily capacity of slightly more than 8,000 barrels of finished products. A test run was completed late in the year, and the plant was shut down until product pricing could be agreed upon by Esso and the Libyan Government. Finished products were to include regular gasoline, premium gasoline, kerosine, diesel oil, and residual fuel oil. The plant capacity could meet virtually all Libyan requirements for these basic petroleum products.

TABLE 4.—Operating petroleum companies as of June 30, 1963

Company	Concession numbers	Number of producers	Production potential (barrels per day)
Amerada/Continental/Marathon [1]	26	3	1,030
	32	109	124,920
	59	76	157,419
	71	1	511
Ausonia Mineraria, S.p.A./D.E.A./S.N.P.A.[3]	25, 27, 28, 29, 30, 31, 33, 60		
	85		
British Petroleum Exploration Co. (Libya), Ltd.	34	1	160
	35, 36, 37, 63, 64, 80, 81		
Compagnie des Pétroles Total (Libya)	23	5	6,059
	49	1	150
	61	1	1,093
	24		
Compagnia Ricerche Idocarburi S.p.A.	82	1	345
Continental Oil Co. of Libya	53, 54		
Deutsch Erdoel, A.G. (D.E.A.)/W.I.A.G. (Libya)	77		
Elwerath Oil Co. Libya/D.E.A./W.I.A.G.	78	1	157
Esso Standard Libya, Inc.	1	1	500
	5	1	960
	6	44	120,522
	3, 4, 7, 8, 48, 58		
Gulf Oil Co. of Libya	66	21	13,585
	67, 68, 79		
Libyan American Oil Co.	18, 19, 21, 22		
Libyan American Oil Co./Grace/Esso Sirte	17	11	6,179
	20	23	46,707
	16		
Libyan Atlantic Co./Phillips Petroleum Co. Libya.	86, 87, 88, 89		
Libya Shell, N.V.	41	2	212
	70	3	1,182
	38, 39, 40, 52, 69		
Mobile Oil Libya, Ltd./Gensenberg Benzin, A.G.	11	21	8,833
	12	4	3,973
	13	6	4,137
	9, 10, 14, 15, 50, 57, 62, 72		
Nelson Bunker Hunt	2		
Nelson Bunker Hunt/B.P. Exploration Co.	65	12	25,530
Oasis Oil Co. of Libya	55, 56		
Pan American Libya Oil Co.	74, 75, 76, 84, 93, 94, 95		

See footnotes at end of table.

TABLE 4.—Operating petroleum companies as of June 30, 1963—Continued

Company	Concession numbers	Number of producers	Production potential (barrels per day)
Phillips Petroleum Co. Libya	92	1	2,235
	90, 91		
American Overseas Petroleum, Ltd[2]	47	26	20,003
	51	1	430
	42, 43, 44, 45, 46, 73, 83		
Total		376	546,882

[1] The Oasis Oil Co. of Libya, Inc., is comprised of: Amerada Petroleum Corp. of Libya, Continental Oil Co. of Libya, and Marathon Petroleum Libya, Ltd.
[2] American Overseas Petroleum, Ltd. (Amoseas) is comprised of: Texaco Overseas Petroleum Co., and California Asiatic Oil Co.
[3] Abbreviations used in table are: D.E.A., Deutsch Erdoel A.G. Libya (with Wintershal A.G. Libya); S.N.P.A., Soc. Nationale des Pétroles d'Aquitaine; WIAG, Wintershal A.G. Libya.

Source: Petroleum Developments in Libya 1954–63. Ministry of Petroleum Affairs. Tripoli, 1964.

Pipelines.—Two major pipelines were put on stream during 1963. Late in January the Raguba field (Esso Sirte and Libyan American) was tied to the Marsa el-Brega port by a 56-mile-long, 20-inch-diameter line. August 3 marked the opening of a 150-mile (mostly 32-inch-diameter) line linking the Oasis oilfields in concession 59 (Cyrenaica) to concession 32 (Tripolitania) and to the port of Ras es-Sidr. Also, Mobil Oil completed a 45-mile gathering system and feeder pipeline for its Hofra field.

Existing lines at the beginning of the year consisted of: the Esso 108-mile, 30-inch line from its Zelten field to its terminal at Port Marsa el-Brega, which started operating in September 1961; the Oasis 85-mile, 30-inch-diameter line from its Dahra field in concession 32 to its port of Ras es-Sidr (started operating in June 1962).

Mobil completed plans for a pipeline connecting wells in concessions 11 and 13 to Ras Lanuf (a new port), and Oasis planned to tie the Geato field in concession 59 to its existing system.

Late in the year Oasis brought the Samah field into its pipeline system.

Port and Storage Facilities.—At Marsa el-Brega (formally inaugurated Oct. 25, 1961), the Esso petroleum port, a bow-mooring device was put into service early in 1963. Not only does this installation greatly increase loading capacity but it enables tankers to load in rough weather, difficult in the two existing offshore berths. A fourth loading line was under construction near the new bow-mooring installation.

Four new storage tanks were under construction during 1963, each with a capacity of 268,000 barrels. This exactly doubled the previous capacity. Eight more similar tanks were contracted to be completed in 1964.

At Ras es-Sidr (formally inaugurated in November 1962) Oasis has two deep-water loading berths 1 mile offshore. Storage facilities consist of 7 tanks, each with a capacity of 313,000 barrels. Plans for three more such tanks were announced in 1963.

The Mineral Industry of the Malagasy Republic

By Thomas G. Murdock [1]

THE MALAGASY Republic (formerly Madagascar) was an important source of high-quality crystalline graphite and phlogopite mica in 1963. Continuation of its chromite exports, begun in 1961, helped to supplement the shortage of this commodity in the franc zone. The Malagasy Republic also made important contributions to French requirements of uranium, quartz crystal, beryl, and monazite. It continued to provide a small market for French crude and finished metals, cement refractories, fertilizers, some petroleum products, and some crude or partly processed minerals.

The economy of the Malagasy Republic is predominantly agricultural. Latest estimates place national annual income at CFAF120 billion [2] (US$489.8 million). The value of the 1962 mineral production at minehead and exclusive of uranothorianite was CFAF613 million. Total mine production on the basis of unit values of exports of individual items and with the official export value of uranothorianite, is estimated at CFAF1,585 million, or about 1.3 percent of the national income.

Mineral exports were a small source of foreign exchange and in 1962 provided only about one-third of the foreign exchange needed for imports of mineral commodities. Employment in the mineral industry, including workers engaged in mica beneficiation, is estimated officially at about 10,250, or 4 percent of all wage earners.

The most significant development of 1963 was the agreement signed in June by the Malagasy Government and five oil companies which will participate in the construction and operation of the 12,000-barrel-per-day petroleum refinery in the country's principal port, Tamatave. It is expected to be in operation by the end of 1965 and to supply all the liquid fuel needs of the Malagasy Republic.

During the year Westinghouse International Corp. conducted an industrial survey in the interest of developing investment projects. The survey included studies of the possibilities of mineral development and industrial production, particularly in the unexploited Sako coalfield in southwestern Madagascar, the lignite deposits in the general vicinity of Antsirabe, and limestone and iron ore deposits near Moramanga.

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[1] Mining engineer, Division of International Activities.

[2] African Financial Community (CFA) francs are used throughout this country review. The official exchange rate is US$1=CFAF245, or CFAF1=US$0.0040816. On July 1, 1963, the Malagasy Institute of Issue (Institut d'Emission Malgache) officially began functioning and the Malagasy franc (FMG) replaced the CFA franc without change in the exchange rate.

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GOVERNMENT POLICIES AND PROGRAMS

A revised mining law which follows the French law in most respects and liberalizes a provisional law effective since September 1960, was promulgated in October 1962. All mineral deposits, except those mined in quarries, belong to the State. Any person, including corporations, may apply for a prospecting permit and a mining permit. Applicants will ordinarily be of Malagasy nationality, but can, under certain circumstances, be of other nationalities. A petroleum code was promulgated at the same time, providing for the granting of a 5-year prospecting permit, renewable twice, to be followed by a 50-year concession in the event of discovery. Profits are to be divided equally between the concession holder and the Government, after certain taxes. The code is designed to encourage oil exploitation.

The Malagasy Government had adopted, in September 1962, an investment code encouraging investment in several categories of enterprises, including mining. The text of this law has been published.[3] In July 1963, an investment guarantee agreement with the United States was signed.

The Government's roadbuilding programs, with financial assistance from France, West Germany, and the European Economic Community, should prove of eventual value to the minerals industry. The United Nations Special Fund inaugurated a project of mineral and ground water investigation in 1963.

SOURCE MATERIAL

Background information for the following sections is from a recent publication,[4] the product of cooperative effort by the Bureau of Mines, the U.S. Agency for International Development, and the Malagasy Republic. Data on output were supplied by the U.S. Embassy, Tananarive, in the annual canvass of world mineral production carried out by the Bureau of Mines and are supported by official publications of Malagasy Government's mineral agency, The Directorate of Mines and Energy. Foreign trade data are from the official trade statistics, published by the Ministry of Finance. In the case of exports, the statistics often differ substantially from the data of the Directorate of Mines and Energy, apparently because a different statistical base is used. The trade statistics are probably based on actual embarkations and declared value and the Directorate data are probably based on sales, supplied by exporters. Where necessary to provide a complete coverage, information from both sources is used. Except for these differences, the information is reliable and complete. A report[5] of the U.S. Regional Minerals Officer has provided complementary current information on activity in the Malagasy Republic.

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[3] U.S. Department of Commerce. Overseas Business Reports. No. OBR 63-42, March 1963, 6 pp.

[4] Murdock, T. G. Mineral Resources of the Malagasy Republic. BuMines Inf. Circ. 8196, 1963. 147 pp.

[5] Keyes, W. F. Madagascar—The Minerals Industry. U.S. Consulate General, Johannesburg, Republic of South Africa Dispatch A-162, Dec. 31, 1963, 18 pp.

PRODUCTION

No overall trend was established in output levels during 1959–63. Some minerals were produced for the first time, and production of manganese ore, nickel ore, zircon, and coal was mainly experimental to determine the feasibility of larger operations.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Beryl	430	636	758	674	411
Chromite			10,500	18,454	11,200
Columbium and tantalum—kilograms	10,024	10,115	21,206	9,400	17,200
Gold—troy ounces	193	273	347	325	900
Manganese ore			300		
Monazite		471	503	637	615
Nickel ore [1]			2	100	
Titanium concentrate (ilmenite)	598	2,729	3,302	3,184	3,653
Uranium ore and concentrate [1]	581	511	410	544	432
Zirconium ore and concentrate	45	132	320	354	388
Nonmetals:					
Feldspar			13		
Garnet, industrial	3		50	100	2
Graphite	11,443	14,445	14,944	17,485	19,245
Mica (phlogopite):					
Block	122	116	101	82	97
Splittings	872	895	908	1,261	868
Phosphate rock	7,000	4,630			
Quartz crystal—kilograms	43,200	11,100	17,850	13,300	28,700
Salt [2]—thousand tons	17	17	17	17	17
Stones, semiprecious—kilograms	1,113	24,492	12,201	762	4,159
Mineral fuels: Coal (bituminous)—thousand tons			2		

[1] Exports.
[2] Estimate.

TRADE

In 1962, the total value of mineral imports was CFAF3,651 million, 12 percent of all imports and 9 percent above the total in 1961. The 1962 import value, by categories, follows: Metals CFAF1,510 million; nonmetals CFAF630 million; and fuels CFAF1,511 million. Three items accounted for 93 percent of the imports, on basis of value, petroleum products (41 percent), rolled steel products (37 percent), and cement (15 percent).

The Directorate of Mines and Energy reported that mineral exports, including scrap metal, were valued at CFAF1,360 million in 1962 and in 1961 CFAF1,180 million.[6] In 1962, minerals constituted about 6 percent of all exports. Combined exports of graphite, uranothorianite, and phlogopite mica were valued at CFAF1,152 million, 85 percent of the total.

France maintained its position as the principal trading partner of the Malagasy Republic. In 1962 it supplied 56 percent of all mineral imports and received 49 percent of all mineral exports; the United States supplied only 2 percent, practically all petroleum products. However, the United States ranked second as a customer, receiving 22 percent of Malagasy exports, chiefly mica and graphite. Mineral

[6] Foreign Trade statistics, which do not identify uranothorianite exports but include exports of scrap metals, show totals of CFAF1,032 million in 1962 and CFAF1,152 million in 1961.

exports to the United States amounted to CFAF315 million and were 9 percent of all Malagasy exports to that destination.

TABLE 2.—Exports of metals and minerals

(Metric tons)

Commodity [1]	1961	1962	Principal destinations, 1962
Metals:			
Beryl	840	725	France 402; United States 304.
Chromite	5,004	19,007	All to France.
Columbite-tantalite	14	7	United States 5.
Copper, scrap	230	336	West Germany 227; Italy 25; France 13.
Iron and steel, scrap	13,356	111	Italy 110.
Lead, scrap	3	10	All to France.
Nickel ore	2	100	Do.
Scandium ore	29	----------	
Thorium minerals [2]	784	951	Do.
Zinc, scrap	3	----------	
Zircon	----------	3	Do.
Other [3]	54	63	Do.
Nonmetals:			
Garnet, industrial	101	77	United Kingdom 75.
Gem stones, semiprecious	9	5	All to France.
Graphite	14 890	16,463	United States 4,984; United Kingdom 3,751; France 2,752; West Germany 2,487.
Mica	1,232	1,086	United States 319; West Germany 208; Japan 161; Belgium-Luxembourg 145.
Quartz crystal	24	22	France 21.
Other	32	10	Islands in the Antarctic 7.
Salt	2,373	1,332	Comoro Islands 741; Reunion 580.

[1] Other commodities were re-exported as follows: fuels, 1961 (50) and 1962 (261); rolled steel products, 1961 (146) and 1962 (86); and, nonferrous metals, 1961 (1) and 1962 (105).
[2] May include some uranothorianite as well as monazite. Directorate of Mines and Energy report exports of monazite as 463 tons in 1961 and 578 tons in 1962. Exports of uranothorianite are reported as 410 tons in 1961 and 544 tons in 1962. All exports of both minerals were to France.
[3] Includes some titanium minerals and perhaps some zircon in 1961.

Source: Statistiques du Commerce Exteriéur de Madagascar (Foreign Commerce Statistics of Madagascar), 1961–62.

COMMODITY REVIEW

Consumption of mineral commodities in the Malagasy Republic corresponds closely to imports. In some cases, however, large differences in imports of some commodities from one year to another may indicate a stock buildup, perhaps due to buying in large quantities at a favorable price. Comparison of imports of 1961–62 with those of earlier years indicates slight increases, corresponding to a growing consumption, in such items as rolled steel products, petroleum products, and cement. Of the minerals exported, practically none are used domestically.

METALS

Beryl.—Production of beryl started in 1950 and totaled about 6,300 tons at the end of 1963; beryllium oxide content was 10.0 to 13.5 percent. Although beryl-bearing pegmatites are found from the northern extremity of the island, around the Daraina field, to the Itrongay in the south, the industrial variety occurs only with potassic pegmatites and the sodalithic pegmatites contain only small quantities of gem material.

TABLE 3.—Imports of major metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum	114	290	France 234; Belgium-Luxembourg 56.
Copper	162	236	France 218; Belgium-Luxembourg 14.
Iron and steel:			
Pig iron and ferroalloys	17	23	All from France.
Scrap	58	93	Do.
Blooms and slabs	5	2	Do.
Rolled steel	28,794	29,919	France 27,973; Belgium-Luxembourg 1,398.
Lead	89	147	France 144; Denmark 3.
Nickel	1	2	All from France.
Tin—long tons	17	11	Do.
Zinc	101	134	Belgium-Luxembourg 86; France 48.
Nonmetals:			
Abrasives, natural	15	18	All from France.
Blocks, paving	----------	419	Comoro Islands 405.
Boron minerals	1	1	All from France.
Cement	80,389	103,768	France 85,850; Belgium-Luxembourg 4,902; British East Africa 3,992.
Chalk	65	47	All from France.
Clays	171	29	France 25; Comoro Islands 4.
Fuller's earth	12	3	All from France.
Gypsum, calcined	1,660	1,143.	Do.
Lime	2,157	2,428	Do.
Magnesium carbonate, natural	2	3	Do.
Mica	12	8	Do.
Mineral pigments	120	136	Do.
Salt	330	3,476	Senegal 2,017; France 1,201; West Germany 231.
Sulfur	7	3	All from France.
Talc	17	9	Do.
Mineral fuels:			
Coal and briquets	4,666	5,417	All from Republic of South Africa.
Coal byproducts	28	38	All from France.
Coke and semicoke	94	47	Do.
Mineral tar	43	39	Do.
Petroleum products:			
Asphalt and bitumen	5,529	3,734	Iran 1,864; South Africa 1,499; France 331.
Gasoline	58,143	59,918	Iran 48,880; Netherlands Indies 5,145; Saudi and other Arabia 4,791.
Kerosine	17,245	17,995	Iran 15,173; Netherlands Indies 2,567.
Fuel oil	1,123	1,239	Saudi and other Arabia 854; Iran 280; French Somaliland 91.
Diesel oil	39,455	46,991	Iran 39,062; Netherlands Indies 4,804; Saudi and other Arabia 2,638.
Lubricants	4,049	5,846	France 1,915; United States 1,136; Netherlands Indies 919; British East Africa 804.
Petroleum gas	1,032	1,298	Arabian countries [1] 1,168; France 96.
Other	154	846	United States 439; Indonesia 384.
Total	126,730	137,867	Iran 105,275; Netherlands Indies 13,436; Saudi and other Arabia 9,705; France 1,615.

[1] Excludes Saudi Arabia.

Source: Statistiques du Commerce Exteriéur de Madagascar (Foreign Commerce Statistics of Madagascar), 1961–62.

The major producers during recent years and their production for the last 2 years available follow:

Producer	Field	Quantity (metric tons)	
		1960	1961
Compagnie des Produits Chimiques Pechiney	Maliakialina	423	440
Société le Quartz	Analalaya	30	122
Société Malgache des Minerais et Gemmes	Tsaratanana	25	53
Société des Minerais Rares de Madagascar	Ampandramaika	15	46
Syndicat Lyonnais de Madagascar	Berere	44	25

Chromite.—Chromite mining began in mid-1961. All production has been from the Ranomena mine of Société d'Électro-Chimie, d'-Électro-Métallurgie et des Aciéries Electriques d'Ugine (UGINE), an important French industrial concern. The property, 37 kilometers by road north of the port of Tamatave, includes a number of lenses which are being mined on the surface with bulldozers and power shovels. Three of these contain an estimated 80,000 tons of chromite and about seven others contain a total of 20,000 tons. The stripping ratio is about 4:1. Only the decomposed ore in the upper parts of the lenses, which contains 40 to 42 percent chromic oxide (Cr_2O_3), is mined. The harder chromite below, representing about another 150,000 tons, contains only about 30 to 35 percent Cr_2O_3. The ore being mined contains 2 to 3 percent silica (SiO_2) and has a chromium to iron ratio of 1.5:1.7. The average f.o.b export value of Ronomena chromite was equivalent to $12.96 per ton, according to published foreign trade statistics.

Ugine has explored chromite deposits in the Andriamena area, 180 kilometers north of Tananarive. This work indicates the crude ore contains an average of 38 to 40 percent Cr_2O_3, although rich zones carry 40 to 41 percent. Concentration to 48 percent and a chromium to iron ratio of 2:1 is believed possible. Despite a reserve of 2 million to 3 million tons, the reluctance to use concentrates makes this somewhat unattractive. The chief obstacle to the development of the deposits in the Andriamena region is their remoteness; a 120-kilometer road would have to be built to the branch railway which runs north to Lake Alaotra from Moramanga on the Tananarive-Tamatave line. The high cost of this road and the nature of the deposit have held back development. Thus far, these disadvantages have outweighed the favorable factors, such as Ugine's interest in having their own source of supply and the desire of the Malagasy Government to encourage economic development.

Monazite.—The increasing production of monazite has been an important development of recent years. All output has been from beach sands near Fort Dauphin. Three major deposits of old dunes are known, in addition to others of noncommercial quality north of Foulpointe. The deposits near Fort Dauphin are at Antete, Vohibarika, and Ialanmainty. Only the first of these has been worked.

The major producer of monazite is the Société de Traitement des Sables du Sud de Madagascar (SOTRASSUM) which was established as a joint venture by the French Atomic Energy Commission (Commissarait a l'Énergie Atomique or CEA) and the Compagnie des produits Chimiques Pechiney (Pechiney). The CEA takes the thorium content, while Pechiney takes the rare earths contained in the monazite.

SOTRASSUM has been mining an old dune deposit at Antete, 40 kilometers southwest of Fort Dauphin, since 1959. Nearly 4 million tons of sands has been proved by close drilling and sampling, averaging 2.00 to 2.55 percent monazite and about 50 percent heavy minerals, including ilmenite and zircon. In 1963, only the monazite was marketed and the ilmenite and zircon were stockpiled at the plant.

Monazite also was mined from beach sands at Fort Dauphin by Société d'Eploitation des Monazites, a subsidiary of Etablissements Tricot, manufacturers of lighter flints in Paris The treatment plant had a capacity of 200 tons of monazite per year, but in 1963, it produced only a fraction of that. At yearend the plant was being moved to Vohibarika.

Nickel.—Investigations have been in progress by the Malagasy Geological Service, the French Bureau de Recherches Géologiques et Minières, and Ugine of the potential nickel resources of the Malagasy Republic. Earlier, efforts to develop the small, low-grade deposits south of Ambositra, classic occurrences of lateritic alteration over periodotites, were unsuccessful. Detailed exploration of nickeliferous laterites around the periphery of the Ambatovy and Analamay ferruginous shields continued in 1963, but results have not been announced. Exploration methods included sample pits and drill holes. The 100 tons exported in 1962 was shipments to France for metallurgical testing. Previously, 35 million tons of lateritic iron ore was proved in the portions of these ferruginous shields inside the areas of nickeliferous laterites.

Uranium.—The Malagasy production of uranium is as uranothorianite, a mixture of uranium and thorium. First exploitation was in 1954 and subsequently the mineral has become the country's second most valuable export. According to the Directorate of Mines, the 1962 exports were valued at CFAF389 million. All exports have been to the CEA plant at Le Bouchet, near Paris.

The uranothorianite occurs as an accessory mineral in pyroxenite lenses in Precambrian rocks; all the economic deposits are within the loop of the Mandrare River, about 80 kilometers due northwest of Fort Dauphin. Mining has been on the surface and overburden has been moderate. At the mines of the CEA, the principal producer, blastholes are drilled with wagon drills and the ore is loaded with front-end loaders into heavy trucks. Most of the pit equipment is of U.S. manufacture. CEA's Ambindandrakemba mine supplied most of the ore until early 1963, when it was exhausted. At that time the nearby treatment plant and the mine town of Ambatomika were closed down and the equipment was moved about 40 kilometers north to Betioky, which is near the ore body, Belafa. The ore reserve at Belafa is estimated at about 2,000 to 5,000 metric tons of uranothorianite (about 100,000 to 300,000 tons of ore), but exploration of the deposit is not complete. The ore body is a typical, almost flat-lying, irregular lens. The ore at Belafa averages about 0.3 percent uranothorianite, ranging from 0.2 to 0.6 percent. At the end of 1963, some ore was being obtained by CEA from three smaller ore bodies near Belafa.

In addition to the operations of CEA, the following four private operators were active during 1963: C. F. Lanoué, Kotovelo (plant at Marovato); Société des Minerais de la Grande Île, Ambatoaho mine; Société d'Exploitation des Mines d'Andrananondambo, Bevalala mine; Société Minière et Forestière, Betanimera.

The CEA will provide a stable market until 1970. The contracts under which the CEA purchases uranothorianite from the small producers offer CFAF2,850 per kilogram of uranium metal content and

CFAF350 per kilogram or thorium for ore high in thorium; in other ores the contracts call for CFAF5,000 per kilogram of uranium and CFAF100 per kilogram of thorium, less CFAF225 per kilogram purchased.

NONMETALS

Graphite.—The Malagasy Republic possesses virtually inexhaustible reserves of excellent quality flake graphite. Graphite production has been an established industry since 1907 and has survived several economic crises. Graphite has been the country's principal mineral export. Malagasy graphite has found a wide market and its quality and reasonable price have made it popular with users of crystalline-flake graphite throughout the world.

The specifications for crucible-grade graphite have changed considerably during the last 6 years, and exports which earlier comprised a greater tonnage of flakes than of powder now consist increasingly of fine product for which buyers demand higher carbon content. The decline in the demand for flakes is reflected in the reduced proportion of these in total exports, from 41 percent in 1958 to 35 percent in 1962. Comparative annual export values per ton for the two, as reported by the Directorate of Mines and Energy, follow:

	CFA francs		Percent increase
	1958	1962	
Flake	26,796	28,459	6.2
Fines	17,943	23,202	29.3
Average	21,543	25,032	16.1

The producers active in 1963 and their production in 1960 and 1961 follow:

Company	Mine	Production (metric tons)	
		1960	1961
Établissements Gallois	Antsirakambo	2,780	6,773
	Marovintsy	2,340	
Établissements R. Izouard	Falariano	2,524	2,933
Compagnie Lyonnaise de Madagascar	Ambatomitamba	1,544	2,014
Société A. Louys et Compagnie	Andasifahatelo	927	1,768
Établissements G. Rostaing	Sahamamy	917	918
Syndicat Lyonnais de Madagascar	Tromoina		475

In late 1963, Société Malgache des Exploitations Minières resumed operations at the Ambalarondra mine in the Brickaville area, closed since November 1960.

Mica.—The Malagasy phlogopite mica deposits are northwest of Fort Dauphin, in numerous pegmatoid veins and occasional pockets, irregularly distributed in beds of pyroxenite which usually are inter-

stratified in the crystalline schists between Ihosy and Fort Dauphin. With the termination of U.S. stockpile purchases in July 1963, several mines shut down and employment in splitting shops dropped to about one-third of the earlier figure.

The average f.o.b. value of mica exports in 1962 compares with that of selected years as follows:

	CFA francs per kilogram		
	1956	1959	1962
Block	713	851	602
Splittings	216	278	363
Average	254	316	379

In 1962, about 15 mines were in operation. Exploration with accessory production was carried out in about 20 additional areas. The major producing companies and mines in 1962 and their 1961 production follow:

Company	Mine	1961 (metric tons)
Société des Minerais de la Grande Île	Benato	400
Union des Micas	Ampandrandava	173
	Sakasoa	
Établissements W. Boetschi	Sakamasy	166
	Ambatomena	
Société Malgache d'Exploitations Minières	Mafilefy	109
Les Fils de C. Jenny	Vohibola	80

MINERAL FUELS

Coal and Lignite.—Despite the existence of the Sakoa coalfield, extending over more than 100 kilometers in the central Onilahy River region in the southwestern part of the country, Malagasy's small requirements of coal and lignite have continued to be met by imports. The Sakoa field contains 60 million tons of noncoking bituminous coal with an ash content of 17 percent. Some experimental mining has been conducted, but high mining costs, the absence of local markets, high cost of transport to the sea, and high coastal shipping rates have combined to discourage development. Lignite deposits adjacent to the railroad between Tananarive and Antsirabe also have been investigated, but the limited thickness of the seams and low calorific value have limited utilization to times of emergency. The 1963 investigations of Westinghouse International Corp. were directed particularly towards an appraisal of economic possibilities for the domestic solid fuel resources.

Petroleum.—There is no crude petroleum production in the Malagasy Republic, although persistent efforts to discover petroleum have been made since before World War II. Since 1947, work has been concentrated in two sedimentary basins along the west coast. These are the

Morondava Basin, between Morondava and Cape Saint André, where 10 years of geophysical work and about 30 drill holes proved unfruitful; and the Majunga Basin, from Cape Saint André to Diego Suarez. The French Société des Petroles de Madagascar (SPM) holds exclusive exploration and exploitation rights and reports expenditures of CFAF5,880 million on the Morondava Basin. Current expenditures are about CFAF320 million annually on exploration in the Majunga Basin.

At Bemolanga, near Morafenobe in the Morondava Basin, exploration has indicated the existence of bituminous sandstones estimated to contain 1 billion tons of bitumen. In 1963, SPM continued earlier investigations of the economic feasibility of exploiting these deposits commercially. Participation of SPM in construction of the Tamatave refinery indicates that for the time being no development of the bitumen is envisaged.

SPM will have the largest interest in the Tamatave refinery. The marketing companies, Caltex, Esso, Shell, and Desmarais Frères, will participate in shares proportional to their share of the market. Late in 1962, an Italian group, Azienda Generale Italiana Petroli (AGIP), obtained permission to import and distribute its petroleum products in Madagascar and formed a subsidiary, AGIP—Madagascar, capitalized at CFAF40 million. The new company reportedly agreed to make substantial investments in the country.

The Mineral Industry of Mauritania

By Thomas G. Murdock[1]

BOTH the former French Administration and the present government of the Islamic Republic of Mauritania stressed the search for and development of the country's mineral resources as part of their efforts to diversify the economy. However, mining occupied an insignificant role until 1963 when facilities for exploitation of the extensive high-grade iron ore deposits near Fort Gourand were completed and the first shipments of ore to Europe were made, marking an important step in Mauritania's attainment of economic viability. The revival of interest in the country's copper deposits was also a significant event of 1963.

Recent data on Mauritania's gross domestic product (GDP) are not available. In 1958, the GDP was US$65 million (CFAF16,042 million).[2]

In 1962 the value of the mineral production was limited to an estimated CFAF2 million worth of salt plus a small value for an unrecorded quantity of gypsum, excluding the iron ore stocked for export pending completion of railroad and port construction. In 1963 the value rose to approximately CFAF2,888 million. Expectations were that with the planned increase of iron ore exports, the contribution of the mines to the economy would rise to CFAF8,885 million in 1964, gradually working up to CFAF13,327 million when full capacity is achieved. A favorable market was assured because the shareholders in the mining enterprise include a number of major European steel producers. According to rough estimates, by 1967 the government will be receiving about CFAF1,974 million as its 50 percent share in the profits plus about CFAF494 million annually as income taxes and customs revenues. This income should provide about one-third of the total revenue for the Mauritanian budget and permit the renunciation of all French budgetary support.

Data on employment in mining are not available. Assuming that one-third of the inhabitants of the iron mining company's newly constructed camps are employees, about 1,500 are employed in the mines and 1,000 in the port. Considering that wage earners in the country number only about 18,500 and of these 6,700 belong to the public sector, the iron ore development is of major importance as an employer, despite the extensive mechanization of operations. Over 90 percent of the country's economically active population earn their livelihood from pastoral and agricultural pursuits; total population is estimated at only 770,000 although some official sources place this as probably closer to 2 million.

[1] Mining engineer, Division of International Activities.

[2] African Financial Community (CFA) francs are used. For Mauritania the exchange rate used is US$1=CFAF246.8 (CFAF1=US$0.004052).

GOVERNMENT POLICIES AND PROGRAMS

No legislative changes affecting the mineral industry were reported in 1963. The basic laws regulating private foreign investment remained in effect; these are the Long-Term Investment Code for Iron Ore Concessionaires as embodied in the law of July 10, 1959, and subsequently amended in 1959 and 1960; the Petroleum Code of June 12, 1961; and the Investment Code of June 26, 1961.

The basic financial agreement between the iron mining company and the Mauritanian Government was that there shall be a straight 50–50 sharing of net profits. In order to insure an income to the government before the first net profits are realized (several years after ore shipments started), the agreement called for the government to receive 6 percent of the gross value of ore embarked at Port Etienne beginning with the first shipment. Such payments are to be deducted from amounts later credited to the government under the equal profit-sharing scheme.

At the official inauguration of the iron mining complex, the president of Mauritania renewed his assurance that the government's commitment towards foreign investors, for which legitimate guarantees will be provided, will always be respected.

The Petroleum Code provides for a sliding scale of royalties on oil and gas production; the 50–50 profit-sharing principle and a 27.5 percent depletion provision are included.

During 1963 work was continued on the construction of the Nouakchott wharf on a coastal dune about 8 kilometers west of the Mauritanian capital. Completion of this and other port improvements, scheduled for about mid-1964, will allow an annual unloading capacity of about 100,000 tons; it will provide an outlet for copper ore from the Akjoujt deposits and permit further exploitation of titaniferous sands and gypsum deposits. Cost of the current first phase development was placed at about CFAF 457 million.

SOURCE MATERIAL

Dispatches of the U.S. Embassy in Nouakchott provided the information on production and 1963 developments. Background data are from a current U.S. Government publication.[3] For several years the technical press has reported the development of the iron mines and a complete detailed account of the mines and facilities appeared in a French journal.[4] The limited data on trade are from a French Government publication, which is the only available source and which lacks completeness and detail.

PRODUCTION

Mauritania's only recorded mineral production in 1959–61 has been of iron ore and salt. Since the beginning of iron ore production in 1960 this has increased annually to permit large-scale exports as soon as transportation facilities were completed. Salt production is only

[3] Hutt, William E. Basic Data on the Economy of the Islamic Republic of Mauritania. U.S. Department of Commerce. Overseas Business Reports. No. OBR–63–6, January 1963. 14 pp.

[4] Mines. (Paris). Special MIFERMA Number. V. 18, No. 108, 1964, pp. 342–391.

an estimated figure and has usually fluctuated from year to year depending upon local demand; the exports to neighboring countries had ceased previously.

Construction materials of domestic origin have been extensively used in the completion of the facilities for iron mining and transportation and also in building at Nouakchott, the new capital city, to provide for an initial population of 6,000 inhabitants; however, no data on quantities produced or consumption are available.

TABLE 1.—Production of metals and minerals

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Iron ore---thousand metric tons--	----------	----------	300	1,000	1,300
Nonmetals:					
Salt [2]---metric tons--	500	800	500	500	600

[1] Gypsum and other building materials have been produced but no quantitative data are available.
[2] Estimate.

TRADE

Prior to 1963, exports of metals and minerals had been limited to small quantities of salt, sample lots of copper and iron ores for experimental purposes, and perhaps some scrap metals and imported petroleum refinery products. This situation changed significantly in 1963 when exports of iron ore were made for the first time. Valued at about CFAF2,777 million, these constituted 69 percent of the value of all exports, estimated at about CFAF4,028 million on the basis of data through September (CFAF687 million in 1962 and CFAF432 million in 1961). Of the 1963 iron ore exports of about 1,250,000 tons, France was the leading recipient (about 412,500 tons and CFAF916 million), followed by Italy (about 287,500 tons and CFAF639 million), West Germany (about 262,500 tons and CFAF583 million), and the United Kingdom (about 212,500 tons and CFAF472 million).

Data on imports of metals and minerals are not available in complete detail for 1962; however, total value for items recorded was CFAF3,257 million (CFAF2,514 million in 1961). Imports of these commodities constituted 37 percent of all imports in 1962 (33 percent in 1961). Neither are data available on the sources of the metals and minerals imports; as France supplied 73 percent of all 1962 imports, the former probably came mainly from that country. The European Economic Community, of which Mauritania is an associate member, supplied an aggregate 78 percent of the total and the United States, 10 percent.

The 1963 imports of minerals and metals had an estimated value of CFAF1,109 million; the decrease over the preceding years was due mainly to the termination of construction work incidental to the bringing into production of the Fort Gourand iron ore deposits and on supporting infrastructure.

TABLE 2.—Principal imports of metals and minerals [1]

Commodity [2]	Quantity (metric tons)		Value (millions CFAF)	
	1961	1962	1961	1962
Metals:				
Iron and steel [3]	[4] 67,327	90,938	2,166	2,865
Other metals [5]	174	163	42	37
Nonmetals:				
Cement and lime	28,330	29,842	120	128
Salt	18	23	1	1
Mineral fuels:				
Petroleum refinery products	15,248	22,248	185	226
Total	111,097	143,214	2,514	3,257

[1] Data on sources are not available; France was undoubtedly the leading supplier.
[2] Data on other items imported are not available, nor is a further breakdown possible.
[3] Mostly rolled products but may include small quantities of pig iron.
[4] Includes 62,156 tons of rails in 1961 and probably a similar proportion in 1962, thus representing an abnormal volume of imports for specific construction subsequently completed.
[5] Includes an unstated quantity of manufactures.

Source: Institut National de la Statistique et des Études Économiques (Paris). January–March 1964.

COMMODITY REVIEW

METALS

Copper.—The year saw a revival of interest in the Akjoujt copper deposits. Negotiations were begun between Northfield Mines, Inc., a Canadian-American concern, and the Mauritanian Government. Expectations were that these would be successful and that the Lindsley and Homestake groups composing Northfield would have a controlling interest, with a respective participation of 27 and 28 percent, respectively; the Mauritanian Government would have a 25-percent holding and the remainder would be in the hands of some of the former owners of Société des Mines de Cuivre de Mauritanie (MICUMA), an association of the French Bureau de Recherches Géologiques et Minières, Société Minière et Métallurgique de Penarroya, the Banque des Paris et des Pays-Bas and private shareholders.

This new effort followed three previous attempts to exploit the deposits, about 270 kilometers north of Nouakchott and estimated to contain about 18 million tons of sulfide ore averaging 1.5 percent copper and 0.008 ounce of gold per ton and 7 million tons of oxide ore averaging 2.9 percent copper and 0.095 ounce of gold per ton. Tests carried out in the United States on samples of Akjoujt ore proved satisfactory and reportedly an annual production of 10,000 tons of copper and 30,000 ounces of gold might be possible. Cost of the project was estimated at about CFAF3,973 million. However, even with an early agreement and the ratification of this by the Mauritanian legislature, commercial production is not expected until after further metallurgical tests have been carried out, probably about 1966.[5]

Iron Ore.—Early 1963 saw the completion of the iron ore project of Société des Mines de Fer de Mauritania (MIFERMA), several months ahead of schedule. The necessary operations included opening up the extensive high-grade deposits near Fort Gourand in northern

[5] Mining Journal (London). Mauritania Copper Development. V. 262, No. 6711, Apr. 3, 1964, p. 253.

Mauritania, construction of the 1.44-meter gage railway across forbidding desert to Port Etienne on the Atlantic 650 kilometers away, and the installation of the modern ore-loading facilities there. The first shipment from the mines was made on April 12, and the first ship was loaded on April 27.

MIFERMA, an international company, was established in 1952 and capitalized at CFAF13.3 billion, distributed approximately as follows: Bureau de Recherches Géologiques et Minières (a French Government organization), 24 percent; French financial groups, 22 percent; French steel interests, 10 percent; British steel interests, 19 percent; Italian steel interests, 15 percent; West German steel interests, 5 percent; and the Government of Mauritania, 5 percent. Financing included a World Bank loan equivalent to about CFAF16.3 billion and other loans amounting to CFAF7.4 billion.

The deposits are near the Mauritania-Spanish Sahara border, in the Kedia D'Idjil, a low mountain range in the form of a triangle which covers about 220 square kilometers and rises about 600 meters above the surrounding Saharan plain. Latest ore reserve data place 125 million tons in the proven category and 75 million tons as probable. The average iron content of the mineralized masses comprising the economic orebodies is 64 percent, ranging between 55 and 70 percent. The iron content of the enclosing rocks, ferruginous quartzites perhaps comprising an additional billion tons of reserves, is 40 percent. An average analysis of the first quantities of ore mined was iron, 65.6 percent; silica, 3.25 percent; alumina, 0.83 percent; phosphorous, 0.03 percent; carbon, 0.06 percent; and moisture, 0.25 percent.

The area of known mineralization consists of several individual deposits, each showing different characteristics. F'Derik, to the west, contains compact ore; the ore in Tazadit to the east and in Rouessa in the center is more friable. All deposits are exploitable by opencut, and actual mining of the Tazadit started in 1961 and continued on an increasing scale as fast as stripping permitted the development of faces. Through the end of July, 1,337,000 tons of ore had been mined; in this way stocks were built up pending the completion of the railway. Additional tonnages moved were 2,429,000 tons of waste and 442,000 tons of low-grade ore set aside for possible later beneficiation.

Open pit equipment at Tazadit included nine 2 to 6 cubic meter capacity shovels, served by sixteen 27-ton and twenty-two 65-ton dump trucks. This equipment permits mining annually 4.5 million tons of ore and stripping 9 to 10 million tons of waste. The F'Derik deposit is to be equipped to produce 1.5 million tons of ore per year and in 1963 an initial production of float ore covering the flanks of the hillside began; mining was by the bulldozers. The installations at Tazadit include a 188-centimeter by 137-centimeter gyratory crusher, a 1,800 tons-per-hour capacity belt conveyor system to carry ore to the stocking bridge, a 3,000 tons-per-hour bucket-wheel excavator to reclaim stocked ore, and another conveyor to carry ore to 800-ton silos equipped for loading railway cars at the rate of 4,800 tons per hour.

The rolling equipment of the railroad includes twenty 2,000-horsepower traction diesel locomotives and 650 cars of 75 tons net capacity each. The pier at the port is 244 meters long with a water depth of 12 meters which can be dredged to 15 meters. Storage facilities for

1 million tons of ore are available, and the original ship-loading installation has an hourly capacity of 3,000 tons, subsequently to be doubled; ore carriers of up to 60,000 tons can be handled. Electric power, generated by diesel engines, is provided by two 1,100-kilowatt units and four 2,260-kilowatt units at the mine and eight 1,000-kilowatt units at the port. Modern industrial cities have been built for staff and workmen at Zouerate near Fort Gourand and at Cansado near Port Etienne.

By November average daily transport of ore by the railroad was 12,000 tons. This level was lower than originally anticipated, being barely sufficient to handle the 4 million tons of ore scheduled for export in 1964 and clearly insufficient for the 6 million tons scheduled for 1970. Transport difficulties have been caused by heavy sand penetration into the working parts of locomotives and abrasive action on the cars. Strike difficulties at Port Etienne in late 1963 caused practically no interruptions to operations because the facilities are highly mechanized. At yearend a secondary crushing and screening plant was being installed at the port to improve MIFERMA's competitive position in a buyer's market and to permit marketing run-of-mine ore or products specifically for sintering plant, blast furnace, and open hearth use.

Titanium.—Black sands occur in large quantity along the Mauritanian coast; reportedly they contain economic amounts of ilmenite, with associated zircon, and are thus similar to the Senegalese deposits which are exploited. The Mauritanian Government reportedly envisages the exploitation of the black sands once the port improvements underway at Nouakchott are completed. Exploration has proven 4 million tons of mineralized sands containing 250,000 tons of ilmenite assaying 52 percent.

NONMETALS

Gypsum.—Although gypsum deposits 0.50 to 2.50 meters thick and containing an aggregate of 17 million tons are known in an area 70 kilometers north of Nouakchott, these have been exploited only on a small scale. Investigations have revealed that the gypsum has similar characteristics to the gypsum of the Parisian basin, and a high quality plaster results from its calcination. A small calcination plant has been built and the product used in finishing buildings in the capital city. A larger production is expected to be possible when Nouakchott port development is completed.

Salt.—In 1963 rock salt production was continued on a scale slightly above that of the immediately preceding years. Two mines were worked, by primitive opencut, at Adrar near Fort Gourand and at N'Teret, to the north of Trarza. Salt production during recent years has remained at less than one-quarter of what it was a decade ago as a result of discoveries in Senegal and Mali, which were formerly the two principal markets. Expectations of an increased local demand have risen from the possibilities of the development of the Akjoujt copper deposits, because the segregation process suggested for use in the treatment of the oxide ores there would require a considerable quantity.

MINERAL FUELS

Petroleum.—Reportedly unsuccessful exploration for petroleum was continued in several areas by the foreign companies holding permits. The following companies held valid permits: Société Africaine des Pétroles (SAP); Société de Participations Petrolieres (PETROPAR); and, Société des Pétroles de Valence. SAP explored the Nouakchott area where its program called for the expenditure of CFAF1,481 million over a 5-year period. PETROPAR was active near Port Etienne where plans were to spend CFAF1,974 million. Programs of expenditures planned by the other companies had not been announced.

Despite the unsuccessful efforts in past years, at the beginning of 1963 it was thought that petroleum might exist in the sedimentary basin of the Senegal River and the Tindouf and Taoudini synclines. The Senegal River stretches over about 65,000 square kilometers along the coast, from the estuary of the Senegal to the Spanish Sahara border. The Tindouf syncline covers an area of 3,500 square kilometers in the northern part of the country, and Taoudini syncline is in eastern Mauritania.

A slightly decreased consumption of petroleum refinery products is reflected in the indicated imports through November; these were at the annual rate of 21,818 tons, 2 percent below that of 1962.

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The Mineral Industry of the Kingdom of Morocco

By Thomas G. Murdock [1]

OUTPUT of some Moroccan minerals was well below the level of immediately preceding years, but substantial gains in the production of coal, phosphate rock, and petroleum occurred. As in 1962, the industry was confronted with low world demand, declining reserves, rising costs, and labor problems. Although relatively small, the decline in output of several major commodities since 1961 marks a significant reversal of the upward trend in production over the previous decade. Mining remained the largest single industry in Morocco, and minerals constituted the largest major class of export. Agricultural activities occupied most of the labor force and less than 1 percent of the total labor force of about 3.3 million was engaged in mining and petroleum production; employment in these sectors totaled 32,200 at the beginning of 1963 and decreased by 7 percent to 29,800 by yearend.

Morocco ranked second only to the United States in production of phosphate rock, and as the traditional world leader in exports, continued to set production standards and fair trade price structure. The country has produced about 10 percent of free world cobalt supply during recent years. In 1962 Morocco ranked sixth in world manganese production, but in 1963 it lost this place to Gabon. Phosphate rock continued to be exported widely, and other minerals helped supply the growing needs of Western Europe. Exports to the United States in 1963 were principally barite and manganese ore.

In 1962 the Moroccan gross national product (GNP) was DH9,943 million [2] (US$1,965 million). In that year, total value of mineral production was DH709 million, or 7.1 percent of the GNP. Moroccan mining companies, exclusive of the Government-owned Office Cherifien des Phosphates (OCP), had an aggregate capitalization of approximately DH227 million, of which DH76 million was held by the Government's agency, Bureau de Recherches et de Participations Minières (BRPM).

During 1963 satisfactory progress was made on the construction of the chemical complex at the port Safi, a venture of OCP, BRPM, and another quasi-governmental body, Bureau d'Études et de Participa-

[1] Mining engineer, Division of International Activities.

[2] Official monetary unit of Morocco is the dirham (DH); US$1=DH5.06 and DH1=US$0.1976. The dirham contains 100 francs.

tions Industrielles (BEPI). In October a Moroccan press announcement [3] stated that major changes in the original plans will reduce the total cost of this project from DH500 million to DH278 million. Scheduled for completion in 1965, the installations are expected to produce annually 200,000 metric tons of triple superphosphate, 150,000 tons of diammonium phosphate, 36,000 tons of ammonium nitrate, 350,000 tons of 65 percent iron pellets, and 2,700 tons of copper. Twenty-five thousand tons of the 435,000 tons of sulfuric acid produced will be marketed. Raw material consumption is to be 561,000 metric tons of phosphate and 470,000 tons of cupriferous pyrrhotite from domestic mines, and 51,600 tons of imported ammonia. The Government's intention to call for bids for the construction of the ammonium phosphate unit at Safi was announced in April.

Labor unrest characterized a substantial part of the first half of 1963. The Zellidja lead mines, strikebound for 3 months, were the hardest hit. Short sympathy strikes resulted in some lost production from other mines. The unions were unable to attain their main objective, to prevent further layoffs; but they gained generous separation terms for workers being discharged. The agreement ending the Zellidja strike was significant in that the union recognized that management could discharge personnel in order to achieve efficient operations. In 1963 the nation's largest union, Union Marocaine du Travail (UMT), maintained its dominant position in the mining industry. UMT reacted to the unemployment problem by demanding nationalization of the mines. In March UMT found support from the Istiqlal Party press, which pointed out that two successful mining cooperatives were in operation in Tafilalet and Quarzazate. In May, Morocco signed an agreement under which West Germany will be permitted to recruit unemployed Moroccan mine labor.

The border conflict with Algeria, in the fourth quarter, had no direct effect on Morocco's foreign trade. The frontier remained open, and Moroccan exports from the Oudja area continued to be shipped through the Algerian port of Nemours.

Freight rates to and from European ports were scheduled to increase by 10 percent on October 15.

GOVERNMENT POLICIES AND PROGRAMS

No significant mining legislation was enacted in 1963. The Moroccan Government continued to play a major role, directly or indirectly, in the entire mineral industry, through ownership of OCP; and BRPM not only serves as a promotion and holding company but also engages in exploration and development activities. The Government emphasized the need for developing new sources, either through extending deposits already being exploited or through finding new ones. Both Government agencies and private companies were active in this program. Perhaps the most notable items in this respect were the several separate concessions for petroleum prospecting, to be undertaken by foreign firms in cooperation with BRPM. The Gov-

[3] Marco Informations (Rabat, Morocco). Oct. 8, 1963, p. 4.

ernment's efforts to promote the training of Moroccans for professional work in the mining industry began to bear fruit in 1963.

To assist the hard-pressed mining industry, in 1963 the Government undertook a further reduction of export taxes and continued rebates on power charges. A decree of April 16, 1963, retroactive to July 1, 1962, established a new schedule of export duties under which all mineral products pay only 0.5 percent ad valorem, except phosphate rock, manganese ore above the first 6,000 tons extracted annually from a single mine, and iron ore. The exceptions still pay the 5-percent duty established in 1959. Rebates in power were granted to the industry, except for phosphates and iron ore, amounting to DH0.02 per kilowatt-hour for electricity and DH0.15 per liter of diesel oil.

In 1963 efforts to further diversify the list of Morocco's trading partners were continued. Existing trade agreements requiring renewal were extended or amended and several new ones were negotiated; all of these include mineral commodities. Communist countries were well represented in the list of agreements signed.

SOURCE MATERIAL

Information is obtained mainly from the Foreign Service dispatches of the U.S. Embassy at Rabat and the Consulate General at Casablanca, supplemented by several publications of the Moroccan Government. The latter's official foreign trade statistics for some commodities differ from those indicated by the Direction des Mines et de Géologie. Except for a few items, the former have been used in order to have a complete coverage of all commodities. Preliminary data for 1963 are used in some cases; these are based on totals shown in Note de Documentation, a monthly publication of the Sub-Secretariat of State for Commerce, Industry, Mines and Merchant Marine.

PRODUCTION

Although output of several major minerals was lower than in 1962, the general level compares favorably with 1959; the increases for phosphate rock, petroleum, and several other items over the 1959–63 period were substantial. Both world market conditions and Moroccan internal developments have contributed to these changes in production levels. Official production indexes show that through October average monthly production, exclusive of fuels, was 5 percent below that for all of 1962 but still 8 percent above that for all of 1958. Exclusive of phosphate rock, it was 20 percent below that of 1962 and 21 percent below that of 1958.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Antimony	229	325	368	407	686
Cobalt, content of concentrate	1,207	1,271	1,290	1,436	1,371
Copper, mine	1,185	1,260	1,737	2,464	1,823
Gold, troy ounces		104	136		
Iron ore, thousand tons	1,265	1,577	1,462	1,149	1,035
Lead:					
Mine	91,700	94,750	88,268	90,104	73,615
Smelter	28,450	30,727	24,488	24,435	18,800
Manganese ore	470,567	483,084	571,084	469,357	334,948
Nickel, content of cobalt ore	241	254	258	287	274
Silver, thousand troy ounces	1,234	1,907	908	858	772
Tin:					
Mine, long tons	9	10	11	10	8
Smelter [1], do	10	10	10	10	8
Zinc, mine	55,611	49,169	40,779	34,420	[2] 37,582
Nonmetals:					
Barite	36,808	84,318	82,183	89,793	94,554
Cement, thousand tons	502	580	630	698	745
Clay, smectic	22,385	37,672	38,603	32,639	37,367
Fluorspar			788	495	6,350
Fuller's earth	3,552	3,750	2,298	2,898	2,959
Graphite	120				
Gypsum [1]	25,000	25,000	25,000	25,000	25,000
Ochre	2,107	1,411	1,541	1,237	869
Phosphate rock, thousand tons	7,164	7,472	7,950	8,162	8,548
Pyrites, including cupreous pyrites	14,418	13,438	14,077	20,700	23,142
Salt, thousand tons	34	30	21	28	37
Strontium minerals	395				
Mineral fuels:					
Coal (anthracite), thousand tons	465	412	410	370	404
Fuel briquets, do	20	23	24	23	18
Natural gas, marketed, million cubic feet	154	352	299	436	[1] 436
Petroleum:					
Crude, thousand 42-gallon barrels	712	695	603	968	1,140
Refinery products:					
Gasoline, do	398	642	592	1,821	2,189
Kerosine, do	69	80	122	541	602
Fuel oil:					
Distillate, do	284	319	435	2,246	2,457
Residual, do	161	242	347	1,511	1,933
Other, do	266	285	333	233	457
Total [3], do	1,227	1,633	1,907	6,557	7,638

[1] Estimate.
[2] Final figure: supersedes figure given in commodity chapter, volume I.
[3] Includes refinery fuel and losses, except in 1963, when they are not reported separately.

TRADE

Mineral exports were valued at DH676 million in 1962 (DH682 million in 1961). In 1962 they were 38 percent of all exports in terms of value and 84 percent in terms of quantity. Exports of phosphate rock alone were valued at DH436 million; phosphate rock, manganese ore, lead ore and metal, and iron ore comprised 92 percent of the total value of mineral exports.

In 1962 the total value of mineral imports was DH136 million, 7 percent of all imports and 31 percent below the DH211 million total in 1961. This decrease was due entirely to the increased output of the domestic petroleum industry. The 1962 import values of minerals were: metals, DH48 million; nonmetallic minerals, DH13 million; and mineral fuels, DH75 million.

France has continued to be Morocco's principal partner in mineral trade, receiving 27 percent of the exports and supplying 51 percent of the imports in 1962. In that year the share of the United States

was only 5 percent of mineral exports, mostly manganese ore, and 3 percent of mineral imports, mainly petroleum products. Mineral commodities comprised 64 percent of all exports to the United States, but constituted only slightly over 1 percent of all 1962 Moroccan imports from the United States.

Preliminary mineral trade data for 1963 indicate that through November exports were 6 percent higher than in the similar period of 1962; imports were about 4 percent lower.

TABLE 2.—Exports of major metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals: [1]			
Aluminum: [2]			
Scrap	1,054	681	Italy 558; France 73; Belgium-Luxembourg 50.
Other	20	83	France 62; Senegal 21.
Antimony ore	1,147	1,014	Spain 590; France 424.
Cobalt ore	11,513	11,443	France 9,014; Belgium-Luxembourg 2,105; West Germany 324.
Copper:			
Ore	4,427	5,458	Sweden 2,605; West Germany 1,703; Spain 923.
Scrap [2]	1,286	697	Italy 438; United Kingdom 157; Netherlands 71.
Other [2]	156	266	West Germany 101; France 57; Hungary 51.
Iron and steel:			
Iron ore—thousand tons	1,909	1,148	United Kingdom 274; Spain 225; France 223.
Ferroalloys	97	32	Italy 22; United States 10.
Scrap	39,987	20,461	Italy 12,849; British European Territories 2,699.
Rolled products	216	41	Algeria 15; Ivory Coast 13; France 11.
Lead:			
Ore	98,342	93,451	France 67,379; Belgium-Luxembourg 12,651; Italy 4,695.
Metal, all forms	23,860	24,159	France 21,102; Czechoslovakia 2,247; United Kingdom 509.
Magnesium, scrap	8	19	United States 10; Italy 9.
Manganese ore:			
Metallurgical	329,821	316,210	France 233,991; United States 29,226; Norway 14,500.
Other	120,334	117,800	United States 93,764; France 12,815; West Germany 4,093.
Tin—long tons	8	[3] 5	All to France.
Zinc:			
Ore	75,291	63,327	France 53,048; Poland 5,100; Belgium-Luxembourg 3,175.
Metal, all forms	82	56	All to France.
Other [4]	459	3,482	France 2,464; West Germany 548; Italy 470.
Nonmetals:			
Barite	74,702	67,069	United States 33,385; Belgium-Luxembourg 13,067.
Cement	21,923	19,296	Spain 10,475; Algeria 4,072; Liberia 600.
Clays:			
Refractory	7,140	3,621	Spain 3,600; France 21.
Smectic [5]	35,660	33,520	France 21,839; Spain 7,829; Algeria 1,460.
Fuller's earth	2,122	2,294	Tunisia 1,619; Algeria 669; France 6.
Fluorspar	232	----------	
Gypsum	31,658	23,390	Portugal 11,760; Uruguay 7,600; Denmark 1,590.
Lime	418	502	All to Spain.
Marble	5,386	6,667	Italy 4,187; Belgium-Luxembourg 1,234; United States 563.
Ochre	1,445	1,078	France 1,060; Algeria 15; Senegal 3.
Phosphate rock—thousand tons	7,628	8,132	France 1,261; United Kingdom 881; Belgium-Luxembourg 805; West Germany 735; Spain 675; Poland 508.
Pyrite:			
Crude	----------	1,799	Belgium-Luxembourg 1,240; Netherlands 526.
Roasted	17,703	23,614	West Germany 5,972; Senegal 5,350; United States 5,080.

See footnotes at end of table.

TABLE 2.—Exports of major metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Nonmetals—Continued			
Salt	[6] 148	13	Ships' stores 10; Algeria 3.
Sulfur	2	324	All to Spain.
Sand	30,295	19,857	Spain 19,283; Algeria 327; Ships' stores 247.
Stone, dimension	60,181	49,686	All to Spain.
Other [7]	1,456	1,319	Spain 1,047; Senegal 100; Algeria 92.
Mineral fuels:			
Coal (all ranks) [8]	198,075	159,920	France 51,465; Algeria 45,609; Belgium-Luxembourg 24,513.
Petroleum refinery products: [9]			
Gasoline—thousand 42-gallon barrels	2	2	Mali 1.
Kerosine—do	5	13	France 7; United States 3; Switzerland 2.
Gas oil—do	----------	24	All to United States.
Fuel oil—do	----------	2	Do.
Lubricants—do	----------	1	All to Ivory Coast.

[1] Except where otherwise stated includes ingots, equivalent forms, and semimanufactures.
[2] Including alloys.
[3] Includes 1 ton of scrap.
[4] Metallic slags, residues, and unspecified ores.
[5] Includes bentonite.
[6] Includes 146 tons of partly evaporated sea water.
[7] Includes graphite, ornamental granules, quartz and unspecified.
[8] Includes briquets (4,863 tons in 1961 and 1,879 tons in 1962) and coke (0 in 1961 and 9 tons in 1962).
[9] Excludes exports and re-exports from Ceuta and Melilla (Spanish enclaves). Quantities not available; except for stock changes, they approximate imports.

Source: Statistiques de Mouvement Commercial et Maritime du Maroc (Foreign Trade Statistics of Morocco) 1961 and 1962.

TABLE 3.—Imports of major metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals: [1]			
Aluminum and its alloys, all forms	1,747	1,773	France 1,626; Algeria 48; United States 25.
Antimony	22	30	U.S.S.R. 25; Belgium-Luxembourg 5.
Bauxite	----------	3,236	France 1,730; British Oceania 1,372.
Copper and its alloys, all forms	1,921	2,174	France 1,679; Algeria 192; Italy 137.
Iron and steel:			
Pig iron	805	877	France 839; Spain 30; Netherlands 8.
Ferroalloys	300	212	France 189; West Germany 20; Algeria 3.
Scrap	398	174	France 143; United States 31.
Rolled products	15,222	20,694	France 15,335; West Germany 3,622; Italy 791.
Lead, including scrap	131	122	France 99; Spain 7.
Manganese ore, chemical	30	50	All from Ghana.
Mercury—76-pound flasks	29	29	All from United Kindgom.
Nickel, including alloys	198	174	Italy 98; France 64; United Kingdom 7.
Tin—long tons	270	292	Malaya 225; Indonesia 44; France 11.
Zinc	625	816	Belgium-Luxembourg 385; France 175; U.S.S.R. 145.
Ores, unspecified [2]	235,000	145,000	All from Algeria.
Metallic slags and residues	188	1	Do.
Nonmetals:			
Abrasives, natural	98	8	France 7.
Asbestos	2,110	2,213	Canada 895; Republic of South Africa 765; France 404.
Barium minerals	42	12	All from West Germany.
Borates	53	94	All from France.
Cement	3,951	4,885	France 4,576; Belgium-Luxembourg 120; Denmark 114.
Chalk	3,094	3,275	France 3,035; Belgium-Luxembourg 120; Italy 120.
Clays:			
Kaolin	1,915	1,470	United Kingdom 1,410; France 39; United States 21.
Refractory	3,697	4,721	France 3,102; British Territories in America 1,372.
Smectic [3]	5,939	2,939	Algeria 2,548; France 381; United States 10.
Other	307	395	France 376; United States 8.

See footnotes at end of table.

TABLE 3.—Imports of major metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Diatomite	463	465	Algeria 244; France 101; Belgium-Luxembourg 90.
Dolomite	400	455	All from France.
Feldspar	256	220	Do.
Graphite	20	19	Do.
Kyanite [4]	133	106	France 90; United States 16.
Lime	1,054	577	All from France.
Magnesite	80	60	Austria 49; United States 6; France 3.
Marble	724	911	Italy 856; Spain 25; Portugal 30.
Pigments, mineral	517	405	France 390; Spain 15.
Potash	13,199	12,389	France 6,806; West Germany 3,788; East Germany 1,459.
Pyrite, roasted	1,570	140,888	Algeria 105,000; France 35,000; Spain 887.
Salt	611	593	Algeria 409; France 123; Netherlands 58.
Sand	6,419	8,153	Belgium-Luxembourg 7,965; West Germany 140.
Sulfur	4,844	8,615	France 7,863; West Germany 752.
Talc	1,434	1,670	France 1,470; Norway 193; United States 7.
Vermiculite	92	50	All from Republic of South Africa.
Other [5]	233	376	France 144; Italy 103; Spain 51; Canary Islands 40.
Mineral fuels:			
Coal, all ranks	85,616	70,529	Poland 64,722; Belgium-Luxembourg 4,674; Portugal 1,000.
Coke	7,346	6,736	West Germany 6,725.
Coal byproducts	1,893	1,930	Italy 999; Belgium-Luxembourg 352; France 278.
Petroleum:			
Crude—thousand 42-gallon barrels.	938	896	U.S.S.R. 640; Republic of Congo (Brazzaville) 256.
Refined [6]			
Gasoline—do	1,447	888	France 385; Canary Islands 171; U.S.S.R. 87.
Kerosine—do	360	230	France 100; United Kingdom 47; Netherlands Antilles 34.
Gas oil—do	1,509	539	France 146; U.S.S.R. 126; Canary Islands 94.
Fuel oil—do	1,412	555	France 187; Iran 133; Canary Islands 64.
Lubricants—do	117	121	France 103; United States 7; Belgium-Luxembourg 6.
Liquefied petroleum gas—do	118	52	France 51; Canary Islands 1.
Asphalt—do	204	210	France 116; Netherlands Antilles 61; Canary Islands 12.
Other—do	44	70	France 50; United States 14.
Total refined products	5,211	2,665	France 1,138; Canary Islands 353; U.S.S.R. 241.

[1] Except where otherwise stated includes ingots, equivalent forms, and semimanufactures.
[2] Believed to be mainly lead ore.
[3] Includes bentonite.
[4] Includes andalusite.
[5] Includes cryolite, fluxing stone, fuller's earth, calcined gypsum, limestone, meerschaum, mica, ornamental granules, phosphate rock, quartz, quartzite, crushed stone, slate, and unspecified.
[6] Excludes imports into Ceuta and Melilla (Spanish enclaves), mainly for bunkers. Reported as totaling 6,359,000 barrels in 1961 and estimated at same quantity in 1962.

Source: Statistiques du Mouvement Commercial et Maritime du Maroc (Foreign Trade Statistics of Morocco). 1961 and 1962.

COMMODITY REVIEW

METALS

Antimony.—Although 1963 antimony production did not reach the 1952 peak of 1,270 metric tons of contained metal, the increase over that of 1962 is indicative of a growing importance of the commodity. No single large deposit has been discovered yet, but over 20 small occurrences are known. Primitive extraction methods have been fol-

lowed and high production costs and a highly competitive market have continued to limit production, mainly to the Beni Mezala mine of Société Minière de Beni Mezala southwest of Ceuta and the Timerdouhne mine of Société Moraccaine des Mines et des Produits Chimiques. Exports totaled 1,451 metric tons of ore, estimated to contain 47 percent antimony. Spain was the principal destination with 600 tons, all from Beni Mezala. Omnium Gerance Industrielle et Minière announced plans for additional exploration at their Tourtit and Masser Aman deposits in the Mrirt area which has been idle since 1956.

Cobalt.—Société Minière de Bou Azzer et du Graara, the country's only producer, continued operations at its mines at Bou Azzer in the Anti-Atlas Mountains, at a slightly reduced rate. The mines have been in uninterrupted exploitation since 1932 and the annual cobalt output normally shows quantitative variations, partly due to the irregular mineralization encountered in the underground mining. Exports are as gravity concentrate assaying 12 percent cobalt and 2 percent nickel; these totaled 16,712 metric tons in 1963 (10,304 to France, 4,000 to mainland China, and 2,408 to Belgium). In 1963 exploration was continued at Aghbar, 10 kilometers east of Bou Azzer, reportedly with satisfactory results.

Iron Ore.—In 1963 iron mining, with the lowest production since 1946, continued to center in the Nador area of the former Spanish zone. The Ait-Amar mine in the former French zone, producer of 21 percent of the 1958–60 country total, remained closed during 1963. About 80 percent of the 1963 output came from the two Uizan mines of Compagnie Espagnole des Mines du Rift (CEMR), a Spanish company in which BRPM has had a 26.7-percent participation since 1959. Most of the remainder came from the nearby mines of Société Anonyme Minière Setolazar, a CEMR affiliate. In 1963 total reserves of the Nador area were estimated at about 50 million metric tons. Marketing difficulties and the increased proportion of ore which must be mined underground at Uixan and of pyritic ore which must be roasted at both properties combined to limit production. Demand for Moroccan ore has continued to decline because of competition from other producers of comparable grade ore favored by lower freight rates through the use of new, large ore-carrying vessels. The Moroccan producers endeavored to improve the quality of their ore, which was 59 percent in 1963. New beneficiation plants at the mines of the two producers, completed in 1962, entered normal operations in 1963. Exports in 1963 totaled 808,879 metric tons; major destinations were United Kingdom, 226,645; Czechoslovakia, 205,362; West Germany, 163,494; and France, 97,438.

Investigations of the Khenifra and other deposits were continued in 1963 by the Directorate of Mines and Geology and two companies, but on a reduced scale. The project for the establishment of a steel plant at Nador remained under active consideration during 1963, but no decision was announced.

Lead and Zinc.—Moroccan lead production was adversely affected by the labor unrest in early 1963 and general market conditions. This was reflected in the decreased exports of lead concentrate and in the decreased amount of lead metal produced at the Ouad-el-Haimer

35,000-metric-ton-per-year smelter of Fonderies Penarroys-Zellidja. The 1963 output of lead concentrate (average grade 68 percent), local sales to the smelter, and exports through November are presented in table 4.

TABLE 4.—Production in 1963, and local sales to smelter, and exports of lead concentrates through November

(Metric tons)

Company and mine	Production	Local sales	Exports
Société des Mines de Zellidja, Boubeker	19,400	19,068	
Compagnie Royale Asturienne des Mines, Hassi Touissit	18,810	3,121	17,484
Société des Mines d'Aouli, Aouli and Mibladen	35,000		33,319
Société Penarroya-Maroc, Ksar Moghal	5,130	1,729	2,116
Société Minière de Jebel Aouam, Jebel Aouam	12,600		12,057
CADET (Cooperative), Tafilalet area	4,700		4,490
Société Minière de l'Atlas, Keba	10,430		1,420
Compagnie Minière d'Agadir, Merouane			1,300
Various other companies		217	6,416
Total	106,070	24,135	78,602
Total 1963 local sales and exports		27,383	83,196

Major export destinations in 1963 were France, 70,301 metric tons; Italy, 7,051; and West Germany, 2,981. Additional quantities of lead concentrate were supplied to the smelter by Zellidja's Algerian affiliate, Société Nord- Africaine du Plomb, whose workings are contiguous to the Boubeker mine. Exports of smelter product were to France (16,722 metric tons), Algeria (420 tons), and Czechoslovakia (270 tons); the total was 17,598 tons. Local sales amounted to 938 tons.

Total production of zinc concentrate in 1963 was 58,618 metric tons (58,810 tons in 1962). Metal content, however, rose from 34,420 tons to 37,582 tons as the result of increase in average grade from 58.49 to 64.11 percent; the higher tonnage and grade from the Hassi Touissit mine accounted for the overall increase in contained metal. Zellidja's Boubeker mine was the principal producer with 33,294 metric tons, followed by the Hassi Touissit with 20,460 tons and three other small producers with a total of 4,864 tons. Corresponding figures for exports were 33, 880, 19,390, and 4,629 tons, respectively. Of the 57,899 tons exported, France was consigned 45,723 tons; Poland, 6,626 tons; and Belgium, 1,882 tons.

Manganese.—The sharp decline in manganese ore production and exports was due mainly to the suspension of purchases for the U.S. stockpile, effective at the beginning of the year, and competition from the New Gabon production. Production in 1963 was 68,900 metric tons of chemical ore (100.599 in 1962) and 266,050 tons of metallurgical ore (368,758 in 1962). Exports totaled only 308,310 metric tons, consisting of 68,652 tons of chemical ore, 154,108 tons of metallurgical ore, and 85,550 tons of sinter. Mine stocks dropped during the year from 171,743 tons to 136,416 tons. The Imini mine of Société Cherifienne d'Études Minières maintained its position as principal producer with an output of 63,604 metric tons of chemical ore and 119,190 tons of metallurgical ore. Société de Bou Arfa produced 109,735 tons of metallurgical ore from its mine of the same name. Output by Compagnie di Tifnout-Tiranimine consisted of 5,355 tons of metallurgical

ore. The remaining 31,786 tons of metallurgical ore and 5,293 tons of chemical ore came from at least nine other producers; 2,868 tons of the chemical ore came from deposits worked by the miners' cooperative in the Ouarzazate area. Average grade of metallurgical ore mined through October was 41.0 percent manganese (42.3 percent in 1962); that of the chemical ore was 81.5 percent manganese dioxide (80.0 percent in 1962). Sinter production was 86,400 metric tons at Sidi Marouf and 2,670 tons at Bou Arfa; quantities of ore sintered were 108,690 and 4,072 tons, respectively.

NONMETALS

Barite.—Production of barite in 1963 established a new high and maintained the almost continual growth since 1959. Exports were 94,713 metric tons, 41 percent above the 1962 total; 52,108 tons were consigned to the United States. Shipments were made to Italy and Venezuela, countries which did not take any exports in 1962, indicating a wider market acceptance of Moroccan barite. Local sales were 1,330 metric tons; these and exports totaled 96,043 tons, of which 81,496 tons came from the Jebel Irhoud mine and 14,547 tons from the Tessaout mines of Compagnie Marocaine des Barytes, a BRPM affiliate. Because exports and local sales exceeded production, old stocks were depleted by 1,489 tons.

Fluorspar.—The greatly expanded fluorspar production in 1963 came from a deposit near Meknes, opened up by Société Anonyme des Entreprises Minières, a company owned by the Continental Ore Corp. of New York and BRPM. The production was stocked until December when the first shipment was made.

Phosphate Rock.—The 5-percent increase in phosphate rock output in 1963 established a record high. Production came from OCP's two groups of mines, both exploited by opencut and underground methods, at Khouribga (about 100 kilometers southeast of Casablanca) and Youssoufia (about 60 kilometers east of Safi). The Khouribga mines produced 6,115,247 metric tons and the Youssoufia mines, 2,433,167 tons, increases of 4 percent and 7 percent, respectively. Exports and local sales (in metric tons) follow:

	Exports	*Local sales*	*Total*
Khouribga	5,929,191	64,352	5,993,543
Youssoufia	2,523,694	7,785	2,531,479
Total	8,452,885	72,137	8,525,022

Exports to major destination follow:

	Metric tons
France	1,417,143
Belgium	920,071
United Kingdom	802,901
West Germany	736,662
Spain	715,585
Netherlands	403,003

OCP announced plans for opening up a deposit at Meraa-el-Arech, 20 kilometers from Khouribga; expectations were that production would start early in 1965 at a daily rate of 6,500 tons. Efforts to improve mining techniques through the use of larger open-pit equipment and more efficient underground methods continued. The ultramodern

washing plant at Oued-Zem reportedly produced high-quality phosphates, comparable to those of Senegal and Togo, contributing to the Khouribga output. Pilot plant studies on the benefication of low-grade rock continued. Efforts made to expand markets included visits of OCP technical representatives to consumers' plants in Europe and Asia to assist in improving the final product.

Potash.—During 1963 Société des Potasses des Zemmours, in which BRPM holds a 50-percent interest, intensified exploration of the Triassic potash deposits in the Khemisset, Berrechid, and Safi regions. Indications are that the Berrechid offers some promise because of its proximity to Casablanca (40 kilometers south), but the economic possibilities are not completely proved. The Safi deposits are obviously small but could be utilized in the chemical complex being installed at Safi. The National Institute of Agricultural Research carried out a specialized investigation of the use of potassium fertilizers on Moroccan soils.

MINERAL FUELS

Coal.—Despite the increased production of anthracite from the Djerada colliery of Charbonnages Nord-Africains, 49 percent owned by BRPM, the output was still below the 1959–61 level. The increase was partly the result of a larger domestic demand, with local sales at 206,250 metric tons (201,506 in 1962). Exports were 172,456 tons (159,920 in 1962). Major destinations were France (49 percent), Belgium (16 percent), and Algeria (14 percent). Production per man-shift underground averaged 692 kilograms through November (636 in 1962). Coal imports through October were at the annual rate of 111,300 metric tons (70,529 tons in 1962). Total consumption for the 10-month period was at the annual rate of 289,000 metric tons (271,000 in 1962). Consumption by major sectors was power generation, 47,300 metric tons; phosphate industry, 26,300; cement plants, 108,000; and sugar refineries, 13,700.

In an attempt to improve efficiency and costs at Djerada, BRPM signed an agreement in September with the West German firm of Preussische Bergwerks und Hütter Aktiengesellschaft (PREUSSAG) to extend technical assistance over a 15-month period.

Petroleum.—The record high for production established in 1963 was due to the increased output from the Sini Rhalem field near Essaouira, which was discovered in late 1961. The older fields in the Sidi Kacem (Gharb) area, nearly exhausted, contributed only 35 percent of the total. All production was by Société Cherifienne des Pétroles (SCP), in which BRPM has a 49.9 percent participation.

The petroleum refinery of SCP at Sidi Kacem and that of Société Marocaine Italienne de Raffinage, jointly owned by the Italian group Ente Nazionale Idrocarburi (ENI) and BEPI, handled the increased production of crude and the 878,739 metric tons of supplementary imports. The latter facility, situated at Mohammedia, entered service in April 1962. With the increased availability of domestic crude and the increased total annual refinery capacity to 1.5 million metric tons, imports of refined products were correspondingly lower than in 1962. Combined imports of gasoline, kerosine, and fuel oils through October were at the annual rate of 4,512 metric tons (28,400 tons in 1962).

Local sales of refined products, roughly equivalent to consumption, follows:

Premium gasoline	barrels	739,335
Regular gasoline	do	1,424,376
Kerosine	do	473,521
Diesel oil	do	1,878,914
Fuel oil	metric tons	292,685
Butane gas	do	24,827
Propane gas	do	2,659

Oil prospecting in various parts of Morocco continued without notable success. SCP endeavored to increase reserves in the areas being exploited. Société Marocaine Italienne des Pétroles, an association of ENI and BRPM, was active in the Tarfaya region and in March was authorized to explore an area of 12,000 square kilometers south of Oujda on the Algerian border. Compagnie Financière de Pétroles, a Belgian concern, in cooperation with BRPM, explored in the Draa Valley. PREUSSAG began work in the Doukkala plain, between Safi and El Jadida. In September an agreement was reached to admit the Richfield Oil Co. to the concession held by a North American group, Allen & Co., Inc., of New York, and Canadian-Delhi Oil, Ltd., which had begun exploration in the Boumalne-Boudenit-Tafilalet region near the Algerian border.

At the end of 1963 the labor force engaged in petroleum production totaled 718. In October an agreement was reached between officials of UMT and the retail motor fuels dealers association setting up a nationwide collective labor agreement. To make possible the benefits of the agreement, a decree was issued at the end of the year reducing wholesale prices for gasoline and high-test gasoline by DH0.014 per liter (about 1.5 cents per gallon). The retail prices were to remain the same and the profit margin would allow the implementation of the agreement. The profit which the Government receives annually because of its effective monopoly of oil importing and refining will be diminished substantially.

The Mineral Industry of Mozambique

By Thomas G. Murdock[1]

THE MINERAL extractive industry in the Portuguese oversea Province of Mozambique showed little significant change in 1963. Mineral production was chiefly by the same individuals or collective enterprises as in the past. On the basis of value, Mozambique's contribution to world mineral supply has been negligible, however, its unusual pegmatite mineralization has gained a certain renown. In 1959 the country ranked third in world production of beryl with 14 percent of the total, but declining prices and mining difficulties intervened, and in 1962 it occupied sixth place with only 6 percent. In 1962 Mozambique was the world's fifth-ranked producer of columbium-tantalum concentrates with about 3 percent of the world total.

In 1963 new plants were inaugurated for cement manufacture and processing montmorillonite. Mozambique continued to play an important role in the transportation of minerals, metals, and fuels of other countries. An appreciable part of the trade of the Republic of South Africa, the Federation of Rhodesia and Nyasaland, and the Republic of the Congo (Léopoldville) moved through the ports of Lourenço Marques and Beira. During 1963 construction was in progress on additional facilities for this transit trade, including a pipeline into Southern Rhodesia, a railway connection for the evacuation of Swaziland iron ore, and a mechanical ore-loading dock at Lourenço Marques.

The 1962 mine production was valued at Esc80 million (US$2.8 million),[2] of which coal accounted for 43 percent. Adding in the value of cement and lime (Esc124 million) and other quarry products (Esc36 million), all estimated on the basis of official 1961 production statistics, the total was Esc240 million. For 1958 the gross domestic product (GDP) has been reported at approximately Esc12,004 million. If the 1962 GDP was 29 percent above that of 1958, as were all exports, the total contribution to the 1962 GDP by the mining and quarrying industry would have been 1.6 percent. The 1962 value of products from the refining of imported crude petroleum was Esc304 million, 24 percent of that of all industrial production.

Employment by the mining and quarrying industries, including cement and lime plants, on January 1, 1962, totaled 334 administrative, technical, and office personnel, and 9,752 workmen; the latter comprised 11 percent of the total industrial labor force. Total salaries and wages for both categories of employees was Esc60 million in 1961, or 9 percent of the total industrial labor bill. An additional 305 employees of all categories were engaged in petroleum refining, and their 1961 total earnings were Esc17 million.

[1] Mining engineer, Division of International Activities.
[2] The basic unit of currency is the escudo (Esc). At par value US$1=Esc28.58 (Esc1=US$0.03499).

GOVERNMENT POLICIES AND PROGRAMS

No significant mining legislation was enacted during 1963. Basic mineral legislation applicable to Mozambique was published in book form in English by the Mozambique Government Press, Lourenço Marques. The mining laws of Mozambique follow the premise that the subsoil is the property of the State. Prospecting on private land is permitted by law; compensation for mining operations on private land is made by private agreement or by arbitration by the courts. Prospecting on government land (most of Mozambique) is free, but the Government may reserve certain areas and forbid prospecting in them. At the end of 1963 several areas were closed, but indications were that all mineral resources in the country might be opened to prospecting.

Despite a continuation of the Government's Development Mission of the Zembézi invitation to develop fluorspar deposits in the Macossa-Marinque region, coppier and iron in an area north of Tete, and cassiterite deposits at Inchope, no public announcements of tender awards were made. Several concessions for pegmatite economic minerals were granted; however, the total area of these was 1,550 hectares. At the beginning of the year, 76 concessions, exclusive of rights for oil exploration, were in effect, covering 12 million hectares, of which 6 million were in Tete District and 4 million in Zambézia.

Efforts to eliminate gradually customs duties on Mozambique trade with Metropolitan Portugal and other escudo areas were continued in 1963. Imports from the dollar area were restricted to commodities considered essential for the local economy and not readily available from Portugal and its overseas provinces or from European Common Market countries. In July the foreign currency reserve of the Mozambique Exchange Fund were completely exhausted, for the first time since establishment of the Exchange Fund in 1932. The Exchange Fund has been maintained through the obligation of exporters to surrender 95 percent of their export earnings to the Fund. After July, payments by the Fund were restricted severely and usually limited to the level of monthly earnings and occasionally payments had to be made from the fast-ebbing gold reserve.

To the extent that available funds permitted, the Government continued its program of economic development. This program, as in previous years, emphasized the improvement and expansion of transportation and communication facilities; expectations were that expenditures of Esc22 million would be made during the year.

In January the President of the Foreign Commerce Board of Mozambique announced a new government attitude toward foreign investment, although this has not been confirmed by any Portuguese Government document. According to the unofficial statement, it will no longer be necessary for firms in Mozambique to have a majority of Portuguese-held capital or administrative control. Other modifications reportedly include a special tax moratorium for new industry, a guarantee covering the repatriation of profits, most favored transportation rates, and possibly exclusive manufacturing rights for periods up to 10 years.

SOURCE MATERIAL

In general information about the mineral industry of Mozambique is adequate and reliable; it is mainly from the Foreign Service dispatches of the U.S. Consulate General at Lourenço Marques, and those prepared by the Regional Minerals Officer on duty at the U.S. Consulate General, Johannesburg. These are supplemented by several publications of the Portuguese Government and technical journals. The 1961 industrial statistics volume of the Mozambique Directorate of Economy and General Statistics was a principal source, giving much detailed information of the extractive and related industries.

PRODUCTION

The 1963 output of most minerals was well below the average of preceding years, and in very few cases was it above that of 1959. Refined petroleum products are the exception; output of these set a record in 1963.

Data on production of the quarry industry are available only for 1961. The 1963 production was probably approximately the same, or slightly lower. In 1961 output was as follows: Clay (other than kaolin and montmorillonite) 129,000 tons; granite 730,000 tons; limestone 434,000 tons; rhyolite 62,600 tons; and sand and gravel 130,000 tons.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Bauxite					
Beryl, 11 to 12 percent beryllium oxide (BeO)	4,284	4,840	4,671	6,216	6,597
Bismuth kilograms	1,414	1,496	973	569	556
Columbium and tantalum concentrates do	10,400	13,600	22,050	[2] 8,458	13,786
Gold troy ounces	145,151	152,174	[2] 168,715	[2] 155,208	[2] 153,280
Titanium concentrate (ilmenite)	295	225	115	99	29
Nonmetals:	10,342	711			
Asbestos					
Cement thousand tons	34	20	147	336	[2] 336
Clay:	213	222	212	179	[2] 190
Kaolin					
Montmorillonite	120	115	120	180	5
Diatomite		40	[3] 40	37	800
Lime		93	360		
Lithium and lepidolite	(4)	10,515	7,454	[3] 7,000	[3] 7,000
Mica, including scrap	90	1	154	274	104
Phosphate rock and guano	6	1	1	1	
Salt thousand tons	91	105			
Tourmaline kilograms	[5] 19	[5] 40	69	62	[5] 40
Mineral fuels:	377	[3] 300	289	522	316
Coal (bituminous) thousand tons	257	270	321	298	283
Petroleum:					
Gasoline			84,310	91,787	94,303
Distillate fuel oil			125,213	116,645	116,734
Residual fuel oil			218,143	214,411	230,659
Butane gas					1,337
Total			427,666	422,843	443,033

[1] In addition, quarry products (including common clays, granite, limestone, rhyolite, and sand and gravel) were produced in every year listed, but complete data on output are not available. Also, small quantities of monazite, cesium (pollucite), and silver have been produced in some years.
[2] Final figure; supersedes figure given in commodity chapter, volume 1.
[3] Estimate.
[4] Data not available.
[5] Rock salt only and thus excludes sea salt, for which production data are not available.

TRADE

Complete data on minerals and metals trade are not available for any year since 1961, when imports of these commodities were valued at Esc681 million (Esc484 million in 1960); exports were valued at Esc259 (Esc63 million in 1960).[3] The appreciable increases in 1961 were mainly due to the Mozambique refinery which began full-scale operations in early 1961; crude petroleum was imported for the refinery, and exports of refined products began. The value of 1962 imports is estimated at Esc602 million and of exports at Esc299 million. Through October 1963, imports were at the estimated annual rate of Esc576 million and exports at the rate of Esc288 million.[4] Decreased imports and increased exports of refined petroleum products accounted for most of the 1962 decline in total imports and increase in total exports. Greater utilization of domestically refined products permitted a further decrease in 1963 imports; total exports were adversely affected by the reduced shipments of metallic ores and thus were slightly below those of 1962.

In 1961 minerals and metals accounted for 17 percent of all imports and 9 percent of all exports. Of the imports in that year, fuels totaled Esc440 million, metals Esc218 million, and nonmetals Esc23 million. Of the exports, fuels were valued at Esc195 million, metals Esc62 million, and nonmetals Esc2 million.

Mozambique's minerals and metals trade shows substantial diversification; there were 36 suppliers and 22 recipients in 1961, exclusive of bunkers and including Portugal's other oversea provinces. In that year Iraq was the chief supplier with 37 percent of the total; other major suppliers were the Republic of South Africa with 16 percent, the European Economic Community countries whose combined total was also 16 percent, and Iran with 9 percent. Portugal supplied only 3 percent. Receipts from the United States amounted to Esc16 million, 2 percent of the total, and consisted of fuels valued at Esc11 million and metals valued at Esc5 million. These constituted 6 percent of all imports from the United States.

The Republic of South Africa was the principal destination of 1961 mineral exports, with 30 percent of the total, followed by the United States (16 percent), bunkers (15 percent), French Somaliland (15 percent), and the Federation of Rhodesia and Nyasaland (9 percent). Exports to the United States were valued at Esc42 million; consisted almost exclusively of metallic ores and constituted 28 percent of the total exports to the United States.

In 1961 the ports of Beira and Lourenço Marques handled direct transit shipments of minerals, metals, and fuels to and from the Federation of Rhodesia and Nyasaland, the Republic of South Africa, and the Republic of the Congo (Léopoldville) amounting to 2,358,000 tons valued at Esc10,036 million. These totals include a small quan-

[3] The 1960–61 exports are exclusive of maritime and aviation bunker deliveries made from stocks of petroleum products in transit. All bunker sales were made from stocks in 1960 and were valued at Esc67 million (Esc64 million maritime and Esc3 million aviation); for 1961 they were reported at Esc62 million (Esc57 million maritime and Esc5 million aviation), and in addition fuels from the local refinery valued at Esc40 million were considered as exports.

[4] For 1962 and 10 months of 1963 values are available only for all common metals and manufactures combined. The estimates assume that the proportion of scrap, crude, and semimanufactures in the total was the same as in 1961.

tity of transshipments to other destinations. Copper was the principal commodity handled on the basis of value (364,953 tons and Esc6,315 million); gasoline led on the basis of quantity (662,573 tons and Esc748 million). Minerals, metals, and fuels comprised 66 percent of all direct transit shipments on the basis of volume and 47 percent on basis of value.

TABLE 2.—Exports of major metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	Principal destinations, 1961
Metals:			
Aluminum	(1)	22	All to Republic of South Africa.
Copper	239	347	Japan 122, West Germany 106, Republic of South Africa 66.
Iron and steel:			
Ferrous scrap	10,107	7,729	Japan 7,707, Netherlands 15.
Rolled products	14	73	Republic of South Africa 63, Federation of Rhodesia and Nyasaland 8, Angola 2.
Lead	122	214	Republic of South Africa 206.
Tin long tons	(1)	1	All to Republic of South Africa.
Zinc	(1)	8	Do.
Other metals, unspecified	234	3	All to Portugal.
Ores, metallic, unspecified [2]	9,555	5,838	Federation of Rhodesia and Nyasaland 4,147, United States 1,093. [3]
Nonmetals:			
Asbestos	80	159	United Kingdom 138, United States 21.
Diatomite	13	39	All to Republic of South Africa.
Lime	----------	33	All to Federation of Rhodesia and Nyasaland.
Mica	1	2	United States 1.
Salt	4,855	4,145	Federation of Rhodesia and Nyasaland 4,128.
Other, unspecified	241	181	Belgium-Luxembourg 100, Netherlands 54, Republic of South Africa 18.
Mineral fuels:			
Coal	59,539	60,826	Federation of Rhodesia and Nyasaland 60,700, bunkers 56.
Petroleum products: [4]			
Gasoline	----------	47,767	Republic of South Africa 42,004, Federation of Rhodesia and Nyasaland 5,763.
Kerosine	1	1	All to bunkers.
Distillate fuel oil	50	52,114	Republic of South Africa 32,402, bunkers 8,948, French Somaliland 6,488.
Residual fuel oil		190,513	Bunkers 65,801, French Somaliland 79,846, French West Africa 14,870, Iraq 11,391.
Lubricants	32	21	All to bunkers.
Other	----------	18	All to Republic of South Africa.
Total	83	290,434	French Somaliland 86,334, bunkers 74,837, Republic of South Africa 74,692, French West Africa 14,870.

[1] Included with other metals.

[2] In 1960 exports consisted of 4,459 tons of bauxite, 5 tons of cassiterite concentrates, 3 tons of iron ore, 5,054 tons of unspecified ores, and 34 tons of miscellaneous mineral raw materials. The unspecified ores include beryl, columbite, ilmenite, and tantalite. The 1961 data make no itemization of what is included, except for 5 tons of iron ore shipped to Japan.

[3] U.S. imports were beryl, 992 tons; columbite concentrate, 27,494 kilograms; and tantalite concentrate, 99,722 kilograms.

[4] Following the completion of the Mozambique refinery (to use imported crude) in late 1960, part of the maritime bunker deliveries are shown as exports. In 1960 these deliveries were made from transit stocks and amounted to 109,815 tons; in 1961 transit stocks supplied 97,082 tons in addition to quantities shown as exports. Aviation bunker deliveries are also supplied from transit stocks and were 2,099 tons in 1960 and 3,099 tons in 1961.

Source: Direcção dos Serviços de Economia e Estatistica General. Comércio Esterno, 1960 and 1961.

TABLE 3.—Imports of major metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	Principal sources, 1961
Metals:			
Aluminum	135	[1] 204	Republic of South Africa 44; West Germany 39; United Kingdom 35; Austria 31; France 26.
Copper and alloys, all forms	416	490	West Germany 108; Portugal 95; Federation of Rhodesia and Nyasaland 83; Republic of South Africa 70.
Gold, troy ounces	35	257	All from Portugal.
Iron and steel:			
Pig iron	1,469	816	Republic of South Africa 582; Federation of Rhodesia and Nyasaland 234.
Ferrous scrap	2	36	Federation of Rhodesia and Nyasaland 33.
Rolled products	34,264	41,902	Belgium-Luxembourg 10,891; Republic of South Africa 9,891; West Germany 9,295; Federation of Rhodesia and Nyasaland 4,414; United Kingdom 3,046.
Lead, all forms	91	124	Republic of South Africa 40; United Kingdom 35; Netherlands 32; Belgium-Luxembourg 14.
Silver and alloys, troy ounces	514	1,125	United States 643; Portugal 257; United Kingdom 193.
Tin, long tons	16	32	Portugal 10; South Africa 7; United Kingdom 6.
Zinc	21	[2] 22	United Kingdom 7; Belgium-Luxembourg 5; West Germany 4; Portugal 2.
Other common metals, unspecified	34	18	Republic of South Africa 6; West Germany 5; Belgium-Luxembourg 3.
Ores, metallic, unspecified		5	All from Republic of South Africa.
Nonmetals:			
Asbestos	720	879	Federation of Rhodesia and Nyasaland 660; Republic of South Africa 215.
Cement	2,004	2,097	Cape Verde 1,093; Portugal 362; Denmark 333; United Kingdom 126.
Chalk	179	280	Republic of South Africa 253; Portugal 21.
Clays:			
Bentonite	1,965	75	France 54; United States 21.
Refractory		291	Republic of South Africa 225; United Kingdom 54.
Kaolin	19	38	Republic of South Africa 28; Portugal 10.
Flint	(3)	1,159	Portugal 603; Republic of South Africa 416; Italy 140.
Gypsum	12,845	9,055	Angola 6,890; Republic of South Africa 1,980; Portugal 146.
Lime	2,254	3,644	Republic of South Africa 2,968; Portugal 654.
Marble	350	734	Portugal 554; Italy 62; Republic of South Africa 41.
Pigments (mineral)	(3)	124	Republic of South Africa 56; United Kingdom 31; Portugal 21.
Salt	2,091	3,124	Angola 2,900; United Kingdom 68.
Slag (metallurgical)	(3)	9,373	Republic of South Africa 9,259; Burma 114.
Sulfur	659	668	Portugal 300; West Germany 198; Belgium-Luxembourg 149.
Other	10,383	818	Republic of South Africa 467; United Kingdom 118; Portugal 97.
Mineral fuels:			
Coal	292,835	304,415	Republic of South Africa 253,051; Federation of Rhodesia and Nyasaland 51,364.
Coke and semicoke	1,041	1,521	Republic of South Africa 1,300; Federation of Rhodesia and Nyasaland 221.
Coal tar and pitch	(4)	242	Federation of Rhodesia and Nyasaland 165; United Kingdom 49.
Coal tar oil	(4)	114	United Kingdom 69; Republic of South Africa 22.
Petroleum:			
Crude	(5)	489,652	All from Iraq.
Refinery products:			
Gasoline	40,394	25,171	Iran 16,604; Saudi Arabia 3,930; other Persian Gulf 2,508.
Kerosine	19,438	20,684	Iran 12,092; Curaçao 4,235; Saudi Arabia 2,133.
Distillate fuel oil	83,247	51,120	Iran 30,756; Saudi Arabia 8,830; Australia 3,650; Other Persian Gulf 3,137; Iraq 2,274.
Residual fuel oil		893	Iran 772; Other Persian Gulf 121.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1960	1961	Principal sources, 1962
Mineral fuels—Continued			
Petroleum—Continued			
Refining products—Continued			
Lubricants	7,290	7,373	United States 2,255; Republic of South Africa 1,624; Curaçao 1,601; United Kingdom 806.
Liquefied petroleum gas	458	851	Republic of South Africa 756; Angola 65.
Asphalts and bitumens	4,792	5,113	Republic of South Africa 4,866; Iran 108.
Other	199	172	United Kingdom 50: Indonesia 44; United States 34.
Total	155,818	111,377	Iran 60,403; Saudi Arabia 14,893; Republic of South Africa 8,488; Other Persian Gulf 7,135; Curaçao 6,525.

[1] Includes 1 ton crude; remainder are semimanufactures.
[2] Includes 4 tons of crude or scrap; remainder are semimanufactures.
[3] Included with other nonmetals.
[4] Included with asphalts and bitumens.
[5] None shown. As experimental operation of the Mozambique refinery started in late 1960 some crude must have been used. It is believed this was from transit stocks and later included with 1961 imports because another source indicates the latter were only 465,000 tons in 1961.

Source: Direcção dos Serviços de Economia e Estatistica General. Comércio Externo, 1960 and 1961.

COMMODITY REVIEW

METALS

Bauxite.—Mining of bauxite at the Alumen and Alumen West mines of Companhia de Cimentos de Moçambique, in Mozambique, about 8 kilometers northeast of Penhalonga, Southern Rhodesia, continued at approximately the rate of the immediately preceding years. Part of the production (5,511 tons in 1962) was exported to Southern Rhodesia and the Republic of South Africa for use in manufacturing alum for water treatment. About 10 percent of the exports are of nodular gibbsite used in manufacturing alumina refractory bricks in a plant near Johannesburg. The bauxite produced averages about 60 percent alumina and 10 to 20 percent silica.

Beryl.—Low prices for beryl did not permit an expansion of beryl production, which remained well below the 1960 high. On a basis of tonnage, however, beryl assaying 11 to 12 percent beryllium oxide (BeO) was the principal mineral produced from the numerous complexly mineralized pegmatites of the Alto Ligonha and adjacent areas of Zambézia District. The total production value for all pegmatite minerals was about Esc46 million in 1961.

The principal 1963 producer of beryl was Empresa Mineira do Alto Ligonha (EMDAL) with 181 tons (320 tons in 1961) from its mines around Muiane. The Napido mines of Monteminas, Ltd., and those of an associated company, Sociedade Mineira de Melela, Ltd., were idle during 1963; in 1961 they produced a total of 483 tons. The Muneia mine of Sociedade Mineira de Mutala, Ltd., produced 40 tons (70 tons in 1961). Other producers were Sociedade Mineira da Zambézia, Ltd., (50 tons in 1961), Minas de Mocuba, Ltd., and Sociedade Mineira de Mocuba, Ltd.

As elsewhere, the beryl ore occurs in greatest concentration between the quartz core of the pegmatite and the kaolinized feldspar normally surrounding it. Most mining is by the opencut, primitive methods

that characterize pegmatite mining throughout the world; the recoverable beryl is hand-cobbed. With the sparse mineralization in beryl, the recovery of other minerals (including bismuth, cassiterite, columbite-tantalite, euxenite, lepidolite, muscovite mica, microlite, monazite, pollucite, and tourmaline), when present in economic quantities, is necessary for a profitable operation. Only the richest of the scores of pegmatites known are exploited. Part of the production results from exploration.

Despite poor demand for beryl, interest of individuals and firms in registering claims for mining concessions continued, and in 1963 several were granted covering beryl and associated minerals. Seven claims, totaling 1,352 hectares, were granted to EMDAL.

Columbium-Tantalum.—The 1963 production of columbium-tantalum minerals dropped somewhat from that in 1962 because of low market prices. Although these minerals are often a byproduct or coproduct of mining pegmatites for beryl, the only major producer, Sociedade Mineira de Marropino, Ltd., emphasizes recovery of columbite-tantalite and microlite. In 1961 this company produced 92 tons of the former and 31 tons of the latter; in 1963 the output was about 57 tons and 73 tons, respectively. Marropino exploits the Morrua deposit west of the Melela River and opposite Napido, where a large flat-lying pegmatite is mined both by hand labor and mechanically. Stripping is done with a bulldozer, front-end loader, and trucks. The ore is treated in a washing plant of perhaps 500 tons of feed per day, where it undergoes screening, followed by gravity concentration and magnetic separation. The product assays 57 to 64 percent tantalum pentoxide and 18 to 24 percent columbium pentoxide. EMDAL is the second largest producer of the pentoxide minerals and small quantities were recovered by the several other beryl producers.

In an endeavor to improve recovery, the operators have modified the plant procedures. The Marropino plant was estimated to be recovering not over 35 percent of the fine tantalite and microlite; additional tables have been installed and another rodmill is to be added. The Mutala Co. formerly recovered tantalite-columbite chiefly in sluices, but in 1963 installed a jig and a shaking table, and ordered another table and a rodmill. In spite of an overall decline in production, their recovery rose considerably, and for the first time a small quantity (1.3 tons) of microlite was recovered in the second half of 1963.

Copper.—The Edmundian Investments Co., a South African concern, reopened a mine in the Isitaca mountains near Manica which had been idle since 1922. The ore was reported to contain 7.5 percent copper. Production at the rate of 1,000 tons of concentrate per month [5] was expected.

NONMETALS

Cement.—In November, Companhia de Cimentos de Moçambique inaugurated the province's third cement plant at Nacala in northern Mozambique. Annual capacity is 100,000 tons; with the Lourenço Marques (131,000 tons) and Beira (100,000 tons) plants of the same company, total capacity is 331,000 tons. The new plant reportedly cost Esc150 million, and the total cost of the three was Esc500 million.

[5] Mines et Metallurgie (Paris). No. 3581, February 1964, p. 62.

The Najala plant is designed to meet the requirements of the Districts of Moçambique, Cabo Delgado, and Niassa; saving on transportation charges may permit sales at lower than previously priced. Expectations are that the new unit will operate at only 20 percent capacity until consumption increases. The decline in production since 1960 has been due to reduced construction activity following the completion of several large public works projects. With the additional capacity now available the announced planned expansion of the Lourenço Marques plant by 200,000 tons annually has not yet been started.

Lithium Minerals.[6]—In the early 1950's the production of lepidolite was of some significance, reaching a peak of 5,712 tons in 1953; however, during recent years it has been small, intermittent, and limited to the byproduct recovery by EMDAL. In late 1963, Marropino started the recovery of lepidolite in the face of a modest demand, but the price was low.

Montmorillonite.—The small production of montmorillonite reported since 1959 has been exported in crude form, mainly to the Republic of South Africa. On October 23, 1963, a plant for processing the crude into a product known as "coral bentonite" was inaugurated near Impamputo, about 56 kilometers from Lourenço Marques. The plant, adjacent to the deposit exploited by open-pit workings employing 60 to 80 laborers, is owned and operated by Lucinada Umbeluzi Mine, Limitada, a Mozambique firm which has invested Esc5 million in the first phase of its operations. Plant capacity is 25 tons daily; production costs are reported at Esc480 per ton, and the selling price on delivery in railway cars at Boane station at Esc720 per ton.

Perlite.[7]—In May 1963, an exclusive charter for perlite exploration was granted to Bedaux, Limitada, a French firm in Lourenço Marques. The concession area is in the District of Lourenço Marques, directly west of Boane. The charter, granted for 2 years, is renewable for 1 year. Renewal of the concession requires the expenditure of at least Esc1 million per year in the form of salaries, wages, and other expenses in Mozambique and Portugal.

MINERAL FUELS

Coal.—Coal continued to be the most valuable mineral product of the country. All production came from a mine at Moatize, 16 kilometers northeast of Tete, where Companhia Carbonifera de Mozambique, of Portuguese-Belgian ownership, exploited deposits in its concession area, which contains about 20 million tons above the 300-meter level. The coal produced contains about 21 percent volatile matter and 19 percent ash. About 45 percent of production is fines smaller than 6 millimeters, and only about 40 percent of the fine coal can be sold. The production continued to be consumed largely in Mozambique by the railroads, the cement plant at Beira, power stations, and small industrial enterprises. Exports dropped to 51,935 tons in 1962 and are believed to have been about the same in 1963. The chief

[6] Minerals Yearbook, v. 1, 1962, p. 821, indicates that in 1962 U.S. imports from Mozambique amounted to 5,661 short tons. This is due to an erroneous declaration of origin for these imports which came from Southern Rhodesia via Mozambique.
[7] Canadian Mining Journal (Quebec). V. 85, No. 2, February 1964, p. 164.

export market has been Nyasaland, where the coal was used for the same purposes as in Mozambique. Pithead price of the Mozambique coal has been about Esc100 per ton, compared with Esc80 for Southern Rhodesian coal and Esc50 for South African coal. Thus the Moatize coal can only be marketed within the limited radius where transportation advantages favor it. The domestic production does not meet the country's coal requirements and the deficit has continued to be met by imports from the Republic of South Africa and the Wankie Colliery in Southern Rhodesia. Despite some replacement of coal by fuel oil since the inauguration of the Mozambique refinery, coal imports increased in 1962 to 324,007 tons; however, through September 1963 they dropped to an annual rate of 304,660 tons, roughly that of 1961.

Petroleum.—Mozambique Gulf Oil Co., owned equally by Gulf Oil Corp. and Pan American Oil Corp., has carried out extensive but unsuccessful exploration since 1948. Of the 11 holes drilled, all but 3 were dry and these gave gas in quantities which the company considered uneconomic. Another group is conducting a market survey in Mozambique and adjacent countries for possible piping from the Buzi No. 1 well south of Beira, where an Upper Cretaceous sand below 1,430 meters yielded a small flow and was capped. Exploration was continued on a reduced scale in 1963 and included the drilling of Pande 2 as an attempted stepout from the 1961 gas discovery there. At yearend, geological exploration in the Zambézi Delta area was underway, and preparations were being made for offshore exploration. In 1962 it was reported that Gulf's current annual expenditures were about Esc28 million.

The refinery at Matola, a suburb of Lourenço Marques has a reported annual capacity of 600,000 tons. It was operated by Sociedade Nacionale de Refinacão de Petroleos (SONAREP), an affiliate of a Portuguese oil company, and partly owned also by private individuals and firms in Mozambique. Output of refined products from imported crude increased by 5 percent in 1963, and butane gas was produced for the first time. Imports of crude totaled 436,820 tons (399,053 tons in 1962). Exports through September 1963, including domestically refined products delivered to maritime bunkers, were at the annual rate of 420,000 tons (269,650 tons in 1962). Increased exports in 1963 were partly due to fuel oil shipments to Portugal, amounting to 67,000 tons through November. Fuel oil shortages were reported in November for the central and northern regions of Mozambique, chiefly for lack of shipping facilities. The exports to Portugal were believed to have been a move to conserve Portuguese escudos within the Portuguese economic area, to strengthen the exchange position of Mozambique in metropolitan escudos, or to find an outlet for surplus production to replace the originally expected markets in earby African territories, which apparently failed to materialize.

Late in the year SONAREP reported plans to invest an additional Esc87 million in the expansion of refinery facilities to provide an annual asphalt production capacity of 118,000 tons and one of 25,000 tons for butane gas. At the beginning of 1963, it was announced that SONAREP had formed a subsidiary company in the Republic of South Africa, known as SONAREP (South Africa), Pty. Ltd., with

a paid-in capital of 20,000 rands (US$28,000) for the purpose of distributing its refined products throughout that country.

Early in the year Portuguese newspapers expressed concern with the announcement of plans for the construction of a pipeline from Durban to Johannesburg. The installation of this facility will be serious for Mozambique since petroleum products now unloaded and transported by rail from Lourenço Marques to the Transvaal represent about 75 percent of all freight between the two points and about 25 percent of all port and rail traffic; the Republic of South Africa also has been an important recipient to products from the Mozambique refinery.

Preliminary work under the supervision of a U.S. contractor was completed on the 25-centimeter crude oil pipeline to connect Beira with the Southern Rhodesian refinery being built at Feruka, 18 kilometers from the Mozambique border. By the end of 1963, almost 158 of the 340 kilometers of the pipeline were laid. The Beira Railway is expected to get annual compensation of about Esc12.5 million for the transportation of crude oil by pipeline. A local hydroelectric company will supply the power for the 1,000-horsepower pumping stations to be located at Beira and at Maforga.

Consumption of petroleum products in 1963 is believed to have been slightly above the 1962 level; in 1962 the following quantities were used:

Gasoline	1,000 liters	58,097
Kerosine	do	23,718
Fuel oils	metric tons	99,008
Lubricants	do	7,323

The Mineral Industry of Nigeria

By Taber de Polo [1]

UNTIL the advent of commercial production of petroleum in 1958, tin was the backbone of Nigeria's mineral economy. Since that year, petroleum has become the first-ranking mineral product, and tin second.

Mineral production has contributed substantially to Nigeria's national economy as reflected in its share of the value of exports, and of industrial employment. In 1962, the latest year for which complete trade data are available, petroleum accounted for 10.2 percent of the value of all exports; tin accounted for 4.3 percent; and columbite, coal and others for another 1 percent. Directly and indirectly the minerals industry furnished employment for 100,000 Nigerians.

Proven petroleum reserves in Nigeria are sufficient to provide for a substantial increase in foreign exchange earnings each year for a number of years. It is likely that reserve figures will continue to increase in view of extensive exploration, both on land and offshore. Reserves of natural gas are also substantial.

In 1963, Nigeria supplied about 4.6 percent of the estimated world tin production and 6.1 percent of free world production of this commodity. The proven reserve of tin ore is estimated at 136,000 tons, and this position reportedly has not changed materially from year to year because the cassiterite produced every year has been partly obtained from outside the declared reserve and because new prospecting has replaced that obtained from declared reserves. Nigeria ranked first among free world producers of columbite and tantalite in 1963, supplying 50.3 percent of recorded new production. The proven reserve of columbite produced mostly as a byproduct of tin, is given as 67,000 tons, and there are large deposits not yet exploited.[2]

Nigeria has reserves of iron ore, coal, and limestone which may be used in a proposed primary steel industry. Coal and limestone mining were already substantial industries in 1963, but no iron ore had been mined commercially by yearend.

The estimated value of reported mineral production in 1962 amounted to almost N£27 million [3] (US$75.6 million). This figure does not include the value of limestone for cement; sand, crushed stone and gravel for mixed concrete, and clays for drilling mud, brick, and pottery. Government revenue from mining and petroleum production operations totaled N£9.9 million, of which oil industry payments totaled over N£8.5 million.

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[1] Foreign mineral specialist, Division of International Activities.
[2] Nigeria Trade Journal. V. II, No. 2. April–June 1963, p. 65.
[3] The monetary unit of Nigeria is the Nigerian pound (N£); N£1=US$2.80.

The mining industry was largely in British hands; the oil industry was controlled by British, Dutch, and United States firms. From October 1, 1960, to October 1, 1963, the number of U.S. firms represented in Nigeria increased from 14 to 67; the more recent figure included 6 firms engaged in petroleum exploration and marketing and 3 firms engaged in mining and other industry.[4]

The first 6-year national development plan (1962–68) called for a total expenditure of N£676.5 million. Under the plan, progress has been made on a number of projects affecting the minerals industry, including Shell Oil's N£10 million refinery. Discussions and planning continued for the installation of the integrated iron and steel industry.

A number of mineral and metal processing and consuming facilities were completed or under construction during 1963; an aluminum rolling mill, a plant producing industrial gases, a galvanized sheet plant, and a glass factory, all at Port Harcourt; a metal container plant at Apapa; a 50,000-ton capacity clinker-grinding plant for cement at Yioko; brick plants at Ikeja and Lagos; a steel rolling mill; an asbestos cement products plant; and an enamelware plant.

Progress was made during the year on commitments to finance the Niger Dam, and tenders were publicly opened for the civil works part of the project. The lowest bid was for N£35.7 million, from an Italian firm. Contracts were signed for preliminary work (roads and access bridges) for the project. A power shortage hindered the development of industry; but progress was made on improvements. During 1963 the Afam power station using natural gas was completed and started operating in May. A N£3.8 million contract was awarded for a new Delta power station at Vyhalli to use natural gas to supply electricity to the Lagos-Ibadan area.

GOVERNMENT POLICIES AND PROGRAMS

In 1963, the Government continued its policy of promoting foreign investment. In the Annual Report of the Mines Division of the Ministry of Mines and Power for the year ended March 31, 1962, The Minister of Mines and Power (as of April 17, 1963) expressed his gratification for "the confidence which overseas investors have shown in Nigeria" and further stated that "history will prove that this confidence is not misplaced."

The Government policy of qualifying Nigerians for technical, supervisory, and administrative positions was also continued. As of March 31, 1962, 21 Nigerians occupied senior staff positions in the Division of Mines, Ministry of Mines and Power, and 12 Nigerians were in training for such positions. Mineral industry companies assisted along these lines; their activities in this field included on the job training programs as well as financing technical education of Nigerians overseas.

Industrial feasibility surveys were sponsored and were generally conducted by experts supplied by American, British, United Nations, and other technical assistance programs.

Changes in Government revenue levels on several commodities influenced the mineral industry. Customs' tariff order Legal Notice No. 42 of 1963 exempted fluorspar and ferroalloys of manganese and

[4] U.S. Embassy, Lagos, Nigeria. State Department Dispatch No. A–299, Nov. 16, 1963, p. 13.

silicon from import duty and removed the export duty on tin and tin ore. Legal Notice No. 82 of 1963 removed export duty of N£1 (US$2.80) per ton on columbite. Legal Notice No. 72 of 1963 accorded pioneer status to the smelting and refining of base metals and the manufacture of their alloys. Pioneer industry status gives a company advantages of income tax relief. The royalty on coal mined by the Nigerian Coal Corp. was abolished on February 1, 1963. A number of tariff increases at the end of the year illustrated the Government's determination to protect local industry.

The Minister of Mines and Power announced in April that Nigeria has applied for membership in the International Atomic Energy Agency. A comprehensive petroleum code was being prepared.

PRODUCTION

Production of petroleum continued to increase throughout the year, and by December 1963, daily output was averaging 82,854 barrels compared with 69,095 barrels in December 1962. Output of tin increased 6 percent over 1962, and columbite production declined 11 percent. Coal output declined by nearly 39,000 tons to a level only 24,165 tons above that of 1960, the record low for 1959–63.

TABLE 1.—Production of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Columbium, concentrate—kilograms	1,614,737	2,080,870	2,384,669	2,298,305	2,044,293
Gold—troy ounces	950	994	676	384	316
Lead, content of ore and concentrate	385	202	6	----------	----------
Monazite, concentrate	14	12	7	9	11
Tantalum, concentrate—kilograms	14,113	11,177	11,898	17,242	15,241
Tin:					
Cassiterite concentrate:					
Gross weight—long tons	7,488	10,374	10,511	11,096	11,788
Tin content—do	5,541	7,675	7,779	8,210	8,723
Metal (smelter output)—do	----------	----------	623	8,024	9,051
Zircon, concentrate	1,134	1,785	755	[1] 494	804
Nonmetals:					
Cement—thousand tons	123	168	364	425	535
Clay:					
Kaolin	5	4	----------	5	15
Miscellaneous (for drilling muds)	[2]	[2]	5,016	[3] 4,000	[3] 1,700
Limestone	181,793	244,111	599,405	724,539	769,665
Mineral fuels:					
Coal	754,144	571,380	607,341	634,326	595,545
Petroleum, crude—thousand 42-gallon barrels	4,067	6,552	16,802	24,624	27,644
Natural gas—million cubic feet	----------	4,939	13,802	18,159	[2]

[1] U.S. imports.
[2] Data not available.
[3] Estimate.

TRADE

In 1963, Nigeria's exports rose, causing a significant improvement in the balance of trade; increases in petroleum and tin exports contributed to the rise. Import figures for the first 11 months of 1963 were reported at N£186 million and export and reexport at N£165.2 million.[5]

Estimated figures for the year were imports N£204.5 million; and exports, N£180 million showing a visible trade deficit of N£25 million,

[5] U.S. Embassy, Lagos, Nigeria. State Department Dispatch A–503, Feb. 8, 1964, p. 3.

a definite improvement over previous years. The United States supplied approximately 8.5 percent of the value of Nigerian total imports for the year.

Continuing a trend, imports from and exports to the European Economic Community markets increased at the expense of Nigeria's largest traditional supplier, the United Kingdom, and of Nigeria's biggest export market, the United States.

There was an increase in total imports due largely to development projects, with their attendant need for raw materials for local processing.

As the result of trade agreements, Japan and the Communist countries also increased their share of Nigerian imports. Association with the EEC improved the long-term outlook of Nigerian trade.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Columbium, concentrate. kilograms	1,869,000	2,302,000	United States 1,047,000; United Kingdom 766,000; Netherlands 375,000.
Lead, concentrate	530	620	Portugal 447; Belgium-Luxembourg 126.
Tantalum, concentrate. kilograms	11,000	13,400	United States 9,200; United Kingdom 2,400; West Germany 1,600.
Tin:			
Concentrate long tons	10,414	347	Portugal 200; United Kingdom 147.
Metal do	623	8,024	Mainly to United Kingdom.
Other ores and concentrates	51	1,782	United States 1,208.
Nonferrous scrap metal	1,967	1,901	Italy 795; West Germany 280; Japan 271; Netherlands 238.
Iron and steel scrap	18,211	4,624	Japan 2,287; Italy 1,218; Egypt 945.
Mineral fuels:			
Coal thousand tons	52	33	All to Ghana.
Petroleum, crude. thousand 42-gallon barrels	16,345	24,553	United Kingdom 16,794; Netherlands 4,238; West Germany 3,390.

TABLE 3.—Import of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Aluminum roofing, sheets, tiles, ridgings.	1,890	1,994	United Kingdom 840; Austria 766; Belgium-Luxembourg 168.
Aluminum and aluminum alloys (worked or not).	2,961	3,347	United Kingdom 1,094; Belgium-Luxembourg 899; Switzerland 625.
Copper and copper alloys, including wire.	874	1,804	United Kingdom 571; Japan 689; Belgium-Luxembourg 169.
Iron and steel (rolled products)	161,222	141,644	United Kingdom 44,673; Japan 28,433; Belgium-Luxembourg 26,892; United States 15,994; West Germany 9,398.
Lead and lead alloys (worked or not).	1	1	West Germany, United Kingdom.
Silver, unworked troy ounces and partly worked.	562	13,737	United Kingdom 11,683; West Germany 2,032.
Tin and tin alloys long tons	19	74	United Kingdom 61.
Zinc and zinc alloys (worked or not)	36	37	United Kingdom 15; Belgium-Luxembourg 12.
Nonferrous base metals, not elsewhere specified.	80	13	United Kingdom 7; India 6.

See footnote at end of table.

TABLE 3.—Import of selected metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Nonmetals:			
Asbestos, cement, sheet, tile, and pipe.	30,677	19,146	United Kingdom 6,832; France 4,058; Israel 3,146.
Asphalt and bituminous emulsions, natural.	13,189	22,240	Netherlands 20,327.
Caustic soda	4,298	6,568	United Kingdom 4,486; Italy 1,394.
Cement—thousand tons	453	340	Poland 96; United Kingdom 71; Israel 51; Egypt 41; Czechoslovakia 34.
Clay products, brick, tile, and pipe	6,775	7,056	United Kingdom 3,093; Italy 2,005.
Gypsum	21,727	34,077	France 21,947; Tunisia 11,685.
Lime	8,581	4,326	United Kingdom 3,717.
Fertilizers:			
Amonium sulfate	1,012	3,994	United Kingdom 1,928; Italy 1,016; Netherlands 578.
Superphosphate of lime	162	3,250	Italy 3,048.
All others including crude potash salts, and mixed fertilizers.	4,539	12,721	Israel 7,511; West Germany 1,813; Netherlands 1,586; United Kingdom 826.
Salt, including salt packaged for retail.	112,694	113,255	United Kingdom 73,929; East Germany 21,143; West Germany 15,477.
Mineral fuels:			
Coal, coke and briquets	2,485	1,461	All from United Kingdom.
Petroleum refinery products:			
Gas- thousand 42-gal. barrels—oline, including aviation gas.	2,522	2,364	Netherlands West Indies 406; Spain 334; Sterling Area in America 323; Venezuela 318; United States 280; Italy 236; Iraq 218.
Ker- thousand 42-gal. barrels—osine.	1,003	976	Spain 190; Iraq 151; Sterling Area in America 138; Netherlands West Indies 127; Venezuela 87; Italy 87; United States 83.
Jet fuel—do	257	373	Netherlands West Indies 118; Sterling Area in America 70; Spain 61; Italy 58; Venezuela 51.
Distillate fuel oil—do	1,870	2,037	Netherlands West Indies 432; United States 317; Venezuela 298; Italy 237; Spain 234; Sterling Area in America[1] 200.
Residual fuel oil—do	1,150	751	Venezuela 270; Spain 166; Italy 154; Netherlands West Indies 85.
Lubricants, including grease. do	129	151	United Kingdom 78; United States 34; Netherlands 26.
Other refined products—do	84	163	Netherlands 130; United Kingdom 13; Italy 5.
Total petroleum products. do	7,015	6,815	

[1] As officially reported; no further detail available.

COMMODITY REVIEW

METALS

Iron Ore.—Iron ore deposits in Nigeria were not exploited. Deposits occur at Agbaja just north of Lokoja, at the confluence of the Niger and Benue Rivers, and at Enugu. The reserve of Agbaja ore is over 110 million tons of 50 percent iron and a large quantity of lower grade ore.[6] The reserve at Enugu has been reported as upward of 100 million tons containing 30 percent or more iron.

Tests of Nigerian iron ore were underway during 1963 at Canadian plants.[7]

Iron and Steel.—West Africa's first steel rolling mill was opened at Emene near Enugu in July 1962 by Nigersteel Co., Ltd., a joint venture

[6] Steel and Coal. Nigerian Iron and Steel Survey. V. 184, No. 4885, Mar. 2, 1962, p. 423.

[7] U.S. Embassy, Lagos, Nigeria. State Department Dispatch A–503, Feb. 8, 1964, p. 7.

between the Government of Eastern Nigeria and Italian interests. It was planned that the mill would use the 12,000 to 15,000 tons of scrap steel generated annually and previously exported, and by so doing, could save Nigeria considerable foreign exchange money. This is Nigeria's first heavy industry and as well as supplying steel for construction and other industrial uses, provides employment and at least limited training in metallurgy.

Attention continued to be given to plans for the development of an integrated iron and steel industry for Nigeria. Sites suggested for the plant are Lokoja and Enugu. There are deposits of iron ore, limestone, and coal in the same general area and should technological problems of the coal and iron ore prove resolvable within economic limits, domestic production of iron and steel would prove of advantage to Nigeria by eliminating the necessity of importing approximately a quarter of a million tons of iron and steel annually. In 1962 Nigeria imported 238,699 tons of construction steel alone valued at N£7,416,000. This item alone was 3.6 percent of the value of total imports.

During the year Nigerian officials participated in meetings sponsored by the Economic Commission for Africa concerning the possibility of establishing a single iron and steel complex for all of West Africa. Port Harcourt has been suggested as a suitable site for such a complex.

Lead.—There was no reported production of lead in 1963 or in 1962. The small quantities mined annually through 1961 came mostly from Plateau Province. Lead-zinc deposits extend discontinuously for about 350 miles in a narrow belt from Ishiagu in the East, through Benue and Adamawa Provinces to Gwana in Bauchi Province. The most important occurrences are South of Abakalika and at Zurak.

Molybdenum.—No report is available on activities during 1963 at the molybdenite lease in Kigom, Zaria Province. In 1962 exploration involving 60 workers was continuing, but no production was reported. Facilities available at the site in 1962 included a crusher, ball mill, classifier, and flotation cells, all of which were reportedly installed to treat molybdenite from surface workings.

Tantalite.—Nigeria's modest production of tantalite declined in 1963 from 1962. The largest percentage of production comes from Benue, Niger, Plateau, and Zaria Provinces.

About 4 percent of the free world's 1963 supply of tantalite came from Nigeria, and the bulk of it was exported to the United States.

Tin and Columbite.—The placer mining of cassiterite and accessory columbite continued to rank second (to petroleum) among Nigerian minerals industries in terms of earnings, and remained a major employer of Nigerian labor, as it was in 1961–62 when it employed an average of 38,847 Africans and 254 non-Africans.[8] The greatest part of the production came from an area around the town of Jos (Plateau Province) on the Bauchi granite plateau.

By far the most important producer was Amalgamated Tin Mines of Nigeria, Ltd., which accounted for over 40 percent of the tin and 36 percent of the columbite produced during the year ended March 31, 1962. In that year 69 other operating firms (including 13 incorpo-

[8] Ministry of Mines and Power. Annual Report of the Mines Division, for the year ended Mar. 31, 1962. Lagos, Nigeria, 1963, p. 9.

rated in the United Kingdom, 43 incorporated in Nigeria, and 13 unincorporated but registered Nigerian firms), together with a sizable number of individual operators were responsible for the balance of output. Three other Nigerian companies were listed among incorporated firms but reported no production.

Each of the 70 operating firms recorded some cassiterite production, 36 of them also produced columbite, and 5 recorded tantalite production, with their tantalite output constituting about 24 percent of total Nigerian tantalite production during the year ending March 31, 1962. Of those reporting cassiterite and columbite output, three produced more columbite than cassiterite, on a tonnage basis, and the ratio of production of columbite to that of cassiterite by others was sufficient to make columbite the premium product on a value basis. Presumably, this situation may well have been altered in 1963 when increasing tin prices and declining columbium prices resulted in increased cassiterite output and declining columbite production.

In spite of better tin market conditions, Amalgamated Tin Mines of Nigeria, Ltd., reported a loss of 40 percent in profits due to increased operating costs.[9] Rising costs of production led to merger of some of the smaller companies.

The Nigerian Embel Tin Smelting Co., Ltd., a Portuguese firm, ceased production early in the year after operating for less than 3 years. Makeri Smelting Co., Ltd., a subsidiary of Williams Harvey & Co., Ltd., of the United Kingdom, began operation in the first quarter of 1962 and was the only tin smelter operating at yearend 1963.

Legal Notice No. 72 of 1963, published in the Supplement to the Federation of Nigeria Official Gazette No. 45, v. 50, of July 4, 1963, accorded pioneer status to the smelting and refining of base metals and the manufacture of their alloys. This action reflects the Government's efforts to protect its existing industry.

NONMETALS

Cement.—Nigeria has the raw materials to become self-sufficient in cement production and should attain this status in 3 to 4 years. Cement imports in 1962 were 45 percent lower than in 1960 in spite of increased consumption.

Nigerian Cement Co., operates plants at Nkalaju and Abeokuta, each with a capacity of around 200,000 tons a year using local limestone as a raw material. West African Portland Cement Co. operates a cement plant at Ewehoro near Lagos and in 1963 began expansion to double its capacity.

In September 1963 the Hamburg firm of Coulinho, Caro & Co. announced plans for a 50,000-ton-capacity plant for grinding clinker to produce cement at Keho in the midwest. Another clinker grinding plant is already under construction near Lagos, and another cement plant was under construction at Sokoto in northern Nigeria, by Terrestoal, A. G. Co., of West Germany.

A new concrete products plant was completed by Nigerian Concrete Industries near Lagos, and Asbestos Cement Products Nigeria, Ltd., completed its second plant near Enugu.

[9] U.S. Embassy, Lagos, Nigeria. State Department Dispatch A–503, Feb. 8, 1964, p. 8.

A number of concrete product and tile companies continued to operate in Nigeria.

Clay.—Large occurrences of clays for pottery, brick, and tile exist in Nigeria. The growing construction industry in Nigeria has increased demand for construction material including clay products. The several small pottery plants do not supply all the local needs.

The first clay products plant with a capacity of 33,000 tons of hollow clay building blocks annually, using local clay began production late in 1962 at Ikeja.[10]

Clay also was mined and pulverized at Isieke Ihekie, for use as a drilling mud. The capacity was 3,000 bags per day.

Legal Notice No. 109 of 1962, published in the Supplement to the Federation of Nigeria Official Gazette, v. 49, No. 66, of August 16, 1962, declared the manufacture of clay bricks, pipes, and tiles a pioneer industry, and clay bricks, paper, and tiles as the pioneer products of the industry.

Limestone.—The quarrying of limestone has become an important part of the local minerals industry, with the bulk of output being consumed by the cement industry.

An additional use for limestone has developed in the recently built tin smelters. The lessening need to import cement in 1962 effected a savings of almost N£3 million in the balance of import-export trade.

Limestone reserves are abundant at Nkalogue in the east and Abeokuta Province in the west where cement plants have been established. In northern Nigeria, reserves of 109 million and 46 million tons of high-grade crystalline limestone have been proved in Sokoto and Jakura respectively.[11]

Other Nonmetals.—In addition to the commodities reviewed separately, others having possibilities for commercial production on the basis of significant reserves reported included barite, diatomite, feldspar, phosphate, salt brines, stone, and talc.

MINERAL FUELS

Coal.—Coal has played a significant part in the economy of Nigeria; the country has been able to supply all its own needs. Some loss of sales has resulted from the dieselization of railways, and this trend probably will continue. Refining of locally produced petroleum and utilization of natural gas could capture some coal markets. However, the continuing increase in industrialization with its attendant need for more electrification and plant fuel, such as for the recently built tin smelters, may help offset losses.

The proposed construction of an iron and steel mill near Enugu could stimulate coal output. Enugu coal, used in a blend containing 10 to 15 percent pitch, reportedly has been coked successfully under commercial conditions in the United Kingdom. Some thought has also been given to the production of fertilizer and tar fractions from Nigerian coal.

The Nigerian Coal Corp. (incorporated in 1950), the only producer of coal, was operating three mines in the Enugu area at yearend: the

[10] Nigeria Trade Journal. V. II, No. 3, July–September, 1963, p. 103.
[11] Nigeria Trade Journal. V. 10, No. 3, July–September, 1962, p. 118.

Okpara (Hayes), opened in 1945; the Ekula, opened in 1956; and the Ribadu, opened in 1961. The Ira mine, opened in 1917, was closed during 1963.

Resources of subbituminous grade coal are reported by the Nigerian Geologic Survey as follows: [12]

Area	Reserve (million metric tons)		
	Indicated	Inferred	Total
Enugu	42.7	12.2	54.9
Ezimo	29.5	17.3	46.8
Orukpa	50.8	7.1	57.9
Okaba	54.9	19.3	74.2
Ogboyoga	83.4	25.4	108.8
Oti		6.1	6.1
Inyi	10.2		10.2
Total	271.5	87.4	358.9

Over 3,000 are employed by the Nigerian Coal Corp.

Principal markets for Nigerian coal are the Nigerian Railway and the Electricity Corp. of Nigeria, which consumed 47 and 28 percent of production respectively in 1962 according to the company.[13]

An amendment to the Minerals Regulations eliminated royalty payments on coal mined by the Nigerian Coal Corp. effective February 1, 1963.

Petroleum.—Crude petroleum, first shipped from Nigeria in 1958, has become a major factor in Nigeria's industrial development as well as the country's foremost mineral product. Production in 1963 established a new high of 27.6 million barrels.[14] Exports were reported to be 26.7 million barrels which accounted for an appreciable amount of all of Nigerian export trade.

Nigeria's production of crude petroleum in 1962 amounted to 0.28 percent of the world total and 8.3 percent of the African total. The country's share of the world crude oil export trade was 0.73 percent of the world total and almost 9 percent of African crude oil entering the export trade.

The value of crude petroleum exports for the first half of 1963 amounted to N£9.4 million or 10.1 percent of the value of all exports from Nigeria. This compares with N£7.2 million, or 7.9 percent of the total value for 1962.

The value of petroleum export for all of 1962 was N£16.89 or 10.2 percent of the total value of exports.[15]

Offsetting the income from crude petroleum exports was the need to import refined petroleum products. During the first 6 months of 1963, 137.7 million gallons of imports were valued at N£7.2 million.[16] Total value of such imports for 1962 was N£14 million.

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[12] Mining Journal. Coal in Nigeria. V. 260, No. 6671, June 28, 1963, p. 645.
[13] Nigerian Coal Corp., Public Relations Department (Enugu, Nigeria). PMB 1053, March 1963.
[14] U.S. Embassy, Lagos. State Department Dispatches; A–683, May 9, 1963, p. 11; A–71, Aug. 1, 1963, p. 9; A–299, Nov. 16, 1963, p. 11; and A–503, Feb. 8, 1964, appendix I.
[15] Federal Office of Statistics, Lagos. Nigerian Trade Summary. V. 48, No. 6, June 1963.
[16] Nigerian Trade Journal. V. II, No. 4, October–December 1963, pp. 152–153.

Nigeria produces more than enough crude oil for its foreseeable needs and when the refinery under construction is completed, the country will be able to supply its own internal needs for refined petroleum products and to produce an exportable excess as well, thus increasing Government revenue from its petroleum resources.

It was announced in April 1963 that a comprehensive petroleum code was being prepared.[17]

Most operations in 1963 were conducted under the terms and procedures for concessions which were outlined in Government Notice No. 2675, published on page 1684 of the Official Gazette of the Federation of Nigeria for December 17, 1959. Also affecting leasing procedures was a March 1961 meeting of prospective operating companies and Government officials at which time the 50–50 profit split was agreed on.[18]

At yearend there were nine established oilfields in Nigeria. Already tied into the Shell-British Petroleum (BP) pipeline system were Bomu (the major producer), Afam, Imo River, Aoara, and Ebubu fields in the east and Obibiri in the west. Plans have been made to tie Vghelli and Rumuekpo in the midwest into the system.

All of the oil and gas showings have occurred in a relatively small area of the country, the Delta section in south-central Nigeria.

In 1963, Shell-BP was the only company to produce crude petroleum; the company has forecast its production at 30.7 million barrels in 1964 and at 43 million barrels in 1965. The company believes the probable Nigerian reserves may be several times the conservative estimate of 300 million barrels often reported.[19]

During 1963 Shell-BP continued drilling additional exploratory and development wells in its extensive onshore holdings, completed plans for new pipelines to bring other producing wells into its gathering system, and progressed slowly on its refinery and loading facilities near Port Harcourt.

During the second quarter of 1963 the first offshore well in Nigeria was spudded by American Overseas Petroleum Co. off Kulama in the Delta. This and two other offshore holes drilled by the same company were dry.

Tennessee Nigeria, Inc., continued exploratory drilling with additional dry holes on the coast, east of Lagos. Gulf and Mobil completed preparations and were ready to start offshore drilling operations. Mobil also commenced a limited operation in the Western Region in 1958.

Shell-BP, in operation in Nigeria since 1937, remained the major concession holder in Nigeria. A French oil company, SAFNEP, secured a license to conduct an area-magnetic survey in the Benue River Basin, hitherto unexplored.

In December 1963, Shell-BP obtained licenses for new pipelines linking its field at Vghelli with the Rumuekpe and Bomu fields and the Bonny oil terminal.[20] A contract was let to construct a pipeline from Imo River fields to the new refinery near Port Harcourt. This adds substantially to Shell's collecting system connecting Afam thru

[17] U.S. Embassy, Lagos. Nigeria. State Department Dispatch A–71, Aug. 1, 1963, p. 7.
[18] U.S. Embassy, Lagos, Nigeria. State Department Dispatch 522, Mar. 10, 1961, p. 1.
[19] U.S. Embassy, Lagos, Nigeria. State Department Dispatch A–503, Feb. 8, 1964, p. 8.
[20] U.S. Embassy, Lagos, Nigeria. State Department Dispatch A–503, Feb. 8, 1964, p. 8.

Bomu to the Bonny terminal and to the line from Oloibiri to Port Harcourt.

Early in the year Shell-BP announced plans for doubling its petroleum storage capacity at Bonny terminal to 940,000 barrels.[21] This port, 18 miles south of Port Harcourt, was completed as a deep-water harbor by Shell-BP early in 1961 and is capable of berthing large tankers.

During 1963, work commenced on Nigeria's first refinery at Alese near Port Harcourt. The agreement between the Nigerian Government and Nigerian Petroleum Refining Co., Ltd. (Shell-BP), was signed in 1962. Ownership is: Nigerian Government—50 percent, Shell—25 percent, and British Petroleum—25 percent.

The refinery will consist of a 42,850-barrel-per-day crude distillation facility and a 4,600-barrel-per-day catalytic reforming unit, as well as storage tanks, auxillary services, and a tanker jetty on Okrika Island in the Bonny River. Cost is estimated at US$27 million.

When completed the refinery is expected to process almost 14 million barrels of Nigerian crude oil yearly. Refined products will be gasoline, kerosine, distillate, and residual fuel oils. Much of the refinery output will be exported.[22]

Natural Gas.—Substantial reserves of natural gas exist in Nigeria. Although Shell-BP Development Co. was the only producer of natural gas in 1963, other reserves occur in concessions relinquished by Shell and now controlled by other oil companies. Some reserves also belong to the Government-owned Nigerian Coal Corp. At yearend 1963, two gas pipelines were operating; one supplied 20 million cubic feet of gas daily from the Afam field to the Electricity Corp. of Nigeria to run its power station in Afam; the other supplied 5 million cubic feet daily from the Apara oilfield to the Eastern Nigerian Development Corp., which distributed and sold gas to factories near Port Harcourt. Other gas pipelines were in the planning stage.

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[21] U.S. Embassy, Lagos, Nigeria. State Department Dispatch A–472, Jan. 31, 1963, p. 2.
[22] Nigerian Trade Journal. Nigeria's Oil Refinery. V. II, No. 4, October–December 1963, pp. 152–154.

The Mineral Industry of the Federation of Rhodesia and Nyasaland

By Thomas C. Denton [1]

THE FEDERATION of Rhodesia and Nyasaland was established on March 24, 1953, and dissolved as of midnight December 31, 1963. It was formed of the following British territories: the self-governing colony of Southern Rhodesia, Northern Rhodesia Protectorate and Nyasaland Protectorate. The divisions of the Federation are discussed separately so that comparison may be made with future issues. However, because foreign trade was reported for the Federation as a whole, the standard format for chapters of this volume has been modified to the extent that principal discussion of trade and trade tables follow the introductory remarks.

The currency of the Federation and of each of its members was the Rhodesia pound, tied to and redeemable in Sterling. The Rhodesian pound (R£) is used throughout the chapter. R£1 equals US$2.80.

TRADE

Exports.—In 1963 the metal and mineral exports of the Federation, exclusive of iron and steel and ferroalloys, totaled R£140.24 million and were 63.2 percent of the value of all domestic exports plus small gold sales within the Federation. The accompanying table of exports in 1961 and 1962 identifies the origin or origins of each item listed.

Imports.—Exact identification of destination within the Federation was not feasible. But with a general knowledge of the economies of the three areas and their relative degree of industrialization, it is roughly estimated that of total imports of metals, minerals, and mineral fuels in recent years, 60 percent went to Southern Rhodesia, 30 percent to Northern Rhodesia, and 10 percent to Nyasaland. The value of imports in 1962 was approximately R£19 million. Three classes of materials accounted for 91 percent of this total value as follows: Liquid fuels, 49 percent; iron and steel semimanufactures, 32 percent; fertilizers, 10 percent. Countries of the Near East, particularly Iran, furnished the great bulk of fuels imported. About 82 percent by value of iron and steel came from the Republic of South Africa. Western European countries supplied most of the fertilizer materials, except that Morocco was the principal source for phosphate rock.

[1] Africa specialist, Division of International Activities.

TABLE 1.—Federation of the Rhodesias and Nyasaland: Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	Origin within the Federation	1961	1962	Principal destinations, 1962
Metals:				
Antimony ore and concentrate.	Southern Rhodesia.	225	182	Belgium 179; India 3.
Beryllium ore and concentrate.	do	387	457	United States 383; France 55; Japan 16.
Cadmium metal	Northern Rhodesia.	5	36	United Kingdom 22; Republic of South Africa 14.
Chrome ore and concentrate.	Southern Rhodesia.	431,810	391,613	United States 298,350; Republic of South Africa 23,146; Norway 15,050; Japan 14,958; United Kingdom 13,805.
Cobalt:[1]				
Alloys	Northern Rhodesia.	5	-------	
Metal	do	549	894	United Kingdom 781; Republic of South Africa 62; Australia 51.
Anode slimes	do	235	163	All to Japan.
Copper:				
Ore and concentrate	Southern Rhodesia and Northern Rhodesia.	11,991	5,683	Republic of South Africa 5,620; United Kingdom 36; Sweden 27.
Copper-cobalt matte	Northern Rhodesia.	13,205	2,619	Belgium 2,619.
Copper anode slimes	do	109	705	West Germany 518; Sweden 146; United States 33.
Metal, unwrought:				
Blister	Northern Rhodesia and Southern Rhodesia.	149,157	120,849	United Kingdom 41,355; West Germany 41,048; Belgium 12,294.
Electrolytic:				
Wirebar	Northern Rhodesia.	340,289	350,574	United Kingdom 159,659; Italy 48,885; West Germany 29,435; France 28,048.
Cathode form	do	34,961	38,356	United Kingdom 23,234; West Germany 6,905; United States 5,080.
Ingot and bar	do	21,038	22,107	United Kingdom 10,187; France 4,753; India 2,913.
Other, not further identified.	do	8,326	13,013	West Germany 5,588; United States 3,886; Italy 1,367.
Semimanufactures, wrought, including alloys.	(2)	92	1,001	Federation of Malaya 997.
Gold:				
Concentrate	(2)	14	26	(2).
Bullion—troy ounces	Southern Rhodesia.	565,169	548,999	(2).
Iron and steel:				
Iron ore	do	14,739	120,459	Japan 116,649; Australia 3,810.
Pig iron, sponge iron, and spiegeleisen.	do	119,727	205,200	Japan 181,199; Italy 10,146; United Kingdom 9,249.
Ferroalloys	do	9,063	8,208	United Kingdom 3,817; Canada 3,252; Australia 387.
Iron and steel scrap	(2)	1,879	10,884	Republic of South Africa 10,843.
Iron and steel ingots and equivalent primary forms.	Southern Rhodesia.	29,882	9,300	Pakistan 9,296.
Iron and steel, other [3]	do	3,400	2,511	Republic of the Congo (Léopoldville) 1,509; Kenya 507; Mozambique 290.
Lead:				
Ore and concentrate	(2)	15	-------	
Bars and ingots	Northern Rhodesia.	11,127	14,139	All to Republic of South Africa.
Manganese, ore and concentrate.	do	42,244	45,862	France 20,991; United States 12,010; West Germany 6,371.
Nickel, ore and concentrate	Southern Rhodesia.	228	266	All to Japan.
Silver, unworked. troy ounces	do	132,547	83,913	United Kingdom 82,765; Republic of South Africa 1,148.
Tantalum, ores and concentrates.	do	39	82	United States 44; Netherlands 19; United Kingdom 8.
Tin:				
Ore and concentrate	Mostly Southern Rhodesia.	259	32	Netherlands 19; United Kingdom 13.
Ingots and bars	Southern Rhodesia.	494	558	Republic of South Africa 550; Republic of the Congo (Léopoldville) 8.

See footnotes at end of table.

TABLE 1.—Federation of the Rhodesias and Nyasaland: Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	Origin within the Federation	1961	1962	Principal destinations, 1962
Metals—Continued:				
Tungsten, ore and concentrate.	Southern Rhodesia.	34	26	All to Republic of South Africa.
Zinc:				
Ore and concentrate	(2)	967	1,872	Do.
Ingots and bars	Southern Rhodesia.	25,663	41,710	Republic of South Africa 24,739; Sweden 5,113; United States 3,200.
Nonferrous metal scrap, not further described.	(2)	2,533	3,185	Republic of South Africa 1,647; Japan 529; United Kingdom 312.
Nonferrous metals, not further described.	(2)	48	36	Republic of the Congo (Léopoldville) 27; Mozambique 6.
Nonmetals:				
Asbestos	Southern Rhodesia.	121,123	131,917	United Kingdom 76,804; West Germany 10,755; United States 5,121.
Cement	Either or both Southern Rodesia and Northern Rhodesia.	614	362	Bechuanaland 263; Tanganyika 84.
Corundum ore	Southern Rhodesia.	2,662	2,973	United States 1,801; Republic of South Africa 1,036; West Germany 76.
Dolomite and limestone	Either or both Southern Rhodesia and Northern Rhodesia.	-------	46	Republic of South Africa 36; Mozambique 10.
Fireclay	Southern Rhodesia.	49	11	All to Mozambique.
Fluorspar	do	18	-------	
Lithium ore	do	29,552	29,671	United States 19,299; Netherlands 3,162; Japan 3,028.
Magnesite	do	12,251	8,967	All to Republic of South Africa.
Mica, unmanufactured:				
Block and sheet	do	30	15	United Kingdom 9; Italy 4.
Waste and crude	do	26	-------	
Quartzite	(2)	9	-------	
Vermiculite	(2)	1	4	Bechuanaland 2; Mozambique 2.
Mineral fuels:				
Solid fuels:				
Coal, lignite, and peat	Southern Rhodesia.	247,698	196,062	Republic of the Congo (Léopoldville) 103,790; Bechuanaland 58,910; Mozambique 33,362.
Coke	do	113,528	53,076	Republic of the Congo (Léopoldville) 52,712; Mozambique 217; Angola 135.
Liquid fuels:				
Total refinery products, reexports.	(4)	29	59	(2).

[1] See also copper-cobalt matte.
[2] Not available.
[3] Includes semifinished steel and other unwrought, not described in detail.
[4] Includes Northern Rhodesia.

TABLE 2.—Federation of the Rhodesias and Nyasaland: Imports of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum semimanufactures	1,137	1,268	Republic of South Africa 917; United Kingdom 224; France 49.
Copper and copper alloys, all forms	846	1,032	Republic of South Africa 616; United Kingdom 335; Republic of the Congo (Léopoldville) 40.
Gold, value—pounds	29,488	48,387	Not reported.
Iron and steel:			
Pig iron and sponge iron	487	89	All from Republic of South Africa.
Iron and steel ingots and equivalent primary forms.	127	1,426	United Kingdom 1,330; Republic of South Africa 96.
Semimanufactures	130,877	103,424	Republic of South Africa 85,053; United Kingdom 14,033; Belgium 1,273.
Lead and lead alloys, all forms	108	68	Republic of South Africa 62; United Kingdom 6.
Nickel and nickel alloys, all forms	18	12	Republic of South Africa 8; Canada 2; United Kingdom 2.
Tin and tin alloys, all forms	78	49	Republic of South Africa 40; United Kingdom 9.
Zinc and zinc alloys, all forms	50	88	United Kingdom 43; Republic of the Congo (Léopoldville) 41.
Nonferrous base metals, not further described.	628	751	Republic of South Africa 471; Belgium 132; United Kingdom 67.
Nonmetals:			
Abrasives	233	187	Republic of South Africa 125; United Kingdom 41; Austria 8.
Cement	1,389	2,583	Republic of South Africa 2,182; United Kingdom 231; Tanganyika 109.
Fertilizer materials:			
Nitrogenous	76,798	85,129	West Germany 54,402; Netherlands 16,071; Belgium 9,580.
Phosphatic, superphosphates only.	21,528	20,527	Netherlands 19,535; Italy 484; Belgium 255.
Potassic	29,439	26,684	France 15,479; West Germany 10,359; Israel 730.
Other, includes phosphate rock	70,479	70,732	Morocco 66,099; West Germany 2,097; Senegal 1,089.
Gypsum and plaster of paris	23,850	19,354	Republic of South Africa 19,030; United Kingdom 241.
Lime	10,343	9,669	Republic of South Africa 9,459; Tanganyika 138; Mozambique 71.
Potash compounds (other than fertilizers).	357	691	Belgium 303; Republic of South Africa 110; Sweden 107; West Germany 101.
Salt	37,087	40,637	Republic of South Africa 23,231; Mozambique 7,404; Angola 4,108.
Mineral fuels:			
Solid fuels: Coal and coke	66,101	63,670	Mozambique 48,595; Republic of South Africa 15,075.
Liquid fuels:			
Gasoline—thousand 42-gallon barrels	2,257	2,312	Iran 1,514; Bahrain 666; Aden 117.
Kerosine—do	323	340	Iran 197; Bahrain 94; Aden 43.
Jet fuel—do	204	257	Iran 217; Aden 28; Bahrain 9.
Distillate fuel oil—do	1,308	1,438	Iran 770; Saudi Arabia 411; Bahrain 216.
Residual fuel oil—do	32	41	Iran 15; Bahrain 14; Republic of South Africa 11.
Lubricants—do	137	158	Republic of South Africa 120; United States 12; Netherlands West Indies 9.
Asphalt and bitumen	7,568	21,595	Republic of South Africa 16,178; United States 2,098; Trinidad and Tobago 1,897.
Other—thousand 42-gallon barrels	24	32	Indonesia 8; United States 8; United Kingdom 3.

[1] Excludes imports of metalliferous ores and scrap, crude minerals not elsewhere specified, and various construction materials—including common brick, refractory brick, tiles, plate and sheet glass, and fire and furnace cement, which are not reported by weight. Values of these imports, in major groups were as follows: Metalliferous ores and scrap—£33,658—1961, £48,876—1962; crude minerals, not elsewhere specified—1961—£287,322, 1962—£379,254; construction materials—1961—£946,401, 1962—£1,027,238.

NORTHERN RHODESIA

Northern Rhodesian mineral industry was an important contributor to world mineral supply. In the overall economy of the country the industry is primary. The position results from the large contribution of the copper industry (mining, smelting, and refining). Significant quantities of other metals are also produced, partly as byproducts of the copper industry.

In 1962 the contribution of Northren Rhodesia to world-copper production exclusive of Sino-Soviet Bloc countries was 14.5 percent and the country ranked third after the United States and Chile. In some years the country has ranked second after the United States. In 1962 Northern Rhodesia also contributed 6.1 percent of world cobalt production, 1.9 percent of selenium, and 1.5 percent of zinc. Other output included lead, cadmium, manganese, gold, and silver.

In the economy of the country, the mining industry is the largest contributor to gross domestic product (GDP) and to exchange earnings, as well as the largest employer of industrial labor. Employment in 1963 was about 41,000 Africans and 8,000 Europeans.[2] The value of mineral production was approximately R£125.8 million, of which copper provided R£118.1, nearly 95 percent. Value of production was 60 percent of the R£207.6 million roughly estimated as the GDP of Northern Rhodesia in 1963.[3] As for exchange earnings, both in 1961 and 1962 the value of mineral exports was approximately R£117 million, and of the order of 75 percent of the value of Northern Rhodesia's domestic-product exports. Countries from which mineral exports earned foreign exchange included Republic of South Africa, most of the countries of Western Europe, and the United States.

There was speculation toward the end of 1963 that discussions were in progress between the Northern Rhodesian Government and the British South Africa Co. about transferring the mineral rights of the company to the government. The company owns mineral rights to nearly all of Northern Rhodesia, which would revert to the government in 1984 without compensation. Meanwhile the company pays to the government 20 percent of net revenue derived from exercise of its rights. In the fiscal year ended September 23, 1963, company mining revenue from royalties and other sources was £6,457,000 after deducting the government share of £2,601,000 and £4,162,000 in local taxes.

No industrywide strike occurred during the year, but between June 1962 and September 1963, there were more than 40 separate strikes or work stoppages by African employees. At the large Mufulira copper mine, work was stopped from February 23 until May 2. At Nchanga another large operation, a riot occurred on June 16, 1963, in which nine Africans were killed, and more than a hundred were injured. The riot resulted from rivalry which developed between members of two political parties.

During the year educational and training schemes for Africans continued to be increased both in scope and number.

The Prime Minister of Northern Rhodesia in public addresses has given assurances that when independent, Northern Rhodesia will not

[2] U.S. Consulate General, Johannesburg. Annual Minerals Report, Federation of Rhodesia and Nyasaland. Airgram A–282, May 1, 1964.
[3] U.S. Consulate General, Salisbury. Airgram A–989, Mar. 6, 1964.

expropriate foreign holdings. Moreover, he has said that expatriates are needed.

SOURCE MATERIAL

Principal sources for information about Northern Rhodesia were official reports of the governments of the Federation and Northern Rhodesia, trade journals, annual minerals reports for the Federation by the American Consulate General, Johannesburg, South Africa, other reports of the Foreign Service of the United States, annual reports of mining companies operating in Northern Rhodesia, the journal of the Chamber of Mines of Rhodesia, and personal observations by the author.

PRODUCTION

A new record of copper production for Northern Rhodesia was achieved in 1963 despite considerable labor unrest. Of the total output of blister copper and electrolytically refined copper, refined production was 438,893 metric tons, or 76.2 percent of output. Refined output has grown steadily in recent years, the increase since 1959 being 18.5 percent. Blister for refining overseas nevertheless was expected to be produced in substantial quantity for some time to come.

Record production of lead and zinc, both from one mine, also was realized in 1963. The increase for lead from 1962 was 32 percent; for zinc, 22 percent.

TABLE 3.—Northern Rhodesia: Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Beryl	2	2			
Cadmium, kilograms		26,400	19,255	16,859	14,993
Cobalt, content of white alloy and matte, metal	2,059	1,847	1,543	860	980
Copper:					
Concentrate, copper content	30	74	97	64	68
Blister	168,190	164,495	151,208	113,743	137,121
Electrolytic	370,400	402,131	416,280	433,292	438,893
Other	1,271	1,220	1,449	718	836
Total	539,891	567,920	569,034	547,817	576,918
Gold [1], troy ounces	4,685	6,300	4,192	3,625	4,960
Lead, refined	14,631	14,661	15,382	14,826	19,610
Manganese ore	54,701	53,449	53,440	46,721	[2] 50,000
Selenium [3], kilograms	15,172	22,734	17,854	18,382	28,527
Silver [4], troy ounces	937,678	920,601	738,558	697,054	883,681
Tin, concentrate, long tons	1		1	8	1
Uranium, U_3O_8	34				
Vanadium, metal			236		
Zinc, electrolytic	30,375	30,271	30,340	40,482	49,168
Nonmetals, except fuels:					
Amethyst, kilograms		2	4,508	12,664	15,443
Cement, thousand tons	136	[2] 127	122	[2] 120	[2] 120
Limestone	485,532	366,029	423,335	460,055	538,679
Phyllite	23,246	10,714	21,129	16,376	13,026

[1] Chiefly contained in blister copper and electrolytic-copper refinery muds.
[2] Estimate.
[3] Contained in electrolytic-copper refinery muds and blister copper.
[4] Refined silver and silver contained in electrolytic-copper refinery muds and blister copper.

TRADE

Northern Rhodesia is the principal source of copper for the United Kingdom; for Continental Western Europe, Rhodesia is a major ultimate source; and for most Western European countries, the principal ultimate source along with the Republic of the Congo (Léopoldville). Of tonnage exported in 1962, five European countries took 75 percent, as follows: United Kingdom 44 percent; West Germany 14 percent; Italy 9 percent; France 6 percent; Belgium 2 percent. Of blister copper, three European countries took 78.9 percent as follows: United Kingdom 34.4 percent; West Germany 34.1 percent; Belgium 10.4 percent. As to refined copper (all forms), 75.5 percent went to four countries in Europe as follows: United Kingdom 46.9 percent; Italy 11.9 percent; West Germany 8.8 percent; France 7.9 percent. Exports to the United States totaled 16,585 tons, about half was blister. U.S.S.R. took 4,471 metric tons of blister and 9,408 tons of electrolytic wire bars. Combined exports to Czechoslovakia and Poland were 1,318 tons of blister and 3,353 tons of refined copper.

COMMODITY REVIEW

METALS

Copper and Cobalt.—Northern Rhodesian copper industry (mining, smelting, and refining) is situated in a relatively narrow strip of country known as the Copperbelt. The Belt extends, roughly, from Ndola northwest about 108 kilometers along the common border of Rhodesia and the Republic of the Congo (Léopoldville). Operating in the Belt at the present time are six mining companies and two refining companies. Two of the mining companies also produce byproduct cobalt. Three of the mining companies also have metallurgical plants at their mines.

Anglo American Corp. of South Africa, Ltd., controls three of the mining companies and a refining company. Rhodesian Selection Trust, Ltd., 46.1 percent owned by American Metal Climax, Inc., controls the other companies, and owns outright a fourth mine equipped with smelter, which it operates as a Division of Rhodesian Selection Trust. Table 4 lists the companies, published ore reserves of the mines, and principal metallurgical facilities of both mining and refining companies.

TABLE 4.—Northern Rhodesia copper mining and refining companies, ore reserves and metallurgical facilities, in 1963

	Published ore reserves [1]		Principal metallurgical facilities
	Millions of metric tons	Copper content, percent	
Anglo American group:			
Mining:			
Bancroft Mines, Ltd	88.9	3.66	Concentrator.
Nchanga Consolidated Copper Mines, Ltd.	[2] 210.4	4.39	Concentrator, leach-electrolysis plant producing cathode copper.
Rhokana Corp., Ltd	113.0	[3] 2.92	Concentrator, smelter, cobalt plant.
Refining: Rhodesia Copper Refineries, Ltd.			Electrolytic copper refinery, sulfuric acid plant.
Rhodesian Selection Trust group:			
Mining:			
Chambishi Mines, Ltd	31.2	3.34	None; mine being developed.
Chibuluma Mines, Ltd	8.8	[4] 4.6	Concentrator, a cobalt-copper matte plant at Ndola.
Mufulira Copper Mines Ltd	159.3	3.34	Concentrator, smelter, electrolytic copper refinery.
Roan Antelope Mine [5]	84.5	2.92	Concentrator, smelter.
Refining: Ndola Copper Refineries, Ltd.			Electrolytic copper refinery.

[1] As of June 30, 1963, if not shown otherwise.
[2] As of Mar. 31, 1963.
[3] Also appreciable cobalt, but cobalt reserves not reported.
[4] Also 0.15 percent cobalt.
[5] Owned outright by Rhodesian Selection Trust, operated as a Division.

The following are some highlights for the Copperbelt mining industry in 1963.[4]

The industry regained its position as the world's second largest copper producer after the United States.

Copper sold amounted to 624,452 short tons (566,490 metric tons) worth £128 million.

Basic wages and salaries earned by 44,789 employees were R£15.5 million, and total earnings were R£26.3 million.

The contribution of the industry to the net domestic product of Northern Rhodesia was 44 percent and to that of the Federation, 16 percent.

The value of mineral exports was about 92 percent of the total value of merchandise exported from Northern Rhodesia and about 54 percent for merchandise exports from the whole Federation.

With other users on the Copperbelt, a record 2,039 million kilowatt-hours of electricity was consumed.

Coal consumed amounted to 698,983 short tons (634,103 metric tons), nearly 50,000 short tons (45,359 metric tons) more than in 1962.

The fatal accident rate of 0.26 per million hours worked was the lowest ever recorded and compared with 0.48 in 1962. The sharp decline coincided with a safety drive begun in April 1963, chiefly to combat fall of ground, transportation hazards and men falling, the three chief causes of fatal mine accidents.

Rhodesian Selection Trust, Ltd. (RST).—In November 1963, RST announced that it would acquire from American Metal Climax, Inc., the latter's business as sales agent for copper, lead, zinc, and certain

[4] Northern Rhodesia Chamber of Mines. 1963 Year Book. Reported in October 1964 issue of "Horizon," published by Rhodesian Selection Trust Ltd.

other nonferrous metals produced by various companies, including those of the RST group. The consideration for the purchase was 1 million RST shares. The transfer was expected to occur on January 1, 1964.

In its report for the fiscal year ended June 30, 1963, RST stated that it was continuing examination of specific areas in Northern Rhodesia that more than 10 years of general exploration had indicated to warrant detailed assessment.

The RST group includes Chambishi Mines, Ltd.; Chibuluma Mines, Ltd.; Mufulira Copper Mines, Ltd.; Roan Antelope Mine; anl Ndola Copper Refineries, Ltd.

Production is expected by mid 1965 from the new open pit mine that Chambishi Mines, Ltd. is developing. Full production of about 26,300 metric tons of copper annually is expected 2 years later. Chambishi has potential for larger output than that for which preparations are underway.

Chibuluma Mines, Ltd. produced 66,597 tons of copper concentrates in the year ended June 30, 1963, which returned 20,340 tons of fire-refinable grade copper. The output was nearly 17 percent larger than in the previous year, as ore was obtained for the first time from the Chibuluma West expansion project.

Production of cobalt-copper concentrates totaled 17,521 metric tons that were sent to the cobalt plant at Ndola where the new matte upgrading section was commissioned early in 1963. Late in the year the upgraded matte was shipped to Belgium for refining.

For the year ended June 30, 1963, planned production of copper by Mufulira Copper Mines, Ltd., was 129,550 metric tons, which is about 85 percent of capacity. A strike interrupted operations for 10 weeks, and actual output was 113,570 tons. This was slightly less than was produced in the previous financial year.

The 1963 operations of the Roan Antelope Mine Division of RST were planned at 85 percent of capacity. Copper production was 77,732 tons, compared to 80,145 tons in the previous financial year. The new Mac Laren shaft was officially opened in August 1963. It is 1,236 meters deep, and the deepest shaft so far sunk from the surface in the Copperbelt. The shaft serves the western end of Roan extension and Muliashi; it is the fourth major service and rock-hoisting shaft to be commissioned. The shaft does not increase production capacity; its establishment was essential to maintain existing capacity.

The annual capacity of the Ndola Copper Refineries, Ltd., for electrolytic copper is about 109,700 tons. Copper refined year ended June 30, 1963 totaled 90,951 tons. The great bulk of copper received for refining came from the smelter of the Roan Antelope mine. Copper was also custom refined for other Copperbelt producers. The quantity of copper refined in 1962–63 was 6,000 tons less than in the previous year due to interruptions resulting from labor disputes.

Anglo American Group of Companies.—The Anglo American group comprises Bancroft Mines, Ltd.; Nchanga Consolidated Mines, Ltd.; Rhokana Corp., Ltd.; and Rhodesia Copper Refineries, Ltd.

During the year ended June 30, 1963 Bancroft Mines, Ltd., continued to encounter difficulties in the No. 1 shaft area, and these became intensified. A leached zone was discovered at the south end of

the 1,150 level, extending at least 2,000 feet. About 750,000 tons of ore was indicated to be unpayable in an area where stoping had been planned. In addition, heavy water inflow at the north end of the level delayed progress. As a result of these developments, copper output for the fiscal year fell by 9 percent to 43,847 metric tons, and profit was reduced by nearly 50 percent. It was estimated that 1963–64 production will be reduced to about 40,000 long tons but that it should improve in the following year.

Largely the future of the mine depends on evidence regarding the water problem to be obtained when the upper hanging-wall water zone is tapped. During 1962–63 the average volume of water pumped daily was 48.99 million gallons. Present daily pumping capacity is 71 million gallons—57 million at No. 1 shaft and 14 million at No. 3 shaft.

Nchanga Consolidated Mines, Ltd. completed the first stage of the R£3.7 million plant extensions program with commissioning of the low-grade oxide leaching plant in December 1962. The plant was opened officially in March 1963.

Production for the year ended March 31, 1963, was less than in fiscal year 1961/62 due to strikes by the Northern African Mineworker's Trade Union. Output of finished copper was 178,793 metric tons, comprising 16,367 tons of blister and 162,427 tons of electrolytic copper. The total figure compares with 198,086 tons of copper produced in 1961/62. Sales of blister and electrolytic copper in 1962/63 totaled 174,638 metric tons which compares with 186,608 tons in 1961/62.

At Nchanga West ore hoisted was about 2.7 million metric tons. Development totaled 143,009 feet. Overall average daily volume of water pumped was 17.1 million gallons.

At Nchanga open pit 881,870 metric tons of ore were sent to the concentrator. Overburden removed totaled 4.69 million cubic yards. Of the total, the bucket-wheel excavator and conveyor system handled 2.42 million yards, and shovels and rubber-tired vehicles 2.27 million yards. Ore available at yearend without further stripping was 2.807 million metric tons. From Chingola open pit 337,800 metric tons of ore were milled. Stripping totaled 1.12 million cubic yards. Stripped ore at yearend was nearly 356,000 metric tons.

The concentrator received a total of 3,946,100 metric tons of ore. Copper grade by source of the ore was as follows: Nchanga mine, 6.06 percent; Nchanga open pit, 3.31 percent; and Chingola open pit, 6.08 percent. Some concentrator data were:

		Quantity
Ore milled	metric tons	3,905,000
Feed assay:		
Total copper	percent	5.45
Oxide copper	do	2.37
Sulfide copper	do	3.08
Oxide to sulfide ratio		0.77:1
Percentage recoveries in concentrates:		
Total copper		90.77
Oxide copper		86.45
Sulfide copper		94.09
Copper production in concentrates	metric tons	193,342

Production of concentrates was:

Type of concentrate:	Quantity, metric tons	Copper content, percent		
		Total	As oxide	As sulfide
Smelter-grade concentrate	259, 216	44. 41	3. 59	40. 82
High-grade leach concentrate	602, 669	12. 34	11. 21	1. 13
Low-grade leach concentrate	130, 550	2. 94	2. 39	. 55
Concentrate recovered from catchment dam	41, 118	11. 93	10. 09	1. 84

Copper recovery improved over that of the previous year, reaching about 91 percent early in 1963. While in part due to a more favorable ratio of oxide copper to sulfide copper, the improvement mostly resulted from scavenging of low-grade oxide copper being introduced.

Rhokana copper output during the year ended June 30, 1963 was adversely affected by a strike and by a slight decline in grade of ore milled. Statistical details on output were:

	Long tons	Metric tons
Primary production:		
Blister copper	10, 648	10, 819
Anodes for refining	85, 289	86, 659
Cathodes from cobalt plant	3, 071	3, 120
Total	99, 008	100, 598
Finished production:		
Blister copper	10, 648	10, 819
Electrolytic	87, 324	88, 726
Total	97, 972	99, 545

In the cobalt plant, cobalt metal deposited was 1,271 metric tons. This is an increase of nearly 47 percent from the previous year. In addition, 414 kilograms of cobalt in hydroxide was produced. The plant also turned out 4,105 metric tons of copper, of which 75 percent was as cathodes acceptable to the copper refinery. The rest went to the smelter for casting as blister.

Ore hoisted, totaled 5,060,100 metric tons, derived as follows: Nkana, 938,500 tons; South Ore body, 917,300 tons; and Mindola, 3,204,300 tons. Development, including stope preparation and shaft sinking, totaled 342,998 feet. The average volume of water pumped daily was 13.4 million gallons.

Salient statistics for operation of the concentrator during the year are:

		Quantity
Ore milled	metric tons	5, 064, 242
Feed assay:		
Copper	percent	2. 28
Cobalt	do	0. 13
Recoveries:		
Copper in combined concentrates	do	92. 88
Cobalt in cobalt concentrate	do	24. 91
Production of concentrates:		
Copper, 37.02 percent Cu; 0.85 percent Co	metric tons	276, 215
Cobalt, 3.81 percent Co; 12.07 percent Cu	do	41, 741

In March 1963 the concentrator reverted to a return water circuit and a common flotation treatment for the various ores. This reduced reagent consumption and improved flexibility in ore treatment. The reversion also lowered the cost of producing cobalt concentrate but

with some decrease in cobalt recovery. It also lowered the copper to cobalt ratio, which improved overall copper extraction.

Rhodesia Copper Refineries, Ltd., owned equally by Rhokana Corp., Ltd., and Nchanga Copper Mines, Ltd., continued to operate its electrolytic copper refinery, as well as the only sulfuric acid plant in the Copperbelt.

Output of finished copper by Refineries, Ltd., in the year ended June 30, 1963, totaled 236,977 metric tons and comprised 23,145 tons of cathodes and 213,832 tons of refined shapes. The latter figure compares with 199,607 tons for the previous year.

Production of 50,384 metric tons of sulfuric acid was 48 percent more than in the previous year. A new plant was commissioned on October 31, 1962, and the two old units later were shut down.

Lead and Zinc.—The Broken Hill mine of the Rhodesian Broken Hill Development Co., Ltd. (controlled by Anglo American Corp.) has accounted for the entire Northern Rhodesian production of lead and zinc for many years. The mine has its own hydroelectric powerplant, an electrolytic zinc refinery, and a lead refinery. In addition, in January 1962 an Imperial smelting furnace was commissioned. Serious difficulties were encountered during the first year of operation of the furnace—particularly rapid-shaft accretion, high-lead volatilization, heavy dross and blue-powder production, and high-zinc content of slag. By early 1963 zinc losses in slag had been reduced to an acceptable figure. The problem of accretion buildup had been virtually solved toward the end of 1963.

Lead output in 1963 was 19,610 metric tons, compared with 14,826 tons in 1962. Zinc production in 1963 totaled 49,450 tons, compared with 40,482 tons in 1962. Additional output in 1963 included 16,859 kilograms of cadmium as extruded pencils. The proved and indicated ore reserve reported at the end of 1962 was 5,351,000 tons, containing 13.5 percent lead and 26.9 percent zinc.

SOUTHERN RHODESIA

Southern Rhodesian mineral industry comprises a large sector of the national economy and is an important contributor to world mineral supply. While the value of output is only about 20 percent of that of Northern Rhodesia, a greater variety of important metals and minerals are produced.

The contribution of the industry in 1963 to the gross domestic product (GDP) of Southern Rhodesia is indicated to have been more than 8 percent. GDP was estimated tentatively at R£294 million.[5] The value of mineral production exclusive of iron and steel and ferroalloys manufactured was R£23.7 million. The industry also contributes substantially to the economy as an employer. At the end of September 1963 it was employing 40,500 Africans and 2,590 non-Africans. The figure for Africans was 2,900 less than at the end of September a year earlier. Exchange earnings of the industry are also important. In 1962 the value of exports was about R£24 million, including R£6,878,180 in gold bullion. Destinations of the exports besides sterling countries

[5] U.S. Consulate General, Salisbury. Airgram A–989, Apr. 6, 1964.

included many of the countries of Western Europe, the United States, Japan, and Republic of South Africa.

In 1963 Southern Rhodesia provided 1.1 percent or more of free world output of 8 minerals as follows: Arsenic, white, 1.1 percent; asbestos, 7.6 percent; beryl, 4 percent; chromite, 15.4 percent; columbium-tantalum minerals, new production, 1.7 percent; corundum, 93.8 percent; gold, 1.5 percent; lithium minerals, 92.9 percent. U.S. capital is heavily involved in the chromite-mining industry and substantially, in that of lithium.

Rhodesian Selection Trust Ltd. (RST) continued to center activities in the Lomagundi area, where in 1962 encouraging results were reported in the search for nickel and copper At one location diamond drilling was undertaken; underground work, at another. In addition, RST amended its Exclusive Prospecting Order (EPO) 102 to include gold in the Hartley District, and took out two more for chromite. One of the areas covered looks promising; the other was abandoned late in the year.

Anglo American Corp. of South Africa, Ltd., formed two Southern Rhodesian companies—Northridge, Ltd., and Middleridge—to investigate chromite in the Great Dyke. One area comprises 151 square miles; the other, 34 square miles. Anglo is also investigating iron ore and has started a survey of the gold resources of Southern Rhodesia.

GOVERNMENT POLICIES AND PROGRAMS

Late in 1963 the government proposed the following actions affecting mineral industry:

To increase the size of the fund available to the mining affairs board for loans and operation of the plan for renting equipment to small operators.

To subsidize gold mines operating at a loss, that demonstrated future possibilities, to the extent of the loss or R£3 per ounce, whichever amount was the smaller.

To increase depletion allowance for gold mining from 10 to 15 percent. The depletion allowance for base minerals was to be increased from 2.5 to 5 percent, effective in the tax year beginning April 1, 1964.

To permit mines now allowed to charge capital expenditures on a life-of-the-mine basis to claim future capital expenditures in the year in which incurred.[6]

SOURCE MATERIAL

Major source materials for Southern Rhodesia were the following: (1) Mineral industry trade publications; (2) government publications; (3) company annual reports; (4) dispatches of the Foreign Service of the United States; (5) observation by the author.

PRODUCTION

The total value of mineral industry output in 1963 exclusive of iron and steel and ferroalloys was R£23.73 million, 5 percent less than

[6] Southern Rhodesia, The Chamber of Mines Journal. V. 6, No. 1, January 1964.

comparable 1962 output. While more than 40 minerals were produced, 90 percent of total value was contributed by only 5 minerals as follows: Gold, 30 percent; asbestos, 25.3 percent; copper, 13.7 percent; coal, 12.7 percent; chromite, 8.3 percent. The decline in total value in 1963 was largely due to reduced output of asbestos and chrome.

TABLE 5.—Southern Rhodesia: Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Antimony, content of concentrate	94	91	62	55	58
Arsenic, white	479	185		1,095	549
Bauxite				508	1,842
Beryl	399	489	359	507	226
Cesium, pollucite	2	5	9	19	
Chromite	492,696	606,364	536,045	460,565	374,116
Copper:					
Concentrate, copper content	10,902	13,483	13,828	13,741	16,773
Blister				40	16,773
Gold, troy ounces	566,883	562,703	570,095	554,647	566,277
Iron and steel:					
Iron ore, thousand tons	130	158	388	619	655
Pig iron, do	72	86	220	241	250
Steel ingots and castings, do	46	86	92	80	50
Manganese ore	1,929	1,520	186	7,237	
Nickel, content of ore		22	58	78	119
Silver, troy ounces	328,947	392,026	106,801	83,540	83,742
Tantalum concentrate, kilograms	52,988	49,024	62,768	72,493	68,492
Tin:					
Concentrate, tin content, long tons	605	642	716	677	498
Metal, do	572	611	673	679	554
Tungsten ore and concentrate, 60 percent WO_3	33	10	50	22	2
Nonmetals:					
Asbestos	108,589	121,529	146,609	128,997	129,051
Barite	217				1,772
Cement, thousand metric tons	424	[1] 443	279	[1] 250	[1] 250
Chrysoberyl, kilograms	[2]	[2]	[2]	10	16
Cordierite, do	[2]	[2]	[2]	[2]	1
Corundum	2,539	3,486	2,533	3,037	5,390
Diatomite, includes tripoli	134	149	371	384	273
Fire clay	12,327	16,704	14,640	13,910	13,180
Fluorspar	9	17		18	311
Garnet, kilograms	[2]	[2]	[2]	[2]	15
Jade	[2]	2	2	4	2
Kaolin		6,000	18,494		11,104
Kyanite	[2]	[2]	[2]	[2]	54
Limestone	903,479	732,211	717,111	615,420	533,173
Lithium minerals:					
Amblygonite			78	32	47
Eucryptite		1,210	1,705	786	1,056
Lepidolite	[3] 52,527	14,048	21,806	19,272	14,657
Petalite		57,457	25,127	19,690	27,167
Spodumene		6,976	1,476	1,357	2,028
Magnesite		7,286	12,592	10,541	10,947
Mica:					
Block	48	41	29	15	26
Crude and scrap		342	46	79	103
Phosphate rock	1,703	3,493	454		
Pyrites	40,883	50,089	59,379	51,265	66,099
Talc				20	20
Topaz, kilograms	[2]	[2]	[2]	[2]	76
Tourmaline, do	[2]	[2]	[2]	[2]	57
Vermiculite	45				
Quartz	10,242	11,863	8,930	10,575	19,054
Quartzite	564	634	344	236	200
Mineral fuels:					
Coal, bituminous, thousand tons	3,759	3,559	3,073	2,826	2,740
Coke, do	188	146	192	102	[1] 105

[1] Estimate.
[2] Data not available.
[3] Exports.

TRADE

Excluding R£6.9 million of gold bullion exported, metal and mineral exports in 1962, including iron and steel and ferroalloys were approximated R£19.9 million. Five items contributed approximately 84 percent of this total as follows: Asbestos, 38.2 percent; pig iron, 14.1 percent; copper, 13.5 percent;[7] chrome, 13.0 percent; ferroalloys, 5.2 percent.

The three largest customers for asbestos by volume were the United Kingdom, West Germany, and the United States. Their shares of total exports were, respectively, 58.7, 8.1, and 3.8 percent. Nearly 90 percent of pig iron exported went to Japan. The United States took 76 percent of chrome exports.

For details on exports and imports, refer to tables 1 and 2.

COMMODITY REVIEW

METALS

Chromium.—Possibly excluding the U.S.S.R., Southern Rhodesia ranks second in the world after the Republic of South Africa for magnitude of chromium resources. Chromite reserves in the Great Dyke of Southern Rhodesia to an inclined depth of 600 feet have been estimated to be nearly 400 million tons. Large reserves also exist in the adjacent Selukwe area. The ore is mostly of metallurgical grade. The bulk of developed reserves is owned by subsidiaries of U.S. companies, which in the aggregate are by far the largest producers.

Southern Rhodesian production in 1963 was 19 percent less than in 1962 and far below peak output of 1960. The decline was due to reduced markets and Russian competition. Export sales, on which the industry chiefly depends, fell to 279,632 metric tons from 391,582 tons in 1962. Exports to the United States were 180,747 tons, 39 percent less than in 1962. At the end of the year some optimism about the outlook for 1964 existed among producers.

Southern Rhodesia has two ferrochrome manufacturers: Rhodesian Alloys, Ltd., in Gwelo and Windsor Ferroalloys (Pvt.), Ltd., at Que Que, a newcomer. Neither company reported production. Exports of ferroalloys, presumably all ferrochromium, in 1962 were 8,208 metric tons valued at R£1,032,334. The quantity exported was 9.5 percent less than in 1961.

Copper.—Major copper mining operations and the smelter are owned or controlled by the South African company, The Messina (Transvaal) Development Co., Ltd. In 1963 Messina reported ore reserves at three Southern Rhodesian operations as follows:

	Quantity, metric tons	*Grade percent copper*
Mangula:		
Proved	13,800,000	1.37
Probable	17,000,000	1.35
Alaska:		
Proved	500,000	2.22
Probable	3,000,000	1.78
Umkando: Proved	958,000	2.86

[7] Value of copper exports is assumed to be the value of blister copper produced in 1962, or R£2.7 million.

Production in 1963 of copper in concentrate was 16,773 metric tons, valued at R£3.23 million, the volume being 2,700 metric tons higher than in 1962. Smelter output of blister during the year ended September 30, 1963, was 12,173 tons, 8.3 percent less than the preceding year. The decline resulted from a drop in copper content of Mangula and Alaska concentrates treated. Copper content at yearend was only about 16 to 17 percent.

Gold.—Gold production in 1963 of 566,277 ounces approached the record peak of 570,095 ounces set in 1961. The achievement was largely due to expansion at the Dalny mine, the second largest Southern Rhodesian gold mine, following the Rio Tinto Cam and Motor mine. Dalny is owned by Falcon Mines, Ltd. Ore reserves in 1963 totaled 820,400 short tons, averaging 0.341 ounces gold per ton. While small by South African standards, the reserve probably is the largest in Southern Rhodesia.

While Falcon Mines, Ltd., and two other companies with several mines now account for the bulk of Southern Rhodesia gold production, it is still true that gold mining as such is the major activity of small-scale miners. There are about 150 registered gold mines.

The Chamber of Mines during 1963 investigated the possibility of establishing a gold refinery in Southern Rhodesia. At yearend the study was continuing.

Iron and Steel.—Iron ore production in 1963 was 655,372 metric tons. Exports, all to Japan, totaled 210,564 metric tons and were 42 percent larger than in 1962. Ore for export came from Rhodesian Iron and Steel Co., the Beacon Tor mine near Que Que, controlled by Kobe Steelworks of Japan; Norie mine in the Bulawayo District, owned by Belingwe Mining Investments (Pty.), Ltd.; and a mine adjacent to Norie owned by Bukwa Iron Mining Co. The two companies operating in the Bulawayo District were jointly financing a 4 mile railroad spur to connect the mines with Ingesi, the nearest station on the railroad to Lurenco Marques, Mozambique. The hope was that upon completion of ore-loading facilities in Lourenco Marques scheduled for September 1964, the Rhodesian ore would be competitive on the European market, and the companies would be free from dependence on small-lot shipments to Japan.

Rhodesian Iron & Steel Co. (Risco), the only steel producer, suffered from reduced local demand and reduced staff during 1963. Steel output was about 45,000 metric tons. Pig iron production, however, reached about 229,000 tons; while exports, mostly to Japan, were 216,698 tons. Risco reportedly hoped to sell 61,700 tons of steel locally in 1964, which steel users considered an optimistic figure.

Additional export markets were found late in 1963. Risco reportedly expected to sell about 60,000 metric tons of steel to South Africa and the United Kingdom in 1964, and Japan contracted for 226,800 tons of pig iron.

Tantalite.—Production of tantalite concentrates at 69 metric tons, valued at R£99,253, was 7 percent less than in 1962. The ore reserve of the Benson mine north of Motko, the principal source, is small. Johannesburg Consolidated Investment Co. continued to show interest in Rhodesian tantalite. It took an option on the Portree mine near Umtali.

NONMETALS

Asbestos.—Southern Rhodesia markets chrysotile asbestos. More than 60 percent of large production comes from mines controlled by Turner & Newall, Ltd., of the United Kingdom. Their mines in the vicinity of Shabanie are world famous both for capacity and quantity of long-fiber asbestos produced.

The volume of asbestos produced in 1963 in the whole country was virtually the same as in 1962, but value fell by R£1.3 million to R£5,996,760.

Pangoni, the major new asbestos mine, was opened in August 1963 by the Prime Minister. Present capacity for fiber is 10,000 tons annually; in 1964 a decision will be made as to whether capacity will be doubled. If it is doubled, the total investment in the project will be about R£3 million. Pangoni is controlled by Asbestos Investments (Pty.), Ltd., of Johannesburg, which Swiss capital controls.

Lithium.—Bikita Minerals (Pvt.), Ltd., controlled by Selection Trust of London and in which American Metal Climax (New York) is interested, accounts for the entire Southern Rhodesian production of lithium minerals; Bikita is a major world source. Bikita exploits a large pegmatite deposit in the vicinity of Fort Victoria.

Late in 1963, in response to increased orders from the United States, Europe, and Japan, Bikita raised its monthly rate of output from 3,600 metric tons to 5,000 metric tons. The increase required quarrying 27,200 metric tons of ore monthly. Concentration of the ore was by handpicking from belts. Labor force was increased, and additional machinery was provided during the year.

MINERAL FUELS

Coal.—Wankie Colliery Company, Ltd., controlled by Anglo American Corp. of South Africa, Ltd., is the sole coal producer in Southern Rhodesia. The gradual decline in Wankie output in recent years continued in 1963. Production was 85,300 metric tons below 1962, and 1 million tons below the 1957 peak. The reasons for the decline, besides the principal one of competition from the Kariba hydroelectric scheme on the Zambesi River, were increased railroad dieselization and somewhat slow business conditions in Southern Rhodesia. A new threat to coal industry was the oil refinery being built near Umtali.

London & Rhodesian Mining & Land Co., Ltd. (Lonrho), second largest Southern Rhodesian gold producer, proposed to the government construction of a 16-inch, 500-mile pipeline to carry annually 4 million tons of Wankie coal to a seaport for export. Late in 1963 Lonrho also proposed consideration of a 900-mile pipeline to South-West Africa to supply 4 million tons of coal.

Wankie Colliery again investigated and again declined to undertake construction of an oil-from-coal plant. A survey team which last year went overseas found costs still too high.

Petroleum.—At yearend construction of the R£10 million Feruka petroleum refinery 6 kilometers from Umtali and 18 kilometers from the Mozambique border was on schedule. Completion of the project is expected in September 1964. The refinery will be operated by Central African Refinerys (Pvt.), Ltd., owned by a consortium of seven oil companies comprising Mobil Petroleum Corp., Shell, British Pe-

troleum, California-Texas Oil Corp., Total Oil Products Rhodesia (Pvt.), Ltd., American Independent Oil Co. and Kuwait National Petroleum Co.

The refinery is being built by Procon, Ltd., a subsidiary of Procon, Inc., of the United States. Crude capacity will be 20,000 barrels a day, although initially the refinery will operate at 65 percent of capacity. It will be one of the most advanced refineries in Africa. It will have a catalytic cracker, making possible the processing of a wide range of crudes. Economics dictated choice of the catalytic cracker inasmuch as virtually no market exists for residual fuel oil in Rhodesia, which has abundant cheap coal and hydroelectric power.

Crude for the refinery will be imported through the Mozambique port, Beira, and transported to Feruka by a 10-inch pipeline about 300 kilometers in length.

NYASALAND

No mineral production was reported for Nyasaland in 1963 except limestone and shale, for which figures were lacking. In the past, production of clinker by Nyasaland Portland Cement Co., Ltd., has been as much as 14,500 metric tons annually.

The bauxite deposits on the Mlange plateau, which the government wants exploited, were the subject of inquiries by the Japanese and an American company. This is perhaps the principal mineral resource presently known in Nyasaland.

The Nyasaland Geological Survey Department continued exploration, including investigation of occurrences of asbestos, bauxite at Lichonya, columbium, copper, gold, graphite, and mica. Results were not promising, except possibly on graphite showings in the Salima area and mica in the Mzimba District, on which more work will be done. In addition, Anglo American Corp. of South Africa, Ltd., continued its investigation of diamond possibilities.

The Mineral Industry of Rwanda

By Thomas G. Murdock [1]

THE REPUBLIC of Rwanda and the adjoining Kingdom of Burundi became independent States on July 1, 1962, following the termination of the United Nations Trusteeship of Ruanda-Urundi, administered by Belgium. Formerly, Ruanda-Urundi had a small but fairly diversified mineral production, but most statistical compilations combined this with that of the former Belgian Congo. Practically all of Ruanda-Urundi's output, except for bastnaesite production which ceased in 1958, came from the area that is now Rwanda.

Mineral production has been generally downward since 1961, and although exact data for 1963 are not available, indications are that record lows were established. Serious racial disturbances in December, between the Tutsis and the Hutus, had a damaging effect on the economy of the country. However, the mining companies were able to continue operations, and little loss of production resulted. Data on metals and minerals imports are available only for 1963, and these were comparatively small for a population of about 3 million.

In 1962 the gross national product (GNP) was RBFr5,700 million (US$114 million),[2] the mineral production was officially valued at RBFr195 million, only 3.7 percent of the GNP.

The mining industry employed a labor force of about 6,250 local inhabitants and 50 Europeans, slightly over one-third of the number engaged 10 years ago when mining employed 19 percent of the total labor force.

GOVERNMENT POLICIES AND PROGRAMS

The political changes following independence reportedly had no adverse effects on the Rwanda mining companies, but very strict exchange control regulations were enforced.

The mining industry continued to be based on the decree of September 24, 1937, made effective in Rwanda in November of that year As provided for by this decree, the Government grants concessions for prospecting and for exploration of mineral deposits to companies and

[1] Mining engineer, Division of International Activities.

[2] Rwanda Burundi (RB) francs are the monetary units used in this chapter. The official exchange rate was RBFr1=US$0.02. The unofficial rate was US$1 at RBFr100.

individuals meeting certain qualifications. Mining permits are for 30 years in the case of surface deposits and for 50 years for deposits at depth.

A Rwandese law, enacted during the year and made retroactive to January 1, stipulated that mines which have not been operative for the 3 previous years shall revert to public ownership. The Government announced plans to expand production by putting new mining legislation into effect. Prospecting rights will continue to be granted but could be awarded by communal administrations in the case of prospecting by individuals. Buying agencies were to be set up. By these measures the Government hoped to double output within 5 years. Expanded production was also dependent upon enlarging the capacity of hydroelectric stations.

A European Common Market prospecting team visited Rwanda, in an effort to replace the abandoned private prospecting by a governmental organization. Expectations were that work would be concentrated mainly in areas where prospects seemed more favorable, the Congo-Nile Divide and the Ruhengeri and Kagera regions. A program of detailed geological mapping was scheduled for implementation by the Government agency concerned, in collaboration with the Royal Central African Museum, of Tervueren, Belgium.

SOURCE MATERIAL

Some information was supplied by the U.S. Embassy in Kigali, but that contained in an English publication [3] has provided practically all of this chapter except for the trade data from a publication of the Republic of Rwanda.

PRODUCTION

Individual commodities showed considerable fluctuations in output during 1959–63. The overall trend is best reflected in the following total value of annual production: 1959, RBFr161 million; 1960, RBFr199 million; 1961, RBFr233 million; 1962, RBFr196 million; and 1963 RBFr166 million (estimate). Market prices have had a minimum effect on the downward trend of most commodities; the decrease from the 1961 high has resulted from local conditions including limited exploration, depletion of the amblygonite deposits, the generally decreasing tenors of ground mined, and the suspension of operations by one of the larger companies. The continual production of beryl and tin ore at above 1959 levels has offset in part the lower production of the other minerals. Unsettled conditions in Rwanda and adjacent countries during latter years have prevented any increase output from mines with otherwise good operating conditions and reserve position.

[3] Mining Journal (London). Annual Review, 1963. May 1963, pp. 183–184; V. 261, No. 6679, Aug. 23, 1963, pp. 169–170; Annual Review, 1964. June 1964, p. 191.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Beryl	170	281	476	357	[2] 228
Columbium and tantalum concentrate kilograms [3]	64,000	48,000	46,000	39,000	[2] 30,000
Gold troy ounces	3,119	1,566	900	[2] 900	[2] 500
Tin content of ore [4] long tons	1,124	1,277	1,474	[2] 1,440	[2] 1,250
Tungsten ore and concentrate (60-percent WO_3 basis)	155	457	666	150	[2] 100
Nonmetals:					
Lithium, amblygonite	2,690	2,381	1,682	326	[2] 268

[1] In addition, construction materials are produced in Rwanda, but no quantitative data are available.
[2] Estimate.
[3] Includes small quantities from adjacent Burundi (2,000 kilograms reported in 1962, only year for which data are available).
[4] Includes small quantities produced in Burundi; except for 1962 and 1963 when these were 35 and 25 tons, respectively, no differentiation is possible.

TRADE

Data on trade in minerals and metals prior to 1963 are not available for Rwanda alone. Exports have been equal to production except for minor stock changes. In 1961 the total value of exports was RBFr220 million, 17 percent of the total combined exports of Rwanda and Burundi. In 1963 Rwanda's recorded exports of metals and minerals were valued at RBFr144 million, 80 percent of the country's total exports. Tin ores and mixtures of tin and columbium minerals totaled RBFr141 million. Recorded imports of metals and minerals (including some metal manufactures) in 1963 were valued at RBFr52 million, 21 percent of all imports.

Data on destination of the exports of metals are not available; Belgium received 80 percent of all exports and probably a higher proportion of most of the mineral commodities. Belgium supplied only 24 percent of all imports. The suppliers of petroleum refinery products, Saudi Arabia and Iran, were the leading sources of metal and mineral imports, with 35 and 26 percent, respectively. No minerals and metals trade with the United States was identifiable from Rwanda statistics; however, in past years a part of the beryl and columbite-tantalite production went to that country but was combined with that from the Republic of the Congo (Léopoldville).

TABLE 2.—Principal exports of metals and minerals in 1963 [1]

(Metric tons unless otherwise specified)

Commodity [2]	Metric tons	Value (thousand RB francs)
Aluminum [3]	4	196
Bismuth ore and concentrate [4]	27	2,503
Tantalum concentrate	2	266
Tin ore and concentrate:		
Cassiterite long tons	1,204	113,424
Cassiterite-tantalite-columbite	285	27,283
Tungsten ore and concentrate	10	245
Total value		143,917

[1] Data for earlier years or showing destinations not available. Belgium was principal destination of most exports.
[2] In addition, lithium (amblygonite) was exported and perhaps some gold from production of previous years; quantities not available.
[3] Designated as unmanufactured but may have been scrap.
[4] Not shown by production; may have originated outside of Rwanda.

Source: Direction de la Statistique Générale et de la Documentation. Bulletin de Statistique No. 1, April 1964.

TABLE 3.—Principal imports of metals and minerals in 1963 [1]

Commodity	Metric tons	Value (thousand RB francs)
Metals: [2]		
Aluminum	420	1,816
Copper	17	945
Iron and steel	464	8,900
Nonmetals:		
Cement and salt [3]	1,436	3,694
Mineral fuels:		
Petroleum refinery products [4]	6,488	36,673
Total value		52,028

[1] Data for earlier years or showing sources not available; Belgium was principal source of imports other than mineral fuels.
[2] Manufactures included.
[3] Not available separately.
[4] Customs classification is "mineral fuels" but is believed to consist entirely of these products. Principal suppliers were Saudi Arabia (3,445 tons) and Iran (2,132 tons). Lubricants may not have been included.

Source: Direction de la Statistique Générale et de la Documentation. Bulletin de Statistique. No. 1, April 1964.

COMMODITY REVIEW

METALS

Beryl.—The decreased output of beryl since 1961 is partly the result of the suspension of operations by Compagnie Minière du Ruanda-Urundi (MIRUDI), a formerly important producer of beryl, cassiterite, and columbite-tantalite. The 1963 production was apparently all by Société des Mines d'Étain du Ruanda-Urundi (MINETAIN), a Belgian company associated with the Société Générale Group, and with widely dispersed activities in Rwanda. The beryl production is a byproduct of the mining of cassiterite with which it is associated in certain pegmatite dikes. Output is not proportionate to that of cassiterite as some zones in the pegmatite bodies are richer in beryl than others and only a part of the Rwanda cassiterite comes from

pegmatites; quartz veins contribute most of the remainder. The beryl is obtained by hand sorting from the pegmatite and beryllium oxide content is 10 to 13 percent.

Columbium-Tantalum.—The pentoxides of these metals, in an intimate association with each other, continued to be mined on a small scale and it is believed that the production during recent years has been entirely as concentrates separated from a mixture of columbite-tantalite and cassiterite mined from pegmatites. MINETAIN continued to operate the plant, located at Katumba, for separating cassiterite from the mixture and as the leading producer may have accounted for all the 1963 output. MIRUDI was formerly a producer of columbite-tantalite, and the decline during recent years was partly due to the suspension of their operations. In 1962 MINETAIN produced 306 metric tons of mixed concentrates; the tantalite-columbite contained apparently constituted about 13 percent of the total. Rwanda columbite-tantalite assays 70 to 75 percent combined pentoxides.

Gold.—The decreased gold production was both a continuation of an earlier trend and a result of increased mining by unauthorized operators, attributed to the attraction of strong currency in the neighboring countries and to a falling off in police supervision. The problem became serious and official production was brought to almost a complete standstill. Data on sources of production in 1963 are not available; in 1950 output reached 7,587 ounces and was mainly from operations of MINETAIN, an associated company, and one or two individual miners.

Tin.—The tin ore production came mainly from the mines of Compagnie Géologique et Minière du Ruanda (GEORUANDA), at Rwinkwavu; Société Minière de Muhinga et de Kigali, at Rutongo; and of MINETAIN, at Katumba, Musha, and in the vicinity of the Congo-Nile Divide. A small output may have been maintained by Compagnie de Recherches et d'Exploitation Minière (COREM) and some of the various individual miners formerly active back in 1953 when the contained tin production of Rwanda and Burundi together was 2,040 long tons. Many of the occurrences exploited in the past are outcrops, but progressive exhaustion of the surface deposits has forced the producers to operate at increasing depths. After an initial concentration by sluices or washers the cassiterite is treated in Harz jigs; the marketable product contains 72 to 74 percent tin. The tin concentrates are normally exported to Hoboken, Belgium, for smelting and refining. In 1962 underground mining accounted for 56 percent of all cassiterite mined; in 1963 this dropped to 45 percent mainly due to the flooding of the mine workings by heavy rains. Difficulties of control and supervision due to the widely separated plants were another factor leading to the decreased output. The ground mined averaged from 1.2 to 1.5 kilograms of cassiterite, columbite-tantalite, or wolframite per cubic meter. The operators have had a natural tendency to exploit successively the richer parts of each deposit; this and decreased prospecting have accounted in part for the reduction of output since the 1956 peak, but the international restrictions of tin for the 1958–60 period were a more important cause. Rwanda did not participate in 1961 in the International Tin Agreement and thus was not bound by the quota scheme.

Tungsten.—There was a remarkable recovery in tungsten ore production in 1961, but this was only temporary and 1963 marked a new low. Little data on sources of production are available; MINETAIN's output through June was at an annual rate of 59 percent below 1962. The large Kifuruwe and Kagogo mines in the Rubengeri area, operated by individuals, are believed to have been the major producers, as in the past.

NONMETALS

Lithium.—MINETAIN continued production of amblygonite from its Rongi mine, the only important deposit known. Reserves were practically exhausted at the end of 1961, and subsequent work has been limited to extracting the small tonnage remaining.

MINERAL FUELS

Natural Gas.—It was reported that a deposit of methane in the waters of Lake Kivu was to be exploited, but little detailed information is available. Known for several years, the deposit was investigated in 1961 by the Union Chimique Belge, and gas reserve was placed at 50 billion cubic meters. Original plans were to install a tapping station on a cape near Kisenyi, on Lake Kivu, and furnish the local brewery with about 400 cubic meters per hour of purified gas obtained from about 1,500 cubic meters of crude gas extracted from the bottom of the lake. About 2 tons of byproduct carbon dioxide might be obtained and used for making dry ice, a market for which would be provided by conservation of fresh food and fish produced by the local industry. The preparation of bottled methane for household use was mentioned as an ultimate objective.

The Mineral Industry of Senegal

By Thomas G. Murdock[1]

MINING in Senegal was limited mainly to the recovery of titanium and zirconium minerals from beach sands of the Atlantic coast and to the production of phosphate rock. While titanium mineral production declined in 1963, this was a temporary condition and progress was made on the installation of new facilities for a substantial increase in output. Senegal's titanium and zirconium mineral production constituted a small fraction of world total; however, it continued to be a principal source for French industries. Phosphate rock production was below the 1962 level; it comprised only 1.2 percent of the world total but was unique because part of it was the rare aluminum phosphate, and the calcium phosphate had a P_2O_5 content greater than that of many competitive producers. Completion of Senegal's only oil refinery at the end of the year was a significant step to an improved mineral economy. The refinery is to operate entirely on imported crude oil. The search for important petroleum deposits proved disappointing.

In 1962 the gross national product (GNP) was CFAF141,120 million (US$576 million);[2] the mineral production had an estimated value of CFAF2,979 million (2 percent of GNP), exclusive of petroleum and building materials other than cement and for which no basis for an estimate was available. In 1963 the estimated total production value declined to CFAF2,902 million.

Current data on employment by the extractive industries are not available. In 1959 their labor force comprised 1,906 workers; this has increased appreciably with the opening of the Taiba phosphate mine in 1960 and its subsequent growth in output. Expectations were that 190 people would be employed in the petroleum refinery. Regardless of the size of the total labor force, the minerals industry employed only a small part of the 27,000 in all industrial activities and of the 100,000 wage earners out of the 3.1 million population.

At yearend U.S. investments in the Senegal minerals industry consisted of the International Minerals & Chemical Corp.'s holdings in the leading phosphate company and of U.S. petroleum companies in the petroleum refinery. Some participation in oil exploration may have been still in effect.

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[1] Mining engineer, Division of International Activities.

[2] African Financial Community (CFA) francs are used in Senegal. The exchange rate for this country review is US$1=CFAF245 (CFAF1=US$0.004081.6).

GOVERNMENT POLICIES AND PROGRAMS[3]

No legislation of specific application to the extractive industries was reported in 1963. A liberal, nondiscriminatory investment code was enacted as Law 61–33 on March 22, 1962. The code was designed to encourage private investments, both foreign and domestic in projects which conform to Senegal's 4-year-development plan for 1961–64. The code guaranteed the general principles of freedom for nationals of all countries to establish businesses in Senegal. Investors were accorded certain benefits, such as the reduction or exoneration of the tax on profits from industry or commerce for 5 years, a reduction of the entry tax for equipment and raw-material imports, a waiver of customs duties, and an exemption from certain taxes on goods which have been reworked in Senegal and then reexported.

A foreign investor may sign a special founding agreement with the Government by virtue of which he receives additional legal, financial, and other assurances in return for his commitment to carry out a certain program. This agreement is extended only to domestic and foreign investors proposing a minimum investment over 3 years of CFAF1,000 million. Investments in mining, ore transforming, metalworking, and petroleum refining, and in projects set forth in the 4-year plan are subject to what is known as the long-run tax benefit program. Following the enactment of the investment code, an investment guarantee agreement was signed between Senegal and the United States, and thus U.S. investments can be guaranteed against inconvertibility, expropriation, and war losses.

The 4-year plan included a systematic inventory of the subsoil resources, and in 1963 the comprehensive program of geological investigations was continued as in previous years. Indications are that petroleum exploration was on a reduced scale. Expectations were that for 1961–64 CFAF4,900 million would be spent in oil exploration; through 1960 expenditures in this search totaled CFAF7,350 million. An evaluation of the 4-year plan in general, made in September, showed overexpenditures for administrative overhead, education, and infrastructure, and that productive investments were behind schedule. Steps were taken to further encourage private investments, to institute an austerity program in Government operations, to raise taxes, and to reduce imports. Political and economic relations with Mali were normalized, bringing the possibility of significant economic benefits to Senegal once Mali's currency problems are resolved.

SOURCE MATERIAL

Data on production and developments are from dispatches of the U.S. Embassy in Dakar, augmented by technical journals.[4] The latter have also provided most of the background information. Foreign trade statistics are inadequate for a complete, detailed analysis;

[3] U.S. Department of Commerce. Basic Data on the Economy of Senegal. World Trade Information Service. Pt. 1, No. 62–23, April 1962, p. 10.

[4] Mining Journal (London). Annual Review—1963. May 1963, p. 194; Annual Review—1964. June 1964, p. 202.
Industries et Travaux d'Outre-mer (Paris). V. 10, No. 106, September 1962, pp. 673–680.
World Oil. V. 157, No. 3, Aug. 15, 1963, p. 1960.

some information has been provided by the Embassy and by publications of the Senegalese and French Governments and the European Economic Community (EEC). For some commodities data on trade shown by different sources do not agree; in these cases efforts have been made to reconcile these or to use those which appear most plausible.

PRODUCTION

The 1959–63 period was characterized by an irregularly declining output of ilmenite and zircon and greatly increased production of phosphate rock. The former was due to operating conditions attending the exploitation of the beach-sand deposits; the latter was entirely the result of opening up the calcium phosphate deposits at Taiba in 1960, with a spectacular immediate rise through 1962 and a subsequent small decline. Output of aluminum phosphate rose through 1962 with a small drop in 1963. Cement production has shown a small increase, and salt output has remained below that of 1959. Senegal produces most of its requirements for construction materials; however, no quantitative data are available. Indications are that 1963 construction activities were slightly below those of 1962, with a decline from 174,800 to 156,300 square meters (estimated) of building permits issued in Dakar.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Titanium concentrate:					
Ilmenite	29,884	21,917	17,496	22,432	12,189
Rutile			170	736	736
Zirconium concentrate	8,670	10,349	5,388	2,336	[2] 3,069
Nonmetals:					
Cement—thousand tons	171	168	182	183	190
Phosphate rock:					
Aluminum phosphate	95,341	105,292	139,380	141,426	125,778
Calcium phosphate		107,686	406,969	497,090	469,872
Salt [3]—thousand tons	70	50	44	48	[4] 48
Minerals fuels:					
Petroleum:					
Crude		1,626	2,242	463	
Refinery products: [5]					
Gasoline					3,481
Kerosine					665
Distillate fuel oil					3,430
Residual fuel oil					3,263
Total					10,839

[1] In addition, building materials other than cement are produced, but no quantitative data are available.
[2] Final figure; supersedes figure given in commodity chapter of volume I.
[3] Includes production of Mauritania, estimated at 500 to 800 tons per year.
[4] Estimate.
[5] Small-scale refinery operations began in December 1963.

TRADE

Data available on metals and minerals traded by Senegal were limited to the major commodities; in 1962 exports of these were valued at CFAF1,898 million and constituted 6 percent of all exports (CFAF 1,685 million and 5 percent in 1961). In 1962 phosphate rock exports

were worth CFAF1,359 million; the value of other exports follows: Phosphatic fertilizers, CFAF211 million; scrap metals, CFAF155 million; titanium concentrates, CFAF142 million; and salt, CFAF31 million. The 1962 major metal and mineral imports were valued at CFAF3,899 million, comprising 10 percent of all imports (CFAF3,624 million and 10 percent in 1961). In 1962 they consisted of metals, CFAF1,495 million; nonmetals, CFAF322 million; and mineral fuels, CFAF2,082 million.

TABLE 2.—Major exports of metals and minerals
(Metric tons)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Copper, scrap	641	625	Italy 246; [1] France 193; [1] Belgium-Luxembourg 70. [1]
Iron and steel, scrap	11,382	10,103	Mainly to Japan; Italy 405. [1]
Titanium concentrate	21,659	22,962	Mainly to France.
Nonmetals:			
Fertilizers, phosphatic [2]	18,981	32,810	[3].
Phosphate rock:			
Aluminum phosphate	90,268	110,920	[3].
Calcium phosphate	308,559	342,043	France 96,120; West Germany 88,493; Japan 54,535; Netherlands 33,301.

[1] Imports from Senegal by country stated.
[2] Includes dehydrated aluminum phosphate and products marketed under trade names of Baylifos, Polyphos, and Phospal. Data on dehydrated aluminum phosphate included are not available for 1961; 27,965 tons apparently were included in 1962.
[3] Data not available.

Source: Bulletin Statistique et Économique Mensuel. No. 11, 1963. European Economic Community. Foreign Trade Statistics, 1962. August 1963.

Detailed valuation of Senegal's 1962 metals and mineral trade with other countries was not available. France undoubtedly continued as the leading trading partner, as was reflected by its share in Senegal's total trade (86 percent of all exports and 65 percent of all imports). In 1962 EEC exports to Senegal were reportedly worth CFAF2,880 million. Minerals and metals were insignificant in 1962 trade with the United States; this trade totaled CFAF42 million for exports of all commodities and CFAF1,477 million for corresponding imports.

On the basis of data through November, the 1963 exports of major metal and mineral commodities, enumerated for 1962, were estimated at CFAF2,081 million. The imports had an estimated value of CFAF3,688 million.

TABLE 3.—Major imports of metals and minerals

(Metric tons)

Commodity	1961	1962	Principal sources, 1962 [1]
Metals:			
Unspecified [2]	30,370	36,803	France 32,131; Belgium-Luxembourg 1,880.
Nonmetals:			
Building materials, unspecified	5,620	3,705	Mainly from France.
Cement	2,557	525	Do.
Fertilizers	19,532	[3] 16,711	France 8,989.
Salt	163	105	France 94.
Mineral fuels:			
Solid fuels and derivatives	529	498	France 353.
Petroleum refinery products:			
Gasoline	73,841	76,965	France 8,362; Italy 5,289.
Kerosine	11,870	12,522	Italy 9,996; France 4,412.
Distillate fuel oil [4]	17,582	20,533	France 54,061; Italy 1,539.
Residual fuel oil [5]	118,320	143,234	Italy 52,703; France 46,742; Netherlands 40,556.
Asphalt and bitumen	4,600	5,629	France 376.
Other	6,189	7,438	France 8,145.
Total	232,402	266,321	France 122,098; Italy 69,527; Netherlands 40,556; Netherlands Antilles 9,781.

[1] Exports of country indicated to Senegal. Excess of exports over imports due to increased quantity in transit at yearend.

[2] Excludes manufactures. No enumeration of individual metals given. In 1962 exports of EEC to Senegal consisted of 99 percent iron and steel rolled products, and 1 percent nonferrous metals.

[3] Includes 10,463 tons of nitrogenous, 3,530 tons of phosphatic, and 2,544 tons of potassic; the remainder was classified as natural, mixed, or other.

[4] Gas oil only. Other distillates included with residual. Quantities exported to Senegal include unstated amounts of other distillates.

[5] Includes distillates other than gas oil.

Source: Bulletin Statistique et Économique Mensuel. No. 11, 1963. European Economic Community. Foreign Trade Statistics, 1962. August 1963.

COMMODITY REVIEW

METALS

Iron Ore.—No progress was reported toward opening up the iron ore deposit in the Kedougou area. Despite a reserve of 40 million metric tons containing 62 to 64 percent iron, the 750-kilometer distance from the coast has been the major handicap to development.

Iron and Steel.—Work continued on plans for the construction of a steel plant in Senegal, to be owned jointly by the Senegalese Government and Compagnie Métallurgique et Minière, a French firm holding the majority of the stock. The proposed plant was to have an estimated annual capacity of 30,000 metric tons, and construction was scheduled to begin in 1964. Initially the installation was planned to remelt scrap collected in Senegal, previously exported to Japan and Italy at the rate of about 11,000 tons per year. Scrap also was to be imported from neighboring African States, and consideration was given also to possibilities of using Mauritanian iron ore, if freight rates on the small volume required were not prohibitive.

Titanium and Zircon.[5]—Société Minière Gaziello et Compagnie (SMG), the wholly-owned subsidiary of the French firm, Thann et Mulhouse, continued mining and treatment of beach sands for the recovery of ilmenite, rutile, and zircon. The decreased output of ilmenite, the main product, was due to the poor condition of the old plant at Djifère-Sangomar near the mouth of the Saloum River and

[5] Metal Bulletin (London). No. 4807, June 25, 1963, p. 21.

the lower grade sands worked. The maintenance of rutile production at the 1962 level and the 31-percent increase in zircon was apparently due to working areas rich in these minerals, or perhaps to re-treating sands from which the ilmenite had already been recovered. SMG began work on a new plant, based on virgin deposits in the M'Bour-Joal area, which would have an annual capacity of 60,000 tons of ilmenite, 10,000 tons of zircon, and 1,000 tons of rutile. The new installation was expected to begin operations in the second half of 1964; it was to consist essentially of a mobile plant for separation of the heavy minerals from the sands and a fixed unit for a final enrichment and separation of the different products. Cost of the project was reported at CFAF550 million. The sands to be fed to the new plant are from old dunes where the mineralization is more uniform than in the irregular and dispersed sands of the open beaches worked in the past.

Senegal ilmenite contains 58 percent titania and rutile, 96 percent; the zircon contains 66 percent zirconia. France has provided the principal market for these products. Thann et Mulhouse and their associated Les Produits du Titane are expected to use the increased production of ilmenite in titanium pigments; some rutile and zircon might be sold on the open market. Exports in 1963 were ilmenite, 11,945 metric tons; rutile, 906 tons; and zircon, 3,279 tons.

NONMETALS

Phosphate Rock.—Compagnie Senegalaise des Phosphates de Taida accounted for the entire output of calcium phosphate; 1963 production was slightly below that of 1962 because of large stocks at yearend. Exports established a record high of 454,878 metric tons; the principal destinations were West Germany, 165,540 tons; Republic of South Africa, 68,069 tons; Japan, 65,720 tons; Netherlands, 44,636 tons; United Kingdom, 39,868 tons; and France, 36,446 tons. The mines are at Taiba, near Dakar, and the deposits were estimated in 1963 to contain a reserve of 100 million metric tons, of which 40 million tons had been proved at a depth of 20 meters and 60 million tons at 30 meters. The phosphate seam was stated to be at least 6.5 meters thick. Waste stripping and phosphate rock mining were by draglines; bucket capacity was 18 cubic meters for stripping and 6 for mining. After a preliminary sizing and removal of quartz, the ore was upgraded by two-stage beneficiation. The first stage employed hydrocyclones for the removal of the argillaceous and very fine elements and the second, flotation with fatty acid reagent, in which the siliceous elements and the oxides of iron and aluminum were depressed. After filtration and drying in a rotary kiln, 2.4 meters in diameter and 24 meters long, the marketable product contains less than 1.5 percent moisture, and 37.6 percent P_2O_5.

The Taiba company was founded in 1957 and capitalized at CFAF2,000 million; the French Government's Bureau de Recherches Géologique et Minières contributed 35.83 percent, the Senegalese Government, 4.17 percent, and the remainder was provided by French banking, chemical, and phopshate groups. International Minerals & Chemical Corp., Skokie, Ill., became associated with Taiba in 1962,

and subsequently it was reported that capital had been increased to CFAF2,275 million and that the U.S. firm's participation eventually would reach 25 percent. During 1963 the Taiba company marketed its output independently of the Union Phosphatière Africaine Sales Organization, following the termination of its agreement with that organization at the end of 1962. International Minerals & Chemical Corp., as a leading U.S. phosphate exporter, undoubtedly was able to facilitate greatly the marketing of the Taiba phosphate. Productive capacity at Taiba was 600,000 metric tons, and in anticipation of a 60-percent increase in sales, measures were being taken to increase production sharply. In December a sales agreement was negotiated with United Kingdom's Imperial Chemical Industries, Ltd., for the sale of 150,000 tons of calcium phosphate in 1964.

Senegal's production of aluminum phosphate rock continued to come from the Thiès mine, east of Taiba, operated by Compagnie de Produits Chimiques et Électrométallurgiques Péchiney, a minor shareholder in the Taiba company. The mine reserve was estimated in 1962 at 37 million metric tons containing 29.5 percent P_2O_5 and 100 million tons if 28-percent material is included. Production declined 12 percent because of large stocks from the previous year. Exports in 1963 were 110,000 metric tons (108,000 tons to France and 2,000 tons to New Zealand). A part of the production continued to be calcined in a plant at Lam-Lam and the clinker finely ground at Sète, and marketed locally, exported as dehydrated aluminum phosphate or under the trade names of Phosphal, Polyphos and Bayliphos. Phosphal contains 34 percent P_2O_5, and this is assimilable by plants. Polyphos is similar to Phosphal and has begun to find markets as animal food. In 1962 and 1963 production and exports of dehydrated aluminum phosphate and special products were as follows:

	1962		1963	
	Production (metric tons)	Exports [1] (metric tons)	Production (metric tons)	Exports (metric tons)
Dehydrated aluminum phosphate	41,681	33,940	17,710	13,900
Phosphal	5,669	3,843	28,594	2,160
Polyphos		135		
Bayliphos	1,621	1,997	14,565	193

[1] Official trade statistics listed exports of phosphatic fertilizers at 32,810 tons; this apparently included 27,965 tons of dehydrated aluminum phosphate, and the remainder was exported as "aluminum phosphate."

MINERAL FUELS

Petroleum.—Little data on activity in 1963 petroleum exploration and production are available. Indications are that there were no important developments and the production from the single well of Société Africaine des Pétroles (SAP), 30 kilometers from Dakar, was insignificant, if there was any output at all. In addition to SAP, Société des Pétroles du Senegal (SPS) and Compagnie des Pétroles Total de l'Afrique de l'Ouest (COPETAO) were formerly active in Senegal. SAP did some work as operator of the St. Louis permit north of Dakar. This permit was held in about equal shares by SAP,

Compagnie de Participations de Recherches et d'Exploitations Pétroliers (COPAREX), Continental Oil Co., and Cities Service; however, the permit was released at the beginning of 1963. SPS dropped its onshore concession in 1962 but subsequently applied for and was granted an offshore permit between SAP's Dakar permit and the Gambian frontier. COPETAO held the Kolda permit (21,340 square kilometers), partly offshore.

The 600,000-ton-per-year petroleum refinery of Société Africaine de Raffinage (SAR), under construction since 1961 at M'Bao near Dakar, went on stream on December 8. SAR was formed by an association of French petroleum interests (41.8 percent); the Senegalese Government (10 percent); British Petroleum, Mobil Oil, Shell Oil, and Texas Oil (11.8 percent each); and Esso (1 percent). During December, 18,357 tons of crude was processed although the refinery was not completely operational; the final work was to be completed by late February 1964. Investments for the refinery amounted to about CFAF4,000 million; at a slight additional cost capacity could be doubled. Five-sixths of the crude-oil supply is expected to come from the Hassi-Messaoud field in the Algerian Sahara and one-sixth from Gabon. The refinery was expected to bring CFAF500 million annually into the Senegalese economy.

New taxes on petroleum products were established effective July 1; expectations were that these would bring in an additional revenue of CFAF250 million annually.

The Mineral Industry of Sierra Leone

By Thomas C. Denton [1]

PRODUCTION of minerals for export continued to be the prime sector of the economy of Sierra Leone, a former British Colony and Protectorate that became independent on April 27, 1961. The industry remained the largest contributor to national cash income, the largest foreign exchange earner, and probably the largest employer of industrial labor.

In 1963, output consisted of diamonds (alluvial), iron ore, bauxite, and small quantities of gold (alluvial). By value the country generally has ranked about third among diamond producers of the world, after Republic of South Africa and Southwest Africa. Small quantities of chromite were produced until 1962, when operations were suspended. Exploration of a deposit of heavy minerals, particularly rutile, near the coast was in progress at yearend and may result in a new mining operation for the country.

Diamonds were recovered by the British company, Sierra Leone Selection Trust, Ltd.; from two large widely separated concessions called Yengema and Kono; and by many small operators. Iron ore was produced exclusively by the British company, Sierra Leone Development Co., Ltd., from the Marampa deposit. Bauxite mining was in the hands of Sierra Leone Ore & Metal Co. (SLOM) owned by Aluminum-Industrie-Aktien-Gesellshaft of Zurich, Switzerland. The heavy minerals project was a joint venture of Pittsburgh Plate Glass Co. and British Titan Products Co., Ltd. who have been exploring near Gbangbamg for 7 years.

Estimates of the gross national product (GNP) of Sierra Leone in West African pounds (WA£) [2] range from WA£54 million to WA£98 million,[3] and the value of mineral production in 1963 was about WA£17.7 million.[4] Thus the contribution of the mineral industry to GNP was between 18 and 33 percent.

In recent years minerals have provided about 75 percent of the total value of domestic exports, more than balancing expenditures for mineral and metal imports and contributing in major degree to the overall favorable trade balance.

In 1961 organized mining operations had more than 6,000 employees, with 207 occupying supervisory and executive positions. The estimated number of persons engaged in small-scale diamond mining during the wet and dry seasons was, respectively, 17,500 and 46,000. These figures are the most recent available; it is believed that in 1963

[1] Africa specialist, Division of International Activities.
[2] The currency of Sierra Leone is the West African pound (WA£). WA£1=US$2.80.
[3] U.S. Embassy, Sierra Leone. Background Information. Jan. 1, 1964.
[4] To obtain the figure, export values were used when production values were unavailable.

organized operations had about the same number of employees as in 1961, but that the number of small-scale diamond miners had decreased substantially.

Principal mineral development in 1963 was commencement of bauxite mining late in the year; and prospects appeared good that rutile mining would soon begin.

Throughout 1963 the Government of Sierra Leone continued its sincere open-door policy to foreign investment.[5]

SOURCE MATERIAL

Source material for this chapter comprised chiefly dispatches from the U.S. Embassy in Freetown, notably A–192, March 13, 1964; semiannual Summary, July 1–December 31, 1963; reports of the Mines and Geological Departments of Sierra Leone; company reports; and articles appearing in trade journals.

PRODUCTION

The value of minerals produced in 1963 was WA£17.7 million; in 1962 it was WA£16.4 million.[6] In both years diamonds provided about 70 percent of total value, and iron ore virtually all of the remaining 30 percent. Bauxite should contribute significantly in 1964, when exports are expected to be about 100,000 tons.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Bauxite					[1] 19,950
Chromite	18,120	5,464	[2] 9,144	[2] 9,550	([3])
Gold, troy ounces			22	[2] 30	[2] 44
Iron ore, thousand tons	1,449	1,470	1,695	2,015	[2] 1,985
Nonmetals:					
Diamond [4]					
Sierra Leone Selection Trust, Ltd, thousand carats	660	694	889	([5])	([5])
Many small operators, do	631	1,215	1,406	([5])	([5])
Total, do	1,291	1,909	2,295	1,907	1,388

[1] Exports. Production estimated at 29,950 tons, which supersedes figure given in commodity chapter of volume I.
[2] Exports.
[3] Production suspended in 1962.
[4] Partly estimated.
[5] Data not available.

TRADE

Sierra Leone has a favorable balance of trade in metals, minerals, and semimanufactures of mineral origin, despite the lack of mineral fuels resources. Net exports for these commodities in 1961 and 1962 were, respectively, WA£18.6 million and WA£10.2 million.

Domestic mineral exports in 1961 were WA£20.8 million, comprising nearly 83 percent of all domestic exports by value. Diamonds ac-

[5] U.S. Embassy, Freetown, Sierra Leone. State Department Airgram A–192, Mar. 13, 1964.
[6] Value included export values when production values were unavailable.

counted for 76 percent of the total and iron ore for virtually all of the remainder.

While the great bulk of the diamonds exported went first to the United Kingdom, major ultimate destinations were the United States and Western European countries. Historically the United Kingdom has also been by far the largest recipient of iron ore. But beginning in 1961, and through the third quarter of 1963, either or both West Germany and the Netherlands have taken larger tonnages than the United Kingdom. Of 2 million tons exported in 1962, West Germany took 35 percent; the Netherlands, 32 percent, and the United Kingdom, 29 percent.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Chromite	9,132	9,507	All to United Kingdom.
Iron ore:			
Fines thousand tons	133	108	All to Netherlands.
Concentrate do	1,652	1,906	West Germany 719; United Kingdom 587; Netherlands 528.
Ferromax do	1	1	Mainly to West Germany.
Total do	1,786	2,015	
Scrap, ferrous and nonferrous metals	6,546	3,508	Japan 1,770; Netherlands 915; Italy 621.
Nonmetals:			
Diamonds:			
Diamond office 1,000 carats	1,413	1,158	All to United Kingdom.
Sierra Leone Selection Trust, Ltd. do	632	(1)	
Total do	2,045	1,158	
Mineral fuels:			
Petroleum, refinery products: [2]			
Gasoline, aviation 1,000 42-gallon barrels	2	4	All to bunker loadings.
Kerosine [3] do	4	15	Do.
Distillate fuel oil do	741	633	Do.
Residual fuel oil do	1,376	1,284	Do.
Lubricating oils do	2	1	Do.

[1] Production withheld until 1963.
[2] All are reexports.
[3] Includes jet fuels.

Metal and mineral imports fluctuate around 18 percent of total imports by value; in 1961 and 1962 they were, respectively, WA£6 million and WA£5.5 million. In each year petroleum products accounted for more than 64 percent of total value. Petroleum products were largely supplied by Venezuela and the Netherlands. In most other import commodity areas the United Kingdom led. The United States increased its exports to Sierra Leone in 1962 to US$4.3 million, including US$920,000 worth of mining and construction machinery and parts.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum, semimanufactures	321	91	Belgium 31; United Kingdom 25; Netherlands 21.
Copper, semimanufactures	99	144	United Kingdom 139; United States 4; Netherlands 1.
Iron and steel, semimanufactures	43,139	26,469	United Kingdom 20,303; Japan 3,913; Belgium 1,527.
Lead, ingots and semimanufactures	94	46	United Kingdom 19; Netherlands 15; Belgium 12.
Silver, unworked and troy ounces	4,349	3,450	All from United Kingdom.
semimanufactures.			
Tin and tin alloys, unworked and semimanufacture	16	8	Do.
Zinc and zinc alloys, unworked and semimanufactures.	3	3	United Kingdom 2; Belgium 1.
Various metalliferous ores	(1)	2	All from Nigeria.
Nonmetals:			
Cement	52,695	62,381	Poland 24,599; Yugoslavia 12,652; United Kingdom 11,529.
Fertilizers, mineral	68	453	Belgium 295; Israel 71; United Kingdom 30.
Lime	275	241	United Kingdom 234; Israel 17.
Salt	7,347	6,463	United Kingdom 6,353; West Germany 104; Portugal 6.
Mineral fuels:			
Coal, including coke and briquets	10,820	15,868	Italy 5,489; United Kingdom 5,342; Poland 4,737.
Petroleum, refinery products: [2]			
Gasoline, aviation. thousand 42-gallon barrels	16	13	Netherlands 11; Venezuela 2.
Gasoline, motor ..... do	174	194	Venezuela 78; Netherlands 51; Netherlands Antilles 50.
Kerosine [3] ..... do	93	127	Netherlands Antilles 56; Netherlands 29; Venezuela 27.
Fuel oil, distillate ..... do	1,027	1,187	Venezuela 545; Netherlands 284; Netherlands Antilles 172.
Fuel oil, residual ..... do	1,467	1,232	Netherlands 482; Venezuela 409; Trinidad 190.
Oil, lubricating ..... do	18	18	United Kingdom 8; Netherlands 5; United States 5.
Asphalt ..... do	18	18	United Kingdom 13; Netherlands 4.

[1] Less than 1 ton.
[2] Comprises total imports including those for bunkers.
[3] Includes jet fuel.

COMMODITY REVIEW

METALS

Bauxite.—Bauxite in significant quantity was first discovered in Sierra Leone early in 1960, by its Geological Survey. The deposit is in the Mokanji Hills in the Mayamba District. The bauxite is of good quality, both for high alumina content and low content of silica and iron. In March 1963 the Ministry of Lands, Mines and Labor announced discovery of another deposit in the Kpaka Chiefdom of Pujehun District, also by the Survey.

In 1962 SLOM obtained from the Government the right to mine the original discovery, and in 1963 SLOM obtained an option on the Kpaka Chiefdom deposit. Production from the original discovery began in 1963, and by the end of the year SLOM had exported nearly 20,000 metric tons—avering 55 percent Al_2O_3. Anticipated future output is about 100,000 tons annually.

Iron Ore.—The value of iron ore exports of Sierra Leone Development Co. (DELCO) in 1962 and 1963 was, respectively, WA£5.1 mil-

lion and WA£4.9 million. DELCO ore mineral is specularite. The principal product exported is a specularite concentrate containing about 65 percent iron. Under the trade name Ferromax DELCO also produces quantities of nearly pure specularite, largely for use as pigment. Both in 1961 and 1962 about 1,000 tons of Ferromax was exported, chiefly to West Germany.

DELCO had in progress a program to increase iron ore production by 40 percent to 2.8 million tons per year by the end of 1965. Projects under the program include deepening the ship channel to the port at Pepel, construction of a new ore-loading pier, improving the company railroad from mine to port, and acquisition of new ore cars and milling equipment.

Rutile.—At the end of 1963 the outlook was that the joint rutile project near Gbangbamg would reach production. In that case Pittsburgh Plate Glass Co. will be the U.S. company with the largest investment in Sierra Leone.

NONMETALS

Diamonds.—About 40-percent of the diamond found in Sierra Leone is gem diamond; and large diamonds (weighing 5 carats and more) comprise a significant part of total production.

Under an agreement reached in late 1962 between Sierra Leone Selection Trust, Ltd., (SLST) and the Government, half of the company output was to be sold to the Diamond Corp. (De Beers) and the other half to three U.S. companies. Pending the new agreement, SLST withheld 1962 production and that of the last 4 months of 1961 until early in 1963, when SLST exported nearly 700,000 carats valued at more than WA£6 million and representing 16 months production. The production of small operators, called diggers, must be sold exclusively to the Government Diamond Buying Office, operated by the Diamond Corp.

SLST.—Consolidated African Selection Trust, Ltd. (CAST), which controls SLST, has reported SLST production during the past 5 years as follows in carats (years ended June 30): 1959—640,000; 1960—702,384; 1961—796,715; 1962—715,808; and 1963—663,865.

CAST reported in part as follows regarding operations during the year ended June 30, 1963.

Profit was £4,271,000; £740,000 more than in 1962.

The decrease of 7 percent in quantity of diamonds produced reflected treatment of lower grade material in accord with grade of reserves. Gravel treated was 755,393 cubic yards. The policy of maintaining balanced working of deep deposits and shallow deposits was continued. As a result the ratio of overburden to gravel excavated increased; 3.5 cubic yards of overburden were removed for each cubic yard of gravel mined. This compared with 3.2 and 2.9 cubic yards, respectively, in the previous 2 years.

Prospecting and development continued in the Yengema and Tongo areas. Sinking the prospect shaft to examine kimberlite exposures in depth was begun. Experimental work continued with the small dredge installed earlier on the Bafi River. Results showed the dredge capable of recovering diamonds from the river bed. After minor

modifications, the dredge was expected to increase overall production to a small extent.

Digger Operations.—The numerous small producers, operated under the Government alluvial-diamond-mining scheme, which has become an important feature of the national economy. The scheme remained under the general supervision of the Assistant Chief Inspector of Mines stationed at Kenema. The area in which the scheme operated in 1962 was roughly 9,500 square miles (24,600 square kilometers). The Revolving Loan Fund, started in 1960 with a free grant of the U.S. Government, continued to be very popular—encouraging miners to use machinery, providing spare parts promptly, and making equipment available at reasonable prices.

Exports of digger production by the Diamond Office in 1962 and 1963 were, respectively, 1,158,000 carats valued at US$19.9 million and 649,000 carats valued at US$18.9 million. The value of exports in 1963 approached the 1962 value despite the sharp decline in volume, because purchases included large quantities of gem diamond for which the market was strong, permitting the Office to increase its buying price. According to the Report of the Department of Mines of Sierra Leone for 1961 (most recent year for which the data are available), 45.5 percent of the purchases of Diamond Office in 1961 were gem diamond. Further data from the report, revealing the significance of gem diamonds follows:

	Carats purchased	*Value WA£*	*Value per carat WA£*
Gem diamond	439,861	9,519,989	21.60
Industrial diamond	966,538	1,859,708	1.92

Barring significant new discovery, it appears that digger production will decline further as the richer and shallower deposits become exhausted. Such a development would seriously hurt the economy of the whole country because the earnings of diggers move directly into the economy, and diamonds provide the largest part of national cash income.[7]

[7] U.S. Embassy, Freetown, Sierra Leone. State Department Airgram A–192, Mar. 13, 1964.

The Mineral Industry of the Somali Republic

By Thomas G. Murdock [1]

THE Somali Republic, also known as Somalia, became independent on July 1, 1960; the northern region was formerly British Somaliland and the southern region, Italian Somaliland, which was a United Nations Trusteeship administered by Italy for 10 years prior to independence. Somalia's mineral resources are meager, and during recent years production has consisted of only a small quantity of salt evaporated from seawater; extensive undeveloped gypsum deposits are known and several other minerals occur in quantity, but adverse economic factors have not permitted their exploitation. Oil exploration was continued during 1963, but optimism regarding discovery prospects decreased following another unsuccessful year. Except in the petroleum sector there was little exploration activity although the results of previous work were reappraised and studied further. Data available on imports of metals and minerals are incomplete, but indications are that imports continued to be comparatively small for a country of 1.97 million inhabitants and consist mainly of petroleum refinery products and metals.

In 1962 the gross national product (GNP) was So Sh550 million (US$77 million).[2] The 1962 salt production was valued at about So Sh177,280; thus mineral production contributed only 0.03 percent to the GNP.

Data on employment in the recovery of salt are not available. Petroleum exploration companies in Somalia employed 588 workers, 80 percent of whom were Somali nationals.

GOVERNMENT POLICIES AND PROGRAMS

No new mining or petroleum legislation was reported in 1963. The Somali Republic encourages investments, especially in oil exploration, and grants concessions on a negotiated basis. At yearend negotiations toward an investment guarantee agreement with the United States, covering covertibility, expropriation, and war risk were nearing completion, and the agreement was expected to be signed early in 1964. A 5-year plan began in 1963, but little information on progress has become available; this plan provided for the exploitation of the gypsum deposits near Berbera port in the northern region.

[1] Mining engineer, Division of International Activities.

[2] Somali shillings (So Sh) are used. The International Monetary Fund exchange rate is US$1=So Sh7.142856 (So Sh1=US$0.14).

SOURCE MATERIAL

This country review has been prepared almost exclusively from a Foreign Service Dispatch,[3] supplemented by an article [4] in the English press and articles in other technical journals.

PRODUCTION

Production has been reported for salt only in some years; it has been estimated for other years. Output was 4,000 metric tons in 1959, rising to an estimated 7,000 tons in 1960. For subsequent years it has remained at about 2,000 tons, although in 1962 the quantity was only an estimate. The decrease since 1960 was apparently due to decreased exports, although these have never been large. Small quantities of construction materials are produced, but no quantitative data are available.

TRADE

Somalia's exports of minerals and metals in 1962 were limited to 412 tons of sea salt, valued at So Sh43,000 (271 metric tons and So Sh31,170 in 1961). Principal 1962 destinations were Kenya 319 tons (So Sh33,010), Ethiopia 70 tons (So Sh7,520), and Saudi Arabia 8 tons (So Sh1,205). Salt exports in 1962 were only 0.02 percent of all exports. Available data on imports only show 1962 metal and mineral imports valued at So Sh21 million, 7 percent of all imports, and consisting of metals, So Sh7.6 million and petroleum refinery products, So Sh14 million. Comparable 1961 data are not available, except for petroleum refinery products which totaled So Sh11 million. Data on sources of 1962 imports are available only for the petroleum refinery products. Value of these imports by principal suppliers was—Iran, So Sh8.2 million; Saudi Arabia, So Sh2.7 million; Italy So Sh1.1 million; United States So Sh0.6 million; United Kingdom So Sh0.4 million.

TABLE 1.—Principal imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1961	1962	Principal sources, 1962
Mineral fuels:			
Petroleum refinery products: [2]			
Gasoline:			
Aviation--42-gallon barrels	2,361	1,396	All from Iran.
Motor--do	49,191	52,915	Do.
Kerosine--do	9,694	7,411	Iran 6,237; Iraq 1,174.
Distillate fuel oil--do	20,267	23,118	All from Iran.
Lubricants	7	9	United Kingdom 8.
Other--42-gallon barrels	1,753	1,909	United Kingdom 1,743; Iran 81.
Undifferentiated [3]	19,957	24,833	Iran 10,079; Saudi Arabia 9,025; Aden 372; United States 221.

[1] Data available only for those shown.
[2] Itemized quantities are those imported into northern region. Total value of quantities itemized was So Sh4,685 in 1961 and So Sh5,106,581 in 1962.
[3] No itemization given for quantities imported into the southern region nor is an accurate conversion to barrels possible. Total value of these imports was So Sh6,134,610 in 1961 and So Sh8,453,902 in 1962.

Source: U.S. Embassy, Mogadiscio, Somalia.

[3] Eblan, J. O. Data for volume IV of Minerals Yearbook. U.S. Embassy, Mogadiscio, Somalia. State Department Dispatch A-569. May 1, 1964, 3 pp.
[4] Mining Journal (London). V. 261, No. 6696, Dec. 20, 1963, p. 583.

COMMODITY REVIEW

METALS

Iron Ore.—Earlier estimates of the undeveloped iron ore reserves at Bur Galan have been revised upward, to 400 million metric tons to a working depth of about 100 meters. Samples analyzed by the Mineral Resources Division had an average iron content of 37.8 percent. Although having a high silica content, the ore is free from other objectionable impurities; the average phosphorous content is just below the Bessemer limit and, therefore, concentrates produced would be of Bessemer grade. The ore is regarded as low- to medium-grade concentrating ore. The United Nations Special Fund agreed to undertake further investigations, including an aerial magnetometer survey and core drilling.

Manganese.—Further investigations were commenced on manganese silicate rocks at Hudiso, in view of renewed interest shown by United Kingdom mineral importers. The reserve of accessible ore was thought to be much less than earlier estimated.

Titanium.—No further information about the extent of the titanium-bearing black sands at the mouth of the Juba River in the southern region has become available.

Tin.—Cassiterite reserves at Dalan were estimated at only 53 long tons to a depth of 30 meters, based on a minimum grade of 0.3 percent metallic tin over a stopping width of 91 centimeters. Quartz veins, not yet exposed, might yield 80 tons more. Two Russian geologists examined the deposits and considered that the reserve estimate could be increased tenfold, based on their experience with similar U.S.S.R. occurrences. Also, they believed that the Dalan deposits could be worked if a suitable water supply was found. Small-scale mining of tin ore in Magiaian region has resulted in the export of about 16 long tons over the past decade.

NONMETALS

Feldspar.—Prospecting operations for potash feldspar continued to be concentrated on a large pegmatite dike in the Humbeli Range, previously worked for mica, beryl, and columbite, with a reserve of high-quality feldspar of about 7,500 metric tons. Smaller tonnages could be obtained from other pegmatites in the region. Development of the feldspar resources was not possible without the provision of adequate transportation facilities; plans have been made for these, but funds have not become available. Possibilities of the marketing feldspar and other minerals in the pegmatites were under investigation by a United Nations trade promotion specialist in the country.

Salt.—Somalia once had a large salt production from the solar evaporation of seawater. Prior to World War II the plant at Ras Hafun had an annual capacity of 300,000 tons; it has fallen into complete disuse and the small annual production continued to be from salt pans along the coast, mainly for domestic consumption and small exports to Saudi Arabia and neighboring African countries. Japanese firms reportedly showed interest in reviving the salt industry, but there were no concrete developments.

Sepiolite (Meerschaum).—Although no quantitative data are available indications are that small quantities of sepiolite may have been mined for local use. Large deposits are reported in the Bur region of the north, but there has been practically no commercial exploitation for export.

MINERAL FUELS

Petroleum.[5]—Sinclair Somal Corp. abandoned Brava well No. 1 at a depth of 381 meters; spudded late in 1962, this well was near the Indian Ocean coast about 200 kilometers southwest of Mogadiscio. Sinclair subsequently intensified seismic work and drilling of another wildcat was scheduled for 1964.

Mobile Petroleum Co. reported completion of three wells for stratigraphic correlation; known as Galcaio 1, 1A, and 2, these wells reached respective depths of 434, 680, and 2,134 meters. Other wells included Idone 1, 72 kilometers south of Galcaio, drilled to 2,134 meters, and Burti 1, at 314 kilometers southwest of Obbia and 169 kilometers inland, drilled to 2,137 meters. Mobile exploration had indicated an evaporite basin near the Somali-Ethiopian frontier; efforts were made to find porous zones in hard limestone downdip of the evaporites, but the company planned on discontinuing drilling early in 1964.

A small area held by an Italian firm, Mineraria Somala, in the northern part of the country was relinquished.

Since 1953 U.S. firms together with Gulf Oil Corp., which has also been active in the Somali Republic, spent the equivalent of about So Sh286 million in exploration. To date no commercial discoveries have resulted, although traces of oil and gas have been found in Coriolei. The Somali Republic Government has realized annually about So Sh2.14 million from its agreements with the companies on operations, tariffs, and foreign exchange transfers.

[5] World Oil. International Outlook Issue. V. 159, No. 3. Aug. 15, 1964, p. 143.

The Mineral Industry of the Republic of South Africa

By Thomas C. Denton [1]

THE REPUBLIC OF SOUTH AFRICA possesses large resources and is an important producer of a great variety of minerals and metals. The value of aggregate output in 1963 was about R1 billion.[2] In addition the Republic has an extensive and sophisticated mineral and metal processing and fabricating industry, such as exists nowhere else in Africa.

Gold continued to rank first among minerals produced in 1963. In 1962 gold production contributed 68 percent of the value of South African mineral production and, by volume, 67.5 percent of world gold production exclusive of Communist countries. Uranium was an important byproduct of gold mining. Coal has provided the energy base of the country. The aggregate reserve is large and far exceeds the measured coal reserve of the rest of Africa. The coal, together with abundant resources of iron ore and limestone, has been the basis for a domestic iron and steel industry with annual capacity 10 times that of any other African country.[3]

Important quantities of more than 40 additional minerals were produced. Included among these minerals were asbestos, diamond, antimony, chromite, copper, manganese, platinum, and vanadium. In fact, if adjacent South-West Africa were included with the Republic, virtually the only important minerals lacking would be petroleum, bauxite, potash, and molybdenum. South-West Africa has lead and zinc, which the Republic lacks. Search for petroleum continued in 1963. As a possible substitute for bauxite, high-aluminum clays are abundant in the country.

In the year ended June 30, 1963, the contribution of mining to the net domestic product (NDP) of the Republic was third after that of private manufacturing and the public sector. The NDP was estimated at R5,481 million,[4] to which mining contributed 13 percent; the public sector, 15 percent, and private manufacturing, 25.5 percent. In 1962 mining provided 14.6 percent.

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[1] Africa specialist, Division of International Activities.

[2] Currency of the Republic of South Africa is the rand (R). One rand equals US$1.40. Effective May 31, 1961, the Union of South Africa, up to that time a member of the British Commonwealth of Nations, became the Republic of South Africa, and withdrew from the Commonwealth. Decimal currency was then adopted; the former South African Pound (SA£) was replaced by the rand, at the rate of SA£1 = R2.00.

[3] Southern Rhodesia and Egypt are the only other African countries with integrated iron and steel industries.

[4] U.S. Embassy, Pretoria. A–302, Mar. 19, 1964.

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TABLE 1.—Contributions of South Africa to world supply of selected minerals in 1963

(Percent)

Commodity	World, exclusive of Communist countries	World, including Communist countries [1]
Gold	70.4	53.1
Chromium ore	33.5	19.5
Platinum-group metals	41.8	20.0
Antimony	37.4	20.1
Manganese ore	20.3	9.0
Vanadium	19.9	[2]
Uranium, U_3O_8	15.0	[2]
Diamond	13.0	11.9
Asbestos	10.3	6.4
Beryl	6.8	5.7
Coal, all grades	3.4	1.6
Fluorspar	3.2	2.5
Copper	1.4	1.2
Corundum	1.0	.6

[1] Most figures for Bloc production are estimates.
[2] Data not available.

Mining, including precious, ferrous, and nonferrous metal smelting and refining, is recognized to be the industry on which the country has basically depended. Largely this has resulted from gold mining. This industry consistently has been the largest single generator of national income, provider of foreign exchange, and employer of labor. In addition, its large requirements for machinery, supplies, and agricultural products (food and lodging are part of wages of African labor) have promoted and stimulated the domestic manufacturing and agricultural industries. Some salient statistics for South African mining industry in 1961, including gold mining, appear below:

Average number of persons at work	667,651
Salaries, wages, and allowances paid—million Rands	293
Value of stores and electric power consumed, million Rands:	
South African	290
Imported	33
Total	323

South Africa in 1963 had extensive facilities for smelting, refining, and manufacturing mineral and metal raw materials. The country, however, lacked facilities for primary smelting of lead and zinc and had only a small capacity for electrolytic copper and nickel production. The bulk of the industries were based on use of domestic raw materials. Existing facilities turned out iron and steel, ferroalloys, sulfuric acid, other acids, ammonia, explosives, superphosphates, cement, a variety of advanced chemicals, and tungsten metal and alloys. In addition, an oil-from-coal plant manufactured approximately one-sixth of South African gasoline requirements besides diesel and fuel oil and chemicals. Artificial diamond also was produced.

Lack of petroleum was by far the most serious mineral deficiency of South Africa; the petroleum refineries used imported crude oil. There were also plants turning out semimanufactures and manufactures of copper, lead and zinc, and aluminum which depended heavily or entirely on imported raw materials.

An important development in 1963 concerned an unusual mineral complex at Phalaborwa, Transvaal Province.[5]

The complex consists of a volcanic pipe about 7 square miles in area. Concentric, vertically dipping rings of ore in the complex include carbonatite (copper and iron), foskorite (iron, apatite, zircon, copper), pyroxenite (pyroxene, apatite, vermiculite), and syenite (potash and aluminum). Tantalum, vanadium, titanium, gold, and silver also occur.

Output from the complex in 1963 consisted of 163,000 metric tons of apatite for superphosphate manufacture, byproduct copper concentrate, and 77,000 tons of vermiculite. Through an R8 million expansion program, apatite production was to be trebled, to satisfy domestic requirements for raw phosphates. In addition, a 3-year program to cost R76 million had been started to exploit the large reserve of low-grade copper ore which had been developed in the complex during the past several years. Design capacity for copper is 73,600 metric tons of blister. Finally, a plant for manufacturing phosphoric acid and superphosphate was to be built near the apatite mine; the sulfuric acid for the superphosphate plant probably would be produced in an acid plant using flue gas from the smelter copper converters. Only about 20 percent of the machinery required for the project would have to be imported.

A new plant for mechanically loading ore into ships, built by the government-owned South African Railways and Harbors at Port Elizabeth, went into operation in April 1963. It cost R1.5 million and can load 1,360 tons per hour. Ore is weighed while it is being moved into the ship. The plant has several storage bins with aggregate capacity of 167,000 tons, making possible storage of several grades of iron ore and manganese ore for which the facility is chiefly intended.

The first full year of production from South Africa's Witwatersrand goldfield was 1887. British capital was principally involved. It soon became evident that large-scale operations requiring heavy capital investment were needed to exploit the field profitably. Many early companies failed, in part for lack of adequate capital. Ultimately most of the survivors came under control of a few strong financial groups, chiefly in London, which incorporated and became mining investment and mine-financing companies. Additional companies were incorporated later.

The companies are known in London and South Africa as Mining Houses or Groups. The Groups conduct extensive exploration and, when successful, float new operating companies. They hold sufficient shares in their operating companies to appoint directors and management and to act as secretaries and engineering and geological consultants to the sponsored companies. Other functions are to purchase supplies and to make loans to the companies of the Group. The Groups have gradually expanded and diversified their interests into other mineral commodities and into industry generally, in South Africa and to a lesser extent elsewhere in Africa and beyond the continent.

[5] Mining Journal (London). V. 261, July 26, 1963, p. 88.

The seven Groups listed as follows now control the great bulk of mining and metallurgical industry in South Africa exclusive of iron and steel and manufacture of oil from coal:

Anglo American Corp. of South Africa, Ltd., no significant American interest.
Anglo-Transvaal Consolidated Investment Co., Ltd.
General Mining and Finance Corp., Ltd.
Johannesburg Consolidated Investment Co., Ltd.
Rand Mines, Ltd.
The Consolidated Gold Fields of South Africa, Ltd.
Union Corp., Ltd.

Anglo American Corp., founded by the late Sir Ernest Oppenheimer, is by far the largest of the Groups and probably is the largest and most diversified mining-investment and mine-financing company in existence. In 1962 mines of the Anglo American Group in South Africa produced R212.9 million worth of gold, one-third of South African output. Diamond sales were more than R192 million. Coal mined by companies of the Group in South Africa and Southern Rhodesia, mostly in the former, was 17.3 million metric tons, representing 40 percent of the total coal production of Southern Africa and 38 percent of all Africa. Copper produced in Northern Rhodesia by mines of the Group was 60 percent of that output and 10 percent of that of the free world.

Private U.S. capital is substantially involved in South African mineral and petroleum refining industries. The overall value of the investment is not available. O'okiep Copper Co., Ltd., in Cape Province, largest copper producer in South Africa, is controlled by a U.S. company. This company and another U.S. company are committed to investment in a new large copper mining and smelting project at Phalaborwa, Transvaal Province. A large share of South Africa's chromite production is obtained from ore reserves owned by South African subsidiaries of U.S. companies. Mobil Refining Co. Southern Africa (Pty.), Ltd., a subsidiary of Socony Mobil Oil Co., has a petroleum refinery at Durban with daily crude capacity of 33,332 barrels. Many U.S. companies manufacturing excavating and other mining equipment have sales offices and personnel in South Africa, which in the aggregate represent substantial investment.

GOVERNMENT POLICIES AND PROGRAMS

During 1963 the South African Government intensified its drive toward maximum economic self-sufficiency. It was prepared to foster new industry, including mineral-transforming industry, by restricting imports through protective tariffs if such action was in the national interest. However, the government was not prepared to use the device to foster inefficient, high-cost operations.

SOURCE MATERIAL

Source material relating to the mineral economy of South Africa is extensive and authoritative. Some principal sources for this chapter are U.S. Foreign Service dispatches; "The Mineral Resources of the Union of South Africa," 1959; "Beerman's All Mining Yearbook," 1963; papers and discussions comprising the Transactions of the

Seventh Commonwealth Mining and Metallurgical Congress, 1961, Johannesburg; annual reports of the Department of Mines of the Republic of South Africa; miscellaneous technical and industrial trade journals; company reports; and personal observation. Statistical data are mainly from government sources, including the Quarterly Information Circular of the Department of Mines and the official foreign trade statistics of the Republic.

PRODUCTION

The South African Government does not report annual value of mineral and metal production. Approximate output value may be obtained by adding reported Department of Mines data on the values of (1) gold and silver production; (2) sales of domestic diamonds; (3) local sales of industrial minerals and of quarry products; and (4) value of exports of industrial minerals, including uranium. Besides uranium, industrial minerals include all minerals sold except gold, silver, diamonds, and quarry products. Local sales of industrial minerals include an item "other" which, it is understood, represents an estimate of value added by the transforming industry to mineral commodities sold locally in semimanufactured form, for example, ferroalloys. "Other" was 14.8 percent of the total value of local sales in 1962 and 17.5 percent in 1963.

TABLE 2.—Approximate value of mineral and metal production

(Thousand Rands) [1]

Commodity	1959	1960	1961	1962	1963
Gold production	500,272	536,019	574,900	636,582	686,312
Silver production	1,326	1,472	1,576	1,952	2,512
Diamond sales, domestic diamonds	31,317	33,852	38,370	36,483	36,638
Industrial minerals:					
Local sales [2]	87,165	94,522	101,748	104,356	116,204
Exports:					
Fissionable materials [3]	97,464	98,519	79,268	73,754	66,762
Other	68,738	89,472	94,680	94,911	99,369
Total	786,282	853,856	890,542	948,038	1,007,797
Quarry products, local sales	2,565	2,904	3,868	2,827	4,274
Grand total	788,847	856,760	894,410	950,865	1,012,071

[1] 1 Rand equals US$2.40. During 1958–60 values were reported officially in South African pounds, which have been converted to Rands at the rate: 1 South African pound equals 2 Rands.
[2] Includes an item identified as "other," which was reported as follows in thousand Rands: 1959, 13,792; 1960, 15,851; 1961, 17,346; 1962, 15,369; 1963, 20,456.
[3] Comprises uranium (U_3O_8) and, before 1962, relatively small quantities of monazite.

During the period 1959–63, the grand total of values reported by the Department of Mines increased steadily, reaching R1 billion in 1963. The uninterrupted improvement mostly resulted from a steady increase in gold production, which rose by 37 percent to a new record of R686.3 million in 1963. The values of other categories reported, either also increased or fluctuated only slightly during the period, except exports of uranium. Uranium exports were highest in 1960 at R98.5 million, declining to R66.8 million by 1963.

TABLE 3.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Antimony, content of cobbed ores and concentrates	12,355	12,281	10,708	10,611	11,173
Beryl, approximately 11.7 percent BeO	184	295	174	327	386
Bismuth, content of concentrates....kilograms	239	232	76	59	911
Chrome ore:					
44 percent or less Cr_2O_3	263,685	238,116	243,076	257,868	132,773
More than 44 percent to 48 percent Cr_2O_3	403,442	521,585	649,988	632,348	639,692
More than 48 percent Cr_2O_3	13,147	12,238	4,795	22,564	19,695
Total	680,274	771,939	897,859	912,780	792,160
Copper:					
Concentrates, metal content	202		2,054	190	642
Blister	34,631	35,117	35,517	35,415	39,470
Fire refined	14,215	11,017	16,702	10,765	15,038
Electrolytic	[1] 467	[2] 1,800	[2] 1,800	[2] 1,800	[2] 1,800
Gold....thousand troy ounces	20,065	21,383	22,941	25,492	27,432
Iron and steel:					
Iron ore, 60 percent or more Fe....thousand tons	2,891	3,071	3,961	4,331	4,460
Pig iron....do	1,703	1,826	2,169	2,220	2,217
Ferroalloys....do	104	173	159	196	224
Steel:					
Ingots and castings....do	1,896	2,112	2,484	2,633	2,834
Semimanufactures....do	1,173	1,338	1,444	1,711	[3]
Lead, content of concentrates	152	123	93	5	15
Magnetite		268	213,077	280,984	529,623
Manganese ore:					
40 percent Mn or less....thousand tons	551	698	713	638	[4]
More than 40 percent to 45 percent Mn....do	164	290	378	519	[4]
More than 45 percent to 48 percent Mn....do	180	154	220	225	[4]
More than 48 percent Mn....do	75	52	107	83	[4]
Total....do	970	1,194	1,418	1,465	1,363
Monazite	2,179			4,832	2,087
Nickel, electrolytic [2]	2,600	2,900	2,600	2,400	2,400
Platinum group metals:					
Osmiridium [5]....thousand troy ounces	5	[1] 6	[2] 7	[2] 6	[2] 5
Platinum and other, contained in concentrates and refinery products [2] thousand troy ounces	375	400	350	300	300
Silver....do	2,021	2,227	2,288	2,549	2,737
Tantalum concentrates	5	6	9	4	29
Tin:					
Concentrates, metal content	1,273	1,266	1,430	1,422	1,554
Metal, smelter production	726	622	870	821	952
Titanium concentrates:					
Ilmenite	79,136	82,038	89,820	79,012	28,158
Rutile	3,067	3,352	3,160	3,243	1,256
Tungsten ores and concentrates, 60 percent WO_3	38	34	27	23	8
Uranium, U_3O_8	5,847	5,840	4,961	4,558	4,116
Vanadium, fused oxide, 99.9 percent V_2O_5	527	1,066	2,311	2,260	2,255
Zircon, concentrates and flour	5,374	6,682	6,901	6,877	2,402
Nonmetals:					
Andalusite	3,396	9,301	7,045	18,338	10,008
Asbestos:					
Amosite	65,063	62,260	62,808	67,933	70,414
Chrysotile	26,604	26,735	28,781	27,209	26,243
Crocidolite	73,606	70,535	85,094	105,532	89,965
Tremolite	201	13	67	87	25
Total	165,474	159,543	176,750	200,761	186,647
Barite	2,136	1,704	1,780	1,699	2,453
Cement....thousand tons	2,647	2,705	2,598	2,659	2,884
Clays:					
Bentonite [1]	2,651	3,475	4,107	5,745	7,814
Fire clay [1]	225,647	198,101	243,841	183,042	223,561
Fuller's earth [1]	762	519	671	668	452
Kaolin [1]	21,795	26,639	24,495	26,920	34,355
Flint clay	[1] 23,261	[1] 59,564	217,513	155,782	136,208
Corundum	564	112	144	317	72
Diamonds:					
Pipe mines....thousand carats	2,366	2,591	3,258	3,290	3,744
Alluvial mines....do	472	549	530	628	631
Total....do	2,838	3,140	3,788	3,918	4,375

See footnotes at end of table.

TABLE 3.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals—Continued					
Diatomite	360	314	124	587	200
Emerald crystals kilograms	802	1,621	860	212	240
Feldspar	10,615	15,850	23,664	28,662	42,036
Fluorspar:					
Acid grade	(3)	(3)	1,706	4,132	7,539
Ceramic grade	(3)	(3)	9,862	31,439	16,632
Metallurgical grade	(3)	(3)	75,396	65,746	28,229
Total	63,790	103,010	86,964	101,317	52,400
Graphite	560	811	874	1,187	609
Gypsum	202,955	195,783	173,361	192,001	187,464
Limestone [1] thousand tons	5,359	5,295	5,244	5,300	5,802
Lithium minerals	9	157	236	1,146	378
Magnesite	53,417	60,593	61,444	92,852	98,256
Mica	1,706	3,045	2,469	2,224	2,123
Mineral pigments	4,908	5,784	5,104	4,559	3,966
Phosphates, crude	231,663	267,649	296,586	307,161	454,911
Pyrites [6]	503,334	500,068	446,805	440,993	418,551
Salt thousand tons	238	253	208	255	198
Shale	212,857	190,882	176,394	163,200	176,180
Silcrete [7]			8,463	11,500	14,878
Silica and silica sand	194,218	183,726	194,678	199,491	275,107
Sillimanite	41,591	53,418	85,760	53,662	56,241
Sulfur, elemental, refinery byproduct	(3)	(3)	2,198	1,944	2,013
Talc	1,281	1,795	2,975	12,629	6,864
Tiger's eye [8]	11	3	15	93	117
Vermiculite	47,534	62,615	64,517	77,595	89,591
Wonderstone [9]	356	634	928	1,676	1,855
Mineral fuels:					
Coal, marketable:					
Anthracite thousand tons	704	643	1,297	1,110	1,152
Bituminous do	35,857	37,530	38,268	40,165	41,302
Total do	36,561	38,173	39,565	41,275	42,454
Coke do	2,074	2,206	2,297	2,313	2,412
Petroleum products: [10]					
Gasoline [11] thousand 42-gallon barrels	4,213	4,327	4,790	5,235	(3)
Aviation turbine fuel do	66	175	230	251	(3)
Kerosine do	1,131	1,159	1,023	1,116	(3)
Distillate fuel oil [12] do	2,556	2,413	2,843	3,069	(3)
Residual fuel oil do	2,334	1,590	2,057	2,237	(3)
Liquefied petroleum gas do	81	107	(3)	(3)	(3)
Asphalt and bitumen do	858	750	(3)	(3)	(3)
Other do	65	268	(3)	(3)	(3)
Carbon black	(3)	(3)	1,870	7,638	9,708

[1] Sales.
[2] Estimate.
[3] Data not available.
[4] Not reported the same as in 1959–62; total includes 1,246,000 metric tons of metallurgical grade ore, 62,000 tons of chemical grade ore, and 50,000 tons of manganiferous ore, containing 15 to 30 percent Mn and 20 to 35 percent Fe.
[5] Natural alloy of osmium, iridium, small quantities of other platinum-group metals, and gold; recovered by certain gold mines.
[6] Includes small quantities of cupreous pyrite.
[7] Dense rock containing up to 98.4 percent SiO_2; used in manufacture of silica refractories.
[8] Decorative material resulting from oxidation and silicification of crocidolite.
[9] A soft, easily worked dimension stone.
[10] Includes production from imported oil, domestic oil shale, and domestic coal.
[11] Includes Union Motor Spirit; a blend of 50 percent imported gasoline and 50 percent sugarcane alcohol.
[12] May include some residual fuel oil.

TRADE

The statistical territory of the Republic of South Africa extends beyond its political boundaries and includes the Territory of South-West Africa (mandated to South Africa by the former League of Nations) and the British High Commission Territories of Basutoland,

Bechuanaland Protectorate, and Swaziland. Hence items of external trade involving only the Republic are not precisely identifiable; this, however, applies mainly for imports. South Africa accounts for the great bulk of external trade of the whole statistical territory. In what follows South Africa is assumed to have taken all import items named. Exports named are known to have originated in South Africa, with minor exceptions.

While petroleum must be imported, South Africa has a favorable balance of trade in nonfuel minerals and in metals and semimanufactures of mineral origin. Net export values in 1961 and 1962 by category were approximately as follows:

	Value, million rands	
	1961	*1962*
Iron and steel [1]	15.8	24.6
Nonferrous metals	100.4	90.3
Nonmetallic minerals	146.0	124.8

[1] Includes iron ore and ferroalloys.

Net-import value of fuels for 1961 and 1962, were, respectively, R66.5 million and R65.7 million. Both in 1961 and 1962 imports of crude petroleum and petroleum products comprised nearly 50 percent of total imports. The decision of Kuwait to sever economic relations with South Africa was not expected to cause a crisis in oil supply but would be inconvenient.[6]

Excluding gold, the value of South African exports in 1962 of minerals, metals, and semimanufactures of mineral origin was about R340 million, including R73.7 million of uranium. The exports were 39 percent of total value of exports of domestic products of R867.4 million, excluding gold. Including R636.5 million of gold production, the mineral industry contributed 65 percent of total export earnings. In few countries of the world is the contribution of mineral industry to exports so large. While the value of exports, excluding gold, in 1962 was 6 percent less than in 1961, the increase in gold production was four times the decline.

The value of mineral exports to the United States in 1962 exclusive of iron and steel was about R19.1 million and somewhat higher than in 1961; decreases in chrome and manganese were more than offset by increases in asbestos and copper. Iron and steel exports to the United States included nearly 14,000 metric tons of ferromanganese and more than 43,000 tons of semimanufactures. Of total 1962 exports of iron ore and pig iron, Japan took, respectively, 82 percent and 52 percent.

[6] South African Mining and Engineering Journal. Jan. 3, 1964, p. 6.

TABLE 4.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	Total		Distribution, 1962 [1]	
	1961	1962	United States	Other principal destinations
Metals:				
Antimony	16,553	18,349	[2] 5,461	
Beryllium	65	318	309	Japan 9.
Bismuth ore	----------	1	----------	Argentina 1.
Chromite ore:				
44 percent and less Cr_2O_3	[4] 450,712	[4] 341,121	(3)	
More than 44 to 48 percent Cr_2O_3.	[4] 405,860	[4] 394,634	(3)	
More than 48 percent Cr_2O_3	[4] 2,115	[4] 2,149	(3)	
Total	[4] 858,687	[4] 737,904	541,853	West Germany 94,686; United Kingdom 57,102; Netherlands 18,221.
Copper:				
Contained in concentrates	242	43	----------	All to Japan.
Fire refined and blister	49,931	43,476	18,486	Belgium 9,753; Italy 5,801; West Germany 3,607.
Gold:				
Contained in troy ounces ores and concentrates.	640	1,393	(3)	
Bullion do	19,505,000	19,390,000	(3)	
Iron and steel:				
Iron ore	556,028	754,312	----------	Japan 619,110; Austria 50,833; France 35,941.
Pig iron [5]	248,054	216,006	4,614	Japan 111,785; Netherland 48,033; Italy 40,427.
Ferroalloys:				
Ferromanganese [5]	132,303	78,687	13,773	United Kingdom 22,014; Canada 10,224; Italy 7,507.
Other [5]	28,752	15,374	1,647	Australia 3,141; United Kingdom 2,919; Netherlands 1,387; Belgium, 1,337.
Steel ingots and equivalent primary forms.	17,545	30,958	2,540	United Kingdom, 14,288; Argentina, 5,013; Uruguay, 4,999; Pakistan, 3,575.
Semimanufactures:				
Angles, shapes and sections. [5]	6,930	8,282	(6)	(6).
Bars and rods [5]	41,986	62,438	(6)	(6).
Drill and tool steel [5]	90	82	(6)	(6).
Plate and sheet:				
Plain [5]	23,334	55,061	(6)	(6).
Galvanized [5]	30,090	28,512	(6)	(6).
Undifferentiated [5]	34,784	105,372	(6)	(6).
Pipe [5]	11,540	10,453	(6)	(6).
Pipefittings [5]	2,011	2,221	(6)	(6).
Rails [5]	17,745	22,768	(6)	(6).
Total	168,510	295,189	43,101	Federation of Rhodesia and Nyasaland 76,555; United Kingdom 71,972; Italy 48,736.
Manganese:				
Ore:				
40 percent and less contained manganese.	[4] 576,809	[4] 546,618	(3)	
More than 40 to 45 percent manganese.	[4] 46,900	[4] 145,689	(3)	
More than 45 to 48 percent manganese.	[4] 119,738	[4] 145,458	(3)	
More than 48 percent manganese.	[4] 7,269	[4] 22,427	(3)	
Total	[4] 750,716	[4] 860,192	161,349	France 223,943; West Germany 111,599; United Kingdom 94,548 Japan 87,353.
Electrolytic metal [5]	----------	3,661	517	United Kingdom 658; Sweden 541; Netherlands 437.
Monazite	----------	8,114	(3)	
Platinum group troy ounces metals.	[7] 350,000	[7] 300,000	----------	All to United Kingdom.
Silver do	1,629,321	2,120,592	1,360,686	United Kingdom 679,993; Japan 79,913.
Tantalite	1	10	5	Netherlands 5.

See footnotes at end of table.

TABLE 4.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	Total		Distribution, 1962 [1]	
	1961	1962	United States	Other principal destinations
Metals—Continued				
Tin concentrates—long tons	1,394	1,422	----------	United Kingdom 1,296.
Titanium:				
Ilmenite	81,785	60,308	(3)	
Rutile	1,904	294	(3)	
Uranium, U_3O_8 [8]	5,188	4,133	[2] 4,262	
Vanadium:				
Fused oxide	2,294	1,440	(3)	
Ammonium vanadate	(9)	47	(3)	
Zircon concentrates and flour	5,325	6,045	(3)	
Scrap and old metal [5]	14,834	5,880	10	Japan 5,387; Italy 257; Netherlands 125.
Nonmetals:				
Andalusite and sillimanite	93,107	46,256	242	United Kingdom 16,006; Japan 12,006; West Germany 11,357.
Asbestos:				
Amosite	61,564	63,193	17,966	United Kingdom 19,164; Australia 5,624; Italy 5,190.
Crysotile	22,765	24,982	----------	Spain 5,565; Australia 4,298; Italy 3,247.
Cape blue	68,675	68,135	8,741	Italy 8,565; France 6,700; Japan 6,247; West Germany 4,843.
Transvaal blue	10,909	10,765	3,071	Japan 1,361; United Kingdom 1,239; Czechoslovakia 963.
Tremolite	4	----------	----------	
Total	163,917	167,075	29,778	
Cement:				
Building [5]	4,006	16,018	----------	(6).
Fire and furnace [5]	4,322	3,908	----------	(6).
Other [5]	1,061	691	----------	(6).
Total [5]	9,389	20,617	----------	Mauritius 14,189; Federation of Rhodesia and Nyasaland 4,614; Republic of the Congo (Léopoldville) 903.
Corundum, crystal	144	317	(3)	
Diamond:				
South African production: [5]				
Rough, uncut [5]—carats	1,818,244	1,743,794	51,972	United Kingdom 1,363,198; Belgium 235,749; Netherlands 63,001.
Unmounted, do—cut and polished. [5]	138,718	132,968	25,401	Belgium 58,310; Hong Kong 28,160; United Kingdom 11,318.
Manufactured [5]—do	----------	998,519	50,095	Ireland 899,783; Federation of Rhodesia and Nyasaland 30,744; France 16,491.
Mixed origin, rough, do—uncut. [5 10]	19,226,908	16,644,518	4,114,317	United Kingdom 11,189,396; Ireland 1,066,712; Federation of Rhodesia and Nyasaland 96,935.
Total [5]	21,183,870	19,519,799	4,241,785	
Emerald crystals—kilograms	546	162	----------	All to United Kingdom.
Feldspar	4,851	7,805	----------	United Kingdom 3,703; Netherlands 1,558; West Germany 1,310.
Flint clay	78,207	73,662	----------	West Germany 35,207; Japan 28,071; United Kingdom 7,970.
Fluorspar:				
Acid grade	526	2,123	----------	Japan 762; Netherlands 722; Australia 379.
Ceramic grade	7,904	26,349	----------	Japan 12,834; Canada 9,902; Australia 749.
Metallurgical grade	69,265	42,458	----------	Netherlands 14,421; Japan 11,927; Sweden 5,271.
Total	77,695	70,930	----------	
Graphite	19	18	----------	All to Singapore.

See footnotes at end of table.

TABLE 4.—Exports of metals and minerals—Continued
(Metric tons unless otherwise specified)

Commodity	Total		Distribution, 1962 [1]	
	1961	1962	United States	Other principal destinations
Nonmetals—Continued				
Gypsum	22,155	14,524	----------	Federation of Rhodesia and Nyasaland 13,152.
Lime and limestone	12,777	11,386	----------	Federation of Rhodesia and Nyasaland 9,485; Mozambique 1,451.
Lithium minerals	51	931	----------	All to United Kingdom.
Magnesite	----------	10	----------	All to Italy.
Marble	----------	7	(3)	
Mica	1,324	795	----------	West Germany 247; United Kingdom 202; France 165.
Mineral pigments	3,048	2,519	97	United Kingdom 2,242; Australia 111; Netherlands 27.
Pyrites, sulfur content	2,282	4,488	----------	Federation of Rhodesia and Nyasaland 2,321; South-West Africa 2,167.
Salt	19,538	25,122	----------	Federation of Rhodesia and Nyasaland 22,565; Swaziland 1,901; Bechuanaland 418.
Silcrete	----------	122	----------	All to United Kingdom.
Silica	518	----------	----------	
Talc	14	1	----------	All to Mozambique.
Tiger's eye	5	57	(3)	
Vermiculite	64,467	69,759	10,975	United Kingdom 22,813; Italy 10,912; West Germany 7,090.
Wonderstone	655	1,036	1,011	United Kingdom 25.
Mineral fuels:				
Coal:				
Anthracite [5]	309,329	524,853	----------	Italy 152,576; Japan 75,950; France 67,952; Netherlands 66,508; Argentina 60,851; Kenya 41,919.
Other [5]	746,877	1,120,549	----------	Mozambique 425,484; Burma 302,514; Pakistan 176,375; Ceylon 166,341.
Coke [5]	9,125	13,811	----------	Burma 10,965; Japan 1,508; Mozambique 660.
Petroleum refinery products:				
Gasoline-thousand barrels	220	212	----------	Republic of South Africa bunker loadings 188; South-West Africa bunker loadings, 24.
Kerosine-----do----	559	444	----------	Republic of South Africa bunker loadings 427; South-West Africa bunker loadings, 16.
Diesel oil-----do----	574	584	----------	Republic of South Africa bunker loadings 567; South-West Africa bunker loadings, 16.
Residual fuel oil-----do----	2,851	8,846	----------	Republic of South Africa bunker loadings 2,844.
Asphalt and bitumen	334	266	----------	Federation of Rhodesia and Nyasaland 86; Mozambique 34

[1] For most commodities, only partial distribution is given, with minor recipients omitted (except the United States when it falls in that category).
[2] United States imports.
[3] Data not available.
[4] Data by grade are provisional figures subject to change and do not add to totals reported in source in the tabulation of exports by destination. Totals for exports by destination, not given by grade are as follows: Chrome ore; 1961, 841,464 tons; 1962, 754,539 tons; manganese ore: 1961, 754,906 tons; 1962, 862,730 tons.
[5] Data from Foreign Trade Statistics, v. 2, Dept. Customs and Excise, Republic of South Africa. Includes exports for High Commission Territories of Basutoland and Swaziland, Bechuanaland Protectorate, and the Territory of South-West Africa.
[6] See distribution of total.
[7] Estimate.
[8] Reported as "Prescribed material under The Atomic Energy Act."
[9] Included with fused oxide.
[10] Includes an undisclosed quantity of South African production together with diamonds produced elsewhere in Africa and shipped to the Republic of South Africa for sorting and subsequent reexport. About 80 percent of the quantity reported is crushing bort from the Republic of the Congo (Léopoldville).

Source: Compiled from Quarterly Information Circular, "Minerals," Department of Mines, Republic of South Africa; this publication lists separately exports from the Republic of South Africa; the High Commission Territories of Basutoland, Swaziland, and the Bechuanaland Protectorate; and the Territory of South-West Africa. These areas are not separated from the Republic of South Africa in Foreign Trade Statistics, Volume 2, Department of Customs and Excise, Republic of South Africa, which has been used to supplement "Minerals" for commodities not listed in the latter publication. Data from "Minerals," however, do not represent officially recorded exports, as data are furnished by producers on intended disposal of output, and thus may differ from actual customs returns.

Imports in 1962 in general followed the pattern of recent years. Middle East countries furnished the bulk of petroleum and petroleum fuels. Copper and zinc came largely from Northern Rhodesia and the Republic of the Congo (Léopoldville). Imports from the United States comprised chiefly aluminum ingot and semimanufactures, and steel semimanufactures. Northern Rhodesia furnished about 72 percent of imports of lead in primary forms. Mainland China and U.S.S.R. supplied 86 percent of imports of antimony metal. Mercury imports in part originated in U.S.S.R. and Yugoslavia.

TABLE 5.—Imports of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1961	1962	Sources, 1962	
			United States	Principal imports from other countries
Metals:				
Aluminum:				
Ingots and equivalent forms [2]	10,362	14,023	573	Canada 13,301; France 146 United Kingdom 3.
Semimanufactures [3]	1,785	2,718	767	West Germany 449; France 431; Belgium 411.
Antimony, crude	161	267	-------	Mainland China 163; USSR 67; Yugoslavia 25.
Copper:				
Ingots and equivalent forms	23,316	24,965	18	Federation of Rhodesia and Nyasaland 18,914; Republic of the Congo (Léopoldville) 5,981.
Semimanufactures	627	[4] 1,143	4	United Kingdom 712; Belgium 249; Italy 118.
Copper alloys:				
Ingots and equivalent forms	71	39	5	United Kingdom 20; Netherlands 8.
Semimanufactures	577	[4] 815	(5)	West Germany 369; Italy 221; United Kingdom 156.
Iron and steel:				
Pig iron, steel ingots and equivalent forms.	312	151	-------	United Kingdom 148; West Germany 3.
Ferroalloys:				
Ferromanganese	2	11	-------	Sweden 6.
Ferrosilicon	455	460	4	West Germany 425; Sweden 19; France 7.
Other	383	412	(5)	Federation of Rhodesia and Nyasaland 227; USSR 124; Belgium 24.
Semimanufactures:				
Bars, rods, profiles and sections.	6,389	6,187	103	United Kingdom 4,259; Belgium 1,136; Sweden 274.
Plate, sheet, strip, and hoop, uncoated.	7,921	8,719	1,189	United Kingdom 3,519; Sweden 1,672; Japan 1,203.
Plate and sheet, coated with tin.	66,377	61,774	592	United Kingdom 49,300; Canada 6,566; France 3,821.
Plate and sheet, other coated.	562	853	108	United Kingdom 565; West Germany 61; Japan 57.
Cast pipe and fittings	1,204	[4] 625	-------	United Kingdom 617; Federation of Rhodesia and Nyasaland 8.
Wrought pipe and fittings	11,479	[4] 7,991	32	United Kingdom 5,958; Italy 556; Belgium 513.
Other tubes and pipes	987	2,044	184	United Kingdom 1,269; Sweden 415; Netherlands 71.
Rails, sleepers, and rail accessories.	404	2,068	20	United Kingdom 1,727; Federation of Rhodesia and Nyasaland 34; West Germany 13.
Tool and drill steel	1,562	1,488	6	United Kingdom 1,046; Sweden 208; West Germany 125.
Rough castings	119	154	3	United Kingdom 127; Federation of Rhodesia and Nyasaland 9; West Germany 6.
Total	97,004	91,903	-------	

See footnotes at end of table.

TABLE 5.—Imports of metals and minerals [1]—Continued
(Metric tons unless otherwise specified)

Commodity	1961	1962	Sources, 1962	
			United States	Principal imports from other countries
Metals—Continued				
Lead:				
Ingot and equivalent forms	12,174	13,646	(5)	Federation of Rhodesia and Nyasaland 9,810; Australia 2,646; Mexico 531.
Semimanufactures	27	76	8	Federation of Rhodesia and Nyasaland 29; Belgium 20; Netherlands 13.
Mercury—76-pound flasks	593	952	1	Italy 308; United Kingdom 227; USSR 167; Yugoslavia 130.
Platinum—troy ounces	845	2,441	-------	United Kingdom 2,440; West Germany 1.
Silver bullion—do	52,000	-------	-------	
Tin:				
Ingots and equivalent primary forms—long tons	670	504	-------	Federation of Rhodesia and Nyasaland 504.
Semimanufactures—do	3	1	(5)	United Kingdom 1.
Zinc:				
Ingots and equivalent forms	22,958	27,095	(5)	Federation of Rhodesia and Nyasaland, 23,228; Republic of the Congo (Léopoldville) 3,807.
Fume dust and shavings	5	59	-------	Federation of Rhodesia and Nyasaland 40; United Kingdom 19.
Semimanufactures	164	200	27	United Kingdom 150; Belgium 10; West Germany 10.
Solder and brazing alloys	207	125	-------	United Kingdom 85; Japan 28; Sweden 7.
Scrap and old metal	8,516	18,268	66	Federation of Rhodesia and Nyasaland 10,766; Republic of the Congo (Léopoldville) 1,755; United Kingdom 1,740.
Miscellaneous crude metals and ores.	76,428	39,578	302	Federation of Rhodesia and Nyasaland 31,540; Mozambique 4,609; Surinam 2,712.
Other metals	392	514	27	United Kingdom 291; Federation of Rhodesia and Nyasaland 88; Canada 62.
Pipe fittings of various metals [4]	-------	1,582	139	United Kingdom 956; West Germany 381; Sweden 51.
Nonmetals:				
Abrasives:				
Emery	38	89	3	Netherlands 56; United Kingdom 30.
Pumice	80	110	(5)	Italy 66; New Zealand 41.
Barite	1,220	2,115	27	West Germany 1,015; Federation of Rhodesia and Nyasaland 941; Netherlands 73.
Borax	2,017	1,706	1,701	United Kingdom 5.
Cement	11,266	9,422	902	United Kingdom 6,584; West Germany 825; Denmark 477.
Clays:				
Cornish stone, kaolin and china clay.	3,975	4,469	1,361	United Kingdom 2,441; West Germany 667.
Fire clay	1,953	1,730	1,460	United Kingdom 248; West Germany 21.
Diamond, rough:				
Of mixed African origin—carats	541,139	1,035,117	65	United Kingdom 970,946; Netherlands 50,457; Federation of Rhodesia and Nyasaland 3,984.
Other—do	16,580,677	15,011,709	-------	Republic of the Congo (Léopoldville) 14,569,958; Tanganyika 321,601; Angola 92,271.
Diatomaceous earth	2,548	2,425	1,971	West Germany 270; Kenya 76; France 53.
Fertilizer and fertilizer raw materials:				
Ammonium nitrate	29,668	19,674	-------	West Germany 12,319; Netherlands 4,842; Belgium 1,369.
Basic slag, Thomas	52,050	44,759	-------	Belgium, 44,759.
Phosphate rock	375,194	451,897	-------	Morocco 346,994; Tunisia 71,077; Togo 11,517.

See footnotes at end of table.

TABLE 5.—Imports of metals and minerals [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Sources, 1962	
			United States	Principal imports from other countries
Nonmetals—Continued				
Fertilizer and fertilizer raw materials—Continued				
Superphosphate	2,704	6,495	----	Federation of Rhodesia and Nyasaland 3,515; Netherlands 1,941; Italy 812.
Potash	66,229	81,597	12,896	West Germany 31,783; France 27,717; Israel 8,574.
Fuller's earth	757	994	405	United Kingdom 584; West Germany 5.
Graphite	289	567	174	United Kingdom 300; Norway 58; Japan 18.
Gypsum, including plaster of paris	2,078	2,444	19	West Germany 1,762; United Kingdom 573; Italy 69.
Mica	28	29	(5)	United Kingdom 18; India 3; West Germany 3.
Silica	903	582	345	West Germany 187; United Kingdom 30; France 15.
Salt	3,054	2,321	71	United Kingdom 1,924; Netherlands, 315; Federation of Rhodesia and Nyasaland 2.
Sulfur	113,146	118,338	46,935	Mexico 71,010; France 163; West Germany 121.
Other earths and clays	997	93	11	USSR 40; Denmark 39; United Kingdom 2.
Mineral fuels:				
Coal	(5)	29	----	(6).
Coke	(5)	(5)	----	(6).
Petroleum:				
Crude 1,000 42-gallon barrels—oil.	11,092	12,095	----	Iran 11,325; Iraq 555; Bahrein 192.
Refinery products:				
Gasoline ---do----	10,257	10,424	----	Iran 4,208; Aden 2,891; Bahrein 2,416.
Naphtna, 1,000 42-gallon barrels—benzine and white spirit.	414	415	73	Iran 317; Indonesia 11; Iraq 8.
Kerosine ---do----	3,164	3,036	(7)	Iran 1,742; Bahrein 628; Aden 514.
Distillate fuel oils ---do----	4,453	4,795	(7)	Iran 1,893; Saudi Arabia 1,130; Australia 965.
Residual fuel oil ---do----	1,429	1,567	----	Bahrein 667; Iran 554; Aden 203.
Lubricating oil ---do----	1,075	1,261	570	Netherlands Antilles 263; United Kingdom 218; Venezuela 181.
Pavement oil ---do----	14	2	----	Canary Islands 1.
Other [8] ---do----	41	37	8	United Kingdom 14; West Germany 9; Netherlands 2.
Bitumen	35,539	31,577	14,619	British West Indies 13,756 Netherlands 1,661; United Kingdom 804.

[1] Includes imports for British High Commission Territories of Basutoland, Swaziland, and the Bechuanaland Protectorate, and for South West Africa.
[2] Includes ingots, pigs, blocks, and cast bars and rods; excludes powder, all rolled products, and most castings in special shapes.
[3] Includes rolling-mill products.
[4] Pipe fittings of copper, copper alloys, iron, and steel were reported separately in 1961 and are included under the appropriate metal; these items were groupedi n 1962 official statistics and are thus not separable, but included under the general category of pipe fittings.
[5] Less than 0.5 ton.
[6] Data not available.
[7] Less than 500 barrels.
[8] Includes brake fluid, insulating oil, tar, and creosote.

COMMODITY REVIEW

METALS

Antimony.—As for many years past, the entire antimony production of South Africa in 1963 was by Consolidated Murchison (TVL) Goldfields and Development Co., Ltd., from a property in the Pietersburg District of Transvaal Province. The ore mineral is stibnite, with which appreciable gold is associated. The ore occurs in lenses in steep-dipping veins ranging in width from a few centimeters to 6 meters. Cobbed ore and concentrates were produced, virtually exclusively for export. The bulk of exports go to the United Kingdom and the United States. Twenty-three percent of U.S. general imports of antimony in 1963 originated in South Africa.

In 1963 Murchison milled approximately 163,500 metric tons of ore, 14.6 percent more than in 1962. Combined output of concentrates and cobbed ore averaging 59.98 percent antimony was 18,621 tons. Ore reserves at the end of 1963 minable for combined antimony and gold at their respective prices on December 31 totaled almost 310,000 tons. Exploration by surface and underground diamond drilling continued. The additional information thus obtained sustained the view that mining operations should continue for at least 8 years, assuming the present price for antimony and present production costs.

Toward the end of the year additional equipment was being installed to bring annual milling capacity to 180,000 tons by June 1964. The move resulted from a firming of antimony prices with withdrawal of supplies from mainland China.[7]

Chromium.—The ultimate reserve of chromite in South Africa is considered by many chromite authorities to be the largest in the world. Reportedly, the presently minable reserve is at least 200 million tons.[8] Two or more companies owned or controlled in the United States retained ownership of a large part of the chromite reserve and operated large holdings.

The ore occurs principally in two belts in the Bushveld Igneous Complex in Transvaal Province. The western belt is about 160 kilometers long, and the eastern belt about 120 kilometers long. In both belts the ore occurs as multiple gently dipping (10–25 degrees) layers or seams of which three groups are recognized, known as the lower, middle and upper groups. The width of the layers ranges from a few centimeters to 2 meters. By using the resuing method of stoping, seams as narrow as 24 centimeters can be profitably mined when chromite prices are good.

In the eastern (Lydenburg) belt only No. 5 seam of the lower group has been extensively exploited. It is 1.5 to 1.8 meters thick but is stoped across only 107 to 137 centimeters, which contains most of the chromite. The seam is traceable for 88.5 kilometers.

In the western (Rustenburg) belt several mines generally are operated in each of the three groups of seams. Most seams are much narrower than No. 5 of the eastern belt.

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[7] Annual Report of the Company for the calendar year 1963.
[8] Beerman's All Mining Year Book, 1963, p. 86.

Most of the ore produced is medium to low grade with a chromium to iron ratio of about 1.56:1.[9] The bulk of output has comprised chemical-grade ore, but metallurgical grade and refractory grade also have been produced. The Republic is the leading world producer of chemical-grade ore; officially, production has not been recorded on the basis of use but according to Cr_2O_3 content.

Most South African chromite continued to be exported, although domestic consumption was increasing. In general about 75 percent of total exports have gone to the United States. For years South Africa has furnished virtually the entire U.S. supply of chemical grade chromite.

With respect to domestic consumption, local sales of chromite in 1963 totaled nearly 82,000 metric tons, more than 68 percent greater than in 1959. While the bulk of consumption has been in ferrochromium manufacture, chromite refractories and small quantities of chromium salts also have been produced. Ferrochromium capacity is being enlarged with a view to increasing sales abroad. Capacity in 1961 was estimated at 10,000 tons, whereas capacity in 1965 was projected for as much as 67,000 tons, distributed as follows:[10]

	Capacity, metric tons	
Company:	*1961*	*Projected for 1965*
African Metals Corp. including ferrometals	[1] 10,000	[1] 12,000
RMB Alloy's (Pty.) Ltd. (Rand Mines and Blelock, Ltd.)	Nil	20,000
Transalloys (Pty.) Ltd	Nil	15,000–20,000
Palmiet Chrome Mines, Ltd	Nil	10,000
Rand Carbide, Ltd	Nil	5,000
Total	10,000	62,000–67,000

[1] Estimate.

In 1963 the plant of Transalloys, at Witbank in the Transvaal, was being constructed. It will manufacture ferrochromium, using a process by which low cr: fe ratio ores can be used to produce a low-carbon product with high-chromium content.

Exclusive of ferromanganese, South African exports of ferroalloys in 1961 and 1962 were, respectively, nearly 29,000 metric tons and more than 15,000 tons, mostly ferrochromium. United States imports for consumption of South African ferrochromium were over 1,000 tons in each of those years.

Copper.—South African mine output of copper regularly has exceeded domestic needs for primary copper. But the country has only a small capacity for electrolytic copper refining, and the bulk of copper mined is exported. Hence refined copper must be imported in quantities that cost substantial foreign exchange. Imports in 1961 of copper in primary forms were valued at nearly R10 million. In a report on South African minerals potential issued in June 1963, the National Resources Development Council recommended consideration of an electrolytic refinery.

Imports of copper in primary forms mostly originated in Northern Rhodesia and Republic of the Congo (Léopoldville). Exports com-

[9] In 1962 ore with a high chromium to iron ratio was discovered; its importance is still unknown.

[10] Metal Bulletin (London). Oct. 30, 1962, p. i.

prised blister and fire-refined copper and small quantities of concentrates, of which Japan has become the largest buyer. In 1962 more than 43 percent of combined exports of blister and fire-refined copper went to the United States. South Africa has generally consumed less than 800 metric tons of fire-refined copper annually.

There were two important, widely separated copper operations in 1963, and a third area was being developed. The active camps were the Messina in northern Transvaal Province near the Southern Rhodesia border and Nababeep in Namaqualand, Cape Province. The new project was at Phalaborwa, Transvaal Province.

The Messina field was exploited by Messina (Transvaal) Development Co., Ltd., which produced exceptionally pure fire-refined copper. Output in 1962 was nearly 11,000 metric tons. As of September 30, 1962, Messina reported ore reserves totaling 6,256,000 tons, assaying 1.53 percent Cu. Messina also has copper mines and a smelter in Southern Rhodesia.

In the Nababeep area the producer was O'okiep Copper Co., Ltd. (American controlled), which mined several deposits and produced blister copper, averaging more than 99 percent copper. Output in 1962 was more than 35,000 metric tons. In January 1963 the new O'okiep mill at Carolusburg was brought into production at an initial rate of 36,250 tons of ore per month. In July the monthly rate was increased to 72,500 tons by installing a new rodmill and moving certain equipment to Carolusburg from the East O'okiep concentrator.[11] The aggregate measured reserve of oxide and sulfide ore in various company deposits as of June 30, 1962, was about 25.5 million tons, averaging 2.07 percent copper.

Expected to be in production by 1966, the new project at Phalaborwa is a bold mining venture, which will cost about R75 million. The operating company is Palabora Mining Company, in which is South African, British, American, Canadian, and German capital on either or both an equity and a loan basis. The project consists of equipping for open-pit mining a large low-grade deposit, averaging 0.7 percent copper, and building a concentrator and a smelter nearby. The capacities of the facilities will be, respectively, approximately 30,000 metric tons of ore per day and 72,500 tons of blister copper per year. Ore reserves on which the venture is based are estimated at 286 million tons to an open-pit depth of 394 meters. Two favorable aspects of the project are that the stripping ratio for mining will be 1:1 and that a substantial tonnage of byproduct magnetite may be produced for local sale.

Another copper development was that the apatite producer in the Phalaborwa area, Phosphate Development Corporation (Pty.), Ltd., agreed to export to Japan annually about 17,000 tons of copper concentrate worth more than R2 million. The first shipment went forward via Lourenco Marques, Mozambique, early in November 1963.

Gold.—South Africa established new records for gold in 1963 for both production and working profit of the gold mining industry. Production was 27.43 million ounces. Estimated working profit was

[11] South African Mining and Engineering Journal. Jan. 3, 1964, p. 5.

R313 million. The profit was 7.9 percent greater than in 1962 and 18.5 percent greater than in 1961.[12]

The volume of gold mined in 1963 was about 70 percent of free world gold production, compared to 67.5 percent in 1962. Gold production has increased each year since 1952, when the country produced 11.8 million ounces.

Geology.—More than 99 percent of South African gold production has come from certain gold-bearing conglomerates (locally called reefs) of the Witwatersrand sedimentary system discovered in 1886. In certain ore bodies of the Witwatersrand (Rand) gold-bearing conglomerates, uranium is associated with gold, and the Rand conglomerates have been the source of all uranium the country has produced. In addition, some of the gold ore bodies contain sufficient pyrite for byproduct pyrite concentrates to be produced. These concentrates have been the major domestic raw material for sulfuric acid manufacture. Another byproduct of certain gold mines has been osmiridium, a natural alloy of osmium and iridium.

The Rand system comprises ancient sediments resting on an irregularly eroded granite floor. The present structure of the sediments is that of a main, apparently completely closed, roughly eliptical basin trending northeast, and what is probably a smaller basin, a short distance southeast of the northeast end of the main basin. The lengths of the axes of the main basin are roughly 256 kilometers and 96 kilometers. The northwest rim of the basin runs through Johannesburg, where it outcrops near the initial gold discovery. The remainder of the rim, mostly buried by younger, flat sediments, is partly in Orange Free State Province.

The sediments comprise two divisions. The Lower Division, resting on the granite floor, is about 4,600 meters thick and is mostly quartzites, minor shale, and conglomerate beds. The Upper Division is about 2,700 meters thick. It consists of quartzites, many conglomerate beds, and the argillaceous Kimberley shale bed. This Upper Division contains most of the gold-bearing conglomerates rich enough to be exploited. It is also the source of most or all of the associated uranium.

The following Reef horizons are or have been mined for gold, with or without byproduct uranium: [13]

Upper Division, from near bottom toward top:
- Main Reef group, including Main Reef, Main Reef Leader, South Reef, and Carbon Leader, etc.
- Bird, Basal, and Vaal Reefs.
- Kimberley Reefs.
- Elsburg Reefs.

Lower Division, from bottom toward top:
- Domion Reef.
- Government Reef.

The reefs are narrow. True widths range from 20 centimeters to 152 centimeters. Dips rarely are steeper than 35 degrees and in depth become progressively flatter.

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[12] Mining Journal (London). Feb. 14, 1964.
[13] Seventh Commonwealth Mining and Metallurgical Congress. Transactions, 1961, v. 2, pp. 489–592. Map accompanying paper by R. Borchers.

Minable stretches of reef have been found at widely spaced intervals along the exposed or more generally buried rim of the basin. Beginning at Johannesburg and proceeding southwest around the rim, major Rand goldfields are known as Central Rand, West Rand, Far West Rand, Klerksdorp, Orange Free State, and East Rand. The mining area of the separate basin is called the Evander (formerly Kinross) area.

In 1962, in the Rand goldfields, there were 55 mines producing gold, several also produced byproduct uranium. In addition, 5 mines were primarily uranium producers, having byproduct gold production. The gold-mining companies, as well as major coal-mining companies in South Africa belong to an efficient, highly organized producers association called the Transvaal and Orange Free State Chamber of Mines. The Chamber issues annually a highly informative annual report; that for 1962 was its seventy-third.

Salient statistics of the gold-mining industry, exclusive of mines primarily producing uranium, including tons of ore milled, gold and uranium produced, and grade of ore are reproduced in table 6. The total volume of ore milled in 1962, including that milled by primary uranium producers, was nearly 68.5 million metric tons. For primarily gold producers, gold recovery per short ton ranged from 0.177 troy ounces by Consolidated Main Reef to 0.99 ounces for West Driefontein.

TABLE 6.—Salient statistics of gold and uranium production by members of the Witwatersrand and Orange Free State Chamber of Mines

	1959	1960	1961	1962	1963
Overall statistics:					
Number of mines producing gold	55	55	[1] 57	[1] 60	[1] 57
Number of mines also producing uranium, U_3O_8	23	23	23	16	14
Labor, (average number of persons at work):					
Europeans, (whites)	41,995	42,977	42,691	41,459	(2)
Non-Europeans, (nonwhites)	372,181	379,212	390,785	384,971	[3] 362,328
Salaries, wages, and allowances:					
Europeans, thousand Rands	111,960	119,087	121,738	123,613	(2)
Non-Europeans, do	52,470	55,494	58,237	58,418	(2)
Supplies purchased:					
Of domestic origin, do	187,531	202,530	204,793	196,307	(2)
Imported, do	20,159	23,915	21,221	18,514	(2)
Electric energy purchased:					
Quantity, million kilowatt-hours	7,089	7,604	7,927	8,383	(2)
Value, thousand Rands	28,545	31,925	33,852	35,102	(2)
Water purchased, do	2,810	2,928	2,960	3,190	(2)
Compressed air purchased, do	925	842	816	748	(2)
Financial results:					
Total profit from gold, uranium, sulfuric acid, and pyrite, thousand Rands	229,817	254,577	264,004	288,311	[4] 309,627
Net dividends declared, do	90,648	93,948	99,543	104,654	112,892
Taxation [5], do	53,988	73,500	86,334	109,988	(2)
Gold:					
Ore milled, thousand short tons	70,473	71,259	[6] 73,143	[6] 75,779	[6] 78,427
Gold recovered:					
Total [7], thousand troy ounces	19,630	20,922	22,505	24,918	27,431
Total per ton of ore milled [8], troy ounces	.2783	.2932	.3253	.3443	.3430
Working revenue: [9]					
Total, thousand Rands	492,249	527,662	566,905	626,265	677,515
Total per ton of ore milled [8], Rands	6.99	7.42	8.21	8.65	9.00
Working costs: [10]					
Total [8], thousand Rands	320,093	331,705	340,148	367,392	392,975
Total per ton of ore milled [8], Rands	4.53	4.65	5.04	5.18	5.33
Total per ounce of gold produced [8], do	16.24	15.80	15.45	15.03	14.91
Working profit:					
Total, thousand Rands	172,156	195,957	213,476	246,169	[4] 270,018
Total per ton of ore milled [8], Rands	2.46	2.77	3.17	3.47	3.67

See footnotes at end of table.

TABLE 6.—Salient statistics of gold and uranium production by members of the Witwatersrand and Orange Free State Chamber of Mines—Continued

	1959	1960	1961	1962	1963
Uranium, U_3O_8:					
Slimes, gold mill tailings, treated thousand short tons	23,948	24,141	17,093	14,115	12,582
Uranium recovered:					
Total thousand pounds	12,526	12,422	10,893	10,048	9,065
Total per ton of slimes treated pounds	.523	.515	.637	.712	.720
Sales:					
Quantity thousand pounds	12,298	12,448	9,919	9,102	[2]
Revenue thousand Rands	104,273	105,039	[2]	[2]	[11] 66,762
Profit do	[12] 54,477	[12] 55,024	47,954	39,390	39,608
Sulfuric acid and/or pyrite:					
Profit do	3,183	3,595	2,574	2,752	[2]

[1] Includes 5 mines that were primarily uranium producers.
[2] Data not available.
[3] Number at work at yearend.
[4] Includes neither profit from gold of primarily uranium producers nor profit from sulfuric acid and/or pyrite.
[5] Estimated amount payable by gold mine members of the Chamber as government share of profits under lease agreements and on account of formula tax.
[6] Includes ore milled by primarily uranium producers as follows, in thousand tons: 1961, 5,778; 1962, 4,973; 1963, 4,778.
[7] Includes relatively small quantities of gold recovered from old tailings and cleanup operations, excluded from ore grade calculations.
[8] Excludes primarily uranium producers.
[9] Includes revenue from gold and silver and, for some companies, revenue from other sources but excludes revenue from uranium and sulfuric acid.
[10] Working costs are exclusive of costs of treatment of uranium-bearing slimes and of production of sulfuric acid.
[11] Value of exports.
[12] Before providing for interest on and repayment of loans.

Sources: 1959–62, Annual Reports of the Transvaal and Orange Free State Chamber of Mines; 1963, Annual Mineral Industries Report for 1963 of the U.S. Consulate General, Johannesburg (Johannesburg Airgram A–7, July 7, 1964).

Refining.—The dore (unrefined) bullion produced by mines in 1963 was refined by a single gold refinery as in the past. This is Rand Refinery, Ltd., largest gold refinery in the world, which is owned by the major gold-mining companies. The refinery reputation for accuracy and uniformity of product is such that refined gold bullion shipped to the Bank of England is not remelted and sampled upon arrival but is accepted for fineness on the Rand Refinery certification.

Principal developments.—Western Deep Levels, which began milling in 1962, by late 1963 had increased quantity of ore hoisted to 186,000 metric tons monthly, when a major accident occurred in No. 2 shaft. It caused extensive damage to the shaft and milling had to be reduced to two-thirds of normal capacity. It was expected that the shaft would be operating again in January 1964 and that by March 1964 normal production of about 181,000 tons of ore monthly would be achieved.

Rose Deep announced that profitable operation no longer was possible.[14] Indications were that by June 1964 underground operations would cease. The mine produced 49,307 ounces of gold in 1962. From the start of operations to December 31, 1962, the mine produced more than 9.5 million ounces of gold.

It was reported that increased production and improved efficiencies resulted in a decrease in unit production costs at President Steyn, President Brand, and Welkom. However, at Free State Geduld and Western Holdings there were nominal increases in costs, despite the

[14] Mining Magazine. V. 109. No. 6. December 1963.

benefits of increased tonnages and efficiency.[15] These gold mines in the Orange Free State are controlled by Anglo American Corp. of South Africa, Ltd.

Iron and Steel.—Except in areas of special steels, South African iron and steel production has exceeded the needs of the country, and exports have been substantial. In recent years, however, rapid expansion of the South African economy has resulted in short supply of some types of steel.

The government controlled and operated South African Iron & Steel Industrial Corp. (ISCOR) continued to be the dominant company of the industry. ISCOR produced 82 percent of the ingot steel manufactured in South Africa in 1962. Other companies include African Metals Corp., Ltd. (AMCOR), and Union Steel Corp. (of South Africa), Ltd., (USCOR); ISCOR has a financial interest in both.

By November 1963, the steel shortage had become severe enough for ISCOR to announce restriction of domestic orders for steel to "the average of recent performance." The expression was defined as the level of orders during the past 1 or 2 years, meaning preboom levels. In December it was reported that every effort was being made to bring in a new plant and equipment as rapidly as possible, and to meet the rapidly rising demand, ISCOR was limiting exports to products in sufficient supply.[16]

ISCOR has in progress a plan begun in late 1961 for expanding steel-production capacity, designed to make South Africa virtually self sufficient in iron and steel by 1969. Annual steel ingot capacity of about 2,130,000 metric tons, was scheduled to be increased to 3,630,000 tons. In this connection the corporation in 1963 was trebling the capacity of its Sishen iron mine ore, to approximately 4.5 million tons. This goal was expected to be reached late in 1964.[17]

Early in 1963 Anglo American Corp. of South Africa, Ltd., announced that it was investigating the possibility of producing steel from titaniferous-vanadiferous magnetites of the Bushveld complex, by a process indicated to resemble the Strategic Udy process. Pilot plant tests had yielded encouraging results. Titanium reportedly can be eliminated, and vanadium can be recovered as a by-product. British experts were studying steelmaking aspects of the project.

AMCOR was expected to begin shipments of pig iron to Japan early in 1964, against its contract to deliver about 4.5 million metric tons of pig iron over a 10-year period.

USCOR proposed to spend R19 million in expansion projects over a 5-year period ending December 1967. Sales of mild and special purpose carbon steels in 1962 were nearly 16 percent higher than in 1961.[18]

Manganese.—South Africa has produced manganese ore and ferromanganese for many years. Ore reserves are very large, but no authoritative estimate is available. Battery-grade manganese dioxide and electrolytic manganese metal were also produced in 1963.

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[15] Mining Journal (London). V. 262, No. 6699, Jan. 10, 1964, p. 35.
[16] U.S. Embassy, Pretoria. A–207, Dec. 20, 1963.
[17] U.S. Consulate General, Johannesburg. A–249, Jan. 8, 1963.
[18] Steel and Coal. V. 186, No. 4954, June 28, 1963.

Manganese Ore.—Production in 1963 was about 40 percent greater than in 1958. Capacity is twice the 1963 output, the limiting factor being rail-transport capacity to distant consumers and ports of export. Exports and local sales in 1963 were, respectively, 902,446 and 452,491 metric tons. Fluctuations in these figures have been minor since 1960, when exports increased sharply and local sales moderately.

Exports generally go to 12 or more countries. In 1963 France and West Germany were the principal recipients with Belgium and the United States ranking third and fourth. Historically, however, the United States has stood first, in 1961 taking more than 200,000 metric tons, or about 27 percent, of South African total exports that year.

No breakdown by end use is available for local sales of manganese ore. Ferromanganese manufacturers accounted for major consumption of richer ores. South African uranium extraction plants were large consumers of low-grade ores. These plants continued to use the acid process for dissolving uranium, in which manganese ore is added to maintain required oxidizing conditions in the solution.

The Republic has two, main, widely separated manganese fields. The more important field, generally known as the Postmasburg field, was discovered in 1922. In this field deposits of manganese and also important iron-ore deposits occur at widely spaced intervals from about 56 kilometers south of Postmasburg, Northern Cape Province, north about 240 kilometers to Black Rock near the Bechuanaland border. The size, shape and attitude of the deposits and the situation with respect to overburden are such that except in one instance the deposits are mined open pit.

The manganese ore is unusually hard and does not disintegrate in storage, thus being excellent for exporting. The ore minerals are mostly manganite and braunite. The bulk of the ore is medium to low grade and high in iron but has low phosphorus and silica content. Typical analyses of three grades of ore appear below:

	Guaranteed minimum Mn, 48 percent	*Guaranteed minimum Mn, 44 percent*	*Guaranteed minimum Mn, 38 percent*
Manganese	49. 26	45. 96	40. 33
Iron	10. 82	13. 33	14. 91
Silica	2. 84	2. 41	2. 24
Barite	1. 28	1. 09	1. 61
Phosphorus	. 046	. 039	. 044
Alumina	4. 53	4. 98	8. 10

In recent years in what is known as the Kuruman part of the field, manganese ore has been found that is much lower in iron and richer in manganese than that for which the analyses are given. Some of these new ores have manganese to iron ratios of 7 to 1 and even 10 to 1. Manganese content reaches 55 percent, but in such ores iron content may also be high. These ores, generally blended to obtain a suitable ratio of manganese to iron, have been mostly consumed in South Africa in ferromanganese manufacture.

Few, if any, companies operating in the Postmasburg field reported production. The largest producer, however, has been Associated Manganese Mines of South Africa, Ltd., with South African Manganese Ltd., ranking second. The former company, also the largest exporter of manganese ore, produced iron ore from its Postmasburg properties,

and large tonnages of ferromanganese through a subsidiary, Ferroalloys, Ltd., at Cato Ridge, Natal Province. The annual report of Associated Manganese for 1962 indicated that ore tonnages sent by rail from its properties were about 523,000 metric tons of manganese ore and 406,000 tons of iron ore.

South African Manganese, Ltd., indirectly is owned or controlled by the government-controlled South African Iron & Steel Industrial Corp. (ISCOR), which accounted for about 80 percent of South African iron and steel production. South African Manganese, Ltd., holdings in the Postmasburg field are extensive, both for manganese ore and iron ore. In its Hotazel mine in the Kuruman part of the field the company, since 1961, has developed a large manganese ore body. Ore output planned for this mine is about 435,000 metric tons per year.

The other manganese area is not as sharply delimited as the Postmasburg field. It is in Transvaal Province, mainly in the Krugersdorp, Randfontein, Ventersdorp, and Marico Districts. Deposits are smaller and in general lower grade than in the Cape Province field. It is believed that by far the largest consumption of the Transvaal ore has been by plants producing uranium.

Durban has been the chief port for export of manganese ore, with smaller tonnages going through Lourenço Marques, Mozambique. The rail haul from the Postmasburg field to Durban is about 960 kilometers. Port Elizabeth is substantially closer, and the completion in 1963 of mechanical ore-handling facilities there has lowered both transportation and handling costs for export manganese.

Ferromanganese.—Since 1958 South Africa has established ferromanganese capacity large enough to permit substantial exports. Present annual capacity is estimated at about 180,000 metric tons. Data on production and domestic consumption are not available. Exports in 1961 reached a record high for the country; in 1962 exports fell by nearly 41 percent. Of total 1962 exports, 30 percent went to the United States and Canada. The sharp decline apparently reflected increasingly keen competition from United States and other manufacturers. The three grades of ferromanganese listed below were manufactured; prices shown were quoted f.o.b. Myerton, Transvaal, by the South African industry late in 1963:

Grade:	Price per metric ton
70–75 percent Mn	R87.00
75–85 percent Mn and 0.75 percent C	232.00
80–85 percent Mn and 2.0 percent C	173.25

Source: U.S. Consulate General, Johannesburg. A–138, Dec. 4, 1963.

The principal producers were Ferroalloys, Ltd., at Cato Ridge, Natal Province, and African Metals Corp., Ltd. (AMCOR), at Kookfontein, Transvaal Province. Both companies used electric furnaces. AMCOR, controlled by African Iron & Steel Industrial Corp., Ltd., is believed the largest manufacturer of ferroalloys in South Africa. Ferroalloys, Ltd., had two furnaces and was erecting two others in 1963 that were expected to be operating early in 1964.[19]

[19] The Associated Manganese Mines of South Africa, Ltd. 1962 Annual Report. 1963, p. 3.

Battery-grade Manganese.—Production of battery-grade manganese dioxide was begun in June 1962 by General Manganese Products (Pty.), Ltd., at Krugersdorp, Transvaal Province. A second plant for such production was scheduled to begin operating in 1963, at Gapani, Western Transvaal. The owner is Marble Lime & Associated Industries. A pilot plant the company built in 1962 to test the feasibility of the project appeared to have turned out a product meeting specifications of battery manufacturers. The output of these plants was not available; that of General Manganese was expected to be sufficient to result in exports of battery-grade manganese dioxide.

Electrolytic Manganese Metal.—In February 1960, Electrolytic Metal Corp. (Pty.), Ltd., after a year or more of test work, began commercial recovery of electrolytic manganese from uranium plant residues, obtained from West Rand Consolidated Mines, Ltd., a gold and uranium producer. This was the first and only such production in Africa. The plant has since been expanded. Output has not been disclosed.

Platinum.—Available information indicates that in 1963 South Africa ranked second after Canada in free world production of platinum group metals. Output is by Rustenburg Platinum Mines, Ltd., from two large underground mines in Transvaal Province, one at Rustenburg and the other on farm Zwartklip No. 405, about 76 kilometers north of Rustenburg. These are the only underground mines in existence from which platinum is the primary product, possibly exclusive of U.S.S.R. The content of platinum group metals is approximately as follows:

	Percent
Platinum	71.5
Palladium	24.9
Rhodium	2.3
Ruthenium	1.1
Iridium	.1
Osmium	.1
Total	100.0

Gold, copper, and nickel are also recovered; part of the copper and nickel are as refined metal.

The platinum group metals are produced in unrefined form and go to Johnson, Matthey & Co., Ltd., of London for refining and selling. In recent years there has been an overall improvement in grade of products shipped. The products in 1963 comprised: (1) Blanket table platinum concentrates called metallics; (2) platiniferous matte; and (3) an enriched platinum-bearing product resulting from local treatment of part of the matte, by Matte Smelters (Pty.), Ltd., jointly owned by Rustenburg & Johnson, Matthey & Co.

Rustenburg did not disclose production, estimated at around 300,000 ounces in 1963. However, net revenue from metal sales was R7.6 million, compared with R7.3 million in 1961–62. Near the close of the year demand for platinum increased markedly and sales for the year increased about 10 percent. The United States, United Kingdom, and Japan continued to be the leading customers. On November 7, 1963, the price for Rustenburg platinum was increased to £30.25

Sterling per ounce. The increase was made in view of sustained upward movement in the Russian price.

Operations at company mines encountered no technical difficulties, and there was no change in average grade of ore mined. Ample ore reserves are available for future mining requirements.[20]

Tin.—Tin was first found in South Africa in about 1905. The combined value of metallic tin and tin in concentrates produced through 1963 was more than R37 million. Most of the output came from Transvaal Province. Since 1939 the major part of output has been tin metal, smelted by Zaaplaats Tin Mining Co., Ltd., from richer domestic concentrates and from small quantities of concentrates imported from South-West Africa. Lower grade domestic concentrates are exported, mostly to the United Kingdom, and tin metal is imported. The average value of production, exports, and imports during 1955–59 inclusive is given as follows:[21]

	Value
Tin produced	R1,200,000
Concentrates exported	1,020,000
Tin imported	1,320,000

The financial year of Union Tin Mines (Pty.), Ltd., which ended June 30, 1963, was successful. Higher than average grade ore was found in the N3 lode on the 10 level. Company technical advisers felt that 88,000 long tons of ore and 28,500 tons of marginal material had been developed. Operations seemed reasonably assured for 4 years. In the year ended June 30, 1962, 32,493 long tons of ore were milled and 246.4 tons of tin in concentrates was produced.[22]

Uranium.—The source of South African uranium is the gold ore of the Witwatersrand sedimentary basin, from which uranium oxide is a byproduct. As of January 31, 1957, the South African Atomic Energy Board estimated that reserves of gold ore totaling 1,000 million metric tons contained 340,000 metric tons of uranium oxide. Average uranium oxide content of the estimated reserves thus is about 312 grams per ton. This figure compared with actual per ton recoveries of uranium oxide by producers in 1962, ranging from 173 grams per ton to 983 grams per ton.[23]

Output of byproduct uranium from the gold ores began in October 1952, when West Rand Consolidated Gold Mines became the first gold mine in the world to produce the metal. The industry was established by an agreement of November 1950 between an American-British purchasing agency called the Combined Development Agency and the South African Atomic Energy Board, created by the South African Government to deal with uranium matters.

The need of the United States and the United Kingdom for uranium was urgent. This need both required production to begin as soon as possible and influenced financing of the project. The agreement for producers included interest-bearing loans to cover cost of plant construction and, based on a cost-plus formula, the price to be paid per

[20] Rustenburg Platinum Mines, Ltd. Annual Report for Year Ended Aug. 31, 1963.
[21] Seventh Commonwealth Mining and Metallurgical Congress, 1961. Transactions. V. 1, 1961, p. 147.
[22] South African Mining and Engineering Journal. Sept. 27, 1963, p. 907.
[23] Union of South Africa, Government Information Office. New York, N.Y. Press release Feb. 15, 1957.

pound of uranium delivered. The average price per pound was about R8.5, later falling to R8.0.

Twenty-four mines ultimately were included in the program, treating annually about 22 million metric tons of gold mill tailings and producing almost 5,700 tons of uranium oxide worth more than R104 million. Profit on such production was more than R54 million. Additional profit of nearly R3.2 million was earned annually by the gold mines from manufacture of sulfuric acid used in the recovery process.[24]

It soon became apparent that excess free world production was beginning, requiring reduction of procurement from South Africa. In 1958, when South African annual-production capacity was about 7,250 metric tons, the ceiling for the country was set at 6,023 tons per year. Later, in 1961, a "stretchout" scheme for deliveries was established. The original contracts with individual producers would have expired between the end of 1963 and the end of 1966, when 25,719 tons of uranium oxide would have been delivered. The stretchout called for delivery of that tonnage by December 31, 1970. In addition, the scheme replaced cost-plus prices with fixed prices related to prices being paid at the end of 1960.[25] It also resulted in some high-cost producers selling their quotas to low-cost producers for a negotiated per ton royalty.

The Italian chief of uranium research visited South Africa in 1962 to investigate the possibility of buying uranium for the nine reactors in Italy. He said South African uranium was the cheapest in the world.[26]

Vanadium.—South Africa began to produce vanadium about 1957. Output rapidly increased and in 1962 the Republic ranked fifth among free world producers. Products marketed comprise fused vanadium oxide (99.90 percent V_2O_5) and small quantities of ammonium vanadate (minimum 75 percent V_2O_5), essentially all of which was exported in 1962, principally to European countries. The value of exports was R2,365,237 in 1962, when Transvaal Vanadium Co. (Pty.), Ltd., a subsidiary of Anglo American Corp., was the sole producer. In European markets vanadium from the Transvaal is highly competitive with that of U.S. producers.

Titaniferous, vanadiferous magnetite deposits at Kennedy's Vale, south of Steelport and elsewhere in Transvaal Province, were the source of output. Exploration in 1958 of such occurrences in the Transvaal suggested that they comprised the largest vanadium resource in the Western World.[27]

A visitor to the mine of Transvaal Vanadium Co. at Kennedy's Vale early in 1963 reported that the central ore body outcrops along the top of a hill and dips at about 70 degrees. At the surface it is about 182 meters long and 24 meters wide. It contains about 2 percent vanadium oxide and 17 percent titanium oxide, the rest being largely magnetite. Reserves are estimated to total at least 12 million tons, sufficient for 50 or 60 years at the present production rate. Mining costs are about R0.50 per ton; truck transport costs, about R0.47; and rail haul-

[24] South African Engineering and Mining Journal. Feb. 3, 1961.
[25] Source cited in footnote 24.
[26] Newsletter. No. 47, May 1962, p. 7.
[27] British Commonwealth Geological Liaison Office. Newsletter. April 1958.

age to Witbank, where the extraction plant is located, about R2.00, for a total cost of about R3.00 per ton delivered at the Witbank plant.[28]

During the year Transvaal Vanadium converted its renewable lease on its property into a continuing lease, indicating optimism for the future of the undertaking.[29]

These Transvaal titaniferous-vanadiferous magnetites were being investigated in 1963 as possible raw material for steel manufacture with recovery of byproduct vanadium.

NONMETALS

Asbestos.—South Africa continued to be a leading world producer of asbestos. Output generally has ranked fourth by value among the minerals the Republic produces, exceeded only by gold, diamonds, and uranium. The country is in a unique position among asbestos producing countries in that it supplies the three principal varieties of fiber. Besides small quantities of tremolite, the following distinct varieties (ranked in order of value of the output in recent years) have been regularly produced: Crocidolite, amosite, and chrysotile. South Africa is the sole commercial source of amosite in the world. Reserves are large. With respect to crocidolite resources and production, Australia is the only serious competitor. Combined exports and local sales of the three varieties in 1962 were valued at R23,137,255, with the breakdown by variety as follows:

	Crocidolite		*Amosite*		*Chrysotile*	
	Quantity, metric tons	*Value* [1]	*Quantity, metric tons*	*Value* [1]	*Quantity, metric tons*	*Value* [1]
Exports	78,900	R12,384,008	63,193	R6,782,481	24,982	R2,912,188
Local sales	3,631	478,112	2,913	202,023	5,051	378,443
Total	82,531	12,862,120	66,106	6,984,504	30,033	3,290,631

[1] Export values are f.o.b. port of shipment; local sales value, f.o.b. at mine.

South Africa regularly furnishes asbestos to more than 40 countries, the largest importers being the United Kingdom and the United States. Particularly large exports of amosite asbestos to the United Kingdom can be attributed to the fact that a large United Kingdom asbestos fabricator controls the only producing amosite mine. With respect to crocidolite, about 90 percent of South African exports go to Europe.

Local use of asbestos has been principally in manufacture of asbestos cement, brake linings, and insulating materials. No substantial increase in local sales has occurred in recent years.

Amosite.—The mineral occurs in Transvaal Province at intervals in banded iron formation extending from Chunies Poort south of Pietersburg to the Steelpoort River north of Lydenburg. The Penge mine, indirectly owned by Cape Asbestos Co. (Pty.), Ltd., the only producer, had by far the largest reserves. Penge remained the largest asbestos mine in South Africa and the only large amosite mine in existence, a status attained in recent years as the result of extensive diamond drilling, shaft sinking, and underground development, which has shown the ore bodies to persist both laterally and in depth. In

[28] U.S. Consulate General. Johannesburg. Airgram A-331, Mar. 12, 1963.
[29] Mining Journal (London). Feb. 28, 1964.

recent years Penge has accounted for about 90 percent of world output of amosite.[30] In mid-1963 it was expected that ore output, then at the rate of about 72,500 metric tons per month, would be increased to 97,000 tons.[31] This would mean in terms of marketable amosite about 81,600 tons per year. Ore reserves appear sufficient for several decades at that rate of production.[32]

Crocidolite.—Crocidolite occurs both in the same belt as the amosite and in Cape Province in banded iron formation, extending about 400 kilometers from about 48 kilometers south of Prieska on the Orange River north through Griquatown and past Kuruman to the border of Bechuanaland. Two-thirds or more of total production usually comes from the Cape Province Belt. The largest producer there is Cape Asbestos Co., Ltd. A substantial contributor is Griqualand Exploration and Finance Co., Ltd., with six mines. At the start of 1963 most crocidolite operators had large stocks on hand.

Chrysotile.—Msauli Asbestos Mining & Exploration Co., Ltd., is the largest producer of chrysotile asbestos in the Republic. Its mine is in Transvaal Province on the Swaziland border. Production of milled fiber in 1962 totaled 15,260 metric tons. The ore reserve as of June 30, 1962, was reported to be about 2.9 million tons, the same as in 1961.

Diamonds.—Diamonds triggered mining activity in South Africa. Their discovery in 1870 at Kimberley and the subsequent profitable exploitation of the field both aroused worldwide interest in South Africa and provided much of the capital later poured into development of the Witwatersrand goldfields.

The South African industry is virtually monopolized by De Beers Consolidated Mines, Ltd. Either directly or through subsidiary companies, De Beers controls all the major privately owned diamond producers in South Africa; the government-owned workings in Namaqualand are the only major South African source not controlled by De Beers. In addition, through a subsidiary company, The Diamond Corp., Ltd., De Beers contracts periodically to purchase diamonds produced outside South Africa and South-West Africa. De Beers has an agreement whereby all sales of Russian gem diamonds to free world countries are made through De Beers.

The mining companies of the De Beers Group, the Diamond Corp., and the South African Government (for its diamond operations) belong to the Diamond Producers Association, formed in 1934 to regulate the industry. All sales of diamonds by members are put through the Association. For gem diamonds, quotas are assigned each producer. A further quota is allocated to the Diamond Corp. with respect to its purchases of diamonds outside South Africa. Quotas do not apply to sales of industrial diamonds.[33]

In recent years roughly 85 percent of South African production of natural diamond has come from large-scale underground mining of diamondiferous kimberlite pipes, and 15 percent has come from alluvial deposits. The principal pipes mined in 1963 were the Premier

[30] The South African Engineering and Mining Journal. June 7, 1963.
[31] Source cited in footnote 30.
[32] U.S. Embassy, Pretoria. Airgram A–218, Nov. 14, 1962.
[33] H. F. Oppenheimer. The Diamond Industry. Paper pres. to Seventh Commonwealth Min. and Met. Cong., Johannesburg, 1961.

near Pretoria; Wesselton, Bulfontein, and Dutoitspan in Kimberley; and Jagersfontein in the Orange Free State. Alluvial operations center in Namaqualand. For the whole industry it is estimated that of the order of 58 percent of output comprises industrial diamond and 42 percent gem diamond. South Africa also produces synthetic diamond.

Natural diamond production has increased steadily in recent years. Output in 1963 was 45 percent larger than in 1958. Sales in 1963 were valued at R36.6 million, compared with R15.5 million in 1958.

The De Beers Organization in South Africa sorts into parcels for sale the bulk of diamonds produced in all Africa. Sorting of gem diamond is done in Kimberley and of industrial diamond in Johannesburg. Exports of these parcels of raw diamond go principally to the United Kingdom, the United States, Ireland, and Continental Europe. Ultimately the United States is also a principal recipient of them from the United Kingdom and elsewhere. Cut and polished stones, of which South Africa is a significant manufacturer, in 1962 went chiefly to Belgium, Hong Kong, the United States, and the United Kingdom.

The total value of South African diamond exports in 1962 was R131.4 million, the breakdown of the total by source and kind being as follows:

South African origin:	*Millions of Rands*
Rough, uncut	R50.4
Cut and polished	22.8
Synthetic	1.1
Mixed origin, rough, uncut	57.1
Total	131.4

De Beers diamond sales on world markets were R231.9 million in 1963, an increase of R39.4 million over sales in 1962, a new record, and about 80 percent of all diamond sales. Sales of South African diamonds were 19 percent of the total value of De Beers sales in 1962. Early in 1963 De Beers increased the level of diamond prices by 5 percent, the first such general increase since about 1957.

It was expected that the old De Beers mine at Kimberley, closed since 1908, would be reopened in about September 1963 and reach full scale production in 1965.

De Beers announced in May 1963 that it had bought Finsch Diamond (Pty.), Ltd., for R4 million. Finsch has a kimberlite pipe near Postmasburg which De Beers had been exploring for nearly a year.

The West End diamond mine at Postmasburg will be reopened in 1963 at a cost of R200,000. This is a pipe from which largely gem diamonds reportedly were produced.

Early in 1963 De Beers entered into an agreement with S. V. Collins, of "diamonds-from-the-sea" fame whereby De Beers will lend R2 million for the right to market production of Marine Diamond Corp. and for first refusal on any stock in Marine which Mr. Collins wishes to sell.

Production of synthetic diamonds was maintained at planned levels during the year. A factory like that in South Africa is to be built at Shannon, Ireland, to serve the North American and European markets more efficiently.

In his statement of May 1964, accompanying the annual report of De Beers for 1963, Mr. Oppenheimer, De Beers' Chairman stated that on account of the Russian support for the boycotting of trade with South Africa, De Beers' contract to buy Russian diamonds was not renewed.

Phosphate.—For many years South African consumption of raw phosphates for superphosphate manufacture and direct use has increased virtually without interruption. Requirements have been met in part from domestic sources but mostly by imports, principally from Morocco. However, by yearend 1963, it was evident that the Republic would soon be self-sufficient in raw phosphates.

Four companies mine phosphates at present. Of these, State-controlled and operated Fosfaat-Ontginningskorporaise (Edms.), Beperk (Phosphate Development Corp. (Pty.), Ltd., or FOSKOR) is by far the most important. In 1962 FOSKAR contributed more than 50 percent of the 307,000 metric tons of crude phosphates the country produced.

FOSKOR mines the phosphate mineral, apatite, from the mineral complex at Phalaborwa, Transvaal Province, described earlier. Taking into account two distinct types of ore, ore reserves total about 100 million tons.[34]

FOSKOR completed construction of its new plant in April 1963. Annual capacity is about 317,000 metric tons of phosphate concentrate. The capacity of the new plant when added to that of the existing plant, about 166,000 tons annually, will be sufficient to eliminate immediate future needs for phosphate rock imports, which have been approximately 363,000 tons annually.

The report of the Viljoen committee of inquiry into the South African fertilizer industry was tabled in Parliament in July 1962. It foresees single superphosphate consumption of 1 million tons annually by 1965.[35] To meet the need 300,000 tons would be manufactured at two existing plants on the coast near Durban and Cape Town. The remainder would be manufactured by three inland plants of equal capacity: Fissons at Sasolburg, which has been expanded; Modderfontein, near Johannesburg, which was completed in March 1963; and a new plant at Phalaborwa, which would use sulfuric acid that will be available from copper smelting operations to be undertaken nearby (see copper).

Pyrite.—South Africa manufactures large quantities of sulfuric acid principally for use in uranium recovery plants and manufacture of fertilizers, explosives, and chemicals. Annual acid capacity is indicated to approach 900,000 metric tons. The bulk of the sulfur needed comes from domestic pyrite. While imports of elemental sulfur in 1962 were 118,000 tons, much of this was believed to have been used for purposes other than acid manufacture.

Production of pyrite in 1963 was 416,161 metric tons. The great bulk of the tonnage was byproduct pyrite recovered by certain gold mines. Several of these mines also have auxiliary sulfuric acid plants. For 1962, seven gold mines reported profits from pyrite and/or sulfuric acid, in amounts ranging from R107,909 to R714,667.

[34] The Government Printing Office, Pretoria. The Mineral Resources of South Africa. Fourth ed., 1959, p. 622.

[35] This will require roughly 500,000 tons of raw phosphate.

MINERAL FUELS

Coal.—Proved reserves of coal in South Africa total some 25 billion tons. There is in addition of the order of 50 billion tons of known coal which has not been thoroughly investigated. The proved and indicated reserves comprise more than 80 percent of the estimated coal reserve of Africa.

Coalfields.—South African coal is widely distributed geographically. Aside from certain inferior coal, fields occur in Orange Free State Province, Northern Natal Province, and northwards from Natal through Transvaal Province into Central Africa. In order of maturity of the coal, major South African fields are Northern Orange Free State (Vereeniging), Springs-Heidelberg, Ermelo-Breyten, Witbank-Middleburg, and Northern Natal.

In the first two fields are two to three seams with thicknesses in places as much as 60 feet. This is low-rank coal, used chiefly for space heating and by large electric power stations situated at the colliery.

In the Breyten field are three seams but only one is of sufficiently good quality to work, taking into account mining costs and transportation charges to distant markets.

In the Witbank field five major seams occur, but not more than two are usually worked. This is the most important field for quality of coal, reserves, and production. To conserve limited reserves of coking coal, some Witbank coal is used as a blend coal in coke production.

The Natal fields have the most mature coal. They provide the entire supply of coking coal, mostly furnished by two Natal collieries. Anthracite or semianthracite also comes from these fields, this coal resulting from the carbonization of bituminous coal by heat given off from sills of igneous rock which occur near the coal.

Mining.—South African coal is among the cheapest in the world because of relatively low cost labor and because the coal is thick and flat and occurs at shallow depths. Mining is by the room-and-pillar method. At Witbank inclined shafts are used, and the coal is usually brought to the surface by conveyor belt. For the whole industry, output per man-shift is about 3.2 metric tons for hand mining and as much as 10 tons for mechanized mining.

Organization and Facilities of the Industry.—In 1961, 53 collieries were operating. Six of these in the Orange Free State fields were producing annually more than 2 million tons each; one was supplying Sasol, the oil-from-coal plant; others were near large powerplants. In the Transvaal 7 collieries were each producing more than 1 million tons annually; 11 more than a half million tons.

Expansion of the industry was expected to continue in 1964 with the opening of two new anthracite mines in the Paulpietersburg area.[36]

Transvaal and Orange Free State producers belong to an association that distributes output of members, except coal supplied by a member to gold-mining-industry power stations under a special contract, and some coal supplied directly by members to the Electricity Supply Commission and the iron and steel industry. Natal producers have a similar but separate arrangement for bituminous coal and anthracite.

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[36] Mining Journal (London). Mar. 20, 1964.

In part due to the efficiency of the Association 1961 f.o.b. prices per short ton for first grade coal ranged from R4.24 to R4.68, despite long rail hauls to market from most of the fields. At colliery, prices per short ton ranged from R1.22 to R2.00.

Rank of Coal.—South African bituminous coal (volatile content more than 14 percent) customarily is divided into the following three market grades: (1) High grade—6,900 calories per gram or higher. (2) medium grade—more than 6,470 calories per gram and less than 6,900 calories per gram, (3) low grade—from 4,850 calories per gram to 6,470 calories per gram. Anthracite sold, usually has a volatile content less than 11 percent and a calorific value greater than 7,170 calories per gram.

Few of the thick seams now mined are uniform enough to have an average calorific value higher than 6,900 calories per gram. Usually high-grade bottom coal deteriorates to inferior top coal. Such seams are worked selectively. Minimum thickness for economic mining is about 2.7 meters.

Consumption.—The breakdown of domestic consumption of coal is roughly as follows: [37]

Use:	*Percent*
Generation of electricity	39
Industry and domestic	21
Railways	18
Carbonization and gasification	15
Mining	6
Bunkers and exports	1
Total	100

Production.—Coal being the energy base of South Africa, the industry has expanded steadily with the economic growth of the country. Production in 1963 increased 1.25 million metric tons from that of 1962, establishing a new record. The 1963 output was nearly 60 percent larger than 12 years earlier. The value of sales was R65.9 million, compared with R65.1 million in 1962.

Foreign Trade.—The position for expanding coal exports to Europe and elsewhere in competition with U.S. producers is a difficult one. Most of the coal ranks lower than U.S. coal available for export, and the haul from coalfields to ports is somewhat lengthy, roughly 430 kilometers. In addition, the railroads at times have been unable to take all coal available. Exports in 1962 were more than 1.6 million metric tons, nearly 55 percent larger than in 1961.

Petroleum.—Annual consumption of all fuels is about 37 million metric tons of coal equivalent. Petroleum fuels comprise about 10 percent of the total, and gasoline accounts for about 50 percent of all petroleum fuels consumed. Consumption of petroleum products has been increasing at an average annual rate of 5 percent.[38] Substantial refining capacity exists, but the country still depends on imports for crude petroleum, none having been discovered to the present. The Sasoloil-from-coal operation somewhat alleviates the

[37] P. N. Lategan. The Coal Mining Industry of South Africa. Pres. to The Seventh Commonwealth Min. and Met. Cong., Johannesburg. 1961.
[38] South African Mining and Engineering Journal. Jan. 3, 1964, p. 6.

need. In 1960 domestic production of liquid petroleum fuels from imported crude was 8.2 million barrels. Sasol produced 560,000 barrels from coal; more than 85 percent was gasoline.

South African crude oil supplies come from Middle East territories and are shipped via Kuwait, Bahrein, and Abadan. The territories are also the chief source of refinery products imported, except that lubricating oils mostly come from countries of the Western Hemisphere. Imports of crude oil and of refinery products in 1962 were respectively, 12 million barrels, valued at R13.9 million, and 21.5 million barrels, valued at R62.6 million.

The government financed and operated South African Coal, Oil & Gas Corporation, Ltd., (Sasol) was incorporated in 1950. Its Fischer-Tropsch synthesis plant situated on a coalfield 80 kilometers south of Johannesburg is one of the largest such plants in the world, if not the largest. The extractable coal reserve available to the plant is about 300 million tons, sufficient for 50 years or more at any production rate the plant is likely to realize.

Late in 1963 a new US$45 million refinery owned equally by Shell and British Petroleum went on stream at Durban. According to a government publication, the plant will refine to 3 million tons of crude oil a year, saving South Africa an estimated US$10 million annually in foreign exchange. African sources estimate the capacity to be more than 60 percent of existing oil refining capacity, and 15 percent of that of the African continent.[39]

A 12-inch-diameter pipeline for refined products is to be laid from sea level at Durban 708 kilometers to Johannesburg at an elevation of 1,900 meters. The estimated cost and time for completion are R20 million and 3 years.

World Petroleum reported in March 1963 that a group of oil companies would begin large-scale exploration in South Africa. The group, which included French, German, British, and American companies, had obtained prospecting permits for 777,000 square kilometers and planned to spend about US$36.4 million.

It was reported that the Foreign Minister of South Africa urged South Africa to search for oil and to increase synthetic oil production to safeguard against possible oil boycott. He was reported to believe that new synthetic oil plants should be undertaken, because South African resources of low-grade coal and water are nearly inexhaustible.

[39] Africa Report. December 1963, p. 20.

The Mineral Industry of the Territory of South-West Africa

By Thomas C. Denton [1]

IN 1963 the mineral industry of the Territory of South-West Africa continued both to play the dominant role in the overall domestic economy and to contribute significantly to world mineral supply. The industry is the largest contributor to national income and export earnings and a large employer of labor. National income in 1962 was estimated at 181.52 million rands [2] of the Republic of South Africa and mineral sales were R52.13 million,[3] the indicated contribution of mineral industry to national income thus being nearly 29 percent. In 1962 the exports of the Territory were estimated at US$96.7 million, to which minerals contributed 54 percent. This compares with 24 percent and 22 percent, respectively, for fish products and agricultural production, the next most significant contributors. Labor employed by the industry in 1962 comprised 8,734 nonwhites and 2,003 whites.

South-West Africa in 1963 furnished 1 percent or more of free world production of beryl, cadmium, diamonds, germanium, lead, lithium minerals, vanadium, and zinc. For germanium, the Mandate is either the world's largest producer or second largest after the Republic of the Congo (Léopoldville). Other minerals produced in significant quantities included copper, silver, tin, and tungsten. Some 20 additional metals and minerals usually are produced.

The mineral industry of South-West Africa is largely in the hands of the four companies named below, the first two of which in recent years have contributed more than 90 percent of the mineral output by value:

1. The Consolidated Diamond Mines of South-West Africa, Ltd. (CDM). For many years CDM has accounted for virtually the entire diamond production of the Territory. At the end of 1963 De Beers Consolidated Mines, Ltd., owned 97.46 percent of the ordinary (common) shares of CDM.

2. The American-controlled company, Tsumeb Corp., Ltd. Tsumeb accounts for the great bulk of copper, lead, zinc, and silver produced and all of the cadmium and germanium.

3. The South-West Africa Co., Ltd. (SWAC), controlled by The Consolidated Gold Fields of South Africa, Ltd. SWAC is the sole

[1] Africa specialist, Division of International Activities.
[2] U.S. Consulate General, Cape Town, Republic of South Africa. Airgram A-9, July 30, 1963. One rand (R) equals US$1.40.
[3] U.S. Consulate General, Johannesburg. Airgram A-63, Sept. 3, 1963.

producer of vanadium and also produces some lead, zinc, tin, and tungsten.

4. Uis Tin Mining Co. (S.W.A.), Ltd. Uis, owned by the South African Iron & Steel Corp. (ISCOR), is the leading tin producer of the Territory.

The outstanding event in mining in 1963 concerns diamonds. By the end of the year it had been demonstrated that gem diamonds occur in gravels on the sea bottom off the South-West African coast, and results from mining operations conducted to the end of 1963 indicated that important quantities of sea diamonds can be recovered. The question of the extent and profitability of the deposits is extremely important to the Territory.

SOURCE MATERIAL

Major sources for this chapter were dispatches of the U.S. Consulate Generals at Johannesburg and Cape Town in the Republic of South Africa, publications of the South African and South-West African Government, trade journals, company reports, and personal observations.

PRODUCTION

The value of mineral and metal production in 1963 as measured by diamond sales, exports of other minerals, and nominal local mineral sales (mainly salt) was R62.2 million, up R10 million from 1962. Diamonds, of which about 95 percent were produced by CDM, contributed nearly 66 percent of the total, approximately the same as in 1962. The 19-percent increase in value mainly resulted from an increase of 41 percent in the volume of diamonds marketed. The volume of diamonds produced rose by 16 percent. Exports of Tsumeb products contributed about 30 percent of the total, and included 19,118 metric tons of blister copper valued at R8.1 million.

TABLE 1.—Production of metals and minerals[1]

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Beryl, 10–12 percent BeO	154	375	229	144	54
Bismuth concentrates, kilograms	784	475	743	220	7,743
Cadmium, recoverable, in concentrates[2]	204	177	123	109	114
Cesium, pollucite, kilograms	24,494		1,769	508	
Copper:					
Ore	2,406	3,900	4,904	1,452	
Recoverable, in concentrates[2]	29,474	23,585	19,621	23,459	24,510
Blister				1,214	20,778
Germanium:[3]					
In concentrates, kilograms	7,257	19,051	10,523	25,125	
In blister copper, do				96	(4)
Dioxide, do			5,162	14,375	20,348
Gold, troy ounces				183	3
Iron ore					15,029
Lead:					
Ore			100		
In concentrates[2]	66,103	68,700	63,805	71,503	80,174
Refined					567
Manganese ore, about 48 percent Mn	44,853	61,180	45,627		
Molybdenite, kilograms					486
Silver, recoverable, in concentrates, thousand troy ounces	1,857	1,406	1,118	1,301	1,143
Tantalite-columbite concentrates, kilograms	1,882	4,712	2,930	5,244	2,069
Tin:					
Tin concentrates	5	138	148	251	269
Tin-tungsten concentrates, about 37 percent Sn and 16 percent WO_3	4	491	589	584	765
Tungsten scheelite, kilograms	12		6,347	2,052	
Vanadium, in lead vanadate concentrate	652	760	1,039	924	1,029
Zinc:					
Ore			2,136	2,950	
In concentrates[2]	13,093	11,384	11,742	17,040	23,901
Nonmetals:					
Aragonite, kilograms	2,722		181	6,350	
Diamonds, carats	930,659	935,404	905,815	1,027,233	1,194,629
Feldspar			90	472	2,232
Fluorspar	128			218	435
Lime	3,231	3,003	3,403	2,928	2,923
Lithium minerals:					
Amblygonite, 6 to 8 percent LiO_2	220	146	123	128	117
Lepidolite, 3 to 3.6 percent LiO_2	1,967	882	1,286	1,616	78
Petalite, 3 to 4 percent LiO_2	2,528	3,546	2,304	914	785
Marble	105	154	331	1,891	925
Mica	106			68	543
Phosphates, guano	1,207		937	583	1,375
Salt	50,288	72,610	55,599	75,573	64,686
Semiprecious stones:					
Amazonite, kilograms				862	16,375
Amethyst, quartz, do		907	3,020	141,937	61,253
Jasper, do				272	181
Opal quartz, do				91	
Rose quartz, do	3,856			227	227
Topaz, do	9,208				
Tourmaline, do	19	6	33	5	62
Chalcedony, do	304		13,698	3,647	1,016
Sillimanite and kyanite	2,942	1,304	2,722	1,512	
Slate					1,189

[1] Compiled from Minerals, a quarterly information circular of the Department of Mines of the Republic of South Africa, from company annual reports, and Beerman's All Mining Yearbook, 1963.

[2] For years ended June 30.

[3] The accuracy of the germanium figures is questonable.

[4] Data not available.

TRADE

Detailed breakdown of South-West Africa mineral and metal imports cannot be made because since 1955 the foreign trade statistics of the Territory have been incorporated with those of the Republic of South Africa. But mineral export statistics based on data supplied by the Inspector of Mines, Windhoek, are published separately by the Department of Mines of South Africa.

The major import by value presumably has continued to be petroleum fuels, coal, and coke. The Territory has no native sources of energy besides wood. Coal comes from South Africa, mostly by rail as far as 2,900 kilometers. Annual imports range around 275,000 metric tons. The bulk of petroleum products are imported by sea, mainly through Walvis Bay. Cargo landed there in 1961 and 1962 totaled, respectively, 282,503 tons and 256,517 tons; each year approximately 50 percent was identified as bulk oils. In addition, CDM imports petroleum fuels for its extensive operations, the tankers discharging directly into the company pipeline that extends out to sea from the property.

Diamond sales, equivalent to exports, in 1962 were valued at R34.2 million, about R700,000 less than in 1961. Destinations for the diamonds were not reported. However, the usual destination of most of the Territory production is London, the center for distribution of raw diamonds to the cutting industry.

All other mineral exports in 1962 were valued at R18.2 million, approximately R576,000 higher than in 1961. More than 88 percent of the total represented Tsumeb products, including concentrates of copper, lead and zinc with accessory silver, germanium and cadmium, germanium dioxide and blister copper. The germanium dioxide export was valued at R1.3 million. The blister copper was the first such export from South-West Africa. Lead vanadate concentrate and tin-tungsten concentrate produced by SWAC contributed, respectively, about R626,000 and R307,000. Tin concentrates from Uis were worth about R167,000. Exports of lithium minerals and salt were valued at R63,876 and R147,066, respectively.

By volume nearly 47 percent of the Tsumeb concentrates in 1962 went to the United States, 44 percent went to Belgium, and nearly 8 percent went to Japan. West Germany took 75 percent of lead vanadate exports, and the Netherlands and Belgium took the remainder. Germanium dioxide went to the United States and Belgium.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Beryl	93	117	United States 116; United Kingdom 1.
Bismuth concentrates kilograms	-------	352	All to the Netherlands.
Cadmium, contained in concentrates	793	552	Belgium 256; United States 256; Japan 28.
Cesium, pollucite kilograms	179	508	All to the Netherlands.
Copper:			
Ore	4,610	1,463	Japan 1,311; Belgium 125; Sweden 30.
Contained in concentrates	23,966	22,290	United States 7,412; Japan 6,568; Belgium 6,206.
Blister	-------	719	(1).
Germanium:			
Contained in blister copper kilograms	-------	961	All to West Germany.
Contained in concentrates do	523	25,125	Belgium 19,519; United States 5,606.
Dioxide do	5,162	14,375	United States 8,001; Belgium 6,374.
Lead:			
Lead vanadium concentrates	8,430	7,716	West Germany 6,321; Netherlands 900; Belgium 495.
Contained in concentrates	58,306	70,224	United States 7,980 Belgium, 7,350.
Manganese ore	59,223	1,480	All to Norway.
Silver, contained thousand troy ounces in concentrates.	1,833	1,253	United States 417; Belgium 401; Japan 302.
Tantalite/columbite kilograms	1,613	4,491	All to United States.
Tin concentrates	179	155	All to Republic of South Africa.
Tin/tungsten concentrates	366	539	Netherlands 377; West Germany 162.
Tungsten ore, scheelite	-------	3	All to Republic of South Africa.
Zinc:			
Ores	2,062	2,950	All to United Kingdom.
Concentrates	2,402	15,909	United Kingdom 7,181; West Germany 5,240; Netherlands 1,820.
Contained in concentrates	21,012	19,850	United States 9,620; Belgium 9,319; Japan 753.
Nonmetals:			
Diamonds:			
Gem carats	787,949	800,498	(1).
Industrial do	119,597	142,690	(1).
Total do	907,546	943,188	(1).
Feldspar	90	477	West Germany 460; Netherlands 17.
Fluorspar	-------	93	Republic of South Africa 91; Japan 1; United States 1.
Lithium minerals:			
Ambligonite	69	132	All to West Germany.
Lepidolite	836	1,339	Japan 1,137; West Germany 134; Netherlands 68.
Petalite	2,138	315	Netherlands 211; United Kingdom 104.
Lime-aragonite	(2)	4	Japan 3; China (not further identified) 1.
Phosphates, guano	-------	240	All to Republic of South Africa.
Salt	40,931	39,478	Republic of South Africa 38,118; Rhodesia 1,129; Republic of the Congo (Léopoldville) 231.
Semiprecious stones:			
Amethyst quartz kilograms	298	4,336	United States 1,823; Republic of South Africa 1,361; West Germany 581.
Amazonite do	-------	862	All to the Netherlands.
Rose quartz do	445	-------	
Tourmaline do	5	-------	
Cat's-eye do	4,300	1,361	All to West Germany.
Chalcedony do	1,179	2,150	All to the Netherlands.
Sillimanite-kyanite	2,758	1,975	Republic of South Africa 1,512; United States 463.

[1] Data not available.
[2] Less than ½ ton.

Source: Republic of South Africa, Department of Mines—Quarterly Information Circular. MINERALS.

COMMODITY REVIEW

METALS

Copper, Lead, Vanadium, Zinc, and Associated Metals.—*Tsumeb Corp.*—The company operated two mines: Tsumeb, about 535 kilometers by rail northeast of the port, Walvis Bay; and Kombat, about 65 kilo-

meters south of Tsumeb. Production from Kombat began only in 1962, whereas Tsumeb has been operating for many years. Tsumeb mine has accounted for the entire output of germanium, zinc, and cadmium by the corporation, and the great bulk of lead, copper, and silver. Based on the gross value of metals contained in a ton of ore hoisted, Tsumeb mine is perhaps the righest large base metal mine operating today. From Kombat, moderate grade or containing copper, lead, and silver is produced.

TABLE 3.—Production of Tsumeb Corp., Ltd.[1]

(Metric tons unless otherwise specified)

	Quantity					Metal content, 1963			
	1959	1960	1961	1962	1963	Copper, percent	Lead, percent	Zinc, percent	Other reported
Mine output:									
Tsumeb mine:									
Sulfide ore	338,349	281,416	283,004	294,773	297,870	3.10	14.26	5.14	
Oxide ore	229,123	275,778	308,423	353,745	299,686	4.90	14.24	3.34	
Total	567,472	557,194	591,436	648,518	597,556	4.00	14.25	4.24	
Kombat mine: Sulfide ore	--------	--------	--------	[2] 19,591	182,968	3.79	2.59	------	
Grand total	567,472	557,194	591,436	668,109	780,524	------	------	------	
Mill output: [3]									
Tsumeb mill:									
Copper-lead concentrate	157,609	160,205	128,880	128,079	137,700	7.99	52.88	------	4.61 troy ounces of silver per short ton.
Copper concentrate	19,502	14,189	14,395	20,426	24,849	37.33	8.52	------	9.40 troy ounces of silver per short ton.
Zinc concentrate	27,292	23,350	23,438	20,539	19,693	------	------	58.07	1.56 percent cadmium.
Total	204,403	197,744	166,713	169,044	182,242	------	------	------	
Kombat mill: [2]									
Copper concentrate	--------	--------	--------	[2] 476	16,940	36.40	2.47	------	7.09 ounces of silver per short ton.
Lead concentrate	--------	--------	--------	[2] 493	6,727	7.66	61.96	------	1.72 ounces of silver per short ton.
Total	--------	--------	--------	969	23,667	------	------	------	
Grand total	204,403	197,744	166,713	170,013	205,909	------	------	------	
Recoverable metal content of concentrates produced: [3]									
Lead	63,357	65,588	59,519	65,222	72,227	------	------	------	
Copper	29,475	23,585	19,621	23,459	24,510	------	------	------	
Zinc	13,093	11,294	10,563	9,551	9,507	------	------	------	
Cadmium—kilograms	204,492	177,241	122,911	109,020	114,495	------	------	------	
Silver thousand troy ounces	1,857	1,406	1,118	1,301	1,143	------	------	------	
Smelter production: Blister copper	--------	--------	--------	--------	11,448	98.78	------	------	

[1] Compiled from annual reports of Tsumeb Corp., Ltd. Years listed are fiscal years from July 1 to June 30.
[2] Began operations during last quarter of fiscal year 1961–62.
[3] Beside metals listed, a large quantity of germanium is produced both as dioxide and in concentrates.

Until recently the ultimate products of the corporation were concentrates which were shipped to overseas custom smelters and, beginning about 1961, some germanium dioxide. In November 1959 the Tsumeb Board of Directors authorized construction of a copper smelter at Tsumeb and in July 1960 a lead smelter and refinery, also at Tsumeb. The copper smelter was blown in on November 1, 1962, and the lead smelter by the end of 1963. Annual capacities of the new installations are 32,650 metric tons of blister copper and 81,650 tons of refined lead. About 180,000 kilograms of high-purity cadmium metal and 4,100 tons of sulfuric acid will also be produced. In addition the corporation expects to produce annually 1 million ounces of silver, 3,600 tons of arsenic trioxide, and germanium in forms more refined than in the past. Germanium production was expected to reach 15,000 kilograms annually. The ultimate effect of these projects is that exports of concentrates by Tsumeb will be virtually limited to some 10,900 to 13,600 tons of zinc concentrates annually.

The new smelters and ancillary facilities reportedly will have cost US$22.5 million.[4] About 78 percent of the material and 100 percent of the labor used were of South-West African and South African origin.[5]

The following details regarding corporation operations are for the year ended June 30, 1963. Net profit was R5.8 million, which compares with R8.5 million in the previous year. Metal sales were R22.8 million, compared with R24.6 million in 1961–1962. Provision of South-West Africa income tax was R14,930, which was small because heavy capital expenditures were incurred and under South-West African tax laws, capital expenditures are chargeable against taxable income in the year incurred.

In the Tsumeb mill overall recoveries in the various concentrates produced were 91.26 percent for copper, 95.45 percent for lead, and 45.18 percent for zinc in combined zinc concentrates. Milling rate was increased in February from 50,000 to 60,000 short tons per month.

In the Kombat mill overall recoveries were 96.46 percent for copper and 96.67 percent for lead. Metallurgical testing of mixed oxides and sulfides indicated that the slightly oxidized ores of the West ore body could be milled satisfactorily.

After minor modifications and mechanical adjustments, the copper smelter operated satisfactorily. It treated 38,910 metric tons of concentrates and other new metal-bearing material averaging 32.78 percent copper. Production of blister copper was 11,448 tons, averaging 98.78 percent copper and 1,245.6 grams of silver per ton.

In the arsenic plant, two roasters and other installations were completed, and experimental roasting of reverberatory furnace and germanium plant baghouse products was started. Progress was made in obtaining satisfactory arsenic elimination and production of calcined residues suitable for smelting and in production of high-grade arsenic trioxide for sale.

The sulfuric acid plant operated on imported sulfur, producing 3,035 metric tons of acid. The acid was used in the germanium plant. Construction of the gas cleaning plant continued. When it is completed,

[4] Mining Journal (London). Mar. 27, 1964, p. 239.
[5] Barclays Bank. Overseas Review. April 1964, p. 20.

sulfur dioxide gas will be delivered from the sinter machine to the acid plant.

The enlarged germanium roast, leach, precipitation plant operated at full capacity throughout the year. Construction of a plant for recovery of cadmium from lead smelter fumes was started.

From the surface 17,198 feet of diamond drilling was done further to explore the Tsumeb, Gross Otavi, Harasib, and Tsumeb West claims. At Gross Otavi two holes encountered encouraging copper-lead mineralization.

As of June 30, 1963 ore reserves were estimated as follows:

	Quantity, metric tons	Grade, percent			Total metal
		Copper	Lead	Zinc	
Positive ore:					
Tsumeb mine, above 30 level	6,198,233	4.87	13.20	3.85	21.92
Kombat mine	1,292,600	3.22	1.70	----	4.90
Probable ore:					
Tsumeb mine, 30-34 level	2,700,000	4.56	12.49	3.73	20.78
Kombat mine	2,010,543	2.39	3.35	----	5.74

Other Operations.—*The South-West Africa Co., Ltd. (SWAC).*—The company continued to operate the Berg Aukas lead-lead vanadate-zinc mine. In the year ended June 30, 1963, the expanded treatment plant operated throughout the year. As a result, the quantity of ore mined rose by 12,891 metric tons to 75,056 tons. Although production of lead vanadate concentrates was at a lower rate than in the previous year because of unfavorable market conditions, output of lead-zinc concentrates at 28,788 tons was 13,846 tons higher. Encouraging development results on the 510 level continued. The work together with underground diamond drilling increased total ore reserves to about 910,000 tons. Particularly encouraging was the increase of almost 50,000 tons in assured reserves of vanadate ore. At the end of the year it had become necessary to begin deepening the vertical shaft below the 500-foot level, then the deepest working in the mine.

Tin and Tungsten.—At the Brandenberg West mine of South-West Africa Co., Ltd., tonnages of tin-tungsten ore mined and milled during the year ended June 30, 1963, increased, with respect to those of the previous year, and output of tin-tungsten concentrates rose by about 26 percent to 717 metric tons. After providing for depreciation, the mine operated at a small loss during the year, due to low prices prevailing for wolframite and an average price for tin lower than in the preceding year.

Uis Tin Mining Co. (S.W.A.) Ltd., South-West Africa's other significant tin producer, was purchased by South African Iron & Steel Corp. (ISCOR) from private interests in 1960 to provide tin for ISCOR's growing tin plating operations. Low-grade tin deposits are in and around Uis near the Brandberg Mountains; ore reserves in 1962 were estimated at about 17.9 million long tons containing about 0.13 percent tin, according to the Inspector of Mines of South-West Africa. The ore is mined in quarries.

In 1963 Uis had in progress a R2-million-expansion scheme to increase production of tin-in-concentrates from 13 to 71 long tons a month, which would meet the needs of ISCOR indefinitely. Milling

capacity would be 58,000 tons of ore per month, including 13,400 tons of present capacity.

NONMETALS

Diamonds.—South-West African diamonds are sold in accordance with delivery agreements with the Diamond Producers Association, under control of the Administrator of South-West Africa, advised by the Diamond Board of the Territory.[6] The diamonds are principally gem diamond, the ratio of gem diamond to industrial diamond for the bulk of output being better than 9:1. This is by far the highest proportion of gems to industrials in any significant diamond field. The gem stones include stones considered to be the most beautiful in the world and in greatest demand.[7]

Until recently, production was almost entirely from gravels of ancient raised sea beaches that run parallel to the coast for miles and lie inland a few thousand feet from the present shoreline. Late in 1961, it was demonstrated that gravels containing principally gem diamond also occur on the sea bottom offshore. By the end of 1963 it had been proved that large quantities of these sea diamonds could be recovered. This unique development was due to the ingenuity and technical skill of S. V. Collins, a U.S. citizen.

In recent years diamond production of the Mandate has increased virtually without interruption. Output in 1963 was 1,194,629 carats, compared with 930,659 carats in 1959. In 1963 The Consolidated Diamond Mines of South-West Africa, Ltd. (CDM) contributed 1,138,050 carats, the small remainder presumably having come from sea operations. Sales in 1963 were as follows:

		Value rands	
	Carats	*Total*	*Average per carat*
Gem diamond	1,181,293	R39,585,949	R33.51
Industrial diamond	148,352	1,410,813	9.51

CDM.—Operations continued through 1963 in the various mining areas of the CDM diamond concession area along the coast north of the mouth of the Orange River. Steps were being taken to increase production. The output in 1963 was 131,141 carats more than in 1962. To achieve the 1963 figure, mining grade had to be increased from 0.35 carats to 0.37 carats per cubic meter. Additional field-screening plants will begin to operate during 1964, and grade will gradually return to normal. In millions of rands, financial results in 1963 were:

	Value million rands
Diamond account	R41.5
Interest, etc	6.8
	R48.3
Deduct mining and other expenses	8.6
Profit for the year	R39.7

The profit compares with R31.6 million in 1962.

[6] Moyer, A., and E. Buxant. The Diamond Industry in 1960–61, p. 25, 1961 VLAAMS Economisch Verbund, Antwerp, Holland.
[7] Page 22 of work cited in footnote 6.

At the end of 1962, gravel reserves were 74.7 million cubic meters estimated to contain 23.3 million carats of diamonds.

Diamonds From the Sea.—The following information regarding production of diamonds from the seabed off the coast of South-West Africa from the beginning of the operation to January 31, 1964, is based on a statement made by S. V. Collins.

In October 1961 the seagoing tug, *Emerson K*, was equipped as a prospecting vessel with machinery to process diamond-bearing gravels. On November 15, 1961, the first diamonds were discovered in Wolf Bay, south of Luderitz; on December 9, 1961, the *Emerson K* returned to Cape Town with 45 gem diamonds weighing 8.96 carats. By the end of March 1962 the *Emerson K* had sampled on a regional scale along the coastline from the mouth of the Olifants River (South Africa) to Luderitz, more than 600 kilometers, recovering more diamonds. The vessel continued to prospect with success.

A floating mining unit called Barge *77* was built, and active mining operations with it began in August 1962 in the Chameis area. On July 1, 1963, Barge *77* was driven ashore by abnormal gales. Barge *111* was built to replace it and began production 80 days after the loss of barge *77*. Barges *77* and *111* were not self-propelled. On January 8, 1964, a self-propelled unit, *Diamantkus*—purchased in the United States—began operations.

Production of these units from the beginning of the project through January 31, 1964, is given in detail below to the nearest carat:

Equipment and operating period:	Quantity Carats
Emerson K, prospecting:	
Oct. 16, 1961, to June 30, 1962	52
July 1, 1962, to June 30, 1963	90
July 1, 1963, to Jan. 31, 1964	21
Total	163
Barge *77*:	
June 16, 1962, to June 30, 1962	9
July 1, 1962, to June 30, 1963	51,917
Total	51,926
Barge *111*:	
Sept. 18, 1963, to Sept. 30, 1963	1,668
October 1963	7,006
November 1963	6,142
December 1963	5,537
January 1964	8,589
Total	28,942
Diamantkus: Jan. 8, 1964 to Jan. 31, 1964	7,987
Grand total	89,018

Gross proceeds from the sale of 73,563 carats was R1,681,509, representing an average value per carat of nearly R23.

The companies first to become interested in the sea diamonds were the holding company, Sea Diamond Corp., Ltd. (SDC), and the operating company, Marine Diamond Corp. (MDC). Late in 1963, at the christening of *Diamantkus*, the Administrator of South-West Africa announced that the ocean-bed diamond mining rights of MDC

had been extended seaward 3 miles, which increased the size of the concession about eight times. The venture already has cost about R6 million, and another R10 million may be spent on it in the near future.[8]

In October 1963 and earlier, De Beers and associated diamond companies concluded various agreements with S. V. Collins, MDC, and other sea-diamond companies. The agreements put De Beers in a position to acquire substantial interest in sea-diamond operations. Considerations, by De Beers for the position include a loan of R2 million and an agreement to survey and prospect 640 kilometers of coastline. In addition, the Diamond Corp. (De Beers) entered into an exclusive contract to purchase the production of MDC until the end of 1965. The survey and prospecting will be directed by a South African subsidiary of the American company, Ocean Science & Engineering Corp., which will use a specially equipped vessel, the *Rockeater*, expected to reach Cape Town in March 1964.

In his statement accompanying the report of De Beers for 1963, H. F. Oppenheimer, Chairman, said that production from MDC area was on "a considerable scale, and prospects look favorable." But it was still too early to assess long-term prospects.

MINERAL FUELS

Coal.—The Geological Survey of South Africa in drilling for water has found indications of coal at Kanorlei. Usable coal had been found earlier in that general area but at considerable depth.[9]

Late in 1963 the London & Rhodesian Mining & Land Co. offered to build a R40 million pipeline to carry coal to South-West Africa from the Wankie field in southern Rhodesia. A suggested route for the pipeline is from Wankie to Tsumeb and eventually to the coast. Southern Rhodesian coal would then be available for export both from the Atlantic coast and Indian Ocean ports. It was reported that such a pipeline would not pay unless utilized to deliver 2 to 3 million tons of coal per year. The present annual coal consumption of the Territory is approximately 300,000 tons.[10]

Petroleum.—The South African Government encouraged petroleum exploration in 1963, both in the country and in the Territory. In the latter, companies and individuals holding concessions included: Etosha Petroleum Co. (subsidiary of Texas Eastern Transmission); Diamond Dredging Co.; Trans-American Mining Corp., Suidwes-Africa Prospekteerders; Consolidated Diamond Mines; Artnell (Chicago); Veedol Minerals (Tidewater Oil-Getty interests).[11]

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[8] South African Mining and Engineering Journal. Nov. 1, 1963, p. 1199.
[9] U.S. Consulate General, Johannesburg, South Africa. Airgram A–63, Sept. 3, 1962.
[10] U.S. Consulate General, Cape Town, South Africa. Airgram A–79, Nov. 12, 1963.
[11] Financial Mail. Johannesburg, Feb. 14, 1964. Enclosure to U.S. Consulate General, Johannesburg. Airgram A–225, Feb. 27, 1964.

The Mineral Industry of the Republic of the Sudan

By Thomas G. Murdock [1]

THE SUDAN is Africa's largest country (374,000 square kilometers). Efforts have been made over a 50-year period to discover major ore deposits; however, the mining industry is practically nonexistent. In 1963, as in previous years, the activity consisted essentially of the small-scale exploitation of a few ancient gold mines and of production of marine salt and gypsum along the Red Sea coast near Port Sudan. Since 1949 cement has been manufactured in the country and since 1958 there has been small, intermittent production of several other minerals; however, the low grade of the deposits and high mining and transportation costs have made their exploitation unattractive. The most significant event of 1963 was the beginning of construction of a plant to refine imported crude petroleum. Copper deposits explored in recent years remained undeveloped, and petroleum exploration has been unsuccessful to date.

With the steady economic development in the Sudan since independence on January 1, 1956, the gross national product (GNP) had risen to Sd£436 million (US$1,260 million) [2] in 1962. Mineral production in that year was estimated to be worth only Sd£1,027,393, about 0.2 percent of the GNP.

GOVERNMENT POLICIES AND PROGRAMS

No significant mining or petroleum legislation was enacted during 1963, and the policy expressed in the Approved Enterprises Act No. 8 of 1956, which encourages private enterprise, has been continued. In the 1963 organization of the petroleum-refining company, the Government has an option to buy 50 percent of the shares. The general program of the 10-year plan was continued with satisfactory progress during the year and improvements in transportation, which hold a high priority in the plan, benefited the mining industry. Work continued at a satisfactory rate on the Roseires Dam in the eastern Sudan and provided a local market for cement, well above domestic production. This facility is scheduled for completion in 1967, and industrial development in the area is expected to create a growing market for

[1] Mining engineer, Division of International Activities.
[2] The monetary unit is the Sudanese pound (Sd£). Sd£1=US$2.89, or US$1=Sd£0.3460, is the exchange used in this chapter.

mineral raw materials. The Sudan Geological Survey Department continued its program of mineral resource investigation, particularly in the Qala en Nahal area and in the vicinity of the Roseires Dam.

SOURCE MATERIAL

Data on mineral production and activity are meager; reported production figures are usually official estimates, supplied to the U.S. Embassy by the Geological Survey Department. Data on trade are complete and reliable. Background information used came mainly from reports of a U.S. consulting firm prepared for the Agency for International Development (AID) and supplemented by published reports of the Sudan Geological Survey Department.

PRODUCTION

Except for chromite production, reported for the first time, there were no significant changes in production in 1963. Small quantities of clay, sand and gravel, building stone, and quartz were produced and utilized locally, however, no statistics on these were systematically collected.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Chromite					[1] 20,000
Gold, troy ounces	1,419	2,116	1,226	[2] 1,500	[2] 900
Iron ore, thousand tons		3		20	
Manganese ore	364				
Nonmetals:					
Cement [3], thousand tons	100	121	83	85	104
Gypsum	[2] 1,700		5,500	[2] 1,700	4,520
Mica	400				
Salt, thousand tons	54	54	53	69	37
Vermiculite	[2] 120		50	[2] 50	
Wollastonite		20			

[1] Part of this output may have been for previous years.
[2] Estimate.
[3] Exclusive of imported clinker ground locally as follows: 1959, 27,500 tons; 1960, 32,485 tons; 1961, 22,609 tons; 1962 and 1963, none.

TRADE

In 1962 the Sudan imported mineral and metal commodities valued at Sd£12.6 million (Sd£8.9 million in 1961). These comprised 14 percent of all imports (11 percent in 1961). By major categories the 1962 imports were fuels, Sd£6.1 million; metals, Sd£5.3 million; and nonmetals, Sd£1.2 million. These came from 45 countries; however, an aggregate of 57 percent came from Iran (31 percent), the United Kingdom (15 percent), and Belgium (11 percent). The European Economic Community as a whole supplied 27 percent and the Sino-Soviet bloc, 10 percent. Mineral imports from the United States amounted to only Sd£154,022 (1.2 percent of those from all sources) and consisted mainly of lubricating oils and rolled steel products.

These commodities comprised only 3 percent of all imports from the United States.

Exports of locally produced minerals, mostly to neighboring countries, were valued at only Sd£21,220 (Sd£37,870 in 1961), an insignificant part of the country's total exports, valued at Sd£75 million in 1962. Exports of nonindigenous mineral, metal, and fuel commodities were valued at Sd£572,512, including some fabricated metals which are not identified separately. Of this total, Sd£470,059 was for aviation bunkers. The foregoing commodities comprised 12 percent of all reexports.

TABLE 2.—Exports of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Iron ore	--	2,000	All to Yugoslavia.
Ferrous scrap	4,900	--	
Gold, troy ounces	113	419	All to United Kingdom.
Nonmetals:			
Cement	129	--	
Lime	20	--	
Salt	938	525	Ethiopia 199; Chad 177; Congo 133.

[1] Reexports of unstated quantities valued at Sd£776,245 in 1961 and Sd£572,512 in 1962 are reported. Bunker aviation fuels are included in totals, and values of these were 78 percent of total in 1961 and 82 percent in 1962.

Source: Sudan Department of Statistics. Annual Foreign Trade Report, 1962.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum [1]	188	467	United Kingdom 403; West Germany 34; India 20.
Copper [1]	228	598	United Kingdom 195; France 141; West Germany 126.
Gold, troy ounces	666	313	All from United Kingdom.
Iron and steel:			
Iron ore	9	4	All from Nigeria.
Pig iron	5	117	All from United Kingdom.
Ferrous scrap	19	4	All from Chad.
Crude [2]	18,206	49,843	Belgium 19,605; U.S.S.R. 13,367; Italy 5,695; West Germany 4,077.
Rolled products	25,471	58,401	Belgium 19,872; United Kingdom 17,825; Australia 6,841; West Germany 4,107.
Lead [1]	129	58	United Kingdom 57; Belgium 1.
Tin [1], long tons	34	35	United Kingdom 25; Malaya 10.
Zinc [1]	138	96	West Germany 51; Poland 20; Netherlands 8.
Other [1]	11	--	
Nonmetals:			
Cement	[3] 94,562	209,836	Poland 50,072; Italy 40,694; United Arab Republic (Egypt) 33,803; U.S.S.R. 24,691.
Chalk	97	116	Greece 58; Denmark 20; United Kingdom 14.
Clay	2,008	50	All from United Kingdom.
Graphite	28	25	Cyprus 15; United Kingdom 10.
Gypsum	197	204	All from Cyprus.
Lime	156	371	Netherlands 150; West Germany 149; United Arab Republic (Egypt) 35.
Salt	54	78	All from United Kingdom.
Stone, precious and semi-precious, kilograms	8,002	10,707	Hong Kong 3,553; Japan 3,182; India 1,364.
Sulfur	9	61	Netherlands 50; West Germany 11.
Other	2,000	--	

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Mineral fuels:			
Coal	16,001	8,394	All from Poland.
Coke	424	1,501	All from West Germany.
Petroleum, refined products:			
Gasoline	88,288	84,390	Iran 60,164; Persian Gulf Shiekdoms 10,516; Aden 7,076.
Kerosine	52,513	62,494	Iran 35,359; Aden 10,993; Persian Gulf Shiekdoms 9,119.
Distillate fuel oil	122,804	142,374	Iran 113,412; Persian Gulf Shiekdoms 14,385; Aden 9,272.
Residual fuel oil	179,234	207,070	Iran 181,807; Aden 14,702; Persian Gulf Shiekdoms 10,561.
Lubricants	11,521	12,311	United Kingdom 6,315; Netherlands 3,300; United States 1,500.
Liquefied petroleum gas	415	613	Aden 497; Italy 116.
Asphalt and bitumen	6,908	8,769	Iran 5,293; Persian Gulf Shiekdoms 2,499; United Arab Republic (Egypt) 574.
Other	27	60	Indonesia 33; United Kingdom 13; West Germany 13.
Tar [4]	31	120	All from United Kingdom.
Tar oil [4]	2,204	74	United Kingdom 50.

[1] Identified as unwrought or wrought but excludes manufactures.
[2] Identified only as crude. Believed to include some rolled products as well as ingots, blooms, billets, etc.
[3] Includes 22,609 tons of clinker (22,430 from United Arab Republic and 179 from West Germany).
[4] Believed to be coal byproducts.

Source: Sudan Department of Statistics. Annual Foreign Trade Report, 1962.

COMMODITY REVIEW

METALS

Chromite.—The Mining & Trading Co., Khartoum, began exploitation of chromite deposits in the Ingessana Hills region near Bau, about 80 kilometers southwest of Roseires, within a concession granted in 1961. A few hundred tons of ore was shipped to France, about 8,000 tons was reportedly stockpiled in Port Sudan, and an additional 10,000 tons was stockpiled at the mine. The ore is trucked to Roseires, from which it is moved by rail to Port Sudan. Reportedly the company has had difficulty in selling the ore because of competition from other producing countries. According to a Sudanese official publication,[3] in spite of the limited number of exploitable deposits, the outlook is encouraging for a substantial production from the area. No data on average grade of ore produced are available; however, the chromite recorded in the Ingessana Hills contains up to 57.45 percent Cr_2O_3. The 1963 production came entirely from surface exposures, but prospects for continuity at depth were considered promising. Estimates were that 50,000 to 60,000 tons per year could be produced if markets open up.

Copper.—During 1963 African Mining Co., of New York, a U.S. registered firm controlled by an Italian financier, continued efforts to obtain financing to open up the Sudan's only known copper deposit, the Hofrat en Nahas in Southern Darfur Province, 320 kilometers from El Da'en, the nearest point on the existing railway. African Mining has held a concession for the deposit since 1962 following exploration

[3] Kabesh, M. L. The Geology and Economic Minerals and Rocks of the Ingessana Hills. Sudan Geol. Surv. Dept. Bull. 11, September 1961, 61 pp.

of the area by the Sudan Geological Survey Department and subsequent calling for international tenders. This exploration proved about 10 million tons of ore containing 2.78 percent copper. Old dump material contained 0.3 ounce of gold per ton, gold content of the copper ore was not determined. The remoteness of the area has discouraged development; reportedly a leading U.S. mining organization was interested in participating in the venture but would have to wait several years. More recent negotiations were with West Germans interests. In August a Sudanese Government official announced that production might be expected by 1965.

Gold.—In 1963 the Sudan's gold production came mainly from the Doishot mine in Northern Province and the Bir Kaneib and Gebeit in Kassalla. The latter, approximately 240 kilometers from Port Sudan and probably one of the oldest active gold mines in the world, was exploited by local inhabitants and produced 3 to 5 tons of ore per day from old workings in pillars above the 20-meter level. The ore was treated in a small stamp mill and the amalgam was retorted on the property; recovery averaged about 1 ounce per day of very fine gold. Additional gold associated with pyrite in the vein was not recovered in the absence of cyanidization facilities.

High production costs, even with the primitive mining methods used, and the exhaustion of easily accessible and high-grade ore in the few mines being worked are the causes of output reductions in recent years. The major market for Sudanese gold is the jewelry trade in Omdurman, across the Nile from Khartoum, where premium prices obtained, up to $55 per ounce and averaging $50.18 in 1962 constituted a virtual subsidy of operations.

Iron Ore.—Preliminary results of the exploration of iron ore deposits in the Sufaya region, 78 kilometers inland from Marsa Delwein on the Red Sea, became available in 1963. The exploration was carried out by the Yugoslav firm ELECTROSOND, of Zagreb. Within the areas explored, only the Ankura and Aderauib deposits have possible importance and the reserves of these are insignificant by world standards, totaling only about 11 million tons for all categories and having an average tenor of 47 percent iron. The low grade and volume and the distance to tidewater discourage development. The 20,000 tons produced in 1962 contained 60 percent iron, and trial shipments were made to JUGOMETAL in Yugoslavia.

No activity was reported for 1963 at the Fodikwan deposits of Central Desert Mining Co. of Port Sudan, 19 kilometers from the harbor of Marob. The limited reserve and low grade, revealed by the exploration that resulted in the small production of 1960, made development unattractive. Although a new railway extension from El Obeid to Wau passes close to El Fula, 110 kilometers south of En Nahud in Kordofan Province in western Sudan, where exploration revealed a reserve of 35 million tons, 1963 saw no renewal of the interest in the deposits.

Manganese Ore.—During 1963 Sudanese manganese producers were endeavoring to market accumulated stocks at their mines, and some exploration and a limited production may have been effected early in the year. The country's major deposits are in Kassalla Province, and the most recent recorded activity was at the Gebeit mine of National

Mining Co. and the Al Amar mine of Sayed Abdel Monim Samkart, situated, respectively, 85 kilometers north of the railroad town of Gebeit and 280 kilometers north of Port Sudan. While ore from these mines reportedly contains over 50 percent manganese, high costs of production and transportation to Port Sudan have discouraged exploitation.

Steel.—In March Compagnie Continentale des Produits, of Paris, won an international tender for supplying 25,000 tons of new rails to replace the lighter ones on the Khartoum-Atbara-Port Sudan line of the country's railroad system at the rate of 200 kilometers per year. The steel cost £33 (sterling) per metric ton, f.o.b. French ports.

NONMETALS

Asbestos.—In 1963 the Sudan Geological Survey Department continued its extensive exploration of deposits of chrysotile asbestos in the vicinity of Qala En Nahl in southeast Kassala Province, about 800 kilometers by rail from Port Sudan. The deposits could be mined by open-pit methods. Although official reserve figures have not been announced, there appears to be several hundred thousand tons of asbestos ore in the area which would yield a fiber recovery of at least 5 percent. A substantial portion of the fiber is of the short variety, but much spinning grade is obtainable. Several foreign asbestos consumers have shown interest in the deposits.

Cement.—During 1963 the extension (from 61,000 to 152,400 tons) of the Atbara plant of Sudan Portland Cement Co. was completed. The Nile Cement Co. continued construction of the country's second plant at Kosti, a locality better situated with respect to construction projects underway and proposed. The Kosti plant was expected to cost Sd£2.15 million, and capital for the venture was raised in part by public subscription.

MINERAL FUELS

Petroleum.—Following the November 1962 formation of Shell and BP (Sudan), Ltd., a joint venture in which the Royal Dutch Shell group and British Petroleum Co. are participating equally, the construction of a 1-million-ton-per-year refinery at Port Sudan was assured. In early 1963 the erection contract was awarded to the Dutch firm of Werkspoor, N.V., and actual construction began in August. Scheduled for completion in September 1965, this facility will refine imported crude and process domestic crude (should it be found, of suitable quality, in the Sudan), producing gasoline, jet aviation fuel, distillate, and residual fuel oil. Selected Middle East crude oil will be imported using large tankers. To provide qualified Sudanese personnel for the refinery, a training center was established at Port Sudan in January; other potential employees were sent abroad for training in operating refineries.

AGIP Mineraria (SUDAN), Ltd., continued its exploration program, which has been carried out since 1961, in its permits along the Red Sea coast and offshore, without success. Durwara 2 well, 2,949 meters deep, was completed during the year, and additional drilling

followed, probably at the Tokara 1 well. In October AGIP renewed its prospecting rights for 2 years at a reported price of Sd£20,000. Equipment in the Port Sudan area was dismantled and shipped out of the country but another type was to be brought in if further drilling was done.

In May, the Shell organization was awarded a contract to supply all petroleum requirements of the Sudanese Government for 3 years beginning July 1. The contract was valued at Sd£5 million. This company has always won this contract, probably because it is the only marketing organization with storage facilities in the southern provinces.

The Mineral Industry of Togo

By Thomas G. Murdock[1]

THE Republic of Togo, a former United Nations Trust Territory under French administration until it became independent on April 27, 1960, only entered the ranks of recorded mineral producers in 1961, with its first output of phosphate rock. Subsequent growth in production of this mineral gave Togo fifth place among African producers in 1963, replacing Algeria, with 1.1 percent of world total. Considering the high quality of the Togolese rock, this contribution was still more significant. With a population of 1.6 million, an area of only about 57,000 square kilometers, its limited industrialization, and essentially dependent upon agriculture, Togo continued to have only limited need for metal and mineral imports. However, in 1963 the value of these was 26 percent above that of 1962 and still higher than the value of phosphate rock exports; the latter became an important earner of foreign exchange and was exceeded only by the value of cocoa exports.

In 1962 the gross national product (GNP) was CFAF26,215 million (US$107 million),[2] and phosphate rock production was valued at CFAF506 million, 1.9 percent of the GNP. With the greatly expanded phosphate rock production in 1963, the value of output increased to CFAF1,144 million with a consequent rise in the share of the GNP contributed by mining.

Employment in phosphate mining and beneficiation consisted of about 60 supervisors and administrative personnel and 650 workmen of all categories, a small part of the total labor force, the size of which is not available.

At yearend U.S. investment included the phosphate industry and oil exploration. The U.S. participation in the phosphate project was believed to have been an important factor in the expansion of exports markets.

GOVERNMENT POLICIES AND PROGRAM

No new mining or petroleum legislation was reported. A coup d'etat in January reportedly delayed the activities of the company engaged in petroleum exploration, but the new government formed in May subsequently approved all contracts entered into by the previous regime.

Togo continued to favor development on a free-enterprise basis,

[1] Mining engineer, Division of International Activities.

[2] African Financial Community (CFA) francs are use in Togo. The exchange rate is US$1=CFAF245 (CFAF1=US$0.0040816).

welcoming foreign private capital and offering special tax incentives for approved investments. The specific terms of these incentives depend on the nature of the investment and are worked out on an individual basis. An investment guarantee agreement with the United States was effected prior to 1963.

A mineral exploration program began in February, with the aid of the United Nations Special Fund. This project was to last 2 to 3 years and hopes were that it might disclose deposits of economic importance, but at yearend no significant finds have been reported.[3]

SOURCE MATERIAL

Data on production, trade, and 1963 developments are from dispatches of the U.S. Embassy in Lomé. Background information and the description of the phosphate development came mainly from an article in the French press.[4]

PRODUCTION

Phosphate rock production began in 1961 with 117,897 metric tons of marketable product, increasing to 193,000 tons in 1962 and 587,500 tons in 1963; the 1963 increase resulted from the successful introduction of the high-quality rock into the export market, an achievement which was not possible immediately upon the earlier completion of productive facilities. Data on production of building materials are not available; indications are that except for cement and lime, Togo was self-sufficient. Indications of some reduction in production are reflected in the decline in permits for the construction of housing in Lomé, from 32,700 square meters in 1962 to 30,000 square meters in 1963.

TRADE

Data on trade in metals and minerals are not available in detail for any year since 1960. Prior to September 1961 exports of these commodities were limited to small quantities of scrap metals and imported petroleum refinery products. Subsequently, exports have been expanded significantly with the development of Togo's phosphate rock deposits. In 1962 exports of phosphate rock amounted to 184,723 metric tons valued at CFAF489 million (12 percent of all exports on basis of value), increasing in 1963 to 441,434 tons[5] valued at CFAF1,068 million (24 percent). Italy was the leading consignee for 1963 exports, with 109,164 tons, followed by Brazil (100,799 tons), France (59,586 tons), Japan (58,677 tons), Belgium (42,390 tons), and the United States (39,792 tons).

Imports of principal metals and minerals in 1963 had a total value of CFAF1,144 million, 16 percent of all imports (CFAF906 million and 14 percent in 1962). These consisted of iron and steel (excluding

[3] Mining Journal (London). Annual Review Number, 1964, June 1964, p. 202.
[4] Coloma-Cimera, J. Bilan des Recherches Géologiques et Minières au Togo. Industries et Travaux d'Outremer (Paris). V. 10, No. 106, September 1962, pp. 202–216.
[5] This tonnage is that reported by customs statistics and probably represented actual embarkations. The Mines Service reported 476,071 metric tons, which may have been quantity licensed for export.

TABLE 1.—Principal imports of metals and minerals

(Metric tons)

Commodity [1]	1962	1963	Principal sources, 1963 [2]
Metals: Iron and steel	5,141	10,209	France 9,735; Belgium 154.
Nonmetals:			
Cement	44,377	39,910	France 33,574; West Germany 4,562; Tunisia 794; Belgium 651.
Salt	9,249	10,934	Senegal 4,788; Spain 3,983; Italy 1,355; Algeria 435; Portugal 359.
Mineral fuels: Refined petroleum products.[3]	30,475	36,965	Netherlands Antilles 22,246.

[1] No additional data available.
[2] Quantities estimated in proportion to those supplied in 1960, unless otherwise specified.
[3] In 1960 when 24,475 tons were imported, the composition was as follows: Gasoline, 34.1 percent; kerosine, 25.7 percent; distillate and residual fuel oils, 34.5 percent; lubricants, 2.6 percent; liquefied petroleum gas, 0.4 percent; and other, 2.7 percent.

Source: Institute National de la Statistique et des Études Économiques (Paris). Donnés Statistique. No. 1, January–March 1964. Service de la Statistique Générale (Lomé). Bulletin de Statistique, 1961.

manufactures), CFAF442 million; cement and salt, CFAF281 million; and refined petroleum products, CFAF421 million.

Italy, as the leading 1963 phosphate rock customer, received about 23 percent of the mineral exports on the basis of value, followed by Brazil (21 percent). The European Economic Community as a whole took 51 percent. Phosphate rock exports to the United States were 8 percent of the Mines Service total and on the basis of value were 27 percent of all of Togo's exports to that country.

Data on 1963 value of metals and minerals supplied by individual countries are not available. Their individual shares were reflected in the values of all imports which showed France supplied 30 percent; the European Economic Community as a whole accounted for 48 percent and the United States, 4 percent. Imports of refined petroleum products from the latter were valued at CFAF3.5 million, 1.1 percent of all imports from that source.

COMMODITY REVIEW

During the year United Nations geologists investigated a manganese deposit north of Dapango; indications were that an economic exploitation was unlikely. The limited bauxite reserves in the Mont Agou deposit, the marginal grade and high production costs of the Ahito chromite, and the remoteness to transportation for the Bangéli iron ore deposits continued to prevent any steps toward development of Togo's better known resources of metals.

Phosphate Rock.—Phosphate production, all by Compagnie Tongolaise des Mines du Bénin (CTMB) from its mine near Hahotoe about 22 kilometers from the sea, reached its highest level since mining began in 1961. The record output followed the 1962 acquisition of about 40 percent of the CTMB stock by the American firm of W. R. Grace & Co. which provided additional capital to finance production expansion plans and new customers through Grace's marketing contacts. Sales had been developing slowly in previous years, the result of introducing a new high-quality product into the competitive world markets. CTMB was founded in 1957 as a partnership of the French

Société Minière du Bénin, which had effected an extensive exploration of the area, and the Togolese Government which took 5 percent of the stock but reserved the right to purchase up to 20 percent. Prior to Grace's participation CTMB capital was reported at CFAF1,180 million.

The phosphate deposit opened up is of Eocene age. It has a thickness of 2 to 5 meters and is overlain by 6 to 25 meters of sand and clay; average overburden to phosphate rock ratio is 6 to 1. The reserve of crude rock is estimated to exceed 100 million metric tons, capable of giving marketable concentrates on the order of 50 million tons. The crude rock contains, in addition to moisture content, 25 to 40 percent of clay. Stripping with power shovels feeding conveyor belts began in late 1959, and in May 1961 a bucket-wheel excavator handling 1,200 cubic meters per hour entered service; by the end of 1961 total overburden removed was 1.5 million tons. A bucket-type excavator of a 250- to 300-ton-per-hour capacity has been used for mining, discharging the rock onto conveyor belts for loading into 25-ton cars. The latter moved in trains of 24, hauled by diesel locomotives, over the company's meter-gage railway to the beneficiation plant at Kpéme at the edge of the sea and 22 kilometers distant. A scarcity of water at the mine led to the installation at Kpéme; salt water at the rate of 2,000 cubic meters per hour is used in beneficiation, followed by a rinsing with fresh water obtained from beneath nearby sand dunes. The crude ore has been treated in the Kpéme plant which included two parallel circuits for the successive screening, treatment by hydrocyclones, dewatering by centrifuging and rotary kiln drying and subsequent rescreening and magnetic separation. Plant capacity was 200 metric tons per hour; the marketable product obtained in 1963 had an average P_2O_5 content of 37 percent. The "first quality" material which comprised 96 percent of the 1963 exports contained 36.6 to 37.6 percent P_2O_5 and the remaining 4 percent was "second quality" with 34.4 percent and was exported to the Republic of South Africa. The marketable concentrate moved by conveyor belt to the 60,000-ton storage shed for subsequent embarkation from the 1,200-meter wharf equipped with loading equipment of an hourly capacity of 2,000 tons and permitting vessels to moor in 13 meters of water. The total cost of the exploration, mine development, plant, and infrastructure was reported at CFAF6,370 million. Mine and plant equipment reportedly were capable of producing 750,000 metric tons of marketable product annually; expectations were that exports would reach about 600,000 tons in 1964 and 1,000,000 tons after an expansion of capacity.

Petroleum.—While little data are available regarding progress in the search for petroleum in Togo, indications are that the small U.S. firm, the Togo-American Oil Co., continued active. This company held a general exploration permit over 6 areas, covering a total of 4,145 square kilometers (2,895 in the Bas-Togo sedimentary zone and 1,250 in the bordering continental plateau). This was granted in 1961 and under the terms of the agreement with the Togolese Government the company was committed to spend at least CFAF1,500 million during the first 3-year period of validity of the permit. It was reported in 1963 [6] that the firm had done 3 months of geological and geophysical correlation work and subsurface analysis of water wells. Expectations

[6] World Oil. V. 157, No. 3, Aug. 15, 1963, p. 161.

were that the first wildcat well would be begun in the year. Azienda Generale Italiana Petroli (AGIP), the Italian-owned petroleum firm, began the construction of a petroleum storage depot, scheduled for completion in the first half of 1964. The depot is near the phosphate wharf at Kpéme, and a pipeline from the wharf to the depot will enable tankers to transfer fuel directly to the depot. Petroleum products were formerly shipped overland from Dahomey and Nigeria. The new depot will permit utilization of products from the AGIP refinery in Ghana, which could not be trucked in following the closure of the Togo-Ghana border, and will give AGIP a definite price advantage in the sale of its products on the Togolese border.

The Mineral Industry of Tunisia

By Thomas G. Murdock [1]

EXCEPT for establishing a record high for phosphate rock production, the mining industry of Tunisia showed little growth in 1963. The country is important to the world's mineral economy only for its production of phosphate rock; in 1963 it was the world's fourth largest producer, with 5 percent of the world total. Only small quantities of iron ore, lead, and zinc have been produced, and output of these has declined sharply over the past decade. An important development of 1963 was the completion of the petroleum refinery near Bizerte to treat imported crude oil.

The 1963 mineral production was valued at D15.5 million (US$36.89 million); [2] of this, phosphate rock comprised D8 million. The 1963 gross national product (GNP) was D346.6 million; thus, the extractive industry contributed 4.5 percent of the GNP.

At the end of November, the labor force engaged at metal and phosphate mines totaled 8,098 employees; the total including lead smelters and phosphate-processing plants was 8,774 (9,581 on January 1); this was 0.6 percent of the entire labor force, which is estimated at one-third of the population.

GOVERNMENT POLICIES AND PROGRAMS

No significant mining legislation was reported in 1963, and indications are that by yearend the program of nationalization of the mines was complete. Management was turned over to the Office National des Mines (ONM) attached to the Secretariat for the Plan and Finances, by Decree-Law 62–9 in early 1962, as part of the Government's control of commerce and industry.

Under the Government's current 10-year plan, the output of the mining industry is scheduled to be increased 43 percent by investments expected to total D147 million during 1962–71. Progress was slow in 1963, and only phosphate rock has shown expanded production. ONM is charged with exploration by the organic legislation, and was scheduled to carry out an extensive program of geological investigation; the only announced result to date has been the discovery of deposits of high-quality marble which might enable Tunisia to become a net exporter. Petroleum exploration was continued at about the same intensity as in preceding years.

During the year, several events indirectly affecting the mineral industry were reported. In April newspapers indicated that a new code

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[2] The Tunisian monetary unit is the dinar (D). Exchange used in this section is D1=US$2.38 (US$1=D0.42).

for private investments was in an advanced stage of study; however, no details as to contents and final decision have been announced. In May a U.S. long-term loan of $15 million was made to Tunisia for financing competitive commodity imports from the United States; this was part of the $180 million 3-year U.S. aid commitment announced the preceding October. On July 15, several important amendments were made to the Social Security Law of 1960, providing further fringe benefits to workers.

SOURCE MATERIAL

Information on activity during 1963 is comparatively limited; it has been gleaned from dispatches of the U.S. Embassy in Tunis and supplemented by the partial coverage of the technical press. The statistical data came mainly from official annual and interim publications of the Tunisian Government.

PRODUCTION

Except for phosphate rock and a few minor commodities, production of metals and minerals has declined, with minor fluctuations, since 1959. Phosphate rock production dropped between 1959 and 1961, and that of 1963 was only 8 percent above that of 1959; world phosphate rock production rose 15 percent between 1959 and 1962.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Iron ore thousand tons	982	1,035	849	761	845
Lead:					
Concentrate, metal content	18,141	18,131	17,384	13,550	[1] 13,808
Soft	21,808	19,862	18,451	15,828	12,801
Antimonial	597	379	1,201	2,087	2,833
Mercury 76-pound flasks	198	166	54	----------	----------
Silver troy ounces	43,339	34,401	69,767	24,325	9,031
Zinc concentrate, metal content	3,317	4,261	4,169	4,272	4,365
Nonmetals:					
Cement thousand tons	442	405	359	363	361
Gypsum	12,200	13,790	16,000	16,000	18,000
Lime	90,164	125,880	120,655	128,747	143,000
Phosphate rock	2,184,963	2,095,997	1,981,780	2,097,103	2,367,093
Salt thousand tons	92	166	161	159	301
Mineral fuels:					
Fuel briquets [2] do	5	5	----------	----------	----------
Gas:					
Gashouse do	15,000	16,000	16,092	16,128	16,025
Natural, marketed do	6,371	7,136	7,261	7,166	7,297

[1] Final figure; supersedes figure given in commodity chapter, volume I.
[2] Estimate.

TRADE

In 1962 the total value of metal and mineral exports was D14.1 million (D15.9 million in 1961) and comprised 29 percent of all exports; they consisted mainly of phosphate rock (D6.9 million), iron ore (D2.4 million), and lead (D1.0 million). Imports were valued at D13.8 million, 15 percent of all imports, compared with D13.9 million and

16 percent in 1961. The 1962 import values were metals D5.5 million; nonmetals D1.1 million; and mineral fuels D7.2 million.

France continued to be Tunisia's principal partner in metal and mineral trade in 1962, receiving 31 percent of the exports and supplying 74 percent of the imports. Italy ranked second with 20 percent of the exports and 15 percent of the imports. Exports to the United States were limited to 5 tons of magnesium scrap valued at D902; imports from this destination, for the most part rolled-steel products, comprised only 0.5 percent of the 1962 imports.

Based on trade in the most important items through November, the 1963 exports rose to about D14.4 million and imports to about D15.4 million.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum:			
Crude	226	214	Italy 184; Belgium-Luxembourg 30.
Scrap	10	100	All to Italy.
Copper:			
Scrap [1]	746	864	Italy 773; West Germany 58; France 33.
Semimanufactures	--	100	All to France.
Iron and steel:			
Iron ore	899,363	713,571	United Kingdom 342,787; Italy 173,872; France 100,812; Poland 39,500; Czechoslovakia 30,000.
Ferrous scrap	20,049	18,530	Italy 11,130; Yugoslavia 7,400.
Rolled products	18	9	Algeria 5; France 4.
Lead:			
Crude [2]	19,047	15,233	France 14,148; Algeria 890; Italy 195.
Scrap	422	334	Italy 247; France 77; Netherlands 10.
Magnesium, crude and scrap	--	10	Italy 5; United States 5.
Nickel, crude	17	--	
Silver---troy ounces	55,428	17,778	All to France.
Tin, crude and scrap---long tons	3	2	Do.
Zinc:			
Ore	9,697	6,760	France 6,414; United Kingdom 346.
Crude and scrap	8	17	All to Italy.
Precious metals, scrap---troy ounces	107,705	85,857	All to France.
Metallic ash and residue	228	1,212	France 950; Belgium-Luxembourg 262.
Nonmetals:			
Cement	111,978	187,781	Italy 80,680; Nigeria 59,876; Spain 36,472.
Clays	--	11	Switzerland 9; Italy 1; Algeria 1.
Fertilizers:			
Phosphate rock---thousand tons	1,691	1,877	France 490; Italy 408; Yugoslavia 139; India 120; Bulgaria 76; West Germany 72.
Superphosphate	156,686	115,089	France 59,435; Netherlands 27,325; Greece 8,350.
Gypsum	--	3,771	Nigeria 3,761; Libya 10.
Salt	148,952	130,831	Italy 42,380; Japan 29,365; France 20,488; Finland 19,063.
Other and unspecified	2	2	All to Algeria.
Mineral fuels:			
Coal	80	--	
Coke and semicoke	--	7	All to bunkers.
Pitch	357	--	
Petroleum:			
Refined products:			
Distillate fuel oil	97	18	Do.
Residual fuel oil	--	25	All to France.
Lubricants	188	118	Bunkers 89; Italy 28.
Asphalts and bitumens	6	--	
Total	728	168	Bunkers 114; Italy 28; France 25.

[1] Includes matte exported to Italy: 17 tons in 1961 and 3 tons in 1962.
[2] Includes 1 ton of pipe and fittings in 1961; also includes antimonial lead.

Source: Secretariat d'État au Plan et aux Finances Statistiques du Commerce Extérieur de la Tunisia (Foreign Trade Statistics of Tunisia). 1961 and 1962.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Crude	107	27	United Kingdom 24; France 3.
Semimanufactured	120	235	France 122; United Kingdom 107.
Copper	516	344	France 291; Algeria 31; West Germany 10.
Gold, troy ounces	35,237	22,891	All from France.
Iron and steel:			
Pig iron	101	122	France 72; West Germany 50.
Ferroalloys	31	43	United States 20; France 15; United Kingdom 8.
Ferrous scrap	61	125	France 107; United States 16; Algeria 2.
Rolled products	64,161	71,199	France 47,810; Italy 8,338; Belgium-Luxembourg 7,362; U.S.S.R. 3,941; West Germany 2,156.
Lead:			
Crude	7	17	All from France.
Semimanufactured	146	109	France 101; United Kingdom 4.
Mercury, 76-pound flasks	10	20	Yugoslavia 9; France 7; West Germany 3.
Nickel	3	6	United Kingdom 5; France 1.
Platinum, troy ounces	-------	129	All from France.
Silver, do.	10,996	3,504	Do.
Tin [1], long tons	46	20	France 10; United Kingdom 10.
Zinc:			
Crude [2]	85	95	France 65; Belgium-Luxembourg 30.
Semimanufactures	109	67	France 36; Belgium-Luxembourg 31.
Other	12	15	All from France.
Ores, unspecified [3]	19	23	Italy 15; United Kingdom 4.
Nonmetals:			
Abrasives, natural	256	43	France 38; Italy 5.
Asbestos	7	5	France 3; Algeria 2.
Barite	822	2,197	France 1,752; Italy 445.
Borates	6	35	All from France.
Cement	4,867	6,120	France 5,890; West Germany 170.
Chalk	84	90	All from France.
Clay	1,222	2,536	Italy 915; France 440; Morocco 763; Algeria 418.
Cryolite	58	60	All from France.
Diatomite	22	34	Do.
Dolomite	50	169	Norway 90; France 79.
Fertilizers, mineral or chemical:			
Guano	19	-------	
Nitrogenous	12,798	13,511	France 11,224; Italy 1,410; West Germany 604.
Phosphates	69	-------	
Potassic	2,517	4,498	France 3,678; West Germany 500; Italy 320.
Flint	41	54	All from France.
Gypsum	276	295	France 285; West Germany 10.
Lime	7	23	All from France.
Magnesite	30	-------	
Marble	3,128	4,260	Italy 4,010; France 250.
Mica	-------	5	All from Italy.
Pyrite, crude	6,625	3,923	Spain 2,123; Algeria 1,800.
Quartz and quartzite	-------	50	All from France.
Salt	5	-------	
Sand	30	11	All from France.
Sodium carbonate, natural	-------	20	Do.
Sulfur [4]	9,567	6,690	France 5,675; Italy 1,000.
Talc	506	666	All from France.
Other and unspecified	750	1,060	Morocco 966; France 92.
Mineral fuels:			
Coal	43,341	27,485	U.S.S.R. 18,549; Poland 8,934.
Coal tar and pitch	5	77	United States 38; France 37.
Coal tar oil	344	380	France 363; Netherlands 10.
Coke and semicoke	9,290	8,804	United Kingdom 3,193; West Germany 2,816; Netherlands 2,795.
Carbon black	8	6	West Germany 4; France 1.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Petroleum:			
Crude	916	6,591	Algeria 6,578; France 13.
Refined:			
Gasoline	70,311	76,291	France 64,375; Italy 11, 299.
Kerosine	46,247	48,903	France 47,346; Italy 1,521.
Distillate fuel oil	139,516	150,725	France 132,984; Italy 15,750; U.S.S.R. 1,447.
Residual fuel oil	209,674	210,669	France 114,874; Italy 56,800; U.S.S.R. 16,963; Spain 10,883.
Lubricants	13,714	9,008	France 8,697; Italy 286.
Liquefied petroleum gas	5,184	5,654	France 4,836; Italy 786.
Asphalts and bitumens	15,246	16,247	Italy 15,205; France 619; United Kingdom 422.
Other	96	78	France 58; West Germany 15.
Total	499,988	517,575	France 373,789; Italy 101,646; U.S.S.R. 18,409; Spain 11,427.

[1] Includes 34 tons as crude or scrap in 1961 and 10 tons in 1962.
[2] Includes an unstated quantity of scrap.
[3] Includes lead ore: 3 tons in 1961 and 1 ton in 1962.
[4] Excludes imports by principal superphosphate plant (47,350 tons in 1962).

Source: Secretariat d'État au Plan et aux Finances. Statistiques du Commerce Extérieur de la Tunisia (Foreign Trade Statistics of Tunisia). 1961 and 1962.

COMMODITY REVIEW

METALS

Iron Ore.[3]—The Djerissa mine of Société du Djebel Djerissa, 200 kilometers southwest of Tunis, continued to provide practically all of Tunisian iron ore production. Although the country's output in 1963 was 11 percent above that of 1962, it was still 18 percent below the 1960 high. The 1963 exports from Djerissa were 783,000 metric tons (667,000 tons in 1962). The Djerissa ore, with an iron content of 54 percent in 1962, continued to face severe competition from higher grade ores of other producing countries. In 1963 mining at Djerissa was by both opencut and underground methods, and extensive advance stripping of overburden was done in an area where mining is due to commence in 1965. Systematic exploration was continued in 1963, to add to the known reserve, reportedly sufficient for 15 to 20 years. Plans were formulated for deepening the basin at the port of La Goulette before the end of 1965, to enable loading of ore carriers of 10-meter draft.

Iron and Steel.—In 1963, Société El Fouladh, Tunisia's iron and steel enterprise, placed contracts for the proposed complex to be built on the south shore of the Bay of Bizerte. The blast furnace and sintering plants are to be supplied by the British firm of Ashmore, Benson, Pease & Co., Ltd.; the Swedish firm of Mogardshammors Mek is to furnish the rolling mill; and a French company, Société Anonyme des Entreprises Leon Ballot, is to execute the civil engineering work. Other Swedish and French companies are to provide other equipment and services. Initial annual capacity of the installation was an-

[3] Djerissa of Tunisia. Metal Bulletin (London). No. 4844, Nov. 5, 1963, pp. i–iv.

nounced at 70,000 metric tons of rolled products; expectations were that this would be doubled by 1971.

To provide wide participation in the investment, shares of D5 were offered for sale to the general public. Plans were to raise D0.5 million by popular subscription, with the Government supplying D1.7 million, and several Tunisian banks and other financial groups an additional D0.5 million.

Lead.—In 1963 Tunisian mines produced 21,917 metric tons of concentrate assaying 63.0 percent lead, compared with 22,048 tons assaying 61.5 percent in 1962. Production by the four companies active in 1962 follows:

Company:	Mine	Production, 1962 (metric tons)
Union Minière de Tunisie	Djebel Semene	5,000
	El Grefa	5,741
Société Nouvelle des Mines de Sidi Bou Aoune.	Sidi Bou Aoune	3,900
Société Anonyme du Djebel Hallouf	Djebel Hallouf	5,631
Compagnie Equatoriale des Mines	El Akhouat	1,776
Total		22,048

No lead concentrate was exported; except for the Djebel Hallouf production it was smelted in the 25,000-ton-per-year plant of Fonderie de Megriné, an affiliate of the French Penarroya Co., at Megriné. The Djebel Hallouf production was smelted in the company's 4,000-ton-per-year plant at Souk-el-Khémis. The 1963 production of soft lead by the two smelters was the lowest since 1947; it was partly compensated by the increased output of antimonial lead (reportedly containing 60 percent lead). Although some price improvement took place, highly competitive conditions in world markets limited smelter production. Lead exports through November were 12,323 metric tons, valued at an average of D70.45 per ton (D66.76 for the same period of 1962).

Zinc.—As in 1962, the entire Tunisian output of zinc came from the El Akhouat mine of Compagnie Equatorial des Mines, also a producer of lead. It consisted of 7,936 metric tons of 55 percent concentrate (7,768 tons in 1962). Despite an improved price for zinc concentrate, the country's other producer, the Fedj el Adoum mine of Compagnie Minière de Tunisie, remained closed. Exports of zinc concentrate through November were 7,082 metric tons, all to France; average value per ton was D17.04 (D14.03 in the same period of 1962).

NONMETALS

Phosphate.—Each of the three phosphate-producing companies increased production in 1963. Compagnie des Phosphates et du Chemin de Fer Gafsa (GAFSA), 51 percent Government-owned, produced an estimated 1,620,320 metric tons of commercial phosphate from the Metlaoui, Moulares, and Redeyef mines (1,485,498 tons in 1962). Output of Compagnie Tunisienne des Phosphates du Djebel M'Dilla (CIPHOS), entirely Government-owned, was an estimated 479,361 metric tons (385,037 tons in 1962), all from the M'Dilla mine. Société Tunisienne d'Exploitation Phosphatiere (STEPHOS), also 51 per-

cent Government-owned, contributed the remaining estimated 267,412 metric tons (226,568 tons in 1962) from the Kalaa Djerda mine. The commercial product ranged in grade from 29.8 to 34.4 percent phosphorus pentoxide (P_2O_5). Mining was entirely from underground workings. Output of dry, sorted, crude rock, beneficiated by washing, air separation, or calcination was approximately 30 percent higher than that of the commercial product.

Ore reserves were estimated as of January 1, 1963. Reserves in terms of dry, sorted crude phosphate containing 27.3 to 29.1 percent P_2O_5 totaled 107 million tons, about one-half of which is in the "possible" category. Reserves of the GAFSA mines aggregated 55 million tons; CIPHOS had 38 million and STEPHOS had 14 million.

Production of finely ground rock, known as hyperphosphate and exported for direct application on some types of soils, was 85,700 metric tons (34,521 tons in 1962) and is included in the total commercial production shown in the first paragraph of this section. The hyperphosphate is prepared for market in a plant at Sfax. This plant was formerly operated by the Tunisian branch of Compagnie Nord-African de l'Hyperphosphate. However, on February 1, 1963, this branch was merged with GAFSA, completing the control of the industry by the Government.

Total 1963 domestic utilization of commercial phosphate rock was about 350,000 metric tons. In addition to that ground for hyperphosphate, part of which was exported, larger quantities were consumed in the manufacture of triple superphosphate for export by Société Industrielle d'Acide Phosphorique et d'Engrais (SIAPE) and for domestic use by Société Algerienne de Produits Chimiques et Engrais. Total triple superphosphate production was 137,842 metric tons (146,532 tons in 1962).

Exports of phosphate rock through November were at the annual rate of 1.8 million metric tons; hyperphosphate exports were at the rate of 92,200 tons.

Early in 1963 work began on the new triple superphosphate plant to be constructed and operated at Sfax by the new Tunisian company, NPK Engrais, S.A.T. Total investment is to be D33.6 million, including D14.3 million in share capital, provided by Aktiebolaget Fornade Superfosfatbriker (Sweden), International Finance Corp., and Freeport International, Inc., a subsidiary of Freeport Sulphur Co. The plant is scheduled to be completed by late 1965, and annual capacity is to be 150,000 metric tons from 250,000 tons of phosphate rock.

Sulfur.—Sulfur consumption in 1963 was near the 1962 level, when imports as shown by customs statistics consisted of 5,041 metric tons of unrefined, 431 tons of refined, and 1,218 tons of colloidal. In addition, 47,350 tons were imported by SIAPE.[4]

An official order of May 27, 1963, prohibited the importation of all refined sulfur except colloidal sulfur. Reportedly this measure was to safeguard domestic sales of the Raffinierie Tunisienne de Soufre, operators of the Djebel Djelloud plant near Tunis which produces

[4] Not included as imports in customs statistics, because under a 1954 decree, upon export of a given amount of superphosphate the exporters may obtain a permit to import tax-free sulfur equal in weight to that used to produce the exported superphosphate.

about 4,000 metric tons of refined sulfur from imported unrefined sulfur.

The new installation of NPK Engrais S.A.T. at Sfax will include a sulfuric acid plant. This will use sulfur at the annual rate of 50,000 tons to be supplied under contract by Freeport Sulfur, a capital participant in the Sfax facility.

MINERAL FUELS

Coal.—In 1963 coal imports increased to 41,872 metric tons; consumption was 40,741 tons (41,268 tons in 1962). Total energy available was 851,200 metric tons of standard coal equivalent (946,000 tons in 1962). The 1963 coal consumption follows: cement and lime plants, 6,140 tons; foundries, 4,427 tons; railways, 698 tons; and others, 29,476 tons. Coal imports through November increased in value from D7.49 per metric ton in 1962 to D7.70 in 1963.

Petroleum.—France continued to supply a significant proportion (39 percent) of the refined products imported; through November these were at the annual total rate of about 540,900 metric tons. Approximate rate for individual products follow: Gasoline, 76,700 tons; kerosine, 49,900 tons; distillate fuel oil, 131,800 tons; residual fuel oil, 264,900 tons; lubricants, 10,900 tons; and liquefied petroleum gas, 6,700 tons.

The new petroleum refinery at Zarzouna, east of Bizerte, was officially inaugurated on December 14, 1963. This facility, built by SNAM-Progetti, an affiliate of the Italian Ente Nazionale Idrocarburi (ENI), at an estimated cost of about D49 million, will be operated by Société Tuniso-Italienne de Raffinage (STIR) and has a capacity of 1 million metric tons per year, although initial output will be at the rate of 650,000 tons. STIR is capitalized at D2.7 million and is owned in equal proportion by the Tunisian Government and ENI. The refinery is designed to utilize crude of the "Iran light" type, which includes the crude delivered through the La Skhirra pipeline from the Edjeleh field in the Algerian Sahara. Results of an international call for bids for crude supply have not been announced.

Reportedly it is expected that the petroleum treated will be of diverse origins; the crude for the first run came from the Kirkuk field in Iraq. The breakdown of the initial run follows: Light gasoline, 6.5 percent; heavy gasoline, 14.0 percent; kerosine, 5.0 percent; distillate fuel oil, 30.0 percent; residual fuel oil, 42.5 percent; liquefied petroleum gas, 1.0 percent; and losses, 1.0 percent. Expectations were that domestic requirements would soon rise to 600,000 metric tons annually and that the surplus will be exported to Italy for marketing in Europe through the ENI distribution system. Design of the refinery provided for expansion to a 1.5-million-ton capacity.

Continued oil exploration brought no significant discoveries and Tunisia remained a nonproducer, despite its proximity to both Algerian and Libyan fields. Expectations were that six wells would be drilled in 1963. Société de Recherches et d'Exploitation des Pétroles en Tunisia (SEREPT) continued exploration within its 33,475-square-kilometer permit in the extreme south, following the withdrawal of its half-interest partner, Mobil Producing Tunisia,

Inc., at the end of 1962. As in preceding years, SEREPT exploited the Cape Bon gasfield in the extreme northeast. Société Italo-Tunisienne d'Exploitation Pétroliere, a joint ENI and Tunisian Government venture, followed up its seismic work in its southern Tunisian holding and began drilling at Garet el Borma near the Algerian border. Conorada Petroleum Corp., Rimrock Tidelands, Inc., and Husky Oil Co., other permitholders, were active in varying degrees. Interest in the offshore possibilities has increased, and in April two French firms, Société Petropar and Société Nationale des Pétroles d'Aquitaine, applied for permits to undertake offshore exploration near Cape Bon and in the Gulf of Gabes.

The Mineral Industry of the United Arab Republic (Egypt)

By Thomas G. Murdock[1]

EXCEPT for petroleum, the minerals industry of the United Arab Republic (Egypt) showed little improvement in 1963. As in 1962, efforts were made to attain self-sufficiency and export the few commodities which can be placed on world markets. Other developments included continued exploration and numerous agreements with foreign firms or companies for technical assistance in the solution of specific problems attending the increase of output or for financial aid in the development of new facilities to provide additional productive capacity.

Less than 2 percent of the total labor force of about 8.2 million was employed in the extractive industries; average employment in 1962 totaled 15,309 (3,958 in mining, 7,256 in quarrying, and 4,095 in crude petroleum production), compared with 12,572 in 1961.

The United Arab Republic (Egypt) continued to rank low as a mineral producer; except for phosphate rock, in which the country ranked ninth in 1963 with slightly over 1 percent of the world total, and small quantities of manganese and titanium minerals, its contribution to world supply was insignificant. Nor do the extractive industries contribute appreciably to the national economy. In 1962 the United Arab Republic (Egypt) gross national product (GNP) was £E1,465 million (US$3,370 million);[2] of this, the mineral industries exclusive of metallurgical plants and petroleum refineries contributed only 1.7 percent, or £E24.4 million (minerals and ores, £E6.9 million; cement and construction materials £E3.2 million; and crude petroleum, £E14.3 million). Sales of domestic steel products were valued at £E7.7 million, and total value of refined petroleum products derived from domestic and imported crude was £E80.4 million.

Further nationalization of the industry took place during 1963, and steps were taken to improve the raw material supply for making steel. Plans were announced for further infrastructure developments to decrease further the dependence upon imports and process some by-

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[2] The U.A.R. monetary unit is the Egyptian pound (£E): since May 7, 1962, the International Monetary Fund parity rate has been £E1=US$2.30 (US$1=£E0.4348). Previously (since 1955), exchange was £E1=US$2.8715 (US$1=£E0.3483).

products which could not be sold without further processing. Critical shortages in some commodities developed during the year, and increased imports of these became necessary. Foreign markets for several commodities showed indications of expansion by yearend.

GOVERNMENT POLICIES AND PROGRAMS

By a sweeping nationalization decree (law 72), all of the remaining private investment in mining companies was taken over by the Government of the United Arab Republic (Egypt) in August. The new law also terminated all private prospecting and mineral exploitation rights. Thus the United Arab Republic (Egypt) has taken a course in its mining industry different from that taken in the petroleum industry, in which a reduced amount of private and foreign investment has been tolerated and foreign private interests have been encouraged to invest. The newly nationalized mining companies include National Gypsum & Plaster Co., Tobia Contracting & Mining Co., El Ballah Gypsum & Plaster Co., Egyptian Abou Hol Gypsum Co., El Quannam Gypsum Co., Egyptian Metal Industries Co., Elba Mining Co., and Minerals Processing Co.

The Government continued to tighten its control of trade. Previously, under the import regulations promulgated in July 1961, importing was done by 15 Government trading firms, by any Government agency or department, or by privately owned factories and industrial organizations that required equipment or raw materials for their own use. A new law of September 4, 1963, limited importing of commodities to Government bodies. Presidential decision law No. 87 excepted bunkering from the provisions of law 129 of 1962, which stipulate that no company shall be allowed to continue supplying or servicing transiting maritime vessels unless the Government owns at least a 25-percent interest.

On June 29, an Investment Guarantee Agreement was signed between the United Arab Republic (Egypt) and the United States. As a result, new U.S. investment in Egypt can be guaranteed against inconvertibility, confiscation, and war losses. In June the Government of the United Arab Republic formally ratified the country's association with the General Agreement on Tariffs and Trade (GATT), provisionally agreed on in Geneva in November 1962.

The Government mineral agencies continued exploration during the year and the reports of 17 field parties were completed. This work included investigation of the Abu Swail copper occurrence and of lead and zinc at Gebel el Rusas. New discoveries include a gold occurrence at Gebel Ashour in the Eastern Desert. Official announcement was made that self-sufficiency had been attained in marble, zircon, rutile, and glass sand.

SOURCE MATERIAL

Information on other than the main sectors of the minerals industry is scant and mainly limited to a few, often unconfirmed, newspaper accounts giving only fragmentary data. Production statistics from different sources are sometimes contradictory and are not available

for some items. In the absence of complete foreign trade statistics covering 1961 and 1962, publications of the Central Bank, giving data for major commodities only, have been used. No available trade data completely itemized trade by countries.

PRODUCTION

Trends in output of the minerals and metals produced in the United Arab Republic (Egypt) have not followed a uniform pattern. Steel production has increased only slowly because operating difficulties have prevented output from reaching the level of plant capacities. Growing competition on world phosphate rock and manganese ore markets has adversely affected output of these commodities. Crude petroleum and refinery products output have shown spectacular gains. Production of building materials has roughly paralleled the growth

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Chromite	250	300	1,390		
Gold—troy ounces	2,486	1,000	973	[1] 1,000	[1] 1,000
Iron and steel:					
Iron ore—thousand tons	246	241	422	460	489
Pig iron and ferroalloys—do	118	148	174	204	[2]
Steel ingots and castings—do	100	136	156	[1] 150	[1] 372
Lead, metal content of ore	700	80	35	540	[1] 500
Manganese ore [3]	61,070	20,000	2,061	38,625	48,651
Titanium minerals:					
Ilmenite	15,500	12,000	34,477	44,643	541
Rutile	1,050	[1] 1,000	[1] 1,000	180	4
Tungsten ore and concentrate, 60 percent WO_3 basis			[1] 85		
Zirconium ore and concentrate	[1] 60	370		171	40
Nonmetals:					
Asbestos	455	450	230	550	174
Barite	1,830	2,600	[1] 2,600	1,230	[1] 1,200
Cement—thousand tons	1,784	2,047	2,141	2,313	[1] 2,300
China clay—do	12	20	27	58	21
Diatomite	400	730	301	50	[1] 50
Feldspar	500	360			
Gypsum	523,508	400,000	462,350	467,570	[1] 470,000
Monazite	[1] 150	[2]	[2]	[2]	[2]
Phosphate rock	629,000	566,000	626,530	601,747	612,070
Pumice	2,500	3,000	3,933	2,065	[1] 2,000
Salt—thousand tons	383	522	517	560	392
Sulfur, elemental:					
From sulfur ore	1,200	3,600	9,000	[1] 6,000	4,750
Other, recovered	2,441	2,383	2,586	2,072	2,393
Talc and soapstone	6,085	6,000	5,956	6,126	4,790
Vermiculite	300	120		284	[4] 60
Mineral fuels:					
Coke, low-temperature [1]—thousand tons	25	30	30	35	[2]
Petroleum:					
Crude—do	3,110	3,500	3,815	4,719	5,650
Refinery products:					
Gasoline—do	341	306	386	553	714
Jet fuel—do	[2]	[2]	[2]	48	30
Kerosine—do	291	370	455	544	[5] 821
Distillate fuel oil—do	437	588	717	895	1,038
Residual fuel oil—do	2,058	2,734	2,651	2,823	3,392
Asphalt—do	129	112	124	153	149
Butane gas [5]—do	16	20	25	31	39

[1] Estimate.
[2] Data not available.
[3] In addition to high-grade ore shown in the table, the U.A.R. produced the following tonnages of less than 35-percent manganese content: 1959, 66,000; 1960, 66,000; 1961, 276,386; 1962, 147,057; and 1963, not available.
[4] Includes mica.
[5] Includes solvents.

in cement production, but exact quantitative data on production of other construction materials are not reported. In 1962, however, the total value of production by the building materials and ceramic industries was £E23.4 million (£E21.4 million in 1961 and £E8.4 million in 1952).

TRADE

Complete detailed data on mineral and metal trade are not available for any year since 1960, when imports of these were valued at £E43.3 million and exports at £E9.2 million. Recorded 1961–62 values for major commodities, accounting for at least 85 percent of the trade in both directions, indicate imports were valued at about £E38.5 million in 1961 and £E50 million in 1962; corresponding extrapolated figures for exports were approximately £E12.8 million and £E18.8 million, respectively. For the first half of 1963 trade in these major commodities was at the annual rate of £E32.5 million for imports and £E19.7 million for exports. Based on comparable rates for the same period of 1962, these represented increases of 40 percent and 35 percent, respectively; however, based on the 1962 experience, this growth was not to be expected for the entire year. In 1962 mineral trade accounted for 17 percent of all imports and 12 percent of all exports.

Fuels consistently have comprised the greatest part of the mineral trade in both directions, and in 1962 crude petroleum imports alone were valued at £E20.0 million and exports at £E11.1 million. In that year the value of major fuel items imported was 59 percent of the mineral imports and 79 percent of the exports. Imports of major crude and semimanufactured metals were valued at £E20.0 million, and exports of manganese ore, the only major export item of the general category, amounted to £E1.0 million. The value of nonmetallic imports was £E1.6 million in 1960, the latest year available. In 1962 the exports of cement and phosphate rock combined were valued at £E2.9 million (4.4 million in 1961).

The U.S.S.R. was the principal source of the 1962 imports, supplying 22 percent of the total, and amounting to £E11.2 million (31 percent and £E13.5 million in 1960).[3]

Imports from other Communist countries (except Yugoslavia) totaled £E9.3 million, or 19 percent, in 1962. Imports from the United States were valued at £E1.5 million, 3 percent of the 1962 total; they consisted of lubricating oil and steel sheets and plates.

Italy was the chief recipient of 1962 mineral and metal exports, with £E8.4 million (45 percent). Other Western European countries were consigned exports valued at £E3.0 million; the Communist countries (except Yugoslavia) received only £E1.0 million. Exports to the United States were £E1.8 million worth of crude petroleum.

Of total 1962 trade with the United States, minerals accounted for 2 percent of imports and 19 percent of exports.

[3] Available trade statistics do not indicate fully the countries of origin and destination for commodities covered; thus trade with countries here shown is only that listed for some individual items; additional trade with these may be included in undistributed totals, so values here shown are minimum ones.

TABLE 2.—Exports of selected metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals: Manganese ore	240,000	159,600	Italy 40,100; Czechoslovakia 30,900; United Kingdom 26,200; Belgium 26,100.
Nonmetals:			
Cement	689,100	443,800	Saudi Arabia 105,800; Sudan 61,400; Aden 58,200; Palestine 57,300; Ghana 44,100.
Phosphate rock	421,100	180,100	Ceylon 50,600; Czechoslovakia 29,900; Japan 19,600.
Salt	382,000	209,000	(2).
Mineral fuels:			
Petroleum:			
Crude—thousand tons	1,810	2,848	Italy 2,323; United States 303; Trinidad 134; Netherlands 71.
Refinery products:			
Gasoline and kerosine	53,700	270,800	United Kingdom 96,100; Netherlands 84,100; China 35,900; Poland 34,000.
Diesel and other fuel oil	176,700	280,600	Greece 181,800; foreign flag bunkers 94,600.

[1] Commodities listed accounted for 89.6 percent of value of all mineral and metal exports in 1960. In 1960 the following additional commodities were exported (metric tons): Copper scrap and crude 40; other copper 3; rolled-steel products 3,372; lead 7; metallic ores and rare earths, unspecified 245,499; clay 7,186; gypsum 40,813; lime 628; limestone 63; Thomas slag 23,263; salt 391,808; stone for mosaics 364; talc 1,294; unspecified nonmetallic minerals 24,577; asphalt and bitumen 548; unspecified refined petroleum products. Data on exports of these are not available for subsequent years.

[2] Data not available.

Source: Central Bank of Egypt. Economic Review. V. 3, No. 1, 1963, pp. 121–122.

TABLE 3.—Imports of selected metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Copper	5,700	7,200	(2).
Iron and steel:			
Pig iron [3]	40,600	123,200	(2).
Rolled products:			
Bars and profiles	56,300	138,200	Mainland China 32,000; Poland 31,100; Hungary 20,200; West Germany 18,900.
Rails and accessories	38,200	29,800	(2).
Plates and sheets	44,600	55,900	Japan 17,700; West Germany 10,500 U.S.S.R. 7,300; France 6,000.
Pipe and fittings	41,800	38,700	Hungary 7,100; United Kingdom 7,100; U.S.S.R. 7,000; West Germany 3,400.
Mineral fuels:			
Coal and coke	329,300	296,600	U.S.S.R. 141,500; Poland 133,700.
Petroleum:			
Crude—thousand tons	3,211	3,401	Saudi Arabia 1,141; U.S.S.R. 1,036; Kuwait 816.
Refinery products:			
Kerosine	336,000	318,000	Rumania 164,000; U.S.S.R. 122,000; Iran 18,000.
Diesel and other fuel oil	269,000	260,000	U.S.S.R. 177,000; Rumania 58,000.
Lubricating oil	53,000	35,400	United States 28,100; United Kingdom 4,900; Yugoslavia 1,800.

[1] Commodities listed accounted for 84.5 percent of value of all mineral and metal imports in 1960. In 1960 the following additional commodities were imported (metric tons, unless otherwise specified): Aluminum scrap 446; other aluminum 2,155; ferroalloys 2,082; ferrous scrap 5,017; steel ingot and billets 3,210; rolled-steel products not listed above 23,178; lead scrap 5,017; other lead 109; unspecified metalloids 523; nickel 281; crude tin and scrap 333 long tons; other tin 24 long tons; crude zinc and scrap 1,715; other zinc 647; metallic ores and rare earths 704; asbestos 6,583; clay 7,635; diatomite 1,940; graphite 320; magnesite and dolomite 6,410; pumice 2,001; pyrite 75,441; sand and gravel 5,304; natural sodium nitrate 10,100; sulfur 14,343; other nonmetallic minerals 4,366; coal byproducts 1,079; peat 777; gasoline 13,149; and miscellaneous refined petroleum products 2,414.

[2] Data not available.

[3] Includes ferromanganese and spiegeleisen.

Source: Central Bank of Egypt. Economic Review. V. 3, No. 1, 1963, pp. 107, 114–117.

COMMODITY REVIEW

METALS

Iron and Steel.—The Egyptian Iron & Steel Co. integrated steel plant at Helwan, 17 kilometers from Cairo, continued operations at approximately the level of 1962, when output was 157,294 metric tons of Thomas steel ingots and 30,342 tons of electric steel ingots. The plant, with an output capacity of 315,000 metric tons, was still about 40 percent below that figure.

The difficulties attending the production of 42 to 44 percent iron ore from the Aswan mines and of transporting the ore to Helwan, 900 kilometers away, have remained acute. Although production for the year ending June 30 was 500,000 metric tons, 9 percent above that of calendar 1962, the supply was still precarious and imports of ore from Morocco began in the second quarter. Accordingly, the project to exploit the higher grade deposits near Baharia, an oasis in the Western Desert, where reserves reaching 48 percent iron total at least 250 million metric tons, received attention during 1963. In February it was announced that the Swedish firm of Svenska Enterprenad, A.B., had been engaged to undertake an engineering survey of the deposits and plan mine layout and facilities. In March, Aereo Service Corp. of Philadelphia began work on an economic feasibility and engineering survey for a railway link to connect the deposits with the existing line about 200 kilometers to the east.

In January, the U.S. firm of Koppers International signed a 5-year contract to provide technical assistance to the U.A.R. steel industry, the firm will first endeavor to increase production and efficiency at the existing Helwan plant and later plan expansion there. Operation at full capacity has been impossible because of deficiencies or omissions in equipment and shortage of spare parts. Although total investment in the integrated works, as reported in 1963, was £E26 million, estimates were that additional expenditure of £E5.1 at mines and plants was required. Facilities needed included a fourth Thomas converter, additional cranes, and modifications and extensions to buildings. In 1962 rolling-mill input was 175,000 metric tons, resulting in 142,000 tons of marketable products, about one-half of which were sold as blooms. The target for the improvement program is the rolling of 269,500 tons of ingots and rolling all blooms into sections, plates, or sheets.

Equipment for injecting fuel oil into the blast furnace was being installed at yearend; this injection, at the rate of 150 kilograms of fuel oil per metric ton of pig iron, was expected to reduce coke requirements by 30 to 40 percent. Construction was started on two additional soaking pits and a finished-products storage yard.

New monthly production records of 20,442 metric tons of pig iron and 19,864 tons of steel ingots were established in September; previous highs were 19,700 and 18,907 tons, respectively. The labor force at Helwan was still high at the beginning of 1963, totaling 6,640 workers, compared with 3,950 in 1960. Early in the year announcement was made of an agreement to ship 15,000 metric tons of U.A.R. steel to Italy, the first sale made to a European country.

Increased production of pig iron was reflected in the lower imports of pig iron and ferroalloys, 18,300 metric tons in 1963. Imports of rolled-steel products were also below the 1962 level, amounting to 96,800 metric tons.

In September a group of Bulgarian technicians came to Cairo to discuss plans for building an 8,000-metric-ton-per-year plant to produce ferrosilicon and calcium carbide at Aswan; only Bulgarian equipment will be used.

Manganese Ore.—The decreased activity in 1963 was reflected in the lower volume of ore exports; only 24,600 metric tons, including some ore with less than 35 percent manganese, had been shipped through June. The downward trend of previous years continued because active competition made difficult the marketing of Egyptian ores, the greater part of which are low grade. Production was limited to the Sinai Manganese Co. mines in the Umm Buqmah areas of Abū Zanimah district. In 1963 this company's capital was raised from £E0.4 million to £E8.0 million. Plans have been announced to build a ferromanganese plant at Abū Rubies; the company also proposed to diversify its activities through the production of gypsum and kaolin.

Thorium and Uranium.—In April a U.A.R.-Yugoslav agreement for scientific cooperation in the peaceful uses of atomic energy was signed in Cairo; the agreement emphasized cooperation in geological and technical research on radioactive minerals. The British consulting firm of Kennedy & Duncan completed its feasibility study of two nuclear powerplants for the U.A.R. Government. Following radiometric air reconnaissance in 1962, the Egyptian Atomic Energy Establishment (AEI) carried out extensive field investigation of anomalies found and reportedly confirmed the occurrence of radioactive minerals at Kossier on the Red Sea coast and in the Qatrari Hill near Fayoum. AEI announced plans to build a plant at Inchass, the site of the installation of their experimental reactor; this plant is to produce radioactive elements from the monazite recovered in the Alexandria plant of the Egyptian Black Sands Co.

NONMETALS

Cement.—The growing local demand resulting from the expanded construction activity continued in 1963, raising consumption above the 1962 figure of 1,856,000 metric tons; the exportable surplus again declined and through June only 93,400 tons were exported. A serious shortage developed during the latter part of the year owing to the 2,000-ton daily shipments to the Aswan Dam. By October the industry was 250,000 tons behind in its deliveries, and to ease the situation, orders were placed in Poland. A contract was signed with East German representatives for the construction of a 200,000-ton-per-year extension to the plant of the Alexandria Portland Cement Co. The recent addition of a new unit by this company accounted for most of the 1963 increased output. In August, law No. 85 added the National Cement Co., operating the slag cement plant at Helwan, to the list of companies in which private ownership was limited to £E10,000; ownership of all shares above that amount and supervision of the company were transferred to the Egyptian Public Organization for Building and Refractory Materials.

Phosphate Rock.—During the year there was some revival of the phosphate industry; exports through June totaled 190,900 metric tons, more than in all of 1962. This was mainly due to renewal of exports to India, formerly a principal customer, which took only 6,000 tons in 1962. In 1963 the Nasr Phosphate Co. capital was raised from £E1 million to £E3.6 million, to expand annual production from 200,000 tons to 750,000 tons. That of the Sagafa Phosphate Co. was raised from £E0.1 million to £E2.8 million for increasing output from 100,000 tons to 330,000 tons. Both companies planned to improve beneficiation facilities. A West German consortium concluded a technical assistance contract with the Egyptian General Mining Organization, the governmental agency in charge of all mining enterprises, under which the German firms will explore the phosphate rock deposits in the Harawein region. An order was placed with a German firm for the construction of a superphosphate plant in Upper Egypt.[4] The production of superphosphates by Société Financière et Industrielle d'Egypt and Abū Zsabal et Kafrel Zayat Fertilizers & Chemical Co. continued in 1963; in 1962 these companies reported a combined output of 163,000 metric tons, and their consumption of phosphate rock accounts for part of the difference between production and exports.

Potash.—The Egyptian press reported that U.A.R. scientists discovered sizable deposits of potash in the areas being prospected for petroleum along the Red Sea coast.

Salt.—The capital of the Government's Nasr Salt Works, which produces salt by solar evaporation of sea water in several localities, was increased from £E0.4 million to £E2.5 million, to increase annual output to 850,000 metric tons. Salt exports in 1962 were 209,000 metric tons (382,000 tons in 1961).

MINERAL FUELS

Coal and Coke.[5]—In 1963 representatives of the U.A.R. 5-Year Plan Organization signed a 4-year contract with the British firm of Powell Duffryn Technical Services, Ltd., for the planning and supervision of work on Egypt's first coal mine, at Maghara in the Sinai Peninsula. The coal deposits, 290 kilometers from Cairo, are of Middle Jurassic age, and occur in two seams ranging in thickness from 0.80 to 2.00 meters. Ash content is 3.8 percent, over 50 percent volatile matter is present, and the coal is cokable. The proposed mine is to have an initial annual production of 120,000 to 150,000 metric tons, most of which will be coked at Helwan. The mine installations and complementary housing and other facilities are to cost about £E2 million. Initial plans call for evacuating the coal by road; however, proposals for building a railway were being considered at yearend.

The byproduct coke plant at Helwan was dedicated in December; actual production was scheduled for early 1964. This installation, constructed under the 1958 Soviet industrial credit agreement at a reported cost of £E11 million (£E4 million was as U.S.S.R. machinery

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[4] Canadian Mining Journal (Gardenvale, Quebec). V. 85, No. 2, February 1964, p. 164.
[5] Mining Journal (London). Egypt's First Coal Mine. V. 261, No. 6691, Nov. 15, 1963, p. 465.

and equipment), has a capacity of 300,000 metric tons per year and will employ 600 workers. Coke oven gas will amount to 140 million cubic meters per year and will be sold to a nearby fertilizer plant. Other byproducts are expected to be valued at £E270,000 per year. Production costs are estimated at about £E14 per metric ton (compared with about £E11 for imported coke).

Imports of coal and coke through June were only 98,800 metric tons, well below the rate of preceding years. The decrease was due to the increasing substitution of oil fuels and to a temporary buildup of coal stocks for making coke at Helwan.

Petroleum.—The United Arab Republic (Egypt) continued to try to attract investment by foreign oil companies in petroleum concessions on the basis of 75–25 percent split in profits in favor of the Government. Offshore concessions were offered in the Gulf of Suez and land concessions were offered in the Nile Delta, Western Desert, and North Sinai. Phillips Petroleum Co. obtained a 96,000-square-kilometer concession in the Western Desert on the 75–25 eventual profit-sharing basis. The Italian Ente Nazionale Idrocarburi (ENI) signed similar oil concession agreements for both the Delta and Suez Gulf areas. A new law authorized both Shell and Compagnie Orientale des Pétroles d'Egypt (COPE), a joint ENI-U.A.R. company, to continue for another 25 years as U.A.R. joint stock companies.

The Petroleum Cooperative Society (COOPS), largest single retailer of petroleum products, was converted into a joint stock company. COOPS lost its concession leases to the General Petroleum Co. (GPC) and became a general marketing company, while GPC gave up marketing to engage exclusively in exploration and production of crude. The marketing elements of GPC were combined with the Egyptian Independent Oil Co. to form a new marketing organization, the Arab Co. for Oil Distribution.

Estimated oil reserves of 100 million metric tons at the beginning of 1963 were announced. COPE concessions were believed to contain 86 percent of the total; Al Nasr oilfields held 8 percent and GPC, 6 percent. During most of the year exploratory drilling continued at a lively pace but without significant results. In the Belayim marine field seven wells were in production in 1963 and the eighth was completed at a total depth of 3,008 meters. Plans were announced to drill ultimately 29 wells in this field. By August exploration at both Rahmi and South Gharib had not resulted in a commercial discovery. Efforts to develop a new marine field at Baba were unsuccessful, and the offshore rig was returned to Italy. The Italian offshore rig at Belayim marine was the only one in U.A.R. waters at yearend; however, the Petroleum Organization began the construction of islands in the Gulf of Suez, through the use of earth fill, to be used as offshore drilling platforms.

A Cairo-Helwan pipeline and a butane gas packingplant at Mostered (Cairo) were completed in late 1963. The 30-centimeter pipeline has an annual capacity of 1.8 million metric tons and supplies various installations in the Helwan area. Work was continued on the £E27 million petroleum coke plant being built at the Government refinery at Suez by Compagnie Tecnica Italiana Petroli, and completion was scheduled for early 1964. Work was begun on the lubricating oil

plant at the Suez refinery; this £E6 million U.S.S.R.-sponsored plant is scheduled to go on stream at the end of 1964 and to produce 70,000 metric tons of lubricants per year, which should meet U.A.R. needs for ordinary lubricants, although special ones will still be imported.

Plans to provide additional refinery capacity of 1 million metric tons were announced in July; this would be installed at the Alexandria-Mex refinery of Société Egyptienne de la Raffinage et Commerce des Pétroles, where an earlier extension of this size installed by Czechoslovakian interests began operations on October 28, 1962. Plans were formulated to establish a petrochemical complex at Alexandria or Suez, to use surplus naphtha being produced by the U.A.R. refineries. Consumption of this naphtha has lagged behind that of other petroleum products because of the high price set by the Government. The proposed plant would process 120,000 metric tons of naphtha yearly into various products. Several U.S. firms have indicated interest in participating in this venture.

Total employment in the entire petroleum industry for 1963 was reported at 23,173. Production of crude in June was at the rate of 5.8 million metric tons annually. The appreciable increase in output from the Belayim offshore field, following first production there in 1962, accounted for much of the gain. The Belayim land field continued to be the principal producer, with 49 percent of the June total.

Contracts called for imports of 3.9 million metric tons of crude during 1963, to be furnished by Caltex, Shell, and the Soviet Union. The supply contracts were tied in with provisions for the suppliers to buy 600,000 metric tons of Egyptian crude and 220,000 tons of products. Italy was expected to take 2.5 million metric tons of crude and 8,000 tons of butane alone. Expectations were that the United Arab Republic would be self-sufficient in products during 1963. Plans were to refine 6.5 million metric tons of domestic and imported crude; with the supplies contracted for, the expected increase in local production, and new refinery capacity, this goal appeared to be within reach. Data on trade for 1963 are not available, but for the first half of the year a favorable balance of oil trade of £E2.4 million was reported. For this period imports of crude were 629,600 metric tons; exports were 1,533,000 tons. Other imports consisted of 30,000 tons of lubricants and 53,700 tons of diesel and other fuel oil. Exports were 63,500 tons of gasoline and kerosine, 321,800 tons of diesel and other fuel oil, and 5,600 tons of other products.

The 1962 consumption of refined products consisted of gasoline 253,000 metric tons; kerosene 817,000 tons; distillate fuel oil 925,000 tons; residual fuel oil 2,394,000 tons; asphalt 139,000 tons; and butane 30,000 tons. Indications are that in 1963 consumption of fuel oils increased.

The Mineral Industry of Upper Volta

By Thomas G. Murdock[1]

THE Republic of Upper Volta (Haute Volta), a former territory of French West Africa until it became independent on August 5, 1960, has been the scene of various small-scale mining activities for many years. However, it was only recently that the mineral deposits were systematically investigated, with the result that gold production from a single mine has become of significance as an export item. A number of other metals have been discovered but so far there have been no definite reports of any which are likely to be suitable for economic exploitation. The year 1963 produced no new developments other than the granting of rights for diamond exploration and announcement of plans for production of ornamental granite; gold production apparently showed a slight improvement. For a population of 4.6 million, and with animal husbandry as the chief economic activity, Upper Volta continued to have only limited need for metal and mineral imports. The value of principal imports of these increased slightly in 1963 and was over twice that of gold exports, thus leaving an important trade deficit in metals and minerals.

In 1962 the gross national product (GNP) was CFAF44,835 million (US$183 million)[2]; the gold production at world price was valued at CFAF341 million, only 0.8 percent of the GNP.

Personnel engaged in gold mining consisted of about 600 African workers and about 20 Europeans, a small fraction of the economically active labor force.

GOVERNMENT POLICIES AND PROGRAMS

No new mining legislation was reported during the year. The government favors private enterprise and has passed special legislation to encourage foreign firms to invest in Upper Volta. Nevertheless investment opportunities continued to be limited. A French-sponsored industrial survey made in 1962 indicated that the most promising opportunities were in the livestock field. A fertilizer plant was considered but nothing came of this as without raw materials and with a high cost of transportation, it would be uneconomic. Late in 1962 announcement was made of West Germany financing to the extent of CFAF400 million for construction of a cement plant, but no record of any progress on the project is available. Following its initial 1963 session, Upper Volta's Council of Ministers announced that the 5-year development plan, scheduled for January 1, implementation, would not be put into effect. Instead a decision was made

[1] Mining engineer, Division of International Activities.

[2] African Financial Community (CFA) francs are used in Upper Volta. The exchange rate is US$1=CFAF245 (CFAF1=US$0.0040816).

to adopt a 2-year interim plan while the longer range document is redrafted. The interim plan was to concentrate on certain sectors rather than the economy as a whole but should fulfill the more important goals of the former plan. Aside from the stable currency, Upper Volta's finances remained in a precarious position; the country has had a continuing trade deficit and economic progress has been slow. Without strong French support, the country's administrative and economic superstructure would be difficult to sustain.

Mineral prospecting and investigations financed by the national budget with French and other assistance were continued under an integrated plan covering the 1963–67 period and embracing work costing CFAF2,500 million.[3] In 1962 the French Bureau de Recherches Géologiques et Minières maintained 13 parties in the field; their work included an investigation of the anomalies resulting from an earlier aerial geophysical survey covering 37,000 square kilometers. The Upper Volta Directorate of Geology and Mines had 3 parties in the field in 1962, engaged in detailed geological mapping and exploration of alluvial gold deposits.

SOURCE MATERIAL

Some information on production and developments was supplied by the U.S. Embassy in Ougadougou, however, English and French publications provided most of that contained in this country review.

PRODUCTION

Recorded production of metals and minerals in Upper Volta consists only of gold. The 1959 gold output was 4,019 troy ounces, declining in 1960 to 1,161 ounces. Production in these years was largely the result of development at the Poura mine; output increased to 15,497 ounces in 1961. With additional working faces exposed and the recovery facilities functioning normally, production was expanded to 39,770 ounces in 1962 and an estimated 45,000 ounces in 1963. Data on production of building materials are not available; indications are that except for cement and lime, Upper Volta is self-sufficient in building materials.

TRADE

Little data are available on the metals and minerals trade of Upper Volta. Exports apparently were limited to gold and in 1962 reportedly accounted for 20 percent of the total on basis of value. All exports were valued at CFAF1,945 million by published statistics, gold exports of 45,364 ounces are indicated; the value of these at the world price of CFAF8,575 per ounce was CFAF389 million.[4] Small quantities of metals and minerals of nondomestic origin may have been exported to neighboring countries, and some scrap metals have been exported to Europe. Principal 1962 imports of metals and minerals

[3] Mining Journal (London). Annual Review, 1964. June 1964, p. 203.

[4] Exports of all gold produced in 1962 would have been worth CFAF341 million at the world price, 17.5 percent of all exports. Thus indications are that 1962 exports may have included 5,594 ounces from earlier production or that the reported 20 percent was an approximation.

had a total value of CFAF764 million, 9 percent of all imports; in 1961, the total was CFAF690 million (exclusive of nonferrous metal imports which were CFAF34 million in 1962), 10 percent of all imports.

Destinations of gold exports are not indicated by statistics nor are they reported in the literature; a part of the gold is recovered from the treatment of amalgamation rejects in Sweden. Neither are data available on the sources of the metal and mineral imports; as France supplied 52 percent of all 1962 imports, they probably came mainly from that country. The European Economic Community, of which Upper Volta is an associate member, supplied an aggregate 57 percent of the total and the United States supplied 4 percent.

The 1963 gold exports had an estimated value of CFAF386 million, assuming that the quantity equaled the production. Based on total imports through November, the 1963 imports of metals and minerals were valued at approximately CFAF805 million, if they were again 9 percent of the total.

TABLE 1.—Principal imports of metals and minerals [1]

Commodity [2]	Quantity (metric tons)		Value (millions of CFAF)	
	1961	1962	1961	1962
Metals:				
Iron and steel [3]	6,881	6,149	262	260
Nonferrous	(4)	[5] 153	(4)	[5] 34
Nonmetals:				
Cement	22,009½	27,106	92	110
Salt	5,251	7,432	37	71
Mineral fuels:				
Petroleum refinery products [6]	31,232	29,734	[7] 299	[8] 289

[1] Data on source are not available; France was undoubtedly the leading supplier.
[2] Data on other items imported are not available, nor is a further breakdown possible.
[3] Mostly rolled products but may include small quantities of pig iron.
[4] Data not available.
[5] Includes: Aluminum 44 tons; copper 102 tons; and lead 7 tons.
[6] Includes 5,755 tons of kerosine in 1961 and 4,997 tons in 1962; and, 182 tons of liquefied petroleum gas in 1961 and 189 tons in 1962.
[7] Includes CFAF128 million of gasoline and CFAF43 million of distillate fuel oil.
[8] Includes CFAF104 million of gasoline and CFAF39 million of distillate fuel oil.

COMMODITY REVIEW

METALS [5]

Gold.—Upper Volta's gold production came entirely from the Poura mine, 175 kilometers southwest of Ouagadougou, and operated by Société des Mines de Poura, owned jointly by a private French company and the French Government's Bureau des Recherches Géologiques et Minières (BRGM). The deposit consists of two veins in greenstone, only one of which was worked in 1963, when ore production came mainly from the 147- and 207-meter levels and hoisting was through two shafts. The lower level had a drift extending about 1,500 meters. Sinking of a shaft to the 327-meter level was completed, and exploration here revealed vein continuation. In 1962 about 81 percent of the gold recovery was by amalgamation in the plant at

[5] Mining Journal (London). V. 261, No. 6683, Sept. 20, 1963, p. 257. Mines et Metallurgie (Paris). No. 3,582, Mar. 1964, p. 131.

the mine and the remainder came from amalgamation rejects treated in Sweden. Average yield from all ore treated in that year was 0.57 ounce per ton. The 1963 target was 58,240 ounces at an average grade of 0.45 ounce per ton, but indications are that actual output was about 23 percent lower. In mid-1962, reserves were estimated to total 416,000 tons of exploitable ore, with another 152,000 tons in a neighboring outcrop which, for technical reasons, must await the completion of the other working. Ore extraction in 1963 apparently was at the rate of about 11,000 tons per month. Exploration indicated that reserves can be held at about the existing figure, but no increase is foreseen. Some surface prospecting was done in 1962, but without success. Drilling was scheduled to be undertaken near Poura in 1963 if the equipment on order arrived in time.

Manganese.—No progress was reported on the development of the 52-percent manganese ore deposit at Tambaou, near Markoye close to the Niger frontier. Although reserves total at least 5 million tons and are placed at 10 million by some sources, their richness does not overcome the disadvantage of the remoteness of their location, almost 1,000 kilometers from the sea. In 1963 the BRGM investigated manganese occurrences in the Tiere, Soukoura, and Kaya-Koto regions.

NONMETALS

Diamond.—The Upper Volta Government awarded the West African Selection Trust, Ltd., a British firm, the right to explore for diamond in 240,000 of Upper Volta's 274,000 square kilometers. The right was granted for 1 year beginning January 1, 1964, and can be renewed for 2 additional years. A subsidiary, Selection Trust Exploration Ltd., will do the actual exploration, and the commitment calls for annual expenditures of about CFAF15 million. Indications of diamond have been found in the region near the Ghanaian border.

Granite.—In October, a 35-ton load of eight granite blocks from Kombissiri, 48 kilometers southwest of Ouagadougou, was sent to Carrare, Italy, for testing. The tests are expected to confirm University of Pisa reports that Upper Volta's granite is among the best in the world. The deposits are reported to be practically inexhaustible and to come in a rich range of 10 different colors. Quarrying on a commercial scale was expected to start in early 1964 after the importation of special equipment.[6]

MINERAL FUELS

Petroleum.—Because of unfavorable geological conditions, Upper Volta has remained one of the few regions of Africa where oil exploration has not been carried out. Imports of petroleum refinery products continued to come in by rail from Abidjan, Ivory Coast, from oversea suppliers. Upon the completion of the refinery at Abidjan, scheduled for 1965, this facility will provide most of Upper Volta's requirement. Imports through November 1963 were at the annual rate of 31,200 tons, roughly the same as the 1961 imports and 5 percent above those of 1962.

[6] Africa Report (Washington). V. 8, No. 11, December 1963, p. 20.

The Mineral Industry of Bahrain

By F. L. Klinger[1]

CRUDE OIL refining continued to be the foremost industry of Bahrain in 1963. This island, the largest of a group 30 kilometers off the Saudi Arabian coast, is the site of the first petroleum discovery in the Persian Gulf and in the Arabian peninsular region. The island's only oilfield was discovered in 1932; exports of crude began in 1934 and the refinery was built in 1936. Although its crude oil has been less than 1 percent of annual Middle East output in recent years, Bahrain has been an important refining center for many years, processing a substantial portion of Saudi Arabian petroleum as well as all local production. The Bahrain refinery annually accounts for 17 percent of the petroleum products produced in the Middle East and 25 percent of the exports.

Bahrain's mineral resources consist of oil, gas, and basic construction materials. Petroleum production and refining are the important mineral industries and contribute most of the national income by payments for taxes, wages, and local services including construction and material supply. The petroleum industry has supported a large share of local business and extensive indirect employment, and its early establishment also helped Bahrain to strengthen its position as a trading center in the Persian Gulf. The country's entrepôt trade produces about 20 percent of Government revenue, and Bahrain is somewhat less dependent on the petroleum industry than are the neighboring States to the west.

In 1963 the petroleum industry contributed about US$32 million to the Bahrain economy. Revenue from petroleum accounts for about 80 percent of all Government revenue and most foreign exchange earnings, and is mainly derived from the Bahrain Petroleum Co., Ltd. (Bapco), owned jointly by Texaco Inc. and the Standard Oil Co. of California. The Government levies an income tax of 50 percent on the net profits of Bapco derived from the sale of products refined from crude oil produced in Bahrain or imported for processing in Bahrain. Bapco is the sole petroleum concessionaire and employed 5,360 Bahraini personnel in 1963.

PRODUCTION

Petroleum production from Bahrain has averaged about 45,000 barrels per day for the past 5 years. In December 1963, Bapco announced an increase in production of 1,000 barrels per day, and

[1] Foreign mineral specialist, Division of International Activities.

additional increases were expected in 1964. The increase in productivity resulted from detailed physical studies of the Bahrain field, new techniques of well stimulation, and the completion of additional wells. All petroleum production was processed at the Bahrain refinery.

Refinery throughput in 1963 averaged more than 229,000 barrels per day. This was 6 percent less than in 1962 but was still the second highest annual output on record. The feed consisted of approximately 79 percent of Saudi Arabian crude, 20 percent Bahrain crude, and 1 percent of other stocks. Principal refinery products, in percent of total production, were residual fuel oil (42), diesel oil (25), gasoline and naphtha (20), and kerosine and jet fuel (12). The gross value of refinery production in 1963 was estimated at US$217 million (based on price quotations at Ras Tanura).

TABLE 1.—Production of crude oil and petroleum products

(Thousand 42-gallon barrels)

Commodity	1959	1960	1961	1962	1963
Crude petroleum	16,473	16,500	16,444	16,446	16,503
Refinery products:					
Gasoline	14,046	14,329	13,577	16,815	16,361
Jet fuel	2,658	2,876	4,715	5,972	5,138
Kerosine	6,019	6,445	4,920	4,532	4,228
Distillate fuel oil	15,777	16,870	18,412	20,410	19,804
Residual fuel oil	26,082	29,620	31,483	34,827	33,362
Other	631	1,266	1,150	379	187
Total refinery products	65,213	71,406	74,257	82,935	79,080
Refinery fuel and loss	3,931	4,725	5,632	5,745	5,608
Total refinery throughput	69,144	76,131	79,889	88,680	84,688

TRADE

Petroleum.—Bahrain normally exports only refinery products. Exports in 1963 totaled 78.95 million barrels including 5 million barrels of bunker fuel. An additional 390,000 barrels of petroleum products were marketed locally.

Bahrain imported more than 66 million barrels of crude petroleum from Saudi Arabia in 1963. Most of this crude entered the country from Dhahran through two 12-inch, 54-kilometer pipelines, and additional shipments were made by tanker. The pipelines have a combined throughput capacity of about 200,000 barrels per day.

Other.—Limited information suggests that the value of Bahrain's trade exclusive of petroleum in 1963 was not appreciably changed from 1960–61 levels. The value of imports was estimated at US$60 million, and reexports at US$21 million. The value of mineral and metal trade probably did not exceed 5 percent of either figure. Statistics for 1957–61 indicate annual imports of about 50,000 tons of cement and 1,200 tons of metal and nonmetal manufactures. About 50 percent of reexports are destined for Saudi Arabia, with the remainder going to Qatar, the Trucial Coast, and Iran. Large quantities of gold bullion are occasionally imported, as in 1957 when imported gold was valued at more than US$10 million.

TABLE 2.—Imports, exports and bunker deliveries of crude oil and petroleum refinery products[1]

(Thousand 42-gallon barrels)

Commodity	1961	1962	1963
Imports:			
Crude oil	63,406	71,934	66,511
Petroleum refinery products:			
Gasoline	552	352	893
Lubricants and other	10	6	8
Exports:			
Petroleum refinery products:			
Gasoline	13,644	16,177	16,850
Jet fuel	4,741	5,468	5,124
Kerosine	4,833	4,518	4,244
Distillate fuel oil	18,273	19,574	18,954
Residual fuel oil	27,210	29,944	28,525
Other	821	799	177
Total	69,522	76,480	73,874
Bunkers:			
Distillate fuel oil	615	649	394
Residual fuel oil	3,280	4,798	4,687

[1] Most if not all crude oil imports are from Saudi Arabia. Data on origin of other imports, and destinations of exports, are not available.

COMMODITY REVIEW

MINERAL FUELS

Petroleum.—All crude oil produced in Bahrain has come from a single onshore field in the southern part of the island. The major portion of the field's production is 33° API gravity oil from Cretaceous formations at depths of 2,000 to 2,600 feet, although there is some production from deeper zones. Petroleum reserves at the end of 1962 were estimated at 240 million barrels.

Considerable work was done by Bapco in 1963 to develop additional petroleum reserves and to increase the rate of production. A program of detailed geophysical and stratigraphic studies, intended to suggest new drilling locations, was continuing at the end of the year. Four 1,500-foot wells were drilled near Sitra for indications of oil-bearing structures but yielded negative results. Three exploration wells were drilled, two of which were completed as commercial producers. The third exploration well, drilled to a depth of 5,858 feet to test productivity of the Fadhili zone, found oil but not in commercial amounts. Six development wells were completed, five as triple-zone producers and one as a dual-zone well. By the end of the year the number of oil-producing wells was 170.

Offshore drilling northwest of Bahrain by the Arabian American Oil Co. in 1963 discovered oil at Abu Safah, located in an area covered by a profit-sharing agreement between Bahrain and Saudi Arabia, and delineation drilling began in September. Previously, Bapco had drilled a 13,993-foot dry well in 1961 on Fasht al-Jarim north of Bahrain, and another dry well southeast of Bahrain in 1962. The latter well was located on Hawar Island and was abandoned at a depth of 8,241 feet.

At the refinery, several large process installations were modified during 1963 to increase production of high-octane gasoline, diesel oil,

and kerosine. Shipping storage capacity was increased by 230,000 barrels.

Shipping facilities completed during the year included a new sea-line manifold, electronic equipment for introducing additives to finished products, and a coastal tanker wharf for bunkering vessels up to 1,000 deadweight tons.

Natural Gas.—Natural gas was used for pressure-maintenance in the Bahrain field, and as fuel for the Government-owned power station. Field injection is normally accomplished through six injection wells, supplied by five production wells. In 1963 gas injection into the main limestone reservoir was suspended for a trial period, although injection was continued into the siltstone reservoir, and only one injection well, supplied by one production well, was in service in 1963.

The capacity of the dehydrating plant for gas supplied to the power station was expanded to 20 million cubic feet daily in 1963.

The Mineral Industry of the Republic of Cyprus

By Anton W. T. Wei [1]

PRODUCTION of pyrites, largely as a coproduct with copper, continued to be the Republic of Cyprus' only mineral output of world significance. In terms of sulfur content, pyrite output represented over 5 percent of the world's total, and the country ranked sixth among its leading producers of sulfur in pyrites. Domestically, copper remained the most important mineral produced. The Republic's mineral industry as a whole has been important to the country's economy. In 1963 mining and quarrying contributed about 6 percent to the country's gross domestic product of approximately US$267 million.

The Forest Oil Corp., which had been granted an exploration license by the Cyprus Government in 1962, continued seismic work during 1963. Actual drilling, with anticipated depth of about 1,600 meters, was not scheduled until 1964. Under the provisions of the license, which covers more than three-quarters of the island area, Forest Oil was to spend US$4.9 million for exploration over 15 years. The license also provides for exploitation rights for 40 years, renewable for an additional 20 years, with government participation on an equal basis, if oil is found in commerical quantities. The company had carried out geophysical work on the island during 1957–58 under licenses granted by the colonial government.

SOURCE MATERIAL

Information on mineral developments of the Republic of Cyprus was obtained from foreign service dispatches of the U.S. Embassy in Nicosia and the Annual Report of the Cyprus Mines Corp. Background information on the mineral industry was derived from annual reports of the Senior Mines Officer of the Cyprus Government. The country's trade data were obtained from the official publication, "Statistics on Imports & Exports," issued by the Department of Statistics and Research, Ministry of Finance.

PRODUCTION

Overall mineral production of Cyprus in 1963 rose slightly over the 1962 level and was valued at approximately US$25 million. Based

[1] Physical scientist, Division of International Activities.

on preliminary information, output of copper concentrates, cupreous pyrite, and cement copper, increased; output of iron pyrite decreased. The internal crisis which began in late December had little, if any, effect on the year's mineral production. Lesser mineral commodities produced on the island were cement, gypsum, chromite, and mineral pigments. Again, Cyprus smelted no metals and produced no mineral fuels.

The Cyprus Mines of the Cyprus Mines Corp., a U.S.-owned company with home offices in Los Angeles, Calif., continued to be the most important mineral producer on the island in 1963. Its Mavrovouni and Skouriotissa operations accounted for over 70 percent of the year's total mine-copper output and about 69 percent of the pyrite output.

TABLE 1.—Production of metals and minerals

(Metric tons)

Commodity	1959	1960	1961	1962	1963 [1]
Metals:					
Chromite	13,642	16,233	17,981	6,538	5,117
Copper [2]	35,700	32,200	25,800	22,900	23,932
Nonmetals:					
Asbestos	13,085	21,152	14,703	20,313	18,108
Cement	83,070	86,430	96,100	96,720	[3] 96,000
Gypsum:					
Crude	200,672	112,909	104,480	104,401	[3] 100,000
Calcined	71,242	9,190	25,000	30,949	([4])
Mineral pigments:					
Terre verte	4	9	4	10	[3] 10
Umber	4,554	4,250	4,320	6,727	[3] 6,000
Yellow ocher	283	297	303	610	[3] 500
Pyrites (sulfur content)	424,250	445,900	402,000	394,700	444,000
Salt	5,437	([4])	2,088	[5] 5,651	6,958

[1] Preliminary figures.
[2] Estimated content of concentrates, cement copper, and cupreous pyrite; excludes content in iron pyrites which may or may not be recovered.
[3] Estimate.
[4] Data not available.
[5] Final figure; supersedes figure given in commodity chapter, volume I.

TRADE

The contribution of the mineral industry of Cyprus to the country's balance of payments may have been of greater importance than its contribution to the gross domestic product. Despite a decline from the 1962 level, mineral exports in 1963, reportedly valued at about US$21 million, represented 38 percent of the total domestic exports. Statistics on imports for 1963 are not yet available, but mineral imports in 1962 totaled roughly US$18 million, more than 90 percent represented by iron and steel and petroleum products.

TABLE 2.—Exports of metals and minerals

(Metric tons)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Chromite	19,122	9,679	West Germany 4,074; Austria 3,048.
Copper ore and concentrate	103,215	94,380	West Germany 69,052; Spain 23,296.
Cement copper	1,759	1,667	All to Spain.
Cupreous pyrites	140,700	107,317	Netherlands 67,755; Italy 39,562.
Nonmetals:			
Asbestos, crude	16,509	14,102	Denmark 4,699; Sweden 3,447.
Gypsum:			
Crude	24,829	35,662	Lebanon 30,074; New Zealand 5,588.
Calcined	1,859	1,950	Lebanon 1,515; Sudan 276.
Lime	122	----------	
Mineral pigments:			
Ocher	303	533	United States 310; United Kingdom 149.
Terre verte	4	6	United States 3; United Kingdom 3.
Umber:			
Crude	315	472	United States 232; United Kingdom 209.
Burnt	4,005	3,945	United States 2,132; United Kingdom 1,424.
Pyrites	835,460	802,700	Italy 279,915; United Kingdom 200,617.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum and alloys	251	184	United Kingdom 61; Greece 53.
Copper, including brass	124	99	United Kingdom 77; Italy 11.
Gold, troy ounces	5,918	7,182	United Kingdom 7,176.
Iron and steel:			
Pig iron	----------	50	United Kingdom 40; Belgium 10.
Ferroalloys	2	10	All from West Germany.
Ingots, blooms, billets, castings, forgings.	1,225	858	United Kingdom 266; Italy 264.
Rolled products	37,348	42,933	France 12,550; Belgium 12,142.
Lead and alloys	127	167	United Kingdom 103; Belgium 24.
Nickel and alloys	4	5	West Germany 4.
Tin and alloys	498	461	United Kingdom 447.
Zinc and alloys	40	69	Australia 41; Belgium 18.
Nonmetals:			
Building stone:			
Unworked, value, pounds	7,744	7,253	Italy 6,074; Yugoslavia 528.
Worked, do	20,749	10,578	Italy 6,845; Greece 2,629.
Cement	43,993	62,467	U.S.S.R. 19,835; Lebanon 18,808.
Clays	115	88	United Kingdom 43; Italy 39.
Fertilizers:			
Nitrogenous	32,590	31,590	Austria 9,831; Italy 8,782.
Phosphatic	38,715	33,924	Netherlands 16,331; Portugal 7,006.
Potassic	9,894	16,421	Portugal 11,123; Italy 3,690.
Pumice	846	822	Greece 821.
Salt	266	215	United Kingdom 200.
Sulfur refined	1,608	1,734	Italy 1,700.
Other	2	9	(1).
Mineral fuels:			
Coal	1	83	West Germany 79.
Coke	325	1,047	United Kingdom 539; West Germany 508.
Petroleum refinery products:			
Motor gasoline, 42-gallon barrels	402,279	431,413	Italy 158,977; France 106,874.
Aviation gasoline, do	42,485	26,591	Netherlands Antilles 22,952.
Kerosine, do	170,633	197,111	Italy 82,398; Netherlands Antilles 70,653.
Jet fuel, do	147,869	28,367	Aden 21,474; France 6,746.
White spirits and solvents, do	1,669	1,980	United Kingdom 1,025; Venezuela 593.
Gas oil, do	419,268	421,508	Italy 191,145; France 95,408.
Fuel oils, including diesel, do	618,253	666,026	Turkey 296,779; Italy 136,981.
LP gas	2,423	3,110	Italy 1,279; Greece 908.
Lubricating oil and grease	4,057	3,618	United Kingdom 2,513; United States 701.
Other, including pitch, wax, and asphalt.	11,384	14,070	Spain 9,041; Israel 2,209.

(1)Data not available.

COMMODITY REVIEW

METALS

Chromite.—The mining operations of the Cyprus Chrome Co., Ltd., the only chromite producer on Cyprus, remained at a standstill throughout 1963. Presumably the reported chromite output for the year came from the milling of old tailings. Disruption of mining activities was due to a strike by the workers which began in July 1962; normal production was not resumed at the end of 1963 because of low world prices and the lack of sufficient export markets for the mine to operate economically.

Copper and Pyrite.—Despite the near depletion of its ore reserves, the Mavrovouni mine of Cyprus Mines increased its output slightly in 1963 and remained by far the largest copper and pyrite producer on the island. In the meantime, the reactivation of Skouriotissa as an open-pit operation by Cyprus Mines, which began in early 1962, continued throughout 1963. Modification of the flotation concentrator was completed, and construction of a new plant for the recovery of copper and pyrites from old tailings was reported to be 80 percent completed at yearend. During the later months of the year, the eastern section of the Skouriotissa ore deposit was uncovered and 127,000 tons of ore was mined. Skouriotissa was slated soon to replace Mavrovouni as the leading copper and pyrite producer on Cyprus. With the open pit mining of the small Apliki deposit at a later date, Cyprus Mines plans to maintain its current level of output into the 1970's.

NONMETALS

Gypsum.—The United Gypsum, Ltd., with its operations at Kalavasos, remained the largest gypsum producer on Cyprus. However, preliminary information indicates that, as in the past, the "unlicensed quarries" produced the majort part of the island's total 1963 gypsum output.

The Mineral Industry of Iran

By L. Nahai[1]

THE oil industry remained the dominant sector of Iranian mineral industry in 1963; it also continued to contribute significantly to the country's overall economy, providing by far the greatest share of Iranian exports in terms of value and employing more of the country's industrial labor than any other segment of industry. Revenue payments of US$377.6 million and purchases of local currency totaling US$84.7 million by the oil companies in 1963 was equivalent to 83 percent of the Iranian foreign exchange receipts (excluding foreign loans and grants) in the Iranian calendar year ending March 20, 1963. The total revenue payments and local purchases were 18.5 percent more than in the previous year. The oil industry was estimated to have contributed 11 to 12 percent of the gross national product. The high rate of growth of the industry provides borrowing capacity necessary for the rapid expansion of public investment.

Other segments of the mineral industry, although not comparable to petroleum, supplied practically all the country's requirements of building raw materials, as well as modest tonnages of metalliferous ores, principaly lead, zinc, and chromium, for export.

The value of minerals other than petroleum produced in Iran in 1962 (the last year for which data are available) has been estimated as about US$5 million. However, this figure excludes the very large tonnage of clays, limestone, and other stones produced throughout the country for making cement, lime, brick, and building stone.

The Iranian Oil Exploration & Producing Co. and the Iranian Oil Refining Co. (together referred to as the Consortium) employed 18,600 workers in 1963, and the National Iranian Oil Co. (NIOC) employed 12,347 to administer nonbasic operations in Abadan and in the oilfields of the Consortium. NIOC's own production and refinery employees, estimated at 10,000, increased the total for the oil industry to about 40,000, exclusive of distribution and the several hundred employed in the offshore operations of Société Iran-Italienne des Pétroles (SIRIP) and Iranian Pan American Oil Co. (IPAC). By comparison, the total industrial labor force of the country in 1963 was estimated at 200,000. Reliable information on employment in metalliferous mines, clay pits, quarries, and cement plants is not available but probably does not exceed a few thousand.

Iran continued as an important world oil supplier, furnishing 10 percent of the crude and 5 percent of the refinery products of total 1962 world exports and re-exports. Preliminary information indicates that corresponding 1963 figures were 10.8 percent for crude and 4.8 percent for refinery products.[2]

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[1] Near East-south Asia specialist, Division of International Activities.

[2] In this calculation, exports to U.S.S.R., Eastern Europe, and mainland China have been assumed at same level as those in 1962.

Except for natural gas, much of which is flared, other mineral commodities produced in Iran were not significant in total world supplies.

Successful exploration during the year increased oil reserves. Production unit capacity of the southern oilfields increased, and work started on a second 40-kilometer 30-inch submarine pipeline from Ganaveh on the mainland to Kharg Island.

The program of modernization and streamlining of operations in Abadan continued. Iranian authorities were concerned with the further utilization of natural gas produced with crude and approached the Instituit Français de Pétrole regarding preparation of a feasibility study for utilization of the natural gas including production of petrochemicals.

On April 1, 1963, the NIOC announced that parts of Iranian Petroleum District 1, including parts of Iranian territorial waters and continental shelf in the Persian Gulf, would be declared open effective on or about July 1, 1964. Two areas were described, each extending to the median line of the Persian Gulf. These did not include territorial waters 3 miles from low tide on the mainland nor the island of Lavan and its surrounding 3-mile limit; these areas lie within the Consortium Agreement area.

By the end of July of 1963, the deadline set by NIOC, 8 individual companies and 5 groups of companies totaling 31 companies of American, French, German, Dutch, and Italian ownership had formally declared their interest in the area and were accepted to participate in financing the marine seismic survey of the area. The cost of the survey was to be shared equally by the 13 participating companies and company groups. NIOC concluded an agreement with the Western Geophysical Co. of United States to perform marine reflection seismic surveys in 45,000 square kilometers comprising the areas involved. The survey was started on September 15, and was still in progress at yearend. Areas to be put up for bidding may be 8,000, 4,500, or 3,250 square kilometers, depending on the degree of NIOC participation or nonparticipation.

Diamond drilling of three promising lead-zinc mines, a project of the U.S. Agency for International Development, found high-grade ore reserves and interested foreign capital in the exploration and development of these properties. Two foreign firms were reportedly negotiating with the Iranian mine owners for collaboration and investment.

Favorable results of this exploration drilling led to the initiation of an assistance program for private mines as a part of the technical assistance program for private industry administered by the Ministry of Economics. The Mines Section of the Ministry plans to expand aid in exploration, surveying, mapping, sampling, and appraising of privately owned mines.

A decree of September 8, 1963, established subsidies for export of Iranian ore: 20 percent for iron, lead, manganese, and chromite and 10 percent for zinc ore to be calculated on the basis of the f.o.b. price.

The Geological Survey of Iran, established in February 1962 as a United Nations Special Fund project, continued its activities during the year, but accomplishments to date have not been reported.

PRODUCTION

The petroleum industry increased its crude output in 1963, continuing a trend which started in 1955 with the Consortium's operation of the oilfields of southwest Iran. Refinery throughput by the Consortium was about the same as in 1962; 84 percent of the throughput was for export by the Trading Companies as products and 16 percent for the account of NIOC for domestic consumption. There was a small increase in output of refinery products; NIOC increased its gross make of refined products (exclusive of Masjed-e Soleyman topping plant) to 2,294,338 [3] barrels. An important factor in this increase was the contribution of 938,182 barrels from the Alborz topping plant.

Production data for other minerals are not available. Chromite output was adversely influenced by smaller exports, but higher world prices may have stimulated production of lead and zinc. Owing to a business recession, building activities were at a reduced level, and this may have adversely affected output of building raw materials. Stocks of cement at yearend were reportedly 150,000 tons which must have had a depressing effect on the cement industry.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Chromite	66,000	68,000	74,000	90,000	(1)
Copper ore (3 to 4 percent copper)	12,000	12,000	5,000	(1)	(1)
Iron ore—thousand tons	58	58	42	8	----------
Lead ore, contained metal [2]	15,000	15,000	15,000	10,000	10,000
Lead, smelter	[2] 900	1,160	1,304	400	(1)
Manganese ore	2,600	7,700	2,100	1,000	[2] 1,000
Zinc, contained metal	6,750	8,500	13,500	7,500	(1)
Nonmetals:					
Barite	1,727	13,000	19,000	15,000	[2] 15,000
Cement, hydraulic—thousand tons	579	797	745	[2] 745	[2] 745
Ocher	7,500	9,800	8,330	(1)	(1)
Salt—thousand tons	80	130	145	145	[2] 145
Sulfur [2]	19,000	20,000	20,000	15,000	20,000
Mineral fuels:					
Coal—thousand tons	237	230	200	200	[2] 200
Coke—do	21	20	20	[2] 20	[2] 20
Petroleum:					
Crude—thousand 42-gallon barrels	338,758	385,749	431,654	481,903	538,098
Products—do	[3] 109,898	[3] 120,414	[3] 106,886	[3] 123,694	[4] 125,396
Natural gas [5]—million cubic feet	236,120	264,354	296,646	324,281	364,928

[1] Data not available.
[2] Estimate.
[3] Excludes products from Masjed-e Soleyman and Naft-e Shah topping plants which may have been shipped directly without further refining.
[4] Total of gross makes of Abadan refinery, Naft-e Shah and Alborz topping plants.
[5] Total production, including that flared without use and that used expansively to drive turbines and then flared.

TRADE

Crude oil export established a new record in 1963 and was 15.5 percent above that of 1962. Export of products increased by 2.3 percent. Crude accounted for 79 percent by weight of total petroleum exports,

[3] Excludes product shipped from the Naft-e Shah topping plant which may have been shipped without further processing.

compared with 75 percent in 1962. This rise continued a long-term trend of more crude exports to meet the demands of foreign refineries as well as a steady rise in Iranian consumption of petroleum products refined in the country, leaving proportionately less crude for export.

NIOC did not export any royalty crude (12.5 percent of the total) to which it is entitled under the oil agreement with the Consortium but instead elected to accept value at posted prices.

Based on preliminary tanker destination reports, the Consortium reported that its crude shipments during 1963 went principally to Europe (46 percent), followed by Japan (14 percent), Southeast Asia (12 percent), North America (12 percent), Africa (10 percent), and Australia (4 percent). Refined products were shipped to Africa (36 percent), Southeast Asia (27 percent), the Persian Gulf mainly as bunkers (20 percent), Japan (7 percent), Australia (5 percent), and Europe (5 percent).

The NIOC exported about 28,000 tons of products to Afghanistan. The products, consisting mainly of kerosine and gas oil, were trucked from Meshed where the NIOC pipeline terminates.

TABLE 2.—Petroleum and petroleum products exports

(Thousand 42-gallon barrels)

	1959	1960	1961	1962	1963
Crude:					
Consortium	212,657	246,285	305,181	338,373	388,404
SIRIP			1,098	2,283	5,111
IPAC			163	94	45
Total	212,657	246,285	306,442	340,750	393,560
Products:					
Delivery to trading companies	90,249	99,817	83,809	101,246	102,655
Exports	77,270	85,483	69,366	82,559	84,302
Bunkers	5,388	14,134	14,453	16,786	18,287
Total, exports and bunkers	82,658	99,617	83,819	99,345	102,589

Mineral exports other than petroleum in the Iranian calendar year ending March 20, 1962, totaled US$4,902,000. In the first 9 months of 1963 exports amounted to approximately 116,500 tons valued at US $2.8 million. Breakdown of the exports for 1963 is not available.

Iran's mineral and metal imports in 1961–62 consisted primarily of iron and steel, some nonferrous metals and industrial minerals, cement, and fertilizer raw materials with a total value of US$80.6 million, or 12.8 percent of all imports of the country. Iron and steel products were the largest group with a value of US$54.7 million followed by nonferrous metals US$6.5 million and industrial and other nonmetallic minerals accounting for the remainder.

TABLE 3.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960–61 [1]	1961–62 [1]	Principal destinations, 1961–62 [1]
Metals:			
Chromite	37,359	67,669	France 17,359; Netherlands 15,195; Italy 12,607; Spain 6,000; Japan 4,500; U.S.S.R. 4,058.
Iron ore	33,260	25,549	Czechoslovakia 17,127; Netherlands 2,570; West Germany 1,000; Belgium 852.
Iron and steel scrap	7,542	6,224	All to Japan.
Lead:			
Ore	12,495	21,274	U.S.S.R. 17,838; United Kingdom 2,700; Belgium 736.
Pig	692	991	All to U.S.S.R.
Magnesium ore	2,350	1,270	Italy 1,250; Iraq 20.
Zinc ore	15,817	21,559	United Kingdom 10,020; Netherlands 4,075; U.S.S.R. 3,390; Belgium 3,065; Japan 1,009.
Other metals and ores, not especially classified.	19,813	1,934	Italy 1,750; U.S.S.R. 180.
Nonmetals:			
Abrasives	5	1	All to Iraq.
Building stone, including crushed stone	6,323	6,244	Kuwait 4,715; Italy 750; Netherlands 500; Oman 215.
Cement	-------	531	Kuwait 500; Afghanistan 31.
Clays	36	63	Kuwait 35; Iraq 27.
Gypsum	4,476	2,732	Kuwait 2,430; Oman 276.
Ocher, chalk and other earth colors	6,217	7,275	United Kingdom 4,450; France 2,200; India 476; Kuwait 57.
Salt	3,282	1,774	Oman 827; Kuwait 802.
Sand (including ground quartz)	142	743	Kuwait 707; Oman 20; Qatar 12.
Sulfur	9	72	Kuwait 59; Oman 13.
Other	846	170	U.S.S.R. 60; Iraq 28; Kuwait 20; India 11; Oman 29.
Mineral fuels:			
Coal and lignite	387	268	Iraq 179; Kuwait 89.
Petroleum:			
Crude—thousand 42-gallon barrels	240,581	310,118	United Kingdom 68,884; West Germany 42,102; India 26,959; Australia 22,664; Japan 21,318; Republic of South Africa 19,954.
Refined products:			
Gasoline—do	43,315	20,195	East Africa 5,983; India 2,986; Republic of South Africa 2,301; Australia 1,468; United Kingdom 1,366; Pakistan 901.
Kerosine—do	9,987	6,733	India 2,802; East Africa 1,118; Pakistan 668; Ceylon 550.
Gas oil—do	7,786	8,200	East Africa 1,824; India 1,302; United Kingdom 922; Pakistan 770; Ceylon 438.
Diesel oil—do	6,547	4,371	East Africa 686; Aden 661; Pakistan 533; India 350; United Kingdom 323; Japan 294.
Fuel oil—do	46,617	43,508	United Kingdom 6,989; East Africa 5,700; Aden 5,264; Japan 3,871; Pakistan 3,776; India 2,249.
Total	114,252	83,007	East Africa 15,311; United Kingdom 9,774; India 9,689; Pakistan 6,648; Aden 6,128; Republic of South Africa 4,312; Japan 4,228; Ceylon 3,406; Australia 2,538.

[1] Iranian calendar year ends March 20 of subsequent year.

TABLE 4.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960–61 [1]	1961–62 [1]	Principal sources, 1961–62 [1]
Metals:			
Aluminum:			
Ingots	1,556	1,727	Canada 746; United States 516; Austria 195.
Rolled and other [2]	1,039	1,138	Japan 331; United Kingdom 270; West Germany 132; Netherlands 71; United States 40.
Antimony	7	3	All from West Germany.
Copper:			
Ingots	281	362	United Kingdom 346; West Germany 14.
Rolled and other [2]	3,402	3,736	West Germany 821; Yugoslavia 723; United Kingdom 573; Italy 389; Iraq 306.
Gold, troy ounces	407,446	417,059	Lebanon 308,454; United Kingdom 77,130; Kuwait 23,084; Switzerland 7,202.
Iron and steel:			
Cast iron including ferroalloys	5,032	736	U.S.S.R. 677; West Germany 13; United Kingdom 3.
Scrap iron	4,195	2,628	Kuwait 697; United Kingdom 546; Oman 500; Qatar 387; United States 238; West Germany 145.
Ingots	222	354	Austria 182; West Germany 107; United Kingdom 42; Belgium 20.
Rolled steel	410,112	293,959	West Germany 135,018; Belgium 37,566; United Kingdom 33,800; France 19,148; United States 14,427; Japan 14,316; Netherlands 11,224; U.S.S.R. 9,449; Italy 7,336.
Lead:			
Ingots	22	44	West Germany 31; United Kingdom 11; Netherlands 2.
Rolled and other [2]	665	34	United Kingdom 23; France 6; United States 4.
Nickel	362	395	Italy 309; West Germany 65; United States 20.
Platinum, troy ounces	450	900	Switzerland 386; United Kingdom 354.
Silver, do	208,015	100,150	Lebanon 91,951; Kuwait 6,752.
Tin:			
Ingots	417	328	Malaya 211; U.S.S.R. 80; Singapore 23.
Rolled and other [2]	112	85	United Kingdom 48; Malaya 15; West Germany 15; Singapore 2; Netherlands 3.
Zinc	146	154	West Germany 58; U.S.S.R. 50.
Other metals and alloys not otherwise specified.	32	111	United Kingdom 104; Italy 6; Japan 1.
Nonmetals:			
Abrasives	164	19	West Germany 15.
Asbestos	1,246	804	Canada 549; United States 93; Republic of South Africa 91.
Barite and witherite	5,606	211	United Kingdom 201.
Building stone including crushed stone	999	547	United Kingdom 536; West Germany 9.
Cement, thousand tons	40	45	United Kingdom 16; U.S.S.R. 6; Iraq 6; West Germany 4; Japan 3; Kuwait 3; Denmark 2.
Clays	8,737	5,364	Greece 2,032; France 1,822; United Kingdom 678.
Fertilizers	15,352	45,752	Italy 21,464; West Germany 14,706; Netherlands 2,516.
Graphite	12	15	West Germany 10; Yugoslavia 5.
Mica	496	714	United Kingdom 291; West Germany 260; Yugoslavia 50.
Salt	100	100	U.S.S.R. 63; United Kingdom 32.
Sulfur	3,543	5,230	France 3,699; Netherlands 1,517.
Talc	10	21	India 12; Norway 6; United Kingdom 3.
Other	2,243	6,845	Italy 4,594; West Germany 569; United States 525; United Kingdom 340; Yugoslavia 234.
Mineral fuels:			
Coke and anthracite	15	8	All to United Kingdom.
Peat and lignite	5	--	
Petroleum products:			
Aviation gasoline, thousand 42-gallon barrels	--	3	U.S.S.R. 1; West Germany 1.
Diesel oil, do	2	--	
Lubricating oils, do	182	181	United States 139; United Kingdom 16; West Germany 12.
Asphalt	6	3	United States 2; West Germany 1.

[1] Iranian calendar year ends March 20 of the subsequent year.
[2] Bars, flat products, wire, tubes, and pipes (and powder in the case of aluminum).

COMMODITY REVIEW

METALS

Chromite.—In recent years the bulk of Iranian chromite has been obtained from two groups of mines in southeast Iran: Abdasht and adjacent mines of the Esfandageh Mining Co. and the Shahriar mine of the Faryab Mining Co. These two operating companies have practically the same ownership. Some ore has also been mined in recent years in the Forumad mine of the Iran Chromite Co. in northeast Iran, but it is doubted that Forumad was operating in 1963. These mines altogether exported 71,400 tons of chromite in the Iranian calendar year ending March 20, 1963. Iranian producers experienced difficulty in marketing their output during 1963 because of competition from other areas and because of sluggish market conditions, but toward the end of the year arrangements were made for sales to Japan.

Abdasht is close to Esfandageh village, and Shahriar is about 115 kilometers by air or 175 kilometers by road from Esfandageh. Ore from these mines is trucked to Bandar-e Abbas port. A $15 million U.S. loan is being used in developing and equipping this port. A modern road is being built, connecting Bandar-e Abbas with the city of Kerman. These improvements are expected eventually to reduce cost of moving the ore from mine to port.

Copper.—Output of copper did not exceed a few hundred tons of blister copper, which is usually refined in a small electrolytic refinery south of Tehran. The copper mines in the neighborhood of Anarak were probably the only ones in production during the year.

Iron Ore.—In an effort to find suitable domestic iron ore for a steel plant, Government organizations concerned with mineral exploration have examined a number of iron ore deposits by surface methods, diamond drilling, and adits.[4] In 1962 and 1963 these efforts were directed to Choghart and other iron deposits of the Bafq area. The Choghart deposit was explored by two adits, driven from the two ends of a hill in which the relatively massive deposit is situated, and a longitudinal drift along the axis of the deposit to connect the two adits and provide access for systematic sampling. Although the deposit is high-grade, phosphorus is present, and the purpose of the sampling is to ascertain the extent and distribution of the phosphorus within the deposit. Information on the results of the activities is not available.

Iron and Steel.—The Government remained committed to a long-sought project for establishing an integrated iron and steel industry based on Iranian raw materials. This project was actually started in 1936, but its implementation by German firms was interrupted by World War II. It has been pursued again since the early 1950's with assistance from a number of engineering firms and consultants which either prepared reports and proposals for a steel mill or evaluated the proposals. Problems involving raw materials and methods of financing the relatively large expenditures required have been principal reasons for the delay in implementation. The Government in 1963 reportedly intended to seek aid from the French Institut de Recherche de la Sidérurgie with respect to some of the raw material problems

[4] Bureau of Mines. Mineral Trade Notes. V. 57, No. 2, August 1963.

and the economic feasibility of a steel plant in Iran.

During the year a preliminary agreement was concluded between an American concern and a consortium of local engineering consultants for erection of a steel-rolling mill near Ahwaz. A local private bank and a number of Iranian capitalists were expected to participate. Necessary ingots for the rolling mill would be imported.

Steel requirements of the country were met by imports. In the Iranian calendar year ending March 20, 1962, the latest year for which official trade statistics have been published, bars, rods, and sections used in the building industry were the most important steel category with imports of 147,757 tons followed by flat products imports of 57,254 tons. Among the flat products, galvanized sheets are used extensively for roofing. Preliminary figures for the first 9 months of 1963 give steel imports of 251,407 tons values at US$45,849,000.

Lead-Zinc.—It is not known which of the many mines that in the past have produced lead-zinc ores were in operation during 1963. The bulk of the lead-zinc ore is exported, but some lead ore is smelted locally.

As a result of diamond drilling in three lead-zinc mines, carried out under a technical assistance program of the U.S. Agency for International Development, the probable reserve in these mines is estimated to have been increased by 10.5 million tons of ore with 21 percent zinc and 6 percent lead content. The three mines were Angouran (west of Zenjan with 4.25 million tons of new reserves), Koushk (near Bafq with 5.0 million tons), and Shahkuh (southwest of Esfahan with 1.25 million tons). Angouran and Koushk are owned by Iran Industrial & Mining Co. (Simiran) which reportedly in 1963 was negotiating an investment agreement with a British company to further explore and develop the deposit. The investment by the British company was to increase in stages depending on results of detailed work to be carried out. An American firm showed interest in the Shahkuh mine of Bama company.

NONMETALS

Besides building raw materials, only barite, salt, and sulfur were produced in commercial quantities for local consumption. Barite was consumed mainly by the oil industry. The bulk of the salt was produced for human consumption, although a small tonnage was used in manufacturing hydrochloric acid.

At the beginning of the year, there were eight cement plants in Iran with a total installed annual capacity of 800,000 to 850,000 tons, of which all but one were in operation. The majority of the plants are privately owned. The Lowshan plant was built in 1956 to supply cement to the Sefid Rud Dam and closed after the dam was completed in 1962; however, the plant may have been reopened during the year.

MINERAL FUELS

Petroleum.—*Exploration.*—During the year three geological survey parties were active in mapping structures and examining stratigraphic sections in Fars Province as well as in the northwest region of the Consortium Agreement area, in mapping of structures in Khuzistan, and in making a detailed study of the lithofacies of the Khami limestone. Three seismic reflection parties were devoted mainly to recon-

naissance of the alluvial plains of Khuzistan and more detailed structural delineation survey over certain known structures.[5]

There were 12 drilling rigs in operation in the Consortium Agreement area at the beginning of the year, of which 3 were for exploration, 8 for development, and 1 for workover. Because of greater efficiency in drilling and improved results, the number of rigs was reduced to 11 rigs at the end of the year, of which 4 were on exploration. Altogether, 45 new well completions and workovers were made, excluding 3 suspended and 2 abandoned new wells. Of these, 7 were for exploration, 26 were for development, and 12 were for workovers. A total of 321,195 feet (97,925 meters) of hole was drilled, 77,086 feet (23,502 meters) for exploration, 239,904 feet (73,141 meters) for development, and 4,205 feet (1,282 meters) for workovers. Drilling in 1963 added some 418,000 barrels per day to the production potential.

Exploration drilling in the Consortium area resulted in the establishment of Bibi Hakimeh (30 kilometers southwest of Gachsaran) as a major Asmari oilfield of high productivity, and discovery of a new field at Karanj northeast of Agha Jari. Bibi Hakimeh 3 and 5 were completed as prolific Asmari producers, while Bibi Hakimeh 4, an 11-mile outstep well, confirmed the continuation of a high structure southeast of the discovery well. The Karanj field is of moderate size compared with Agha Jari, but a very thick oil column was indicated. By proving a considerable extension of the Ahwaz field, development drilling added substantially to the reserves of the field. Drilling on Kharg island gave disappointing results. Mansuri, Khalafabad, Bushgan, and Gulkhari were classed as minor discoveries.

The NIOC was active in the Alborz area, in Gorgan, and in Emam Hassan 200 kilometers west of Kermanshah. Alborz No. 13 and Emam Hassan No. 1 were drilling as of November 1963 at 3,041 feet (927 meters) and 8,702 feet (2,650 meters), respectively. In Gorgan, Gorgan No. 3A was reported drilling at 7,082 feet (2,160 meters) in August.

IPAC completed an additional three wells in its Darius offshore field. As of November 1963, the company was reported drilling Darius 6 at 4,206 feet (1,282 meters) and Cyrus 5 at 5,686 feet (1,733 meters). SIRIP completed a seventh producing well at the end of 1963.

Production.—Crude production by the Consortium and other producers increased by 11.7 percent in 1963. The Consortium, still the dominant producer, set a new record of 1,444,000 barrels per day, a 10.9-percent increase from production in 1962. Consortium output was obtained from 8 fields with 117 producing wells distributed as follows at yearend: Agha Jari 38, Gachsaran 12, Ahwaz 7, the central fields (Masjed-e Soleyman, Lali, Haft Gel, and Naft Safid) 59, and Pazanum where production commenced toward the end of the year at 12,000 barrels per day. Agha Jari continued as the leading producing field with an average of 785,000 barrels per day (771,000 in 1962), followed by Gachsaran averaging 358,000 (287,000 in 1962). In the latter field, production unit No. 3 with 200,000-barrel-per-day capacity was commissioned during the year. Installation of permanent production facilities led to a substantial increase from the Ahwaz field to 97,000 barrels per day from 33,000 in 1962. The central fields

[5] Iranian Oil Operating Companies, 1963 Annual Review. Tehran, 1964, 44 pp.

maintained their production level at 204,000 barrels per day (211,000 in 1962).

Production of Gachsaran is scheduled to be increased further to 530,000 barrels per day. Laying of a second submarine pipeline was necessary to attain this objective. The pipeline parallels the submarine portion of the Gachsaran-Ganaveh-Kharg 26/28/30 inch pipeline which was built in 1960 and designed to move 330,000 barrels per day of crude by gravity. Capacity of the terrestrial part of this line has been increased by installations of pumping equipment which can be fully utilized when the second submarine line is completed.

With seven producing wells and completion of pipeline and shore terminal facilities, Société Iran-Italienne des Pétroles (SIRIP)[6] increased its crude output by 238 percent. These facilities include a 23-mile 16-inch underwater pipeline from the Bahrgansar field to a land terminal consisting of five storage tanks having a total capacity of 62,000 tons, a crude desalting unit, and a 6-mile 18-inch pipeline to a deepwater tanker facility.

Iranian Pan American Oil Co. (IPAC)[7] was not producing crude commercially pending completion of loading facilities on the Kharg Island expected in late 1964. IPAC plans to produce initially at the rate of 50,000 barrels per day from the Darius field, and production is to be gradually increased to 100,000 barrels per day.

TABLE 5.—Production of crude oil and natural gas by producers

	1959	1960	1961	1962	1963
Crude petroleum:					
Consortium (net)--thousand 42-gallon barrels--	336,843	383,378	427,489	475,060	527,172
NIOC:					
Naft-e Shah (net)----do----	1,915	2,371	2,904	2,388	2,413
Alborz----do----	----------	----------	----------	2,080	2,988
SIRIP----do----	----------	----------	1,098	2,281	5,423
IPAC----do----	----------	----------	[1] 163	[1] 94	102
Total----do----	338,758	385,749	431,654	481,903	538,098
Natural gas:					
Consortium----million cubic feet--	234,767	262,676	294,522	322,118	362,707
NIOC----do----	1,353	1,678	2,124	2,163	2,221
Total----do----	236,120	264,354	296,646	324,281	364,928

[1] Test production.

Refining.—Refinery throughput at Abadan refinery of 132,306,000 barrels was 1.1 percent more than in 1962 (130,855,000), and averaged 382,481 barrels per day (358,507 in 1962). Of the total throughput 111,034,000 was for the account of the Trading Companies; that is, for export as products, and 21,272,000 for the account of the NIOC, the products being entirely for internal consumption. Quantities of Ahwaz crude processed at the refinery rose to 110,000 barrels per day by yearend (32,172, in 1962).

Shipment of refinery products from Abadan increased 3 percent from shipments in 1962: 122,348,500 barrels in 1963 and 118,662,200 in 1962. In 1963, 102,651,900 barrels were exported and 19,697,000

[6] For ownership of SIRIP and IPAC and details on their concession areas see Bureau of Mines Information Circular 8203, 1963.
[7] Work cited in footnote 6.

were delivered to the NIOC. Total shipments in 1963 consisted of the following, in barrels: Liquified petroleum gas 100,737; aviation gasoline 4,951,103; motor gasoline 16,944,562; aviation turbine fuel 7,008,183; kerosine 14,199,199; special solvent 1,257,663; vaporising oil 1,701,330; gas oil 17,299,442; diesel oil 4,149,634; fuel oil 53,565,102; lubricating oil 156,588; and bitumen 1,014,972. NIOC produced a total of 3,022,173 barrels from the Kermanshah refinery and the Naft-e Shah topping plant (2,937,739 in 1962) and obtained an additional 938,182 barrels of gas oil from processing of Alborz crude.

TABLE 6.—Output of refined products

(Thousand 42-gallon barrels)

	1959	1960	1961	1962
Consortium:				
Gasoline	22,010	24,879	18,639	22,303
Kerosine	14,987	15,190	13,559	15,203
Jet fuel	3,592	4,168	4,248	5,787
Gas oil and diesel oil	22,375	20,634	19,170	22,748
Fuel oil	41,843	49,904	45,361	51,448
LP gas	22	43	64	81
Lubricating oil	106	126	133	135
Bitumen	1,611	1,615	1,813	1,424
Other	2,575	2,899	2,638	3,269
Total	109,121	119,458	105,625	122,398
NIOC:				
Gasoline	368	282	307	327
Kerosine	277	226	252	238
Gas oil	23	70	93	122
Fuel oil	86	341	567	584
Unfinished	23	37	42	25
Total	777	956	1,261	1,296
Total all refined products [1]	109,898	120,414	106,886	123,694

[1] Excludes products from Masjed-e Soleyman and Naft-e Shah topping plants which may have been shipped without further refining.

Three large kerosine treating units, each with a capacity of 13,500 barrels per day using copper chloride as a sweetening catalyst, were commissioned in Abadan. These replaced the older acid refining process in the production of high-grade illuminating kerosine. By installation of side reflux systems and increased heater capacity in three of the four major crude distillation units of the Abadan refinery, performance of these units was increased and provided for maximum gas oil recovery at full throughputs of up to 110,000 barrels per day.

On May 30, the NIOC as an authorized agent of the Iranian Government signed a contract with a French and German consortium for the financing and construction of a refinery in Tehran and a 20-inch crude pipeline from Alborz and a 20-inch gas pipeline from Sarajeh to Tehran. The German participants, consisting of Phoenix Rheinrohr International, Stahlunion Export, and Mannesman Export would finance and construct a 4-million-ton-per-year refinery at a cost of $80 million to utilize Alborz crude. The French (Société Entrepose) would finance and construct the two pipelines. These contracts had not been implemented at yearend. The decision of NIOC to construct a second products pipeline from Ahvaz to Tehran has caused postponement of its plan for the Sarajeh-Tehran gas pipeline.

Domestic Sales.—According to NIOC, sales of petroleum products amounted to 29,062,488 barrels of refined products. Of this total, kerosine represented 7.91 million, fuel oil 7.74 million, gas oil 7.28 million, and gasoline 4.42 million barrels. The remaining 1.71 million barrels comprised all other products. The 3.2-percent increase in consumption continued the downward trend in the gains of earlier years: 5.7 percent per year in 1962 and 9.4 percent in 1961. About 86 percent of product consumption was supplied by the Abadan refinery and the Consortium's topping plants at Masjid-i-Soleyman.

Sales are carried out by 58 branches, 117 filling stations, 85 agencies, and 2,500 dealerships.[8] The distribution organization of the NIOC is entrusted with the procurement, transportation, and distribution of petroleum products and derivatives as well as of natural and liquefied gas.

The role of pipeline in transportation of products has increased, and over 50 percent of products are transported by pipeline. The 105-kilometer Qazvin-Rasht extension of the Tehran-Qazvin-Rasht pipeline was under construction.

Natural Gas.—Of the associated natural gas produced in 1963, which was 12.5 percent more than in 1962, only 11 percent was fully utilized. The Marvdasht fertilizer plant near Shiraz, the first project to utilize natural gas outside of the oilfields, was formally opened in October. The plant, designed to produce urea and ammonium nitrate equivalent to 30,000 tons of nitrogen, receives treated gas from a plant in Gachsaran with 20-million-cubic-feet-per-day capacity through a 265-kilometer 10-inch pipeline. A cement plant and a sugar refinery will also use the gas. Further utilization of natural gas for production of petrochemical was under active study by the Plan Organization, the governmental agency which is responsible for administration of Iran's economic development programs.

TABLE 7.—Production and consumption of natural gas[1]

	1962		1963	
	Million cubic feet	Percent	Million cubic feet	Percent
NIOC:				
Utilized	682	31.5	682	30.7
Flared	1,481	68.5	1,539	69.3
Total production	2,163	100.0	2,221	100.0
Consortium:				
Utilized	36,462	11.3	39,540	10.9
Used expansively, then flared	70,017	21.8	68,289	18.8
Flared	215,639	66.9	254,878	70.3
Total production	322,118	100.0	362,707	100.0
Iran:				
Utilized	37,144	11.4	40,222	11.0
Used expansively and flared	70,017	21.6	68,289	18.7
Flared	217,120	67.0	256,417	70.3
Total production	324,281	100.0	364,928	100.0

[1] Associated gas produced with petroleum.

[8] NIOC News Letter. No. 54, December-January 1962–63. 14 pp.

The Mineral Industry of Iraq

By F. L. Klinger[1]

PETROLEUM is the most important mineral product of Iraq. Crude petroleum produced in 1963 constituted 17 percent of Middle East production and 4 percent of world output, and Iraq ranked fifth in world petroleum exports. Iraq also produced petroleum products, salt, and construction materials for domestic consumption. Gypsum and natural bitumen were formerly mined, and deposits of iron and phosphate rock were being investigated at the end of the year.

In 1962, products of the petroleum industry were valued at an estimated 258 million dinars (US$722 million).[2] This was 97 percent of the value of all mineral products and more than 50 percent of the gross national product. In the same year, the petroleum industry (excluding marketing and distribution) employed an estimated 15,500 persons, 85 percent of all mineral industry workers and 23 percent of total estimated industrial labor.

Petroleum revenue provides most of Iraqi foreign exchange earnings and more than half of all government revenues. Under a 1952 agreement with the Iraq Petroleum Co.[3] (IPC), the government receives 50 percent of all company profits before foreign taxes. This revenue amounted to US$266 million in 1962 and a record US$308 million in 1963. IPC also supplies crude petroleum at cost to government refineries which annually produce about 15 million barrels of petroleum products.

Outstanding developments in 1963 were an alltime record in petroleum production, the settlement of a dispute between the government and IPC on cargo and port taxes to be levied on tankers loading petroleum at the port of Basra, and the exemption of shipping companies from income taxes on profits realized from Basra oil liftings. The last two issues had been largely responsible for the steady decline in Basra oil exports since 1959, and their settlement contributed to the significant increase in national petroleum output during 1963.

Law No. 80, passed in December 1961, continued to be the most important factor in relationships between the government and the petroleum companies. Under this law, 99.5 percent of the petroleum concessions held by IPC companies were withdrawn from company control, including those areas with proven but undeveloped petroleum reserves. The IPC has not accepted the legality of this action, but the law was reiterated by the government early in 1964 when it estab-

[1] Foreign minerals specialist, Division of International Activities.
[2] Exchange rate, 1 dinar=US$2.80.
[3] This company includes Iraq Petroleum Co. (IPC), Basrah Petroleum Co. (BPC), and Mosul Petroleum Co. (MPC).

lished the Iraqi National Oil Co. This company will be authorized to engage in all phases of the petroleum industry including petrochemicals, and to explore all areas for oil with the exception of those areas allocated to the IPC companies under Law 80.

Of potential significance to the mineral industry is the new 550-kilometer standard-gage railway under construction between Baghdad and Basra. Track laying was completed by early 1964, and the last of 1,600 freight cars ordered from Poland were expected to arrive during this year. The railway is to be operational in the spring of 1965.

PRODUCTION

Petroleum production in 1963 was 15 percent greater than in 1962. This rise resulted from production increases of 8.5 percent (26 million barrels) in the Kirkuk fields, and 44 percent (28 million barrels) in the Zubair-Rumaila fields of Basrah Petroleum Co. There was no significant change in the output of other minerals.

In 1962 the mineral production of Iraq was valued at an estimated 266 million dinars (US$745 million). Of this total, petroleum accounted for 91 percent, refinery products, 6 percent, and other materials, 3 percent.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Cement	660,453	617,548	936,994	920,702	901,067
Salt	(1)	36,710	36,956	38,450	(1)
Mineral fuels: Petroleum:					
Crude—thousand 42-gallon barrels	311,193	353,833	365,594	366,832	[2] 422,581
Refinery products:					
Gasoline—do	1,775	2,067	2,230	2,394	[3] 2,135
Kerosine—do	2,082	2,413	2,938	3,015	[3] 3,146
Distillate fuel oil—do	2,521	2,945	2,906	3,034	[3] 2,792
Residual fuel oil—do	4,764	5,730	6,900	7,044	[3] 6,654
Lubricants—do			165	162	(1)
Asphalt—do	(1)	(1)	264	226	(1)
LP gases—do	(1)	(1)	11	21	(1)
Refinery fuel and loss—do	993	1,287	1,443	1,656	(1)
Other—do	503	471	(1)	(1)	(1)

[1] Data not available.
[2] Includes 420,756,000 barrels by the IPC group and an estimated 1,825,000 barrels for government operations.
[3] Estimate based on 6 months production.

TRADE

Metal and mineral exports in 1962 were valued at US$630 million, or 91 percent of all exports. Of this value, petroleum made up 99.5 percent and cement, 0.3 percent. Petroleum exports in 1963 increased 15 percent over those of 1962 and were equivalent to nearly 96 percent of petroleum output. Seventy-five percent of the exports were by pipeline to the Mediterranean and the remainder by tanker from Basra. As in previous years, Western Europe was the largest recipient of Iraqi petroleum.

Iraq must import all of its metals and most requirements of industrial minerals. Metal and mineral imports in 1962 were valued at US$35.6 million, or approximately 10 percent of all imports. Iron and steel were the most important items, valued at US$30 million (8 percent of all imports), followed by nonferrous metals (0.8 percent), nonmetallic minerals (0.5 percent), and mineral fuels (0.2 percent). Metal and mineral imports in 1962 were not significantly different from 1961 levels, except for copper imports which nearly doubled.

TABLE 2.—Exports and reexports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum	4	52	Lebanon 50.
Iron and steel	2,446	1,668	United Kingdom 748; Qatar 325; Iran 231 Syria 149.
Lead	263	203	United Kingdom 112; Lebanon 51; Syria 40.
Nonmetals:			
Cement	147,405	152,158	Saudi Arabia 40,286; Qatar 33,517; Jordan 26,521; Ceylon 21,793.
Other (reexport only)	788	198	All to Thailand.
Mineral fuels:			
Crude petroleum. thousand 42-gallon barrels	347,149	347,808	Italy 59,311; United Kingdom 55,213; France 54,270; West Germany 38,865; Netherlands 32,881.
Asphalt do	57	95	Ceylon 34; Syria 29; Lebanon 19.
Gasoline and fuel oils do	--------	[1] 152	Bunkers except for 2,000 barrels of gasoline to Saudi Arabia.

[1] Estimate.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Ingots, including scrap	507	601	Canada 347; Austria 254.
Rolled and other [1]	1,750	1,327	Lebanon 433; U.S.S.R. 385; Belgium 160; mainland China 115; West Germany 70.
Copper [1]	1,015	1,907	West Germany 513; Belgium 504; Finland 263; Netherlands 198; United Kingdom 119.
Iron and steel:			
Pig iron, powder and scrap	212	489	U.S.S.R. 305; Belgium 159.
Ferroalloys	40		
Cast iron (pipes, etc.)	36,015	20,254	West Germany 9,303; United Kingdom 8,316; Belgium 1,069; Netherlands 735.
Rolled steel	209,643	210,934	Belgium 100,161; U.S.S.R. 50,524; West Germany 16,595; United Kingdom 10,078; mainland China 7,142.
Lead:			
Ingots, including scrap	39	16	All from Netherlands.
Rolled and other [1]	46	23	United Kingdom 20; West Germany 2; Denmark 1.
Magnesium [1]	3	2	All from United Kingdom.
Nickel [1]	4	11	Netherlands 3; West Germany 3; Lebanon 2.
Tin:			
Ingots, including scrap—long tons	16	27	Malaya 26; mainland China 1.
Rolled and other [1]—do	69	64	United Kingdom 45; Malaya 7; Lebanon 6.
Zinc:			
Ingots, including scrap	76	51	All from Belgium.
Rolled and other [1]	17	44	Lebanon 15; United Kingdom 11; West Germany 10; Belgium 8.
Other	3	7	United Kingdom 4; Lebanon 3.
Nonmetals:			
Asbestos	1,046	1,502	Canada 1,226; Republic of South Africa 192; Italy 40; West Germany 38.
Barite	43	124	United Kingdom 113; West Germany 11.
Cement	14,440	14,324	Denmark 5,721; Japan 3,480; Belgium 3,305; mainland China 922.
Chalk and earth colors	836	831	United Kingdom 591; Belgium 237.
Clays	1,595	446	Netherlands 178; United Kingdom 145; United States 74; India 31.
Fertilizer (mineral or chemical):			
Nitrogenous	4,059	6,895	West Germany 5,639; Belgium 360; United Kingdom 340; Netherlands 290; Austria 263.
Phosphatic and potassic	2,436	1,742	West Germany 1,469; Belgium 154; U.S.S.R. 56; Netherlands 51.
Gypsum and lime	90	291	United Kingdom 188; West Germany 103.
Steatite	401	291	India 253; mainland China 38.
Stone:			
Building stone	1,408	903	Jordan 633; Italy 94.
Crushed stone and sand	420	833	Jordan 733; United Kingdom 73; Lebanon 30.
Limestone and dolomite	394	261	All from Denmark.
Sulfur	875	1,299	United States 722; West Germany 344; United Kingdom 232.
Other	442	453	United Kingdom 86; Netherlands 45; United States 16.
Mineral fuels:			
Coal and coke	791	1,589	West Germany 680; Belgium 456; Iran 206; United Kingdom 104.
Petroleum products:			
Lubricating oils—42-gallon barrels	21,070	14,553	West Germany 4,075; United States 3,784; United Kingdom 3,347.
Asphalt and bitumen—do	11,696	3,848	Iran 2,272; West Germany 1,097; United Kingdom 479.
Tar and pitch—do	9,750	1,169	Iran 733; United Kingdom 436.
Waxes—do	1,385	1,959	West Germany 1,116; India 666; United States 176.
Petroleum jelly—do	189	448	Netherlands 133; West Germany 115.
Gasoline—do		437	All from Iran.

[1] Wire, bars, flat products, tubes, and pipes; powder and flake in case of aluminum and copper.

Several changes in Iraqi trade policy occurred during 1963. Trade restrictions were lifted from many commodities as well as from several countries including Lebanon, United Arab Republic, Japan, France, Italy, and the United Kingdom, and a swing in trade from Communist countries towards the West was reported. Little or no change was reported in Iraqi tariffs. Iraq has a single-column tariff but gives preference to commodities imported from Arab states. Raw materials needed for industry are duty-free, but import taxes of up to 6 percent of c.i.f. value are imposed on several items, including rolled steel products; higher taxes are levied on imports of mineral commodities which can be produced within the country.

COMMODITY REVIEW

METALS

Iron and Steel.—No decision had been reached on the proposed Baghdad steel mill by the end of 1963. Bids on feasibility studies, design, and supervision of construction of the mill still were being received in December. Originally a Soviet-sponsored project, the mill was to have an annual capacity of 70,00 tons of iron and steel products, using imported scrap as raw material. Early in the year, a large iron deposit reportedly was discovered in the western desert by Soviet prospecting teams. The deposit originally was estimated to contain 300 million tons of ore with an average iron content of 60 percent, but more recent reports indicate that these figures are too high.

NONMETALS

Cement.—Cement production in Iraq in 1963 was 64 percent of total rated capacity, slightly below the level of 1962. In 1962, about 13 percent of production was exported, with the remainder used mostly for dam and bridge construction. An estimated 40,000 tons was used in the manufacture of prestressed concrete and asbestos-cement products.

Production facilities include six plants, two of which are government-owned, with a total rated capacity of 1,400,000 tons per year. Productive capacity is well in excess of demand, because of overbuilding before 1958. The industry produces sulfate-resistant cement as well as portland (types II and IV).

A drop in cement consumption may have occurred in 1963 because the large Derbendi Khan Dam project was nearing completion. Increased exports to Kuwait were likely, however, and if a cement plant is not built in Kuwait it is possible that Iraq will establish a plant west of Basra to supply Kuwaiti requirements.

Ceramic Materials.—In 1963, bids were invited for feasibility studies, design, and supervision of construction of a ceramics plant at Ramadi. As presently conceived, this plant would annually produce housewares (3,000 tons), sanitary ware (2,500 tons), wall tile (3,000 tons), and undetermined quantities of firebrick and drainpipe.

Construction of a glass plant also is planned at Ramadi. The plant evidently will be built under a Soviet aid agreement and much of the equipment has already arrived. The plant is to have a capacity of

22,000 tons of glass per year and will utilize local resources of sand and dolomite.

MINERAL FUELS

Petroleum and Natural Gas.—Petroleum production averaged 1.15 million barrels per day in 1963. The largest producer was IPC, which at the beginning of 1963 had 87 wells producing nearly 800,000 barrels per day from the Kirkuk fields of northern Iraq. Basrah Petroleum Company had 63 wells producing 180,000 barrels per day from the Zubair-Rumaila fields in the southeast; of the remaining production, 26,000 barrels per day were produced from 16 wells of the Mosul Petroleum Company and an estimated 5,000 barrels per day came from government-owned wells in the Naftkhaneh field northeast of Baghdad. Total reserves in 1963 were estimated [4] at more than 24,000 million barrels. Iraq also has natural gas resources estimated at 22.5 million million cubic feet.[5]

Principal developments in productive capacity during the last 2 years were in transportation and processing facilities. BPC's new deepwater loading terminal at Khor al-Amaya was commissioned in April 1962 and doubled the annual loading capacity at the port of Basra to 22 million tons. Since then, BPC also has completed construction of a 30-inch, 65-mile pipeline from the oilfields to the Fao tank farm; three new degassing and pump stations in the Rumaila field; and 57 miles of 16-inch pipelines. In 1962, IPC increased capacity of its processing plant at Kirkuk to 250,000 barrels per day.

The IPC companies did no exploration drilling in 1961–63. In 1962, IPC and MPC completed 20,000 feet of development drilling which brought in four producing wells and increased production by 3,000 barrels per day. In 1963, IPC drilled seven development wells in the Kirkuk field, and the government used a Soviet rig to drill one well at Naftkhaneh.

During the first 6 months of 1963, refinery output appeared to be slightly below the level of 17 million barrels reached in 1962. The Qaiyara bitumen refinery, idle since 1958, was reactivated late in 1963 and was scheduled to produce 50,000 tons per year of bitumen along with heavy and light fuel oils. A 12-inch, 130-kilometer pipeline was completed during the summer from Khanaqin to the al-Daura refinery near Baghdad and reportedly was supplying Naftkhaneh crude to the plant in late 1963.

In 1963 the government asked for bids on design and construction of a sulfur recovery plant at Kirkuk, and in early 1964 contracted with the Italian firm of Techint for evaluation of bids and supervision of construction. Award of a construction contract was expected by mid-1964. It is believed that the proposed plant will use natural gas to produce gasoline, LP gases, and 300 to 350 tons per day of sulfur. The plant also will supply cleaned gas for commercial use. In connection with this project, a contract was made early in 1964

[4] World Oil. V. 157, No. 3, Aug. 15, 1963; p. 173.
[5] Oil and Gas International. V. 4, No. 1, January 1964; p. 40.

with a French firm for consulting services and for designing a 200-mile natural gas pipeline from Kirkuk to Baghdad.

In other 1963 developments, the government asked for bids on construction of a 630,000-barrel petroleum products storage depot at Zaafaraniya in Baghdad. Bids submitted for feasibility and marketing surveys for a petrochemicals plant and a fertilizer (ammonium sulfate) plant at Basra were being considered. A French firm, Petro-Chimie, S.A., was appointed to study the developments of production facilities for fertilizers based on natural and refinery gas in Iraq.

The dispute between Iran and Iraq over sovereignty of an offshore area at the head of the Persian Gulf remained unresolved at yearend.

The Mineral Industry of Israel

By F. L. Klinger [1]

PRODUCTION of Israel's small but relatively diversified metal and mineral industry increased during 1963. Preliminary data suggest that the total value of production increased 10 percent over that of 1962, when output was valued at an estimated US$82 million or 4 percent of the gross national product. About 55 percent of the 1962 value (US$46 million) originated from domestic resources which include potash, copper, phosphate, bromine, oil and gas, and various construction materials. The remainder was value added by the diamond-polishing, petroleum-refining, and steel industries, which are largely dependent upon imports. The diamond-polishing industry ranks first in foreign exchange earnings, producing a net added value of US$15 million in 1962 or four times the value of either potash or copper exports. Israel's diamond-polishing industry is second only to Belgium and accounts for about 25 percent of world exports. In addition, the potash, bromine, and phosphate resources have fostered a chemicals industry which manufactures fertilizers and other chemical products at the rate of 300,000 metric tons per year. An estimated 15,200 persons, or about 2 percent of the national labor force, were employed in these industries in 1963—53 percent in diamond polishing, petroleum refining, and steelmaking; 35 percent in domestic mineral production; and 9 percent in the chemicals industry.

GOVERNMENT POLICIES AND PROGRAMS

Except for the steelworks at Acre, which is owned by the General Federation of Jewish Labor (Histadrut), and diamond polishing, the mineral industry is principally owned and operated by the Israeli Government. Mineral exploration and development are also carried out or controlled by government agencies, principally through Israel Mining Industries, Ltd. (IMI). A continuing program of applied research has developed new and cheaper processes for the manufacture of phosphoric acid, carbon steel, and tetrabromoethane (TBE). TBE, produced from Dead Sea brines, has been successfully applied to minerals beneficiation on an industrial scale. These processes have created international interest and are being used or tested in the United States, Europe, and Japan.

Improvements underway in basic transportation included construction of a new port facility at Ashdod and a 30-kilometer railway spur from Beersheba to Dimona.

[1] Foreign mineral specialist, Division of International Activities.

PRODUCTION

The general increase in production of Israel's mineral industry in 1963 was marked by substantial gains in several key commodities. As compared with 1962, production of phosphate increased by 42 percent, cement-copper by 30 percent, potash by 24 percent, and petroleum products by about 15 percent. Output of bromine and bromine compounds increased by nearly two-thirds although the aggregate tonnage was only about 40 percent of the quantity produced in 1961. The demand for construction materials remained strong and cement production increased by 100,000 metric tons.

The aggregate value of mineral and metal production in 1963 was estimated to be US$90 million. Of this total, construction materials were estimated to have accounted for 33 percent, followed by mineral fuels (20 percent); polished diamonds (16 percent); metals (13 percent); potash, phosphate and bromine (11 percent); and other materials (7 percent).

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Copper [1]	4,480	5,580	6,253	5,909	7,720
Steel	22,000	40,000	[2] 61,000	80,000	82,798
Nonmetals:					
Bromine:					
Elemental	1,050	2,400	4,400	} 1,800	2,941
Compounds	930	1,378	3,300		
Cement	780,978	805,507	[2] 850,000	920,000	1,021,591
Clay, all types	10,000	24,780	38,670	39,000	27,302
Crushed stone—cubic meters	2,000,000	(3)	(3)	3,700,000	(3)
Gypsum	41,960	(3)	(3)	74,000	(3)
Lime	110,000	(3)	(3)	(3)	(3)
Marble—cubic meters	4,000	1,500	5,000	5,500	(3)
Phosphate, beneficiated	213,800	224,180	230,000	210,000	300,000
Potash (potassium chloride)	104,000	136,000	140,000	153,000	[2] 190,000
Salt	33,988	37,220	47,500	38,000	(3)
Silica sand	21,003	24,729	26,000	34,000	50,000
Mineral fuels:					
Natural gas—thousand cubic feet	----------	(3)	93,500	265,000	347,097
Peat—cubic meters	14,000	(3)	10,000	(3)	(3)
Crude petroleum—thousand 42-gallon barrels	925	932	[4] 978	[4] 968	1,093
Refined products:					
Gasoline—do	1,563	1,772	1,613	2,350	(3)
Kerosine—do	1,368	1,387	1,592	1,833	(3)
Distillate fuel oil—do	2,272	2,824	3,022	4,157	(3)
Residual fuel oil—do	3,480	3,547	4,124	6,028	(3)
Other—do	700	643	827	1,149	(3)
Refinery fuel and loss—do	97	552	582	817	(3)
Total refined products—do	9,480	10,725	11,760	16,334	[2] 18,784

[1] Metal content of cement-copper exports, calculated on basis of 75 percent copper.
[2] Estimate.
[3] Data not available.
[4] Bulletin of the American Association of Petroleum Geologists. V. 47, No. 7, July 1963. World Oil. V. 157, No. 3, Aug. 15, 1963.

TRADE

In 1963, exports of diamond, potash, copper, raw phosphate, and bromine products were substantially greater than in 1962 and showed an aggregate increase in value of 24 percent. Available export data follows: Cement copper 10,297 tons; bromine and bromine compounds

2,941 tons; clay 5,434 tons; cement 99,000 tons; polished diamond (gross exports) 1,155,000 carats; phosphate rock 124,888 tons; and potash 164,231 tons.

Exports of metals and minerals in 1962 were valued at an estimated US$109 million, or 38 percent of all exports. Polished diamonds were the most important commodity, accounting for 32 percent of the value of all exports, followed by nonmetallic minerals (3 percent), metals (2 percent), and mineral fuels (1 percent).

TABLE 2.—Exports of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1961	1962
Metals:		
Aluminum, all forms	877	1,807
Copper:		
Cement copper	8,338	7,879
Metal, all forms	529	1,265
Iron and steel:		
Ingots and scrap	1,767	1,384
Semimanufactures	3,836	6,101
Other:		
Base metals	13	[2]
Metalliferous ores	92	----
Nonmetals:		
Abrasives, natural	----	86
Bromine and compounds	4,003	1,800
Clays	8,568	9,182
Construction materials:		
Building and ornamental stone	820	455
Cement	181,443	168,562
Limestone, lime, gypsum, quartz, sand	[3] 1,350	922
Diamonds:		
Cut or polished carats	738,975	[4] 975,576
Industrial do	75,434	96,284
Powder (including other precious and semi-precious stone) do	6,963	5,291
Fertilizers:		
Crude:		
Phosphate	93,716	65,418
Potash	126,591	133,687
Processed:		
Phosphatic	134	2,998
Potassic	73,423	[2]
Other	8,350	979
Sulfur	100	20
Mineral fuels:		
Distillate fuel oil (Solar) thousand 42-gallon barrels	641	1,036
Liquefied petroleum gas do	21	[2]
Gasoline, kerosine, other do	73	484
Total	735	1,520

[1] Countries of destination not available.
[2] Data not available.
[3] Semiofficial figure.
[4] According to "Israel Industry & Commerce" (v. 15, No. 5-6, June 1964), gross exports of gem diamond in 1962 totaled 898,331 carats.

TABLE 3.—Imports of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1961	1962
Metals:		
Aluminum:		
Unwrought	4,087	4,999
Semimanufactures	1,659	2,095
Cadmium (anodes)	[2] 8	5
Copper:		
Unwrought, including alloys	3,149	1,461
Semimanufactures, including alloys	4,980	6,974
Gold, unwrought, troy ounces	[3]	6,301
Iron and steel:		
Iron ore	[3]	14,500
Pig iron	23,465	18,532
Scrap and other	344	3,265
Ferromanganese and spiegeleisen	972	3,817
Other ferroalloys	3,435	725
Semimanufactures:		
Alloy and high-carbon steel	13,257	12,120
Other	233,088	271,173
Lead:		
Unwrought	1,198	1,652
Semimanufactures	226	102
Magnesium, all forms	27	28
Manganese ore	[3]	1,016
Nickel, all forms	72	82
Platinum, unwrought and partly worked, troy ounces	[2] 1,353	1,209
Silver:		
Unwrought, do.	[3]	535,052
Semimanufactures, do.	[3]	212,005
Tantalum, kilograms	259	[3]
Tin, all forms	139	120
Zinc, all forms	2,979	3,225
Miscellaneous:		
Other metallic ores	47,077	116
Other base metals	79	77
Other nonferrous metals, scrap, waste, ashes, residues	246	158
Nonmetals:		
Abrasives, natural	302	159
Asbestos	8,670	8,159
Barite, including witherite	122	203
Borates, natural	[3]	50
Chalk	41	122
Clays:		
Refractory	575	399
Other	8,738	8,484
Construction materials:		
Cement	8,790	41,511
Gypsum, chalk, stone, dolomite, glass sand, other	762	[3]
Cryolite and chiolite		65
Diamonds:		
Uncut (rough), carats	1,644,905	2,154,656
Semipolished, do.	2,850	
Cut or polished, do.	7,754	19,544
Industrial, including bort, do.	11,719	
Dust, including other precious and semiprecious stone, do.	24,836	17,030
Feldspar	2,077	1,939
Fertilizers:		
Nitrogenous	[3]	20,236
Other	7,101	500
Fluorspar	567	366
Fuller's earth and infusorial earths	1,772	3,254
Graphite	56	47
Magnesite	907	1,340
Mica	61	91
Quartz, including quartzite	271	421
Steatite	485	747
Sulfur	43,770	68,904
Titanium oxides	[3]	1,164
Other	282	115

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals [1]—Continued

(Metric tons unless otherwise specified)

Commodity		1961	1962
Mineral fuels:			
Coal		17,892	20,445
Peat briquets		225	483
Coke, including semicoke		27,545	26,009
Coal tar and derivatives		(3)	3,364
Petroleum:			
Crude	thousand 42-gallon barrels	10,760	15,208
Refinery products:			
Gasoline	do.	76	70
Kerosine	do.		12
Diesel oil	do.		32
Residual fuel oil	do.	4,097	2,592
Lubricants, including grease	do.	97	119
Waxes	do.	14	16
Other	do.	17	21
Total refined products	do.	4,301	2,862

[1] Countries of origin not available.
[2] Estimated from official import values.
[3] Data not available.

In 1962, imports of metals and minerals were valued at US$185 million or 29 percent of all imports. Rough diamonds were valued at nearly 12 percent of all imports, followed by mineral fuels (7 percent), iron and steel (7 percent), other metals (2 percent), and nonmetallic minerals (1 percent). Increased allocations from the Diamond Trading Co. increased volume of diamond imports by 31 percent as compared with 1961. Expanded capacity and production at the Haifa refinery was responsible for a 41-percent increase in imports of crude petroleum as well as a 33-percent decrease in imports of refinery products. Imports of rolled iron and steel products increased by 18 percent, and substantial but less significant increases were recorded in aluminum, cement, and sulfur. In 1963, the value of all Israeli imports rose by US$46 million, or 7 percent, over that of 1962; more than half of this total was accounted for by diamond imports.

Although countries of destination and origin are not shown in tables 2 and 3, Israel's foreign trade is conducted principally with the United States and members of the European Economic Community (EEC) and European Free Trade Association (EFTA) organizations. These countries supply about 90 percent of all Israeli imports and receive about 80 percent of all exports.

COMMODITY REVIEW

METALS

Copper.—Cement-copper production in 1963 increased by approximately 30 percent over that of 1962. All production came from the government-owned mine and plant at Timna, 25 kilometers north of Eilat. The proved ore reserve at Timna is estimated to be 15 million tons containing 1.89 percent copper, although mine-run material appears to contain between 1.25 and 1.5 percent copper. The main ore

mineral is chrysocola. Ore production in 1963 totaled about 500,000 tons from open pit and underground mines; this has been the average for the last 5 years.

With open pit reserves diminishing, production from the underground mine increased to 20 percent of total production in 1962–63. Underground development, underway since 1959, includes more than 6 kilometers of tunnels. An expansion plan to produce 15,000 tons of copper annually, mostly from underground ore, was deferred temporarily in October, pending further cost studies of underground mining.

Copper was extracted by a sulfuric acid leach process and subsequently cemented. The plant treated about 1,500 tons of ore daily, producing about 25 tons of cement copper with a metal content of 75 percent. Sulfuric acid (90 tons daily) was made at the site, using a vanadium catalyst contact converter and imported sulfur.

Iron and Steel.—No primary iron has been produced on a commercial scale from domestic deposits. Beneficiation research and mine development presumably continued on the Har Ramin hematite deposits of Upper Galilee. These deposits are estimated to contain 40 million tons of material having an iron content of 26 to 28 percent. If the iron content can be raised to 42 percent, the material may be usable at Acre.

The Acre steelworks had an estimated capacity of 100,000 tons of steel products made from ingots, scrap, and iron ore. The plant was in operation in 1963, but production was not reported. In mid-1963, the Acre works reportedly was stopping imports of scrap and switching to the purchase of ingots abroad.

NONMETALS

Cement.—In spite of a 40-percent decline in exports caused by reductions in sales to Turkey, production of cement increased by 11 percent. The increase was mainly due to the demand created by construction projects at Ashdod Port and the Dead Sea Works. The government-controlled Nesher Cement Co. announced operation of a second kiln at its Ramleh works in November, and reported a third kiln under construction. Operation of the new kiln, which has a capacity of 210,000 tons annually, raised capacity of this plant to 370,000 tons and increased the capacity of the Israeli cement industry to an estimated 1.4 million tons. Two cement products plants, one for ready-mixed concrete and the other for cement blocks, were opened in Beersheba during 1963.

Diamond.—Israel's diamond trade increased substantially in 1963. As compared with 1962, net imports of gem diamonds increased by 37 percent and net exports by 25 percent. However, owing to a higher proportion of returned stones, the net earnings were about 20 percent less than in 1962. Prospects for the industry in 1964 were uncertain, owing to a serious cut expected in allocations of rough diamonds from the Diamond Trading Co. and an expected 9-percent increase in labor costs.

Flint Clay.—In 1963 a new plant for the calcining and magnetic beneficiation of flint clay was under construction at Makhtesh Ramon in the Negev. Earlier in the year, a partnership was formed between

the government-owned Ceramics & Fine Sands Co. and an Italian firm. A total investment of US$3.3 million was anticipated.

Phosphates.—Phosphate deposits of Oron, mined and processed by the government-owned Chemicals Phosphate, Ltd., continued to supply practically all of the country's output. In 1963 production rose 40 percent as the country's new calcining plant went into operation. This plant is expected to make possible an annual production of 400,000 tons of phosphate containing 35 to 38 percent phosphorus pentoxide (P_2O_5) from open pit ore containing 24 percent P_2O_5. Also completed during 1963 was a pipeline from the Zohar gasfield to Oron, which will supply fuel for plant operations. In January 1964, the company began constructing a processing plant for phosphates and limestone at Arad, 60 kilometers north of Oron. The plant is the first unit of the company's planned chemical complex at this site.

The same company discovered a new phosphate field at Zefa Ef'eh, north of Oron and only 5 kilometers south of the S'dom-Dimona highway.

In late 1963 Israel American Phosphates, Ltd., a private concern, was preparing to begin open pit mining at the Ein Yahav deposits, 35 kilometers southeast of Oron. Tenders were issued for overburden removal, and heavy equipment was on order. This company is also exploring deposits to the south and west, at Har Hameishar and Hor Hahar.

At the end of 1963, phosphate deposits were known at six localities, distributed over an area of about 5,000 square kilometers in the central and southern Negev. Minimum total reserves appeared to be about 80 million tons.

Potash and Bromine.—Potash production from the Dead Sea Works at S'dom was about 15 percent greater than in 1962. Increased output was due to favorable weather and to new evaporation areas made available by the large expansion project which was still underway at the end of the year.

The expansion project will cost US$70 million when completed; it will add 100 square kilometers to the original evaporation area by diking off part of the Dead Sea and will increase annual production capacity to 600,000 tons. Construction was scheduled for completion in 1965. Two-thirds of the planned evaporation area was expected to be available in 1964 as two of three new evaporation basins were nearly

TABLE 4.—Phosphate deposits and reserves in 1963

Location	Ownership	Minimum reserve (million metric tons)	Estimated average P_2O_5 content (percent)
Oron	Chemicals and Phosphates, Ltd.	15	24
Arad	do.	30	28–30
Zefa Ef'eh	do.	15	33
Ein Yahav	Israel American Phosphates, Ltd.	[1] 10	28–32
Hameishar	do.	([2])	24–26
Hor Ha'har	do.	10	27

[1] Minimum estimate. According to company officials, reserves are sufficient for 20 to 30 years operation, but production rate was not specified.
[2] Data not available.

completed. The government plans to invest an additional US$16.6 million to increase production capacity to 900,000 tons by 1972.

In 1963 construction continued on a new processing plant which was to be completed in April 1964. The plant will employ a hot-leach process to improve potash recovery and quality, and will use natural gas piped from the Zohar gasfield.

Residual brines from potash production contain bromine and chlorides of sodium and magnesium, but in 1963 only bromine and sodium chloride were recovered. After successful production of magnesium oxide from magnesium chloride on a pilot plant scale, plans to build a refractory brick plant were announced in early 1963 but were later deferred because of uncertain market conditions.

Elemental bromine is produced only at the Dead Sea Works plant at S'dom, which has an annual capacity of 10,000 tons. Output fell sharply in 1962 owing to market restrictions in the EEC countries. In 1963 production increased by about 60 percent but was running well below total capacity. In January, a new bromine plant with an annual capacity of 2,000 tons was opened in Beersheba.

MINERAL FUELS

Crude Petroleum.—Development of the new Kokhav field north of Heletz-Brur led to a 10-percent increase in Israeli petroleum production. Domestic production now supplies about 10 percent of demand.

In 1963 production from the Heletz-Brur field averaged about 2,660 barrels per day from 27 wells; by midyear this was augmented by an estimated 600 barrels per day from the three wells at Kokhav. Petroleum was found in four additional wells at Kokhav later in 1963 but the added production is unknown. One of these wells (Kokhav 10) was expected to yield over 1,000 barrels daily, but a heavy flow of salt water was later encountered. Development drilling at Kokhav during the year was estimated to total 17,000 meters and at least 10 wells were completed. Elsewhere in the country, drilling was reported at four locations: Two in the Negev, one south of Heletz, and one south of Haifa. Total reserves in all fields were estimated at 27 million barrels, compared with 15 million barrels at the end of 1962.

In mid-1963 the government approved new regulations for petroleum prospecting. The maximum area held by a single concessionaire in any one district was increased to 1 million acres. Concession fees also were increased, and the applicant is now required to submit details of financing as well as a program for exploration.

Refinery Products and Petrochemicals.—Output of the Haifa refinery during 1963 was reportedly 2.63 million tons of petroleum products. This indicates a 15-percent increase over that of 1962 and a 100-percent increase over 1959. Fuel oils accounted for most of the increase in production. A program of modernization and new construction which began in 1961 was continued during 1963. The capacity of the refinery was expected to increase to 3 million tons in 1964 and 4 million tons in 1965. The modernization program includes installation of a new catalytic cracking unit.

The first plant of the petrochemicals complex at Haifa started producing ethylene in December 1963. The plant's capacity is 15,000 tons

per year. A carbon-black plant with an annual capacity of 20 million pounds was scheduled to begin production in January 1964 and a 6,000-ton polyethylene plant was scheduled for production in April.

Natural Gas.—Natural gas production increased at an unspecified rate during 1963 with completion of a new pipeline from the Zohar fields to industrial plants at Dimona and Oron and increased consumption at S'dom. At the beginning of the year Zohar gas was being supplied to the Dead Sea Works at the rate of 350 million cubic feet per year, an increase of 30 percent as compared with 1962. Gas from the new Hakanaim field, just north of Zohar, was connected with the Zohar distribution system late in 1962 and had produced 218 million cubic feet by February 1, 1963.

Total gas reserves are unknown, but reserves in the Zohar field were estimated to total 53,000 million cubic feet in late 1961.

The Mineral Industry of the Hashemite Kingdom of Jordan

By L. Nahai [1]

PHOSPHATE ROCK has been Jordan's principal mineral product. Output in 1963 was slightly over 1 percent of world's total. The country will begin making a small contribution to the world potash supply when the present project for utilization of potash from the Dead Sea comes into production.

Although Jordan's mineral output is quite small, it is important to its national economy. Phosphate rock accounts for nearly 30 percent of the value of total exports. The Jordanian cement plant and petroleum refinery meet a part of domestic demands for these products. Most construction raw materials are generally available throughout the country.

The 1963 value of mineral output was JD4,835,000 [2] (US$13,538,000). This does not include the value added by the petroleum refinery to the crude oil which Jordan receives from Saudi Arabia through the pipeline of the Trans-Arabian Pipeline Co. (Tapline) which crosses Jordan. Value of mineral production was equal to 4.2 percent of the estimated 1962 gross national product and consisted essentially of phosphates (US$7,246,000) and cement (US$5,929,000). It is estimated that 2,500 persons were engaged in mines and quarries and in the plants processing these raw materials and imported crude oil.

PRODUCTION

The value of minerals (except petroleum refinery products) produced in Jordan in 1963 apparently declined by about JD166,000 (US$465,000) from the level attained in 1962, primarily as a result of a 67,000-ton decline in phosphate production but also because of declines in marble and salt output. The gain in cement output of about 50,000 tons partly compensated for these declines. Generally, over the 5-year period 1959–63, Jordanian mineral output has shown appreciable gains.

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[1] Near East-South Asia specialist, Division of International Activities.

[2] The monetary unit of Jordan is the Jordanian dinar (JD). Conversion to U.S. currency has been made at the rate of JD1.00=US$2.80. The value of mineral production is a total of reported values for each of the nonfuel commodities listed in the production table except for gypsum, the value of which was estimated on the basis of the 1962 reported value of production.

TABLE 1.—Production of minerals

Commodity [1]	1959	1960	1961	1962	1963
Nonmetals:					
Cement—thousand metric tons	110	165	223	235	285
Gypsum—metric tons	(2)	(2)	7,000	8,660	[3] 8,700
Marble—square meters	10,349	(2)	15,400	15,600	11,450
Phosphate rock—thousand metric tons	338	362	422	681	614
Salt—do	16	12	19	19	18
Mineral fuels:					
Petroleum refinery products:					
Gasoline—thousand 42-gallon barrels		29	254	328	(2)
Kerosine—do		28	242	432	(2)
Distillate fuel oil—do		27	236	812	(2)
Residual fuel oil—do		37	230	256	(2)
Other—do		4	34	104	(2)
Total (including refinery fuel and losses) thousand 42-gallon barrels		132	1,154	2,032	[4] 2,235

[1] In addition to commodities listed, Jordan also produces limestone for cement manufacture.
[2] Data not available.
[3] Estimate.
[4] Estimate, based on reported 10-percent increase in refinery output.

TRADE

Except for salt and construction materials, most of Jordan's mineral and metal requirements must be provided by imports. Total value of these imports in 1962 was JD5,596,000 (US$15,669,000), or 12 percent of total imports. Principal imports and their equivalent values in dollars were as follows: Crude petroleum US$3,661,000; petroleum refinery products US$3,622,000; iron and steel US$6,283,000; nonferrous metals US$547,000; cement and clinker US$918,000; fertilizers US$358,000; and other nonmetallic minerals US$280,000.

In 1962 bars and rods constituted 55 percent of iron and steel imports followed by angles, shapes, and sections (13 percent), pipes and fittings (10 percent), and flat products (4 percent). Most of the steel is used in construction, but a small amount is used in fabrication of metal furniture and other products at the handicraft level.

Phosphates were Jordan's largest single export. The 1962 exports valued at JD1,456,152 (US$4,077,000) amounted to 29.5 percent of the country's total domestic exports.

TABLE 2.—Exports of minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Nonmetals:			
Cement	8,343	7,907	All to Saudi Arabia.
Lime	278	473	Saudi Arabia 449.
Granite and other stones	2,755	2,764	Lebanon 1,630; Iraq 634.
Marble	[1] 1,194	1,276	Iraq 645; Lebanon 280; Syria 231.
Phosphate	382,809	358,345	Yugoslavia 134,423; India 128,682; Czechoslovakia 81,073; Poland 9,400; Japan 4,667.
Salt	163	8,993	Syria 8,828.
Mineral fuels:			
Gasoline—42-gallon barrels	3,840	6,023	All to Saudi Arabia.

[1] Includes 156 tons of marble rubble.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum, semimanufactures	206	266	Mainland China 197; West Germany 30.
Copper, semimanufactures	115	261	France 55; Belgium 53; Netherlands 48.
Iron and steel:			
Pig iron	--------	315	West Germany 305.
Steel ingots	--------	82	Yugoslavia 59.
Semimanufactures	40,642	49,561	Belgium 16,819; France 10,415; West Germany 6,336; Luxembourg 4,494.
Lead, unwrought	192	279	West Germany 160; Australia 99.
Tin, all forms	26	26	United Kingdom 25.
Zinc, all forms	21	21	(1).
Nonmetals:			
Abrasives	--------	41	West Germany 28.
Cement and clinker	21,429	48,586	Iraq 25,856; Lebanon 18,449; Denmark 2,393.
Fertilizers	4,397	[2] 6,196	West Germany 2,480; Austria 1,350; Italy 602.
Marble	337	306	Italy 203.
Ochres and iron oxides	481	--------	
Refractory bricks and other refractory materials.	-------	871	(1).
Sulfur	1,478	1,581	West Germany 983; United States 572.
Mineral fuels:			
Petroleum:			
Crude—thousand 42-gallon barrels	1,532	1,866	All from Saudi Arabia.
Refinery products:			
Gasoline—1,000 42-gallon barrels	48	15	(1).
Kerosine—do	156	128	Aden 39; Italy 28; United States 25; France 15.
Gas and diesel oils—do	445	385	Italy 325; Aden 60.
Lubricants—do	27	41	United States 23; Italy 8.
Asphalt—do	16	2	All from United States.
Total refinery products—do	692	571	Italy 354; Aden 102; United States 54.

[1] Data not available.
[2] Phosphatic 2,747; nitrogen fertilizers 2,670; potassic 779.

COMMODITY REVIEW

METALS

Copper.—The government concluded an agreement with a West German firm to carry out detailed exploration and feasibility studies for the exploitation of copper deposits in Wadi Abu Khusheiba, about 100 kilometers north of Aqaba port. These deposits were discovered by the German Geological Mission which has been operating under a technical assistance agreement with Jordan since April 1961.

NONMETALS

Phosphate Rock.—Detailed investigations of the Hasa phosphate deposits, nearly 200 road kilometers north of Aqaba port, were carried out during the year by Ralph M. Parson Co. It is believed these deposits may contain more than 30 million tons of ore. A plant for beneficiating some of the phosphate produced at Al Roseifa mine, 15 kilometers by road northeast of Amman, also came into operation. The bulk of 1963 output was from this mine, but production was being shifted to the Al Hasa deposits which are closer to Aqaba port by about 160 kilometers.

To increase the export of phosphate, the port fees at Aqaba were reduced to 5.6 cents per ton from former duties which varied from 5.6

to 12.6 cents per ton depending on tonnage exported. Planned expansion of the Aqaba port through a JD1,350,000 (US$3,780,000) loan from West Germany will be significant to the phosphate trade. Buildings and pier facilities reportedly will be expanded so that the port may handle 1,500,000 tons of phosphate annually, the eventual target of phosphate production in Jordan.

MINERAL FUELS

Petroleum.—There was no petroleum exploration in Jordan during 1963, but the West German firm Gewerkschafe Elwerath Erdoeworke of Hanover sent representatives to Jordon to negotiate oil prospecting rights. The crude oil throughputs in the petroleum refinery at Zerka during 1961 and 1962 were the same as crude oil imports shown in table 3. The larger throughput in 1962 did not result from any additional equipment but by the more efficient operation of existing facilities.

The Mineral Industry of Kuwait

By F. L. Klinger[1]

KUWAIT was the leading petroleum-producing country of the Middle East in 1963. In recent years it has produced about 7 percent of the world's annual petroleum supply and has been second only to Venezuela in the volume of petroleum exports. In addition nearly one-fourth of the world's proved petroleum reserve is in Kuwait. The country has no other known mineral resources except for natural gas and a few construction materials.

The Kuwait economy is almost totally dependent on activities of the petroleum industry. Estimated value of production of petroleum and refinery products[2] was US$1,140 million in 1963 and was nearly equal to the value of the gross national product. Government revenue from petroleum, estimated at nearly US$500 million in 1963 (including income from the Kuwait-Saudi Arabian Neutral Zone), provided 94 percent of all government revenue and practically all foreign-exchange earnings.

The petroleum industry employs an estimated 5,000 persons, 6 percent of the country's labor force and has indirectly created a construction industry employing more than 20,000. Important new water supplies, cheap industrial fuel, a new commercial port facility, and increasing electric power also have resulted from petroleum exploration, development, and revenue. Kuwait's wage scale was reported to be the highest in the Middle East and the national income, on a per capita basis, was one of the highest in the world.

All petroleum production in Kuwait proper was from onshore fields of the Kuwait Oil Co. (KOC), owned equally by British Petroleum Co. (BP) and the Gulf Oil Corp. Offshore explorations were conducted by KOC and a subsidiary of the Royal Dutch Shell Group. In the Kuwait-Saudi Arabia Neutral Zone, Kuwait's onshore concession is leased to the American Independent Oil Co. and offshore areas (beyond the 6-mile limit) are leased to the Japanese-owned Arabian Oil Co. Essentially all of Kuwait's revenue from petroleum has been obtained from KOC and companies operating in the Kuwait-Saudi Arabia Neutral Zone. Under the KOC agreement, the government received 50 percent of the difference between production costs and the posted price of crude oil produced.

The most notable recent development in Kuwait petroleum affairs took place in May 1962, when the Kuwait Oil Co. relinquished half of

[1] Foreign mineral specialist, Division of International Activities.
[2] Estimated on the basis of posted crude prices at Mina al-Ahmadi and posted refinery product prices at Ras Tanura.

its original concession area to the government and agreed to release an additional 1,000 square kilometers of offshore area by 1967. Exploitation rights in the relinquished area were subsequently assigned to the government-controlled Kuwait National Petroleum Co. (KNPC). KNPC, which was established in 1961, also handles the distribution of petroleum products in Kuwait, receiving its supplies from KOC at cost. In 1963 KNPC acquired control of 51 percent of the aviation fueling concession which was formerly owned by the BP. The remaining 49 percent of stock was retained by BP.

Other developments in 1963 included a 5-percent increase in crude oil production, a 30-percent increase in refinery capacity, and suspension of onshore and offshore exploration drilling in the northern and western part of the country owing to unsettled boundary disputes between Iraq, Iran, and Kuwait. There was also a possibility that definition of the southern boundary of Kuwait would transfer some of KOC's concession area to the Neutral Zone, notably the Umm Gudair field.

PRODUCTION

Kuwait's petroleum production in 1963 was estimated at 28 percent of Middle East production and 7 percent of total world output. The average daily production of 1,932,800 barrels was an increase of nearly 100,000 barrels per day or 5 percent more than in 1962. Production of construction materials was not reported specifically but accounted for an inconsequential share of the total value of mineral output.

TABLE 1.—Production of petroleum and petroleum products

(Thousand 42-gallon barrels)

	1959	1960	1961	1962	1963
Crude petroleum	504,855	594,278	600,226	669,284	705,471
Refined products:					
Gasoline	904	1,444	1,410	2,505	2,167
Jet fuel	13	191	105	151	204
Kerosine	288	215	311	300	317
Distillate fuel oil	9,159	10,776	10,312	16,072	18,604
Residual fuel oil	39,734	49,693	47,648	37,292	38,419
Liquefied petroleum gas				956	1,774
Other refined products	37	205	224	5,302	5,101
Refinery fuel and loss	1,881	2,519	2,423	8,303	7,483
Total output refined products, including refinery fuel and loss	52,016	64,943	62,433	70,881	74,069

TRADE

About 18 percent of world petroleum exports originated in Kuwait. Kuwait also has been an import center for goods destined for neighboring areas. The country has a liberal trade policy, and although preference is given to imports from other Arab States, there are no bilateral trade agreements and few export or import controls. Almost all imported commodities are either exempt from duty or are taxed at 4 percent ad valorem. In 1963 Kuwait became a full member of the General Agreement on Tariffs and Trade.

The volume of petroleum and refined products exported in 1963 increased by 5 percent over that of 1962. These commodities were valued at more than US$1,000 million, with crude oil accounting for about 90 percent of the value of all exports and refinery products for 8 percent. Seventy-five percent of the crude and 65 percent of the refined products were destined for western Europe and Japan. All exports were by tanker.

Import statistics for 1963 are not available. In 1962 imports of metal and mineral products were valued at an estimated US$23 million or 8 percent of all imports. Cement was the largest single item, accounting for more than half the tonnage of all imports and possibly 4 percent of the total value, followed by iron and steel products (estimated at 4 percent of total value) and petroleum products (0.2 percent).

TABLE 2.—Exports of mineral fuels

(Thousand 42-gallon barrels)

	1962	1963	Principal destinations, 1963
Crude petroleum	599,630	629,158	United Kingdom 163,595; Japan 97,307; Italy 94,798; France 56,786; Netherlands 44,493; United States 35,576; Australia 24,622; Malaya and Singapore 21,442; Aden 18,093; Belgium 15,114; West Germany 11,220; Brazil 8,779.
Refined products:			
Light distillate	5,050	5,475	United States 3,390; United Kingdom 1,198; Australia 428; Philippines 214; South Africa 98; Uruguay 71.
Distillate fuel oil	14,580	16,820	United Kingdom 7,192; Singapore 1,835; Netherlands 1,523; Japan 1,435; Thailand 649; Syria 476; India 434; Uruguay 376; Formosa 310; Belgium 266.
Residual fuel oil	13,712	13,813	Japan 5,070; Netherlands 2,928; Singapore 1,905; United Kingdom 1,730; Thailand 596; Canary Islands 567.
Liquefied petroleum gas	947	1,753	Japan 1,749; Australia 4.
Other refined products	4,213		
Total refined products	38,502	37,861	
Bunkers:			
Jet fuel		199	(1).
Diesel oil	906	25,800	(1).
Residual fuel oil	23,499		(1).

[1] Data not available.

TABLE 3.—Imports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals: Iron and steel	48,501	53,815	Belgium 45,285; France 2,028; West Germany 1,576; mainland China 923; United Kingdom 932; Netherlands 703.
Nonmetals:			
Cement	275,877	618,966	Japan 318,794; Poland 120,765; Yugoslavia 71,330; USSR 40,954; Rumania 30,823; Egypt 20,900.
Gypsum and lime	2,145	608	(1).
Mineral fuels: Lubricants. thousand 42-gallon barrels	12	12	(1).

[1] Data not available.

Source: Kuwait customs, through Foreign Service despatches, U.S. Department of State.

COMMODITY REVIEW

NONMETALS

Cement.—Kuwait imports relatively large quantities of cement, although it has some limestone resources which might be adequate for cement manufacture. A feasibility study on the production of cement in Kuwait was underway in 1963. An alternative plan, by which Iraq would build a cement plant near the Kuwaiti border (at Jebel Sanam) with all production going to Kuwait, has also been proposed.

MINERAL FUELS

Crude Oil.—The Kuwait Oil Co.'s record petroleum production in 1963 came from 7 fields containing a total of 445 production wells, 35 of which were brought into production during the year. The Burgan field produces most of Kuwait's oil from Cretaceous sands at depths of 3,500 to 4,500 feet. It had 308 production wells at the end of the year, followed by the Magwa field with 53 wells; Ahmadi, 35; Raudhatain, 27; Minagish, 10; Sabriya, 7; Umm Gudair, 4; and Bahra, 1. An additional six wells had not been connected to production facilities by December 31.

In KOC drilling operations, 23 exploration wells and 28 development wells were completed during 1963, and 5 wells were being drilled at the end of the year. Of the development wells completed, 18 were drilled in the Burgan field and 8 at Magwa. At Minagish, where oil is produced from the Ratawi zone at 10,000 feet, two development wells were completed as producers in the Burgan zone at 6,500 feet. At Khashman, north of the Magwa field, a well drilled to test deep formations found no oil at depth but was completed as a producer in the Magwa zone at 5,000 feet. At the end of 1963 the company's proved petroleum reserves were estimated at 67,000 million barrels. No oil in commercial quantities has been found by offshore drilling, either by KOC which was drilling from an artificial island north of Kuwait City, or by Kuwait Shell which completed 3 wells in 1963 beyond the 6-mile limit.

Natural Gas.—Kuwait's gas reserves are estimated at 33 million million cubic feet.[3] Of the natural gas produced from petroleum operations, approximately 20 percent or 72,000 million cubic feet was utilized in 1962, the remainder being flared or vented. Of the total used, 45 percent was consumed in KOC operations; 25 percent was used for reservoir injection; 20 percent was delivered to government installations; and 10 percent was used in the manufacture of liquefied petroleum gas. Most of the gas received by the government was used for fuel in the water distillation and electric power plant at Shuwaikh port. Natural gas was also being used as fuel in sand, lime, brick-making, and asphalt-mixing plants and in an asbestos-cement plant which was commissioned in 1963.

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[3] Oil and Gas International. V. 4, No. 1, January 1964.

Arrangements have been made with the Kuwait Oil Co. to supply an additional 75 million cubic feet of gas daily to the site of the government's planned industrial complex at Shuaiba. The Shuaiba development is primarily intended to exploit Kuwait's natural gas as a source of cheap industrial fuel and as raw material for petrochemical manufactures. The government has invited bids for construction of a port facility and for an ammonia plant with a capacity of 400 tons per day. Plans were also being considered for other chemical plants, as well as a steel plant and an aluminum smelter.

Petroleum Refinery Products.—The KOC refinery at Mina al-Ahmadi processed an average 203,000 barrels of crude petroleum per day during 1963. The plant's capacity was increased from 190,000 to 250,000 barrels per day by modifications to two distillation units. Production and storage facilities for liquefied petroleum gas were also increased and the quantity of LP gas exports rose by 75 percent over that of 1962.

Plans for construction of a government refinery, with a capacity of 80,000 barrels per day, were announced in late 1962 by the Kuwait National Petroleum Co. The refinery is to be located at Shuaiba, 27 miles south of Kuwait City.

The Mineral Industry of the Kuwait-Saudi Arabia Neutral Zone

By F. L. Klinger [1]

THE Kuwait-Saudi Arabia Neutral Zone was established by treaty in 1922 as a solution to the boundary problem then existing between Kuwait and the Arabian province of al-Hasa. The zone originally comprised a land area of roughly 2,000 square miles, but by application of the continental-shelf concept in 1949 its area was extended seaward to include some 2,400 square miles of the Persian Gulf. In these areas, Kuwait and Saudi Arabia each have an undivided half interest, and mineral concessions are negotiated on this basis. Commercial oil deposits were found on land in 1953 and offshore in 1960. Except for natural gas, no other mineral resources are known.

The Neutral Zone ranked fifth in petroleum production in the Middle East in 1963, accounting for 5 percent of Middle Eastern output. On the basis of posted prices, this production was valued at an estimated US$159 million.[2] Except for petroleum company requirements, all production was exported, with about one-fourth being partially refined before shipment. Government revenue from oil goes to both the Kuwaiti and Saudi-Arabian Governments; in 1963, total receipts were estimated to exceed US$40 million.

Three oil companies hold concessions in the Neutral Zone. Operations onshore and extending out to the 6-mile limit are jointly conducted by the American Independent Oil Co. (Aminoil) and the Getty Oil Co., which have equal shares in production. Areas beyond the 6-mile limit are leased to the Japanese-owned Arabian Oil Co. (AOC). Aminoil's concession is granted by Kuwait, the Getty concession by Saudi Arabia, and AOC has separate agreements with each country. Aminoil's agreement provides for payment to Kuwait of 57 percent of realized profits or 50 percent of the difference between posted price and cost of production, whichever is larger. In 1961 the Getty Oil Co. reportedly paid to the Saudi Arabian Government a royalty of US$0.55 per barrel with a minimum annual payment of US$1 million. Under AOC's agreements the company, in effect, now guarantees each government 28.5 percent of net profits, for a total royalty payment of 57 percent. Additional benefits are required when certain levels of average daily production are reached. The companies employed an estimated 1,500 persons in 1963.

The principal developments in 1963 were an increase of 120 percent in offshore petroleum production; an agreement by AOC to raise the

[1] Foreign mineral specialist, Division of International Activities.
[2] Actual sale value was somewhat less because of discounting.

Saudi Arabian Government's share of profits to equal the percentage paid to Kuwait; and boundary negotiations between the two countries. The Zone's land area is being divided for administrative purposes but this evidently will not change either country's half interest in the petroleum concessions; however, no settlement was reached on the problems of concession rights to offshore islands, nor on relocation of Kuwait's southern boundary. Also in 1963, AOC is believed to have relinquished 20 percent of its unexploited concession area to the Saudi Arabian Government.

PRODUCTION AND TRADE

A review of available estimates suggests that petroleum reserves in the Neutral Zone may be as high as 25,000 million barrels. Total Neutral Zone production averaged 315,000 barrels per day in 1963, an increase of 28 percent over 1962. New oil reserves were found on land, south of the Wafra field, and offshore at Khafji and al-Hout, 25 miles north of Khafji. The discoveries were made in the Ratawi limestone and yielded higher grade oil (33° to 36° API) than is now produced.

Refinery throughput in 1963 averaged 71,000 barrels per day in Aminoil's plant at Mina Abdullah (Kuwait), and 14,000 in the Getty refinery at Mina Saud. Both refineries produce only fuel oil and small quantities of naphtha. At Ras al-Khafji, AOC plans to begin construction in 1964 of a similar refinery with a capacity of 30,000 barrels per day.

The only recorded trade in mineral commodities in 1963 consisted of crude and refined petroleum. Of the total exports, including bunker deliveries, nearly 83 percent was crude oil.

TABLE 1.—Production of petroleum and petroleum products[1]

(Thousand 42-gallon barrels)

	1959	1960	1961	1962	1963[2]
Crude petroleum	42,438	49,829	65,153	89,224	114,535
Refined products:					
Residual fuel oil	9,150	10,250	14,600	25,971	27,390
Other refined products	1,350	1,200	1,180	1,885	2,707
Refinery fuel and loss	430	400	520	967	955
Total output refined products	10,930	11,850	16,300	28,823	31,052

[1] Refined products estimated 1959-61.
[2] American Independent Oil Co., Getty Oil Co., Arabian Oil Co., through the U.S. Embassy, Kuwait. Preliminary figures, subject to revision.

TABLE 2.—Exports of petroleum and petroleum products

(Thousand 42-gallon barrels)

	1961	1962	1963 [1]	Principal destinations, 1963
Crude petroleum	52,239	63,047	92,908	Japan 63,514; United States 15,684; Italy 6,222; West Germany 3,200; Netherlands 1,598; Aden 956; France 624.
Refined products:				
Residual fuel oil	6,250	16,992	15,692	Japan 5,213; Italy 4,080; Greece 1,546; Singapore 1,159; Netherlands 915; Thailand 662; Norway 594; United States 508; Somaliland 480; Belgium 127.
Other refined products	1,180	1,885	566	United States 419; Netherlands 95; South Africa 52.
Bunkers (residual fuel oil)	3,886	3,661	3,100	(2).

[1] Preliminary figures, subject to revision.
[2] Data not available.

COMMODITY REVIEW

MINERAL FUELS

Petroleum.—*Onshore.*—All onshore production comes from the Wafra field, which produced 16° to 26° API gravity oil from Eocene and Cretaceous strata at depths of 2,000 to 4,000 feet. Wafra production averaged 181,500 barrels per day in 1963 and accounted for 58 percent of all Neutral Zone production. At the beginning of 1963, 352 wells were producing and an additional 110 wells were shut in. In development drilling, a total of 185 wells was completed during the previous 2 years and an estimated 70 additional wells were to be drilled in 1963. Wafra reserves were estimated to be 6,500 million barrels in 1961.[3]

New oil reserves were found at South Fuwaris, 7 miles south of Wafra. Tests in 1963 on two exploration wells yielded 3,000 barrels of 33° API gravity oil per day from one well and upwards of 300 barrels per day from the other. The oil is produced from the Ratawi and Upper Jurassic formations at depths below 5,000 feet.

Offshore.—Offshore petroleum production accounted for 42 percent of Neutral Zone output in 1963. The average production rate of 132,300 barrels per day was 120 percent greater than in 1962. All of the 1963 production came from 37 wells in the Khafji field, which produces a relatively heavy crude (26° API) from two Cretaceous strata (Bahrain sands) at a depth of 5,400 feet. The Ratawi oil found at Khafji and al-Hout in 1963 is lighter (34° to 36° API) than the crude heretofore produced and contains half as much sulfur (1.7 percent). The new horizon was found 300 meters below the Bahrain sands. Total offshore reserves are estimated at 18,000 million barrels.[4]

Khafji production is expected to increase substantially in 1964. Highly automated gathering and loading facilities have been installed and the productive capacity of the field is now 210,000 barrels per day.

[3] Saudi Arabia. In The Middle East 1961. Europa Publications, Ltd., London, 1961; p. 288.
[4] Petroleum Engineer for Management. V. 36, June 1964, p. 92.

The Mineral Industry of Qatar

By F. L. Klinger [1]

IN RECENT years, Qatar has produced about 3 percent of the annual crude petroleum output of the Middle East. It ranked 6th in Middle East production and 10th in world petroleum exports in 1963. The country has no other known mineral resources except natural gas produced in association with crude oil, and construction materials.

Petroleum has been almost the only source of national income. Production in 1963 was valued at an estimated US$136 million, using Umm Said posted price, and provided 99 percent of all government revenue. Government revenues from petroleum, estimated at US$53 million in 1962, are obtained from three oil companies: Qatar Petroleum Co. (QPC), which accounted for all petroleum production until 1964; Shell Overseas Exploration Co., which now accounts for an estimated 10 percent of total production; and Continental Oil Co. (Conoco) which began explorations in 1963. These companies employed an estimated 3,500 persons in 1963, including about 2,000 Qataris.

PRODUCTION

All petroleum produced from Qatar through 1963 came from the onshore Dukhan field, operated by QPC. The offshore field of Idd al-Sharqi, discovered by Shell in 1960, was expected to begin production in 1964 and to account for about 10 percent of total Qatari production.

Dukhan production in 1963 averaged 191,000 barrels per day from

TABLE 1.—Production of petroleum and petroleum products

(Thousand 42-gallon barrels)

	1959	1960	1961	1962	1963
Crude petroleum	61,431	63,088	64,386	67,911	69,811
Refined products: [1]					
Gasoline	72	72	60	60	51
Kerosine	24	24	36	30	27
Distillate fuel oil	60	72	60	50	47
Residual fuel oil	24	24	84		61
Other				5	4
Refinery fuel and loss	14	24	12	5	(2)

[1] Estimate.
[2] Data not available.

[1] Foreign mineral specialist, Division of International Activities.

a total of 48 wells. This rate of production was 3 percent more than that of 1962 and was the highest since production began in 1949. The rate of production is now at a near-maximum level.

TRADE

All Qatar petroleum is exported except for approximately 500 barrels per day which is refined for local consumption. Petroleum exports in 1963 were valued at an estimated US$135.7 million, with the principal countries of destination being the United Kingdom, France, West Germany, and the United States. All exports were from Umm Said, 20 miles south of Doha, which is the terminus of a 55-mile pipeline from the Dukhan field.

Little information is available on imports into Qatar. In 1961, the value of all imports was US$45 million, with goods imported by QPC comprising 30 percent of this total. Imports of refinery products made up 2 percent of the total value. Qatar imposes a general import tax of 2½ percent ad valorem.

TABLE 2.—Exports and imports of petroleum and refined products[1]

(Thousand 42-gallon barrels)

	1961	1962	1963
Exports: Crude oil	64,134	67,728	69,623
Imports:[2]			
Gasoline	96	84	(3)
Kerosine	24		(3)
Distillate fuel oil	96	156	(3)
Lubricants, including grease	5	4	(3)

[1] Data on destinations and origins not reported in detail.
[2] Estimate.
[3] Data not available.

COMMODITY REVIEW

MINERAL FUELS

Substantial portions of the QPC and Shell concession areas were relinquished to the government during 1963, and in September, exploration rights in these areas were acquired by Conoco. QPC has now relinquished 7,700 square kilometers or 75 percent of its original concession, and Shell has released 13,000 square kilometers or 60 percent of its offshore area. The Conoco concession includes about 800 square kilometers of area south of the Dukhan field which QPC did not completely explore.

QPC expects to increase petroleum recovery by a program of gas injection and was building a compression plant in 1963. A problem of salt-water intrusion may also require remedial action. Dukhan crude, which is produced from Jurassic limestone at an average depth of 6,500 feet, is relatively light (41° API). In 1963 its posted price (US$1.95 per barrel) was the highest in the Persian Gulf area. The field was instrumented for fully automatic operation in early 1962.

The Shell offshore field at Idd al-Sharqi, located south of Halul island 50 miles east of Doha, is producing 25,000 barrels per day of 24° to 38° API gravity crude from Jurassic limestone at a depth of approximately 8,000 feet. Eight wells have been completed and have a combined productive capacity of 30,000 barrels per day. A converted tanker serves as a gathering and loading station, and exports were expected to begin in February 1964. A new field was discovered at Maydan Mahzam 20 miles north of Idd al-Sharqi.

Total petroleum reserves in 1963 were estimated to be approximately 3,000 million barrels.

The Mineral Industry of Saudi Arabia

By F. L. Klinger[1]

SAUDI Arabia has the second largest petroleum production of the Middle East and ranks fifth in world production. Its annual production has been about 6 percent of world output, and for several years the country has ranked third in world petroleum exports. As for other mineral resources, Saudi Arabia continued to produce a small quantity of cement and other construction materials and until 1954 was also a producer of gold and silver. Deposits of other metals and nonmetals are known to be present, but little is known of their economic potential.

The petroleum industry has dominated the national economy, providing almost all government revenue, foreign exchange earnings, and industrial employment. The value of crude petroleum produced in 1963 is estimated at US$1,000 million,[2] probably equivalent to 98 percent of the gross national product. The industry employed an estimated 11,000 Saudi Arabs, as compared with an estimated 800 engaged in quarrying and processing of construction materials.

The government obtained petroleum revenue under profit-sharing agreements with the Arabian American Oil Co. (Aramco), Trans-Arabian Pipeline (Tapline), and companies operating in the Kuwait-Saudi Arabia Neutral Zone. Under these agreements the government received at least 50 percent of company profits before foreign taxes. Government revenue from petroleum, which was equivalent to US$400 million in 1962, was increased by more than US$100 million in 1963 by settlement of two longstanding tax and royalty disputes between the government and the Aramco and Tapline companies and by accelerated income tax payments. Under these settlements, Aramco profits on oil exported to Lebanon are calculated on the higher posted prices at Sidon instead of at Ras Tanura, and Tapline agreed to begin transit-royalty payments.

GOVERNMENT POLICIES AND PROGRAMS

Government activities in the field of minerals increased during 1963. Under an agreement signed on March 24, the Arabian American Oil Co. relinquished to the government 65 percent of its exclusive concession area and all of its preferential rights in other areas. Petroleum exploration was being carried out in these areas by the government

[1] Foreign mineral specialist, Division of International Activities.
[2] Calculated from 1963 posted prices at Ras Tanura.

through its agency, General Petroleum and Mineral Organization (Petromin), which had been authorized to engage in all phases of the mineral industry. Under the March agreement, Aramco will progressively relinquish an additional 30 percent of its original concession by 1993. Petromin became a distributor of petroleum products early in 1964 after purchasing the Aramco bulk plant at Jiddah, and also planned to extend its activities into drilling, refining, and petrochemicals production.

In February, Saudi Arabia's first mining code was established. While asserting basic state ownership of all mineral deposits, the code appears to encourage private investment. Tax and royalty arrangements will be negotiated for each individual venture.

In September, exploration and development of mineral resources other than petroleum were accelerated by a technical assistance agreement with the U.S. Government. Saudi Arabian mineral resources are known to include deposits of base and precious metals, as well as magnesite, fluorite, barite, and large deposits of salt. With assistance from Aramco and the U.S. Government, geologic mapping of the country has now been completed on a scale of 1:500,000. The series of 22 maps is available to the public and includes a 1:2,000,000 geologic map of the country.

PRODUCTION

Production of both crude petroleum and refinery products was 7 percent greater than in 1962. Petroleum production averaged 1,629,018 barrels per day, an increase of 108,000 barrels per day as compared with 1962. Nearly 40 percent of the increase came from the Abu Hadriya field which began production in 1963. At the Ras Tanura refinery, daily throughput averaged 270,000 barrels, an increase of 20,000 barrels per day from 1962. Production of liquefied petroleum gases increased 100 percent as compared to the previous year.

TABLE 1.—Production of minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Cement	[1] 75,000	[1] 90,000	105,000	152,000	186,000
Gypsum				[1] 10,500	[1] 36,000
Lime	(2)	(2)	(2)	(2)	6,200
Marble	(2)	(2)	(2)	[1] 240	(2)
Salt	(2)	(2)	(2)	(2)	9,700
Mineral fuels:					
Crude petroleum—thousand 42-gallon barrels	399,821	456,453	508,269	555,056	594,592
Refined products:					
Aviation gasoline—do	86	288	427	313	335
Motor gasoline—do	8,062	9,779	9,046	8,327	10,440
Jet fuel—do	3,119	2,553	3,361	4,428	4,506
Kerosine—do	4,884	5,950	5,839	3,775	3,805
Distillate fuel oil—do	10,546	10,635	13,065	12,310	15,174
Residual fuel oil—do	31,171	45,148	49,758	51,951	53,388
Liquefied petroleum gas—do	43	216	(2)	1,058	2,116
Miscellaneous—do	1,844	2,533	4,322	4,593	4,866
Refinery fuel and loss—do	3,855	5,210	4,994	4,180	3,872
Total refined products—do	63,610	82,312	90,812	90,935	98,502

[1] Estimate.
[2] Data not available.

TRADE

Virtually all Saudi Arabian exports are of crude petroleum and refinery products. Exports and reexports of other minerals and metals in 1961–62 (Hijrah 1381)[3] were valued at US$258,000, of which iron and steel products accounted for 99 percent.

Exports of crude petroleum in 1963 were 7 percent greater than in 1962, while refinery product exports increased by 19 percent. The estimated gross value of these exports was approximately US$1 billion,[4] of which crude oil accounted for 83 percent, and refinery products, 17 percent. Fifty-nine percent of all petroleum exports were by tanker from Ras Tanura; 30 percent by tapline to Sidon, Lebanon; and 11 percent by pipeline to Bahrain.

Imports of metals and minerals in 1961–62 were valued at US$30 million, or 12 percent of all imports. Iron and steel products were valued at 8 percent of all imports, followed by nonmetallic minerals (1.6 percent), mineral fuels (1.4 percent), and other metals (0.7 percent). Principal supplying countries (for all imports) were the United States, United Kingdom, Japan, West Germany, Italy, and the Netherlands. Imports from Communist countries were valued at 1.6 percent of all imports, the principal mineral product being 26,000 tons of cement from Rumania.

In early 1962 Saudi Arabia revised its tariff schedule—reducing or eliminating duties on most commodities but raising the duty on cement, gypsum, and marble. In December 1963, the tariff on gasoline imports was substantially increased. Petroleum products imported in 1962 and 1963 consisted of gasoline (about 4,000 barrels in each year), and lubricants (24,000 barrels in 1962 and 27,000 barrels in 1963).

TABLE 2.—Exports and reexports of petroleum and petroleum products[1]

(Thousand 42-gallon barrels)

Commodity	1962	1963
Crude petroleum	462,222	494,992
Refined products:		
Aviation gasoline	227	115
Motor gasoline	6,534	8,421
Jet fuel	4,417	4,445
Kerosine	3,253	3,018
Distillate fuel oil	10,609	13,813
Residual fuel oil	36,614	42,901
Liquefied petroleum gas	995	1,674
Total	62,649	74,387
Bunkers, all flags:		
Distillate fuel oil	500	557
Residual fuel oil	14,300	15,446

[1] Data on geographic distribution of individual items not available. Continental distribution of total crude oil and refinery products produced by ARAMCO (excluding bunkers) in 1962 was as follows, in percent: Asia and Australia 41; Europe 36; South America 11; North America 9, and Africa 3.

Source: Arabian American Oil Co. reports.

[3] Latest available figures.

[4] Estimate based on posted prices at Ras Tanura as of Dec. 17, 1963. Values of US$0.14/U.S. gallon and US$2.33/barrel were used for aviation gasoline and LPgas, respectively. Estimate does not include bunker loadings.

COMMODITY REVIEW

METALS

There are iron deposits of possible commercial value at Wadi Fatima, 50 kilometers east of Jiddah, and at Wadi Sawawin, near the Red Sea coast about 200 kilometers south of Aqaba. The Wadi Fatima deposits consist of two layers of oolitic hematite from 1 to 5 meters thick; tentative estimates suggest that 60 million tons of material with an iron content of about 47 percent is available. At Wadi Sawawin, very large deposits of low-grade (30 to 35 percent iron) ferruginous sediments are found about 60 kilometers from the coast. Aeromagnetic surveys were carried out in this area in 1962, and ground exploration, sampling, and beneficiation tests are continuing.

At yearend, it was indicated that the government soon would allocate funds for construction of a steel products rolling mill at Jiddah. The plant would operate on imported steel pellets and have an annual capacity of 45,000 tons of steel-reinforcing bars and sections.

NONMETALS

In 1962, two cement plants were operating in Saudi Arabia; one at Jiddah, with an estimated daily capacity of 450 tons, and one at Hofuf near the oilfields, with a daily capacity of 300 tons. A third plant may be built at Riyadh. A gypsum plant with a capacity of 100 tons per day began production in Riyadh in late 1961, and two lime plants have been operating near Dhahran since 1962. The marble industry is based at Jiddah, with numerous small quarries located east of the city at Wadi Fatima. The lime plants near Dhahran and the cement plant at Hofuf are fueled by natural gas and consumed a total of 530 million cubic feet in 1963.

MINERAL FUELS

Aside from the revenue and concession agreements of March 24, the principal developments in the petroleum industry during 1963 were the entry of three new fields into production, the discovery of a new offshore field (Abu Safah) and additional onshore reserves at Qatif, and expansion of production facilities for both crude petroleum and refinery products.

Petroleum produced in 1963 came from 247 wells in 9 fields. The Ghawar field accounted for 47 percent of total production, followed by Abqaiq (23 percent), Safaniya (18 percent), Khursaniyah (4 percent), and Abu Hadriya (2.5 percent). Total production was 39 million barrels more than in 1962 and 88 percent of the increase was produced from Ghawar and Abu Hadriya fields. Abu Hadriya, tested for 3 days in 1962, began regular production in 1963 and produced 15 million barrels. Two other new fields, Fadhili and Khurais, began production in 1963 but did not contribute significantly to total production.

A new offshore field, Abu Safah, was discovered 27 miles northeast of Ras Tanura, and delineation of the field began in September. Abu Safah lies within an area covered by an agreement whereby petroleum revenue will be shared between Saudi Arabia (75 percent) and Bahrain (25 percent). In the Qatif field, 30 miles southwest of Abu Safah, new oil reserves were found below the Arab D member, and the (northern) extension of the field was proved by delineation drilling. The first offshore well of the Qatif field was being drilled at the end of the year.

Seventeen wells were drilled during the year, including 10 development wells, 1 exploration well, and 6 for stratigraphic or observation purposes. Three wells were drilling at the end of the year. At the end of 1963, proved liquid hydrocarbon reserves were estimated to be 57,800 million barrels, and gas reserves were estimated at 24,096,000 million standard cubic feet.

In 1963 the productive capacity of the Safaniya field was increased by 9 percent to 425,000 barrels per day, and the Manifa field, with an initial capacity of 100,000 barrels per day, was being prepared to start production in 1964. Both of these fields are offshore. Onshore, the Ghawar field capacity is scheduled to be increased by 159,000 barrels per day in 1964 with completion of additional wells at 'Ain Dar and a 65-mile pipeline connecting the southern (Haradh) part of the field to existing facilities. At the Ras Tanura refinery, capacity of the refrigerated liquefied petroleum gas plant was tripled to 12,000 barrels per day in 1963, and a new crude stabilization plant (for removal of hydrogen sulphide) with a capacity of 170,000 barrels per day was nearly completed at the end of the year.

In longer range plans, the productive potential of the Ghawar and Abqaiq fields was being increased by injections of water and gas. Average daily injections during 1963 included 300,000 barrels of water, 20,000 barrels of liquefied petroleum gas, and 250 million cubic feet of gas. At Ras Tanura, a new marine loading facility, scheduled for completion in 1965, will increase the crude oil shipping capacity of the port by 500,000 barrels per day.

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The Mineral Industry of the Federation of South Arabia[1]

By F. L. Klinger[2]

THE Federation of South Arabia, including Aden and 11 other States, covers the western 60,000 square miles of Aden Protectorate. Aden is the only part of the Federation having significant mineral production or trade, and is one of the world's largest bunkering stations, supplying fuel to about 6,000 ships annually. It is also the principal port of entry for all goods (including minerals and metals) into Yemen.

The mineral industry consists of petroleum refining and production of salt from sea water. Petroleum products account for more than 99 percent of the value of mineral production, and the trade in petroleum and petroleum products accounts for 60 percent of the value of all trade. The mineral industry is probably the largest single source of government revenue other than subsidies and provides additional port revenue from bunkering services. Employment is estimated at 2,100 in petroleum refining, 1,400 in bunkering operations, and 300 in the local salt industry. The principal employer is British Petroleum (Aden), Ltd., which operated the area's only refinery and accounted for most bunkering sales.

Aden's accession to the Federation in January 1963, shifted responsibility for commerce, industry, banking, and currency to the local government, but was not expected to appreciably alter mineral production or trade. The principal development in the field of minerals has been the expansion of the Aden refinery. Other developments include a British mineral survey in the protectorate area completed in 1962, which found no deposits of economic value, and the start of construction of three "dolphin" berths at the port, which will increase cargo handling capacity as well as reduce tidal restrictions on ship movements.

The East Aden Protectorate covers 75,000 square miles between the Federation of South Arabia and the Dhofar Province of Muscat and Oman. This area has a subsistence-level agricultural economy, and there is no industry or mineral production aside from local quarrying of construction materials. Government revenue, estimated at US$2 million annually, is mostly obtained from customs duties, subsidies from the British Government, and petroleum concession rentals; the latter totaling about US$350,000 in 1963.

[1] Includes information on the East Aden Protectorate.
[2] Foreign minerals specialist, Division of International Activities.

PRODUCTION

In 1963 the estimated gross value of mineral production and processing in Aden was US$148 million, of which petroleum products accounted for 99.9 percent, and salt for 0.1 percent. Refinery production in 1963 was 10 percent more than in 1962 and resulted from increased production of fuel oils. Output of residual fuel oil increased 19 percent, and diesel oil, 7 percent. Fuel oils accounted for 74 percent of refinery production in 1963 and 70 percent in 1962.

TABLE 1.—Production of minerals[1]

Commodity	1959	1960	1961	1962	1963
Nonmetals: Salt---metric tons	171,200	102,897	118,132	78,000	81,280
Mineral fuels:					
Refinery products:					
Gasoline---thousand 42-gallon barrels	3,926	3,315	4,122	3,760	3,463
Jet fuel---do	953	2,502	4,083	5,092	5,430
Kerosine---do	2,358				
Distillate fuel oil---do	5,937	6,133	7,811	8,703	9,356
Residual fuel oil---do	14,679	15,169	17,987	21,258	25,327
Other refined products---do	893	2,048	2,920	3,617	3,262
Refinery fuel and loss---do	1,967	1,857	2,109	2,488	2,574
Total throughout---do	30,713	31,024	39,032	44,918	49,412

[1] All recorded production is from Aden.

TRADE

Exports of petroleum products (excluding bunkers) in 1963 were valued at an estimated US$84 million or 44 percent of all exports. This was a 10-percent increase in value over that of 1962. In terms of value, 35 percent of the petroleum products exported in 1963 were destined for the United Kingdom. An additional 11 percent was consigned to Japan and about 5 percent each to Singapore and Australia. As compared with 1962, the value of exports to Japan increased sixfold to about US$10 million.

Bunker loadings in 1963 totaled 3,847,000 metric tons, valued at US$65 million or 34 percent of all exports. This was a 9-percent increase in volume but a 3-percent decrease in value compared with 1962. British Petroleum supplied 73 percent of all bunker loadings; Mobil Oil (East Africa), Ltd., 17 percent; and Caltex Oil (Aden), Ltd., 10 percent.

Mineral and metal imports in 1963 were valued at an estimated US$122 million, about 45 percent of the value of all imports, compared to US$113 million in 1962. Crude petroleum accounted for an estimated 34 percent of the value of all imports, followed by petroleum products (10 percent), iron and steel (0.8 percent), and cement (0.6 percent). These proportions were not appreciably different from 1962 although imports of fuel oils increased by more than 50 percent and accounted for the increase in total value.

In 1963 substantial changes took place in the total value of imports of crude oil and petroleum products from the principal supplying countries. The value of imports from Iran increased about 40 percent while those from Kuwait fell nearly 25 percent. Shipments

from Iraq and Bahrain more than doubled in value but decreases of 30 percent were reported for Qatar and the Trucial Coast.

Imports of cement and products of iron and steel, which rose sharply in 1961 as civil and military construction projects began, were expected to remain at relatively high levels through 1964.

TABLE 2.—Exports of metals and minerals from Aden [1]

(Metric tons unless otherwise specified)

Commodity	1961	1962
Metals:		
Iron and steel	1,205	1,284
Nonmetals:		
Cement	7,043	6,338
Salt	118,240	101,456
Mineral fuels:		
Coal	3	----------
Petroleum products:		
Gasoline---thousand 42-gallon barrels	6,823	7,096
Kerosine and jet fuel---do	3,919	4,400
Distillate fuel oil---do	2,176	2,353
Residual fuel oil---do	9,912	10,722
Bunkers:		
Distillate fuel oil---do	5,371	5,213
Residual fuel oil---do	20,702	20,093

[1] Destinations not available for exports of metals, nonmetals, or coal. For petroleum products, destinations are available in terms of value only (see text).

TABLE 3.—Imports of metals and minerals into Aden

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals: Iron and steel	12,701	10,853	(1).
Nonmetals:			
Cement	68,719	92,984	(2).
Salt	68	45	(1).
Mineral fuels:			
Coal	1,661	(1)	(1).
Petroleum:			
Crude---thousand 42-gallon barrels	39,738	46,684	Kuwait 24,241; Iran 8,353; Qatar 6,095; Iraq 3,773; Abu Dhabi 3,680.
Refined products:			
Gasoline---do	233	294	(1).
Kerosine---do	(1)	6	(1).
Fuel oil---do	10,778	7,710	(1).
Lubricants---do	[3] 12	[3] 12	(1).

[1] Data not available.
[2] Limited data suggest that principal supplying countries were Kenya, Egypt, and East European countries including the U.S.S.R.
[3] Estimate.

COMMODITY REVIEW

NONMETALS

Salt.—All production was from the Indo-Aden Salt Co., the last of four salt companies formerly operating in Aden. During the 1950's, the combined annual output of the four companies was nearly 400,000 tons per year. The closing of the other firms and the reduced level of Aden's output is due to a sharp decline in Indian salt imports and to subsequent intensified competition for Japanese markets.

MINERAL FUELS

Petroleum.—Refinery improvements and expansion begun in late 1960 have increased capacity of the Aden refinery from 120,000 to 136,000 barrels per day. The refinery, established in 1952, processes only imported crude. During 1963, it operated at 95 percent of rated capacity, compared with 89 percent in 1962 and 73 percent in 1961.

Petroleum exploration was being conducted in the East Aden Protectorate by the American International Oil Co. (formerly, Pan American Oil Co.) a subsidiary of Standard Oil Co. (Indiana). Exploratory work completed in 1963 included 24 party-months of surface geological surveys and 7 party-months of seismic surveys. No drilling activity was reported.

The oil rights in this area were originally held by Petroleum Concessions, Ltd., a subsidiary of Iraq Petroleum Co. (IPC), but were relinquished in 1960. The Hadhramaut concession, covering the western three-fifths of the protectorate, was acquired by American International from the sultans of Qu'aiti and Kathiri in 1961. The Mahra concession, adjoining Dhofar, was acquired in 1962 from the Sultanate of Qishm and Socotra and includes 2,000 square miles of Socotra Island. Both concession agreements include a 10-year exploration period, a 30-year development period and provide that the Sultanates receive 55 percent of net profits as well as participation rights of up to 20 percent.

The Mineral Industry of the Syrian Arab Republic

By F. L. Klinger [1]

SYRIA is essentially an agricultural country but produces petroleum products, cement, salt, glass sand, gypsum, and other construction materials. The country also has unexploited reserves of phosphate rock, petroleum, and natural gas.

Petroleum refining and cement production were the most important mineral activities in 1963. Value of petroleum products and cement produced in 1962, the last year for which complete production data are available, was estimated at S£107 million,[2] equivalent to US$28.3 million. This was about 4 percent of the gross national product and 99 percent of the value of all mineral products.

Government revenue from mineral activities amounted to S£127 million (US$33.2 million) in fiscal year 1961–62. Petroleum transit royalties accounted for 85 percent of this total and continued through 1963 to supply a substantial share of Syrian foreign exchange earnings. Transit royalties are derived from the crude petroleum shipped across Syria through pipelines of the Iraq Petroleum Co. (IPC) and the Trans-Arabian Pipeline Co. (Tapline).

IPC pipelines also supplied crude to the Government refinery at Homs. This refinery, with a capacity of 1 million tons a year (about 20,000 barrels per day), was completed in 1959 and supplies about 75 percent of Syrian demand for petroleum products. The value of crude petroleum delivered to the refinery in 1961–62 is included in the figure for Government revenue.

It is estimated that 7,000 persons were employed in all mineral-based industries in 1963. About 500 were engaged in direct production of minerals, with 1,250 in cement and glass manufacture, and 5,300 in petroleum transport and refining.

PRODUCTION

Production gains were realized or predicted in most mineral commodities in 1963. The gross value of mineral products in 1962, the last year for which complete data are available, was estimated at about US$28.5 million, of which petroleum products and cement accounted for about 59 percent and 40 percent, respectively.

[1] Foreign minerals specialist, Division of International Activities.
[2] Syria's official monetary unit is the Syrian pound. The official exchange rate is 3.82 Syrian pounds equal US$1.00.

TABLE 1.—Production of minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Asphalt, natural	20,691	21,462	27,576	32,633	36,782
Bitumen calcareous silt (bitumen 10 to 14 percent)	25,100	35,000	(1)	(1)	(1)
Cement—thousand tons	447	489	540	607	685
Glass sand	(1)	(1)	(1)	[2] 8,000	(1)
Gypsum	6,000	13,500	8,000	15,000	[3] 15,000
Salt—thousand tons	8	10	7	18	15
Sulfur	(1)	53	47	----------	(1)
Mineral fuels:					
Refinery products:					
Gasoline—thousand 42-gallon barrels	328	910	1,024	995	1,076
Kerosine—do	220	752	846	818	819
Diesel fuel—do	440	1,301	1,464	1,501	1,881
Residual fuel—do	712	1,908	2,150	2,183	2,222
Asphalt—do	(1)	104	165	127	158
Liquefied petroleum gas—do	(1)	7	39	49	84

[1] Data not available.
[2] Minimum estimate based on Damascus plant capacity and 1962 Syrian production. Plant supplied from nearby sand deposits.
[3] Estimate.

TRADE

Practically all metal, industrial mineral, and commercial fuel requirements of Syria must be met by imports, which in 1962 were valued at US$49.7 million and constituted 22 percent of all imports. Iron and steel products were the most important group with 12 percent of all imports, followed by mineral fuels (7 percent), nonmetallic minerals (2 percent) and nonferrous metals (1 percent).

Mineral and metal exports were valued at S£7 million, 1 percent of the value of all exports. Gasoline represented more than 90 percent of this value.

Compared with 1961, imports of iron and steel doubled in 1962 because of increases in light constructional items, and aluminum imports were up 60 percent owing to a 600-ton increase in ingots. Imports of most other nonferrous metals were not appreciably changed.

Of mineral fuel imports, valued at US$15 million, crude petroleum accounted for 68 percent and petroleum products (largely distillate fuel oil) for 31 percent. Mineral and chemical fertilizers made up 65 percent of total nonmetal imports, which were valued at about US$5,236,000. Imports of combined fertilizers (phosphate-nitrate-potash) increased five times over that of 1961 while others decreased 30 percent.

Tariff regulations remained unchanged. For the most part, Syria has a single-column tariff but gives preferential treatment to many commodities imported from Arab States. Syrian tariffs and taxes on imported commodities aggregate 25 to 30 percent of import (c.i.f.) value. A new regulation, effective in January 1964, will permit issuance of import licenses only after a percentage of c.i.f. value of import shipments is deposited. The rate is 15 percent for mineral commodities (including mineral fuels) and 40 percent for metals.

TABLE 2.—Exports of metals and minerals

(Metric tons)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Iron and steel:			
Scrap	3,108	3,194	Yugoslavia 2,445; Lebanon 741; Jordan 8.
Rolled and other	205	69	Lebanon 52; Saudi Arabia 13.
Nonferrous metals and alloys	7	5	Lebanon 3; Jordan 2.
Nonmetals:			
Asphalt, natural	467	415	Cyprus 300; Lebanon 115.
Cement	2,415	1,003	Jordan 1,000.
Gypsum	5,857	430	Jordan 259; Lebanon 170.
Talc	127	139	Jordan 137.
Various construction materials	406	247	Lebanon 144; West Germany 76; Jordan 19.
Miscellaneous	30	3	All to Jordan.
Mineral fuels:			
Coal and fuel briquets	38	3	Do.
Petroleum refinery products: Gasoline	249	435	Netherlands 425; Saudi Arabia 9.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum:			
Ingots	123	404	Jordon 117; Kuwait 103; United Kingdom 76.
Semimanufactures	864	1,195	Lebanon 433; Italy 208; United Kingdom 196.
Copper:			
Ingots, including scrap	236	333	Kuwait 116; Jordon 98; United Kingdom 55.
Semimanufactures, including alloys	1,059	855	United Kingdom 356; Italy 243; West Germany 130.
Solder	15	23	West Germany 12; Belgium 6; Italy 5.
Gold—troy ounces	1,123	608	United States 553; West Germany 42.
Iron and steel:			
Cast iron	655	1,437	U.S.S.R. 850; mainland China 289; West Germany 200.
Scrap	1,514	1,986	United Kingdom 594; United States 450; Kuwait 379.
Ingots	12	326	France 158; West Germany 134.
Rolled steel	95,878	181,011	Poland 30,536; Belgium 29,989; France 25,170; mainland China 24,168; Luxembourg 12,778; Yugoslavia 12,241; West Germany 10,766; U.S.S.R. 6,011.
Lead:			
Ingots	675	721	Kuwait 132; West Germany 102; Belgium 81; Iraq 79; Jordan 76.
Semimanufactures	217	178	West Germany 85; Netherlands 51.
Platinum—troy ounces	1,639	-------	
Silver—do	1,646	5,222	Netherlands 3,200; United Kingdom 1,415.
Tin:			
Ingots	94	71	Malaya 27; mainland China 26.
Semimanufactures	27	19	United Kingdom 8; West Germany 6.
Zinc, all forms	180	208	Belgium 115; Poland 32; United Kingdom 27.
Other nonferrous metals and alloys	299	222	Belgium 151; West Germany 52.
Nonmetals:			
Abrasives	276	583	Greece 565; West Germany 9.
Barite	2,684	61	All from U.S.S.R.
Building stone, including broken stone	48	266	Jordan 181; Lebanon 81.
Cement	3,584	16,541	Yugoslavia 6,245; Denmark 5,471; France 2,307; United Arab Republic (Egypt) 1,204.
Clays	1,918	866	U.S.S.R. 444; Czechoslovakia 106; West Germany 106; Bulgaria 100.
Fertilizers (mineral and chemical)	77,562	64,409	West Germany 28,499; Netherlands 12,181; Austria 11,858; Italy 6,989.
Graphite	68	36	West Germany 16; Norway 15.
Gypsum	21	9	United Kingdom 8.
Magnesite	25	55	Bulgaria 40; India 15.
Marble	4,166	7,028	Italy 6,403; Jordan 465.
Ocher and other earth colors	529	630	France 317; West Germany 185; Hungary 61.
Salt	-------	18,104	United Arab Republic (Egypt) 9,538; Jordan 8,065.
Sand (including quartz)	444	912	Lebanon 887; West Germany 17.
Sulfur	919	1,049	Bulgaria 341; France 308; West Germany 202.
Talc	416	499	Mainland China 376; Hungary 33.
Other	17	28	Argentina 10; Lebanon 5.
Mineral fuels:			
Coal and anthracite	214	551	United Kingdom 276; Belgium 275.
Coke (including petroleum coke)	2,275	1,949	Belgium 961; West Germany 927.
Fuel briquets	2,121	1,625	Belgium 1,440; United Kingdom 120.
Petroleum:			
Crude	5,724	5,856	All from Iraq.
Refinery products:			
Gasoline—thousand 42-gal. bbls	55	49	United States 26; Venezuela 11; Iran 6.
Kerosine—do	45	43	France 21; Aden 10.
Diesel fuel oil—do	837	[1] 700	[2].
Lubricants—do	91	155	United Kingdom 69; United States 25.
Liquefied petroleum gas—do	17	21	Italy 14; France 6.
Other (including asphalt)—do	15	44	Iraq 25; United States 5.
Total refinery products—do	1,060	[1] 1,012	

[1] Estimated minimum requirements, based on increased refinery output in 1962 and minimum apparent requirements of previous years.
[2] Data not available.

COMMODITY REVIEW

METALS

Iron and Steel.—Iron deposits near Radjou, formerly regarded as a source of raw material for a Syrian iron and steel industry, now appear to be uneconomic because of their low grade (25 percent iron) and unfavorable metallurgical properties.

A small quantity of iron and steel scrap is consumed by Syrian industry each year. Comparison of import and export statistics indicates the following quantities available for use or stockpiling: 1961, 2,453 tons; 1962, 1,757 tons; and 1963, 3,006 tons.

NONMETALS

Cement.—Cement production has risen steadily over the past 5 years and this trend is expected to continue. In 1963 an Aleppo firm intended to double its daily capacity to 600 tons, and a new plant with a capacity of 300 tons per day may have been nearing completion at Homs. Total productive capacity of Syrian cement plants in 1963 was estimated to be at least 700,000 tons per year.

Fertilizers.—During the past 5 years, sedimentary phosphate deposits southwest of Palmyra have been extensively drilled and sampled. Proved reserves, under a maximum of 20 meters of overburden, are estimated at 15 million tons containing 28.5 percent P_2O_5 (Kneifis deposits) and 60 million tons containing 24.5 percent P_2O_5 (Eastern deposits). Large additional reserves are indicated in the Eastern field. In 1963 the Government awarded a contract to Western Knapp Engineering, Inc., to investigate the requirements for production of superphosphate and beneficiated phosphate rock from these deposits.

A nitrogenous fertilizer plant was under construction at Homs during 1963. The plant is to have an annual capacity of 110,000 tons of lime ammonium nitrate, but initial production was not expected to begin until 1966.

Glass Sand.—Glass sand deposits near Al Mazzih are the principal source of raw material for the Damascus glass factory, but production from these deposits is not reported by the Government. The factory has an annual capacity of 10,000 tons of glass and supplies most of Syrian requirements as well as sheet glass for export.

Salt.—Extensive new salt deposits have been found near the Euphrates River near Deir es Zor. The best deposit is a layer 14 feet thick, estimated to contain 13 million tons of high-quality salt. The deposit may be difficult to exploit economically, as it is found at a depth of 130 meters.

MINERAL FUELS

Petroleum.—The Karatchok-Soueidia oilfields of northeastern Syria have been under development since 1959. By 1963, recoverable reserves were estimated at 1,250 million barrels and development drilling had brought in at least 16 producible wells having an estimated total production potential of 27,000 barrels daily. Three additional wells were being drilled at the beginning of 1963. The oil is found in Cretaceous

limestone at depths of 5,000 to 7,000 feet; its API gravity ranges from 20° to 24°, and its sulfur content exceeds 4 percent.

Production has been delayed by inadequate transportation facilities. At the end of 1963 the Syrian General Petroleum Authority was supplying detailed specifications for construction of a 22-inch pipeline from the oilfields to the port facility being constructed at Tartous, a distance of about 650 kilometers. This port is to be ready for shipping in 1966. Early in 1963 the Government was considering construction of a new refinery at Tartous to refine Syrian crude; however no action was taken. Instead, by yearend, plans had been formulated to expand the capacity of the Homs refinery to 1.7 million tons per year (about 34,000 barrels per day). Also under consideration was the establishment of a small refinery and the development of a petrochemical industry in the Karatchok area under the second 5-year plan (1965–69).

The Homs refinery operated at 83 percent of rated capacity in 1963, compared with 77 percent in 1961 and 70 percent in 1960. In 1963, contracts were let for construction of a 512-kilometer, 6-inch products pipeline from Homs to Damascus, Aleppo, and the port of Latakia, and at the end of the year the General Petroleum Authority announced that the pipeline to Aleppo and Latakia would be completed in early 1964.

Natural Gas.—An important but unexploited reserve of natural gas is in the Jibissa area, 45 kilometers south of Hasakeh and 100 kilometers northeast of Deir es Zor. Total reserve is unknown, but the potential yield from one well (Jibissa No. 1) is estimated at 24 million cubic feet daily of gas containing 92 percent methane.

The Mineral Industry of the Trucial Coast and Muscat and Oman

By F. L. Klinger [1]

TRUCIAL COAST

THE TRUCIAL COAST is the most recent addition to the petroleum-producing areas of the Middle East. Commencing production in 1962, the output of petroleum in 1963 exceeded that of Bahrain, and in 1964 the rate of production is expected to be the sixth highest in the Middle East. Other mineral activities in the Trucial States have been mostly limited to petroleum exploration; small tonnages of red ochre have been produced from an island off Sharajah, but no other mineral sources aside from construction raw materials are known. In most of this area, petroleum operations are the only means of industrial employment and provide all government revenues. Additional income is obtained by the State of Dubai from customs duties and a reportedly thriving traffic in gold.

MUSCAT AND OMAN

The Sultanate of Muscat and Oman (including Dhofar) covers an area of about 85,000 square miles along the southeast Arabian coast. The area has no mineral production or important industry. Small quantities of cement, salt, and petroleum products are imported but their aggregate value is estimated to be less than 5 percent of all imports. Government revenue, roughly estimated at US$1.5 million annually, is mainly derived from customs duties and petroleum concession rentals.

Since 1955, petroleum exploration has revealed oil deposits in three inland areas, two in Oman and one in Dhofar. None of these discoveries has proved to be of commercial value, mainly because the productive potential has not been sufficient to warrant construction of transportation facilities. Rumors persist, however, that commercial deposits were found in Oman in 1963.

PRODUCTION AND TRADE

Crude oil is the only mineral commodity produced in the entire area for which output data are available. All commercial production came from Abu Dhabi, largest of the seven Trucial States and the only one

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in which commercial petroleum deposits have been found. Cumulative production from 1962 to the end of 1963 was 23.5 million barrels. Using posted prices at Das Island this production was valued at an estimated US$42 million. Production in 1963 accounted for about 75 percent of this value.

In December, the output of petroleum from Abu Dhabi was more than doubled as production began from the onshore Murban field. By the end of 1963, petroleum operations had provided an estimated US$11 million in revenues to the Abu Dhabi Government and were providing employment for 3,000 persons.

Exports of petroleum from Abu Dhabi, assumed to be equal to the volume of production, were valued at an estimated US$31 million in 1963 and US$11 million in 1962. Of the estimated value of all exports, petroleum comprised 68 percent in 1962 and 86 percent in 1963. Except for petroleum, Trucial coast exports consist mostly of reexports from the port of Dubai.

Imports in 1962 were valued at approximately US$20 million, of which petroleum products made up an estimated 4 percent. Although detailed figures are not available, gold bullion may account for more than 25 percent of the value of all imports.

TABLE 1.—Production of petroleum and imports of petroleum products

(Thousand 42-gallon barrels)

	1961	1962	1963
Production, Abu Dhabi: Crude petroleum	447	[1] 5,551	17,591
Imports:			
Gasoline	(2)	[3] 84	(2)
Kerosine	(2)	[3] 32	(2)
Distillate fuel oil	(2)	[3] 76	(2)
Lubricants	(2)	[3] 4	(2)

[1] Total production of 5,998,029 barrels is reported for the Umm Shaif field to Dec. 31, 1962, by AAPG. V. 47, No. 7, July 1963. Probably includes output from earlier production tests.
[2] Data not available.
[3] Estimate.

COMMODITY REVIEW

MINERAL FUELS

Petroleum.—*Abu Dhabi.*—The Trucial coast Umm Shaif field, 105 kilometers offshore and 80 kilometers southeast of the Qatar offshore development at Idd al-Sharqi, was being operated by Abu Dhabi Marine Areas, Ltd., owned two-thirds by British Petroleum Co. and one-third by Cie. Française des Pétroles. A medium-weight oil (34° API) was produced from Cretaceous and Jurassic limestones at depths of 5,500 to 8,800 feet. By the end of 1963, the field was producing 60,000 barrels of petroleum daily from 17 wells. An additional six wells were scheduled to increase the total productive capacity to 90,000 barrels daily by mid-1964. Umm Shaif production is remotely controlled from the export terminal at Das Island, 32 kilometers west.

Oil was found 80 kilometers southeast of Umm Shaif in the Zakum No. 1 exploration well drilled in 1963 by Abu Dhabi Marine Areas, Ltd.

The Murban field, 16 kilometers inland and 144 kilometers southeast of Umm Shaif, began production in December from 24 wells at an estimated aggregate rate of 80,000 barrels per day. Production was scheduled to increase to 120,000 barrels per day in early 1964 as a result of additional well completions. Extensive gathering, processing, and loading facilities completed in 1963 included four gas-oil separators having a total capacity of 200,000 barrels per day; three stripping columns for the removing of hydrogen sulfide by a hot carbonate process; a 112-kilometer, 24-inch pipeline from field to storage facilities at Jebel Dhanna; and two sea berths connected to Jebel Dhanna by 4.5-kilometer, 36-inch sea lines for gravity loading. Exports began December 15. The Murban field produces a relatively light crude (40° to 42° API), with a high H_2S content and a gas to oil ratio of 1,200 cubic feet per barrel, from Lower Cretaceous limestone at depths between 8,000 and 9,300 feet. No oil has been found in Jurassic strata equivalent to the Arab Zone reservoirs of Saudi Arabia and Qatar. Exploration and development work in the area is continuing.

A new field has been discovered at Bu Hasa, 25 miles southwest of Murban. Two wells were completed in 1963, and each was reported to have a production potential of 15,000 barrels per day. There is a possibility that the Bu Hasa field extends southward across the undemarcated boundary with Saudi Arabia.

Reserves were estimated at 7,000 million barrels at yearend,[2] compared with 6,000 million barrels at the end of 1962 and 1,500 million barrels at the end of 1961.[3]

Dubai.—About 125 miles east of the Murban oilfield, Dubai is the center of population and general trade on the Trucial coast. A minor boom in the local economy resulted from oil discoveries in Abu Dhabi and exploration activities in Dubai. Petroleum exploration was continued during 1963, and by early 1964 exploration drilling was expected to be underway at two locations, one offshore and one onshore. The wells were to be drilled by the Dubai Petroleum Co., a subsidiary of Continental Oil Co., which acquired the onshore concession and a half interest in the offshore concession in 1963. The onshore concession was formerly held by an associate of the Iraq Petroleum Co. but was relinquished in December 1962 after the drilling of an unsuccessful 12,000-foot well. Dubai Marine Areas, Ltd., owned by British Petroleum & Cie. Française des Pétroles, holds the other half interest offshore.

Other Trucial Coast States.—Petroleum concessions in the States of Sharjah, Ajman, and Umm al-Qaiwain were acquired in 1962 by John W. Mecom of Houston, Tex. In partnership with the Pure Oil Co., geophysical surveys of onshore and offshore areas of Sharjah were completed in mid-1963 and one well had been drilled to a depth of 5,358 feet at Abu Musa, 35 miles offshore, by the end of the year.

Petroleum concessions in Ras al-Khaimah were expected to be acquired in early 1964 by the Union Oil Co. of California. The concessions were formerly held by an Iraq Petroleum Co. subsidiary but were given up in 1960.

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[2] Petroleum Management. June 1964, p. 72.
[3] World Oil. Aug. 15, 1963.

The Perkins Oil Co. of Wichita, Kans., was negotiating for concessions in the State of Fujairah during 1963.

Oman.—Petroleum Development (Oman), Ltd., formerly an IPC subsidiary but in 1963 owned 87 percent by Royal Dutch Shell and 13 percent by the Gulbenkian interests (Partex), found oil in the Yibal and Natih areas, 325 and 200 kilometers, respectively, southwest of the port of Muscat and about 360 kilometers southeast of Abu Dhabi's Murban field. Four wells were drilled at Natih in 1963, and testing was still in progress at the end of the year. The oil is found in Cretaceous strata below several thousand feet of Tertiary salt. No further details were available.

Dhofar.—The Dhofar concession, covering about 32,000 square miles in the southern part of the Sultanate, was acquired by John W. Mecom from Cities Service Petroleum Corp. and Richfield Oil Co. in 1962. These companies had drilled about a dozen wells and had discovered oil in 1955 at Marmul, 175 kilometers northeast of Salalah and about 80 kilometers from the coast. By 1958 four wells had reportedly been developed with a combined productive capacity of 2,500 barrels per day. Oil of several gravities (16° to 37° API) is found in Cretaceous strata at depths from 2,700 to 4,400 feet.

In partnership with the Pure Oil Co., Mecom had drilled five additional wells by early 1964. One well, Marmul No. 4, drilled to 3,500 feet, tested 150 barrels of oil per day; another, drilled 3,000 feet, reportedly flowed 500 barrels per day of 19° API crude and was located only 14 miles from the coast. Although the remaining wells were dry of oil, two of them found important supplies of fresh water.

The Mineral Industry of Turkey

By L. Nahai [1] and Clarence A. Wendel [2]

THE value of Turkey's crude mineral production in 1963 is estimated at US$150 million,[3] 4.2 percent more than in 1962. The value of crude minerals plus that of steel, blister copper, and cement (after deducting as far as possible the value of materials consumed in production of these commodities) is estimated to be 8.5 percent more than in 1962, and equivalent to 3.5 percent of gross national product (GNP) estimated at US$6.15 billion in 1963.

The country's first 5-year plan became operative on January 1, 1963. This plan aims at raising the GNP from the equivalent of US$5.8 billion in 1962 to US$8.2 billion in 1967, or by an average of 7 percent annually. According to the report of the State Planning Organization, the GNP rose by about 7 percent during 1963. Available information indicates that this rate of increase was maintained or somewhat exceeded by the mineral industry as a whole.

Construction of the Erĕgli steel mill continued during the year, and the Antalya ferrochromium plant began production in April; the plant was closed later because of lack of markets. Etibank, a State-owned economic enterprise with extensive mineral industry holdings, issued invitations to U.S. mining companies for proposals on a feasibility study for development of three copper deposits near the Black Sea coast under its concession. This organization also concluded arrangements for purchase of Polish equipment for a boron processing plant in the Marmara area. The Mineral Research and Exploration Institute reported progress in mapping and exploration programs. In areas closed to petroleum exploration by private industry, some 8,250 square kilometers were examined for petroleum prospects. Another 70,000 square kilometers were prospected for ores, lignite, and nonmetallic minerals, and 80,500 square kilometers for phosphate and radioactive minerals.

Discoveries in 1963 reported by the Director of the Institute included 4.5 million tons of iron ore, 38 million tons of bauxite and diaspore, 28 million tons of lignite, 13 million tons of low-grade phosphate rock, and uranium ores containing 330 tons of uranium.

During the year the Government established an international phosphate and chromium research center under an agreement with the Organization for Economic Cooperation and Development (OECD).

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[1] Near East-South Asia specialist, Division of International Activities.
[2] Minerals attache, U.S. Embassy, Ankara, Turkey.
[3] In calculating this figure, half of the value of the blister copper produced was assigned to copper ore, for which a figure was not available.

The center reportedly is primarily to provide analytical and ore beneficiation research facilities and will not do more than incidental fieldwork.

In the fiscal year 1963 (ending March 31, 1964) the Mining Assistance Commission (MAC), through 20 agreements, granted loans equivalent to US$64,000 to private mineowners, bringing the total for the 3 years of its activity to US$347,100. The Commission, with a staff averaging 40 throughout the year, received 165 applications and performed 210 examinations. The MAC was established in 1961 by the Union of Chambers of Commerce, Industry and Commodity Exchanges of Turkey. Concurrently with its organization, TL10,000,000[4] (US$1.11 million) counterpart funds were supplied by the United States to establish two loan funds, a TL7,500,000 (US$833,000) Private Mining Risk Capital Fund and a TL2,500,000 (US$278,000) Private Mine Development Fund, to supply soft loans when the outlook for profitable development of a prospect or increasing in an existing mine seemed favorable.

GOVERNMENT POLICIES AND PROGRAMS

There were a number of Government actions in the field of minerals. A new Ministry of Energy and Natural Resources was created which assumed responsibility for administering a number of Government agencies and enterprises engaged in mineral activities including production. These include Etibank, The Mineral Exploration and Research Institute (Maden Tetkik ve Arama Enstitüsü—MTA), The Turkish Petroleum Corp. (Türkiye Petrolleri Anonim Ortakligi—TPAO), the Mining Department, the Petroleum Administration, Turkish Coal Enterprises (Türkiye Kömür Işletmeleri Kurumu—TKI), and the Atomic Energy Commission.

Etibank owns and operates the country's two copper mines and smelters, two major groups of chromite mines, a cupriferous pyrite mine, the country's largest colemanite deposit, the only sulfur mine and refining plant in Turkey, a small lead-zinc mine and concentrator, and a mercury mine. MTA is the agency concerned with geological survey and mineral exploration and the Mining Department administers the mining law and regulations. TPAO produces petroleum from fields discovered and developed by the Government and operates a Government-owned refinery. The Petroleum Administration administers the Petroleum Law of 1954. TKI produce all the bituminous coal and 60 percent of the lignite.

Remaining under the Ministry of Industry are the following: the Karabük Iron & Steel Works, at present the only primary producer of iron and steel; the Azot Sanayii T.A.Ş. (State Enterprise in the Nitrogen Industry) which produces nitrogen fertilizers; the government-owned cement plants; and Makina ve Kimya Endüstrisi Kurumu—MKEK (Machinery & Chemical Industries Organization) which, among other activities, operates steel and brass mills and appliance plants.

[4] The monetary unit of Turkey is the Turkish lira (TL). TL1=US$0.111.

In July, 60 articles of the Mining Law of 1954 were revised to facilitate its administration. Meanwhile, a U.S. consultant under contract to the Turkish Government prepared a draft for a new mining law but no legislative action was taken regarding the draft.

PRODUCTION

Production of most of the minerals used primarily by domestic consumers increased in 1963. Commodities registering gains included coal, lignite, crude oil, sulfur, and raw materials for cement and other construction materials (gypsum, clays, and limestone). Out-

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Antimony, ore and concentrate	1,304	2,463	2,213	2,991	2,915
Chromite	387,662	[1] 479,620	402,729	[1] 469,149	[1] 283,783
Copper, blister	25,036	26,220	19,994	25,775	24,790
Iron and steel:					
Iron ore—thousand tons	873	790	758	813	747
Pig iron and blast furnace ferroalloys [2]—do	236	247	236	293	211
Steel ingots—do	214	265	283	242	361
Lead:					
Concentrate (lead content)	620	610	60	575	640
Metal	462	470	633	637	1,881
Manganese ore	35,690	28,224	30,000	21,248	6,304
Mercury—76-pound flasks	1,479	1,339	1,864	[1] 2,661	2,982
Pyrite, cupreous (gross weight)	88,675	42,285	98,417	107,088	97,082
Zinc:					
Zinc-lead ore, hand-sorted	3,104	2,800	10,930	[3] 6,929	[3] 4,500
Zinc ore, calcined	2,908	2,360	5,700	6,399	4,000
Zinc concentrate	2,129	2,383	2,512	2,112	1,867
Nonmetals:					
Asbestos	373	216	450	643	370
Barite	2,280	1,500		1,900	981
Boron minerals	73,336	69,839	65,026	113,941	88,088
Cement—thousand tons	1,734	2,038	2,028	2,316	2,684
Clays, including fire clay—do	[4]	[4]	[4]	11,000	13,000
Emery	4,829	6,814	8,327	3,408	7,490
Fluorspar	68	326	38	581	652
Gypsum	[3] 52,000	61,134	60,000	140,000	180,000
Magnesite		15	2,190	9,740	17,917
Marble—cubic meters	[4]	[4]	[4]	10,000	[3] 10,000
Meerschaum—50-kilogram boxes	427	735	917	1,648	210
Perlite	[4]	[4]	200	700	20
Salt, all types—thousand tons	491	445	268	431	399
Sodium sulfate		623	2,485	4,774	[4] 10,000
Sulfur	13,385	17,100	15,755	18,539	19,430
Mineral fuels:					
Bituminous coal (salable)—thousand tons	3,745	3,653	3,773	3,899	4,156
Coke—do	746	713	714	740	1,071
Lignite—do	2,673	2,684	2,608	2,979	3,402
Petroleum:					
Crude	389,627	375,172	441,748	595,408	744,933
Refined products:					
Liquefied petroleum gas			630	6,063	11,155
Gasoline	75,302	71,958	117,853	522,869	541,124
Solvent	639	726	1,246	1,526	1,598
Kerosine		8,371	16,402	281,937	395,605
Diesel (distillate)	34,914	24,579	78,476	615,717	879,739
Fuel oil (residual)	179,600	182,468	274,487	1,114,973	1,429,266
Asphalt	46,574	37,724	56,090	90,106	119,395
Miscellaneous					20,883
Total refined products	337,029	325,826	545,184	2,633,191	3,398,765

[1] Revised figure, supersedes that given in commodity chapter, volume I.
[2] Includes remelted scrap through 1962.
[3] Estimate.
[4] Data not available.

put of most commodities produced to a significant extent for export declined; mercury and magnesite were notable exceptions.

Among mineral products, steel ingots registered significant increases in 1963 because of the new facilities at the Karabük steel plant. Copper metal output declined only slightly, and smelter lead production nearly tripled but was still relatively small. Refined petroleum product output gained appreciably.

TRADE

The value of mineral and metal exports (excluding petroleum products) fell from US$24,850,000 in 1962 to US$16,166,000, the lowest level since 1950. The ratio of the value of mineral and metal export, excluding petroleum products, to total exports continued the steady decline of recent years and in 1963 was only 4.4 percent, compared with 6.5 percent in 1962 and 7.6 percent in 1961.

TABLE 2.—Mineral and metal trade

(Metric tons unless otherwise specified)

	1962		1963	
	Tons [1]	Value (thousand U.S. dollars)	Tons [1]	Value (thousand U.S. dollars)
Imports:				
Metallic ores, slags and ashes	449	50	443	63
Scrap	954	108	9,688	382
Pig iron and ferroalloys	15,520	1,367	24,137	1,499
Iron and steel [2]	229,012	36,422	363,021	48,819
Nonferrous metals and semimanufactures	13,860	9,714	12,582	7,462
Nonmetallic minerals	37,820	1,008	120,647	2,091
Cement	2,554	178	91,071	1,048
Solid fuels (mainly coke)	625	77,079	4,143	66,487
Petroleum and petroleum products—thousand tons	3,088		3,217	
Total value of imports		125,926		127,851
Exports:				
Metallic ores	668,697	12,879	323,346	6,635
Ferrochromium			1,369	349
Copper	14,427	8,776	10,043	5,931
Nonmetallic minerals	149,098	3,195	165,829	3,251
Petroleum products	539,890	6,161	748,060	9,194
Gas, natural and manufactured	7,401	100		
Total value of exports		31,111		25,360

[1] Quantities are not strictly comparable with data presented in detailed trade tables.
[2] Includes iron and steel pipes.

Source: United Nations Commodity Trade Statistics, Statistical Papers, Ser. D, v. 12, No. 1–18; v. 13, No. 1–17.

Most of the decline resulted from a drop in the export of chromite, which was affected by Soviet chromite sales on world markets and slumps in United States and West European imports. Lower export of copper was caused by increased domestic consumption. Five major iron mines, under contract to supply ore to the Ereğli Steel Co., were contributing to Turkish iron ore stockpiles and did not enter the export market. Two iron mines in the Aegean area, which for a number of years had been operating for export, suspended operations because

their marginal-quality ore could not compete with high-grade ore available on the world market. These factors reduced export of iron ore. Shipment of high-grade, hand-sorted lead-zinc sulfied ores dropped because the producing mines shifted to development of less easily mined ore bodies than those exploited in the past 3 or 4 years.

Total value of imports was US$127,851,000 of which petroleum and its products accounted for 52 percent followed by iron and steel which accounted for 38 percent. The cost of importing the minimum petroleum requirements of the Turkish economy constitutes an important party of Turkey's adverse balance of trade which was US$241 million in 1962 and US$323 million in 1963.

TABLE 3.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1962	1963	Principal destinations, 1963
Metals:			
Antimony ore	2,981	3,781	West Germany 1,698; Czechoslovakia 1,240.
Chromite	349,575	212,664	United States 57,583; France 39,080; West Germany 26,964; Yugoslavia 26,875; Norway 12,999; Czechoslovakia 11,729; Austria 10,176; United Kingdom 6,514; Japan 4,907.
Copper:			
Cupriferous pyrite	110,685	85,495	West Germany 43,995; Italy 41,500.
Blister	14,427	10,043	Spain 8,043; Finland 999; West Germany 499; Netherlands 499.
Iron ore	171,641	12,100	All to Italy.
Ferrochromium	----------	1,369	Italy 1,239.
Lead-zinc ore	6,929	5,088	United Kingdom 4,088.
Manganese ore and concentrate	22,482	12,043	Yugoslavia 5,245; United States 4,248.
Mercury----------76-pound flasks	2,183	2,742	United Kingdom 1,614; Japan 435; Netherlands 194.
Zinc ore, roasted	6,399	4,000	All to Italy.
Nonmetals:			
Borates	88,480	91,540	Italy 43,300; France 20,516; United Kingdom 6,099; Poland 5,999; East Germany 5,000; Czechoslovakia 4,199.
Cement	----------	2,460	All to Cyprus.
Emery	5,879	8,352	Netherlands 4,900; United Kingdom 1,928; United States 1,524.
Refractory minerals:			
Magnesite	3,350	10,604	All to Austria.
Other	----------	165	(1).
Marble	3,347	4,421	Italy 3,590.
Other stone and gravel	----------	222	(1).
Meerschaum	51	41	Austria 22.
Salt	53,454	58,736	All to Japan.
Other nonmetals	----------	708	(1).
Mineral fuels:			
Coal	----------	5,950	(1).
Petroleum refinery products:			
Gasoline	----------	41,855	West Germany 20,972; United Kingdom 15,198.
Distillate fuel oil	42,422	20,831	All to West Germany.
Residual fuel oil	497,468	674,398	United Kingdom 226,719; Greece 132,991; Netherlands 106,422; United Arab Republic 57,910; Ireland 53,419; Belgium-Luxembourg 50,246.

[1] Data not available.

Imports in all major categories except nonferrous metals increased. In the iron and steel category, steel ingots, wire rods, bars, and sections showed large increases. For petroleum, although the tonnage was larger, the value was less than in 1962 because a larger share of imports was crude petroleum.

TABLE 4.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1962	1963	Principal sources, 1963 [1]
Metals:			
Aluminum:			
Ingots	1,280	1,216	France 614.
Semimanufactures	2,911	2,642	Israel 688; Greece 326; Netherlands 318; West Germany 282; France 226; Belgium-Luxembourg 179.
Copper and alloy semimanufactures, including ingot copper.	108	[2] 428	Italy 237; West Germany 85.
Iron and steel:			
Scrap	954	9,688	United States.
Pig iron including cast iron	8,947	23,044	West Germany 11,169; Belgium-Luxembourg 8,182; Spain 3,632.
Ferromanganese and other ferroalloys.	4,470	1,093	European Economic Community 714.
Blooms and billets and other primary forms.[3]	9,647	76,442	U.S.S.R. 24,342; Hungary 18,549; Bulgaria 13,071; West Germany 11,818; Rumania 8,191.
Rolled steel	189,324	259,704	West Germany 65,226; United States 48,790; United Kingdom 34,468; U.S.S.R. 22,068; Belgium-Luxembourg 19,185; Hungary 13,370; Japan 9,757.
Iron and steel tubes, pipes, etc	29,546	26,688	West Germany 8,895; United States 6,507; France 4,081; Israel 2,240; Hungary 1,997; U.S.S.R. 1,591; United Kingdom 792.
Cast iron pipes	495	187	[4].
Lead and lead alloys unwrought	2,136	2,340	United Kingdom 703; Bulgaria 653.
Lead and lead alloys wrought	101	17	United Kingdom 11.
Nickel semimanufactures, including ingot nickel.	88	[5] 118	Italy 61.
Tin and semimanufactures	1,257	509	United Kingdom 245; Federarion of Malaya 158.
Zinc and zinc alloys unwrought	3,393	1,951	Belgium-Luxembourg 1,048; West Germany 900.
Zinc alloys and semimanufactures	2,538	3,340	Belgium-Luxembourg 1,373; Poland 865; Yugoslavia 485; West Germany 299.
Metallic ores, slags and ashes	449	443	United Kingdom.
Other nonferrous metals and semimanufactures.	49	21	United States 18.
Nonmetals:			
Asbestos	1,516	1,254	United Kingdom 579.
Cement	2,171	91,068	U.S.S.R. 89,302.
Chalk, lime, crushed stone, and dolomite.	182	728	France and Norway.
Feldspar and fluorspar	290	725	United Kingdom.
Graphite	80	107	West Germany.
Magnesite	77	93	Greece.
Mica	11	18	United Kingdom.
Phosphate rock	33,349	116,248	Morocco 103,598; Tunisia 9,849.
Quartz and quartzite	151	15	Belgium-Luxembourg.
Refractory clays	2,288	1,689	European Economic Community 1,347.
Sulfur	17	248	West Germany.
Talc	181	284	Italy.
Miscellaneous	65	375	[4].
Mineral fuels:			
Coke	575	4,143	United Kingdom.
Retort carbon	50	336	[4].
Petroleum:			
Crude—thousand tons	2,021	3,080	Iraq 1,120; Iran 1,013.
Petroleum products:			
Gasoline	185,280	4,957	United States 3,697.
White spirit and kerosine	296,425	38,500	United States 23,609; United Kingdom 12,090.
Distillate fuel oil	462,478	108	[4].
Residual fuel oil	58,233		
Lubricants	63,348	91,778	United States 79,202; United Kingdom 6,245.
Mineral jelly and wax	1,930	2,016	West Germany 947.
Total petroleum products	1,067,694	137,359	

[1] Wherever possible, detail on quantity from principal sources has been given; where only a country name appears, detailed quantity data are not available.
[2] All but 4 tons of copper and alloys worked.
[3] Includes coil for rerolling and iron and steel blanks for pipes and tubes.
[4] Data not available.
[5] All but 16 tons of nickel and nickel alloys worked.

COMMODITY REVIEW

METALS

Antimony.—As in 1962 Özdemir Antimuan Bakir İsletmesi produced all the antimony ore in Turkey from mines near Turhal. Results of the company's operation in the last 2 years in tons follow:

	1962	1963
Ore mined (3.5 percent antimony)	42,517	35,808
Sorted ore milled (5.0 percent antimony)	25,117	30,098
Concentrate shipped	1,440	1,805
Average antimony content—percent	62.45	61.66
Hand-sorted ores shipped	1,541	1,225
Average antimony content—percent	42.54	43.06
Regulus (99 percent antimony) produced	------	48

Rasih ve Ihsan was exploring an antimony-mercury prospect near Nigde, and 120 tons of ore were mined from exploratory work.

Chromite.—As exports declined stocks of chromite in Turkey increased to an estimated 500,000 metric tons, including off-grade ores. Many small mines closed and by yearend about 12 mines or mine groups owned by 8 companies were operating. With 110,271 tons output, Etibank was the largest single producer—77,939 tons from its mine in the Güleman area and 32,332 tons from Üçköprü mines. Sales by the company totaled 74,260 tons. Its concentrator at Güleman was inactive, but about 10,000 tons of ore from Üçköprü mines were treated in the Goçek mill of Türk Maadin Şirketi which is located near Etibank's mines. Sitki Koçman was the largest producer among private companies and accounted for half of exports by this section of the industry.

Compared with 1962, exports of chromite dropped 39 percent in tonnage and 50.8 percent in value (US$9,103,000 in 1962 and US$4,479,000 in 1963). As a result, value per ton in 1963 was only US$21 compared with US$26.55 in 1962.

It is estimated that of the exports, 50,000 tons was refractory and low-grade ore and about 163,000 tons were metallurgical. Exports of metallurgical grade chromite in 1963 were equal to about half of the quantity shipped in 1962. Of the 163,000 tons of metallurgical grade shipped in 1963, 55,000 tons were concentrates sold by Turkish producers who have European affiliates which produce ferrochromium.

The average value of US$11.80 per ton for shipment to Yugoslavia indicates that this material was off-grade or fines for concentration and possible use in manufacture of refractories. The remainder of the low-grade chromite was probably shipped to the United States.

F.o.b. prices of chromite (48 percent Cr_2O_3, 3:1 chromium to iron ratio) and of high-grade concentrate at yearend ranged between US$21 and US$24 per ton compared with US$28 to $29 in 1962.

To assist the industry, the Governments of United States and Turkey negotiated for a multilateral barter of U.S. agricultural commodities and Turkish chromite whereby about 150,000 short tons of chromite would be shipped to the United States (of which a third or less would be made into ferrochromium in the United States). The latter would ship agricultural commodities to countries with which Turkey has bilateral trade agreements, and these countries would ship goods to

TABLE 5.—Chromite producers and mines active in 1963

Company	Name of mine or mining district	Grade of chromite produced	Normal annual production (metric tons)
Etibank	Uçköprü Group	Lump	45,000
	Şark (Soridag) Group	Lump	130,000
		Concentrate	10,000
Türk Maadin (Metallurg)	Göeçk	Lump	30,000
		Concentrate	20,000
	Kavak	Concentrate	55,000
Fethiye Maden	Fethiye Group	do	23,000
Sitki Koçman	Acipayam	Lump	60,000
	Köyceğiz	do	
	Kayra	do	
	Fethiya	do	
	Harmancik	Concentrate	10,000
Özdedeoğlu	Kayseri	Lump	3,000
Oz Krom	Pozanti	do	2,000
Örko Krom	Harmancik	Concentrate	5,000
Bafka	Malatya area	Lump [1]	20,000

[1] Refractory.

Turkey in payment of the chromite shipped to the United States. Important criteria in the selection of third countries in the barter would be that shipment of agricultural commodities to that country would not displace normal commercial exports of these commodities to these countries, and that the transactions would have no adverse effect on the U.S. balance of payments. At yearend a barter agreement has not been signed.

Copper.—The drop in blister copper output resulted from smaller production at the Ergani mine where production of direct smelting ore and average grade of this ore declined. Of the blister copper output, entirely in the two mines of Etibank, 14,486 tons was sold domestically (11,692 tons in 1962). Principal recipients of copper were MKEK and Rabak Electrik Bakir ve Mamulleri. The latter has an electrolytic refinery at Kağithane with an annual capacity of 4,000 to 5,000 tons copper and copper alloy semimanufactures.

TABLE 6.—Salient statistics of copper mines

(Metric tons unless otherwise specified)

	Ergani		Murgul	
	1962	1963	1962	1963
Ore produced	[1] 147,685	[1] 123,830	(2)	(2)
Average copper content—percent	8.37	8.43	(2)	(2)
Ore milled	112,260	117,132	511,423	429,959
Average copper content—percent	5.61	5.00	1.91	1.76
Cement copper produced	1,420	965		
Blister copper produced	16,600	15,515	9,175	[3] 9,275

[1] Direct smelting ore which was not concentrated.
[2] Data not available.
[3] Includes copper obtained from concentrates stockpiled in 1962.

Etibank requested new tenders for the construction of a flotation mill and smelter to treat low-grade Ergani copper ore which will constitute the bulk of future production of this mine because the high-grade ore is approaching exhaustion. The bank will utilize a US$8

million credit, originally granted by the Export-Import Bank in 1957, to finance the foreign exchange requirements of the plant. Etibank also issued invitations to mining companies and consultants for a proposal on a feasibility study for the integrated development of three copper deposits on the Black Sea coast (Küre, Espiye, and Murgul) under its concession.

Occurrence of copper disseminated in andesite in Zara was reported, but detailed information is lacking.

Iron Ore.—Divriği iron mine, which is a captive operation of the Karabük steel plant, produced 580,389 tons of ore and privately owned mines 166,202 tons. After producing 50,000 tons of ore, Büyü Eğmir mine stopped operation because of lack of export outlet. This mine presumably will start producing again to meet its contractual obligation to ship 75,000 tons of ore annually to Ereğli steel plant. Shipments to the Kangal, Çetinkaya, and Hekimhan railheads were for eventual shipment to Ereğli. East and West Hekimhan, Akdag, Oltukikise, and Çetinkaya are the principal mines which will supply iron ore to Ereğli. In 1964 these mines must deliver 228,000 tons of ore to this plant and, together with other mines, must increase shipments to 710,000 tons in 1965 and 800,000 tons by 1967.

Iron and Steel.—Production of pig iron, steel ingots, and coke at Karabük increased during the year. MKEK produced about 30,000 tons of carbon steel at Kirikkale using scrap. Metaş at Izmir is also reported to be producing 10,000 tons of steel per year from scrap.

TABLE 7.—Production and shipment of iron ore

(Metric tons)

Company	Mine	Shipments		Destination in 1963
		1962	1963	
Divriği	Türk Demirve Çelik	500,125	[1] 460,989	Karabük plant.
Kesikköprü	Kesikköprü Maden	87,000	80,000	Do.
Otlukilise	Demir Export (Koç)	40,792	11,000	Railhead, Kangal.
Çetinkaya	do	43,013	14,000	Railhead, Çetinkaya.
Deveci	Bilgin Maden	15,284	4,800	Railhead, Hekimhan.
Karakuz	do	11,400	10,000	Do.
Akdağ	Necati Akın		11,035	Railhead, Divriği.
Camisağir	Kesikköprü		15,000	Karabük plant.
Büyük Eğmir	Dumeks Limited	92,435	12,100	Italy.
Miscellaneous			10,000	Karabük plant.
Total		790,049	628,924	

[1] Production reported as 580,389 metric tons.

The program inaugurated at Karabük in 1960 to expand steel capacity from 180,000 tons to 600,000 tons per year was nearing completion. A new sintering plant completed in 1962 increased the capacity from 225,000 to 700,000 tons of iron ore per year. Also in 1962, annual coke production capacity had been increased from 540,000 tons to 950,000 tons by the addition of a new plant with 3 batteries of 21 ovens each. At that time, byproduct recovery facilities were added to the 4 older batteries of 21 ovens each. These batteries produced 822,766 tons of coke in 1963 (512,656 tons in 1962). The third blast furnace (325,000 tons per year) was commissioned in December 1963 (after

a burnout in lining which occurred during the initial test in July was repaired), bringing total annual pig iron and hot metal capacity to 540,000 tons. In the steel melting shop, two new furnaces (150 tons per day) were being added to four existing open-hearth furnaces (75 tons per day), bringing total capacity to 600,000 tons per year. In the rolling mill section, extension of the 34-inch blooming and slabbing mill and reconstruction of the 28-inch section mill progressed; the 28-inch section mill may have been completed by yearend. Similarly, the erection of a continuous bar, wire rod, light section, and skelp mill was in progress during the year. This plant, which will produce yearly 230,000 tons of light sections with one-shift operation, is expected to be in operation sometime in 1964.

The Karabük plant is utilizing a US$15 million credit from the Export-Import Bank for further improvements and additions. The loan has already financed the construction of a water purification and pumping plant which was completed in March. Other additions will be a steel fabrication shop with 15,000-ton annual capacity (based on one-shift operations) and gray iron and steel foundries which will provide spare parts, ingot molds, rolls, and nonferrous castings.

Construction of the Ereğli iron and steel plant, being built with a US$129,600,000 loan from the U.S. Development Fund granted in January 1961, was on schedule, and certain units of the rolling mill are expected to be ready in 1964. The blast furnace will be blown in 1965 when 50-percent production capacity is expected; full capacity will be attained in 1968. The plant will have an initial ingot capacity of 400,000 tons per year which will be expanded to 1 million tons per year; it will produce mainly flat products.

Lead-Zinc.—Four private firms and Etibank worked lead-zinc properties during the year; only Etibank and Kurşun milled their ore to produce concentrates. Others produced hand-sorted lead-zinc ores which were shipped from Mersin to Imperial Smelting Co. in England or calcined products made by roasting zinc carbonate ores.

The concentrates produced by Etibank were not smelted in Turkey but Kurşun Sanayii shipped a lead concentrate with about 65 percent metal to a smelter at Darinca near İstanbul and produced 1,001 tons of metal. Of the remaining metal output, Mutler Battery Co. produced 780 tons in a small blast furnace in İstanbul. Lead is consumed principally for making batteries and for making ammunition including sporting ammunition.

Turkey also recovers lead from scrap. Production of lead from scrap increased substantially to 3,218 tons in 1963, compared with 722 tons in 1962. Annual consumption is estimated at about 5,000 tons.

During the year Rasih ve Ihsan began reopening the old Balya mines which were worked from 1910 to 1934 by Penarroya. There was also considerable exploration activity in the Zamanti River district by private companies. MTA has programed a major exploration program for lead and zinc for 1964.

Manganese.—Most mines were inactive during the year because easily mined reserves that could be worked economically at current prices were largely depleted. The bulk of the sales, which exceeded production, was probably obtained from working of old stocks.

Karabük contracted for a total of 24,000 tons of ore to be shipped in 1963 and 1964, but actual shipments to this plant are not known.

Mercury.—Sizma mercury mines near Konya were the leading mercury producers with an output estimated at 2,000 flasks. Etibank treated 18,270 tons of ore (reported average grade 0.268 percent mercury) from its Haliköy mine, which started operation in November 1962, and produced 763 flasks of mercury. Mercury recovery at Etibank's operation was low due to high stack losses and attempts are being made to improve the recovery.

The Mining Assistance Commission assisted in the establishment of a small retort plant near Manisa which produced 25 flasks in 1963. All mines in the old Karaburun area west of Izmir remained closed, and the Göksu mine near Kastamonu retorted mainly residues from previous operations which contained good metal values.

TABLE 8.—Lead-zinc producing mines and companies

(Metric tons unless otherwise specified)

Company	Mine	Ore milled	Grade (percent)	Production
Etibank	Keban	19,024	Zinc 6.4 Lead 4.5	1,110 lead and 1,867 zinc concentrate.
Kurşun Sanayii Ltd., Şirketi	Karakoca near Simav	12,210	Lead 9.4	2,000 lead concentrate.[1]
Rasih ve Ihsan	Cukurmaden and Akdağmaden.	(2)	Zinc 36–40 Lead 18	4,500 lead-zinc.
Saim Selim Budin Ltd., Şirketi	Kaleköy near Bakirdaği			
Karamanci Şirketi	Mines in Zamanti River district near Bakirdaği.		(3)	4,000 calcined zinc ore.[4]

[1] This concentrate was smelted to produce lead metal.
[2] Ore is not milled but hand sorted.
[3] Data not available.
[4] Estimate, bulk of which was produced by Karamanci.

NONMETALS

Boron Minerals.—Although output of boron minerals declined by 23 percent from that of 1962, there was a 34-percent increase in exports.

The average declared value of boron mineral exports was US$29.30 per ton. Minimum export price set by the Turkish Mining Association upon authority delegated to it by the Ministry of Commerce was reduced to US$24 per ton f.o.b. Turkish ports.

Etibank's Hisarcik mine was the leading producer with 60,000 tons. This company also exported 43,125 tons of the total. Private producers were the Bortaş Türk Madencilik Şirketi and Türk Boraks Madencilik, a subsidiary of Borax Consolidated, Ltd.

Türk Boraks was producing trial lots from its Kirka mine (70 kilometers south of Eskisehir) and continued to recover ore from its Susuluk dumps. There was a new venture in boron mining. American Potash & Chemical Co. and the Fethiye Mining Co., one of the oldest chromite mining companies in Turkey, formed a joint venture called Cumek. Cumek purchased the Tulu mine of Rasih ve Ihsan Mining Co. located near Bigadiç as a partial source of colemanite ore for the new Subor plant in France pointly owned by American Potash and Ugine.

The application of Borax Consolidated, Ltd., to establish a boric acid plant at Susuluk was rejected by the Committee for Encouragement of Foreign Investments. Meanwhile, Eitbank concluded an agreement with Poland to design and erect a plant to process 35,000 tons of ore and produce 20,000 tons of borax and 5,000 tons of boric acid. The plant which will cost a total of US$1,200,000 in local and foreign currency is expected to be completed in 2 years and will be built on a site near Banderma.

Cement.—The upward trend in production and consumption continued with an increase of 16.1 percent in output and 15.5 percent in deliveries to the internal market which consumed 2,325,000 tons in 1962 and 2,686,000 tons in 1963, or a per capita consumption of 89 kilograms in 1963. Nominal capacity increased by 160,000 tons to a total of 2,670,000 tons with the addition of a privately owned wet-process plant in Konya; 1959 capacity was 1,960,000 tons.

Most Turkish cement was produced by the wet process and 43 percent was from privately owned plants. Almost all of the cement used domestically was shipped in bags. As in the last 5 years cement prices remained unchanged.

The industry employed 6,450 including 880 salaried employees.

Gypsum.—The largest gypsum mining operation in 1963 was that of Azot Sanayii T.A.Ş. atUlukişla. This company's nitrogenous fertilizer plant 5 kilometers north of Kütahya used gypsum as a source of sulfur for production of ammonium sulfate. The gypsum was railed 600 kilometers to the plant site which had a rated annual capacity of 60,000 tons of ammonium sulfate, 50,000 tons of calcium ammonium nitrate, 6,000 tons of highly concentrated nitric acid, and 10,000 tons of technical ammonium nitrate, or a total of 30,000 tons of nitrogen per year.[5]

Magnesite.—Both production and export of magnesite increased, production by 83 percent and export by 216 percent. The calcining plant of the Austrian magnesite producer Radenthein went into operation at Eskişehir, and the plant of a subsidiary of Continental Ore Co. designed to produce 8,000 tons of caustic magnesia per year was under construction.

Phosphate.—Turkey's phosphate requirements was met by imports which increased substantially in 1963. Superphosphate output was 175,000 tons compared with 60,429 tons in 1962 and available capacity of 262,000 tons. Domestically produced sulfuric acid from the Murgul copper plant met a part of Turkey's requirement for superphosphate manufacture.

Exploration for phosphate deposits was accelerated after discovery of a phosphate horizon in 1962 by the Mining Assistance Commission in the Mazidağ (Denek-Mardin area) district. MTA reported extension of this to the northeast and south. New horizons, some less cherty than the originally discovered beds, were sampled and analyzed. Despite the establishment of a greater reserve of phosphate-bearing rock, reported grades are still too low to justify exploitation for making superphosphate. Calcining tests being conducted by MAC give promise of producing material for direct application to acidic soils

[5] Nitrogen, No. 18, July 1962, pp. 28–32.

such as those in the Black Sea area. MTA also reports encouraging results for calcining tests of low-grade rock.

Sodium Sulfate.—The sodium sulfate was recovered from brines of Tersakan Gölü and Bolluq Gölü southwest of Toz Gölü north of Konya and from Aci Göl east of Denizli. The MAC supplied technical assistance and a loan for sodium sulfate production.

MINERAL FUELS

In 1963 wood, either as fuelwood or charcoal, and animal waste accounted for about half of all energy consumed in Turkey, estimated at 20.5 million tons of standard coal equivalent. Coal and lignite supplied approximately 27 percent, petroleum products 19.5 percent, and hydroelectric power 5.5 percent of the total, compared with 33 to 34 percent for all commercial fuels in 1950. At yearend the country had an annual refining capacity of 4,850,000 tons of crude (100,000 barrels per day) and 1,330,000 kilowatts of electric power generating capacity.

Coal, Coke, and Lignite.—All coal and lignite mines owned by Türkiye Kömür Işletmeleri Kurumu (TKI) increased their output with the exception of the Soma mine. Coal requirements will increase when the Ereğli steel mill commences operation; it is expected that this plant will require 705,000 tons of coal annually. To meet this demand, Ereğli Kömür Işletmesi and Armutcuk Kömür Işletmesi, the subsidiaries of TKI that operate Zonguldak and Armutcuk fields, respectively, are equipping two shafts at Çatalagzi and Armutcuk to start hoisting in 1964. Equipping of the shafts is financed from a Development Loan Fund of US$14.5 million granted in 1959. Production from the entire Zonguldak Basin is scheduled to increase to 4.5 million tons of salable coal in 1966 and 4.7 million tons in 1967.

TABLE 9.—Solid fuels production distributed by mines and planned production

(Thousand metric tons)

	Production			Planned production			
	1961	1962	1963	1964	1965	1966	1967
Bituminous coal:							
Çelik	1,390	1,456	1,594	(1)	(1)	(1)	(1)
Üzülmez	1,208	1,241	1,253	(1)	(1)	(1)	(1)
Kozlu	890	952	1,011	(1)	(1)	(1)	(1)
Kandilli	284	244	294	(1)	(1)	(1)	(1)
Total salable	[2] 3,772	[2] 3,893	[2] 4,152	4,232	4,388	4,520	4,677
Lignite:							
Tunçbilek	825	982	1,042	1,100	1,100	1,347	1,347
Soma	369	422	380	670	670	670	670
Değirmisaz	135	156	189	130	130		
Seyitömer	180	308	441	570	570	570	570
Total	1,509	1,868	2,052	2,470	2,470	2,587	2,587
Privately owned mines	1,099	1,111	1,185	(1)	(1)	(1)	(1)
Total lignite	2,608	2,979	[2] 3,237	(1)	(1)	(1)	(1)

[1] Data not available.
[2] Data furnished by Eregli Komur Isletmesi (EKI); differs from that officially reported by State Statistical Institute and given in table 1 of this chapter.

Coal sales increased notably to the Karabük steel plant where the coke ovens used 1,264,000 tons of coal compared with 785,000 tons in 1962. Sales to railroads continued a downward trend because more diesel locomotives were being used.

All the bituminous coal and lignite produced by the TKI was sold by its subsidiary, Kömür Satiş Tevzii Müessesi (Coal Sale & Distribution Organization). This organization attempts to place the high-grade fuels in the most essential markets. For this reason, retail sales of bituminous coal for space heating have been quite small compared with sales to industry and transportation. Some of the coal sold to industry is used for power generation so that the quantity of coal used for power generation is greater than that officially credited to thermal power plants.

Coal prices, set by the Government, have not been high enough to permit the Zonguldak mines to operate at a profit.

Coke.—Coke is produced at Karabük, Zonguldak (low-temperature), and at municipal gas works in Ankara, İstanbul, and İzmir. Of the total 1963 coke output, 822,766 tons was produced at Zonguldak. The Ereğli steel mill will have 74 ovens with capacity to produce 435,000 tons of coke per year.

TABLE 10.—Solid fuel sales [1]

(Thousand metric tons)

	1961	1962	1963
Coal:			
Industrial plants:			
Karabük steel plant	708	785	1,246
Cement	358	388	458
Sugar	92	63	60
Small industry	132	59	80
Zonguldak semicoke plant	102	102	96
MKEK	21	17	9
Other	175	200	165
Total industrial sales	1,588	1,614	2,114
Transportation:			
State railways	805	786	740
Merchant marine and navy	143	152	109
Other	49	38	35
Total transportation sales	997	976	884
Municipal thermal powerplants	452	799	652
Municipal gas plants	221	246	218
Retail sales (mainly for heating)	351	277	290
Total sales	3,609	3,912	[2] 4,167
Consumption by TKI	82	71	72
Lignite:			
Retail sales	666	587	850
Municipal thermal powerplants	233	406	397
Small industry		33	32
Kütahya nitrogen fertilizer plant	56	191	261
Cement	53	67	84
Sugar	103	75	90
MKEK	28	41	43
Textile	65	84	107
Total	1,204	1,484	1,864
State railways	136	189	165
Total sales	1,340	1,673	[3] 2,052

[1] Excludes sales of lignite produced in privately owned mines which in 1963 were probably as follows: Retail sales 859,000; sugar mills 112,000; cement plants 143,000; and small industry 71,000.
[2] Includes 9,000 tons exports.
[3] Includes 23,000 tons self-consumption.

Lignite.—TKI, through its subsidiary Garp Linyitleri Işletmesi (Western Lignite Operation), was the largest but not the sole lignite producer, as it was for bituminous coal. Private industry with numerous mines serving local markets produced 37 percent of total output in 1963. Of the four Government-owned mines, Soma is in Manisa district and the other three in the Kütahya Province. The bulk of output of Garp Linyitleri is used in larger powerplants, but a significant part of the production from Seyitömer is used by the nitrogenous fertilizer plant.

Petroleum.—As of December 31, 1963, 13 companies held 114 exploration licenses in Turkey covering an area of 5,230,368 hectares. The following were some of the companies with their respective areas: Türkiye Petrolleri Anonim Ortakliği (TPAO), 41 exploration licenses with a total of 1,957,919 hectares; Mobil Exploration Mediterranean, Inc., 24 with 1,167,962 hectares; Turkish Gulf Oil Co., 13 with 610,870 hectares; Compagnie d'Exploration Petrolière, 9 with 413,180 hectares; Pan Oil Co., 3 with 149,950 hectares; and N. V. Turkse Shell, 4 with 104,440 hectares.

In 1963, 41 party-months of geological fieldwork, 38 party-months of geophysical work, and 84,178 meters of drilling were carried out. The drilling was almost equally divided by length between development and exploratory drilling. Fifty wells were drilled (including four suspended wells). The wells were classified as 17 wildcats, 7 extension wells, and 27 development wells. Seven additional wells were drilling at yearend. Of the wells drilled, 30 were producers, 13 dry, 1 injection, and the remainder accounted for by suspended wells and others. TPAO, Shell, Mobil, and Tennessee Turkey, Inc., were the only companies engaged in drilling, having drilled 59,441, 12,783, 7,509, and 4,445 meters, respectively. Tennessee Turkey, Inc., drilled in Thrace on areas held by the American Overseas Petroleum, Ltd. (Amoseas), but the company abandoned drilling by yearend and terminated its drilling contract with Amoseas.

TPAO made a high-viscosity crude discovery near Çelikli in southeast Turkey, reportedly flowing at 1,100 barrels per day. Mobil continued its drilling activities in the Silivanka field where the company had already discovered oil in Cretaceous limestone. Shell discovered oil in Kürkan 1, 10 kilometers west of Kayaköy oilfield.

TABLE 11.—Petroleum production by companies and fields

Company	Field	Number of wells (1963)	Production (metric tons)		
			1961	1962	1963
Turkiye Petrolleri Anonim Ortakliği	Raman	27	174,497	156,369	126,532
	Bati Raman	15	696	24,396	68,223
	Garzan-Germik	43	237,880	295,872	348,608
	Magrip	10	710	24,267	66,432
	Kurtalan	1	488	9,764	2,344
	Bada 1 and Çeliklil	----	----	----	[1] 409
Total		96	414,271	[2] 510,670	612,548
Mobil Exploration Mediterranean, Inc.	Bulgurdağ	3	14,202	51,795	54,470
	Silivanka	1	----	----	2,396
	Raman (extension)	shut-in	----	----	----
N. V. Turkse Shell	Kayaköy	4	13,243	32,943	56,538
	Kürkan	3	----	----	5,889
Eran Petroleum Industrial Co.	Kâhta VI	----	32	----	13,142
Total		107	441,748	595,408	[3] 744,933

[1] Produced on test.
[2] Reported total; 2 metric tons not accounted for.
[3] Reported total, detail adds to 744,983 tons.

Crude oil production increased by 25 percent during the year; TPAO remained the largest producer accounting for 82 percent of total Turkish output. Domestic production was equivalent to one-fourth of consumption, which has increased at an average annual rate of 11 percent during 1957 to 1963. Garzan-Gemirk field was the largest producing field.

Refining capacity stood at 4,850,000 tons per year (100,000 barrels per day), including Batman refinery—600,000 tons per year (12,500 barrels per day); Anadolu Tesfihanesi Anonim Şirketi refinery (ATAS—owned by Socony Mobil 56 percent, Shell 27 percent and British Petroleum 17 percent)—3,250,000 tons per year (65,000 barrels per day); and Instanbul Petrol Rafinerisi A.Ş. refinery (IPRAŞ—owned by Caltex 49 percent and Türkiye Petrolleri Anonim Şirketi 51 percent)—1,000,000 tons per year (21,800 barrels per day).

Refinery output was approximately 800,000 tons in excess of Turkey's requirements, mainly in residual fuel. Also during the year the Batman refinery could not dispose of all its gasoline. The Ministry of Commerce was given authority to control the entry of bonded petroleum products made of imported crude until the excess gasoline at Batman was disposed of, not only by the Government marketing firm Petrol Ofisi, but also by three foreign marketing firms—Mobil, Shell, and British Petroleum.

TABLE 12.—Production of refined petroleum by refineries

(Metric tons)

	1960	1961	1962	1963	Detail of products in 1963
Batman:					
Crude oil throughput	362,457	410,511	492,819	568,285	
Refinery output	325,826	371,012	451,860	532,535	Gasoline 77,311; solvent 1,598; kerosine 20,637; diesel 69,604; fuel oil 243,990; asphalt 119,395.
Izmit (Ipraş):					
Crude throughput	----------	219,295	935,433	990,205	
Refinery output	----------	174,172	842,380	888,941	Liquefied petroleum gas 11,155; gasoline 132,064; kerosine 95,674; diesel 249,633; fuel oil 400,415.
Mersin refinery (Ataş):					
Crude throughput	----------	----------	1,458,574	2,057,304	
Refinery output	----------	----------	1,338,951	1,977,289	Gasoline 331,749; kerosine 279,294; diesel 560,502; fuel oil 784,861; naphtha 20,883.

Crude oil imports increased by over 1 million tons to meet requirements of Mersin refinery which began operation in April 1962, but product imports were only 12.7 percent of those in 1962. Cost of crude and product imports were US$53.0 million and US$13.3 million, respectively.

In October 1963 the bilateral agreement between Turkey and the U.S.S.R. was revised to increase kerosine imports from US$200,000 to US $1,000,000. The Istanbul area experienced a kerosine shortage, partly as a result of the strike at ATAS refinery and increasing consumption.

Turkey exported 784,000 tons of crude products valued at about US$9 million. Included in the exports were 41,855 tons of gasoline shipped mainly to West Germany and United Kingdom and 674,000

tons of fuel oil shipped mostly to the Netherlands and United Kingdom. Bunker sales in the last 10 months of 1963 totaled 79,661 tons (49,793 tons in 1962).

TABLE 13.—Civilian consumption [1] of refined petroleum products

(Metric tons)

Product	1962	1963	Percentage change
Aviation gasoline	3,170	2,069	−34.7
Motor gasoline	510,218	515,737	1.1
Jet fuel	8,116	9,130	12.5
Kerosine	397,881	449,096	12.9
Motorine (gas oil)	735,355	875,465	19.1
Diesel oil	36,593	40,152	9.7
Residual fuel oil	383,661	538,561	40.4
Lubricants, grease	70,413	72,731	3.3
Asphalt	92,395	116,062	25.6
Solvents	979	1,455	48.6
Paraffin, vaseline	144	41	−71.5
Special preparations	1,394	6,787	386.9
Liquefied petroleum gas	1,740	8,766	403.7
Total	[2] 2,242,136	2,636,052	17.6

[1] Sales to distributors.
[2] Reported total; 77 metric tons not accounted for.

The prices of automobile gasoline, kerosine, and diesel fuel are set and controlled by Government decree. As of the end of the year, main depot sale (wholesale) price of gasoline (80 octane) and kerosine in U.S. cents per gallon were as follows:

	Gasoline			Kerosine		
	Retail price	Includes—		Retail price	Includes—	
		Duty	Taxes		Duty	Taxes
Mersin	38.20	4.67	20.06	17.42	1.46	5.99
İskenderun	38.61	4.67	20.13	17.78	1.46	6.05
İzmir	39.25	4.67	20.52	18.49	1.46	6.01
İstanbul	38.96	4.67	20.48	18.06	1.46	5.97
İzmit	38.03	4.67	20.01	19.34	1.46	5.94
Batman	39.26	4.67	20.11	18.06	1.46	6.02

To the wholesale price, the retailer adds his own transportation cost, evaporation and leakage losses, local taxes, and his profit margin. These markups differ in each locality, influenced mainly by inland transport charges. Gasoline pump prices in the main consuming centers of İstanbul, İzmir, İskenderun and İzmit were 41.34, 41.80, 41.17, and 40.92 cents per U.S. gallon, respectively.

The Government of Turkey reestablished the Liquid Fuel Price Stabilization Fund which had been allowed to lapse. Petroleum companies are now obliged to deposit into this special account an amount of money equal to reduction in world petroleum prices exceeding 5 percent which have not been reflected in domestic prices. World price of some products have fallen since June and July. Because prices in

Turkey have remained constant, petroleum companies are expected to have to deposit about TL11 million (US$1.22 million) into this fund. This fund will be used to insure the stability of the retail price of all petroleum products.

The production capacity of the fields of TPAO in District V exceed the refining capacity of Batman refinery, and TPAO requested bids for a 550-kilometer pipeline to connect the fields to İskenderun with an annual carrying capacity of 1.2 million tons per year.

The Mineral Industry of Afghanistan

By L. Nahai [1]

COAL, salt, lapis lazuli, and construction materials such as lime, gypsum, slate and stone were the only mineral commodities produced in Afghanistan during 1963. Beryl has been produced sporadically. Small deposits of chromite and lead-zinc are known but remained unexploited because there were no domestic markets for the two commodities and transportation costs from Afghanistan to world markets were too high. Oil fields of sufficient magnitude to justify exploitation have not been discovered, but known natural gas reserves are substantial and have potential significance. There is evidence of large high-grade iron ore resources, but these are in an unfavorable location.

The contribution of the mineral industry to the economy was small, although precise figures are not available. The reported value of mineral production in 1963 (excluding barite) was 181.6 million afghanis (about US$4 million). Employment in the industry, including cement plants and quarries, was estimated to be no more than about 2,000.

Although mineral activity in 1963 was small, planned investment in this industry during the second 5-year plan (1961–62 to 1965–66) [2] may total 10 to 12 percent of the total investment program. Significant projects in the minerals field under the plan include: (1) exploration and development of natural gas and petroleum fields; (2) installation of pipelines to bring natural gas (and possibly petroleum) to centers of consumption; (3) utilization of natural gas for production of nitrogen fertilizers; (4) expansion of coal production; and (5) possible establishment of an oil refinery capable of satisfying home demand (if domestic crude oil reserves are proven). It is the government's hope that by 1965–66 annual crude oil production will total 300,000 to 350,000 tons per year, coal output will be 170,000 tons, and a plant to produce 56,000 tons of nitrogen fertilizers annually will have been installed. The plan also provides for further survey of mineral resources (particularly iron deposits) and for the start of a steel industry. However, many problems regarding raw materials and transportation will have to be resolved before a steel industry can be established.

In November 1962, an agreement was signed by Afghanistan and the U.S.S.R. whereby the latter was to undertake surveys for coal, iron ore, gold, lapis lazuli, and beryl. The surveys will be part of the assistance to be rendered in support of Afghanistan's second 5-year plan. During 1963 German technical assistance to Afghanistan included geological work in the southern part of the country.

A petroleum bill, drafted some time ago, was considered by the National Assembly but apparently was not passed by yearend. Re-

[1] Near East-South Asia specialist, Division of International Activities.
[2] Afghan calendar year is Mar. 21 of 1 year to Mar. 20 of the succeeding year.

portedly, the draft would permit foreign capital participation in exploration and development of petroleum resources.

PRODUCTION

Output of Afghanistan's two most significant mineral industry products, cement and bituminous coal, showed significant gains in 1963 over that of 1962; 1963 production of both commodities was nearly three times that of 1959. Recorded salt production, however, fell to a level below that estimated for 1959, 1960, and 1962 and was only 38 percent of the reported peak of about 89,000 tons attained in 1961.

TABLE 1.—Production of minerals
(Thousand metric tons unless otherwise specified)

Commodity [1]	1959	1960	1961	1962	1963
Metals:					
Beryl—metric tons		10			
Nonmetals:					
Barite—metric tons				(2)	1,000
Cement	34	37	41	[3] 70	95
Lapis lazuli—kilograms	[4] 1,795	[4] 2,800	[4] 3,268	[4] 2,823	5,421
Salt:					
Rock	26	26	23	22	21
Other	[3] 40	[3] 50	66	65	12
Mineral fuels:					
Coal:					
Bituminous	36	46	68	69	98
Briquets	[3] 22	[3] 20	19	[3] 19	[3] 20

[1] In addition to commodities listed, Afghanistan is also known to have produced limestone, marble, gypsum, clays, and talc, but data are insufficient to make any quantitative estimate of output.
[2] Data not available.
[3] Estimate.
[4] Data are for the Afghan fiscal year, Sept. 21 to Sept. 20.

TRADE

Afghanistan's first official trade statistics publication was released in 1963; the publication covers the Afghan calendar years March 21, 1956 to March 20, 1962. The country's mineral exports are insignificant. Lapis lazuli has been exported irregularly—about 1,000 kilograms in 1961–62 was shipped to West Germany and mainland China; a small tonnage of beryl was exported in 1957, but apparently none has been shipped since then. Value of imports by major classes of commodities for the 2 latest years reported was as follows:

Class	Value (thousand U.S. dollars)	
	1960–61 [1]	1961–62 [1]
Metals and metal manufactures [2]	3,121.1	2,210.5
Nonmetals and nonmetallic mineral manufactures [3]	4,290.4	3,285.7
Petroleum products	599.4	7,380.5
Total	8,010.9	12,876.7

[1] Year begins Mar. 21 and ends Mar. 20.
[2] Iron and steel, nonferrous metals, and manufactures of metals not described in detail.
[3] Lime, cement, building stone, building materials, clay construction materials, grinding and polishing wheels, glassware, pottery, etc.

Data on quantities of minerals and metals imported are available only in the case of petroleum products, which totaled nearly 450,000 barrels more in 1961–62 than in 1960–61.

TABLE 2.—Imports of petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1960–61 [1]	1961–62 [1]	Principal sources, 1961–62
Gasoline	480	807	U.S.S.R. 467; Iran 180; United States 85; Pakistan 65.
Kerosine	36	45	U.S.S.R. 25; Pakistan 13; Iran 6.
Diesel fuel oil	121	198	U.S.S.R. 109; United States 40; Pakistan 38; Iran 11.
Lubricants	14	50	U.S.S.R. 45; United States 3; Pakistan 2.
Total	651	1,100	U.S.S.R. 646; Iran 197; United States 128; Pakistan 118.

[1] Afghan calendar year; begins Mar. 21 of 1 year and ends Mar. 20 of the following year.

In 1961–62 mineral and metal imports constituted 13 percent of total imports; petroleum products alone accounted for 7.5 percent of all imports. In the same year U.S.S.R. accounted for 61 percent of Afghanistan's imports of gasoline, 56 percent of kerosine, 55 percent of diesel fuel oil, and 90 percent of lubricants. This significant reliance on the U.S.S.R. was partly because of the interruption of trade via Pakistan as a result of the closure of the Pakistan-Afghanistan border. On April 10, 1963, the Governments of Afghanistan and Iran signed an agreement whereby Afghanistan undertook to purchase 28,000 tons of petroleum products from National Iranian Oil Co. during the 12 months beginning April 21, 1963.

Afghanistan's mineral exports are insignificant. Lapis lazuli has been exported irregularly—1,000 kilograms in 1961–62 was shipped to West Germany and mainland China. A small tonnage of beryl was exported in 1957 but apparently none has been shipped since then.

COMMODITY REVIEW

METALS

Beryl.—A new beryl deposit was discovered in 1963 by a geological team of the U.S.S.R. operating in Afghanistan. The deposit is in the same general area north of Jalalabad, where beryl has already been mined, from time to time. Last recorded production was in 1960.

Iron Ore.—The iron ore of the Hagigak iron formation in the Hindu Kush Mountains, 120 kilometers northwest of Kabul, has been the object of much interest and speculation. Preliminary examination of these deposits during 1963 indicated reserves of rather high-grade hematite possibly exceeding 100 million tons, and estimates as high as 2,000 million tons have been cited without reference to grade. The deposits, however, are in a geographically unfavorable area.

Radioactive Materials.—In September the Afghan Government signed an agreement with the U.S.S.R. under which the U.S.S.R. undertook to build a small atomic research reactor at Kabul University. U.S.S.R. will provide fuel and additional equipment for experimental work and will train personnel in Afghanistan as well as in the U.S.S.R. It is expected that the reactor may become operational during the first half of 1965.

NONMETALS

Cement.—Production capacity of cement increased to 500 tons per day when the second 200-ton-per-day kiln started operation in the Ghori plant near Pul-i-Khumri. This plant already had a 200-ton-per-day kiln which began production early in 1962. Afghanistan's only other cement plant, one with a 100-ton-per-day capacity, was at Jabal-us-Seraj, 80 kilometers north of Kabul. It had been completed in 1957. Both plants, built with the assistance of Czechoslovakian technicians, use coal as fuel. The total 500-ton-per-day capacity of these plants is considered sufficient for domestic consumption.

MINERAL FUELS

Coal.—The bulk of 1963 coal output was obtained from the Karkar and Ishpushta mines, which have produced about 240 and 80 tons of coal per day, respectively. Karkar is about 15 kilometers north of Pul-i-Khumri, and Ishpushta is a similar distance northeast of Doab. These mines supplied Afghanistan's two cement plants and the Kabul area with coal. Another mine was being developed with U.S. assistance at Darra Suf, where Afghanistan's best coal resources are located. Work on this project continued during 1963. The Darra Suf area, which is 160 kilometers south of Mazar-i-Sharif and 640 road kilometers from Kabul, will eventually produce 150,000 tons of coal per year.

In December the cornerstone for a modern coal briquetting plant was laid at Karkar. The plant, which will utilize coal fines produced during mining, is of French manufacture and is expected to produce 8 tons of briquets daily starting in late 1964.

Natural Gas.—A new natural gas field, with 350 billion cubic feet reserves, was discovered at Yatime-Taq in the Shibarghan area of north Afghanistan. The new field together with Khwaja Gogirdak, which has an estimated 1,325 billion cubic feet reserve, give the country a total reserve of 1,675 billion cubic feet.

On October 18, the Governments of Afghanistan and the U.S.S.R. signed an agreement which will provide Soviet financial and technical assistance for the development and exploitation of the natural gas fields. Also under study are plans for laying pipelines to the Soviet border and to the site of the proposed Afghan fertilizer plant at Mazar-i-Sharif. Commencing in 1966, 70 billion cubic feet of natural gas will be produced annually of which three-fourths reportedly will be exported to the U.S.S.R.

The Mineral Industry of Burma

By K. P. Wang [1]

BURMA, long believed to be a rich mineral province, has been only a minor producer in recent decades, even by Far East standards. Its 1963 mineral output value of roughly US$45 million was far smaller than that of Thailand, Taiwan, and South Korea, countries not considered prominent in mining. The mineral industry is not of great consequence to Burma's predominantly agricultural economy; the value of minerals in 1963 was 3.5 percent of the gross national product. However, under British rule before World War II, mineral products were extracted at several times the present level and constituted a significant item in the county's export trade.

Burma's mineral industry has been concentrated in a few enterprises and mining districts. The leading mineral product, petroleum, came under control of the government enterprise People's Oil Industry, which took over the Burma Oil Company in 1963. A specific development during the year was the completion of a new oil refinery at Syriam near Rangoon. The Burma Corp. (1951), Ltd., producing lead, zinc, silver, and other metals at levels less than one-fourth of the historic peaks, was on the verge of becoming nationalized by yearend. The Government's Petroleum and Mineral Development Corporation (PMDC) planned in 1963 to reopen the Mawchi tin-tungsten mine, idle for many years except for small-scale tributary operations. The small Ywama steel mill in Insein near Rangoon continued to have problems with scrap shortages and high operating costs. The Thayetmyo cement plant increased production substantially without plant expansion, in order to take up the slack caused by import reductions. Plans were made to develop and nationalize the jade industry.

GOVERNMENT POLICIES AND PROGRAMS

March 1963 marked the first anniversary of the present government, which made clear its policy of neutralism in international affairs, minimum involvement with foreigners in industrial development, and nationalization of important enterprises. By the end of 1963, almost all of the leading mineral enterprises had become government operations. Foreign loans and grants and technical surveys from any source, including United Nations assistance and Japanese reparations, were welcome. However, foreign investment was neither encouraged

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nor forthcoming, despite the shortage of domestic capital. A few international mineral and industrial consultants were employed, indicating the desire to utilize foreign know-how. The Government of Burma, while attempting to build up some industries, left little doubt that industrialization is not considered the basic tool in improving living standards for the country's 23 million inhabitants.

PRODUCTION [2]

The estimated US$45 million worth of minerals produced in Burma during 1963 comprised some $25 million of petroleum and natural gas products, $6 to $7 million of nonferrous base metals and byproducts, and $2 to $3 million each of tin-tungsten concentrates, iron and steel products, cement, and salt. The overall mineral output level rose only slightly during the last 5 years, with some items increasing and others declining. Thus, no significant progress has taken place in mineral exploitation.

Comparing production in 1963 with that of 1959, petroleum rose slightly because a little more crude oil came down the Mandalay River by barge without interference. Lead-zinc-silver output declined substantially midway in the 5-year period because of depletion of the very high grade ores from the Bawdwin mine; however, an upward trend began in the last 2 years. Tin output was nearly the same as that of 1962, whereas tungsten decreased owing to depressed world prices. Steel showed nominal advances, and salt hovered around a somewhat stable level. Cement attained a new output high in 1963, when capacity was more fully utilized.

Petroleum has been produced for domestic consumption only, with crude oil refined into the kinds of products needed by the economy. Steel, cement, and salt also have been produced for local use. On the other hand, virtually all the nonferrous metals and ores have been extracted for the export market, and lead and silver have been exported in the refined metal form.

[2] The Revolutionary Government of the Union of Burma, Central Statistical and Economics Department (Rangoon, Burma). Selected Monthly Economic Indicators. November 1963, pp. 1–25.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Antimonial lead (18 to 20 percent antimony) [1]	519	539	413	459	578
Antimony ore (40 to 50 percent antimony)	342	212	151	68	(2)
Copper matte (40 percent copper) [1]	384	365	279	370	431
Gold, refined—troy ounces	212	304	194	(2)	(2)
Iron and steel:					
Iron ore	3,751	15,922	[3] 15,000	9,162	(2)
Steel ingot [3]	11,000	5,000	11,000	13,000	15,000
Rolled steel [3]	8,000	4,000	8,000	10,000	12,000
Lead:					
Concentrate lead (50 to 60 percent lead) [1]	34,518	32,107	29,007	33,449	[3] 36,000
Refined metal (99.99 percent lead) [1]	19,474	16,792	15,763	17,385	17,738
Manganese ore	550	294	178	193	(2)
Nickel speiss (20 to 22 percent nickel) [1]	433	332	650	536	452
Silver, refined [1]—thousand troy ounces	1,728	1,501	1,325	1,498	1,511
Tin concentrate (68 to 72 percent tin)	1,069	1,060	1,047	924	[3] 615
Tin-tungsten concentrate (35 percent tin and 30 percent tungsten trioxide)	1,326	1,122	1,222	1,161	[3] 1,279
Tungsten concentrate (55 to 65 percent tungsten trioxide)	451	354	378	215	[3] 22
Zinc concentrate (54 to 56 percent zinc) [1]	19,372	18,028	13,122	15,119	14,924
Nonmetals: [4]					
Barite	1,016	1,626	2,039	4,048	(2)
Cement	36,202	44,901	39,570	53,282	124,130
Gypsum	1,956	1,052	853	2,084	(2)
Limestone	35,403	40,000	36,065	65,289	(2)
Marl	16,135	24,016	23,171	26,293	(2)
Salt	112,630	148,181	126,544	[5] 155,697	[3] 160,700
Mineral fuels:					
Coal	1,391	114	1,611	2,423	(2)
Natural gas—million cubic feet	178	261	333	440	(2)
Petroleum:					
Crude oil—thousand 42-gallon barrels	3,967	4,078	4,194	4,366	4,761
Refinery products: [6]					
Gasoline—do	1,260	1,250	1,312	1,292	1,238
Kerosine—do	818	687	718	702	854
Other—do	768	882	1,260	1,229	1,280
Total—do	2,846	2,819	3,290	3,223	3,372

[1] Output of Burma Corp. (1951), Ltd. All figures tantamount to national production; however, other companies sporadically produce small quantities of lead, zinc, and silver.
[2] Data not available.
[3] Estimate.
[4] Burma also produces a variety of semiprecious and precious stones, including amber, jade, ruby, sapphire, and spinel.
[5] Final figure; supersedes figure given in commodity chapter, volume 1.
[6] 1959–61 figures are for fiscal years, October to September of subsequent year. For 1962 and 1963, residual fuel is apparently not included and "Other" is comprised mainly of distillate fuel.

TRADE [3]

Although minerals were once important in earning foreign exchange for Burma and probably could be again, the benefit derived has been limited in recent years. Total mineral and metal exports approximated only US$10 million annually in 1962–63, equivalent to 3 percent of all exports, compared with 60 percent for rice. Burma produced a surplus of petroleum before World War II; it is now short of oil and exports only petroleum wax.

Imports of mineral and related products have steadily risen; the $40 to $50 million credited to this category in 1963 was nearly a fifth of all imports. By far the principal subcategory in the mineral field is metals and manufactures. The small steel industry of Burma was not even able to furnish one-tenth of the national requirements and

[3] Work cited in footnote 2.

TABLE 2.—Exports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1962	1963	Principal destinations, 1962
Metals:			
Antimony ore	240	22	(1).
Copper matte	405	239	Japan, West Germany.
Lead:			
Ore (galena)	457	457	All to Japan.
Metal:			
Antimonial lead	336	494	All to India.
Refined	19,999	16,301	Mainly to India.
Nickel speiss	----------	423	Japan.
Silver bullion, thousand troy ounces	1,401	1,251	Mainly to United Kingdom.
Tin and tungsten:			
Tin ore and concentrate [2]	1,916	[3] 1,288	Mainly to Malaysia; also to United Kingdom.
Tungsten ore and concentrate	417	[3] 376	Mainly to Japan.
Mixed tin-tungsten concentrates	256	387	Japan; United Kingdom; Netherlands.
Tin ingots	26	(1)	(1).
Zinc:			
Ore	190	(1)	(1).
Ingots	(1)	50	(1).
Nonmetals: Salt	[4] 10,863	(1)	Mainly to mainland China.
Mineral fuels: Petroleum wax	10,896	11,202	Mainly to United Kingdom.

[1] Data not available.
[2] Includes several tons of bismuth-bearing concentrates.
[3] Incomplete. Exports from ports of Tavoy and Mergui, near the main tin-tungsten area, are not available.
[4] Year beginning Oct. 1, 1961, and ending Sept. 30, 1962.
Sources: Rangoon customs list, and Tavoy Chamber of Mines (tin and tungsten only).

TABLE 3.—Imports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	October 1961 to September 1962	Principal sources
Metals:		
Aluminum semimanufactures	2,800	Mainland China 1,200; United Kingdom 400; Hong Kong 300.
Copper semimanufactures	650	United Kingdom 240; U.S.S.R. 140; Japan 110.
Iron and steel semimanufactures:		
Iron ingots	2,628	Australia 1,999.
Joists	5,799	U.S.S.R. 2,214; Belgium 1,705; Japan 878.
Bars and rods	28,598	Japan 9,911; U.S.S.R. 8,563; mainland China 2,227.
Uncoated plates and sheets	14,315	U.S.S.R. 7,166; Japan 4,576.
Galvanized and corrugated sheets	30,050	Japan 13,638; Australia 12,960.
Tinplate	51,383	Japan 50,144.
Wire	4,143	Mainland China 1,427; Japan 1,199; U.S.S.R. 952.
Tube and fittings	10,737	United Kingdom 6,849; Japan 1,569.
Large pipes	4,372	Japan 2,661; Belgium 986.
Zinc semimanufactures	800	Australia 320; Northern Rhodesia 220.
Nonmetals		
Asbestos	347	Republic of South Africa 269.
Cement	166,121	Mainland China 50,283; United Arab Republic 16,920; Japan 14,245.
Fuller's earth	954	India 700.
Phosphate fertilizer	6,870	Japan 6,794.
Sulfur	1,938	United States 1,402.
Mineral fuels:		
Coal	268,577	Republic of South Africa 235,138.
Coal coke	8,065	All to Republic of South Africa.
Petroleum:		
Gasoline, thousand 42-gallon barrels	131	Iran 56; U.S.S.R. 44.
Kerosine, do	167	U.S.S.R. 166.
Medium-flash diesel oil, do	60	Iran 59.
High-flash diesel oil, do	88	U.S.S.R. 73; Iran 14.
Lubricants	104	United Kingdom 81; Belgium 5; United States 5.
Asphalt, thousand 42-gallon barrels	2,297	Iran 1,143; Republic of South Africa 940.

Source: Official trade returns of Burma.

very few nonferrous metal manufactures were produced domestically. In 1962–63, annual imports of refined petroleum and coal each amounted to about $4 to $5 million, approximately, or 600,000 barrels of oil and 300,000 tons of coal. Imported refined oil represented about one-fifth of the 1963 supply; crude requirements for the second refinery may have to be met in large part by imports. Burma has the Kalewa subbituminous coalfield among others, but only nominal amounts of coal are produced and reliance on imports has been almost complete. About US$2 million of cement was imported in 1962; half this amount was imported in 1963.

COMMODITY REVIEW

METALS

Copper, Lead, Zinc, Silver.—For the Burma Corp. (1951)[4] the country's only important nonferrous base-metal enterprise, 1963 was a pivotal year. Production increased about 10 percent. In October, the company announced that reserves were 3 million metric tons, containing 11.2 ounces of silver per short ton, 15.1 percent lead, 9.2 percent zinc, and 0.85 percent copper ore; this was about 8 percent higher in combined metal content than the 1962 reserve. Improved metal prices were partly responsible for profits of 2.73 million kyats (officially, US$1 equals 4.72 kyats) during the 15 months ending September 1963, in contrast to losses of 3.27 million kyats reported for the financial year ending June 1962. However, the foreign partner (British and United States) of this joint venture did not derive much benefit because of high taxes and cumbersome regulations. In 1963, PMDC, the Government of Burma partner, was appointed sole agent for the sale of zinc.

A basic program to revitalize operations was under study by the corporation with US$667,000 worth of United Nations Special Fund technical assistance. Evaluation of reserves indicated there were large quantities of lower grade ores that could be mined profitably. Construction of a zinc smelter was also considered. Upon conclusion of exploration during 1963, a United Nations expert was sent to Bawdwin to investigate mining methods; this latter work was still in progress at yearend.

Iron and Steel.[5]—Attention was focused on the dwindling local scrap supply for the Ywama electric steel plant built with West German equipment by the firm DEMAG (Deutche Electrometallurgie Aktiengesellschaft). Utilization of imported high-price scrap was not considered feasible for the time being.

In 1963, the Ywama plant produced only about 8,000 tons of bars and rods (plus 4,000 tons of nails derived from them), approximately 4,000 tons of black sheet, and nominal quantities of wire products. Management was planning to expand sheet capacity and possibly add corrugating facilities.

[4] See company reports covering 1963.
[5] Far Eastern Economic Review (Hong Kong). Steel for Asia. V. 42, No. 13, Dec. 26, 1963, pp. 680–681.

Burma's iron and steel requirements had to be met primarily by imports. Actual consumption of major items in 1963 is estimated as follows: 60,000 to 70,000 tons of sheets and plates, mostly galvanized iron and tinplate; 15,000 to 25,000 tons of bars and rods; 10,000 to 20,000 tons each of tubes, pipes, and structural steel, and nearly 10,000 tons of nails.

Construction of an integrated iron and steel plant to satisfy existing demand has been under serious consideration for several years. At the invitation of the Government of Burma, Krupp of West Germany had undertaken a survey of the iron and coal potential and submitted its report in mid-1963. Since Burma has iron ore but no coking coal, the latest thinking was to construct a Strategic-Udy plant to use iron ore from Taunggyi, waterpower from Bahrchaung, and coal from Kalewa. However, this proposal was still most speculative in 1963.

Tin and Tungsten.—PMDC, with help of the United Nations expert, announced a development plan for the Mawchi tin-tungsten mine in 1963, involving geological investigation and rehabilitation and expansion of the mill. With PMDC scheduled to allot 1.5 million kyats from October 1963 to September 1964, it was hoped that production of mixed concentrates could be raised to 50 to 60 tons monthly during the first 3 years and 100 tons thereafter.

MINERAL FUELS

Petroleum.—Burma's oil industry became fully nationalized in 1963; the People's Oil Industry (POI) was designated as the managing corporation. The British Burma Oil Co. was fully compensated by the end of 1963, ahead of schedule. Exploration by foreign concerns was indefinitely deferred. Instead, plans were made to buy additional drilling rigs. The exploration program for 1963–64 would cost 35 million kyats (about US$7.3 million, at US$1 equals 4.72 kyats), approximately 3.8 million kyats more than actual expenditures in 1962–63. POI announced that it had made a 40-million-kyat profit in the first 9 months of 1963, compared with a 8.5-million-kyat loss in 1962. Apparently, faster extraction of known reserves and reduced salaries and wages to workmen contributed to this reported profit.

The second oil refinery at Syriam was formally opened on November 29, 1963. Rated at about 14,500 barrels per day, this unit is 2.5 times the size of the first Syriam refinery and has more than twice the capacity of the Chauk refinery. Domestic crude production was far short of the new throughput capacity, so that imports became necessary. Foreign crude was scheduled to come mainly from Indonesia, with the Indonesian Government and Caltex providing most of the oil. Thus, Burma, a crude oil exporter of some significance before World War II, became a net importer.

The Mineral Industry of Cambodia

By J. M. West [1] and K. P. Wang [2]

CAMBODIA, a country of about 6 million people and an estimated gross national product of US$650 to US$700 million,[3] had practically no mining activity in 1963 except a small production of gold. Salt sufficient for domestic consumption was extracted by evaporation of sea water. Phosphate rock deposits have been only intermittently worked for local use. Cambodia depended upon imports for small but increasing quantities of petroleum products, iron and steel, and cement. Technical assistance in mineral exploration was provided by the French and the Communist Chinese during 1963. Petroleum surveys made with the help of Polish and Soviet geological teams in 1960–62 apparently met with little success. Chinese aid resulted in the completion of a cement plant in Kampot Province in late 1963.

Cambodia's attempts to develop mineral industries have been seriously handicapped by the absence of domestic mineral fuels and the shortage of electric power. For example, plans to establish a small iron and steel industry in the northern part of the country, based upon local iron ores, reportedly had to be shelved in mid-1963 for lack of satisfactory fuel. Cambodia's total electric power generating capacity was only 65,000 kilowatts, and the modest goal of the 5-year plan, to end December 1964, was only 10,000 additional kilowatts.

A 50,000-kilowatt hydroelectric plant scheduled to be built in the Kamchay Gorge of the Tuk Chhon River in Kampot Province would relieve part of the longstanding power shortage. An agreement signed in Moscow in early 1963 by Soviet and Cambodian delegations provided a 12-year Soviet credit equal to US$11.4 million at 2.5 percent interest for this project. Construction with Soviet technical assistance was to begin in 1965. Cement for the project would be available from the newly completed cement plant, but copper wire for transmission lines and structural steel would have to be imported.

Trade deficits and inflation apparently slowed industrial development. The deficit in the first half of 1963 was US$4.3 million. U.S. economic aid, withdrawn in the fourth quarter of 1963, had provided about 10 percent of Cambodia's Government expenditures. The cost of living rose steeply during the year. Outlook for investment was obscure; guarantees of nonnationalization for 15 years were offered for new industrial enterprises.

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[1] Physical scientist, Division of International Activities.
[2] Chief specialist, East Europe-Far East, Division of International Activities.
[3] US$1 equals 35 Cambodian riels.

PRODUCTION

Cambodia's mineral production during 1959–63 consisted mainly of gold and salt; some phosphate rock and nominal amounts of zircon and jet were produced intermittently. Gold output rose sharply despite dwindling reserves. Salt output has remained steady. Phosphate rock production was first recorded in 1962.

TABLE 1.—Production of metals and minerals

Commodity	1959	1960	1961	1962	1963
Metals: Gold—troy ounces	4,832	4,180	4,180	965	6,687
Nonmetals:					
Salt—thousand metric tons	50	37	54	[1] 54	[2]
Phosphate rock—do	[2]	[2]	[2]	150	[2]

[1] Estimate.
[2] Data not available.

TRADE

Cambodia has no significant mineral exports; mineral import data reflect consumption levels. Mineral commodities constitute an important part of the country's imports; they aggregated one-fourth the total in value during 1963. Iron and steel products from Japan and mainland China, cement from Poland, the U.S.S.R., and China, and petroleum products from Indonesia were among the country's principal imports for the year.

A trade agreement was signed between Cambodia and North Korea near the end of 1963 for annual imports of US$1.4 million, comprising cement, coal, machinery, and various manufactured products. Additional cement imports valued at about US$1.1 million were expected from Poland and North Viet-Nam, owing to trade agreements made in October. Increases were expected in imports of aluminum sheets to replace galvanized sheets for construction and in bare copper wire to meet electric transmission needs. In 1963, Cambodia consumed nearly 1,000 tons of aluminum sheets and several hundred tons of copper wire. Cambodia's leading mineral import during the year was refined petroleum.

TABLE 2.—Imports of selected metals and minerals

(Metric tons)

Commodity	January-June 1963	Principal sources, 1963
Metals:		
Aluminum	400	Japan 321.
Copper	72	Japan 41.
Iron and steel	27,523	Japan 10,665; mainland China 4,424; Czechoslovakia 3,249.
Lead	21	Japan 10.
Tin	17	Belgium 7; France 5.
Zinc	50	Belgium 24.
Nonmetals:		
Asphalt	23,728	U.S.S.R. 10,693; Iran 7,834; Japan 3,760.
Cement	85,136	Poland 28,800; U.S.S.R. 11,500; mainland China 7,600.
Talc (steatite)	221	Mainland China 150.
Mineral fuels:		
Coal and coke	79	Japan 53.
Petroleum, refined products:		
Gasoline—thousand 42-gallon barrels	324	All from Indonesia.
Kerosine—do	92	Do.
Distillate fuel oil—do	173	Do.
Residual fuel oil—do	202	Do.
Lubricants—do	29	United States 28.

COMMODITY REVIEW

METALS

Iron and Steel.—In 1963, as in previous years, Cambodia relied on imports for iron and steel products. Development of a 4-million-ton reserve high-grade hematite-magnetite iron deposit near Phnom Dek in the Kompong area to supply a steel plant proposed to be built with Communist Chinese aid was actively considered until mid-1963. This 50,000-ton project for producing bars, rods, castings, and plates—the principal iron and steel products now imported—was temporarily abandoned because charcoal, the only available fuel, appeared to be too costly to use.

Nonferrous Metals.—During the last few years, most of the gold produced by Cambodia came from a single lode mine at Phnom Long in Lompong Thom Province. This mine, with rich ores and worked entirely by hand methods, once employed 1,000 laborers. The country also produced some placer gold from the Kompong Thom and Siem Reap areas. As of the end of 1963, all known goldfields in Cambodia apparently were nearing exhaustion in ore reserves.

During 1963, a search for bauxite by the French in the Lower Mekong Basin was unsuccessful.

Scattered occurrences of lead minerals are known in the Phnom Trek area, but no production has been reported. The Cadamones Range was reportedly considered worth further prospecting.

NONMETALS

Cement and Lime.—Cambodia's cement requirements, hitherto met entirely by imports, have been increasing. During the first half of 1963, more than 85,000 metric tons was imported. There have been

temporary lulls in demand, related to construction activities. However, the overall trend is upward.

A 50,000-ton-per-year cement plant at Chakrey Ting in Kampot Province, to be opened in early 1964, was intended to decrease imports. State-controlled, the plant was built with the aid of the Communist Chinese. The plant is coal fired, but plans have been made to convert it to oil.

Cambodia has adequate limekilns in Kampot Province to meet the country's needs. No statistics are available on output.

Phosphate Rock.—Mining of the Tumkias phosphate rock deposit in Kampot Province, where beds with estimated reserves of 120,000 tons of ore are worked in three separate hills, began in 1961. A processing plant with 12,000-ton annual capacity was proposed for a site at Tuk Meas in 1962. The ground product was expected to average 23 percent phosphorus pentoxide. Hitherto, almost all of Cambodia's fertilizer requirements have been met by imports.

Salt.—Salt was produced in 1963 by evaporation of sea water near Kampot, Ream, and to a lesser extent near Sre Umbell, in southern Cambodia. Small outcroppings of rock salt are widely distributed in several Provinces, but deposits have not been worked.

MINERAL FUELS

During 1963, French interests made a proposal to the Cambodian Government for the construction of a US$15 million oil refinery at Sihanoukville, with a stipulation that a 15-year marketing monopoly be included in any agreements. The plant would refine 8,000 barrels of crude oil per day from Kuwait—more than adequate to supply Cambodia's requirements for most petroleum products.

The Mineral Industry of Ceylon

By Charles L. Kimbell [1]

CEYLON's only significant contribution to world mineral supplies continued to be amorphous and crystalline lump and chip graphite, material that for certain applications cannot be replaced satisfactorily by other forms of natural graphite or by manufactured graphite. Ceylon's reserves, production, foreign trade, and consumption of other mineral and metal commodities were insignificant in terms of world totals. However, the cement industry ranked ahead of the graphite industry in value of output, and thus was of greater local economic importance.

The total value of Ceylon's 1963 mineral output is estimated at about 25.6 million Ceylonese rupees (Cey Rs) (US$5,376,000) or about 0.4 percent of the country's gross national product. Of total mineral industry output value in 1963, cement accounted for about Cey Rs8.6 million, graphite for about Cey Rs5.1 million, gems for approximately Cey Rs3.6 million, and salt for nearly Cey Rs1.9 million.

Ceylon's 1962 mineral and metal imports, with a value of approximately Cey Rs271 million (US$57.0 million), constituted about 16.3 percent of total imports, while mineral and metal exports were valued at about Cey Rs9.25 million (US$1.9 million) and constituted about 0.5 percent of total exports. This situation contributed to an unfavorable trade balance. Of the total value of mineral and metal imports, mineral fuels accounted for nearly half.

The Ceylonese mineral industry provided employment for some 10,000 to 15,000 persons in 1963. This included several thousands working only seasonally for recovery of solar salt and part time for the recovery and cutting of gems. Total mineral employment represented less than 0.5 percent of the nation's labor force.

GOVERNMENT POLICIES AND PROGRAMS

The trend toward government ownership of industry, apparent for several years, continued in 1963. Construction continued on the Government-owned steel-rolling mill being built under an economic-technological aid program with the U.S.S.R. Completion of a Government-owned kaolin refinery and a corresponding expansion of the government-owned ceramics plant were reported.

Increasing penetration of the private sector of the minerals industry was exemplified by the declaration in late 1963 of the government's plans to grant monopolistic status in petroleum product distribution

[1] Physical scientist, Division of International Activities.

to the government-owned Ceylon Petroleum Corp., effective January 1, 1964. This declaration was accompanied by a government statement of intent to acquire all remaining facilities of the three private oil companies operating in Ceylon. Previously (1962), the government had acquired part of the distribution facilities of these companies, to provide outlets for the then newly created government company.

Among other established government enterprises, the Ceylon Minerals Sand Corp. showed a gain in output but had not yet attained its production potential, the National Salt Corp. failed to meet its programmed goals, and the Ceylon Cement Corp. fell considerably short of its record production of 1962.

SOURCE MATERIAL

Production data for most commodities were derived from publications of the Government of Ceylon, supplemented (particularly in 1963), in the absence of such sources, by data furnished by the U.S. Embassy in Colombo. Specifically, the Ceylon Yearbook, Administrative Reports of the Government Mineralogist, Administrative Reports of the Salt Commissioner, and Administrative Reports of the Director of Industries should be cited. Foreign trade data were taken entirely from the Ceylon Customs Returns. Published data on output and trade are reliable, but information on production of gem stones and most construction raw materials (clays, crushed stone, dimension stone, and common sand and gravel) are not recorded by the government. The level of gem output may be roughly gaged by the level of gem exports, but no reliable estimates can be made for the construction raw materials. Information on mineral exploration, plant development, and technology is from a wide variety of sources, including the governmental reports previously cited, recent newspaper and magazine articles, and Embassy reports.

PRODUCTION

Output of Ceylon's three most significant industrial mineral commodities—cement, graphite, and salt—declined in 1963, but value of total output apparently was slightly higher than in 1962 because of increases in value of production of ilmenite, gem stones, feldspar, and glass sand. Causes of decline in cement and graphite production were not clear; declining salt production apparently reflected poor salt-harvest climatic conditions, and continued effects of administrative and technological difficulties experienced by the salt industry for several years, which the government apparently had not completely rectified by yearend.

TABLE 1.—Production of metals and minerals[1]

(Metric tons)

Commodity	1959	1960	1961	1962	1963
Metals:					
Ilmenite	----------	6,096	10,161	4,220	19,088
Monazite	85	335	216	----------	----------
Nonmetals:					
Cement	94,964	84,965	81,765	84,781	75,238
Feldspar	(2)	33	108	57	111
Glass sand	1,650	2,357	1,941	3,932	4,339
Graphite[3]	7,998	9,169	9,086	8,769	8,447
Gypsum	6	----------	----------	----------	----------
Kaolin	(2)	(2)	(2)	(2)	1,016
Salt	32,594	56,449	34,544	46,529	[4] 20,446

[1] Ceylon also produces chalk and a wide variety of precious and semiprecious gems. Output of chalk is estimated at less than 1,000 tons per year; output of gems somewhat exceeds exports, which totaled 157,538 carats in 1963.
[2] Data not available.
[3] Exports; actual production data not available.
[4] Final figure; differs from estimate reported in commodity chapter in volume I.

TRADE

As in the past, Ceylon's significant 1963 mineral exports were limited to ilmenite concentrates, graphite, and precious and semiprecious gems. Requirements for iron, steel, all nonferrous metals, many nonmetals and all mineral fuels were supplied by imports. The value of mineral imports in 1962 (271 million Ceylonese rupees) was distributed as follows:

Major classes of commodities:	*Percent*
Iron and steel	23.5
Nonferrous base metals	6.0
Precious metals	.7
Nonmetals	9.7
Construction materials	10.3
Coal and coke, including briquets	3.4
Petroleum products	46.4

Over half of the total iron and steel imports in 1962 consisted of structural steel bars, rods, and sheet goods. Aluminum was the principal nonferrous base metal import. Fertilizers accounted for over 80 percent of the total value of nonmetals imports; cement was by far the leading construction material imported.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals: Ilmenite	----------	2,794	All to Japan.
Nonmetals:			
Gems, precious and semi-precious	carats 321,871	227,803	Hong Kong 118,170; West Germany 45,686; Singapore 19,912.
Graphite	9,086	8,768	United Kingdom 2,475; United States 2,372; Japan 1,866.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum	2,555	2,927	United Kingdom 2,136; Hong Kong 360.
Antifriction and similar alloys	67	47	United Kingdom 45.
Copper (including brass and other alloys).	609	425	United Kingdom 270.
Gold, troy ounces	11,971	11,945	United Kingdom 11,920.
Iron and steel:			
Pig iron	706	595	United Kingdom 390.
Steel ingots	3,870	4,456	Belgium 1,971; United Kingdom 1,209.
Rolled steel (including pipes)	63,350	72,025	United Kingdom 19,208; Belgium 17,664; Japan 15,561.
Lead	161	250	United Kingdom 248.
Nickel	2	-------	
Silver, troy ounces	-------	19,751	United Kingdom 19,667.
Tin, including alloys, long tons	48	45	United Kingdom 33.
Zinc	111	162	United Kingdom 146.
Nonmetals:			
Abrasives	150	77	United Kingdom 75.
Asbestos	323	-------	
Cement, thousand tons	217	213	Japan 71; India 35; United Kingdom 22.
Clays	763	907	United Kingdom 730.
Fertilizers:			
Potassium chloride	48,245	38,626	France 31,090; West Germany 6,181.
Phosphate rock	58,630	53,114	United Arab Republic (Egypt) 53,013.
Superphosphates	860	1,476	Netherlands 1,323.
Other	7,997	10,017	West Germany 5,520; Netherlands 1,987.
Salt, thousand tons	(1)	56	India 36; Pakistan 10; United Arab Republic (Egypt) 10.
Sulfur	3,522	973	Belgium 680.
Talc	1,555	2,226	India 1,953.
Other nonmetals	148	154	United Kingdom 152.
Mineral fuels:			
Coal, thousand tons	137	139	All from Republic of South Africa.
Coke	2,246	530	United Kingdom 407.
Petroleum products:			
Gasoline, 1,000 42-gallon barrels	1,401	1,292	Iran 892; Bahrain 177; U.S.S.R. 145.
Kerosine, do	1,304	1,348	Iran 675; U.S.S.R. 247; Bahrain 144.
Distillate fuel oil, do	1,478	1,660	Iran 921; U.S.S.R. 463; Bahrain 166.
Residual fuel oil, do	179	482	Iran 261; U.S.S.R. 169; Bahrain 45.
Lubricants, do	101	95	United Kingdom 48; United States 40.
Other (largely asphalt), do	14	28	Iran 19.
Total, do	4,477	4,905	

[1] Negligible.

COMMODITY REVIEW

METALS

Ilmenite.—Production by the government-owned Ceylon Mineral Sand Corp., from the Pulmoddai deposit on the northeast coast of Ceylon, increased sharply in 1963. Output of the plant, even at the production peak recorded in 1963, was only about one-third of installed capacity. Rated capacity remained unchanged at 60,000 tons of ilmenite per year from a feed of 100,000 tons of sand, with recovery of associated rutile and zircon. Lack of markets reportedly has been the reason behind curtailed production.

Iron Ore and Iron and Steel.—Construction of a rolling mill at Oruwella, which was started in late 1961, continued during 1963. The target completion date remained 1965. The mill has a planned annual capacity of 10,000 tons of wire rods and 25,000 tons of merchant sections, and was being built for the government-owned Ceylon Steel Corp., with technical and financial assistance of the U.S.S.R., at a cost of 80 million Ceylonese rupees (US$17 million). It is the first phase

of a small integrated steel industry designed to reduce import requirements, which averaged 67,716 tons per year during 1958–62. Further phases, still in the planning stage at yearend, included the installation of a steel furnace to process imported pig iron and imported or domestic scrap, and subsequent erection of either a blast or an electric furnace to smelt indigenous iron ore.

The country's known iron ore resources in 1963 were estimated to total 8 to 14 million tons of material containing over 50 percent iron. Of this, 4 million tons consists of hydrated iron oxides, chiefly limonite, in a number of scattered deposits in the southwest part of the island. These are regarded as economically marginal. The balance is in an incompletely explored magnetite deposit at Kottikanda-Panirendawa, which reportedly contains 4 to 10 million tons with an iron content of 65 to 70 percent.

Monazite.—Monazite output during 1959–61 was from a small deposit on the southwest coast at Beruwela, and apparently was stopped in 1961 owing to the absence of a market. This deposit was worked by the Ceylonese Department of Mineralogy, operating a small plant with several Exolon magnetic separators. Output consisted of 99 percent monazite concentrate with reported rare-earth oxide content of 66 percent, including thoria. Of 457 metric tons of this material stockpiled at the start of 1963, 305 tons was exported during the year, leaving 152 tons in stock.

Nonferrous Base Metals.—As in previous years, Ceylon's entire nonferrous metal requirement in 1962 was met by imports. Apparent domestic consumption of the various metals, as indicated by average imports during 1958–62, are presented in table 4.

TABLE 4.—Average nonferrous base metal imports during 1958–62

Commodity	Principal forms	Unit	Quantity
Aluminum	Sheet	Metric tons	2,287
Copper and alloys	Copper wire, copper and brass semifinished products.	do	572
Lead	Ingot	do	166
Tin	Ingot and solder	Long tons	[1] 54
Zinc	Ingot	Metric tons	137

[1] Excludes several thousand tons annually of material officially reported, apparently in error, as "sheets and plates of tin."

NONMETALS

Cement.—The government-owned Ceylon Cement Corp. plant at Kankesanturai was the country's only operating cement works. In 1963 the plant produced at about 75 percent of its rated capacity of 100,000 metric tons annually, supplying 25 to 30 percent of Ceylon's apparent requirements. Expansion of this plant to a 250,000-ton-per-year production level, underway in 1963, was scheduled for completion during 1964. Development of ancillary facilities for a 200,000- ton-per-year clinker-grinding plant at Galle continued during 1963. Completion of the plant was scheduled for 1965. A second cement plant was projected for erection at Puttalam.

Graphite.—Ceylon's major graphite mines continued to produce at a level in keeping with demand for Ceylon's special grades—amorphous and crystalline lump and chip graphite. However, output remained far below the levels which were attained before and during World War II, and which apparently could be attained again should demand rise. Total reserves, though not reported, are known to be adequate to support production at considerably higher levels of production for a number of years. About 1,000 small mines have produced when market prices were high; virtually all of these remained closed. The Bogala property apparently produced about half of the output.

Kaolin and Ceramic Materials.—Expansion of the government-owned Negombo ceramics plant from a 500-ton to an 840-ton annual capacity continued in 1963. A contract for the erection of Ceylon's second ceramics plant was awarded to a British firm. Completion of this plant, at Boralesgomuwa, was slated for January 1965. Raw materials are to be provided by another major plant in the overall ceramics industry expansion scheme, a 5,500-ton-per-year kaolin refinery at Boralesgomuwa. This facility, already completed, cost about Cey Rs3.8 million (US$800,000). The government expects that completion of the whole ceramics industry development program will make the nation self-sufficient in crockery.

Salt.—Ceylon's salt output declined to the lowest level recorded since 1958. Diminished production apparently was attributable to poor climatic conditions during salt harvest seasons and continued administrative and technological difficulties of the National Salt Corp., the government-owned corporation established to develop salterns on the island's southeast coast. During 1962, this organization failed to complete development of its saltern complex at Hambantota (underway since 1957) and consequently was unable to meet its 1962 production goal of 300,000 tons of salt, including 200,000 to 250,000 tons for export. A special high-level governmental commission was established to investigate the activities of the salt commission. The report of this commission, cited numerous instances of technological and financial mismanagement within the corporation.[2] This report led to a reappraisal of the goals of the Hambantota scheme, which were revised downward drastically. Under the more realistic scheme adopted, Hambantota was to provide only part of the domestic requirements, supplementing the production from other salterns, notably

[2] Government of Ceylon. Report of the Commission on the Salt Corporation. Sessional Paper 9—1963. Government Publications Bureau, Colombo, July 1963.

the traditionally first ranked Elephant Pass facility in the northern part of the island. However, because of the amount of work still necessary to ready the Hambantota area salterns for production as of the end of 1962, the new management was unable to bolster 1963 output levels.

MINERAL FUELS

Petroleum.—In late 1963, the three private firms—Caltex Ceylon, Ltd., Esso Standard Eastern, Inc. (Ceylon), and Shell Co. of Ceylon, Ltd.—that had shared Ceylon's markets with the government corporation through 1962–63 were notified of the government's intention to acquire all their remaining distribution facilities in early 1964. Negotiations with these firms over compensation for facilities acquired by the government in 1962 continued throughout 1963. Government proposals advanced during these negotiations did not comply with the Hickenlooper amendment to the U.S. foreign aid bill; therefore the entire Agency for International Development (AID) technical assistance program for Ceylon was suspended on February 8.

Petroleum products imports from the U.S.S.R., nil in 1960–61, increased to 21 percent of the total in 1962 and were significant in view of the changes in domestic distribution.

The Mineral Industry of Mainland China

By K. P. Wang [1]

MAINLAND CHINA is an important mineral producer by world standards, although not in terms of per capita output. Its estimated 1963 mineral output value (mine output plus added value derived from smelting and processing) of approximately US$3,500 million, although only a little more than half that of Japan, exceeded that of the rest of the Far East countries put together and ranked mainland China just within the first 10 top mineral producing nations in the world. The mining component of the Chinese mineral industry remained much stronger than the metallurgical component; coal alone provided about 40 percent of the total mineral production value in 1963.

Mainland China produces not only most basic minerals needed for its own industrial development but also produces many other minerals primarily for export. Many minerals were extracted in world significant quantities during 1963. In 1963 the country was one of the three foremost world producers of bituminous and anthracite coal; tin, tungsten, and antimony; and salt and magnetite. It also ranked about fifth or better in bismuth, manganese, mercury, molybdenite, asbestos, fluorspar, and graphite; about seventh in iron and steel; and about tenth in the major nonferrous metals, cement, barite, as well as pyrite and sulfur. Notable production deficiencies continued in several commodities including petroleum, chromite, nickel, copper, and phosphate rock; known reserves of most of these were limited.

Mineral products particularly the basic items such as coal, iron and steel, cement, and petroleum continued to be of great importance to the Chinese economy. A firm figure for the 1963 gross national product is not available, but the mineral share may amount to 4 to 6 percent. The mineral industry was responsible, directly or indirectly, for a significant part of the country's expanding industrial production.

The most significant mineral developments in 1963 concerned petroleum. It was claimed near the end of the year that the country had become "mainly self-sufficient" in oil.[2] Apparently this claim was based on the importance assigned to the Ta-ch'ing or Sungliao oilfield in Manchuria. There was news that the fair-sized Maoming oil shale plant in Kwangtung was "basically completed."[3] Negotiations were

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[2] China Reconstructs (Peiping), March 1964, p. 12.
[3] Hsin Wan-pao (Hong Kong), Apr. 14, 1964.

TABLE 1.—World significance of selected Chinese minerals in 1963 [1]

Commodity	Approximate rank in world output	Share of estimated world output (percent)	Adequacy in production	Reserves or resources
Metals:				
Aluminum	14	2	Virtually adequate	Considerable.
Antimony	1	27	Large surplus	World's largest.
Bismuth	4	10	do	First rank.
Chromite	Insignificant	Very small	Greatly deficient	Unimportant.
Copper	10	2	Deficient	Moderate.
Gold	Not among the first 20.	Small	Can use more	Do.
Iron ore	4	7	Adequate	First rank.
Iron, pig	5	6	do	Not applicable.
Iron, steel ingot	7	3	do	Do.
Lead	8	4	Slight surplus	Moderate.
Manganese ore	5	7	Surplus	Considerable.
Mercury	4	11	Large surplus	First rank.
Molybdenum	4	4	Sizable surplus	Do.
Nickel	Insignificant	Very small	Greatly deficient	Unimportant.
Tin	2	15	Large surplus	First rank.
Tungsten concentrate	1	38	do	World's largest.
Zinc	11	3	Slight surplus	Moderate.
Nonmetals:				
Asbestos	5	3	Moderate surplus	Considerable.
Barite	10	3	Slight surplus	Do.
Cement	9	2	do	Extensive raw materials.
Fluorspar	4	9	Sizable surplus	Considerable.
Graphite	5	6	Adequate	Moderate.
Gypsum	15	1	do	Considerable.
Magnesite	3	11	Surplus	First rank.
Phosphate rock	8	1	Seriously deficient	Considerable.
Pyrite	5	6	Can use more	Do.
Salt	2	11	Slight surplus	First rank.
Sulfur	9	2	Surplus	Moderate.
Talc	5	5	do	Do.
Mineral fuels:				
Anthracite	2	11	Adequate	First rank.
Bituminous coal	3	14	do	Do.
Coke	6	5	do	Do.
Petroleum, crude	18	.5+	Deficient	Moderate.
Petroleum, refined	Not among the first 20.	.5+	do	Not applicable.

[1] Chinese production estimated by author generally as an order of magnitude rather than as a definitive quantity. Consequently, the determinations of world rank and of share of world output can be regarded only as approximations. Moreover, these determinations may also be inexact because of incomplete or erroneous reporting of the output of other countries.

underway to have the French, Italians, and Japanese help build oil refineries.

In mid-1963,[4] it was reported that about 160 mineral projects were being developed of which more than 60 were in the ferrous and nonferrous fields, including iron, manganese, magnesite, copper, bauxite, tin, and lead-zinc.

In iron and steel, the effort in 1963 was to develop and expand iron mines, improve smelting practices including more widespread use of magnesium-alumina refractories, make best use of available capacities, continue to construct unfinished facilities, diversify and improve the quality of steel products, and build up fabrication facilities. The coal industry was definitely making headway towards increased production during 1963. For the established coal mining enterprises, the program was to extend shafts to greater depths; for coal-short supply areas, the program was to sink new shafts to tap available reserves.

In the fertilizer raw materials field, many pyrite mines and mills and two large phosphate rock mines—one in Hupeh and the other in

[4] Jen-min Jih-pao (People's Daily; Peiping), July 6, 1963, p. 2.

Kweichow—were being built. In the cement field, the emphasis was on developing new limestone quarries for existing plants. Work began on doubling the capacity of mainland China's largest asbestos mine in Szechuan during 1963.

GOVERNMENT POLICIES AND PROGRAMS

The first year following the close of mainland China's second 5-year plan was 1963; no announcement of a third 5-year plan was made and thus industrial targets were not revealed.

Stress was placed in 1963 on development of mineral and industrial enterprises. Especially, the policy was to improve product quality, diversify products, reduce cost and increase productivity, and conserve materials and recover more from waste. Accordingly, many mines and plants were consolidated, with the better ones slated for expansion. Small and local operations were not ignored, but their economic indices had to be within a specified range. Investment and basic construction in 1962 had been limited and additional construction in 1963, was primarily devoted to completing half-finished projects. More coal washeries and mineral dressing plants were erected and special attention was given to the development of metal fabrication facilities.

The needs of agriculture were also especially considered in 1963; production of chemical fertilizer raw materials, such as pyrites and phosphates, was expanded. Larger fertilizer imports were reported and arrangements were made to have foreign concerns build fertilizer plants in the country. Even the steel industry, which produced increasing varieties of products in 1963, was geared partly to make steel parts for agricultural equipment.

Mainland China continued to pursue the policy of strengthening the mineral and metal base in support of general economic development. During 1963, emphasis was placed on development of new reserves, a function that had lagged behind exploitation for several years. The policy regarding the disposal of surplus minerals in 1963, when the Soviet Union was no longer the primary purchaser, was to sell to any market.

Impetus was given to training personnel in facilities staffed by Chinese; this was necessary partly because of withdrawal of Soviet technical help. Training of technicians in local schools and mineral enterprises continued to progress. For example, during 1963 the number of technicians, many in on-the-job training, reportedly employed in the Anshan steel enterprise was three-fifths more than were employed 3 years previously. Also, the first cement, oil, and fertilizer plants designed and built by Chinese were placed in operation during 1963. However, the need for advanced technology was recognized and accordingly, the Chinese negotiated contracts to have foreigners build industrial and mineral plants, such as those for oil, fertilizer, and aluminum.

PRODUCTION

Mineral output value of mainland China during 1963 was about 10 percent more than in 1962, reaching an estimated level of roughly

US$3.5 billion. This was approximately the same level as in 1959 and was much below the 1960 peak. The mineral industry, with a reasonably good metallurgical sector, operated substantially in a conventional manner during 1963 after having done away with many small inefficient enterprises previously established in haste.

TABLE 2.—Production of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite [2]	300,000	350,000	400,000	400,000	400,000
Alumina	150,000	175,000	200,000	200,000	200,000
Metal, refined	[3] 70,400	80,000	100,000	100,000	100,000
Antimony, mine	15,000	15,000	15,000	15,000	15,000
Bismuth, mine	300	300	300	300	300
Copper:					
Mine	50,000	70,000	80,000	90,000	90,000
Metal, refined	80,000	100,000	100,000	100,000	100,000
Gold, troy ounces	40,000	50,000	60,000	60,000	60,000
Iron and steel:					
Iron ore [4], thousand tons	45,000	55,000	35,000	30,000	35,000
Pig iron, do	[3] 20,500	[3] 27,500	15,000	15,000	17,000
Steel ingot, do	[3] 13,350	[3] 18,450	9,500	10,000	12,000
Rolled steel, do	8,000	10,000	8,000	9,000	10,000
Lead:					
Mine	70,000	80,000	90,000	90,000	100,000
Metal, refined	60,000	70,000	85,000	85,000	90,000
Magnesium	1,000	1,000	1,000	1,000	1,000
Manganese ore, thousand tons	1,000	1,200	800	800	1,000
Mercury, 76-pound flasks	23,000	23,000	26,000	26,000	26,000
Molybdenum, mine	1,500	1,500	1,500	1,500	1,500
Silver, troy ounces	800,000	800,000	800,000	800,000	800,000
Tin, refined [5]	26,000	28,000	30,000	28,000	28,000
Tungsten concentrate [6]	18,000	20,000	20,000	20,000	20,000
Zinc:					
Mine	65,000	80,000	100,000	100,000	100,000
Metal, refined	60,000	70,000	90,000	90,000	90,000
Nonmetals:					
Asbestos	80,000	80,000	90,000	90,000	100,000
Barite	50,000	60,000	80,000	80,000	90,000
Cement, thousand tons	[3] 12,270	[3] 13,500	8,000	8,000	10,000
Fluorspar	200,000	250,000	200,000	200,000	200,000
Graphite	40,000	40,000	40,000	40,000	40,000
Gypsum	500,000	600,000	400,000	400,000	500,000
Magnesite, thousand tons	800	1,000	700	800	900
Phosphate rock	500,000	600,000	500,000	600,000	700,000
Pyrite, thousand tons	850	1,000	1,000	1,100	1,200
Salt, do	[3] 11,040	[3] 12,900	11,000	10,000	10,500
Sulfur	200,000	250,000	250,000	250,000	250,000
Talc	150,000	150,000	150,000	150,000	150,000
Mineral fuels:					
Coal, thousand tons	[3] 347,800	[3] 420,000	250,000	250,000	270,000
Coke, do	20,000	25,000	15,000	15,000	15,000
Petroleum:					
Crude, do	[3] 3,700	[3] 5,500	6,200	6,800	7,500
Refined, do	4,000	5,500	5,500	6,500	7,000

[1] Estimated except for a few claimed figures (see footnote 3).
[2] Mostly diasporic bauxite. Data shown include only the bauxite for aluminum manufacture. Actually, 100,000 to 200,000 tons were produced each year for making refractories.
[3] Claimed figures. Coal, pig iron, and steel data appear to be grossly exaggerated by perhaps one-fifth or more.
[4] Converted to equivalent 50 percent Fe ore.
[5] Recoverable metal content of mine production is also estimated at the same level.
[6] About 68 percent WO_3 grade.

Coal accounted for about two-fifths of the 1963 mineral output value; iron and steel (including ferroalloy), just under 35 percent; petroleum, nonferrous metals, and cement, each about 7 to 8 percent; and nonmetallics, chiefly salt, 4 percent. Thus, coal overshadowed petroleum and iron and steel was far more important than nonferrous metals, although quite a few lesser nonferrous metals were outstanding by world standards.

The Chinese Communists have not reported any mineral output statistics since 1960 when many figures apparently were grossly exaggerated on account of the confusion of the "Great Leap." Most of the lesser items have never been reported.

Mineral production during 1961 and 1962 apparently was considerably lower than in 1960, particularly for basic products such as coal, iron and steel, and cement. The 1963 estimated output levels for most minerals, although higher than in the previous 2 years, were still much below the reported 1960 peaks. There are important exceptions to these generalizations. Petroleum production apparently has been steadily increasing, with the 1963 output of crude at about twice the 1959 rate. Output of nonferrous metals has been generally stable. Production of fertilizer raw materials increased during this period, and salt output fluctuated with the weather. Production of the asbestos industry increased and was about to be enlarged substantially.

TRADE

The trade volume of mainland China, which was never much of a trading country, declined sharply in recent years as a result of the internal economic dislocation and strained relations with the Soviet Union, mainland China's principal trading partner. Mineral and metal products, however, occupied an important place in overall international commerce, normally accounting for perhaps 15 to 20 percent of both exports and imports. In fact, Chinese mineral exports attained a maximum annual level of approximately US$200 million a few years ago. Generally, production of mainland China's traditionally exported minerals showed no radical decline in 1963; however, export sales were difficult because of unwillingness of the Soviet Union to buy and because the Chinese lack time to establish new channels. Mineral imports were reduced sharply, which was partly caused by somewhat higher domestic output.

Absence of official Chinese statistics makes it difficult to concisely evaluate mineral trade. However, Soviet trade with mainland China covering 1960–62 shows important trends. In this period, Soviet overall exports to mainland China declined from 735 million to 210 million rubles,[5] and mineral exports dropped from about 165 million to 102 million rubles; Soviet overall imports from mainland China declined from 763 million to 465 million rubles and mineral imports dropped from about 130 million to 77 million rubles. Petroleum was by far the most important mineral commodity exported from the U.S.S.R. to mainland China, and shipments probably were much lower in 1963 than in 1962. The bulk of Chinese mineral exports to the U.S.S.R. comprised tin, tungsten, antimony, molybdenum, mercury, bismuth, cement, and miscellaneous nonmetallics.

Chinese trade with Japan, although of historical and potential significance, was small in 1963. Breakdown statistics on mineral imports by Japan from mainland China during 1961–62 are of interest from the viewpoint of items rather than tonnage. Virtually all mineral products shipped from mainland China to Japan consisted of crude materials, whereas shipments from Japan were primarily manu-

[5] 0.9 ruble equals US$1.

factured products like iron and steel as well as chemical fertilizers. Chinese iron ore and bituminous coal were exported only in nominal amounts in 1963.

TABLE 3.—Soviet Union's imports of mineral products from mainland China

(Metric tons unless otherwise specified)

Commodity	1960	1961	1962
Metals:			
Ferromolybdenum	400	500	
Iron, pig	166,200	107,000	93,700
Lead concentrates	10,200	4,200	100
Lead	10,900	8,100	400
Tin	17,700	11,200	8,700
Tungsten concentrates	18,900	18,300	13,000
Zinc concentrates	7,500	2,200	
Other metal ores [1] thousand rubles	20,607	10,591	9,310
Other nonferrous metals [2] do	10,174	8,735	7,506
Nonmetals:			
Bituminous coal	200,000	186,000	201,000
Borax	18,100	14,400	6,400
Cement	552,000	595,000	689,000
Fluorspar	35,000	38,900	42,700
Mica	747	317	
Quartz (for fusion)	317	501	
Sulfur	50,300	44,500	20,100
Talc	80,000	40,500	57,700

[1] Presumably includes undisclosed items like molybdenum concentrate, bismuth concentrate, and antimony concentrate and sulfide, etc.
[2] Presumably includes undisclosed items like antimony regulus, mercury, bismuth, and nonferrous alloys, etc.

Source: Official trade returns of the Soviet Union.

TABLE 4.—Soviet Union's exports of mineral products to mainland China

(Metric tons unless otherwise specified)

Commodity	1960	1961	1962
Metals:			
Aluminum:			
Ingot	1,200	1,500	1,400
Semimanufactures	1,000	400	288
Chromite	41,000		
Cobalt	28	10	
Copper, semimanufactures	672	164	245
Ferroalloys	10,100	6,600	2,000
Iron and steel semimanufactures	197,500	106,900	95,200
Nickel	113	76	57
Other nonferrous metals	2,700	1,600	1,700
Mineral fuels:			
Crude petroleum thousand tons	636	568	
Petroleum refinery products:			
Gasoline do	1,055.2	1,325.2	764.7
Kerosine do	386.2	512.1	488.3
Diesel fuel do	708	841.0	378.4
Lubricants do	219.0	221.8	213.4
Paraffin do	2.9	2.4	2.5

Source: Official trade returns of the Soviet Union.

Chinese mineral exports to Eastern Europe and Western Europe in 1963 increased somewhat over those of 1962, a trend that may continue unless trade relations between the U.S.S.R. and mainland China are readjusted. Mainland China occupies a dominant world position in tungsten and antimony; sales of these metals from China in Western European markets during 1963 temporarily depressed prices there. Significant quantities of phosphate rock from North Africa and copper from Chile were imported by mainland China in 1963.

TABLE 5.—Japanese imports of mineral products from mainland China

(Metric tons)

Commodity	1961	1962
Metals:		
Antimony ore and concentrate	970	712
Antimony sulfide	85	130
Copper ore and concentrate	----------	117
Copper matte and native copper	----------	360
Pig iron [1]	72,173	19,678
Manganese ore	----------	10,154
Silver	1.0	9.9
Tin	819	833
Tungsten concentrate	186	56
Zinc ore	4,497	----------
Nonmetals:		
Alumina shale	3,042	1,960
Barite	----------	1,792
Feldspar	----------	397
Flint	2,083	865
Fluorspar	21,451	26,518
Graphite, crystalline	----------	58
Magnesia clinker	14,822	5,041
Marble	----------	109
Quartz and quartzite	----------	305
Salt	66,732	309,788
Steatite (soapstone)	11,081	5,000
Talc		2,126
Mineral fuels:		
Anthracite	12,636	16,505
Coking bituminous coal	----------	157,875

[1] In 1963, 80,271 tons.

Source: Official trade returns of Japan.

COMMODITY REVIEW

METALS

Iron and Steel.—An upturn for the Chinese steel industry was clearly evident in 1963. Apparently, steel ingot output rose by about 2 million tons compared with that of 1962. This industry had been hit even harder than the coal industry by the debacle of the "Great Leap" and the departure of Soviet technicians. Steel production during 1961 was not much more than half of the exaggerated claim of 18.45 million tons for 1960. Most small operations were abandoned and only a few were earmarked for future expansion. Basic construction came to a standstill, with many plants only one-half finished. Even as late as 1963, much crated machinery for steel plants was awaiting installation; for example a strip mill at the Wuhan Steel Works remained only two-thirds completed. However, the available annual steel capacity of mainland China already was in excess of 15 million tons.

Iron ore extraction and beneficiation received much attention during 1963. Within the Anshan complex, two open pits including Ta-ku-shan were expanded and a new vertical shaft was built for mining high-grade ore. Overburden removal on a new opencut operation progressed at a rapid rate at the Penhsi (Pen-ch'i) Works in Liaoning. A large beneficiation plant of more than 5 million tons of mine-run ore per annum was being built for the Maanshan Works in Anhwei. The Hsiang-pi-shan open pit near Tayeh was enlarged to meet the needs of the Wuhan complex.

Emphasis was placed on quality improvement and on raising operational efficiency in general. The Chinese claim that productivity in iron ore extraction was raised one-fourth during the first 8 months of 1963, as compared with 1962 figures. A more meaningful claim was the 8.6-percent drop from 1962 level of coke consumed per ton of pig iron by the key enterprises. The average coke ratio for these enterprises was reported at 610 kilograms for August 1963.

The iron and steel industry of mainland China was concentrated in eight major centers which in 1963 apparently produced about 60 percent of the pig iron and over 80 percent of the crude steel. The foremost of these centers was Anshan. Many other individual plants at various points around the country were primarily important for pig iron production.

TABLE 6.—Mainland China: Estimated pig iron and crude steel output, by major centers [1]

(Thousand metric tons)

Center	1962		1963	
	Pig iron	Steel ingot	Pig iron	Steel ingot
Anshan	4,500	4,500	5,000	5,000
Wuhan	1,200	1,000	1,500	1,400
Paotou	700	400	800	800
Shihchingshan	900	[2] 200	950	[2] 200
Tientsin, Tangshan, and Peking	100	900	100	1,000
Shanghai	200	1,000	500	1,500
Taiyuan	500	500	500	500
Chungking	300	300	400	400
Total	8,400	8,800	9,750	10,800
Other [3]	6,600	1,200	7,250	1,200
Grand total	15,000	10,000	17,000	12,000

[1] Rolled steel output of mainland China was about 9 million metric tons in 1962 and 10 million tons in 1963.
[2] New steel converters were to have been constructed in mid-1960, but no confirmation of their existence is available. Apparently, surplus Shihchingsham pig iron is sent mainly to Tientsin for conversion to steel and to Tangshan for rolling.
[3] Includes many smaller plants like Penhsi, Tayeh, Lungyen, Hantan, Maanshan, Shihlu (Hainan), Hofei, Sanchiang and Weiyuan in Szechuan, Kunming, Chengtu, and Dairen, etc. Large quantities of pig iron are produced by plants other than those listed as centers, but a large portion of the pig iron was never converted into steel.

At Anshan, approximately 4.5 million tons of steel products, including many types of new rolled products, were produced during 1963. Anshan with nearly 50 mines, mills, and plants and about 200,000 workers is one of the 10 largest steel complexes in the world and has been the training ground for mainland China's steel technicians. The number of technical personnel employed in 1963 was said to be 60 percent more than in 1960. The Chinese claim that by December 15 Anshan had overfulfilled its 1963 targets by 102,000 tons of steel products and 83,000 tons of steel ingots. The 1,513-cubic-meter No. 10 blast furnace underwent major repairs; nevertheless it reportedly achieved its output goal for 1963. Anshan's 10 blast furnaces and 25 open-hearth furnaces were capable of producing more than 16,000 tons of pig iron and 18,000 tons of steel ingot daily. With new magnesium-alumina refractories, the No. 17 open-hearth furnace established a record of 700 heats of continuous operation in 332 days.

At the end of 1963, the 3-million-ton new steel center at Wuhan was about two-thirds completed and was operating at half its ultimate capacity. Installed facilities included a sintering plant, two blast furnaces (1,386 and 1,436 cubic meters), five open-hearth furnaces (one 250-ton and four 500-ton capacity), byproduct coke ovens, a 1.5 to 2-million-ton blooming mill, and a rolling mill. The Chinese Communists claim that Wuhan's 1963 outputs of steel and rolled steel were nearly 50 percent greater than in 1962.

The Paotou steel center, also planned for a 3-million-ton production, was only one-third to one-half completed as of 1963. A 1,513-cubic-meter blast furnace (first of three) and a 600-ton open-hearth furnace had been readied for operations back in 1960, and construction had begun on a second blast furnace, on two more large open-hearth furnaces, and on many other facilities necessary for integrated iron and steel production. The Chinese Communists reported that Paotou's pig iron and steel outputs in 1963 were respectively 11 and 100 percent greater than in 1962. It appears therefore that one blast furnace and one open-hearth furnace were being operated in 1962 and that an additional second open-hearth furnace was also in use in 1963.

Shihchingshan, with three blast furnaces (the largest is a 1,000-cubic-meter blast furnace which has a capacity greater than the other two combined), had a total pig iron capacity of about 1 million tons. Other facilities operating in 1963 include sintering plant, byproduct ovens, converters, and rolling mills for bars, plates, and pipes. Steel and rolled steel capacities were much smaller than pig iron production and surplus pig iron went mainly to the Tientsin plant for conversion into steel and thence to the Tangshan plant for rolling. These three plants put together should be looked upon as being integrated and capable of producing 1 million tons plus of steel products per annum.

Shanghai has at least 10 medium or small iron and steel plants of various kinds, which together can produce about half a million tons of pig iron and 2 to 3 millions tons of steel annually. The steel furnaces are mostly Bessemer converters. The Shanghai No. 1 Steelworks alone, with the bulk of the metropolitan area's pig iron capacity (two blast furnaces), reportedly produced half a million tons of steel products in 1963. At yearend, a small tin-plating mill was readied for operations at the Shanghai No. 10 Steelworks.

Taiyuan has several blast furnaces, including one of 1,000 tons per day, plus byproduct coke ovens and corresponding steel and rolling facilities. Output is conservatively estimated at about half a million tons of steel products in 1963.

The Chinese press frequently mentioned Chungking as an important steel plant in 1963. As a minimum, this plant had a 620-cubic-meter blast furnace, a 300,000-ton-per-annum byproduct coke unit, refractory facilities, four open-hearth furnaces, and rolling mills to produce plate, rail, pipe, and seamless tube. An equivalent-size pig iron and steel capacity was reportedly under construction in 1960. The Chinese claim that pig iron output in the first 9 months of 1963 was 105 percent of the 1962 total. It is conservatively estimated that pig iron and steel outputs for Chungking in 1963 were both abtout 400,000 tons.

Other Metals.—The Chinese Communists seldom discuss their "colored" metals industries; however, indirect information on trade and

developments in nonferrous metals and ores are occasionally available so that rough output levels for many items can be estimated. Generally, Chinese nonferrous metals had a reasonably good year in 1963. Established mines and plants were not seriously affected by the previous economic dislocations. Basic construction on new projects and expanded capacity picked up after several years in the doldrums. Some surplus minerals were bartered for deficient ones, and hard currency and precious metals were used sparingly to buy items in critical short supply. Regarding the famous "export" metals, reduced trade with the Soviet Union forced mainland China to seek markets elsewhere and thus caused disturbances in freeworld metal supplies and prices.

Mainland China produced about 7 percent of the world's manganese ore in 1963, but half was low-grade and high in iron. An offer of 20,000 tons of manganese ore to Japan for 250 tons of chromium metal was made. Shortages in metallurgical and refractory chromite were not alleviated, and the Soviet Union stopped shipments in 1961–62. The Chinese claim success, however, in using magnesia-alumina brick in lining steel furnaces as a substitute for refractory chromite. The nickel shortage was also severe, and imports came from Cuba which reportedly furnished 5,000 tons of contained nickel in oxides and sulfides during 1962. The Chinese steel industry although consuming most of the manganese ore, uses very little tungsten and molybdenum.

Of the nonferrous base metals and light metals, only copper was in short supply. During 1963, the Chinese bought 10,000 tons of Chilean copper for about US$8 million cash payment to supplement indigenous production about ten times this amount. Zinc production appeared sufficient for domestic needs, and there was a little surplus of lead. The heart of the Chinese aluminum industry was still the Fushun plant in Manchuria. Bauxite was produced not only for aluminum manufacture but also for refractory use in steel furnaces.

Mainland China's famous export metals; namely, tin, tungsten, antimony, mercury, bismuth, and molybdenum, had a somewhat difficult year in 1963 not because of production but because of marketing difficulties. Tin output was still slightly lower than the historic peak of 30,000 long tons, with Kuchiu holding its own and Kwangsi having some operational problems. The trend towards greater tin exports to the free world and Eastern Europe and reduced shipments to the Soviet Union continued. In 1963, the U.S.S.R. imported only 4,300 long tons of Chinese tin, or about half of the 1962 tonnage. Tungsten production held firm at about 20,000 metric tons of concentrates, with most surplus still going to the Soviet Union (12,000 tons in 1963). During 1963, the Chinese first flooded Western Europe with tungsten and then withdrew in the last quarter of the year when prices became very low. Chinese antimony also disappeared from Western markets. Exports of mercury increased; sizable quantities went to the Soviet Union and Eastern Europe in 1962–63 and to the United Kingdom in 1962. The annual surplus in molybdenum remained at perhaps 1,000 tons contained in concentrate and ferromolybdenum. Large molybdenum deposits were still being developed.

NONMETALS

Asbestos.—Production of asbestos was used in cement and textile products and also was exported. Output in 1963 rose by about 10 percent over that of 1962. Thus, mainland China maintained growth in this relatively new industry uneffected by the depressed economy in recent years and more than retained its position as a medium world producer of good quality, long and short fiber asbestos. The Shihmien area in Szechuan, with about a dozen mines supplying a large ore dressing plant, was the source of more than two-thirds of the country's asbestos; the area embarked upon an expansion program to double 1962 output.[6] Ten projects aimed at greater mechanization and higher output were started during 1963. These included a large hydroplant, electricity transmission stations, an access highway, storage and vehicle maintenance facilities, compressed air stations, and four additional mine adits. Four of these projects were completed by October, enabling output for the first 8 months to increase by 12 percent over that of the same period in 1962.

Cement.—Output of cement in 1963 was nearly 2 million tons higher than during 1962. The Chinese claim [7] that the 1963 cement target for large and medium plants was achieved on November 10 and that combined output for these plants during the first 10 months was 24 percent higher than in the same period of 1962. The relative production increase for small plants, which contributed roughly 15 percent of the country's cement, was lower than for the large and medium plants. Generally, the industry became more stabilized in 1963, with operational standards and product quality much improved as compared with the "Great Leap" years. Demand for cement rose considerably in 1963 and exports, mainly to the Soviet Far East from Manchuria, remained at the level of 0.5 to 0.9 million tons yearly. Whereas some areas, including Manchuria, had cement surpluses; others, such as northern China, had shortages. The overall cement raw material position remained good, although many plants had to develop more reserves.

About a third of the approximately 50 large and medium cement plants (with 90 to 100 kilns, mostly rotary but some vertical) were mentioned in the Chinese press. For example, Liuliho by achieving the year's output goal 39 days ahead of schedule was able to produce more than 60,000 tons over the target. Chungking, after raising 1962 output 25 percent above the 1961 level, made another 3.5 percent improvement in the first 10 months of 1963 despite the usual wet summer weather which hindered operations. Ch'ihsin fulfilled its 1963 goal about November 12. Kwangchow brought its fourth kiln (125 meters long and 3 meters in diameter), the first modern, rotary, Chinese-designed and Chinese-built cement kiln, into operation during May. Yungteng, which surpassed its 1962 target by 30 percent, further raised output in 1963. Tzupo's first stage 160,000-ton plant started production in August. The Liuchow plant, built with Czech help, was nearing completion late in the year. The Chungkuo plant in Nanking ran its No. 3 kiln nearly a year without stoppage. Kiangnan was said to be the

[6] Jen-min Jih-pao (People's Daily; Peiping), Oct. 20, 1963.
[7] Jen-min Jih-pao (People's Daily; Peiping), Nov. 29, 1963.

TABLE 7.—Mainland China: Estimated cement output and capacity, by plants, in 1963 [1]

(Thousand metric tons)

Plant	Province	Capacity	Output
Anshan	Liaoning	100	100
Chao Hsien	Anhwei	300	150
Ch'ihsin	Hopeh	400	350
Chinhsi	Liaoning	100	100
Ch'iyi	Kirin	440	200
Chungking	Szechuan	550	500
Chungkuo	Kiangsu	270	250
Dairen	Liaoning	200	200
Fushun	Liaoning	550	500
Harbin	Heilungkiang	110	100
Hofei	Anhwei	300	150
Huahsin	Hupeh	1,000	700
Kiangnan	Kiangsu	250	200
Kunming	Yunnan	330	300
Kwangchow	Kwangtung	700	400
Kweiyang	Kweichow	300	100
Liaoyang	Liaoning	100	100
Liuchow	Kwangsi	200	--
Liuliho	Peking	700	500
Mutanchiang	Kirin	400	300
Nanping	Fukien	100	100
Penhsi	Liaoning	300	300
Paot'ou	Suiyuan	200	200
Shihlingtzu	Kirin	300	100
Tatung	Shansi	500	450
Tzupo	Shantung	160	50
Urumchi (Tihua)	Sinkiang	300	300
Wusung	Kiangsu	100	100
Yao Hsien	Shensi	1,000	500
Yungteng	Kanau	600	400
Total		10,860	7,700
Other [1]		3,140	2,300
Grand total		14,000	10,000

[1] At least 20 other so-called large and medium plants have been mentioned in literature as being partly or wholly constructed, including two important ones; namely, Hantan in Hopeh and Hsiao-t'un in Liaoning. Estimated combined output of these and numerous very small operations is given under "Other."

only plant making oil well cement. By making technical improvements, hourly output of Mutanchiang was raised from 29.4 to 38 tons.

Many mines and quarries were being developed or expanded for the cement industry. For example, the K'ungshan limestone mine was being reconstructed and enlarged to meet the future needs of the Chungkuo and Kiangnam cement plants. The Huangchinshan limestone quarry was being developed for the Huahsin cement plant. A new limestone quarry was also being opened for the Ch'ihsin plant in Tangshan. Development of the Luchuang sandstone mine near Chingwangtao was reportedly nearing completion. The Fushun cement plant in Manchuria continued to use byproduct oil shale as a raw material. Most established cement plants strengthened their raw material base during 1963. Gypsum has never been a problem, indigneous mines provided the 300,000 to 400,000 tons consumed in cement manufacture in 1963.

Fertilizer and Chemical Materials.—Mainland China's problem with food shortages dictated the policy of developing new sources of fertilizer and chemical raw materials. Special emphasis was given to pyrite and phosphate.[8] It was claimed that, for making ammonium sulfate

[8] Jen-min Jih-pao (People's Daily; Peiping), July 6, 1963, p. 2.

alone, 14 new pyrite mines were being developed in mid-1963. A new benefication plant for producing pyrite concentrates containing 35 to 40 percent sulfur was placed in operation at the Hsiangshan mine in Anhwei Province late in the year. This plant is of strictly Chinese design and became the largest in the country; its initial annual capacity was rated at 400,000 tons of ore. The Yingte mine in Kwangtung Province, with an eventual yearly capacity of 300,000 tons of pyrite, was claimed to be nearly one-half completed. Seven small mines in Kwangtung Province were being expanded to a combined yearly pyrite output of 120,000-odd tons. Many other pyrite mines were in operation, and nonferrous mines provided several hundred thousand tons of pyrite in 1963. Numerous small mines in Szechuan and Shansi also produced pyrite for sulfur.

Demand for phosphate rock continued to rise, and the policy was to increase domestic production so as to replace imports, such as the approximately 270,000 tons from Morocco in 1963. Accordingly, several large mines were in various stages of development. The 600,000-ton-per-year (first stage capacity) Chinghsiang phosphate rock mine in Hupeh Province, of Chinese design and well mechanized, was virtually completed at yearend. A second large phosphate rock mine was under development at K'aiyang in Kweichow Province. A modern phosphate fertilizer plant in Nanking had been in full-scale operation for several years. Another phosphate plant, rated at 300,000-odd-tons-per-year capacity, in Ch'angsha, Hunan Province, is expected to start production in 1964. Greater output of pyrite and sulfuric acid to meet the needs of phosphates and other chemical fertilizers became more pressing toward the end of 1963.

A considerable increase in chemical fertilizer production was claimed for 1963, however, the apparent available supply of 4 to 5 million tons, two-fifths imported, was far short of demand. Seven major nitrogenous fertilizer projects in various parts of the country were reported to be in various stages of construction with some nearing completion by the end of 1963. The Wuching plant in Shanghai, the first to be designed by the Chinese and rated at 25,000 tons of urea or 100,000 tons of ammonium sulfate, went into production late in the year. At a plant near Canton (Kwangchow), ammonium sulfate production started early in April. A byproduct ammonium sulfate plant was also completed at the Chungking Iron and Steelworks.

The Chinese were active in purchasing foreign fertilizer plants. A US$8.4 million ammonia plant was ordered from Humphreys and Glasgow, Ltd., of the United Kingdom for Luchow in central China. Subsequently, a complementary $7 million urea fertilizer plant for Luchow was ordered from Continental Engineering of the Netherlands. Negotiations with a West German fertilizer firm in 1963 apparently did not result in a contract. However, the Italians may be asked to build two large ammonium sulfate plants.

Although pyrite is the main sulfur-bearing raw material used in making sulfuric acid and fertilizers in mainland China, elemental sulfur is of equal importance. During 1963, about half of the roughly 250,000 tons of sulfur produced came from pyrite and the other half came from 20-percent sulfur ores. The country had surplus sulfur

but the tonnage exported, mainly to the Soviet Union, has been declining in recent years.

Salt.—Mainland China retained its position as the world's second largest producer of salt in 1963, with output of about 10.5 million metric tons, 6 percent more than in 1962. Most of the salt was consumed for food purposes, but a plentiful supply is available for making chemicals. The bulk was produced from the coastal provinces by evaporation of sea water, the largest fields being Ch'anglu in Hopeh and Ying-kai in Liaoning. Efforts were made to improve the quality of crude salt and streamline the salt farms which basically are greatly dependent upon the weather. Salt farms in coastal Kwangtung reportedly had a very good year in 1963. The Tzuliuching salt wells near the oil and gasfields in inland Szechuan Province, which provided about one-tenth of the national salt output, reportedly improved the efficiency of drilling operations and evaporation during 1963.

Other Nonmetals.—Magnesite from Manchuria was still of great world significance, but output in 1963, although greater than in 1962, had not yet returned to the peak level of a few years ago. The Anshan enterprise opened a new magnesite facility in 1963, and consumption of this material in making refractories became much more widespread. A surplus of barite was apparent despite increased needs in oil drilling. Fluorspar production from Chekiang and north China remained steady to meet the combined needs of steel, aluminum, and exports. One-half of the Chinese steatite talc from Taling, Liaoning was used in the domestic market and the other half in foreign markets. In recent years, polished marble slabs have been exported.

MINERAL FUELS

Coal.—The Chinese coal industry received much emphasis during 1963. Of the 160-odd major mining projects reportedly undertaken during the year, a large number were coal projects. The Chinese Communists claim that 67 pairs of new coal shafts were under construction at the end of 1963, mostly in the low-level coal production areas of eastern, central-south, and northwest China. Thus, 30 to 40 million tons of annual coal capacity was being developed, assuming that each pair of shafts ranges from 200,000 to 1 million tons and that the average is 500,000 tons. In addition, 60-odd pairs of shafts reportedly were being extended at the established coal mining centers, another aspect of expanded future capacity.

Coal production improved in 1963 and output was about 20 million tons higher than in 1962. Thirty-three coal mining administrations with at least 66 key mining projects provided about two-thirds of the country's coal in 1963. The seven big coal mines (Fushun, Fushin, Kailan, Huainan, Chihsi, Hokang, and Tatung, roughly in descending order) each produced 10 to 20 million tons and together approximately 100 million tons. Half a dozen others were in the 5- to 9-million-ton range, still another half dozen were in the 2- to 5-million-ton range, and the remaining mines were in the 1- to 2-million-ton range each. The total from the 33 administrations was roughly 180 million tons. Adding about 90 million tons for the medium and small mines, many

having daily capacities of 500 to 2,000 tons, mainland China's overall 1963 coal output is estimated at 270 million tons. The bulk was bituminous coal, with anthracite only some 20 million tons. Possibly 20 million tons were produced by hydraulic mining during 1963.

Fluctuations in coal output during recent years were not as great as figures imply. The claimed 1959–60 data probably were exaggerated by about 20 percent on account of unrealistic claims and inclusion of very dirty coal so that the 1960 production, for example, may have been only some 350 million tons on a basis comparable with 1963. A precipitous drop occurred in 1961 as an aftermath of the "Great Leap" disaster, forcing closure of many inefficient small mines and dislocating normal operations of large mines. Coal demand was sharply curtailed and many operations were not able to produce at former levels because of depletion of blocked out reserves. In 1962, the small mines surviving the crisis were consolidated and enlarged, and operations of the established mines were normalized. The trend continued in 1963, while coal facilities in areas of lesser reserves were being constructed.

About 5 to 10 million tons of new coal capacity was created in 1963, and much development in facilitating production and delineating reserves was done. The Chinese Communists claim [9] an increased productivity of 18 tons per man-year over that of 1962 and reductions of 4.5 percent in cost and of 25.5 cubic meters of mine timber consumption per 10,000 tons of coal output, as compared with the previous year. Coal beneficiation and quality control were stressed, resulting in an average drop of 1.5 percent in ash content of ordinary coals and of 0.8 percent in ash content of coking coals. Definite contract arrangements were made between coal producers and major consuming industries to stabilize marketing.

Petroleum.—Mainland China's oil production, unlike that of other industrial products, was not seriously affected by the economic collapse. Exploration in some fields and refinery construction were slowed down for a few years, but overall output continued to rise steadily. In 1963, production of crude oil (including oil from shale) was approximately 7.5 million tons or twice the 1959 level; virtually all crude oil was domestically refined. Furthermore, imports (bulk from the U.S.S.R. and some from Rumania) declined from about 3 million tons in 1961 to 2 million tons in 1962 and to possibly 1.4 million tons in 1963, primarily because of the Sino-Soviet impasse and the Soviet decision to send lesser amounts to mainland China. The Chinese, in striving for self-sufficiency, developed additional capacity in some fields and discovered a few important new fields. Apparently, a 10-million-ton-per-year industry is in sight.

Chinese claims of accomplishments during 1963 include fulfillment of the year's production goals for crude oil and refined petroleum; near self-sufficiency in terms of both quality and type of basic oil products like gasoline, kerosine, diesel oil, and lubricants; an output increase of crude oil of roughly 11 percent over that of 1962; 18 to 35 percent rise in byproducts, including ammonium sulfate, carbon black, paraffin, and tar; completion of new refining capacity 4 to 5 times that built in 1962; a 70-percent increase in capital construction of oil fields

[9] Ta-kung Pao (Peiping), Dec. 31, 1963, p. 2.

during the first two-thirds of 1963, as compared with same period in 1962; and a capability in manufacturing most basic equipment needed in oil prospecting, drilling, pumping and refining.

The Fushun shale oil enterprise in Manchuria continued to furnish about 1.8 million tons of refined petroleum annually. During 1963 reconstruction of the low-pressure recovery system (which follows retorting) at Fushun resulted in greater processing capacity and higher recovery of light products; also an additional large refining facility was built.

The country's only important natural gasfields are located in Szechuan. The Chinese reported that the 1963 output rate was 16 times that of 1957 and that gas was being piped to industries such as brine salt, electric power, transport, smelting, and chemical. A long distance gasline was completed to a large steel enterprise, presumably Chungking.

Fifteen projects were simultaneously under construction at Sinkiang's Karamai oilfields during 1963, and 38 new oil wells reportedly were brought into production between January and August. The Yumen oilfields showed no great change from previous years. A new important oilfield has been developed in recent years, namely the Sunglioa [10] (Anta or Ta-ch'ing) field between Harbin and Tsitsihar with about 40,000 workers. A second oilfield in Manchuria reportedly has been discovered west of Chinchow (the site of the country's only operating synthetic oil-from-coal plant), but this lacks confirmation. An estimated breakdown of the 1963 crude oil output by fields is as follows, in millions of metric tons: Fushun (shale oil), 1.8; Yumen, 1.8; Karamai, 1.5; Sungliao, 1:5; Szechuan, 0.4; Tsaidam, 0.4; and other 0.1.

The Lanchow refinery, originally designed for 1 million tons, was expanded substantially in 1962–63 both in capacity and variety of products. Among other facilities at Lanchow, a pressure-reduction tower was being installed late in the year. Completion of a big refinery of Chinese design at an unspecified location was claimed for 1963. This may be the new refinery at Fushun, conceivably built to handle some of the crude oil from the Sungliao field. The Shanghai refinery placed a new heavy oil facility in operation. The refinery at Karamai was expanded in 1963, but there was no news of the Tushantzu refinery in the Sinkiang complex. The Yumen refinery in Kansu and the Nanchung refinery in Szechuan carried on uneventfully. There has been no recent information on a large refinery formerly reported under construction at Nanking and the facility may not have been completed. Several modern refineries were reportedly under construction in mid-1963. An estimate and breakdown of the 1963 refined petroleum output is as follows in millions of metric tons: Fushun (shale oil), 1.8; Lanchow, 1.3; Shanghai, 1.0; Karamai and Tushantzu, 1.0; Yumen, 0.4; Tsaidam, 0.4; Nanchung, 0.3; and unaccounted, 0.8.

The Chinese Communists were very active in international oil negotiations in 1963. Inquiries on purchasing foreign crude oil were halfhearted since there seemed to be no immediate need. Offers to sell crude to Japan, presumably based upon the claimed oil discovery

[10] U.S. Consulate, Hong Kong. State Department Airgram A–803, Mar. 27, 1964.

near Chinchow, appeared to be temporary in nature in view of the general shortage of oil on mainland China. Arrangements to buy French-controlled Iranian refined petroleum seemed plausible to fill the void left by reduced Soviet shipments, yet the Chinese were stated to have become essentially free from the dependence on foreign oils. The possibility of having the French install a large refinery was investigated, and Chinese technicians visited the Lacq chemical and gas complex in France. An agreement was made with the Italians to build a medium-sized refinery with catalytic reforming and aromatic extraction facilities. Negotiations were underway to purchase US$5.6 to US$8.4 million worth of refining equipment from Japan. The Chinese were clearly interested in special oil refining equipment and facilities from abroad plus international petroleum know-how to supplement their own capabilities.

The Mineral Industry of Hong Kong

By J. M. West[1]

HONG KONG and its new territories, with a combined area of less than 400 square miles and population estimated at 3.6 million in 1963, was a fair consumer of mineral products, although producing only about US$15 to US$20 million in mineral value annually. Operating as a free port, it had one of the world's busiest harbors. Agriculture and fishing were secondary to tourism and trade, which created a great deal of activity in construction and manufacturing. Hotels and reservoir projects to overcome water shortages required large expenditures on construction. Electric power consumption, about 1,530 million kilowatt-hours in 1962, has increased about 20 percent annually. Refugees from the Chinese mainland provided a labor surplus. A cement plant, a number of small metal-processing plants, ship-scrapping facilities, and an iron mine were the main components of the mineral industry. During the year, two steel-pipe plants were under construction, Fuji Marden was expanding its line of steel products, the Ma An Shan iron mine completed a new haulageway to raise capacity, and another oil-bunkering terminal for ships was opened.

GOVERNMENT POLICIES AND PROGRAMS

Although Hong Kong did not have many minerals and only a small mineral-processing industry, the Government was trying to encourage development by an open investment policy and active efforts to stimulate trade. As a free port, Hong Kong enjoyed an unrestricted flow of mineral commodities, part of which was entrepôt trade destined for transshipment. A small mines department was maintained, chiefly for controlling blasting and arranging royalty collections from mineowners. The department granted mining licenses and leases, investigated mine accidents, and published a review of activities.[2] Many of the colony's metalworking industries were Japanese subsidiaries or joint Japanese-Hong Kong enterprises. Nonresident Chinese were also important investors. Government programs to expand water supply facilities, public housing, and other construction required large quantities of cement, steel, and other building materials. Mineral trade was favored by Hong Kong's lack of politically imposed restrictions, preferential treatment as a British Commonwealth member, and eligibility (established in 1962) as a source of purchases financed by the U.S. Agency for International Development.

[1] Physical scientist, Division of International Activities.
[2] Commissioner of Mines (Hong Kong). Annual Department Reports. 1962–63, 21 pp.

PRODUCTION

The colony produced a variety of minerals, with cement and iron ore the main products and a less important production of clays, feldspar, graphite, quartz, and wolframite. In previous years there also had been some lead-silver mining. Salvage of metal scrap was a sizable business. Cement output in 1963 was valued at US$3.5 million and iron ore at US$875,500. The per-ton value of graphite ranged from US$24 for the best grade to US$5 for a poorer grade. Iron and steel from scrap contributed about two-thirds of the total mineral output value.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Iron ore concentrate----------thousand tons--	122	117	119	112	114
Wolframite, 65 percent tungsten trioxide (WO_3)-	40	32	17	15	7
Nonmetals:					
Cement----------thousand tons--	142	150	184	212	216
Feldspar----------	1,744	2,551	1,225	952	1,710
Graphite----------	3,340	3,860	1,690	818	809
Kaolin----------	7,370	6,770	8,560	6,470	5,100
Quartz----------	3,620	3,870	4,110	4,220	3,040
Mineral fuels: Coke and breeze [1]----thousand tons--	20	18	[2] 17	17	15

[1] Between ½ and ⅔ consumed by the producer in making town gas.
[2] Estimate.

TRADE

Mainland China, recognized by the Hong Kong Government supplied large quantities of coal, cement, and steel products to the colony. Fertilizers were imported from Western Europe and reexported in about the same quantities to mainland China, with 1963 imports nearly tripling the 1962 level. Sizable gold imports were almost all reexported to the gambling city of Macao. Manufacture of surgical-scientific equipment and jewelry accounted for fairly large purchases of foreign platinum, silver, and mercury. Diamond trade was impressive, with total imports valued at US$52 million in 1963. Most of the diamond came from Belgium and Israel. In 1963, about US$370,000 of uncut jade was imported from Burma and US$620,000 of cut and polished but unset jade was imported from mainland China and the Malaya portion of Malaysia. Pearls valued at US$2.8 million came into Hong Kong during the year, nearly all from Japan. Most important among Hong Kong's exports were iron ore, all going to Japan, and steel scrap from shipbreaking, which went mainly to Japan.

TABLE 2.—Exports and reexports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1962	1963	Principal destinations, 1963
Exports:			
Metals:			
Aluminum products	1,782	1,692	South Viet-Nam 436; Thailand 421; Ceylon 294; Malaysia 260.
Iron and steel:			
Iron ore thousand tons	117	122	All to Japan.
Semimanufactured products do	43	57	Thailand 35; South Viet-Nam 6, Cambodia 5.
Scrap do	110	138	Japan 117; Taiwan 21.
Nonmetals:			
Cement do	36	15	Malaya 8; Macao 1.
Feldspar-fluorspar	406	650	Philippines 330; Thailand 313.
Graphite	469	102	All to United States.
Kaolin	4,730	4,190	Japan 3,550; Taiwan 670.
Reexports:			
Metals: Gold thousand troy ounces	987	1,176	All to Macao.
Nonmetals:			
Cement thousand tons	7	16	Sabah 5; Sarawak 3; Macao 3.
Diamond, cut and polished. thousand carats	65	93	Belgium 34; Israel 28; Japan 12.
Fertilizers:			
Ammonium sulfate. thousand tons	28	102	All to mainland China.
Others do	10	26	Do.
Graphite	1,180	73	Thailand 68.
Mineral fuels:			
Petroleum refinery products:			
Gasoline. thousand 42-gallon barrels	21	18	Macao 17.
Kerosine do	29	35	All to Macao.
Distillate fuel oil thousand tons	16	19	Do.
Residual fuel oil do	1	1	Do.
Lubricants. thousand 42-gallon barrels	17	33	Taiwan 13; Malaya 8; Macao 4.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1962	1963	Principal sources, 1963
Metals:			
Aluminum:			
Metal and alloys	6,280	6,430	Canada 5,370; United States 1,000.
Products [1]	2,440	3,360	Japan 1,785; mainland China 510; Taiwan 328.
Bauxite	325	304	All from mainland China.
Brass metal and semimanufactures	6,400	7,050	Japan 3,400; United Kingdom 1,600.
Copper:			
Metal	138	124	Republic of South Africa 51; United Kingdom 42.
Semimanufactured products [1]	1,050	1,525	Japan 771; United Kingdom 312; mainland China 254.
Gold [2] thousand troy ounces	969	1,179	Australia 513; Canada 479; United Kingdom 167.
Iron and steel:			
Iron ore	8,390	12,450	All from mainland China.
Pig iron (sponge)	5,920	9,730	Mainland China 6,520; North Korea 2,610.
Ingots, slabs, blooms, bars	4,720	3,040	Mainland China 2,500; United Kingdom 469.
Ferroalloys	56	121	Japan 41; Norway 37.
Semimanufactured products [1] thousand tons	317	411	Japan 186; mainland China 87; United Kingdom 63.
Scrap do	43	42	United Kingdom 28; Australia 6; West Germany 2.
Lead:			
Metal	523	263	Japan 146; United Kingdom 62.
Semimanufactures	108	114	United Kingdom 49; Belgium 41.
Manganese:			
Ore	36	50	All from mainland China.
Dioxide	2,956	2,240	Japan 1,087; Thailand 800.
Mercury 76-pound flasks	715	544	Mainland China 525.
Platinum troy ounces	11,275	22,426	West Germany 17,894.
Silver thousand troy ounces	26	86	North Korea 71; Macao 10.
Tin	206	216	United Kingdom 107; mainland China 61; Malaya 48.
Titanium oxides	2,380	2,245	United Kingdom 935; Japan 702; Italy 225.
Zinc:			
Ore	-------	185	All from North Korea.
Metal	4,570	4,520	Australia 2,870; North Korea 790.
Products	553	531	Belgium 122; West Germany 113.
Nonmetals:			
Cement thousand tons	585	831	Mainland China 437; Japan 183; Taiwan 174; North Viet Nam 35.
Diamond, cut and polished thousand carats	372	426	Belgium 200; Israel 129.
Feldspar-fluorspar	1,855	1,540	Mainland China 1,520.
Fertilizers: [3]			
Ammonium sulfate thousand tons	33	102	Belgium 68; Netherlands 34.
Others do	15	30	West Germany 26.
Graphite	215	184	Mainland China 90; Japan 61.
Lime thousand tons	45	59	Mainland China 46; Japan 11.
Magnesite	111	101	All from mainland China.
Quartz sand	4,250	2,060	Mainland China 1,620.
Salt thousand tons	39	35	Mainland China 19; Thailand 12.
Stone, industrial do	300	350	Japan 241; mainland China 109.
Sulfur, crude and refined	1,454	1,708	West Germany 469; France 453; mainland China 203.
Mineral fuels:			
Coal thousand tons	219	193	Mainland China 144; Japan 28; North Viet-Nam 13.
Coke	4,080	4,100	Taiwan 1,580; Japan 1,370.
Petroleum products:			
Gasoline thousand 42-gallon barrels	617	734	Malaysia 368; Iran 216; Persian Gulf Sheikdoms 112.
Kerosine do	1,695	2,069	Malaysia 801; Iran 718; Persian Gulf Sheikdoms 256.
Distillate fuel oil thousand tons	264	294	Malaysia 123; Iran 68; Persian Gulf Sheikdoms 36; Saudi Arabia 33.
Residual fuel oil do	987	1,282	Malaysia 572; Indonesia 340; Iran 125.
Lubricants thousand 42-gallon barrels	140	139	United States 68; West Indies 32; United Kingdom 23.

[1] Estimated by Bureau of Mines.
[2] Mostly reexported to Macao.
[3] Mostly reexported to mainland China.

COMMODITY REVIEW

METALS

Iron Ore.—Ma An Shan in the new territories, Hong Kong's only iron mine, employed about 650 workers in 1963. Mining from this contact metamorphic deposit was started from the surface but had gone underground. The ores were being magnetically upgraded from 32 to 56 percent iron in an 800-ore-ton-per-day wet concentrator. About one-fifth of the production came from handsorted dump recoveries. Technical assistance was provided by the Japanese, and all production was exported to Japan. Output was expected to double after opening a mile-long tunnel in October 1963, extending to the orebody bottom.

Iron and Steel.—Hong Kong's numerous small iron and steel plants, rolling mills, and foundries produced a limited range of products such as bars, rounds, and flats. The industry employed an estimated 2,700 persons and produced roughly 200,000 tons of steel bars in 1963, working at about two-thirds capacity.[3] Steel-bar consumption was much higher than production, requiring net imports of 149,000 tons. In addition, net imports of other iron and steel products amounted to more than 200,000 tons. Fuji Marden, built in 1960 by Fuji Iron Works (Japan) and Wheelock Marden (Hong Kong) and probably the colony's largest plant, produced about 25,000 tons per years of iron bars and was expanding to include iron sheets, pipe, and galvanized products. The company also was completing a large shipbreaking yard, with the scrap scheduled to be sent to the local mill and, to a lesser extent, Japan. Sigma Shipping operated a rerolling mill on Tsing Yi Island. Sakai Steel Pipe, organized by Japanese and Hong Kong interests, was building a 300- to 500-ton-per-month plant at Kowloon to make pipe from Japanese imported steelplates. Another pipe plant under construction was to produce 2,000 tons per month. It was reported that a stainless steel plant capable of producing 20,000 tons per year of finished products would be built on Lantao Island to utilize the scrap formerly sold to Japan.

Scrap was basic to the local steel industry. Hong Kong, with its busy shipbreaking yards, was a net exporter of 96,000 tons of scrap in 1963. Exports, going chiefly to Japan, were one-fourth higher than in 1962. However, the number of ships imported for breaking fell to 29 from 46 in 1962 because of greater cargo traffic and better freight rates. Fewer ships for scrapping pushed hull prices up. Strips cut from ship plates were rolled directly into steel bars. Remelting, an expensive step with high-cost Hong Kong electricity, was thus avoided and gave producers a small competitive edge over imports, at least for the smaller bars. Larger bars were manufactured by a few companies having electric furnaces.

[3] Wu. Michael. A Market and 26 Rolling Mills. Far Eastern Econ. Rev., v. 42, No. 13, Dec. 26, 1963, pp. 676–677.

NONMETALS

Cement.—Apparent consumption of cement, an indication of construction activity, was about 1 million tons in 1963, more than one-third higher than in 1962. Production, all by Green Island Cement Co., Ltd., was slightly above that of 1962, while imports jumped 246,000 tons in 1963. All coal and gypsum and some limestone were imported for making cement. Plans were announced to build a 120,000-ton-per-year clinker-grinding plant in the Hong Kong harbor area; the clinker would be supplied by the Taiwan Cement Corp. in Taiwan, a principal investor in the enterprise.

Other Nonmetals.—Brick and tile clays were mined and processed at brickworks in the Castle Peak area, but production data were unavailable. High-grade kaolin was mined at Cha Kwo Ling, near Devils Peak, by Hong Kong Clays and Kaolin Co., Ltd., and exported mostly to Japan. Graphite from the West Brothers Island deposit, where an interbed 1 to 10 feet thick occurs in sandstone, consisted of two grades, 50- and 80-percent fixed carbon. In 1963, 537 tons of the total production was high grade and a fifth of this was exported to the United States.

MINERAL FUELS

Coal.—The principal coal users were the Hong Kong and China Gas Co., Ltd., the sole producer of coke, and several shipbuilding and ship-breaking yards. Coke was consumed by local foundries. Coal imports in 1963 came mostly from mainland China. Coke had come from that source until 1962 when, because of quality considerations, Chinese coke was displaced by Taiwanese and Japanese coke on the Hong Kong market. Consumption of coal fell one-eighth from 1962 to 1963. Oil, less demanding of precious storage space, was replacing coal. Another factor was a Government prohibition on installing coal-burning equipment in new buildings.

Petroleum.—All petroleum requirements were met by imports of refined products, mainly from Malaysia and the Middle East. Total oil imports in 1963 exceeded 3 million barrels. Small quantities of the oil went to Macao by reexport. Ship and aircraft bunkers were large consumers. Bunkering facilities were expanded when Gulf Oil Terminal, Inc., a Gulf Oil Corp. subsidiary, opened a US$2.5 million harbor terminal at Tsuen Wan in January 1963. Other companies in the harbor area with ship-fueling facilities included Shell Co. of Hong Kong, Standard Vacuum Oil Co., and Caltex (Asia), Ltd.

The Mineral Industry of India

By L. Nahai [1]

IN 1963 India's mining industry accounted for about 19 percent of the world mica output and 7.4 percent of the world manganese output. The country produced 4.8 percent of the world salt output, and for iron ore, pig iron, coal, cement, bauxite, and gypsum, the country's share of total production was from 2 to 2.6 percent. Steel ingot production was 1.5 percent of the world total.

India contributed significantly to other nations' requirements for iron ore, manganese ore, ilmenite, mica, and rare earth compounds. However, exports of manganese ore and ilmenite have declined in the last decade. With respect to export earnings, these declines have been balanced in part by increase in iron ore exports. Other minerals exported during 1963 were bauxite, chromite, magnesite, salt, barite, kyanite, sillimanite, and steatite; but the quantities involved were not very large. Resources of monazite, zircon, and beryl are sufficient to permit their export but normal exports of these minerals are prohibited by the Government. The coal, iron, and steel complex was of the greatest importance to the domestic economy.

The total value of ores and crude minerals produced in India in 1963, exclusive of petroleum and atomic energy minerals, is estimated at US$445 million, or 1.6 percent of the gross national product (GNP) and US$50 million more than in 1962. Coal and lignite accounted for 74 percent of total value, metallic minerals for 12 percent, and nonmetallic minerals for 14 percent. Metals recovered from domestically produced ores and fuels and fluxes had a total value of US$680 million, 18 percent higher than in 1962 primarily because of increased steel production. Iron and steel including ferroalloys accounted for over 91 percent of the metals total; aluminum, antimony (from imported ore), copper, lead, gold, and silver accounted for most of the balance. Cement output, estimated on the basis of US$15-per-ton ex-works, was valued at US$140 million.

In 1962 the average daily number of persons working in and about mines regulated by the Mines Act, 1952, was about 691,000, of which 433,000 were engaged in coal, 26,100 in mica, 50,100 in iron, 39,100 in manganese, and 54,500 in limestone mining. Including the nearly 200,000 employed in steel plants (including rerolling), other metallurgical plants, and cement plants, the total employment in the mineral industry may approach 1 million or about 5 percent of industrial labor.

The most significant mineral industry development during 1963 was that there was no shortage of coal; on the contrary, supply exceeded

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demand. This resulted partly from improved transportation of coal from mines, excessive production of inferior grades which had limited demand, and the failure of other industrial activity to achieve levels anticipated by the third 5-year plan. To improve mineral export potential, mechanical loading facilities were under construction at Visakhapatnam for iron ore exports and port improvements were being made at Madras and Paradip.

The 1956 industrial policy statement remained the basic mineral policy of the Government. Under this statement, most mineral industries are within a category of industries whose future development is an exclusive responsibility of the State. The statement does not preclude the expansion of existing privately owned units or the possibility of the State securing the cooperation of private enterprise in establishing new units. The policy was applied pragmatically in 1963; the Government looked with favor on projects for expanding aluminum output by private industry and licensed expansion of privately owned steel capacity. It also participated with private capital in establishing a refinery and a lubricants plant but did not agree to the expansion of the privately owned refineries.

The Government took some action to encourage imports of machinery for use in coal mines and showed awareness of problems in the existing system of distribution and pricing of iron and steel in India. Government actions included establishment of the Government-owned Mineral & Metals Trading Co. in October to take over from the State Trading Corp. the functions of exporting ores and minerals, importing of ferrous and nonferrous metals and alloys, and implementing barter deals which the Government may specify. This firm handles all iron ore exports to Japan. New royalty rates were announced on August 27 on an additional group of ores by an amendment to the Second Schedule of the Mines and Minerals (regulation and development) Act, 1957. The revision established fixed amounts per unit of weight for abrasive, barite, bauxite, china clay, corundum, garnet, glass sand, kyanite, ocher, quartz, and steatite. The royalty payable on ores of precious metal, copper, lead and zinc remain on a percentage of pithead value.

The Mines Act, 1952, the Mines and Minerals (regulation and development) Act, 1957, and the Mineral Concession Rules, 1960 were applied to Goa, Damau, and Diu canceling a number of taxes and custom duties which were previously levied on iron ore exports and paid by mineowners. However, Section 16 of the Mines Act, 1952, which refers to the modification of existing leases, will—for the present—not be applicable to Goa.

PRODUCTION

The most significant trend in mineral production of India during 1959–63 has been increases in the output of iron and steel and raw materials such as coal, iron ore, and refractory materials needed in steel production. During 1959–63 production of coal, iron ore, and steel ingots increased by 38 percent, 87 percent, and 242 percent, respectively. Bauxite and aluminum had the highest increase rate among ores and metals. Production of some minerals such as manganese,

mica, and ilmenite which have traditionally been produced for export have declined because of increased competition from other sources.

Rise in construction (dams, roads, plants, and factories) is reflected by increase in cement and limestone output. Production of other nonmetallic minerals such as barite, fire clay, china clay, gypsum, kyanite, magnesite, and salt also generally has increased over the 5-year period.

Petroleum production trend is upward, both in the oilfields of Assam and in the Ankleswar field in Gujarat State, the latter starting regular crude shipments to Burmah-Shell and Esso refineries in February 1962. In 1962 Ankleswar crude constituted about 34 percent of total output.

TABLE 1.—Production of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite thousand tons	218	387	476	573	565
Metal	17,355	18,255	18,382	35,403	55,208
Antimony, smelter	674	812	616	661	909
Beryl		907	803	136	
Chromite	95,596	100,112	45,926	[2] 66,648	64,790
Copper:					
Ore thousand tons	404	448	423	492	474
Metal content of ore [2]	8,100	8,800	8,800	9,900	10,010
Smelter (fire refined)	7,674	8,910	8,336	9,780	9,581
Gold troy ounces	165,383	160,593	156,510	163,326	[2] 138,409
Iron and steel:					
Ore thousand tons	7,982	10,683	12,270	13,362	14,926
Pig iron do	3,125	4,175	4,987	5,796	6,603
Ferroalloys do	67	93	112	121	138
Steel ingots and metal for casting do	2,468	3,286	4,084	5,042	5,967
Rolled steel do	1,796	2,226	2,816	3,564	4,257
Lead:					
Concentrate	6,488	6,245	5,532	6,384	5,920
Metal content of concentrate [3]	4,801	4,528	4,062	4,595	4,316
Smelter	3,958	3,745	3,664	2,849	3,537
Manganese ore 35 percent plus thousand tons	1,178	1,199	1,230	1,186	1,075
Silver, smelter troy ounces	124,777	132,718	191,008	138,698	128,314
Titanium:					
Ilmenite thousand tons	303	250	174	138	26
Rutile	389	982	815	1,616	1,871
Tungsten (wolfram)	1	3	10	11	5
Zinc:					
Concentrate	9,978	9,787	9,254	10,024	10,627
Metal content of concentrate [3]	5,500	5,400	5,100	5,533	5,860
Nonmetals:					
Apatite	16,350	14,921	20,140	29,018	13,127
Asbestos	1,328	1,711	1,468	[2] 1,692	2,712
Barite	13,552	13,586	15,717	[2] 32,662	37,312
Calcite	7,679	9,235	10,885	13,541	13,554
Cement thousand tons	6,936	7,835	8,244	8,586	9,355
China clay do	261	353	371	390	404
Corundum	214	250	329	301	658
Diamonds carats	682	1,159	1,313	1,131	1,432
Dolomite thousand tons	341	650	721	901	1,070
Feldspar	9,896	10,652	[2] 9,073	[2] 19,224	20,933
Fire clay thousand tons	221	258	270	346	368
Fluorspar	[4]	[4]	[4]	657	708
Garnet	367	469	241	415	361
Gypsum thousand tons	860	997	865	1,121	1,188
Kyanite	16,499	20,156	27,155	49,618	31,655
Limestone thousand tons	10,831	12,728	14,346	16,907	17,057
Magnesite do	158	156	210	213	235
Mica, crude	28,846	29,226	28,347	28,354	25,098
Ocher	21,190	20,400	19,248	17,449	20,991
Quartz and silica	48,539	66,730	97,452	200,350	215,826
Salt thousand tons	3,178	3,435	3,481	3,886	4,539
Sillimanite	7,696	8,483	8,113	8,255	11,285
Steatite	64,485	93,392	98,793	110,449	117,974
Vermiculite	[5] 2	215	632	[2] 433	677
Mineral fuels:					
Coal thousand tons	47,800	52,593	56,065	61,370	65,927
Lignite	33,163	46,945	63,765	210,748	991,718
Coke, all types thousand tons	6,238	6,722	9,428	9,271	9,762

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Mineral fuels—Continued					
Petroleum:					
Crude—thousand 42-gallon barrels	3,377	3,370	3,356	8,016	12,266
Refinery products:					
Gasolines—do	8,064	8,868	9,084	10,381	11,893
Kerosines—do	5,688	7,200	7,864	9,488	10,881
Distillate fuels—do	10,560	11,904	12,447	13,489	14,860
Heavy ends—do	11,184	11,268	12,062	11,041	15,333
Lubricants—do	156	157	177	176	253
Asphalt—do	1,752	2,424	2,656	3,845	2,266
Miscellaneous—do	432	456	530	1,407	844
Natural gas—million cubic feet	4,794	5,201	(4)	(4)	(4)

[1] Excludes production of Goa which in 1962 comprised 5,440,491 tons of iron ore, 87,754 tons of manganese 208,581 tons of ferruginous manganese, and 9,908 tons of salt. Data for 1963 are not yet available.
[2] Revised figure, supersedes that given in commodity chapter, volume 1.
[3] Estimate.
[4] Data not available.
[5] Processed.

TRADE

In 1963 the value of India's export of minerals was equivalent to US$111 million, that of metals and scrap to US$17 million, and that of petroleum products to US$12 million, giving a total of US$140 million (US$112 million in 1962) for all minerals and metals, or 6 percent of value of all exports. An important factor in the increase of mineral export value was the inclusion of exports of Goa in Indian trade statistics for the first time.

Principal minerals exported in 1963 were iron ore (US$66 million), mica (US$18.6 million), manganese ore (US$17.2 million), and petroleum products (US$12.2 million). Ferromanganese, pig iron, iron and steel, and aluminum constituted principal metal exports. Japan was the major buyer of Indian minerals, accounting for 45 percent of total mineral exports, followed by Czechoslovakia (8 percent), United States (7 percent), United Kingdom and West Germany (5 percent each), and Pakistan, Poland, and Rumania (4 percent each). Minerals (mainly iron ore, manganese, mica, bauxite, chromite, and salt) play an important part in trade between Japan and India, accounting for a third or more of India's exports to Japan.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963
Metals:				
Aluminum:				
Bauxite	99,293	175,621	135,170	Japan 67,745; Italy 30,944; West Germany 18,979; Australia 6,706.
Alumina	48	20	5,882	Belgium 3,495; Formosa 1,516; United Kingdom 734.
Chromite	41,843	16,534	10,334	Mainly to Japan.
Copper and brass and bronze	687	275	562	Hong Kong 193; Ceylon 110; Iran 85; South Viet-Nam 62.
Ilmenite	125,213	101,246	76,456	United Kingdom 48,718; Japan 14,250; United States 12,900.

TABLE 2.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal destinations, 1963
Metals—Continued				
Iron and steel:				
Iron ore:				
India	3,466	3,390	7,914	Japan 6,116; Czechoslovakia 962; West Germany 694.
Goa	6,458	5,278	(1)	
Iron and steel scrap	320,708	162,591	383,185	Japan 382,940.
Pig iron	98,745	21,664	332	Pakistan 172; South Viet-Nam 160.
Ferromanganese	66,659	9,186	4,189	North Korea 3,100; United Kingdom 814; West Germany 193.
Rolled steel	399,733	14,708	25,181	South Viet-Nam 8,378; Ceylon 3,008; United States 2,237; Cambodia 2,065; Pakistan 1,453.
Manganese ore:				
India—thousand tons	1,014	783	922	Japan 370; United States 111; West Germany 97; United Kingdom 64; Czechoslovakia 53.
Goa—do	[2] 104	[2] 120	(1)	
Zinc:				
Concentrate	10,197	10,751	11,680	Japan 11,680.
Metal	649	18	183	Singapore 170; Colombia 13.
Nonferrous metal scrap	-------	871	972	Belgium 557; Japan 371; United Kingdom 43.
Miscellaneous nonferrous metals	186	-------	39	United States 25; Singapore 5.
Other nonferrous base metal ores and concentrates.	-------	1,999	3,099	Japan 2,064; Yugoslavia 435; Netherlands 250.
Nonmetals:				
Barite	7,335	5,506	9,193	Japan 5,614; Formosa 1,501; Australia 602; Tanganyika 459.
Cement—thousand tons	100	41	56	Pakistan 32; Ceylon 18.
Chalk and lime	181	177	34	Ceylon 20; Singapore 5.
Clays including bentonite	1,383	1,328	520	Pakistan 447; Burma 27; Iraq 20.
Feldspar	1,268	1,093	1,369	United Kingdom 711; France 350; West Germany 300.
Gravel and crushed rock	26,688	60,217	19,133	Pakistan 19,132.
Kyanite	31,727	36,946	28,332	Italy 7,194; United Kingdom 3,246; West Germany 3,126; France 2,249; Denmark 2,166.
Limestone	104,749	98,091	109,828	Pakistan 109,828.
Magnesite	31,932	32,062	33,349	Netherlands 10,759; United Kingdom 8,390.
Mica:				
Block	2,083	1,994	1,805	
Splittings	8,259	8,545	7,074	
Condenser films	-------	187	106	
Scrap	16,037	20,462	25,090	
Total	26,379	31,188	34,075	United Kingdom 9,671; United States 8,558; Norway 3,556; Japan 2,559; West Germany 2,324.
Salt	135,373	112,775	220,411	Japan 170,178; Ceylon 40,207; Kuwait 8,120.
Sillimanite	5,494	4,899	5,464	West Germany 2,852.
Steatite (block and powder)	9,636	15,665	14,240	Italy 3,046; United Kingdom 2,524; Norway 1,893; Ceylon 1,273.
Stone (including marble)	7,347	546	5,296	Pakistan 5,245.
Miscellaneous nonmetallic and building raw materials.	560	8,725	8,162	Pakistan 6,248; Japan 1,572.
Mineral fuels:				
Coal—thousand tons	942	1,082	874	Pakistan 863; Japan 11.
Petroleum products:				
Gasoline.	1,440	2,124	3,348	(1).
Paraffin—do	95	95	-------	(1).
Other—do	111	70	101	(1).
Total—do	1,646	2,289	3,449	(1).
Bunker loadings—do	3,026	2,930	(1)	(1).

[1] Data not available.
[2] Including ferruginous manganese ore.

At yearend, shipments of iron ore from India (exclusive of Goa) to Japan were governed by a 2-year agreement signed in May 1963 between State Trading Corp. and 10 major Japanese steel companies whereby the Japanese firms agreed to buy, at US$10.22 per ton, 2.2 millions tons of ore in 1963–64 and 2.25 million tons in 1964–65. Two previous agreements provide for export of 6 million tons of Indian iron ore to Japan per year starting in 1966. Other agreements concluded in 1963 provide for the export of 600,000 tons of iron ore to Rumania and 800,000 tons to Czechoslovakia.

A program prepared by the Ministry of International Trade of India aims toward attaining an export target of 30 million tons of iron ore by 1970–71. Achievement of the target would require considerable expansion of transportation and port facilities.

In 1963 the total value of tabulated imports was approximately US$532 million (nearly a quarter of total imports) distributed as follows in million U.S. dollars: petroleum 208; iron and steel 181; nonferrous metals (aluminum, copper and copper alloys, lead, tin, zinc, silver and platinum group, and miscellaneous) 114; and ores and minerals (unprocessed) 29. Among the nonferrous metals in terms of value, copper and its alloys constituted the most important item (US$55,500,000), followed by zinc (US$19,897,000), aluminum (US$14,100,000) and tin (US$11,450,000). In the foreseeable future, India will continue to depend on imports to meet all or a major portion of its requirements of nonferrous metals except aluminum.

Nearly one-third of the import value of unprocessed minerals was accounted for by sulfur, of which three-fourths was used for making sulfuric acid. Some of the other mineral imports, in order of importance, were asbestos, phosphates, sodium nitrate, borax, cryolite, fluorspar, and gypsum.

The United States has been an important supplier of iron and steel and some of the nonferrous metals, as well as sulfur. A determining factor in this trade has been a number of nonproject low-interest, long-term loans which U.S. Agency for International Development has given to India. India could import a number of commodities including minerals and metals in using a US$240 million loan made available in February 1963.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963
Metals:				
Aluminum	25,392	37,369	25,827	United States 13,582; Canada 7,495; United Kingdom 1,774; Yugoslavia 1,062; West Germany 452; U.S.S.R. 401.
Antimony ore	1,079	1,398	1,920	Bolivia 1,833; Peru 60; Australia 22.
Brass and bronze	6,454	2,654	2,403	United Kingdom 802; West Germany 595; Yugoslavia 264; United States 169; Japan 167.
Chromite	2,851	(1)	(1)	(1).
Copper	62,061	70,391	72,687	United States 49,462; Canada 12,460; Federation of Rhodesia and Nyasaland 6,515.
Iron and steel:				
Iron and steel scrap	6,907	3,303	1,152	United Kingdom 576; United States 510.
Pig iron	1,642	87	691	U.S.S.R. 431; Sweden 243; United Kingdom 9.
Ferroalloys	7,966	4,437	2,372	Japan 699; Norway 312; United Kingdom 249; West Germany 235; Yugoslavia 231; Netherlands 202.
Steel ingots	2,527	74,065	34,696	U.S.S.R. 12,913; United States 7,503; Sweden 4,874; United Kingdom 4,604.
Rolled steel [2] thousand tons	1,023	789	1,041	United States 245; Japan 130: United Kingdom 104; Canada 63; West Germany 60.
Steel pipes and tubes do including cast iron.	39	34	38	United Kingdom 9; Japan 7; U.S.S.R. 5; Canada 4; West Germany 4.
Lead	25,103	35,514	36,096	Burma 15,526; Australia 10,553; Canada 6,756; U.S.S.R. 1,913.
Magnesium	(3)	(3)	390	United States 277; Norway 50; United Kingdom 21; Netherlands 18.
Manganese	(1)	20,687	9,320	Ghana 9,296.
Nickel	1,789	1,383	1,641	United Kingdom 960; Canada 415.
Platinum troy ounces	3,825	3,825	6,174	U.S.S.R. 2,411; France 2,379; West Germany 804.
Silver do	90,825	79,926	55,393	Belgium 24,467; United Kingdom 15,497; Netherlands 10,867; West Germany 3,922.
Tin	4,674	4,658	8,844	Malaya 6,749; United States 1,102; Singapore 896.
Zinc	75,398	79,549	85,933	United States 29,646; Canada 18,455; Australia 14,419; U.S.S.R. 10,159; Belgian Congo 8,360.
Miscellaneous metallic ores and concentrates.	2,199	5,317	217	United Kingdom 142; United States 23; Peru 21.
Miscellaneous nonferrous metals and alloys.	(4)	525	237	United Kingdom 87; Japan 68; Belgium 20; United States 13; West Germany 10.
Miscellaneous nonferrous metal scrap.	--------	1,953	2,639	United States 922; United Kingdom 484; Canada 316; Netherlands 157; Belgium 105; Singapore 96; Denmark 70.
Nonmetals:				
Abrasives including tripoli and pumice stone.	3,994	2,825	3,175	United States 1,832; United Kingdom 711; Greece 280; West Germany 150; Japan 130.
Asbestos, crude	19,486	22,378	36,959	Canada 18,411; U.S.S.R. 7,947; Federation of Rhodesia and Nyasaland 6,062; Mozambique 1,998.
Borax	6,317	758	717	United States 668; United Kingdom 15.
Chalk	2,600	1,871	1,763	United Kingdom 1,575; Australia 92.
Clays including bentonite and fuller's earth.	16,350	12,561	13,848	United Kingdom 6,728; Czechoslovakia 3,629; West Germany 1,441; United States 918; Japan 875.
Cryolite	2,811	3,230	2,746	Italy 1,329; Czechoslovakia 485; Denmark 473; France 300; Poland 155.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1963
Nonmetals—Continued				
Diamond, industrial including bort.—thousand dollars	161	300	301	United Kingdom 114; United States 107; France 74.
Diatomite	1,070	1,377	1,152	United States 1,016; West Germany 76.
Fluorspar	5,891	9,375	8,690	Mexico 4,448; Thailand 2,919; United Kingdom 811; United States 493.
Graphite	1,752	2,242	1,084	Ceylon 450; Norway 194; North Korea 155; United Kingdom 91.
Gypsum	37	21,668	46,433	West Pakistan 46,339; Italy 78; United Kingdom 16.
Phosphate	233,551	287,721	297,687	Tunis 112,843; Morocco 80,627; Jordan 64,853; United Arab Republic 39,360.
Sodium nitrate	18,851	16,335	14,901	All from Chile.
Sulfur	191,433	248,031	261,018	United States 256,767; Canada 3,975.
Other nonmetallic minerals and building materials.	412	3,401	1,724	United States 802; West Germany 360; United Kingdom 274; France 150.
Mineral fuels:				
Coal and coke including briquets	4,120	14,082	2,864	United States 2,305; Norway 500.
Petroleum:				
Crude—thousand 42-gallon barrels	44,700	43,967	41,905	(4).
Refined products:				
Gasoline—do	762	926	642	(4).
Kerosine—do	8,163	12,413	10,217	(4).
Distillate fuel oil—do	2,448	3,729	3,828	(4).
Residual fuel oil—do	1,206	2,377	3,708	(4).
Lubricants—do	1,519	1,816	2,316	(4).
Other—do	185	424	136	(4).
Total—do	14,283	21,685	20,847	(4).

[1] Included in miscellaneous ores.
[2] Includes railway track accessories exclusive of wheels, tires, and axles.
[3] Included in miscellaneous metals.
[4] Data not available.

COMMODITY REVIEW

METALS

India has excellent-to-adequate reserves of the major essentials for producing iron and steel and has five major integrated steelworks, four of which have rated capacities of 1 million tons or more. Necessary iron ore, chromite, coal, manganese, and limestone are available from Indian mines, and reserves of the metallic ores are sufficient to permit appreciable exports. The only significant steel industry raw material deficiencies are tungsten and nickel. India's consumption of these metals has been small because little alloy steel has been produced. This situation will change, however, when the 100,000-ton-per-year-alloy steel plant, started in June 1963, is completed.

India is not so fortunate with regard to mineral resources for producing major nonferrous metals (except aluminum) as it is with respect to iron and steel raw material resources. Bauxite reserves, estimated at 64 million tons in 1960, are adequate, and annual aluminum production capacity, 53,000 tons, is increasing. In 1963 domestic production met about two-thirds of the aluminum requirements and perhaps less than 10 percent of the lead requirements. No primary zinc or tin was produced. Requirements of these metals by 1965–66 are estimated as follows, in tons: aluminum 115,000; copper 150,000; lead 65,000; tin 10,500; and zinc 187,500.

Beach sand deposits of South India contain large quantities of ilmenite, monazite, rutile, and zircon; output of ilmenite and rutile has been significant.

Aluminum and Bauxite.—There was a 2-percent decline in bauxite production. Bihar continued as the leading producing State with 49 percent of the output followed by Gujarat which accounted for 32 percent.

Bauxite consumption was estimated at 427,000 tons, with the aluminum industry consuming 300,000 tons, the cement industry 75,000 tons, the chemical industry 25,000 tons, and refractory and abrasive usage accounted for 27,000 tons.

India's bauxite reserve is estimated by the Indian Bureau of Mines at 260 million tons, of which nearly 77 million is reported as high grade containing more than 50 percent alumina.

In 1963, India's aluminum supply (not allowing for stock changes) was 81,027 tons. Semimanufactures produced totaled 41,912 tons, including sheets and circles 21,224 tons, wire rods 12,730 tons, foils 2,255 tons, and rods and extruded sections 3,703 tons. Imports consisted of the following: ingots 6,292 tons, bars and rods 15,556 tons, sheets, plates and strips 974 tons, foil 438 tons, wire 732 tons, circles 460 tons, pipes and tubes 188 tons, and others 1,179 tons.

By yearend India had an installed annual capacity for 53,000 tons of aluminum ingots, which is expected to increase to 70,000 tons by the end of 1964. Increased aluminum output during the year resulted partly from new production obtained, starting in mid-1962, from the 20,000-ton-per-year plant of the Hindustan Aluminium Corp., Ltd., at Renukoot in Uttar Pradesh. This company is a joint venture of Birla interests and Kaiser Aluminum & Chemical Corp. In April 1963, the Export-Import Bank extended a US$5 million loan to the Hindustan Aluminium to finance the addition of a plant for making drawn, extruded, flat, and coiled products at the rate of 15,000 metric tons per year—6,000 tons of redrawn wire, 7,000 tons of sheets and plates, and 2,000 tons of extruded products. Total cost of the plant is to exceed US$11 million. The company also desires to add 40,000 tons per year to its ingot capacity and apparently has obtained Government approval.

The Indian Aluminium Co., Ltd., a subsidiary of Aluminium Ltd. of Canada and the oldest aluminum producer in India, started with the expansion of its Alipuram smelter in Kerala from 5,700 tons to 10,800 tons per year and the erection of a 2,500-ton-per-year foil plant at Kalwa near Bombay. The additional capacity at Alipuram is expected to be completed in 1964; the Government meanwhile approved the company's proposal to further enlarge the plant capacity to 15,800 tons per year. The company recently completed enlargement of its smelter at Hirakud to the present annual capacity of 20,000 tons. It produced alumina for both smelters at Muri in Bihar (55,000 tons alumina per year) and had its fabricating plant in Belur (with capacity to produce 16,800 tons of rolled products per year).

India's third primary aluminum producer, the Aluminium Corp. of India, completed expanding its aluminum smelter in Asansol, West Bengal, from 2,500 tons of aluminum ingots to 7,500 tons per year. Work continued on the 10,000-ton-per-year plant of Madras Aluminum

Co. at Salem in Madras, being built by Madras State with the collaboration of Montecatini. The plant was scheduled to start production in the second half of 1963.

India's aluminum production target has been set tentatively at 250,000 tons for the fourth 5-year plan. During 1963 there were press reports on projects for establishing a 20,000-ton-per-year plant in the vicinity of the Koyna hydroelectric plant with technical collaboration of the Vereinigte Aluminium Werke of West Germany and another plant with 30,000-ton capacity in the States of Maharashtra or Mysore. By yearend no progress had been made on either project. The Government also asked the Hungarian Government to submit a project report for a 25,000-ton-per-year plant to be established at Korba in Madhya Pradesh. The project, if approved will be implemented by National Industrial Development Corp., a Government corporation, but with Hungarian assistance.

Copper.—All primary copper was produced by the Indian Copper Corp., from three underground mines in the Ghatsila region of Bihar State. The concentrator and smelter are at Moubhandar.

In 1963 the Indian Copper Corp. mined 474,345 tons of ore averaging 2.225 percent copper. The decrease of 4 percent in ore output resulted from the lost time on account of breakdown in the ropeway which moves the ore from mine to mill.

The company's copper output does not show great variation. The small increase shown since 1960 resulted from addition to the mill in 1960. In June 1962 the company started building an electrolytic refinery with 8,400 tons annual capacity; this plant is scheduled to be completed by December 1964. Imported blister copper will be used as raw material for the refinery. In addition, the Government approved plans by the company to replace its obsolete smelter facilities at Ghatsila with a new plant with a capacity of 16,500 tons per year of fire refined copper. This new plant will treat concentrates from increased ore production from the corporation's mines. Sulfuric acid also will be produced.

Copper imports were principally electrolytic wire bars 32,365 tons; ingots and billets 37,803 tons. Copper tubes, sheets, and strips and other products accounted for the remainder. Principal consumers were brass mills and manufacturers of cables, but defense needs increased during the year and demand was estimated at 115,000 tons compared with the total imports and production of 82,000 tons. As a result, prices of copper increased. Price of copper averaged US$1.28 a kilogram in 1962; in November 1963 it was reported at US$1.37. Domestic scrap and clean wire averaged US$1.30 per kilogram.

Exploration for copper deposits has been stepped up in the last few years to improve India's self-sufficiency. The Indian Bureau of Mines has carried out diamond drilling in the Khetri and Daribo deposits in Rajasthan and was investigating the old Rakha copper mine in the Ghatsila copper district and Dikchu in Assam. The National Mineral Development Corp. (a Government-of-India entity) has the responsibility for developing the Khetri mine with Western Knapp Engineering Co. serving as consultants. In conjunction with the mine development, construction of a 21,000-ton-per-year electrolytic copper refinery is projected, with production to start in 1965. Estimated cost of mine

development, mill, and refinery is about US$40 million, exclusive of housing and roads. The rate of production envisaged at Daribo is 1,500 tons of metal in concentrates which would be shipped to Khetri. Implementation of the Khetri project was slow because of lack of funds.

Gold.—Kolar Gold Fields and the Hutti mines in Mysore State were the only producers, accounting for about 85 and 15 percents of the 1962 gold output, respectively. Both mines are high-cost producers; in Kolar the gold produced costing nearly twice the international price. The Central Government took over the Kolar Gold Field in December 1962, but the Mysore Government still holds 96.5 percent of shares of the Hutti mine.

Average grade of gold mined in the three mines of Kolar Gold Fields was 5.69 grams (0.18 ounce) per ton compared with 7.07 grams (0.22 ounce) in 1962. Under a US$3.15 million modernization program, a new mill was put in operation at the Nundydroog mine, increasing grinding capacity from 21,000 to 28,000 tons per day and obviating the need of shipping some ore from this mine to Champion mine for milling. On basis of an encouraging report, the Mysore mine started sinking three new shafts in a new mining area.

Ore production at Hutti is to be increased from 350 to 1,000 tons per day. Necessary milling facilities will be added.

Efforts to combat illegal gold imports in order to reduce the outflow of foreign exchange, and attempts to find means of employing large private gold holdings for economic development reengaged the attention of the Government in late 1962 and 1963. These actions were prompted by the emergency created by the Chinese invasion. In September 1962 a bill was passed enabling the Government to control the supply, production, and distribution of gold, to ban future trading in gold, and to limit the purpose for which gold could be purchased. In November 1962, 15-year "gold bonds" were issued at a 6.5 percent interest rate. These bonds were to be bought with gold valued at world prices and would be redeemed in rupees. These actions at first brought down the price of gold—the average price for spot gold in Bombay declined from US$78.66 to US$60.58 per ounce, but the trend was reversed in December, the price rising to US$73.32 per ounce. On January 9, 1963, the Government promulgated "Gold Control Rules" which put restrictions on the free market in gold.

Iron Ore.—High-grade iron ore reserves are estimated to total 21,300 million tons and constitute perhaps a third of the world total. The low-grade reserve has not been determined but probably is large. Nearly one-third of the high-grade ore is in the States of Bihar and Orissa, relatively close to India's most important coalfields. These iron ore deposits supply four of India's steel plants. Large deposits of high-grade hematite exist in Madhya Pradesh State; one of these is mined to supply ore to the Bhilai steel plant. Other ore-rich regions of India are located in Mysore State, in Goa, and at several other points near the west coast.

Iron ore forms the bulk of India's nonfuel mineral production. Output in the last decade has more than trebled to meet the requirements of the expanding iron and steel industry and the export trade. In 1963 of States of Orissa, Bihar, Mysore, and Madhya Pradesh produced

40 percent, 23 percent, 16 percent, and 16 percent of the total, respectively. Nearly half of the 1962 production was obtained from 5 mines and an additional 27 percent from 16 mines. The remainder was distributed among 248 mines which produced from 500 to 100,000 tons in 1962. All the mines are opencast and about six are fairly well mechanized. Currently more than half of the output is obtained from privately owned and operated mines.

The National Mineral Development Corp. continued its activities in developing the Kiriburu and Bailadila deposits which will supply iron ore to Japan; Kiriburu will also supply the Bokaro steel plant when it is built. With removal of 340,000 cubic meters of overburden by yearend, stripping at Kiriburu was 82 percent completed. Production is expected at Bailadila by 1966 when, according to a 1960 contract, the Government will ship annually 4 million tons of ore from this deposit to Japan.

The railroad from Kiriburu to Visakhapatnam was completed, but mechanical stacking and loading facilities were not expected to be ready before April 1965. When completed, the material handling facilities will be able to dump 2,000 tons of ore per hour from railroad cars, and two loaders, each with 1,500-ton-per-hour capacity, will load ships. Eventually, the port will be able to handle 8.2 million tons of iron ore per year.

With a view of future expansion of iron ore exports the Government of India in February 1963 announced its decision to undertake the development of iron mines in the Tomka-Daitari-Kayagarh area and a port at Paradip in Orissa with Japanese technical and financial assistance. The project is to be completed in two stages. The first stage, estimated to cost US$63 million, envisages development of the mines, construction of a 160-kilometer road from the mines to the port, and erection of three berths for bulk ore carriers from 40,000 to 60,000 dead weight tons. This will allow the port to export 2 million tons of iron ore annually. In the second stage, further development of port facilities, improvement of the road, and construction of a 270-kilometer railway line from Kayagarh will be undertaken. With the completion of the second stage the port will reportedly be capable of handling iron ore exports of 5 to 10 million tons each year. A team of Japanese experts was to arrive in India to discuss further details of the collaboration. In November the Minister of International Trade submitted a plant which would increase iron ore exports to 30 million tons by end of the third 5-year plan in 1966. The developments at Paradip and the mines it would serve were included in the master plan.

Iron ore mining in Goa with Japanese financial and technical assistance showed a spectacular growth during 1950–60 in response to good market demands. The industry was, however, experiencing some difficulty in 1963 because of insufficient export orders, and many of the small mines were closed. The State Trading Corp. established an office in Goa with a view to assisting small mines, and presumably this function will be continued by the Mineral & Metal Trading Corp.

Prices of Goan iron ore were fixed by the Government of India effective May 28, 1962. These prices per metric ton f.o.b. vessel varied from US$5.41 for 55-percent ore to US$12.47 for 65-percent ore. These floor prices were lowered for 55 to 58-percent ore in January 1963

to US$5.25 to US$5.90 with further reduction (US$5.10 to US$5.70) permitted when 20 to 30 percent of total quantity of ore shipped against a contract was exported on Indian vessels. When quantities shipped on Indian vessels were 50 percent of the total quantity of an export contract, minimum prices would still be lower US$4.85 to US$5.45 per metric ton.

Iron and Steel.—In view of the favorable raw material base and the great need of the country, construction of steel plants received a high priority in India's second 5-year plan (1956–61). In 1963 India had an installed capacity for producing a little over 6 million tons of crude steel and 4,265,000 tons of finished steel. Roughly half of this capacity was in public sector plants; the balance was under private ownership. The Government-owned plants, managed by Hindustan Steel Ltd. (HSL), are Durgapur in Bihar State, Rourkela in Orissa State, and Bhilai in Madhya Pradesh State. Durgapur and Rourkela each have about 1-million-ton capacity; Bhilai's capacity is closer to 1.2 million tons. The 3-million-ton, privately owned capacity is distributed two-thirds Tata Iron & Steel Co. (TISCO) and one-third Indian Iron & Steel Co. (IISCO). The Mysore Iron and Steel Works (MISW) owned by Mysore State had 85,000-ton capacity. There is some degree of specialization of products among the three Government-owned plants; Bhilai concentrates more on heavy structurals, Durgapur makes merchant mill products and light structurals, and Rourkela produces only flat products. The Jamshedpur plant of TISCO, which is still the largest in India, produces a wide range of products. Both Bhilai and the steel plant of IISCO at Burnpur produce pig iron in addition to their own requirements for sale.

Production.—Of the pig iron produced in 1963, 4,831,000 tons was basic pig iron, 1,379,000 tons was foundry pig iron, and 393,000 tons was of other types; 1,184,023 tons was available for sale to founderies. Raw materials used by the steel industry included about 10.6 million tons of iron ore, 9.4 million tons of coking coal, 942,000 tons of non-coking coal, 2.9 million tons of limestone, 780,000 tons of dolomite, 831,000 tons of scrap, and 277,000 tons of manganese ore. For the first time oil injection was tried in one of the blast furnaces in Jamshedpur with favorable results. The experiment is of great interest to other producers because it offers a means of reducing coke consumption.

Production of steel ingots increased by 20 percent. The steel ingots were produced in basic open-hearth furnaces, except in Rourkela where three-fourths of the 1 million-ton steel capacity is in oxygen LD furnaces.

All classes of rolled steel with the exception of skelp registered increases. Rolled steel output included 1,009,700 tons produced by secondary producers and rerollers which produce rolled steel from billets and semifinished steel and from scrap, respectively.

Supply and Demand.—For a number of years the supply of steel in India has not been sufficient to meet all demands of the economy. Imports are limited by available foreign exchange. Large steel imports were arranged during the year by utilizing a U.S. loan and credits provided by United Kingdom, Austria, and Netherlands for steel, particularly plate, imports.

TABLE 4.—Production of pig iron, steel ingots and rolled steel by producers in 1963

(Metric tons)

	Pig iron				Steel ingots			Rolled steel
	Basic	Foundry	Other	Total	Basic	Electric	Total	
Tata Iron & Steel Co	1,838,125	----------	42,192	1,880,317	1,877,099	17,442	1,894,541	1,034,967
Indian Iron & Steel Co	1,086,753	171,770	--------	1,258,523	1,027,713	--------	1,027,713	649,857
Hindustan Steel Ltd.:								
Bhilai plant	288,730	736,280	233,678	1,258,688	1,124,670	--------	1,124,670	640,713
Durgapur	828,445	356,834	61,558	1,246,837	965,920	--------	965,920	355,002
Rourkela	757,693	61,437	27,153	846,283	845,562	--------	845,562	525,986
Mysore Iron & Steel Works	26,957	30,111	26,268	83,336	43,607	2,298	45,905	41,225
Others	----------	29,279	--------	29,279	----------	64,279	64,279	[1] 138,256
Rerollers:								
Registered	----------	----------	--------	----------	----------	--------	----------	688,785
Unregistered	----------	----------	--------	----------	----------	--------	----------	122,691
Wire drawing units	----------	----------	--------	----------	----------	--------	----------	60,036
Total	4,826,703	1,385,711	390,849	6,603,263	5,884,571	84,019	5,968,590	[2] 4,257,520

[1] Of this 100,879 tons is tinplate; Tinplate Co. of India produced 84,108 tons, Rourkela 12,191 tons, and Khemchand 4,580 tons.
[2] Details do not add to total because of rounding.

Source: Iron and Steel Control, Monthly Bulletin, May 1964, p. 206.

TABLE 5.—Production of rolled steel by categories

(Metric tons unless otherwise specified)

	1961	1962
Light and medium structurals	471,069	637,000
Heavy structurals	208,245	174,400
Special sections	49,438	57,600
Rails and railroad ties	441,546	536,000
Bars and rods	1,343,318	1,555,600
Sheets	261,325	323,400
Plates	219,189	374,000
Galvanized sheets	151,935	149,700
Hoops and strips	47,374	89,100
Skelp	194,994	159,800
Tinplate	94,325	100,000
Wheels, tires, and axles	34,655	59,600
Wire	46,685	60,100
Total	3,564,098	[1] 4,276,300

[1] Excludes production of spring steel, tool steel, and fish plates.

Source: Iron and Steel Control, Monthly Bulletins for January to December, 1961 and 1962. Ministry of Steel, Mines and Heavy Engineering, Department of Iron and Steel, Calcutta.

In 1963, with imports of 1,041,000 tons, total rolled steel available to the economy was 5,298,000 tons (not taking stock changes into account) compared with an estimated demand of 5.6 million tons. It is believed that there were heavy stocks of semifinished steel and heavier sections in the mills during part of 1963 which may have decreased the effective supply. There were critical shortages of certain items.

Shortages of pig iron led to partial curtailment of foundry production in certain parts of India. Against annual requirements of 2 million tons, only 1,184,000 tons was available for sale.

There have been many estimates of anticipated steel demand in India. The National Council of Applied Economic Research placed

the demand in 1965–66 as 6.9 million tons of rolled and mild steel equivalent to 9.7 million tons of ingots. The corresponding figures for 1970–71 are 13.6 million tons and 18.3 million tons, respectively. It is expected that the imbalance of supply and demand will continue in the third 5-year plan and in 1965–66 there will still be a deficit of 1.2 to 1.3 million tons of finished steel. In shortest supply will be plates, hot-rolled sheets and strips, cold-rolled sheets and strips, and galvanized sheets.

Distribution.—The Government of India, in September 1962, appointed a four-man committee to study the existing system of production, pricing, planning, and distribution of iron and steel. The committee found that the current cost-plus method of fixing steel prices does not allow for plant replacement and does not reflect the real costs of producing different sizes and categories of steel. The committee suggested categorization of steel demands into priorities and the establishment of a free market for nonpriority steel. It also urged the abolition of present system of distribution controls. It recommended that the authority to fix the retention price (price the steel producers are allowed to retain, which is established at some level in excess of production cost) should be removed from the Tariff Commission and entrusted to a Joint Plant Committee composed of the general manager of each plant with the Iron and Steel Controller as chairman. The Government has accepted most of the recommendations of the Committee, and a revised system of control and pricing was to become effective March 1, 1964.

In June the Government announced the following increase in the retention prices:

	Steel	Pig iron
Apr. 1, 1962 to Mar. 31, 1962	US$2.10	US$1.26
Apr. 1, 1963 to June 30, 1963	US$1.68	US$0.84
From July 1, 1963	US$2.10	----------

The increases were granted because of higher royalties on iron ore, limestone and other raw materials, statutory increase in price of coal and railroad freight, and increase in war-risk insurance. Selling price of steel was also increased by US$2.10 per ton on July 1, 1963, and that of pig iron of all grades by US$6.30 as of January 4, 1964.

Expansion Program.—India had planned to expand the steel capacity by 1966, the last year of the third 5-year plan, to 10.36 million tons of steel ingots and 6.91 million tons of finished steel. In view of the delay in starting construction of a new plant at Bokaro latest information sets the target at 9.375 million tons of steel ingots. The new capacity is to be achieved by the expansion of the three existing Government-owned plants to 5.9 million tons (Bhilai 2.5 million, Durgapur 1.6 million, and Rourkela 1.8 million). The Government has agreed in principle to let Indian Iron & Steel Co. expand to 310,000 tons of steel ingots, which will be the first stage in a 1-million-ton expansion program. Tata Iron & Steel Co. is expected to be allowed to expand only marginally.

TABLE 6.—Expansion of existing iron and steel plants and construction of new facilities

Plant	Projected capacity (million metric tons)	Expansion cost (million dollars)		Anticipated completion date	Remarks
		Foreign exchange	Total		
Bhilai	2.5	(1)	(1)	1965	Construction of coke oven and blast furnace started.
Rourkela	1.8	100	100	1966	Loan agreement between India and West Germany for $100 million signed in April 1963. The credit will be for 20 years at 5.75 percent interest with a grace period of 7 years.
	0.1 tinplate	117.6	273	(1)	Contract for installing an electrolytic tinning line awarded to Demag.
Durgapur	1.6			1965	Construction of blast furnace started in August.
Burnpur	1.31 and 2.0	12.8	25.62	(1)	Financing of the foreign exchange cost is expected to be by a loan from International Bank for Reconstruction and Development.
Jamshedpur	2.03	22.5	38	(1)	Do.
Durgapur [2](alloy steel plant).	0.1	46	140.7	1966–67	Of the foreign exchange cost, $40 million will come from Japan's Aid-India consortium pledge and $3.25 million will be financed from a special credit from the Canadian Government's Export Credit Insurance Corporation. Cornerstone of the steel smelting shop laid in June 1963 and completion is expected during 1966–67.

[1] Data not available.
[2] New plant.

In 1963 expansion of Bhilai Steel Plant was well underway and that of Rourkela was formally inaugurated in August. Subsequently, work started at Durgapur on the foundation for a new blast furnace.

Construction of a new steel plant with an initial capacity of 1 million tons at Bokaro in Bihar State was envisaged for the third 5-year plan. Beginning in July 1962 a team of experts from the United States Steel Corp. went to India in behalf of U.S. Agency for International Development to make a feasibility study of this plant. Their report, presented to the Government of India on April 8, 1963, proposed a plant with an initial capacity of 1.4 million tons, thereafter rising in two stages to 4 million tons by 1977. The report recommended management for the plant independent of Hindustan Steel Ltd. during an initial 10-year operating period and suggested further studies of raw material supplies. The costs were estimated at US$920 million for the initital stage, US$245 million for the second stage, and US$340 million for the final stage. The proposed plant would produce flat products.

In India it was hoped and even expected that Bokaro would be built with U.S. aid. The Director of AID announced at the end of July that no decision would be taken regarding U.S. aid in 1963. It was also made clear that any assistance to Bokaro would have to come from the overall American assistance to India. Subsequently, the Government of India withdrew its request for U.S. aid for the Bokaro Steel Plant. Although plans for the construction of this plant are actively

pursued, the Indian Government has now abandoned the expectation of realizing output from Bokaro during the third 5-year plan.

Hindustan Steel Ltd. issued a letter of intent to a group of five Japanese companies for construction of 100,000-ton-per-year alloy steel plant in Durgapur. The letter of intent accepted the Japanese firms' proposal covering the design, supply, erection, and commissioning of plant and equipment for 9 of the 11 sections into which the project had been divided. The Amco Furnace Constructors Ltd. of Rexdale, Ontario, will design, supply, erect, and commission the three heating furnaces and soaking pits. The bid for a fourth heating furnace was still pending in June.

Alloy steel plants were being built also by Bagla Alloy Steel Ltd. at Kanpur, Uttar Pradesh, Mahindra Ugine Steel Co. at Khapoli, Maharshtra, and Firth Sterling Steel Co. near Thana, Maharashtra.

Tata Iron & Steel Co., the only producer of silicon sheets, received Government approval for expanding its 24,000-ton-per-year capacity to 42,000 tons. Proposals were considered for a 20,000-ton-per-year silicon-steel facility adjunct to the existing hot and cold-rolling facilities at the Rourkela plant.

To meet the need for foundry pig iron which cannot be fully met by the large integrated steel plants, the Government of India has issued licenses for small plants to produce 540,000 tons of pig iron. In 1963 only one 30,000-ton-per-year unit in Barabil was actually producing, and another unit of 12,000-ton annual capacity was built in the Chanda district of Maharashtra and may have started production. The other licenses have not been utilized.

Lead-Zinc.—In 1963 the Metal Corp. of India continued to be the sole producer of lead-zinc ore and lead metal. It mined about 500 tons of ore per day (average grade 3.03 percent lead, 4.41 percent zinc) from its Zawar mine in Rajasthan. The company also produced 5,920 tons of lead concentrate with 72.9 percent lead and 5.64 percent zinc, and 10,627 tons of zinc concentrate with 55.14 percent zinc and 1.52 percent lead. The lead concentrate was smelted at the corporation's smelter in Tundhoo in Bihar; 11,680 tons of zinc concentrate was shipped to Japan for custom smelting. The ore is argentiferous and in 1963, 118,315 ounces of silver was recovered at the Tundhoo plant. To increase daily production to 1,500 to 1,700 tons of ore a new 30-meter shaft is being sunk at the mine and is expected to be completed in late 1964. A rich deposit with 10 percent zinc and 2 percent lead was reportedly discovered at Balaria, a few kilometers from the present mine; the reserve was estimated to be 25 million tons.

Imports of lead and zinc are mainly ingots. Lead imports in 1963 consisted of 32,652 tons of pig lead, 2,793 tons unwrought lead, 554 tons of antimonial, and the remainder (98 tons) bars, pipes, tubes, and sheets. Zinc imports were comprised of 81,306 tons of slab, 3,280 tons of zinc base alloys, 349 tons of sheet and strips, and 1,109 tons of others. Lead was used principally for making batteries, paints, and alloys (each about 7,000 tons per year) and cable (1,000 to 2,000 tons per year). Estimated consumption pattern of zinc is as follows: Galvanizing 28,000 to 30,000 tons, brass and other alloys 22,000 to 25,000 tons, and zinc oxide 8,000 to 10,000 tons per year. Prices of lead

758-002—65——84

and electrolytic zinc averaged 46 and 53 cents per kilogram, respectively.

A number of steps have been taken or envisaged to increase domestic production of lead and zinc. The Metal Corp. of India, in addition to its program to increase ore production from the Zawar mine, is also building an electrolytic zinc plant near Udaipur to produce 18,000 tons of zinc and from 70 to 80 tons of byproduct cadmium annually. Its lead smelter at Tundhoo is also being expanded to produce 8,500 to 10,000 tons of metal per year. Consolidated Mining & Smelting of Canada and Metal Distributors Ltd. of Calcutta have formed Cominco Binani Zinc Ltd. This firm will build a 20,000-ton-per-year zinc smelter in Edayar near Alwaye in Kerala State; imported zinc concentrates will be used. Byproducts will include 45,000 tons of sulfuric acid and 30 to 40 tons of cadmium. This refinery was scheduled for mid-1966 completion.

Manganese Ore.—The generally declining trend in India's manganese ore production since the mid-1950's continued in 1963. Production was 55.6 percent of the maximum production achieved in 1953. It is estimated that 70 percent of the output was 35 percent manganese ore or higher grade which, in the majority of mines, is brought up to grade by hand cobbing. Orissa was the largest producing State with 31 percent of total output. Other producing States and corresponding percentages of total output were: Mysore 22; Madhya Pradesh 22; Maharashtra 14; Andhra Pradesh 5; Gujarat 2; and Bihar 2. Manganese is also produced in Goa.

Reserves of all classes of manganese ore in India were estimated in 1956 to total more than 100 million tons of mine-run ore, equivalent to about 60 million tons of marketable ore. Much of the ore is of metallurgical grade, but low-phosphorus ore is limited. Principal mines are in the States of Madhya Pradesh and Maharashtra.

In 1961, there were 416 manganese mines in India, with an aggregate average daily employment of 46,923. It is believed 1963 figures are lower. The majority of the mines were small surface operations, but there were about 12 fairly large mines, mainly owned by Manganese (India) Ltd. Principal manganese producers in India and their important mines were the following:

Company:	*Principal mines*
Manganese (India) Ltd	Balaghat, Ukwa, Dongri Buzurg, Tirodi, and Chikla in Madhya Pradesh, and Kandri and Mansar in Maharashtra.
Tata Iron & Steel Co., Ltd	Joda West.
R. B. Seth Shreeram Durgaprasad	Gowari-Wadhona in Madhya Pradesh.
Shivrajpur Syndicate	Bamankua and Pani in Gujarat State.
The Jeypore Sugar Co., Ltd	Mines in Orissa.
Agarwal, R. S. Seth Gopikishan	Mine near Tirodi in Madhya Pradesh.
Orissa Mineral Development Co., Ltd	Mines in Orissa.
Serajuddin & Co	Do.
M. A. Tullock	Barabil, Orissa.

Manganese (India) Ltd. was formed in 1962 with the Government of India and the State Governments of Madhya Pradesh and Ma-

harashtra holding 51 percent of the shares and the British firm, Central Provinces Manganese Ore Co., 49 percent. The latter for many decades had been India's largest producer.

Manganese exports increased from the 1962 level, which was the lowest during the last decade. In spite of the rise, 1963 exports were only 53 percent of the maximum achieved in 1957. New sources of manganese in Africa and Brazil and higher cost of Indian manganese have been the reasons for decline in Indian exports. The US$40 million barter agreement concluded between the United States and India in June 1963 will be of great assistance to the industry. The agreement provides for exchange of agricultural products (90 percent cotton) for approximately 300,000 tons of manganese, 130,000 tons of high-carbon ferromanganese, 6,000 tons of beryl ore, and a minimum of US$2 million of mica block and film.

In 1963 prices of manganese ore with 46 to 48 percent manganese (f.o.b. Indian ports) ranged from US$19.95 to US$22.47 per ton. Average price for other grades was as follows: 42 to 44 percent, US$18.45; 40 to 42 percent, US$16.85; 38 to 40 percent, US$12.47; and 30 to 32 percent, US$8.82. There has been a steady decline in the price of manganese ore exported from India; the 1956 price of high-grade ore was about US$53.

Decline in the export of manganese is partly offset by increasing consumption by the domestic iron and steel and ferromanganese industry. Current consumption for all uses is about 400,000 tons per year.

Mineral Sands.—The large beach deposits of Kerala in South India constitute a large and rich source of ilmenite, monazite, rutile, and zircon. Thorium nitrate and rare earths chlorides and crabonates are produced from processing monazite at the Rare Earths Factory at Alwaye. The thorium salt is further processed for extraction of uranium.

By quantity, ilmenite is the most important mineral produced from India's mineral sands deposits extending from Quilon to Cape Comorin. Production has been declining because of the industry's inability to find export markets. Presence of a small amount of chromite has also adversely affected the marketability of Indian ilmenite. Production was only about one-fifth of that of 1962, and exports declined 24.5 percent. As of December 1962 stocks of unsold ilmenite totaled 300,000 tons. Domestic consumption is limited to less than 10,000 tons used in the plant of Travancore Titanium Products Ltd. (controlled by the Government of Kerala State) at Trivandrum which manufactures titanium paints. The company has been licensed by the Government of India to increase titanium dioxide production by 50 tons per day from the present level of 18 tons per day. Expansion is to be achieved in two stages.

The capacity of the monazite processing plant at Alwaye was increased to 3,000 tons per year of monazite in late 1962, and monazite output has reached this level. Apparently India is able to market readily the rare earths chlorides produced at the Alwaye plant. Thorium hydroxide from the plant is treated at the plant of Indian Atomic Energy Commission at Trombay near Bombay where thorium nitrate, thorium oxide, and uranium fluoride are produced.

Silver.—Of the total silver produced in India in 1963, Metal Corp. of India accounted for 118,315 troy ounces recovered from lead concentrate of the Zawar mine. The remainder was a byproduct of refining gold produced at Kolar Gold Field. Silver was not imported. Prices ranged from US$1.31 per ounce in January to US$1.50 in December, averaging US$1.38 per ounce.

NONMETALS

India has outstanding resources of sheet mica. High-quality refractory minerals such as fire clay, quartzite, magnesite, kyanite, and sillimanite are also available. Much of the industry for manufacturing fire clay refractories and silica brick is near the coalfields of the Bihar-Bengal area where the raw materials are found.

India is deficient in many industrial minerals such as chrysotile-grade asbestos, borax, fluorspar, and sulfur. Fertilizer raw materials (phosphate rock and potash) are completely lacking, except for some apatite deposits.

Cement.—There were 36 cement plants in India with an annual installed capacity of nearly 10 million tons; all but one of these plants was privately owned. The largest producer was the Associated Cement Cos. with 14 plants and 40 percent of the output. Production in 1963 was not sufficient to meet all demands. Inadequate fuel and power supplies and insufficient transportation facilities for moving the cement have at times adversely influenced production.

As of the beginning of the year, licenses for establishing 22 new plants(annual capacity 4.7 million tons) and expansion of 12 existing plants (1.95 million tons additional capacity) were in force. Additionally, seven other projects, with a total capacity of 1.5 million tons, had been approved but not yet licensed. If implemented on schedule, these licenses and approved projects will bring the capacity over the 1965–66 target of 15 million tons. Progress in the establishment of new plants must necessarily be limited by the available foreign exchange and the capacity of the domestic plants for making cement plant machinery, of which there were three in 1963.

The price of cement for sale in bulk is fixed by the Government of India on a uniform free on rail (f.o.r.) destination basis. For most plants the ex-works price of cement is US$15.17 per ton. The uniform f.o.r. destination price of unpacked cement is US$20.53.

Mica.—India normally produces 70 to 80 percent of the world's dressed mica (block, sheet, and splittings). The high quality of the raw material and ample supply of labor skilled in cutting, sorting, and splitting of mica gives India a unique position in this industry. The mica is produced principally in Bihar, Andhra Pradesh, and Rajasthan. In 1963 these States produced 45 percent, 28 percent, and 25 percent, respectively, of India's total output. Mica mines are numerous; 720 were listed in 1960. This year, however, 42 percent of the total crude mica output was reported from 50 mines, having an annual production capacity exceeding 140 tons. Principal producing companies are:

Andhra Pradesh	Krishna Mining Co. Tellabodu Co. (Private) Ltd. C.V.C. Mining Co. (Private) Ltd. The Premier Mica Co.
Bihar	Chrestien Mica Industries Ltd. Chatturam Horilram (Private) Ltd. The Indian Mica Supply Co. (Private) Ltd. S. K. Sahana & Sons Ltd. Eastern Manganese & Mineral Ltd.
Rajasthan	Duduwal and Co. Rajasthan Minerals & Co. Ram Lal Sons R.B. Seth Moolchand Nemichand (Private) Ltd.

Consumption of mica in Indian industries was estimated at 3,000 tons mainly of scrap resulting from dressing. Some of this scrap is utilized in the manufacture of micanite bricks and allied products.

During 1959–63, export of block mica generally declined but splittings and scrap exports have shown an increasing trend. As a result, value of mica exports declined to US$18.6 million, compared with US$22.45 million in 1962, although the tonnage exported was 9 percent higher. Mica splittings accounted for US$10.3 million of the value of all mica exports. A Mica Promotion Council was established in 1956 to bring stability and integrity in the mica trade and to establish better quality control.

The 1963 price of mica, per kilogram f.o.b. Calcutta, averaged from US$5.25 to US$69.30 for various grades of block mica and US$0.63 to US$5.25 for splittings, depending on quality.

In September 1963 the Bihar Regional Mica Convention passed a resolution recommending embargo on exports of mica waste, but at yearend the Ministry of International Trade had not acted upon the recommendation.

Salt.—Except for 3,400 tons of rock salt produced in the Mandi mines of Himachel Pradesh, all salt was recovered from sea brine. Principal producing States and their 1963 production were as follow: Gujarat 2,454,200 tons; Madras 868,600 tons; Maharashtra 462,700 tons; and Andhra Pradesh 266,200 tons. The remainder was produced in Orissa, Mysore, West Bengal, and Kerala. The third 5-year plan envisages a production of 6 million tons of salt by 1965–66. The bulk of the salt is for human consumption, although industrial use is increasing rapidly.

Sulfur and Pyrite.—The sulfuric acid industry (1961–62 production 436,000 tons, 1965–66 target 1.5 million tons) is based almost entirely on imported elemental sulfur, and consumes 75 percent of the imports. Sulfur requirements, currently about 200,000 tons per year, are expected to increase to 500,000 tons by 1965–66. Gypsum for production of ammonium sulfate is used at the Sindri fertilizer plant. However, the gypsum obtained from the Bikaner deposits in Rajasthan has not been suitable, and in 1962 India was importing gypsum from Pakistan. Reportedly Sindri will change to the conventional process of using sulfuric acid in production of ammonium sulfate.

The Indian Bureau of Mines has for some years been examining the Amjor pyrite deposit to determine ore reserves and plan a mining system. The Government-owned Pyrite and Chemicals Development Co. was established in 1960 for the exploitation of the deposit, with a view to recovering elemental sulfur from the pyrite and using the pyrite as is in production of sulfuric acid. The Central Fuel Research Institute reportedly started erection of a pilot plant of 1-ton-per-hour capacity for the recovery of elemental sulfur from pyrite.

MINERAL FUELS

India's energy requirements are met by bituminous coal and lignite, petroleum, hydroelectric power, wood, and animal and agricultural waste. The reserves of coal of all types in India in seams of 4 feet and over up to a depth of 2,000 feet were estimated in 1956 at about 43,000 million tons. This comprises 39,000 million tons of Gondwana (bituminous coal) and 4,000 million of Tertiary (noncoking coal). Of the Gondwana reserve, metallurgical coal, found largely in the Jharia, Raniganj, Giridih, and Bokaro fields of Bihar and West Bengal, comprises about 2,000 million tons. Other coalfields are in Madhya Pradesh and Andhra Pradesh States. The largest lignite deposit is at Neyveli in Madras State, and there are Tertiary coal seams in Assam. Concentration of much of the coal output in a small area of northeast India adds to the price of coal in south and west India.

Although coal is the dominant source of commercial energy, petroleum consumption has increased rapidly. Adequate distribution facilities make petroleum products readily available throughout India. In spite of increasing production, India will remain an importing country in the foreseeable future with more of the imports as crude.

India's hydroelectric potential is estimated at 41 million kilowatts. Installed hydroelectric capacity in 1961 was 1,650,000 kilowatts of a total installed electric production capacity of 5,590,000 kilowatts—the difference accounted for mainly by coal consuming plants. Planned capacity for 1966 is 12,660,000 kilowatts with hydroelectric plants accounting for 5,070,000 kilowatts and coal 7,130,000 kilowatts.

Coal.—*Production and Consumption.*—Both in tonnage and value, coal was the most important mineral commodity produced and continued as India's principal energy source. Coal accounted for nearly three-fourths of the value of mineral output. Production exceeded demand. Pit-head stocks at yearend were 4.72 million tons compared with 3.48 million at the end of 1962; stocks held by consumers totaled 4.4 million tons. Of the total output, 17.5 million tons were coking coal.

In 1962 output per man-shift in coal mines of India was 1.26 tons for miners and loaders, 0.67 ton for all underground and surface workers, and 0.46 ton for all workers; the latter figure increased to 0.51 ton in 1963.

TABLE 7.—Energy consumption 1960–61

Source	Consumption		
	Million tons of coal equivalent	Commercial energy, percent	Total energy, percent
Commercial fuels:			
Coal	54.60	84.00	33.00
Oil	9.50	14.60	5.80
Hydro	.90	1.00	.60
Total commercial fuels	65.00	100.00	39.40
Noncommercial fuels:			
Cattle dung	46.00		27.90
Fuelwood	35.00		21.20
Agricultural waste	19.00		11.50
Total noncommercial fuels	100.00		60.60
Total	165.00	100.00	100.00

Source: M. S. Randhawa, "Assessment and Development of Natural Resources in India," United Nations Conference on the Application of Science and Technology for Benefits of Less Developed Countries. Geneva. February 4–20, 1963.

Bihar continued to be the leading producing State with 49 percent of the total output, followed by West Bengal (30 percent), Madhya Pradesh (12 percent), and Andhra Pradesh (5 percent). Orissa and Assam supplied the remainder.

Important consumers were railways (31 percent), iron and steel (19 percent), power (11 percent), cement and textiles (5 percent each), and cotton mills and paper mills about 3 percent each.

Because of declines in the demand for coal by industrial consumers, estimates of coal consumption by 1965–66, the last year of the third 5-year plan, were revised downward several times, the latest figure being 90 million tons. Of this total, requirements for coking coal were set at 20.4 million tons and for coal to be used to make soft coke for domestic use at 4.5 million tons. Railroads, power and cement plants are expected to require 20.0 million, 13.6 million, and 6.3 million tons, respectively. The fourth 5-year plan target for coal to be attained in the 1970–71 has also been revised downward from 180 million tons to 154.5 million tons.

Distribution.—The improved supply position in 1963 resulted not only from increases in output but also from improved transportation. Railroads were able to move more coal because competing demands on railroad cars were not as severe as before. Coal shipments by rail in 1963 totaled 53.2 million tons compared with 49.2 million tons in 1962. An additional 5.3 million tons were shipped by other means.

Transportaton of coal from mines and its distribution has not always kept up with mine production or requirements of the consumers, particularly the steel industry. The problem arose partly from insufficient railroad cars, long turn-around periods, and the heavy traffic on the Indian railroads in the coalfield area. Pipeline transportation of coal slurry has been considered as a means of supplementing existing facilities. In 1963 a team from the International Bank for Reconstruction and Development (IBRD) was in India to examine ways and means of improving coal transportation.

Principal Mines and Companies.—In 1963 there were 850 operating coal mines in India, with total average daily force of 434,000. Of these, 616 produce less than 100,000 tons, 41 over 200,000 tons, and 30 over 300,000 tons of coal annually. The 71 mines in the latter two groups accounted for almost 50 percent of total output. Coking coal was produced in 180 mines, almost all privately owned. The majority of the mines are underground.

TABLE 8.—Principal coal producing companies and their mines

Company	Date of establishment	Authorized capital (thousand Rs.)	1961 production (thousand metric tons)	Principal mines
Bengal Coal Co. Ltd	1844	12,000	3,200	Poidih, Parbelia, Banksimulla, Sitalpur, Sodepur, Murulidih.
Equitable Coal Co. Ltd	1863	4,000	1,800	Disergarh, Bejdih, Methani, Ranipur, Charanpur, Jamuria.
Burrakur Coal Co. Ltd	1901	15,000	1,300	Loyabad, Mudidih, Teetulmuri, Katras, Saltore.
East Indian Coal Co. Ltd	1893	----------	1,087	Bararee, Jealgora, Kenwadih, South Bulliari, Upper Mehtadih, Selected Jamburiya.
Amalgamated Coalfields Ltd	1924	3,000	1,004	Bhamori, Eklehra, Jatachappa, Datlawest, Rawanwara.
New Beerbhoom Coal Co. Ltd	1873	2,500	790	Kendah, Victoria, Bermondia, Bastacolla.
Bhowra Kankanee Collieries Ltd	1954	7,000	738	Bhowra, Amlabad, Pootkee, Kankanee.
Pench Valley Coal Co. Ltd	1905	3,000	529	Chandametta, North Chandametta, Barkui, Dongarchickli.
Raneegunge Coal Association Ltd.	1873	2,400	502	Kustore, Alkusa, Burragarh.
Katra Jharia Coal Co. Ltd	1893	1,500	350	Seebpore, Laikdih.
Western Bengal Collieries Ltd	1944	20,000	347	Moira, Samla Manderboni.
Tata Iron & Steel Co. Ltd	1907	308,622	1,697	Bhelatand, Choitodih, Bigwardih, Jamodoba, Malkera, Sijua.
Indian Iron & Steel Co. Ltd	1918	160,000	319	Jinagore, Chasnala, Noonodihjeetpur, Ramnagore, Het Kanra.

The publicly owned companies comprise the National Coal Development Corp. (NCDC) and the Singareni Collieries Co. Ltd. NCDC was established in 1956; its paid up capital of about US$29 million, is entirely subscribed by the Central Government. It operates mines in Bihar, Madhya Pradesh, Orissa, and Maharashtra. Andhra Pradesh State owns the majority of the shares of the Singareni Collieries Co. Ltd. which operates three coal mines all in this State. This company produced 3 million tons of coal in 1963.

Expansion and Development.—The third and fourth 5-year plans of India called originally for the following production targets:

Year	Production, million tons			Remarks
	Private mines	Publicly owned mines	Total	
1965-66	64.5	33.5	98	To include 18 million tons of coking coal.
1970-71	89.0	91.0	180	To include 58 million tons of coking coal.

Although these demands have been revised downwards, the NCDC still has to increase its production by perhaps 17 to 20 million tons to meet the 1965–66 target. This organization received assistance from France, Poland, the U.S.S.R., the United Kingdom, and the United States. The U.S. Agency for International Development has financed preparation of engineering plans and estimates for establishing opencast and underground mines in Ramgarh coalfield in Bihar, with total production of 1.5 million tons per year. This Agency is also financing the foreign exchange of ropeways for moving sand needed in stowing operations at Jharia and Raniganj fields of Bihar, but this assistance was not exclusively for NCDC. An agreement signed August 4, 1962, between NCDC and Tjazhpromexport, a supply organization of the Soviet Union, called for the Soviet Union to supply machinery and equipment valued at US$5.7 million as well as technicians to develop the Banki and Surakachar mines in Korba field of Madhya Pradesh. The goal of the project was for the mines to produce a total of 1.7 million tons of coal by 1965.

Another agreement in April 1963 between the same parties provided for development of an open-pit mine at Manikpur in Madhya Pradesh to produce 1 million tons. The U.S.S.R. will supply equipment worth US$1.58 million and technicians for the project. In September 1963 Tjazhpromexport contracted to establish a coal washery at Kathara with an annual capacity of 3 million tons of raw coal. The US$4.3 million equipment cost will be financed by the Soviet Union. Polish assistance is involved in sinking shafts and developing nine deep coal mines to produce coking coal. Development cost for each property will vary between US$31.5 million and $42 million, 30 percent of the costs to be supplied by Poland. Sudamih and Monidih in Bihar are the first mines to be developed, each with 2-million-ton-per-year projected output by 1972. The National Coal Board of the United Kingdom submitted a preliminary project report on a deep-shaft mine at Jarangdih also in Bihar, which is to be developed with United Kingdom assistance. The French contribution is modest (US$210,000) and will provide equipment and personnel to develop an NCDC property in Karanpurian where thick coal seams occur. In addition to the above, NCDC is starting or will start on the following projects, all located in Madhya Pradesh:

Mine	Total cost (million) dollars	Projected output (million tons)	Target date	Type of operation
Singrauli	31.5	2.54	1956–64	Opencast.
Bijuri	4.33	0.3	1963–64	(1).
Kathkona	5.46	(1)	(1)	(1).

[1] Not available.

Private industry is also scheduled to increase its output during the third 5-year plan, although not to the same extent as the publicly owned companies. The International Bank for Reconstruction and Development (IBRD) in August 1961 provided a US$35 million loan to the Government of India to be used by the private coal industry to

meet foreign exchange costs of purchases of equipment. By yearend, coal companies had placed orders for equipment worth US$27.4 million.

Coal Washeries.—Indian coals have a variable and high ash content, and coke made from these coals causes a high slag volume in the blast furnace. To improve the quality of coke, both the private and publicly owned steel companies have built and are continuing to build coal washeries. Seven existing washeries have a capacity of 9.25 million tons of raw coal, producing over 6 million tons of washed coal.

Addition of new washeries and modification of existing plants are scheduled to increase annual input capacity to 31 million tons by 1967–68, producing about 18.5 million tons of washed coal. One of these at Patherdih in Bihar was under construction and is expected to be in operation in mid-1964.

The largest existing washery, Dugda I, with annual throughput capacity of 2.4 million tons, was designed and fabricated by McNally Pittsburg of Pittsburg, Kans. This firm, in a joint venture with Bird & Co. (private) Ltd. of Calcutta, in 1961 established the McNally Bird Engineering Co. Private Ltd. for manufacturing component parts for coal washeries. Bird & Co. (Private) Ltd. is a large British-controlled Indian Managing Agency.

Government Regulations.—To assist the industry, the Government of India reduced import duty to 15 percent on machinery intended for the coal industry effective April 21, 1963, and later introduced a bill in the Lower House of Parliament (Lok Sabha) to amend the Income Tax Act so as to increase from the existing 20 percent to 35 percent the development rebate permissible in respect of certain machinery and equipment installed in a coal mine between April 1, 1963, and March 31, 1966.

Circular 23 entitled "Flameproof Apparatus and Equipment of Indigenous Make" issued in April 1963 to the Indian coal mining industry by the Chief Inspector of Mines in India stated that "* * * The Central Mining Research Station, Dhanbad, have now the necessary facilities to carry out tests on the flameproofness of an electrical apparatus or equipment and some of the indigenous-made apparatus and equipment have passed the necessary tests and approved by this office for use in gassy mines." It is understood that all coal mining equipment, whether imported or made in India, must first meet the Indian Standards Specifications, I.S. 2148 "Specification for Flameproof Enclosures of Electrical Apparatus" and protoypes of the equipment must then be tested by the staff of the Central Mining Station. The Indian Standards Institute is in the process of drawing up further standards and specifications for gathering-arm loaders, arc-wall coal cutters, conveyors, cutter picks, mine cars, axles, wheels, and couplings.

The Coal Board continued to extend assistance to collieries for sand stowing to improve extraction and safety. Payments made for this purpose during the fiscal year ending March 31, 1963, totaled US$4.4 million.

Coal Prices.—Pit-head prices of coal at yearend varied as follows, depending on grade:

	Run-of-mine, dust, and slack coal	Steam coal and nut size
Noncoking	US$3.78 to 5.18	US$3.98 to 5.41.
Coking	US$5.75 to 5.84	US$4.92 to 6.05.

During 1963, coal prices were increased three times. All these increases were connected with wage awards which had to be implemented from certain specified dates. The first increase of Rs0.80 (US$0.17) per metric ton was effected on March 1, 1963. The corresponding increase in the price of hard and soft coke was Rs1.07 per metric ton (US$0.22 per metric ton). The second increase of Rs0.49 (US$0.10) per metric ton was approved on April 1, 1963, to cover another wage increase. The third increase of Rs0.06 per metric ton (US$0.01) was allowed from June 1, 1963, to cover a step-in increase in wages of workers.

Lignite.—The Neyveli Lignite Corp. in Madras in May 1963 invited global tenders for the supply of machinery required to increase the production of lignite from the original annual target figure of 3.56 million tons to 4.88 million tons. The proposed increase in production is to meet the requirements of the Neyveli power station whose capacity is to be raised from 250,000 kilowatts (produced by five 50,000-kilowatt units) to 400,000 kilowatts through the installation of additional units. The integrated lignite project as originally planned envisaged production of 3.56 million tons of lignite to be used as follows in million tons: power generation 1.52; production of nitrogenous fertilizer 0.52; domestic and industrial fuel 1.52.

The lignite is mined in a very large opencast mine which started producing on a relatively small scale in 1961. Full production has not been attained, although output increased to 991,718 tons from 210,748 tons in 1962. The second, third, and fourth units of the powerplant were put in operation, and the last unit was to be completed early in 1964. A revised schedule calls for operation of the fertilizer plant by 1966 and of the briquetting and carbonization plant by 1965.

Petroleum.—*Exploration and Production.*—In 1963 the Oil and Natural Gas Commission (a stautory body set up by the Government of India in 1956) was the most active organization in petroleum exploration in India. On March 19 the Commission announced its decision to drill 120 wells in sedimentary basins of India. Greatest effort will continue in the Ankleswar-Kalol areas in Gujarat, but drilling will also be carried out in the Cambay field and in selected areas of Punjab, Madras, Bihar, and Assam. In the latter State, Oil India Ltd. (a 50–50 partnership between Government of India and Burmah Oil Co.) has obtained a license from the Assam Government to explore for oil in approximately 3,340 square kilometers (1,290 square miles) in the Doomdooma region of Lakhimpur district. The company has programed to drill 30 wells. The Government of India also showed interest in oil exploration in the Persian Gulf with the hope of developing a source of crude for its refineries.

In October 1963 it was reported that 154 wells had been drilled so far in the Ankleswar and Cambay fields: 80 producing wells, 17 gas wells,

41 being tested, and 16 dry. Reserves of Ankleswar were given as 45 million tons.

The large increase in crude oil production in 1963 (4.9 million barrels) resulted primarily from growing production in Ankleswar field.

Refinery production increased nearly 13.1 percent over that of 1962. The increase resulted principally from stepped up operations at the Esso and Burmah Shell refineries in Bombay.

Refineries which were operating at yearend had a total throughput capacity of 9.1 million tons of crude oil. Of this total, 750,000 tons of capacity was publicly owned (Gauhati in Assam), and the remainder was accounted for by the privately owned Burmah-Shell in Bombay 3,750,000 tons, Esso Eastern in Bombay 2,500,000 tons, Caltex in Visakhapatnam 1,600,000 tons, and Digboi in Assam 500,000 tons. In Barauni, a Government refinery was under construction with an initial capacity of 2 million tons to be expanded to 3 million tons annually.

Expansion of the Industry.—On April 27 the Government of India and Phillips Petroleum Co. signed an agreement for the construction of a 2.5-million-ton-per-year refinery at Ambalamukal, 10 miles south of Cochin port in Kerala. A company, Cochin Refineries Ltd., will be formed in which the Government of India will have 51 percent of the shares, Phillips Petroleum Co. 25 percent, and others, including private Indian investors, the remainder. In addition to this, a Government refinery will be built at Koyali (Gujarat) with an initial annual capacity of 2 million tons (two atmospheric units of 1 million tons each and a catalytic reformer) to be increased eventually to 3 million tons. As of late 1963, active construction of Koyali and Cochin refineries had not started. When these two refineries and Barauni are completed, total available capacity will just exceed 15 million tons, roughly equivalent to estimated consumption in 1965.

The private refining companies in India have requested permission to expand their plants to meet some of the anticipated consumption increase (beyond 1965), but Government of India has not licensed them to do so. However, at the yearend the Government was considering proposals for minority participation in erection of a refinery in Madras. The Government also approved a proposal of Esso Standard Eastern Co. to establish a 165,000-ton-per-year lubricant plant, using feedstock from the Esso refinery in Bombay. The Government and Esso will be equal partners in a new company which will be organized. Annual demand of lubricants in 1963 was about 275,000 tons, whereas only 30,000 tons per year has been produced at Digboi and 70,000 tons will be produced when Barauni is completed.

India is receiving financial and technical assistance from the U.S.S.R. in the exploration and development of the oilfields of Gujarat and in the construction of the Barauni and Koyali refineries. Out of the US$375 million Soviet credit for third 5-year plan projects of India, US$69.3 million has been allotted for the petroleum industry. Provision for assistance to the industry was also included under the US$125 million supplementary third 5-year plan credit extended in February 1961. A contract was signed between the Oil and Natural Gas Commission and Technoexport, the U.S.S.R. supply organization, for delivery to India of US$18.9 million worth of oil exploration and production equipment. Technoexport will supply six drilling rigs,

pipes, and other production, transportation and geophysical equipment.

India also imports petroleum products from the Soviet Union, the quantity envisaged for 1963 was 1 million tons, of which 300,000 tons was to be furnace oil. By the end of the second quarter, 220,000 tons of oil products were imported. This oil was distributed by Indian Oil Co., a Government-owned marketing and distributing company formed in 1959.

Pipelines.—The 756-kilometer, 14-inch pipeline from Gauhati to Barauni, with an annual capacity of 2 million tons, was ready for operation in February 1963. This is the second section of the 1,158-kilometer line (owned by Oil India Ltd.) from Nahorkatiya and Moran fields in Assam to Barauni, the first portion of which, 402 kilometers of 16-inch line, was commissioned in March 1962. The Government-owned Indian Refineries Ltd. signed a contract on July 31 with the Ente Nazionale Idrucarburi of Italy for the construction of two product pipelines, each of 12-inch diameter. One 530-kilometer line will connect Haldea near Calcutta to the Barauni refinery, and the other 680-kilometer line will connect the same refinery to Kanpur in Uttar Pradesh. The foreign exchange cost of the two pipelines (US$11.15 million) will be met out of the US$100 million credit granted by the Italian Government in 1961.

Government Regulations.—For the first time the Government of India extended preferential treatment to products refined from indigenous crude. As of June 1 furnace oil and light diesel oil produced wholly from indigenous crude was exempted from all excise taxes and duties when used in the generation of electricity by the publicly owned electricity undertakings, and in the case of furnace oil, when used in railway locomotion.

The 1963–64 budget leveled exceptionally high taxes on kerosine, high-speed oil, and gasoline.

With the aid of the United Nations Special Fund, an Indian Petroleum Institute was established in Dehra Dun.

The Mineral Industry of Indonesia

By Anton W. T. Wei[1]

INDONESIA's contribution to world mineral supplies is primarily its production of tin and petroleum. Tin output in 1963 accounted for about 6.5 percent of the world's total and ranked the country sixth among world producers. In the same year, Indonesia contributed less than 2 percent to the world's crude petroleum output and ranked 11th among world producers. Indonesia was the largest petroleum producer among the Far Eastern countries but ranked below Malaysia, mainland China, and Thailand in tin production. In previous years, Indonesia's tin production had been considerably greater than that of Thailand.

Domestically, petroleum was by far the most important mineral produced. The 1963 output accounted for nearly 80 percent of the total mineral production value of roughly US$400 million. Tin contributed less than 10 percent, and cement, salt, coal, and bauxite made up most of the balance. Government revenue from minerals in 1963 probably was equivalent to about US$125 million, with roughly 80 percent from petroleum and 10 percent from the tin industry. The contribution of the mineral industry to the gross national product was probably 2 to 3 percent.

Although Indonesia's 1963 overall mineral output was at a lower level than in 1962, activities to expand and diversify the mineral industry continued. Construction and site clearing work for iron and steel facilities was advanced. Most of the construction work on the 25,000-long-ton-per-year tin smelter at Muntok on Bangka Island was completed. In the meantime, all Indonesian tin concentrate, as of November, was being shipped to Arnhem for processing under a smelting contract signed with the Netherlands earlier in the year; formerly, most of the concentrate had been shipped to Malayan smelters.

In September, the government made public a new production-sharing regulation designed to make the concept more attractive to potential foreign investors. Under this concept, repayments of loans by foreign interests are to be made in the form of goods or minerals produced. While confirming that management in principle shall be in Indonesian hands, the new regulation allows for full foreign participation in management if it is deemed essential by the Indonesians. It also provides that equipment, goods, etc., may be imported at the favorable rate of Rp315 to US$1 and that a 5-year tax holiday shall apply to all production-sharing arrangements. Nevertheless, in-

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creased economic problems resulting from Indonesia's dispute over the formation of Malaysia and the government's confrontation program have discouraged many foreign companies from making any type of investment in the country.

GOVERNMENT POLICIES AND PROGRAMS

According to Indonesian laws, mineral resources are basically properties of the state, and only a limited number of commodities are exploitable by domestic private interests through negotiation with the government. Foreign interests are permitted to participate in mineral development in Indonesia only on a production-sharing basis. In 1963, petroleum remained the only mineral industry that was not controlled by the government. However, the parliamentary passage on November 9 of petroleum laws governing the operations of foreign oil companies, by far the most significant development in Indonesia's mineral industry during the year, laid down the foundation for the eventual purchase by the government of certain facilities of the oil industry.

SOURCE MATERIAL

Most of the production statistics represent official records carried by the Indonesian Bureau of Mines and supplied to the U.S. Embassy. Data on trade were obtained from official government returns. Information on mineral activities came mainly from Embassy dispatches; the most important of these is the annual minerals report for 1963.

PRODUCTION

Increases in the production of bauxite and coal during 1963 were more than offset by decreases in tin and petroleum output. Indonesia's tin output showed the sharpest decline since World War II as production of concentrates dropped almost 34 percent [2] from the 1962 level. This represented a little more than a third of the postwar peak level achieved in 1954 and roughly half the 1958–60 rate, when export controls were enforced under the International Tin Agreement. Moreover, for the first time in recent history, Indonesian tin production fell below that of Thailand. The country's crude petroleum output, on the other hand, declined only slightly from an average of 457,800 barrels per day in 1962 to 445,200 barrels in 1963.

In contrast to the reductions in tin and petroleum output, the production of bauxite from Bintan and adjoining islands increased by over 6.9 percent (nearly 32,000 metric tons) in 1963. The 1963 bauxite output, however, was nearly 7,000 tons short of the Indonesian Government target of 500,000 metric tons. Similarly, coal production in 1963 increased more than 120,000 metric tons over that of 1962, but fell 59,000 tons short of the government target of 650,000 tons.

[2] Tin (London). Statistical Supplement. April 1964.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Bauxite	387,253	395,678	419,856	[1] 461,168	493,111
Gold [2] troy ounces	7,750	5,660	5,370	4,470	4,440
Manganese ore	[1] 36,755	[1] 11,423	[1] 13,300	4,953	[1] 1,726
Monazite sand	(3)	(3)	101	139	(3)
Nickel ore [4]	7,400	13,758	18,000	12,722	45,705
Silver thousand troy ounces	333	311	324	248	280
Tin:					
Concentrate, metal content long tons	21,613	22,596	18,574	17,587	12,917
Metal do	1,971	1,977	[5] 2,000	[5]2,000	[5] 1,800
Nonmetals:					
Asphalt rock	5,508	1,936	5,590	6,053	9,678
Cement thousand tons	344	387	445	511	[5] 511
Iodine (content of cupreous iodide)	356	3,594	3,144	4,373	(3)
Phosphate rock	9,901	6,870	9,882	5,796	[5] 6,000
Salt:					
Government (reported) thousand tons	315	198	447	304	(3)
Private (estimated) do	150	150	250	240	(3)
Total do	465	348	697	544	(3)
Sulfur	3,458	500	817	932	1,050
Mineral fuels:					
Coal	638,417	657,164	563,530	470,703	591,356
Petroleum:					
Crude thousand 42-gallon barrels	139,038	152,988	155,369	167,771	[1] 162,500
Refinery products [6] do	[5] 85,000	[5] 86,700	79,840	[5] 80,000	[5] 75,000
Natural gas million cubic feet	83,224	90,725	95,577	100,988	[5] 103,222

[1] Final figure; supersedes figure given in commodity chapter, vol. I.
[2] Officially reported Indonesian statistics representing government output; private production, by small unorganized producers, may be as much as 30,000 troy ounces per year.
[3] Data not available.
[4] Reported output, believed to represent mainly, if not entirely, export shipments from wartime stocks.
[5] Estimate.
[6] Breakdown reported for 1961, in thousand barrels, as follows: Gasoline 18,215, kerosine 14,766, distillate fuel oil 18,883, residue fuel oil 26,168, and other 1,810.

TRADE

Most of Indonesia's mineral commodities are exported; the total represents nearly 90 percent by weight and more than a third by value of all Indonesian exports. Mineral exports in 1963 showed a decline from the 1962 rate because of reduced shipments of petroleum and tin. These two commodities have accounted for 95 percent or more of the country's annual exports of mineral commodities. The reduced tin export followed the downward production trend, but the marked decline in the production and export of refined petroleum products was due to the Indonesian Government's intensification of its economic offensive against Malaysia. Although exports of crude oil were up slightly, from an average of 251,200 barrels per day in 1962 to 257,400 barrels for 1963, average daily exports of refined products fell from 123,800 barrels in 1962 to 107,500 barrels in 1963. Definitive 1963 trade data on bauxite, the only other Indonesian mineral export of some significance, are not yet available. However, in line with the increase in production, total shipments, all to Japan, probably were at a slightly higher rate than in 1962.

TABLE 2.—Exports of metals and minerals

(Metric tons, unless otherwise specified)

Commodity	1960	1961	Principal destinations, 1961
Metals:			
Bauxite	272,549	420,728	All to Japan.
Copper scrap	0	8	
Iron and tinplate scrap	6,531	8,363	Hong Kong 5,275; Japan 3,088.
Manganese ore	24,792	4,267	All to Japan.
Nickel ore	13,758	15,000	Do.
Tin:			
Concentrate	34,394	23,499	Malaya 12,272; United States 10,222.
Metal	1,793	1,825	Belgium-Luxembourg 1,515.
Mineral fuels:			
Coal	133	90	(1).
Petroleum:			
Crude—thousand tons	7,416	9,731	Japan 3,109; United States 2,406; Australia 2,305.
Refinery products:			
Benzene and gasoline—do	1,502	1,168	Singapore 549.
Kerosine—do	492	435	Singapore 361; Australia 31.
Motor oils:			
Bunker—do	106	125	United Kingdom 46; Norway 25; Singapore 23.
Other—do	1,178	928	Singapore 502; Thailand 76; South Viet-Nam 52.
Fuel oil—do	3,140	2,987	Singapore 1,359; Hong Kong 553; United Kingdom 300.
Other—do	95	83	(1).

[1] Data not available.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	Principal sources, 1961
Metals:			
Aluminum	2,992	6,381	United Kingdom 1,879; West Germany 1,460; Japan 786.
Copper	1,842	3,404	West Germany 2,080; Japan 688; United Kingdom 392.
Iron and steel	221,022	346,266	West Germany 119,179; Japan 79,417; United States 44,074.
Lead	1,585	3,998	Australia 2,805; West Germany 820.
Zinc	1,117	1,785	West Germany 1,002; Japan 396; Australia 236.
Miscellaneous nonferrous metals	148	222	
Other [1]	5,587	10,216	West Germany 6,181; mainland China 1,391; United Kingdom 576.
Nonmetals:			
Abrasives	147	256	(2).
Asbestos	589	2,206	United States 779; Republic of South Africa 588; Canada 519.
Cement	75,058	343,080	Japan 190,063; Poland 49,530; U.S.S.R. 37,399.
Clays	9,342	10,467	Singapore 6,021; United Kingdom 1,313; United States 1,096.
Graphite	283	513	
Gravel and crushed stone	4,147	7,528	All from Singapore.
Gypsum	10,001	10,056	Mexico 9,808.
Salt	86	42	(2).
Sulfur	8,582	9,444	United States 3,887; West Germany 3,555; United Kingdom 1,218.
Other	8,960	12,910	Mainland China 4,199; Netherlands 3,271; West Germany 1,600.
Mineral fuels:			
Coal	34,831	25,478	West Germany 16,904; United States 8,574.
Coke	258	654	United Kingdom 499; West Germany 153.
Petroleum:			
Crude	354,724	2,142,137	Kuwait 1,394,350; Iraq 727,146; Burma 20,641.
Refinery products:			
Benzene and gasoline	467,933	371,030	Sarawak 209,740; Singapore 157,386; Iraq 3,872.
Kerosine	26,757	186,255	Singapore 180,727; Sarawak 5,528.
Diesel and residual fuels oils	3,316	----------	
Lubricating oils	45,813	64,939	United States 46,258; United Kingdom 10,213, Curacao 6,349.
Other mineral oils	74	288	(2).
Asphalt, all types	14,486	54,563	Aden 40,224; India 5,276; Saudi Arabia 5,071.
Other	889	2,063	(2).

[1] Includes mineral pigments and metallic ores and concentrates.
[2] Data not available.

COMMODITY REVIEW

METALS

Gold and Silver.—The Indonesian Department of Basic Industries and Mining announced in 1963 that it had contracted for the construction of an electric power plant and power lines to an abandoned dredge at the nonoperating Logas gold mine in Riau Province. The department hoped that mining operations at Logas would resume in 1964. The Logas deposit has been estimated as being capable of producing the equivalent of 200 to 300 kilograms of gold per year.

In the meantime, the government-owned company, P.T. Tambang Mas Tjikotok, with mines at Tjikotok and nearby Tjirotan in West Java, remained the only gold-and silver-mining operation officially in existence during 1963. However, many unofficial small-scale opera-

tions known as "people mining" were active and probably produced more precious metals than the official operation.

Iron and Steel.—Construction continued on the Soviet-financed steel mill at Tjilegon in West Java. This 100,000-ton-per-year steel plant and rolling mill has no iron-smelting facilities and initially will use domestic scrap and imported pig iron as raw materials.

The search for iron ore and coking coal for the establishment of an integrated iron and steel industry was continued throughout 1963 by a team of Soviet technicians in Kalimantan, but information from Indonesian Government sources indicates no discovery of any significance. In the meantime, it was reported that core drilling of iron deposits in the Lampung area of South Sumatra by engineers of the Directorate of Geology delineated only 300,000 tons of ore instead of the 10 million tons estimated previously. It has been reported that the blast furnace facilities, to be erected in the area with financing from West Germany, will have to depend on iron sands from south Java as part of the raw materials. At yearend, actual construction had not begun, although land clearing had started at the project site.

Manganese.—The Manganese Mining Co. at Kliripan, Special District of Jogjakarta (central Java), formerly a privately operated company, was taken over by the Special District government. Thirty million rupiahs worth of equipment was purchased from Japan to renovate the mine. Meanwhile, mining operations on Java were dormant during most of 1963 because of lack of markets. Stockpiled ore on the island was reported to be 30,000 tons near yearend. Japanese interests continued to be the only purchasers of Indonesian manganese.

Nickel.—Negotiations between the Japanese Sulawesi Nickel Resources Development Cooperation Co., the General Management Board of (Indonesian) State Mining Enterprises, and P.T. Nickel (a privately owned Indonesian company), which began in 1961 and continued through 1962, were successfully concluded in 1963. A final series of negotiations in Tokyo resulted in the signing of a production-sharing contract in which Japan agreed to provide credits equivalent to US$1.35 million in the form of mining equipment and technical services. Repayment of the loan is to be made in nickel over a 7 year period. Production was to begin in mid-1964 and the near-future target is 16,000 tons of ore per month, 6,000 tons from Mantang Island and 10,000 tons from Pomalaa on the mainland of southeast Sulawesi. The nickel content of the ore averages about 3 percent.

Tin.—Although most of the construction on the Peltim smelter at Muntok, Bangka Island, was completed during 1963, work on harbor and related facilities continued into 1964. Officials of the Indonesian Tin Bureau expected the smelter to go into full production in mid-1965. In the meantime, the smelting contract with the Arnhem smelter of the Netherlands, signed in early 1963, contains a clause allowing for cancellation when Peltim goes into full production.

A formal application for a development loan of US$12 million was submitted to the U.S. Agency for International Development (AID) during June 1963 by the Indonesian General Management Board (Badan Pimpinan Umum—BPU) for State Tin Mining Enterprises (Perusahaan Tambang Timah Negara—TIMAH). The tin project contemplated under the terms of the loan application conformed

with recommendations of the Colorado School of Mines Research Foundation contained in its report dated October 1962. It was conceded by both United States and Indonesian officials that approval of the loan would depend on acceptance by the Indonesian Government of a plan sponsored by the United States and several European countries to stabilize the economy; the application was pending at yearend.

Indonesia was paying increasingly more attention to the offshore mining of tin as known land reserves on the tin islands are limited. BPU–TIMAH signed a contract in 1963 with the United Kingdom firms of Simon-Lobnitz and Alexander Stephen and Sons, Ltd., for the construction of a large deep sea dredge capable of producing 1,000 tons of mine tin per year; 80 percent of the contract price was financed with a loan of £2,240,000 from United Kingdom banks. Completion of design and construction of the dredge would take 3 years.

MINERAL FUELS

Coal.—The increase in coal production in 1963 reversed the downward trend of the past several years. The Bukit Asam open pit operation in South Sumatra has always been Indonesia's largest coal producer. The Paul Weir Co. of Chicago, in its report of 1963 based on its feasibility study conducted in late 1962 under AID sponsorship, proposed a 4-year program with moderate expenditure to increase annual production of Bukit Asam to 700,000 tons of coal. Meanwhile, large-scale improvements would be made, so that the mine would be equipped and organized to go on to an annual output of 2 million tons within 3 additional years. The cost of this overall project was estimated at US$11.7 million, US$10.5 million for equipment and US$1.2 million for engineering and technical services. Through yearend BPU had made no application to AID for a development loan, as had been intended originally.

The Ombilin underground mine in west Sumatra was being converted into a modern mechanized operation with credits, equipment, and technicians provided by the Government of Poland. The project calls for an eventual annual output of 1 million tons. The Mahakam Coal Mine is the official name given to the State enterprise in east Kalimantan, often referred to by such place names as Samarinda, Laokula, and Sebuku. Production from this small operation using crude methods will not become important unless large-scale modernization is undertaken.

Petroleum.—The Indonesian petroleum industry passed one of its major milestones in 1963 when the government enacted two laws on November 9 which approved working agreements between the State-owned oil companies and foreign interests operating in the country. The first, and by far the more important, approved contracts signed on September 25, 1963, between the Indonesian Oil Mining Co. (Pertambangan Minjak Indonesia—Pertamin) and the Caltex Pacific Oil Co., between National Oil and Natural Gas Mining (Pertambangan Minjak dan Gas Bumi Nasional-Permigan) and P.T. Shell Indonesia, and between National Oil Enterprise, Ltd. (P.T. Perushaan Minjak Nasional-Permina), and P.T. Stanvac Indonesia. Under the terms of the contracts, these established foreign oil companies agreed to give up

all rights held prior to the 1960 Minerals Law and to become contractors to the Indonesian State companies. The second law approved the agreement reached between Pertamin and the Pan American Oil Co. in June 1962, when the latter first ventured into Indonesia for the purpose of oil exploration work.

Upon signing the contract, each company agreed to pay US$5 million as an initial bonus; the companies also will pay the government 60 percent of their net profits calculated on actual earnings, the same rate that had been applicable during the previous 2 years. These oil companies are to sell all domestic marketing facilities to the Indonesian Government within the next 5 years. Shell and Stanvac were guaranteed retention of their refineries for 10 years, but provision was made for the sale of these facilities to the Indonesian Government before the end of 15 years, with the sale price decreasing to zero if the transaction is made at the end of the period. The companies' exploitation rights on existing producing areas are to extend for 20 years. Perhaps most significant to the future of Indonesia's petroleum industry is the provision for the companies to explore in extensive new areas in Kalimantan and Sumatra for a maximum of 30 years.

The Mineral Industry of Japan[1]

By K. P. Wang[2]

JAPAN'S mineral industry ranked about sixth or seventh in the world in 1963. Its estimated mineral and metal output value (mine output value plus added value derived from smelting and processing) in 1963 was approximately US$4.5 billion, about equal to that of France and substantially more than that of mainland China. The mining industry was only of moderate significance. However, the metallurgical industry was very large and diversified to meet the demands of the Japanese industrial-manufacturing economy.

While Japan's mineral resource base has proven stronger than it was generally suspected in the past, raw material requirements have far exceeded domestic supplies of most commodities, necessitating large imports from many parts of the world. Possessing an advanced technology, the country processed various crude ores into finished mineral and metal products partly or primarily for export. To meet domestic and foreign demand, many mineral commodities were produced in world significant quantities during 1963.

The country ranked fourth behind the United States, the Soviet Union, and West Germany in output of steel, and the annual steel production rate in late 1963 indicated that Japan could surpass West Germany in 1964. Japan was a significant world producer of nonferrous base metals, being more prominent in zinc and copper than lead. Aluminum production rose; Japan ranked fifth in the world in its production. The country remained second in titanium production behind the United States. Japan was also a prominent producer of ferroalloys, minor metals, and high-purity metals. Among nonmetal mineral products, Japan ranked first in the world in pyrite output, third in cement production (which increased sufficiently to maintain this position) behind the United States and the U.S.S.R., and either first or second in pyrophyllite output. In mineral fuel commodities, Japan was an important refiner and consumer of crude oil and produced sizeable quantities of coal. Japanese output of many additional mineral commodities constituted 1 to 2 percent of the world totals.

Steel, Japan's premium industry, experienced growth in many directions during 1963. All of the large steel companies were either building new steel centers or adding new facilities to existing centers. Technical improvements were made, particularly with regard to intensifying blast furnace smelting and streamlining oxygen converter

[1] For background data and further details see Wang, K. P. Minerals in Japan's Industrial Economy. BuMines Inf. Circ. 8100, 1962, 37 pp.

[2] Chief specialist, East Europe-Far East, Division of International Activities.

TABLE 1.—World significance of selected Japanese metal and mineral products, 1963

Commodity	Approximate world rank in output	Approximate share of world output (percent)	Adequacy of production	Raw material supply [1]
Metals: [2]				
Aluminum (smelter).	5	4	Roughly self-sufficient	Virtually all bauxite imported.
Bismuth	About 5	10	Moderate surplus	Byproduct of nonferrous ores.
Cadmium	5	8	Large surplus	Mostly domestic zinc byproduct.
Copper (smelter)	8	5	Somewhat deficient	Ore imports exceed output.
Iron, pig	4	7	Slightly deficient	About 85 percent iron ore imported.
Iron, steel ingot	4	8	Self-sufficient	Nearly one-fourth metallic iron imported.
Iron, steel products	4	About 8	Sizable surplus	Virtually all steel ingot used is made locally.
Lead	8	4	Somewhat deficient	Ore imports nearly equaled output.
Magnesium	7	2	Slightly deficient	Raw material is local dolomite.
Manganese ore	10	2	Greatly deficient	All high grade ores imported.
Mercury (mine)	8	2	do	Ore imports 4 times mine output.
Nickel (smelter)	Among first 10.	Under 2	Somewhat deficient	All nickel ores imported.
Tin (smelter)	11 [1]	1	Greatly deficient	Ore imports nearly twice.
Titanium [3]	2	20	Large surplus	Mostly domestic titaniferous sands.
Zinc (smelter)	3	About 8	Slightly deficient	About one-fourth ore imported.
Nonmetals:				
Cement	3	About 8	Small surplus	Predominantly domestic; some gypsum imported.
Feldspar	7	3	Self-sufficient	Almost all domestic.
Pyrite	1	20	do	All domestic.
Pyrophyllite	1 or 2	23	do	Domestic pyrophyllite clays.
Sulfur	6	2	do	Domestic sulfur-pyrite ores.
Mineral fuels:				
Coal	10	2	Great shortage of coking coal.	Steam coal reserves can sustain output.
Coke	5	5	Nearly self-sufficient	Most good coking coal imported.
Refined petroleum	About 5	About 4	Self-sufficient except fuel oil.	More than 98 percent crude oil imported.

[1] Estimate.
[2] Japan produced and exported large quantities of ferroalloys, based mainly upon imported ores. It also produced great varieties and sizable tonnages of lesser and minor metals.
[3] Status pertains to the free world countries only, with the Soviet Union excluded.

operations. In the nonferrous base metals industry the most noteworthy developments were Mitsubishi Metal's decision to build a very large and modern copper refinery and the start of aluminum production by a fourth company, Mitsubishi Chemical, which processed alumina imported from Australia. A number of giant-sized cement kilns were installed in 1963. Japan experienced its worst coal mine disaster at Mitsui Coal Mining's Miike mine—the country's foremost coal mine. Hydraulic coal mining was being encouraged. The oil refining industry greatly expanded, with additional refining capacity being built. At yearend, it became increasingly apparent that crude oil production from Japan's concession in the Kuwait-Saudi Arabia Neutral Zone showed great promise.

GOVERNMENT POLICIES AND PROGRAMS

The Japanese Government continued in 1963 to pursue the policy of maximum development of domestic resources and importation of de-

ficient items as required. With Japanese industry operating under the private enterprise system, the Government exercised its regulatory functions only to a moderate extent while carrying out definite mineral policies.

Government programs included giving assistance to small mines in 1963 through favorable taxation and aid in exploration. Large mining companies were able to benefit from this assistance also by placing marginal and new operations into the status of small subsidiaries. The program of rationalization was emphasized, involving closure of uneconomic mines, consolidation of operations, erection of new shafts, and technical improvements in general. Japanese mines were being readied for more open world competition under the trade liberalization program and through the reduction of foreign exchange restrictions. The coal industry was still protected in 1963, but the policy was to rely on imported petroleum to meet most of the expanding energy needs.

The government exerted considerable influence on mineral and metal imports through foreign exchange controls, import quotas and duties, and direct and indirect financing. Private Japanese companies were urged to present a united front abroad in developing and purchasing minerals. The policy has been to spread raw material imports in as many areas as possible to insure dependability of supply and balanced trade with various countries. An ore carrier construction program to reduce shipping charges from distant lands has been in existence for some years. The quasi-government Overseas Mineral Resources Development Co. was formed in 1963 to help develop some of the more risky mines abroad.

In the case of metallurgical and refining facilities, which process both indigenous and imported raw materials, the role of the government has been to encourage rationalization and modernization, promote establishment of new facilities according to need, pass judgment on important large projects, allocate production quotas among individual companies, and help hold back construction programs in times of economic stress. Better conditions in 1963 as compared with conditions in 1962 brought about more liberal policies towards development of additional plant capacity.

Japanese laws have been designed to attract foreign investment, loans, and technical assistance. The Foreign Investment Law of Japan, applicable to all firms, does not prohibit majority stock ownership by foreign concerns, although in practice Japanese capital almost always prevails. As of 1963, foreign capital (particularly U.S. capital) was involved heavily in the oil, aluminum, and mining equipment industries. On the other hand, the steel industry, which used foreign loans and technical licensing arrangements to accelerate development, was solidly in Japanese hands. Most large nonferrous base metal concerns were also predominantly financed by Japanese capital, but recently a few have joined with foreign capital in developing mineral deposits abroad. The Japanese Government held the power of approval over specific projects involving foreign participation.

PRODUCTION

Japan's overall mineral output value in 1963 was more than 10 percent higher than that in 1962. Progress during 1959–63 was even more striking, with a total increase well over 50 percent. Production based upon domestic mineral raw materials rose at a far lesser pace than that based upon imported raw materials. The large and modern metallurgical industry, exemplified by the steel sector which relied primarily on foreign iron ore and scrap, has expanded greatly in the last 5 years.

The Mining Yearbook of Japan, published annually by the Ministry of International Trade and Industry (MITI) and containing fairly accurate statistics, gives only a partial picture of the country's mineral output value. For 1962 (the last year available) US$1.882 billion was credited as the output value. By adding major omitted items, such as the estimated added values derived from domestic raw material-based cement and steel and imported raw material-based steel, nonferrous metals, and oil, the actual total would exceed US$4 billion for 1962. The US$4.5 billion dollar estimate made for 1963 constituted about 7.5 percent of the gross national product (GNP for fiscal year 1963 was about US$61 billion).

TABLE 2.—Reported value of selected mineral products, 1962[1]

(Million U.S. dollars)

Commodity group	Output value	Added value	Total
Metal ores	178	118	296
Nonmetal ores	103	64	167
Metals other than iron	386	52	438
Coal	562	362	924
Oil and gas	36	21	57
Total	1,265	617	1,882

[1] Includes only items produced from domestic raw materials and does not include added value derived from domestically based cement, iron and steel. The figures also exclude very sizable mineral output values derived from processing imported raw materials such as ferrous and nonferrous ores and crude oil.

Steel, chiefly as a result of added value through processing imported raw materials, accounted for about 33 percent of the 1963 mineral output value; domestic coal, about 20 percent; oil refining, about 12 percent; added value for metals produced from domestic ores, about 10 percent; domestic metal ores, about 7 percent; added value in processing imported nonferrous ores about 3 percent; cement, about 7 percent; and other nonmetals, about 4 percent.

Production of specific mineral products clearly reflects the overall expanding nature of the economy, in terms of greater and more diversified internal demand, general success in acquiring foreign raw materials and selling finished products abroad, mass construction of new production facilities, and improved efficiency in operations and maximum utilization of available resources. Although the general tendency was upwards, output was affected by Japanese and worldwide economic cycles which, for example, showed that 1962 was a recession year and 1963 a year of recovery and renewed expansion.

During 1959–63, output of steel, aluminum, and cement approximately doubled, there being a steady demand for these products in

construction and no raw material shortages. Because of cost difficulties and competition from oil, coal production increased only slightly from 1959 to 1962 and fell in 1963 by over 2.5 million tons nearly to the 1960 level. Petroleum refining and consumption showed a phenomenal rise, with oil furnishing about half of the 1963 energy supply. In nonferrous base metals, mine production rose slightly during 1959–63, whereas metal production increased by more than 50 percent. Some special metals and alloys, which are depended upon the foreign market to an important extent, fluctuated mildly while others declined. Output of many minor metals increased. Almost all of the nonmetals showed production increases. A very notable trend in 1959–63 was that Japan's overall mineral consumption had risen radically.

By yearend 1963 Japan was producing at an annual rate of 35 million tons of steel, 30 million tons of cement, and over 50 million tons of both refined oil and coal. Among the lesser but still important mineral products, the country was also producing roughly 1 million tons of nonferrous metals, 500,000 tons of ferroalloys, and a total of 3 million tons of various kinds of pyrites.

TABLE 3.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Alumina	298,428	354,788	420,518	433,469	510,539
Metal, ordinary	99,122	131,239	152,513	169,664	222,073
Metal, superpure	1,018	1,984	1,186	1,786	1,869
Oxide, fused	(1)	(1)	(1)	35,830	33,728
Antimony:					
Mine	308	271	195	172	192
Regulus (metal)	1,464	1,618	2,127	2,268	2,067
Oxide	888	1,021	1,237	1,091	1,175
Arsenic (white)	1,075	1,131	950	917	820
Bismuth, metal kilograms	101,237	118,429	191,566	259,839	373,500
Cadmium, metal	491	568	724	883	1,012
Cerium kilograms	35,452	42,395	65,630	96,181	(1)
Chromium:					
Concentrate, almost all low-grade	57,677	67,489	70,171	58,082	43,731
Metal	990.2	641.8	509.8	211.0	(1)
Cobalt kilograms	18,927	17,768	5,365	48,385	20,273
Copper:					
Mine	85,248	89,183	96,409	103,620	107,019
Metal, primary electrolytic	193,972	248,108	277,005	270,430	295,201
Metal, secondary	(1)	(1)	(1)	87,881	88,863
Germanium, metal kilograms	11,975	22,140	24,373	22,368	14,493
Germanium, oxide do	5,126	11,727	14,724	18,619	(1)
Gold, refined troy ounces	328,195	336,007	378,929	420,950	432,556
Iridium do	(1)	112,142	139,084	150,658	(1)
Iron and steel:					
Direct smelting ore thousand tons	1,191	1,290	1,159	1,144	1,130
Iron sands do	1,357	1,564	1,712	1,443	1,268
Pyrite sinter do	1,746	1,876	1,909	2,004	2,000
Pig iron do	9,446	11,896	15,821	17,972	19,936
Ferroalloys:					
Ferrochrome	69,953	80,420	100,095	84,528	81,880
Ferromanganese	157,841	155,603	185,531	166,593	165,594
Ferromolybdenum	2,059	1,786	1,985	505	1,017
Ferronickel	33,407	55,334	62,647	35,972	46,883
Ferrosilicon	65,686	75,062	98,120	75,355	94,174
Ferrotitanium	93	227	456	457	172
Ferrotungsten	579	1,197	1,703	883	760
Ferrovanadium	426	859	1,289	608	1,287
Silicomanganese	57,916	57,693	95,849	(1)	(1)
Steel ingots thousand tons	16,629	22,138	28,268	27,546	31,501
Rolled steel, hot rolled do	12,090	16,051	20,392	20,809	23,307

See footnotes at end of table.

TABLE 3.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals—Continued					
Lead:					
Mine	36,146	39,532	46,280	53,455	52,721
Metal, refined	64,312	74,193	83,283	92,192	101,106
Magnesium	1,564	2,144	2,247	2,087	2,439
Manganese:					
Ore, mostly low-grade	348,086	323,984	304,121	308,590	277,151
Oxide	2,267	3,507	7,477	9,396	(1)
Metal, electrolytic	2,600	4,028	4,568	4,800	(1)
Mercury:					
Mine	215	200	189	153	160
Metal	556	1,158	875	566	641
Molybdenum:					
Mine, MoS_2	637	635	610	623	553
Metal—kilograms	61,297	86,617	90,346	106,667	(1)
Nickel: Metal	5,227	5,553	6,065	5,665	6,190
Palladium—troy ounces	341	563	1,550	1,372	1,326
Platinum—do	470	1,396	2,247	1,872	1,714
Selenium—kilograms	104,093	126,206	136,198	140,304	142,200
Silicon, high-purity—do	23	2,606	4,068	6,315	10,743
Silver, electrolytic thousand troy ounces	9,478	10,420	12,514	14,753	15,214
Tantalum—kilograms	(1)	(1)	5,702	4,704	5,319
Tellurium—do	1,252	6,201	7,478	10,509	6,013
Tin:					
Mine—long tons	998	842	852	859	858
Metal, electrolytic and fire—do	1,308	1,260	1,644	1,903	1,976
Titanium:					
Slag	3,125	1,310	1,609	524	874
Metal	2,477	2,307	2,283	1,513	1,759
Tungsten:					
Concentrate	921	835	825	920	651
Metal	310	488	570	440	515
Zinc:					
Mine	142,337	156,734	168,259	192,481	197,943
Metal, electrolytic	100,537	109,540	135,743	158,895	177,127
Metal, distilled	58,803	70,918	76,688	86,413	87,210
Sulfate	22,536	28,200	27,685	24,944	32,873
Oxide	4,323	5,153	4,726	6,656	
Zirconium—kilograms	67,127	52,178	44,377	83,000	(1)
Nonmetals:					
Asbestos, chrysotile	12,368	15,460	17,054	13,977	16,520
Barite	19,351	22,847	29,250	38,116	37,518
Bromine	1,576	1,951	2,772	2,887	3,552
Cement [2]—thousand tons	15,170	22,537	24,498	28,650	29,789
China clay (kaolin)	20,867	21,279	26,939	71,860	109,755
Dolomite—thousand tons	1,330	1,702	1,874	1,796	1,743
Feldspar, aplite	69,724	84,378	124,848	162,254	205,985
Fire clay—thousand tons	691	826	1,002	904	809
Fluorspar	5,156	9,170	14,811	15,531	20,859
Graphite:					
Amorphous	818	1,037	481	428	457
Crystalline	3,222	3,480	2,999	3,030	2,485
Gypsum—thousand tons	541	735	725	800	783
Iodine	783	950	1,120	1,409	1,686
Lime, quick—thousand tons	(1)	(1)	(1)	1,171	1,371
Limestone—do	31,162	38,519	44,026	49,964	53,479
Phosphates (superphosphates)—do	1,852	2,150	1,879	1,809	1,662
Potash, carbonate	3,516	4,230	4,184	5,906	5,583
Pyrite—thousand tons	1,886	2,057	2,273	2,349	2,587
Pyrrhotite—do	247	258	244	231	
Cupriferous pyrite—do	28	384	384	445	(1)
Salt—do	1,166	886	828	856	782
Pyrophyllite	214,263	251,072	283,546	266,575	289,059
Sulfur, refined from ore	219,129	247,593	242,282	223,975	221,495
Sulfur, recovered from oil	7,955	8,460	8,294	8,686	11,612
Sulfur ore, for making acid thousand tons	661	725	736	656	(1)
Sulfuric acid—do	4,195	4,452	4,683	4,910	4,991
Talc	40,163	50,728	55,853	57,237	67,604
Silica:					
Soft silica stone—thousand tons	1,396	1,760	1,891	2,139	2,092
High-grade sand	923	1,097	1,380	1,524	1,608

See footnotes at end of table.

TABLE 3.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Mineral fuels:					
Coal:					
Anthracite thousand tons	[2] 1,616	[2] 1,803	[2] 1,894	1,873	1,798
Bituminous do	[2] 45,272	[2] 48,919	[2] 52,148	52,525	50,255
Lignite do	1,469	1,408	1,309	1,111	914
Coke from coal:					
From coke ovens do	7,120	8,549	10,913	11,548	15,440
From gas plants do	3,224	3,720	3,797	3,454	3,374
Natural gas million cubic feet	18,913	27,297	35,464	45,120	63,243
Petroleum:					
Crude oil thousand 42-gallon barrels	2,838	3,678	4,590	5,316	5,485
Refinery products:					
Gasoline thousand 42-gallon barrels	32,098	38,491	45,645	50,362	58,370
Naphtha do				14,621	20,651
Jet fuel do	1,714	2,267	3,016	3,396	4,299
Kerosine do	9,799	13,316	14,606	18,649	24,779
Gas oil do	10,556	14,722	18,229	22,270	29,498
Fuel oil A do	7,832	7,794	10,207	11,185	11,926
Fuel oil B do	22,628	27,617	29,992	32,750	34,788
Fuel oil C do	38,854	69,772	89,296	107,175	153,111
Lubricating oil do	3,331	4,039	4,632	5,099	5,403
Liquefied petroleum gas	207,409	357,414	582,471	760,812	[1]
Paraffin	46,340	45,797	45,680	49,102	[1]
Petroleum asphalt	420,733	469,214	605,580	622,933	[1]
Petroleum coke		9,759	56,865	59,414	[1]
Petroleum grease	26,932	31,416	34,599	36,344	[1]
Total thousand 42-gallon barrels of refined products	135,450	190,620	234,080	280,260	361,030
Carbon black	19,187	24,990	42,609	66,690	73,445

[1] Data not available.
[2] Revised figures; supersedes those given in commodity chapter, volume 1.

Sources: U.S. Embassy, Tokyo, Japan. Mineral Production Statistics Questionnaire 1963. State Department Airgram A-1273, Apr. 21, 1964. Mining Yearbook of Japan, 1959–62. Ministry of International Trade and Industry. Petroleum Yearbook of Japan, 1961–62. Ministry of International Trade and Industry.

TRADE

Japan has been an important world trader of mineral raw materials and products, being both prominent as an importer and an exporter. Among the major items imported during 1963 were more than 26 million tons of iron ore, over 4 million tons of steel scrap, nearly 10 million tons of coking coal, just under 52 million tons of crude oil, 1.4 million tons of bauxite, nearly 300,000 tons of copper, almost 150,000 tons of combined lead-zinc in terms of ore content, over 300,000 tons of manganese ore, nearly 250,000 tons of chromite, roughly 1 million tons of potash, 2 million tons of phosphate rock, and 3 million tons of salt. Japan's mineral imports were not only important by world standards but also represented a significant share of the country's overall imports, roughly 30 percent of the total value.

Steel semimanufactures represented by far the leading class of Japanese mineral and metal exports, and the country was one of the world's foremost exporters of such products. This class alone, comprising over 5 million tons in aggregate weight and valued at more than US$700 million in 1963, constituted one-seventh of Japan's total exports. Large quantities of additional steel were exported in the form of finished products. Japan's 2 million tons of cement exports in 1963 also loomed large by world standards, although valued at only some US$30 million. Many other mineral products were exported in lesser amounts. Generally, mineral exports were not as important as min-

eral imports, since Japan's economy places much greater stress on exports of manufactured products.

The United States was Japan's most important single mineral trading partner, furnishing nearly one-third of the imports and taking more than one-fourth of the exports. American coking coal, steel scrap, molybdenum concentrate, and phosphate rock represented well over one-half of Japan's imports of such items during 1963. In return, the United States took about 30 percent of Japanese iron and steel exports. The Near East provided four-fifths of Japan's crude oil imports, including an important share from Japanese concessions in the Kuwait-Saudi Arabia Neutral Zone. Malaya (subsequently Malaysia) was the leading source of iron ore, followed by India. The Philippines, Australia, and Canada were the prominent suppliers of nonferrous base metals (mostly in concentrate form). Although emphasis has been placed on closer areas, such as Southeast Asia, South Asia, and Australia, Japan continued to draw mineral supplies from all over the world. Japanese steel products were likewise shipped to many parts of the world, with significant shares going to the United States and to less developed Far East countries. The principal foreign markets for Japanese cement were within the Far East.

TABLE 4.—Mineral trade with the United States in 1963 [1]

Item	Total (million U.S. dollars)	U.S. share of total (percent)	Item	Total (million U.S. dollars)	U.S. share of total (percent)
Imports:			Imports—Continued		
Aluminum and aluminum alloy scrap	6.9	53.8	Petroleum	971.2	5.6
Copper and copper alloys	36.3	23.3	Total	1,951.0	20.2
Copper and copper alloy scrap	42.1	42.2	Total all imports	6,738.5	30.8
Iron ore	355.7	7.2	Exports:		
Iron and steel	89.3	11.3	Iron and steel	702.1	30.3
Iron and steel scrap	185.8	73.0	Nails, bolts, nuts, etc	48.5	77.9
Molybdenum concentrate	6.3	91.7			
Phosphate rock	33.5	66.2	Total	750.6	33.3
Potassium fertilizer	43.0	29.2	Total all exports	5,453.6	27.6
Coal	180.9	53.8			

[1] Selected major items only.

As one result of the worldwide quest for mineral raw materials, Japan encountered both domestic and international pressures to liberalize import regulations. Specific mineral and other products were controlled in terms of foreign exchange allocation and import quotas, and tariffs were set up to protect domestic industry. Although the Japanese concept of "liberalization" was to reduce restrictions and permit more open competition, duties were in some cases temporarily increased. Crude oil import controls were liberalized in October 1962 and those of copper in April 1963. At the end of 1963, lead and zinc import regulations were due to be liberalized. A new era was beginning for Japan in international trade as a result of the gradual liberalization of imports in minerals and other products.

TABLE 5.—Selected exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1962	1963	Principal destinations, 1962
Metals:			
Aluminum:			
Ingots and equivalent primary forms.	5,493	14,095	United States 3,628; Italy 1,000; South Korea 749.
Semimanufactures, including alloy semimanufactures.	12,618	18,217	United States 4,985; Thailand 1,271; Hong Kong 1,190; South Korea 959.
Bismuth and alloys, including products.	89	162	France 48; Netherlands 20.
Cadmium and alloys, including products.	259	1,194	Netherlands 79; France 46; United States 42; West Germany 31.
Copper:			
Cathodes and wire bars	2,082	1,458	All to Taiwan.
Semimanufactures, including alloy semimanufactures.	16,154	18,307	Hong Kong 4,045; Philippines 3,393.
Iron and steel:			
Ferroalloys:			
Ferromanganese	21,429	14,385	United States 11,471; United Kingdom 2,925; West Germany 2,299.
Ferrosilicomanganese	6,567	3,760	United States 5,054; United Kingdom 613; Canada 560.
Ferrochrome	12,485	7,964	United States 4,025; Netherlands 2,588; United Kingdom 2,039.
Ferrovanadium	281	382	North Korea 142; Taiwan 100.
Other	4,065	860	(1).
Total	44,827	27,351	United States 20,677; United Kingdom 5,577; Netherlands 3,770.
Semimanufactures:			
Heavy plates. thousand tons	404	464	Argentina 75; United States 65; South Korea 36; Italy 30.
Medium plates do	93	129	Spain 11; United States 11; South Korea 10.
Thin plates and sheets. do	816	1,054	United States 83; Philippines 78; Italy 64; Belgium 59; Spain 59.
Tin plates do	124	186	Philippines 19; Taiwan 19; mainland China 12.
Galvanized sheets do	306	420	United States 45; Nigeria 29; India 15.
Coils for rerolling do	81	272	Italy 34; Spain 30; United States 13.
Wire rod in coils do	383	479	United States 286; U.S.S.R. 24.
Bars and rods do	542	840	Hong Kong 100; U.S.S.R. 83; United States 81.
Shapes do	77	170	United States 18; South Korea 8.
Wire do	251	269	United States 113; Thailand 22.
Tubes and pipes, seamless. do	166	230	United States 29; Canada 18; U.S.S.R. 10.
Tubes and pipes, welded and clinched. do	273	465	United States 186.
Magnesium and alloys, including products.	120	20	United States 110; Canada 9.
Molybdenum and alloys, including products.	7	28	U.S.S.R. 7.
Manganese dioxide	7,960	9,102	Hong Kong 2,202; West Germany 951.
Silver troy ounces	1 668,135	1 93,237	United States 398,669; United Kingdom 208,980.
Titanium:			
Dioxide:			
Rutile type	11,671	13,234	Belgium 2,188; Argentina 920; Republic of South Africa 871.
Other	10,369	10,720	United States 2,775; Australia 1,940; Netherlands 804.
Metal and alloys	1,019	1,434	United States 878; United Kingdom 38.
Tungsten and alloys, including products.	23	56	India 9; West Germany 7; United States 6.
Nonmetals:			
Caustic soda	35,024	30,729	U.S.S.R. 12,001; India 11,198; Republic of South Africa 3,207.
Cement thousand tons	1,834	2,011	Singapore 291; Ryukyu 290; South Korea 238; Kuwait 238.
Fertilizers, chemical do	1,313	1,746	South Korea 627; Taiwan 272; mainland China 260.
Iodine	874	1,128	United States 372; United Kingdom 92; India 81; West Germany 76.
Phosphorus, red	231	216	India 110; Pakistan 30.
Selenium	51	48	Poland 11; Italy 10; India 8.

See footnotes at end of table.

TABLE 5.—Selected exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1962	1963	Principal destinations, 1962
Mineral fuels:			
Petroleum refinery products:			
Gasoline—thousand tons	365	243	United States 143; Ryukyu 104; Philippines 39.
Kerosine—do	69	86	Ryukyu 40; Philippines 17; Thailand 9.
Distillate fuel oil—do	76	76	Philippines 51; Thailand 16.
Residual fuel oil—do	11	1	All to Philippines.
Lubricating oil—do	12	412	Taiwan 9.
Jelly and wax—do	9	8	Brazil 3; Taiwan 2.
Bitumen—do	83	176	Thailand 40; South Korea 15; Pakistan 10.

[1] Data not available.
[2] Approximate; converted from metric tons.

Source: Official Trade Returns of Japan.

TABLE 6.—Selected imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1962	1963	Principal sources, 1962 except where otherwise specified
Metals:			
Aluminum: [1]			
Bauxite—thousand tons	1,099	1,421	Indonesia 480; Malaya 245; Sarawak 204.
Metal	17,402	16,698	Canada 12,714; United States 4,398.
Scrap	17,214	18,526	United States 11,822; Canada 3,685.
Antimony ore and concentrate	5,026	6,196	Bolivia 2,663; Republic of South Africa 1,411; mainland China 712.
Chromite [2]	254,882	226,516	Philippines 103,547; U.S.S.R. 79,380; Federation of Rhodesia and Nyasaland 24,503.
Copper:			
Ore and concentrate	558,486	600,150	Philippines 181,184; Canada 128,781; Australia 79,426.
Ingot	36,713	56,209	United States 16,386; Australia 5,835; Federation of Rhodesia and Nyasaland 5,199.
Metal and alloy scrap	74,093	82,850	United States 46,597; Australia 6,418; Hong Kong 6,271.
Iron and steel:			
Iron ore—thousand tons	22,445	26,268	1963: Malaya 6,700; India (including Goa) 5,899; Chile 3,318; Peru 2,915; Canada 1,886; United States 1,821; Philippines 1,429.
Pig iron—do	1,437	1,543	1963; U.S.S.R. 639; West Germany 214; Federation of Rhodesia and Nyasaland 139.
Scrap [3]—do	3,404	4,368	1963: United States 3,219; India 303; Australia 299.
Lead:			
Ore and concentrate	38,615	68,649	Peru 25,033; Australia 8,429.
Metal	26,195	24,021	Australia 18,538; Canada 4,872; U.S.S.R. 1,292.
Magnesium	4	493	1963: Largely from United States.
Manganese ore and concentrate [4]	395,422	367,730	India 144,998, U.S.S.R. 68,580; Australia 53,711.
Mercury	712	890	Mexico 430; Philippines 140; Peru 82.
Molybdenum concentrate	1,306	3,100	United States 1,048.
Nickel:			
Metal and alloy products	1,740	1,020	Canada 940; United States 350.
Ore and concentrate (low grade)	674,871	679,496	New Caledonia 633,694.
Matte	687	3,931	Burma 674.
Platinum—thousand troy ounces	132	220	U.S.S.R. 89; United Kingdom 40.
Silver—do	3,937	3,675	United Kingdom 1,761; United States 1,151; Peru 449; mainland China 319.
Tin:			
Ore and concentrate—long tons	927	1,578	Thailand 777; Burma 150.
Metal—do	11,610	14,354	Malaya 10,717; mainland China 820.
Titanium:			
Ore and concentrate	122,298	141,890	Malaya 71,028; Australia 38,211
Slag	28,608	26,739	All from Canada.
Tungsten concentrate	2,197	2,327	Australia 435; Portugal 307; South Korea 269.

See footnotes at end of table.

TABLE 6.—Selected imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1962	1963	Principal sources, 1962 except where otherwise specified
Metals—Continued			
Vanadium concentrate	603	758	All from United States.
Zinc:			
Ore and concentrate	144,699	147,506	Australia 77,485; Peru 38,268; India 10,986.
Metal	8,135	8,404	Australia 4,430; West Germany 801.
Nonmetals:			
Asbestos	96,674	115,492	Canada 69,487; Republic of South Africa 14,951; U.S.S.R. 9,130.
Cryolite	3,800	6,411	1963: All from Greenland.
Fluorspar	102,244	128,892	Republic of South Africa 31,193; mainland China 26,518; South Korea 25,576.
Graphite:			
Crystalline and special amorphous.	5,070	4,952	Ceylon 1,654; West Germany 1,291; South Korea 1,147.
Amorphous	61,233	56,346	South Korea 54,048.
Gypsum	79,628	108,284	United Arab Republic 38,981; Australia 21,046; Mexico 19,575.
Kaolin	35,975	49,066	United States 17,541; South Korea 10,405.
Magnesia clinker	40,100	20,559	North Korea 21,118; mainland China 5,041.
Mica blocks and splittings	1,737	1,853	India 1,323; Madagascar 205.
Potassium chloride	703,058	969,416	1963: United States 314,032; Canada 238,832; U.S.S.R. 228,882; France 112,264.
Potassium sulfate	39,014	100,861	1963: France 48,582; Italy 30,401; West Germany 16,828; Taiwan 3,300.
Phosphate rock—thousand tons	1,889	2,063	United States 1,249; Tunisia 212.
Salt—do	2,653	2,948	Mexico 606; United States 482; mainland China 310.
Steatite (soapstone)	35,150	30,602	South Korea 15,952; U.S.S.R. 9,550; mainland China 5,000.
Talc	6,321	15,854	Mainland China 2,126; South Korea 2,000; North Korea 1,011.
Mineral fuels:			
Coal	11,928	11,143	1963: United States 5,465; Australia 2,899; U.S.S.R. 976; Canada 690; North Viet-Nam 545; South Korea 247.
Anthracite—thousand tons	1,309	1,238	North Viet-Nam 652; South Korea 296; Canada 108; South Africa 76.
Heavy coking coal (less than 8 percent ash)—thousand tons	5,799	5,707	United States 5,422; Australia 241.
Heavy coking coal (more than 8 percent ash)—do	2,710	2,736	Australia 1,472; U.S.S.R. 699; Canada 362.
Other bituminous coal (mostly for coking)—do	2,110	1,462	Australia 1,125; United States 530; U.S.S.R. 261.
Petroleum:			
Crude—thousand tons	39,996	51,895	1963: Kuwait 15,600; Saudi Arabia 9,580; Iran 8,000; Kuwait-Saudi Arabia Neutral Zone 6,850; Indonesia 5,320; U.S.S.R. 2,160.
Residual fuel oil—thousand tons	9,186	10,738	1963: United States 2,385; Saudi Arabia 1,670; U.S.S.R. 1,053; Kuwait 974; Bahrain 908; Iran 862.
Lubricating oil—do	300	426	United States 200; Saudi Arabia 46.
Petroleum coke—do	417	592	United States 416.

[1] Also imported 6,541 of aluminum alloys in 1963.
[2] Refractory an metallurgical chromite lumped together. Most Philippine supply is refractory chromite.
[3] Includes only scrap fit for smelting. Several hundred thousand tons annually of scrap fit for remanufacturing are not included.
[4] Includes ferruginous manganese ore, which amounted to 115,430 tons in 1963.

Source: Official Trade Returns of Japan.

COMMODITY REVIEW

METALS

Iron and Steel.[3]—Japan's steel production in 1963 reached a new high, putting the country in a virtual third place tie with West Germany behind the United States and the U.S.S.R. Oxygen converter steel rivaled open-hearth steel for the first time, and is due to take over

[3] Far East Iron & Steel Trade Reports (Tokyo). No. 110, Mar. 12, 1964, pp. 1–20.

the leading position shortly because most additional steel capacity being built is of this type. Pig iron production was slightly under 20 million tons. Output of 2.46 million tons of alloy steels made Japan the third largest world producer in this category. Statistics for the last quarter of 1963 and new facilities recently placed in operation show that the upward trend in both steel and pig iron output can be expected to continue.

During 1963, Japan imported about 22 million tons of iron, nearly three-fourths contained in iron ore, one-fifth in scrap, and the rest in pig iron. Special ore carriers enabled the country to acquire raw materials cheaply from distant sources. About 55 percent of the iron ore came from nearby Asian countries, with Malaya ranking ahead of all other suppliers; two-thirds of the scrap came from the United States. While imports of iron materials rose one-fourth over those of 1962, imports of coking coal, mainly from the United States and Australia, remained at roughly the same level. Foreign purchases of coking coal were held down in 1963, partly because of reduced coke requirements per ton of iron produced in blast furnaces and greater use of inferior quality domestic coking coals.

Of Japan's total 1963 semifabricated steel output (including special steels), roughly 21 percent valued at some US$760 million was exported. While domestic demand rose markedly, the 30-percent increase in steel exports over 1962 steel exports made Japan a very prominent world exporter of steel. Direct exports of steel products in 1963 were equivalent to 7 million tons of crude steel, and indirect exports contained in finished products like ships and automobiles amounted to another 3 million tons of crude steel. The trend was toward indirect exports beyond the 1963 level. Overall, Japan imported about one-third of the iron materials needed for steel manufacture in 1963 and exported nearly one-third of the steel as steel and other finished products, emphasizing the indispensable role of iron and steel trade.

Japan, with the largest oxygen steel converter capacity in the world, has strengthened its competitive position by adopting the most advanced steelmaking techniques. In 1963, efforts were directed toward technologic improvement in ore mixing, sizing, sintering, and pelletizing as well as toward increasing automation. Injection of heavy oil, such as done at Yawata Iron & Steel Co., Ltd's. No. 3 furnace at Tobata, was employed in at least 28 blast furnaces, with the oil volume per ton of pig iron produced raised to 13 to 18 gallons, compared with 8 to 13 gallons in 1962. High-pressure operations were initiated at three blast furnaces, and Fuji Iron & Steel Co., Ltd's. No. 3 furnace at Muroran achieved the record pig iron tapping ratio of 2.05 metric tons per cubic meter of hearth volume. Average Japanese coke ratio was lowered 10 percent to not much more than 500 kilograms per ton of pig iron produced by these practices coupled with greater use of sintered ore.

As of September 1963, there were 29 LD (Linz Donawitz) top blown ogygen converters of 40- to 150-ton size operating in Japan. Most converters produced above rated capacity; some were computer controlled. Improvements were made in oxygen generators and converter waste gas recovery. Yawata Iron & Steel Co., Ltd. and Yoko-

yama Engineering Co., Ltd. jointly developed a waste gas recovery technique known as the O.G. process, which was successfully applied in Japan and licensed for use by West German firms. A new iron sand electric smelting technique known as the E.K. process was jointly developed by Nisso Steel Mfg. Co., Ltd. and Electrochemisk of Norway. This technique is capable of cutting power requirements and overall costs by 15 percent.

Four small-scale special steel companies were employing continuous casting, and large producers of ordinary steel were studying the technique for inclusion in major new steelworks being built or planned. A contract was reportedly signed on October 23, 1963 between Kobel Steel Works, Ltd. on behalf of the Japanese steel industry and Moscow for the rights to adopt a Soviet continuous casting method that would do away with many heating pits and moulds and eliminate blooming and slabbing mills altogether. In rolling, multistand hot strip mills with automatic thickness gages and loop controlling devices started operations in 1963, and a plan was conceived for computer control of the entire strip mill process.

The big six steel companies, headed by Yawata Steel and Fuji Steel and each with one or more large new projects, continued to dominate the Japanese steel industry, providing about 90 percent of the pig iron and two-thirds of the crude steel in 1963.

Yawata Steel's Tobata Works was fully completed, the Kisarazu Works passed beyond the planning stage, and construction of a mammoth blast furnace and two converters at Yawata Steel's Sakai Works was resumed at yearend. Fuji Steel's new project is the Nagoya Works of its subsidiary Tokai Iron & Steel Co., Ltd.; a hot strip mill, a cold strip mill, and a Sendzimir continuous galvanizing line were already in operation there in 1963, and the first of five large blast furnaces was expected to be blown in by September 1964. Nippon Kokan Kabushiki Kaisha (Nippon Steel Tube Co., Ltd.) started first-stage construction on its Fukuyama Works, after reclaiming the necessary land site from the sea in November 1963. Kawasaki Steel Corp. completed its second large cold strip mill at the Chiba Works in mid-1963 and was working hard on building the fourth blast furnace at this site. Sumitomo Metal Industries, Ltd. blew in the second of five proposed large blast furnaces at the Wakayama Works in April 1963.

Ferroalloys, Ferroalloy Metals and Their Ores.—Japan retained its prominent world position in the production of ferrous metals for

TABLE 7.—Approximate annual output rate of major steel firms during the third and fourth quarters 1963

(Million metric tons)

Firm	Pig iron		Crude steel	
	Third quarter	Fourth quarter	Third quarter	Fourth quarter
Yawata Steel	5.3	5.5	6.3	6.5
Fuji Steel	4.8	5.2	5.2	5.6
Nippon Kokan	2.7	2.9	2.9	3.6
Kawasaki Steel	2.2	2.5	2.7	3.5
Sumitomo Metal	1.8	2.2	2.7	3.1
Kobe Steel	1.0	1.0	1.6	1.6

alloying during 1963, with total output of ferroalloys at about 500,000 metric tons, up 33,000 tons over that of 1962. Although increased steel production raised demand for ferroalloys, the Japanese ferroalloy industry comprising about 45 producing firms was beset by difficulties. Much capacity, some obsolete, remained unused. The export market had dwindled to about 27,000 tons and the steel industry was abandoning its paternalistic purchasing policy in ferroalloys. Increasing power costs and liberalization of ferroalloy imports were squeezing the less efficient operations out of business. Some large plants such as the Shimminato Works of Nippon Kokan and certain specialized plants were able to compete effectively. However, merger of companies was generally looked upon as a method to streamline the industry. In September 1963, Toho Denka K.K. and Nippon Denki Yakin (Nippon Electric Metallurgical Co., Ltd.)—two of Japan's leading ferroalloy producers—announced plans to merge in 1964.

The raw materials base for supporting the Japanese ferroalloy industry remained very weak. All the high-grade and metallurgical-grade chromite and manganese ore required had to be imported. Japan was dependent upon Climax Molybdenum for most of its molybdenum concentrate imported, and demand was expected to rise to 5,000 tons annually in the near future; Canada Explorations was scheduled to make its first shipment of molybdenum concentrate to Japan in August 1965. Tungsten concentrate imports were four times production, but the concentrate was inexpensive and easily available. All nickel ore was imported, the bulk from New Caledonia. The United States was the only important source of vanadium concentrate.

The same Japanese firms producing ferroalloys also produced pure ferrous metals. Tekkosha K.K. occupied a commanding position in diversity as well as total tonnage in 1963, being the sole important producer of electrolytic manganese and chromium in Japan. Sumitomo Metal Mining Co., Ltd. and Shimura Kako (Shimura Chemical Industry Co., Ltd.) were the only two nickel producers; and Mitsubishi Metal Mining Co., Ltd., Tokyo Tungsten Co., Ltd, and Tokyo Shibaura Denki (Tokyo Shibaura Electric Co., Ltd.) controlled the metallic tungsten and molybdenum business. Most of the chromium and one-half of the manganese were exported. There was a small surplus of metallic tungsten and molybdenum, whereas all of the nickel was domestically consumed. During 1963, Japan produced 6,190 tons of nickel, 515 tons of tungsten, roughly 400 to 500 tons of chromium, 4,000 to 5,000 tons of manganese, and over 100 tons of molybdenum.

Nonferrous Metals.[4]—Japan's nonferrous metals industry, which with the exception of aluminum has a much stronger raw material base than the steel industry, experienced the same general growth as steel in 1963. However, world significance of the country's copper, lead-zinc, and aluminum industries was less than that of steel. Japan has had to purchase nonferrous raw materials from many parts of the world to meet smelter requirements and domestic consumption. In 1963, nonferrous imports totaled nearly US$250 or roughly two-fifths the smelter value. Aluminum production was based entirely on imported raw materials, but output of copper, lead, and zinc came in part from domestic mines which still provide an important though decreasing

[4] Japan Metal Bulletin (three times weekly) 1963–64. The Sangyo Press, Ltd., Osaka.

share of the total ore supply. The protected base metals mining industry was being readied for more open world competition during 1963, with copper imports liberalized in April and lead-zinc imports to be liberalized in early 1964.

Aluminum.—The one-third rise in aluminum output in 1963 was brought about by vastly increased demand, expanded capacity at existing plants, and commencement of operations by the Chiba plant of Showa Denko near Tokyo and the Naoetsu plant of Mitsubishi Chemical Industries Co., Ltd. in northern Nigata. The 30,000-ton-per-year Naoetsu plant, that began production in September 1963, used Australian alumina exclusively. At yearend, annual capacities for the other three companies were as follows: Nippon or Japan Light Metal Co., Ltd., 110,000 tons; Showa Denko K.K., 80,000 tons; and Sumitomo Chemical Industries Co., Ltd., 60,000 tons. A new 7,500-ton-per-year plant belonging to Sumitomo Chemical was nearing completion. Japan's newest and best reduction pot lines consume 16,000 kilowatt-hours per metric ton and have fluorine recovery and gas shield systems. Should ALCAN's Arvida Works be successful, Nippon Light Metal which is affiliated with ALCAN, expects to install a 10,000-ton-per-year direct reduction plant in 1966 or 1967.

Copper, Lead and Zinc.—The trend toward greater imports of copper, lead, and zinc to meet rising demand continued in 1963. However, Japanese mining firms, which built their business initially on local ores, retained control of the overall raw materials supply and smelting activities. The Sumitomo enterprise founded on the Besshi copper mine, the Mitsui enterprise on the Kamioka lead-zinc mine, and the Nippon mining enterprise on the Hitachi copper mine, together with a few other firms not only managed the major domestic nonferrous mines and the much larger smelters but also various projects abroad.

The most important developments in mining during 1963 took place in the field of the metallurgically difficult-to-treat complex "kuroko", or black ores, of northern Honshu, Japan. These ores, found in three subzones of varied composition and sometimes associated with recoverable gypsum, can average 2 to 3 percent copper, 5 to 20 percent combined lead-zinc, and much silver. In 1963, Dowa Mining Co., Ltd. was developing a very modern mine-mill plant based upon the 9.3-million-ton Uchinotai ore deposit; Nippon Mining Co., Ltd. delineated 1-million-ton ore reserve at Shakanai, with prospects for finding much more ore, and started to sink a shaft; Mitsubishi Metal Mining Co., Ltd. was readying the 2.5- to 3-million-ton Furutobi ore deposit for production. These and other finds can only add some 10,000 tons of mine copper and corresponding amounts of lead-zinc annually to the Japanese supply.

Foreign raw materials played a much more significant role. Emphasis was placed on acquiring dependable long-term suppliers, primarily of concentrates but also of ingot and scrap. Many mines abroad were developed with Japanese aid. Nippon Mining contracted to import half the copper output of Marinduque, Philippines, for the next decade. Sumitomo Metal Mining Co., Ltd. received the first shipments of Bethlehem copper ore from Vancouver. Mitsubishi Metal and Mitsui Mining & Smelting Co., Ltd. continued to import

virtually all the copper concentrate produced at Toledo and Sipalay in the Philippines, respectively. Dowa Mining was helping to develop copper deposits at Whim Creek, Australia, and Santa Rosa, Chile; and Nitto Mining Co., Ltd. completed a copper mill at Chacarilla near La Paz, Bolivia. The Overseas Mineral Resources Development Co. was involved with the Chapi copper mine in Peru and Matilde lead-zinc mine in Bolivia. The Japanese also purchased concentrates and metals from established mines, including lead and zinc from Broken Hill and Mount Isa, Australia, and zinc concentrate from Bawdwin, Burma and Aguilar, Argentina.

Japan's nonferrous smelting facilities have undergone steady modernization and expansion to process both domestic and imported ores. At yearend, total annual capacities were approximately 370,000 metric tons of electrolytic copper, 120,000 tons of refined lead (85 percent electrolytic and the rest Parkes) and 340,000 tons of refined zinc (62 percent electrolytic and the rest distilled). Nippon Mining still led the copper refineries, but Mitsubishi Metal and Mitsui Smelting in particular were moving up. Mitsui Smelting retained its dominant position in lead-zinc, followed by Mitsubishi Metal, Toho Zinc, and Nippon Mining.

The most important nonferrous smelting development in 1963 concerned Mitsubishi Metal's decision to build a 60,000-ton-per-year copper refinery at Onahama in Fukushima north of Tokyo for completion by September 1965, to cut costs by 20 percent, and replace the firms less efficient capacity. Mitsubishi already has a large new zinc refinery with fluosolid reactors at Akita in the north, where annual capacity was recently expanded to 42,000 tons. Toho Zinc's Annaka zinc refinery was expanded one-sixth to 64,800 tons per year in mid-1963. Mitsui Smelting added 4 new vertical zinc retorts to the existing 12 at Miike, raising capacity to 28,800 tons yearly. Nippon Mining further improved its direct reduction converter copper plant at Hitachi and, through its subsidiary Nippon Seiren Co., Ltd., completed an electrothermic zinc unit to the already large Middaichi zinc refinery.

Titanium and Magnesium.—The Japanese titanium industry, long producing below one-half capacity, was preparing to raise output above the 1,759-ton level registered in 1963. Osaka Titanium Co., Ltd., which operated 6 of 10 furnaces, planned to place 2 more in production. Toho Titanium Co., Ltd. was the only other producer of sponge. Much work was done by Kobe Steel in titanium fabrication to promote domestic consumption and relieve dependence on the U.S. market for sales.

The titanium industry in employing the Kroll Process helped the magnesium industry to get started again. Furukawa Magnesium Co., Ltd., the lone Japanese producer of the metal, in foreseeing expanding markets in aluminum alloying, titanium smelting, and ductile iron casting, planned to raise annual capacity from 3,000 to 5,000 tons. Dolomite was used as the raw material for making magnesium, and 19 furnace units with 304 retorts were operated by Furukawa in 1963.

Lesser and Minor Metals.—Japan, to meet the demands of its advanced industrial economy, produced and/or consumed a great variety and sizable tonnages of lesser and minor metals in 1963. Many such

metals were byproducts of smelting, and quite a few were mainly supported by indigenous raw materials. Some have been discussed under "Ferrous Metals," although the purified metals were not necessarily used in steelmaking. The Japanese also produced a number of superpure metals. Lesser metals important by world standards include bismuth, cadmium, mercury, and selenium, with Japan producing 8 to 15 percent of the world total in each case.

Bismuth was extracted at lead and copper smelters, mainly by Sumitomo Metal & Mitsui Smelting. At yearend, Sumitomo Metal contracted to sell most of its monthly output of 14 tons to the United Kingdom, whereas the other firms sold to the domestic market. Cadmium was produced at the zinc refineries, primarily from domestic ores; most of the total extracted in 1963 was exported. Japan produced only about 2 percent of the approximately 1,000 tons consumed in 1963, importing mainly from the Congo via Belgium. Less than one-tenth of the tin supply was from domestic ores, with the rest imported mainly as metal; however, Ishihara Sangyo Industrial Co., Ltd. was building a 750-ton-per-month tin smelter near Kuala Lumpur to give Japan more direct access to Malaysian tin. Nomura Mining Co., Ltd.'s Itomuka mine furnished less than one-fifth of Japan's 1963 requirements.

Japan produced significant quantities of gold in 1963, as byproducts of nonferrous base metal smelting. The country was the third ranking world producer of selenium, after the United States and Canada, and an important producer of zirconium. Many other minor metals were produced, including barium, beryllium, cerium, tantalum, and tellurium. Japan produced high-purity aluminum and zinc, but the best known high-purity metal products were silicon and germanium. The country's electronic-grade silicon output in 1963 ranked second in the world, following U.S. output.

NONMETALS

Cement.[5]—Japan probably was the third largest world producer of cement in 1963, surpassed only by the Soviet Union and the United States. The country was, as in several previous years, the world's foremost exporter of cement; the bulk of approximately 2 million tons exported in 1963 went to southeast Asia. While exports held somewhat steady, production and home consumption rose sharply between 1959 and 1960 and again between 1961 and 1962. Increasing amounts of cement were needed in Japan's construction and roadbuilding programs Although total cement plant capacity (42 million tons per year in September 1963) had already overtaken demand, additional facilities were still being installed. All kinds of cement were produced, headed by ordinary portland but including small tonnages of pozzolan, rapid hardening, heat resistant, blast furnace, and white cements. The country's raw material position for making cement was excellent, except that minor amounts of gypsum had to be imported in 1963.

During 1963, 21 Japanese firms produced cement, 1 more than in 1962. About 77 cement plants with about 190 kilns were in operation.

[5] Cement Information Service, Tokyo. Japan Cement Yearbook 1963 (in Japanese). V. 15, September 1963, p. 470.

Onoda Cement Co., Ltd. maintained its position as the leading cement producer, and its Tsukum plant in Oita was Japan's biggest. Nihon Cement Co., Ltd., was a close second to Onoda; in 1963, this company was building Japan's largest kiln, 205 meters long and 5.25 meters in diameter, at the Saitama plant. Sumitomo Cement Co., Ltd. (formerly Iwaki Cement Co., Ltd.) ranked third and Osaka Yogyo Cement Co., Ltd. fourth. Chichibu Cement Co., Ltd., with a large and modern plant of the same name, added more capacity at its smaller Kumagai plant in Saitama during 1963. Mitsubishi Cement Co., Ltd. expanded the Higashidani plant and installed a new large kiln at the Kurosaki plant in Kyushu. Daichi Cement Co., Ltd. similarily enlarged its Kawasaki plant. Higashidani and Kawasaki plants are equipped with dry kilns with high-heat efficiency suspension preheaters, forerunners of other such kilns to be built in Japan. Tokuyama Soda Co., Ltd. introduced computer controls on two kilns and reported good profit. Mitsui Cement Co., Ltd. was organized, but had not yet started production during 1963. There were signs that the very modern and strongly financed Japanese cement industry will continue to suffer from overproduction and excessive competition.

Fertilizer and Chemical Materials.—Japan's fertilizer and chemical industries, with a strong resource base in some raw materials and hardly any in others, retained their prominent world position during 1963. The fertilizer industry, producing 2.3 million tons of ammonium sulfate, 1.7 million tons of calcium superphosphate, 3.0 million tons of compound fertilizers, and 1.0 million tons of urea during the year, depended upon foreign markets, particularly the Far East, for about two-fifths of the sales. On the other hand, the basic chemical industry which produced approximately 5.0 million tons of sulfuric acid, 1.7 million tons of ammonium, 0.6 million tons of soda ash, and 1.0 million tons of caustic soda, essentially supplied the domestic market in making fertilizers and for other uses.

Nitrogen was mainly obtained by fixation. Almost all of the sulfur and pyrite consumed was domestic. Nearly four-fifths of the salt supply or close to 3 million tons had to be imported in 1963, since Japanese salt output from the Inland Seas declined. Japan was virtually totally dependent upon foreign potash and phosphate rock, importing over 1 million and 2 million tons, respectively, with potash mainly coming from the United States, Canada, and the Soviet Union and phosphate rock primarily from the United States.

The sulfur and pyrite industry of Japan, long of world importance with pyrite output exceeding that of any other country, did not undergo great change in 1963. The Yanahara pyrite mine of Dowa Mining still maintained its dominant position, and Matsuo Sulfur Co., Ltd. remained the principal elemental sulfur producer as well as an important supplier of mixed sulfur-pyrite ore to sulfuric acid plants. Of Japan's total sulfur output, about 5 percent (11,612 tons) came from oil refineries which were installing more recovery plants. The waste gases from oil refineries also provided nearly one-fifth of the sulfur for making sulfuric acid. Small amounts of sulfur were imported in 1963 at prices much lower than those paid for indigenous output. Japan's production of pyrite plus equivalent pyrites (such as pyrrhotite, cupriferous pyrite, and mixed sulfur-pyrite ore) totaled more than

3.5 million tons in 1963, with the nonferrous industry also contributing an important share. Although almost all of the pyrites were used as the sulfur material for making sulfuric acid, much of the pyrite cinder derived was subsequently sintered for use as a primary iron material.

Other Nonmetals.—In addition to cement and certain fertilizer and chemical materials, Japan produced an interesting variety of nonmetallics, some of world consequence but few in adequate quantities for consumption. One important exception is limestone, reserves of which may be as high as 50 billion tons. Japan was one of the world's largest producers of pyrophyllite, a talc substitute associated with clays. Feldspar output was also large by world standards. There were small but rapidly growing perlite and expanded shale industries. Another nonmetal produced in adequate quantities was barite. Asbestos imports were nearly eight times production, and came mainly from Canada. Fluorspar imports were about six times domestic output. Japan had a fair supply of clays, but sizable tonnages of good grade kaolin came from abroad. Only a small portion of the graphite and hardly any of the mica was locally produced. Talc output was about four times imports. Some high-grade glass sands were imported from South Vietnam.

MINERAL FUELS

Coal.—1963 was a bad year for the Japanese coal industry. Output of bituminous coal was down almost 2.4 million tons as compared with that of 1962 and several million tons below what the government and industry had hoped for. Pressure of imported fuel oil competition has mounted, and many marginal mines were shut down.

However, the most important single event contributing to the production decline was Japan's worst mine disaster in history at the Mikawa pit of Mitsui Mining Co., Ltd.'s Miike mine—normally a 5-million-ton-per-year operation—on November 9, 1963. The explosion left 348 dead and 487 injured, including the cream of the technical supervisors. As a result of investigations, shortage of personnel, and bad morale, Mikawa and two sister pits remained idle during the rest of 1963. Repercussions of the disaster were also serious in that large numbers of miners from this and other coal mines started to leave the industry to seek employment elsewhere.

The Japanese were doing their utmost to streamline the coal industry in the face of difficult mining conditions and handicaps in coal quality. Closure of smaller mines and sinking of new shafts improved the situation somewhat. Coal blending and making byproducts of coal were thoroughly investigated. The companies tried hard to diversify into endeavors such as transport, power, cement, and real estate, but with only a limited measure of success. The government was anxious to maintain a domestic annual output of about 55 million tons of coal.

Two major technical developments took place in the coal industry during 1963. There was a pronounced trend toward increased use of hydraulic mining, starting from the coal mines in Hokkaido. Meiji Mining Co., Ltd.'s Ponki mine, the only Japanese coal mine employing hydraulic methods exclusively, achieved improvements in productivity

and cost. Kaijima Coal Mining Co., Ltd., Nittetsu Mining Co., Ltd., Furukawa Mining Co., Ltd., and Aso Sangyo also used the method to some extent, and Mitsui Mining Co., Ltd. and Mitsubishi Mining Co., Ltd. were also looking into the concept. The Japanese Government made preliminary studies on slurry transport of coal from the Ishikari coal field to the port of Tomakomai in Hokkaido, and was hopeful that adoption of the method would have transportation charges, which presently constituted one-third of the price of the 13 million tons of Hokkaido coal shipped annually to the main island of Honshu.

Japan's basic shortage of coking coal continued, although some steam coal was imported in 1963 as a stopgap measure. Roughly 10 million tons of coking coal annually was imported during 1962–63, more than one-half from the United States and one-fourth from Australia. Blended with inferior quality domestic coals, Japan produced an annual average of nearly 15 million tons of coke in 1962–63, three-fourths for use by the steel industry. The importance of U.S. coal was much greater than implied by statistics in view of the quality, but its relatively high cost placed Australian coal within competitive range. The Japanese were negotiating for lower prices for U.S. coking coal, but instead were told of a slight price increase on account of wage boosts for U.S. coal miners. Such developments made Australian and other coals more attractive. Japan purchased more than one-half million tons of North Vietnam anthracite.

Petroleum and Natural Gas.—Japan's domestic petroleum production in 1963 was, even more than in past years, overshadowed by imports. Crude oil imports went up nearly 12 million tons, and fuel oil imports rose more than 1.5 million tons compared with that of 1962. Total imports, a fair gage of consumption, reached about 62.6 million tons or roughly 450 million barrels, compared with only 5 to 6 million barrels produced and a similar amount exported in 1963. The country's per capita oil consumption in 1963 was about the same order as that of the Soviet Union.

Japan was a very prominent world consumer of petroleum products and a refiner of crude oil, ranking fifth or higher. Refining capacity already installed ranks second only to the United States in the free world. An allied petrochemical industry, in full-fledged operation only since 1958, was expanded greatly in 1962–63.

The Japanese oil refining industry was in a state of confused rapid expansion. Big non-Japanese firms like Caltex, Esso, Socony Mobile, Tidewater, Shell, and British Petroleum owned large shares of Japanese oil companies, including many sales companies. This group, with their own crude oil supplies, controlled about two-thirds of Japan's 1963 petroleum refining capacity. The rest was in the hands of about seven Japanese firms, headed by Idemitsu Kosan Co., Ltd., Maruzen Oil Co., Ltd., Daikyo Oil Co., Ltd., and Nippon Mining. There has been constant jockeying for the right to build additional refinery capacity to meet the estimated total Japanese oil demand of 3 million barrels per day a decade from now. One-half of the 1963 applications for new refineries were turned down by the government. Since Japanese financial resources were and will continue to be short, foreign capital, particularly American, must play an important role.

Japan's energy supply has undergone a revolution from coal to petroleum in recent years, with the tempo quickening in 1963. The need for regulatory measures to moderate expansion, apportion oil markets, and set up standard prices was considered by the Japanese Government through Ministry of International Trade and Industry (MITI) and the industry to be desirable. Accordingly, the Petroleum Industry Law of 1962 was enacted in May, with implementation unfolding in 1963. This law, planned as a compromise between the business activities of the oil industry and national interest, was also introduced to counterbalance the liberalization of crude oil imports, which was accomplished in October 1962. Meanwhile, new problems developed, such as the question of accepting Khafji crude from Kuwait-Saudi Arabia Neutral Zone by domestic oil companies and the burning of unprocessed crude oil by the electric power companies. The petroleum law, with its approval system for refinery crude runs and expansion of facilities, made it easier for MITI to carry out its oil supply plans.[6]

Most crude oil imports came through the international oil companies operating in Japan or through direct purchases, with the Near East as a whole providing about four-fifths of the total. However, MITI's long-range program is for the Japanese to develop more new oilfields abroad, such as the northern Sumatra and Khafji operations, and a 57-percent profit scheme for the host country is acceptable The Khafji offshore field in the Neutral Zone, run by the Japanese firm, Arabian Oil Co., Ltd., has been of increasing importance to Japan. Imports from Khafji in 1963 amounted to 7.0 million kiloliters (about 44 million barrels), or nearly 12 percent of all Japanese crude imports and more than twice the 1962 level. Further great increases are imminent on the basis of 1964 data and new reserves found. Two new, very extensive offshore fields were reported in September 1963, namely Al Hout No. 1 with preliminary reserves of 1.34 billion metric tons and Khafji No. 44 with 0.8 billion tons.

Although small in comparison with imports, domestic crude output in 1963 rose about 4.2 percent over that of 1962. The Kubiki field of Teikoku Oil Co., Ltd., and Mitsuke field of Japan Petroleum Exploration Co., Ltd. (Japex) accounted for most of the output increase in recent years. Natural gas production more than tripled during 1959–63, reaching 1.695 billion cubic meters in 1963. Teikoku Oil's Sekihara field and Japex's Katakai field in Niigata were responsible for most of the increase in natural gas output. At the end of 1962, Japex completed a 205-mile natural gas line from Kubiki to the Toyosu plant of Tokyo Gas Co., Ltd. and a 42-mile oil line from Mitsuki to Niigata City. Japan's production of LPG gas has risen sharply during the last 5 years.

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[6] Kamimura, Eisuke. Impact of the New Petroleum Law on Japan's Oil Industry. World Petroleum, v. 34, No. 11, October 1963, pp. 36–38.

The Mineral Industry of North Korea

By K. P. Wang [1]

NORTH KOREA was a significant world mineral producer in 1963. Its estimated mineral output value of some US$400 million was a little lower than that of Yugoslavia in Europe and ranked the country approximately on a par with Indonesia after mainland China and Japan in the Far East. North Korea's mineral and metal output, in terms of per capita production value, ranked close to that of Japan.

North Korea has produced a variety of mineral and metal products, many in significant quantities by Far East standards. During 1963 the country ranked among the first five in world production of tungsten concentrate, graphite, and magnesite, thereby contributing about 7 to 13 percent of the total world production in each case. Production of mine and smelter lead as well as zinc, pyrite, and barite were 2 to 3 percent of the world total. The country also produced lesser shares of the world total of bismuth, cadmium, copper, gold, iron ore, pig iron, steel, cement, fluorspar, salt, talc, and coal.

North Korea's mineral industries are moderately well advanced technologically. Steel, nonferrous metals, and fertilizer industries are integrated to some extent although weak in fabrication. None of the other countries in the Far East except mainland China and Japan have corresponding facilities. North Korea was the third-ranking producer among Far East countries of coal and cement during 1963.

Minerals play a vital role in the economy; 10 to 15 percent of North Korea's 1963 gross national product (GNP) was derived from them. The bulk of production has been traditionally consumed locally, meeting an increased industrial demand. However, exports remained important, particularly lead, tungsten, zinc, barite, fluorspar, graphite, magnesia clinker, and talc.

Important advances were made in many mineral industries during 1963. In the iron and steel sector, developments centered around the construction of rolling mills and mine concentrators. However, progress in developing Kimchaek into a large integrated steel plant was slow. In the nonferrous metals industry, construction of a new zinc plant was started, a copper rolling mill was completed, and a Waelz kiln and heavy media facilities were being built. Cement production was raised through more efficient operations, and refractory facilities, particularly magnesia clinker, were greatly expanded. A number of new shafts were completed in the coal industry during 1963, and mine transportation as well as the handling of materials were improved.

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However, coal output, although surpassing 1962 figures, fell short of the 1963 target.

GOVERNMENT POLICIES AND PROGRAMS [2 3]

North Korea, the industrial half of the Korean Peninsula where about 11 million people live, made significant progress in economic and industrial development in recent years. The GNP growth in both 1963 and 1962 over that of the previous years was claimed to be about 10 percent. The industrial output growth in 1963 was reportedly 8 percent over that of 1962 and that in 1962 was 20 percent over that of 1961. Industry contributed about three-fifths of the GNP in 1963 and was more than twice as important as agriculture. Minerals and related industries accounted for about one-fourth of the industrial output in 1963.

Ever since the establishment of the present government after World War II, stress has been placed on the development of basic industries, many of which are mineral industries. Enlargement of existing facilities and creation of many new ones has resulted in a steady rise in mineral and metal production, increased diversification of products, and growing capability in smelting and processing. The country's natural mineral resource base is exceptionally strong, except for oil—a deficiency partly compensated by extensive and well-developed hydroelectric power and exploitation of sizable reserves of coal. North Korean Government policy in the mineral field has been to attempt to meet the growing industrial requirements of the country from domestic resources, importing as little as feasible, and exporting as much as possible and in forms that are most advantageously marketable.

PRODUCTION

Mineral output of North Korea has shown an overall steady increase in recent years, the estimated value for 1963 of some $400 million being roughly 10 percent greater than in 1962. The country has developed a metallurgical component of the mineral industry that contributed roughly one-fourth of the mineral production gross value.

Coal accounted for about one-third of the 1963 mineral output value, iron and steel one-fourth, cement one-fifth, nonferrous metals one-eighth, and miscellaneous nonmetals the remainder. Thus, not only was the country an important mineral producer relative to its size, but it also had relatively well balanced and diversified mineral and metal facilities.

North Korea's level of mineral development and industrialization is illustrated by the 1963 production of approximately 14 million metric tons of coal, 1 million tons of steel, 180,000 tons of nonferrous metals (two-thirds in the metallic form), 2.5 million tons of cement, 2 million tons of other nonmetals, and 850,000 tons of various kinds of fertilizers.

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[2] Democratic Peoples Republic of Korea State Planning Commission. (Result of the fulfillment of the 1963 national economic development plan.) Report of the Central Statistical Board, Jan. 17, 1964, pp. 1–15.

[3] U.S. Department of Commerce. The Growth of National Income and the Improvement of Living Conditions in North Korea. Office of Technical Services, JPRS 22764, Economic Report on North Korea No. 108, Jan. 16, 1964, pp. 5–16.

During 1959–63, iron and steel output more than doubled, coal output rose by nearly three-fifths, and cement production increased in excess of one-quarter. Nonferrous metals showed a small increase in mine output and a substantial increase in metal output on account of new and expanded smelting facilities. Sizable capacities for producing various nonmetallics have been developed in the last 5 years.

TABLE 1.—Production of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity [2]	1959	1960	1961	1962	1963
Metals:					
Cadmium, electrolytic	20	50	80	90	100
Copper:					
Mine	5,334	6,000	6,000	8,000	8,000
Electrolytic	4,970	8,200	8,000	10,000	10,000
Gold, troy ounces	160,000	160,000	160,000	160,000	160,000
Iron and steel:					
Iron ore [3], thousand tons	2,703	3,108	3,550	3,340	3,860
Pig iron [4], do	694	853	930	1,213	1,159
Steel ingot, do	451	641	776	1,050	1,022
Rolled steel, do	331	474	536	633	762
Ferroalloys, do	15	17	20	25	25
Lead:					
Mine	40,000	50,000	50,000	50,000	50,000
Smelter, primary	20,000	30,000	40,000	40,000	40,000
Nickel, electrolytic	200	300	400	400	400
Silver, troy ounces	320,000	500,000	640,000	640,000	640,000
Tungsten concentrate	4,000	5,000	5,000	4,000	4,000
Zinc:					
Mine	85,000	85,000	90,000	90,000	100,000
Electrolytic	25,000	50,000	60,000	60,000	65,000
Nonmetals:					
Apatite	50,000	100,000	150,000	200,000	200,000
Barite	15,000	40,000	55,000	60,000	70,000
Cement, thousand tons	1,926	2,285	2,262	2,376	2,530
Fluorspar	30,000	30,000	30,000	30,000	30,000
Graphite	52,000	62,000	65,000	65,000	70,000
Magnesite:					
Ore as mined, thousand tons	50	50	200	500	800
Clinker, do		20	100	200	385
Pyrite, do	200	250	300	350	400
Salt, do	400	324	392	421	450
Talc and soapstone, do	2,000	4,000	15,000	20,000	20,000
Mineral fuels:					
Coal, do	8,859	10,620	11,790	13,200	14,040
Anthracite, do	5,535	6,778	7,500	9,000	9,700
Bituminous [5], do	3,117	3,524	4,000	4,000	4,000
Other, do	207	318	290	200	340
Coke, do	703	817	900	1,100	1,200

[1] All figures are estimated, except for iron and steel items (ferroalloy data available for 1959–60 only), copper (data available for 1959 and earlier), cement, graphite (data available for 1959–60 only), magnesite (data available for 1963 only), salt (data available for 1960–62 only), coal (breakdown data available for 1959–60 only), and coke (data available for 1959–60 only). The firm figures are official North Korean data.

[2] Many other mineral commodities are produced, but reasonable output estimates cannot be made. These include antimony, beryl, bismuth, chrome, cobalt, manganese ore, mineral sands (ilmenite, zircon, columbite, rutile, monazite), minor and rare metals (selenium, tellurium, germanium, indium, silicon), molybdenite; and alum, arsenopyrite, asbestos, boracite, clays, kaolin, lepidolite, limonite, mica (phlogopite), and silica (including glass sands).

[3] 1959–61 data apparently represent crude ore, most of which was 30 to 40 percent Fe grade. 1962–63 data undoubtedly included some concentrates.

[4] Includes Krupp-Renn granulated iron or luppe.

[5] Low calorific value, much of which might be classified as low-rank coals.

With the aid of the Soviet Union and other Communist countries, North Korea concluded a 5-year plan in 1960, raising overall industrial output to a level several times the peak of what it was during the Japanese occupation. The objective of the present 7-year plan covering 1961–67 is roughly to triple the 1960 production. Experi-

ence indicates that performance may be slightly below expectations. Data on the 1963 output, the 1964 plan, and the 1967 targets for selected major mineral and related commodities show that North Korea still has a long way to go in meeting its ambitious objectives.

TABLE 2.—Production and production goals for mineral products and energy

(Million metric tons unless otherwise specified)

Commodity	1963 output	1964 quantity plan	1967 target
Electric energy—kilowatt hours	11.77	(1)	17.0
Coal	14.04	16.00	23.0 to 25.0
Iron ore	3.860	4.0	7.0 to 7.5
Pig and granulated iron	1.159	1.270	2.2 to 2.5
Steel ingot	1.022	1.167	2.2 to 2.5
Rolled steel	.762	.870	1.6 to 1.8
Chemical fertilizers	.853	.950	1.5 to 1.7
Cement	2.530	2.780	4.0 to 4.5

[1] Data not available.

TRADE

North Korea is a significant mineral exporting country, particularly in nonferrous metals and in nonmetals. Mineral and metal exports in 1963 probably were on the order of US$50 million or perhaps one-eighth of production. This points out that mineral consumption in the country also has attained fairly high levels.

Specific official trade information by the North Korean regime is not available, but the predominant share of the trade has been with the Communist nations, particularly the Soviet Union and to a lesser extent mainland China. Japan and, very recently, Great Britain were North Korea's main free world trade outlets. These generalizations on overall trade are equally valid for mineral trade. In the absence of official North Korean statistics, mineral imports by the Soviet Union and Japan from North Korea and petroleum exports by the Soviet Union to North Korea have been substituted. The magnitude of North Korean mineral exports to other Communist countries was not known but was believed to be smaller than the combined total for the U.S.S.R.

The Soviet Union has imported substantial quantities of primary lead and zinc materials from North Korea, but the proportion of concentrates has been declining in line with greater Korean smelting capacity. It has imported quantities of Korean pig iron, rolled steel, and cement, presumably for use in the Soviet Far East. North Korean barite (for oil drilling), magnesia clinker, and talc have been finding growing markets in the U.S.S.R. No doubt the Soviet Union has imported sizable amounts of North Korean tungsten concentrate and lesser metals like cadmium and bismuth, but this has not been reported. Soviet petroleum has been indispensable to North Korea. Other Soviet exports to North Korea have included ferroalloys, steel pipes, rolled nonferrous metals, and asbestos.

Mineral trade between North Korea and Japan was already moderate and diversified. In addition to the items traded in 1962, negotiations between the two parties late in 1963 indicated that Japan might

obtain more Korean iron concentrate, from Musan, as well as 100,000 tons of pig iron, and some nickel-cobalt materials in exchange for mineral and metal products like tinplate, steel wire and pipe, ferroalloys, and aluminum ingot. Great Britain and North Korea signed an important two-way trade contract in November 1963 whereby British sheet steel products (tinplate as well as hot and cold rolled sheets) will be traded for Korean lead and zinc.

TABLE 3.—Exports of selected metals and minerals to the Soviet Union and Japan [1]

(Metric tons unless otherwise specified)

Commodity	By the U.S.S.R.		By Japan	
	1961	1962	1961	1962
Metals:				
Cadmium	(2)	(2)	2,002	9,966
Copper:				
Metal	30		9	
Bars, cathode, and wire	200	400		40
Iron and steel:				
Iron ore				500
Pig iron	27,200	47,300	12,005	16,187
Sponge iron				1,069
Luppe				523
Ferroalloys (ferrosilicon)	3,400	1,700		
Rolled steel	35,300	56,900		
Lead:				
Concentrate	10,900	3,700		
Metal	24,200	19,800	92	202
Oxide	1,000	800		
Manganese ore and concentrate				900
Silver troy ounces			[3] 104,300	[3] 65,850
Titanium ores			1,411	5,677
Zinc:				
Concentrate	73,300	42,200	4,249	1,418
Metal	23,600	24,200		
Nonmetals:				
Aluminous shale			116	984
Barite	51,400	57,900	607	410
Cement	351,000	161,000		
Flint			654	
Fluorspar	(2)	(2)	2,954	4,105
Graphite:				
Crystalline			36	107
Amorphous			3,353	6,730
Kyanite				20
Magnesia clinker	53,500	67,300	24,942	21,118
Magnesite			280	200
Mica sheet			10	
Quartz and quartzite				776
Talc and soapstone	[4] 8,900	[4] 11,900	4,089	5,594
Mineral fuels:				
Anthracite			4,611	6,043

[1] Derived from official import statistics of the Soviet Union and Japan.
[2] Data not available.
[3] Approximate; converted from data reported in kilograms.
[4] Separate data on soapstone, if any, not reported.

TABLE 4.—Imports of petroleum products from the Soviet Union [1]

(Metric tons)

Commodity	1961	1962	Commodity	1961	1962
Gasoline	134,600	179,900	Mazut (mainly fuel oil)	8,400	5,400
Kerosine	10,000	7,900	Lubricants	39,500	48,500
Diesel fuel	123,400	191,700	Paraffin	300	1,600

[1] The U.S.S.R. is North Korea's main source of petroleum. Data are derived from official export statistics of the Soviet Union.

COMMODITY REVIEW

METALS

Iron and Steel.—North Korea's roughly 1-million ton steel industry recorded slight declines in pig iron and steel ingot output in 1963 as compared with 1962 figures. However, rolled steel production reportedly exceeded that of the previous year by about one-fifth. Some 50 types of new rolled steel products were said to have been produced, with the most notable advances in thin steel plate and wire rope. Finished steel products, particularly coated and uncoated sheets, represented a weak aspect of North Korea's iron and steel economy and, in late 1963, contracts were signed with Japanese and British traders to obtain these items.

At the Hwanghae (Whanghai) steelworks, and the country's largest and only integrated plant located south of P'yongyang along the southwest coast, construction of a 400,000-metric-ton blooming mill to complement other existing facilities made important headway in 1963, following the completion of two 40-metric-ton oxygen converters. Progress in making Kimchaek on the east coast into a large integrated steel plant was slow in 1963, although first-stage construction up to converter steel facilities (no rolling mill yet) on a scale slightly smaller than Hwanghae had already been completed.

Kangson, located north of the Hwanghae steelworks, produced both electric and Bessemer converter steel but no pig iron and specialized in shaped steel products; a 300,000-ton rolling mill started operations in late 1962 and a 50,000-metric-ton seamless pipe mill was nearly completed by the end of 1963. Songjin on the east coast produced electric pig iron and special steels and had a 200,000-ton-metric rolling mill including a recently completed 80,000-metric-ton heavy plate mill. Chongjin, the country's fifth steel plant in the northeast corner of North Korea primarily produced "granulated iron" (capacity about 130,000 metric tons per year) by the Krupp-Renn rotary furnace process.

North Korea has adequate iron ore to support a moderate steel industry, but the ore is mostly of inferior quality requiring upgrading. The foremost iron mine, Musan, in the east near the Manchurian border, already had sufficient milling facilities but an improved concentration method was being considered; one new project completed in 1963 was a large ore conveyance facility at the open pit. At the Mandok magnetite-pyrite mine in Hamgyong-Namdo, construction of a 280,000-metric-ton concentrator made headway in 1963. Also, during the year, a mill capable of producing 400,000 tons of concentrates from nearly 1 million tons of ore went into operation at the Unyul (Ullyul) open-pit limonite mine near P'yongyang.

Because of the shortage of coking coal, mostly supplied by mainland China, the low-grade nature of the magnetite and limonite, and moderate pit iron output levels, the high-shaft blast furnace operation—the principal method now employed—is not felt to be the most advantageous for the future. Electric pig iron smelting is also considered expensive in many cases. The long-range thinking of the

North Koreans, as of 1963,[4] was to build more granulated iron continous steelmaking (combination Krupp-Renn and steel refining) facilities together with conventional facilities. The use of ferrocoke (coking coal mixed with fine iron ore) in blast furnace smelting is an interesting North Korean innovation. At the end of the present 7-year plan, the hope is to produce three-fifths of the steel by the oxygen converter method.

Zinc, Lead, and Copper.—North Korea's mine output of zinc, lead, and copper in 1963 were significant. The regime envisages doubling the value of nonferrous production in a few years. The plan to increase values includes raising mine output somewhat, particularly copper, creating more smelting and processing facilities, and producing a greater variety of nonferrous metals and alloys. As in previous years, there were sizable surpluses of lead-zinc concentrate and metal in 1963.

At Munpyong the big lead-zinc smelter in the central coastal part of the country, a large sulfuric acid plant was reportedly installed to complement the 40,000-metric-ton electrolytic zinc plant completed in 1960; recent information indicates that the building of a Waelz kiln unit was well underway in 1963. The Poles reportedly were helping North Korea to build another zinc plant of 15,000 tons, with corresponding sulfuric acid facilities, that might become operative by 1965.

The most important recent development at the Namp'o copper-zinc smelter on the west coast was the completion of a 12,000-metric-ton copper rolling mill with wire and cable units. As of 1963 the smelter had diversified facilities—fluosolid reactors, 5,000-ton-plus copper refinery, 20,000-ton electrolytic zinc refinery, gold and other byproduct units, as well as sulfuric acid and superphosphate units. North Korea's third major nonferrous smelter was Hungnam to the northwest of Munpyong. In addition to copper and gold, Hungnam treated antimony, manganese, tungsten, molybdenum, and nickel.

Developments at specific base metal mines during 1963 are not known, but most operations have been fairly well stabilized for some time. The principal lead-zinc mines are in Kwangchon and Hochon in Hamgyong-namdo, Yongnim and Nangnim in Chagangdo, Songchon in P'yongan-namdo, and Ongjin and Changyon in Hwanghae-namdo. In 1963, heavy-media separation was reportedly introduced in lead-zinc operations. The two main copper mines of North Korea were Kapsan in Yanggando and Hwap'yong in Changangdo, with the former much the more important.

OTHER METALS[5]

Production of precious metals in North Korea was obtained primarily as byproduct output from copper and lead-zinc operations. The country had mines producing mainly gold; however, the relative importance of these has declined as base metal recovery has increased.

[4] U.S. Department of Commerce. Characteristics of Fuels and Iron Ores in Korea and the Necessity of Introducing Proper Steel Making Processes. Office of Tech. Services, JPRS 22236, Economic Report on North Korea No. 103, Dec. 11, 1963, pp. 8–16.

[5] U.S. Department of Commerce. North Korean Mineral Resources. Office of Tech. Services, JPRS 18242, Economic Report on North Korea No. 72, Mar. 20, 1963, pp. 65–68.

At the Holtong gold-copper-scheelite mine in Hwanghae-pukto (North Hwanghae Province) construction of a 410-meter vertical shaft was well underway in 1963.

During 1963, the Inp'yong Mine continued to be the sole producer of antimony ore and sent its output to Hungnam for smelting. Important quantities of electrolytic cadmium were recovered from zinc refining, and bismuth was recovered from lead smelting. Minor metals like selenium, germanium, indium, and silicon were also produced by the nonferrous smelters in 1963. North Korea has mined mineral sand (containing ilmenite, zircon, rutile, and monazite) for many years, although the level of production is not known.

North Korea has long been a producer of tungsten concentrate, mostly wolframite but also scheelite. The two leading mines are apparently Sinp'yong in Hwanghae-pukto and Taehung in Hamgyong'-namdo (South Hamgyong Province). The last reported output figure is 2,418 metric tons of concentrate in 1957, about three-fifths of the probable 1963 level. Some of the tungsten is consumed locally in making high-speed alloys and tool steel. Nickel-cobalt ores containing several hundred tons of nickel yearly are extracted at the Toksan Mine and elsewhere and made into electrolytic nickel at the Hungnam smelter. Chrome and manganese ore were also produced in 1963; manganese ore production apparently was not adequate for domestic demand.

The country has the raw materials and power to make magnesium. There is local demand for aluminum, and the North Koreans are considering resumption of production by 1967, with a 20,000-ton reduction plant based upon nephelite.

NONMETALS [6]

Barite.—By exploiting deposits at Changdo in Kangwon-do, Sugyo in Hwanghae-pukdo, Sokkge in P'yongan-pukto, and Tongchang in Hwanghae-namdo, North Korea has suddenly emerged as a significant barite producer.

Cement and Other Construction Materials.—North Korea has steadily expanded its cement industry; 1963 production came from about six 150,000- to 600,000-ton plants scattered around the country. Raw materials are generally adequate, except for gypsum which was imported in part from mainland China. The lime, brick, ceramics, and refractory materials industries were also sizable.

Chemical and Fertilizer Materials.—As of 1963, a fairly well balanced basic chemical and fertilizer industry with a strong raw material base as well as sulfuric acid and soda components already had been established. Pyrite, the source of sulfur, was extracted according to need, and sea water salt operations had a reasonably good year. Large quantities of apatite, mainly from the Sinp'ung mine in Hamgyong-namdo, were mined and utilized to make superphosphate. Nitrogen-fixation with hydroelectric and thermoelectric power provided the nitrogen base. North Korea's two principal chemical and fertilizer

[6] U.S. Department of Commerce. Nonmetallic Mineral Resources in North Korea. Office of Tech. Services, JPRS 18514, Economic Report on North Korea No. 75, Apr. 3, 1963, pp. 14–18.

centers in 1963 were Hungnam and Namp'o, both with superphosphate plants.

Graphite.—North Korea is a traditional graphite producer but by far the bulk of its 1963 production was amorphous grade. The crystalline grade component apparently has declined in relative importance in recent years.

Magnesite.—The North Koreans officially reported 385,000 metric tons of magnesia clinker output for 1963, making the country a prominent world producer and exporter of this material. Much of the magnesia clinker was made at plants in Chongjin and Songjin, both in Hamgyong-pukto. Extensive and high-grade magnesite reserves are known to occur in the Machon Mountain Range.

MINERAL FUELS

North Korea's output of fuels and power showed only a slight improvement in 1963 over that of 1962. Indigenous coal (primarily anthracite) and hydropower remained as the principal sources of energy consumed. Petroleum has been traditionally imported, mainly from the Soviet Union. Its use has been carefully controlled and solid fuels and electricity have been substituted for oil whenever possible. Wood and vegetable materials have played a minor role in industrial-scale heat and power generation. The 11.8 million megawatt-hours of electricity reportedly produced from all thermal and hydropower sources in 1963 ranked Korea high among world nations on a per capita basis. Many potential hydropower sites on the Yalu and other rivers remain to be developed.

Coal.—Coal production gains in 1963 fell slightly short of target. There was need to block out more reserves in order to increase the rates of extraction. Much basic work was done in mine transportation, such as electric railroads at the Anju brown coal mine, belt conveyors at the Bongchon and Choyang (open-pit) anthracite mines, and heavier tracks at the Yongdong mine. During 1963, vertical shafts were completed at the Aoji, Kokonwon, and Hamyon anthracite collieries. For the anthracite mines, mainly located in P'yongan-namdo in the west, special efforts were made in underground drainage which constitutes a problem in the rainy season. Modifications were made in mining methods for many mines, and hydraulic mining was reportedly introduced. Conservation of timber was stressed. Output at the Sinchang anthracite mine in the central Taedong River Basin—largest coal mine in North Korea—topped 2 million tons in 1963.

The bituminous coal situation apparently did not improve during 1963, much of the output included in this category being actually lower rank coals. Good-grade bituminous coal had to be imported from Manchuria in China, primarily Shuang-ya-shan, for coking purposes. To cut down the import requirements, anthracite has been used as much as possible in blast furnace smelting, electric smelting has been stressed, and greater application of iron and steelmaking methods requiring little or no coking coal, such as the Krupp-Renn process, has been considered. Anthracite was not only the principal fuel for

thermal power in 1963, but also was used in chemicals and ammonia fertilizers. Low-rank coals, mostly extracted in Hamgyong-pukto, were important as fuel for railroads although thought was given to converting such coals into electricity to supply electrified railroads in the future.

The Mineral Industry of South Korea

By J. M. West [1] and K. P. Wang [2]

SOUTH KOREA's economy is chiefly agricultural, in contrast to that of North Korea, a much more industrialized country. With a population of 27 million, South Korea produced approximately US$150 million worth of mineral products in 1963. In comparison, North Korea, with two-fifths of that population, produced more than 2.5 times the mineral value of South Korea. Although South Korea is mineral-poor, compared with its northern neighbor, some leading mineral products such as anthracite, tungsten, and graphite, are common to both countries. Most of South Korea's larger mineral and industrial enterprises are controlled by the government.

Anthracite has been South Korea's most important mineral product in terms of value in recent years, replacing tungsten, for which the country had been most noted. The output value of anthracite in 1963 was 1.5 times that of all the other mineral and metal products combined, and twice the combined value of the next two ranking categories, which were cement and iron and steel. Lesser mineral industries included iron ore, tungsten-bismuth, gold, graphite, and salt. The nonferrous base metal industry is small, but the country has produced fair amounts of nonmetallics, such as fluorspar, talc, and pyrophyllite.

South Korea provided about one-half of the world's graphite in 1963, but the material was poor in grade. It probably was also the third-ranking world producer of tungsten, accounting for over 10 percent of the total and more than 25 percent of the free world supply. In addition, South Korea produced approximately 9 percent of the world's anthracite, 5 percent of the bismuth, and 2 percent of the fluorite (fluorspar).

Minerals and metals were significant to the country's economy; combined output value in 1963 was approximately 7 to 8 percent of the gross national product. Anthracite mining probably was the most important single industrial activity in South Korea. The mineral industry as a whole has grown consistently in recent years; progress has been particularly strong in 1962–63.

Probably the most important mineral development in 1963 was the near completion of a petroleum refinery at Ulsan, a large industrial complex being constructed on the southeast coast. Plans for building an integrated steel plant at Ulsan were scaled down and remained under study. A 20,000-ton steel-rolling mill was opened at

[1] Physical scientist, Division of International Activities.
[2] Chief specialist, East Europe-Far East, Division of International Activities.

Toksu near Seoul. Agreements were reached to build mixed nitrogen-phosphate-potash fertilizer plants at Ulsan and Changhang. Coal production increased at a rate exceeding government plans. Three cement plants were under construction, two in Chungchong-pukto (North Chungchong Province) and one in Kangwon Province. A fluorspar-processing mill went into operation at Kumsan, Cholla-Pukto (North Cholla Province). Owing to unfavorable markets, operations at the Sangdong mine were curtailed and tungsten production declined. The search continued for iron deposits to supply the proposed Ulsan integrated steel plant and the growing export trade with Japan. At Changhang, the country's only base metal smelter, lead smelting and gold-silver cyanidation plants were under construction.

GOVERNMENT POLICIES AND PROGRAMS

The government's 1962–66 5-year plan emphasizes improvements in electric power, coal mining, transportation, and communications; and construction of additional cement and fertilizer facilities, an oil refinery, and a steel mill.[3] Greater production of iron ore and tungsten is also planned. A fundamental objective of the plan is to cut down on unfavorable trade balances.

Government-controlled industries, such as the Daihan Coal Corp., Daihan Iron Mining Corp., Daihan Mining & Smelting Corp., and Korea Tungsten Mining Corp., were authorized under the Mining Development Assistance Act (law 1089) of June 1962 to extend financial and technical aid to private companies for development projects. An enforcement decree issued in August 1962, outlined specific areas of responsibility in the mineral field. The Mining Encouragement Decree (as amended, Cabinet Decree 1234) enacted in March 1963, established procedures for the Ministry of Commerce and Industry to subsidize exploration, mills, and mine roads and to lend equipment to private mine owners and developers. The Mine Safety Law (law 1292), also enacted in March 1963, provided severe penalties to mine operators for violation of Ministry of Commerce and Industry orders to suspend operations because of unsafe conditions, equipment, or mining methods.

Increased emphasis was placed on fuels and power. Most of the power industry is government owned. Thermal plants under construction were expected to consume an additional 1 million tons of coal annually. A U.S.-financed 132,000-kilowatt thermal plant was being built near Pusan in 1963, and construction was to begin on a German-equipped 100,000-kilowatt thermal plant at Yongwol. A

[3] Republic of Korea, Economic Planning Board (Seoul). Summary of the First Five-Year Economic Plan, 1962–66. January 1962, 88 pp.

30,000-kilowatt generator was installed at the Samchok thermal plant. The Agency for International Development (AID) authorized a US$12.8 million loan for a 66,000-kilowatt thermal plant at Kunsan near the Changhang smelter. Work continued on the 57,000-kilowatt Chunchon hydroproject on the North Han River and the 35,000-kilowatt Uiam project on the Han River upstream from Chongpyang. South Korea's total generating capacity at the start of 1963 was rated at 434,000 kilowatts, scheduled to be increased to 678,000 kilowatts by 1965.

Assisting in South Korea's resource development program, the Mineral Industries Engineers, Inc., of Golden, Colo., completed geophysical and geological studies under an AID contract in 1963 and signed a new contract extending to July 1965.

The metric system, used on a trial basis during the last quarter of 1963, was adopted officially by South Korea for all statistics and measurements, effective January 1, 1964.

PRODUCTION [4]

Mineral output of South Korea roughly doubled in value between 1959 and 1963, and the estimated figure of US$150 million in 1963 was about 15 percent greater than in 1962. The metallurgical component of the mineral industry was small, because of the poor resource potential in metallic ores and the relatively low level of industry activity.

Coal accounted for about 60 percent of the 1963 mineral output value, cement and steel each 10 to 15 percent, and nonferrous metals and nonmetallics each 5 to 8 percent. Other mineral-producing operations were small, compared with coal mining and steel and cement production. A decade ago tungsten was also important, because prices were more than five times the present level.

Anthracite and cement more than doubled and steel quadrupled from a nominal base in the past 5-year period. Gold production increased by about 50 percent, and a small nonferrous industry was developed during these 5 years. Tungsten output in 1963, while much higher than in 1959, was well below that of 1962, reflecting the drastic decline in prices. In the nonmetallic area, graphite operations were greatly expanded. The barite, fluorspar, pyrophyllite, and talc industries either were new or bore no resemblance to their small-scale beginnings of 5 years ago. Salt production has fluctuated owing to varying weather conditions.

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[4] Bank of Korea (Seoul, Korea). Monthly Statistical Review. 1963–64.
Mineral Resources Development in Korea 1961–62 (prepared for ECAFE Mineral Subcommittee). 1963, pp. 1–90.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum products	3,929	4,507	6,650	7,310	7,272
Bismuth:					
Concentrate (30 to 45 percent bismuth)	343	480	505	534	528
Metal (99 percent bismuth)	105	102	108	154	135
Copper:					
Ore (4 to 10 percent copper)	4,798	5,892	5,296	10,726	12,297
Electrolytic metal	748	1,010	1,321	2,210	2,379
Sheet	251	387	545	740	1,518
Gold, troy ounces	65,690	65,814	84,105	107,880	90,093
Iron and steel:					
Iron ore and concentrate (45 to 57 percent iron), thousand tons	282	392	505	471	501
Pig iron	8	14	9	----------	5
Steel ingots (mostly from scrap), thousand tons	38	50	66	148	160
Lead:					
Concentrate (50 percent lead)	464	1,837	1,750	2,825	3,834
Plate	106	145	270	299	585
Manganese ore (40 percent manganese)	450	1,380	1,377	1,002	4,155
Molybdenum concentrate (90 percent molybdenite)	41	82	59	138	130
Nickel ore (3 to 4 percent nickel)	20	----------	934	868	855
Silver, troy ounces	241,898	329,649	460,341	412,812	443,977
Tungsten ore and concentrate [1] (65 to 85 percent tungsten trioxide)	2,924	4,915	6,303	5,797	5,222
Zinc:					
Concentrate (50 percent zinc)	7	84	900	839	2,260
Oxide	2,222	2,346	2,441	2,208	2,568
Nonmetals:					
Asbestos	80	671	309	1,209	[2] 1,923
Barite (90 to 95 percent barium sulfate)	----------	200	700	920	2,758
Cement, thousand tons	358	431	523	790	778
Diatomite	1,692	2,400	1,804	688	1,694
Fluorspar (90 to 95 percent calcium fluoride)	6,122	18,900	27,932	32,970	39,785
Graphite:					
Amorphous (75 to 80 percent carbon)	82,444	91,631	88,489	183,879	[2] 337,985
Crystalline (74 to 87 percent carbon)	151	700	1,224	1,216	[2] 1,692
Kaolin	42,813	51,231	[2] 51,177	38,193	52,262
Limestone, thousand tons	492	637	1,265	1,260	1,363
Monazite [3]	59	12	775	([6])	([6])
Quartzite (99 percent silica)	3,170	5,881	270	21,153	26,243
Pyrophyllite	420	6,600	23,985	18,112	31,811
Salt, thousand tons	390	399	122	388	[2] 230
Talc (30 percent magnesia)	16,643	15,979	21,674	28,368	32,393
Mineral fuels:					
Coal, anthracite, thousand tons	4,136	5,350	5,884	7,444	8,859
Fuel briquets (anthracite-clay mix), do	2,226	2,908	[4] 4,000	4,953	3,452
Peat [5], do	90	97	41	[4] 100	([6])

[1] Includes synthetic scheelite and small quantities of wolframite. Average grade approximately 70 percent tungsten trioxide.
[2] Revised figure; differs from that given in commodity chapter, volume I.
[3] Reported variously as concentrate containing 28 percent cerium and 10 percent thorium oxide, or 30 percent combined oxides.
[4] Estimate.
[5] Used in agriculture.
[6] Data not available.

TRADE

Minerals and metals were important in South Korea's trade, accounting in value for about one-fifth of both exports and imports in 1963. However, mineral exports were less than US$20 million, whereas mineral imports exceeded US$100 million. Aside from South Korea's three main mineral products (anthracite, cement, and steel), many others, except precious metals, are primarily exported. The two principal categories of mineral imports are petroleum and steel products, which together constituted two-thirds of the value of all mineral imports in 1963. South Korea has been entirely dependent on foreign crude and refined oil.

Japan and the United States have been South Korea's principal trading partners. More than two-thirds of the 1963 mineral exports went to Japan; the only important item going primarily to other destinations was tungsten. Japan also furnished South Korea with about one-fourth of the mineral imports, primarily steel products and secondarily cement and fertilizers. The United States took half of the country's tungsten, and furnished the bulk of the oil, nonferrous metals, sulfur, and phosphates. The U.S. share of South Korean mineral imports was 40 to 50 percent.

TABLE 2.—Exports of selected metals and minerals

(Metric tons)

Commodity	1961	1962	1963	Principal destinations, 1962
Metals:				
Copper	733	40	(1)	Mainly to Japan.
Iron and steel [2]	8,079	2,594	46,663	Mainly to South Viet-Nam.
Iron ore	443,818	363,988	549,647	Japan 342,903.
Lead concentrate	1,622	1,443	4,982	All to Japan.
Manganese ore	500			
Nickel ore	750	916	546	All to Japan.
Tungsten ore and concentrate	5,927	4,713	5,107	United States 2,301; Western Europe 2,006; Japan 173.
Zinc concentrate	560	725	3,144	All to Japan.
Nonmetals:				
Barite	951	299	1,688	Japan 59.
Fluorspar	33,383	23,611	31,896	Japan 22,354.
Graphite [3]	57,450	47,379	47,416	Japan 44,975.
Kaolin	12,257	7,741	13,845	Japan 7,655.
Talc	14,508	18,369	17,570	All to Japan.
Mineral fuels: Anthracite	241,286	301,487	262,954	Do.

[1] Data not available.
[2] Consists of all pig iron in 1961 and all steel plates and sheets in 1962 and 1963.
[3] Includes crystalline graphite estimated at 1,200 tons in each year.

Steel trade increased sharply in 1963, with imports of products reaching about 300,000 tons, more than double the 1962 rate; exports rose from a few thousand tons to nearly 50,000 tons, primarily to South Viet-Nam. Scrap iron import of 30,000 tons in the first half of 1963 was a fourth higher than in all of 1962. Petroleum imports in 1963 increased by about one-third over the 1962 figures, cement imports rose about 50 percent, and bituminous coal imports declined about 30 percent.

TABLE 3.—Imports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	1963	Principal sources, 1962
Metals:				
Aluminum	3,471	11,804	7,653	United States, Taiwan.
Brass, bronze, other copper alloys	85	524	517	Japan.
Iron and steel:				
Scrap iron	150	22,300	(1)	Far East.
Ferroalloys	2,285	5,471	4,855	Western Europe.
Steel ingots	19,038	1,489	44,421	West Germany.
Semimanufactures [2]	32,008	129,165	238,557	Japan, Western Europe.
Mercury	17	25	(1)	United States.
Tin	164	318	218	Malaya.
Titanium oxide	1,015	1,312	983	United States, Japan.
Zinc	4,712	5,017	10,467	United States.
Nonmetals:				
Cement	75,647	180,385	274,294	Japan.
Gypsum and plasters	21,197	22,093	29,972	Mexico, Japan.
Magnesite	507	1,722	2,077	Austria, Japan.
Sulfur	7,647	217	1,476	All from United States.
Superphosphate	47,277	56,369	27	United States, Japan.
Mineral fuels:				
Bituminous coal	281,685	180,018	130,208	Taiwan, Australia.
Petroleum refinery products: [3]				
Gasoline thousand 42-gallon barrels	949	701	630	United States.
Kerosine do	310	390	402	Do.
Distillate fuel oil do	1,182	1,932	3,579	Do.
Residual fuel oil do	2,553	3,923	4,514	Do.
Lubricants do	64	91	234	Do.
Other do	196	279	452	Do.
Total do	5,254	7,316	9,811	Do.

[1] Data not available.
[2] Includes steel plates and sheets totaling 17,661 tons in 1961, 63,480 tons in 1962, and 149,244 tons in 1963.
[3] Excludes petroleum products used for military purposes.

Source: Research Department, the Bank of Korea, Seoul.

Exports of tungsten concentrates, still mainly to the United States and Western Europe, were a little higher, despite slightly lower production. Iron ore exports in 1963 rose more than 50 percent over the 1962 figures, fluorspar exports increased 35 percent, and anthracite exports declined by about 15 percent. Most of these developments reflect greater industrial activity and higher mineral production and consumption in South Korea.

COMMODITY REVIEW

METALS

Copper.—Changhang has a small copper smelter and electrolytic refinery plus a 100-ton flotation mill, treating scrap and copper ores from a few small mines. Two additional facilities under construction in 1963 were due for completion in 1964; a 30-ton-per-day lead smelter and a 25-ton-per-day cyanidation plant for treating gold-silver ores.

Gold.—South Korea's gold comes mainly from straight lode-type gold mines, although there are small placer and nonferrous smelting operations. Estimated 1963 output was more than 15 percent less than in 1962, a year when substantial gold was recovered at the Kwangyang mine in development work. Normally, over one-half of the country's gold output is from the Kubong and Muguk mines.

Iron and Steel.[5]—Demand for steel increased sharply in 1963 owing to a construction boom. As a result, output of steel ingots and imports of steel products[6] more than doubled the 1962 rate. Apparent consumption of steel products in 1963 exceeded 400,000 tons, compared with ingot production of only some 160,000 tons. AID-financed steel exports (mostly sheets and plates) were expected to be short lived because of reduced export subsidies and other restrictions. The existing scrap-based steel industry and small plants processing intermediate steel products have not been able to meet the growing needs of South Korea, and the iron ore industry has been purely an export industry.

The heart of South Korea's 1963 steel enterprise was the Inchon plant near Seoul; the plant belongs to the government-owned Daihan Heavy Industry Corp. Its 50-ton open-hearth furnace and 100,000-ton-per-year medium-section rolling facility turned out nearly one-third of the country's steel output, including most of the 10,000 tons of sheets. The rest of the output, which consisted mainly of rods and bars, was provided by about 30 other small and mostly privately owned steel plants, with overall about 3 open-hearth furnaces (3- to 10-ton size), 12 electric furnaces (1- to 5-ton size), 12 converters (1- to 5-ton size), and 50 rolling mills. These latter plants had to use supplementary imported steel ingots and blooms amounting to over 40,000 tons in 1963. Some operations worked on imported uncoated sheets and produced roughly 32,000 tons of galvanized sheets for South Korea.

In September 1963, the Zion Iron & Steel Industrial Co., Ltd., started to operate its 20,000-ton rolled-steel plant at Toksu, east of Seoul on the Han River. Two 60-ton melting furnaces had been installed and three 120-ton unspecified furnaces were under construction. The raw material for this plant may have to be imported scrap or steel ingot.

Plans originally submitted in November 1962 by Korea Steel Co. and Blaw-Knox Associates for an integrated iron and steel plant in the Ulsan industrial complex were scaled down to 304,000 tons of pig iron, 202,000 tons of steel ingot, and 178,000 tons of rolled products. The revised project under study will cost about US$80 million and was rated a key item in the government's 5-year plan. Emphasis was expected to be placed on sheet products, which South Korea produces in only very small quantities.

As of 1963, the iron ore reserve needed for an integrated steel plant plus exports was far from assured. The most optimistic reserve estimate credits South Korea with only about 20 million tons of iron ore, perhaps one-third of which is proved. The 500,000 tons produced for the Japanese market in 1963 would not be adequate for the proposed Ulsan plant even if not exported. Korea's leading mine, Yangyang in Kangwon Province, has only 5 to 8 years of reserves for an annual output of 300,000 tons of iron ore. AID-sponsored aerial and ground

[5] Far Eastern Economic Review (Hong Kong). Steel for Asia. V. 42, No. 13, Dec. 26, 1963, pp. 677–678.

[6] Iron and steel imports (excluding scrap) during 1963 consisted of 4,855 tons of ferroalloys, 44,421 tons of steel ingots and blooms, 15,498 tons of steel wire and rods, 14,521 tons of steel bars and shapes, 149,424 tons of steel sheets and plates (mostly uncoated), 25,463 tons of hoops and strips, 18,309 tons of rails and accessories, and 15,522 tons of steel tubes and pipes.

geological surveys led to the discovery of 2 million tons of 56 percent iron ore at Mulgum in South Kyongsang Province, where ore shipping began in mid-1962.

Lead-Zinc.—Output of lead and zinc concentrates rose significantly in 1963. There were only a few lead-zinc mines, probably the largest being the Sihŭng. Battery scrap supplied most of the country's lead requirements, since lead concentrates are exported.

Tungsten, Bismuth, and Molybdenum.—Much of South Korea's 1963 tungsten concentrate output consisted of synthetic scheelite, but some natural scheelite and wolframite concentrates were also produced. Over 90 percent came from the Sangdong mine, world famous for its size and richness. Synthetic scheelite was produced from the lower grade ores at Sangdong in a 400- to 450-ton-per-month plant opened in 1960; it is considered to be the world's largest such operation. Dalsung supplied some wolframite. Both mines are operated by the government's Korea Tungsten Mining Corp. (KTMC).

The market for tungsten, historically an important foreign exchange earner for South Korea, was depressed in 1961–63, mainly because of dumping of mainland Chinese tungsten in Western Europe. Prices fell below US$9 per short-ton unit there, and were only several dollars higher at the end of 1963. South Korea was only enabled to sustain operations by the synthetic scheelite plant, which could treat previously unworkable ores. Toward the end of 1963, mine production at Sangdong was curtailed somewhat in order to use up several thousand tons of impure concentrate on hand.

A tungsten metal plant being built by KTMC at Yŏngdŭngp'o, a Seoul suburb, was scheduled for completion by the end of 1964. Wah Chang Corp. of New York provided technical assistance.

Bismuth has been a valuable byproduct of tungsten in South Korea, output generally representing about 5 percent of the world total. Virtually all is from the Sangdong mine, where bismuth content of ores amounts to about one-tenth the weight of scheelite. Metallic bismuth of 99.7-percent grade or better is produced at a KTMC refinery at Sangdong, opened in 1961.

Sangdong mine's tungsten-bismuth ores contain recoverable molybdenum, about 3 percent of the scheelite by weight; molybdenum concentrates were recovered at the synthetic scheelite plant. Additional quantities of molybdenum came from small private mines.

NONMETALS

Cement.—Booming building activity in 1963 created a great shortage of cement and pushed imports sharply upwards. The government found it difficult to hold the price line, and cement prices tripled in some cases. Apparent consumption reached nearly 1.2 million tons during the year. The 5-year plan envisaged a cement consumption of 1.65 million tons by 1966.

Besides two existing plants, the 330,000-ton United Nations Korean Reconstruction Agency plant at Mungyong and the 300,000-ton Tangyang Cement Co. plant at Samchok, three others were under construction. These included two 400,000-ton plants, one at Sangyang in

Kangwon Province, and the other in Tangyang County, North Chungchong Province, both financed in part by West German credit; and a 150,000-ton plant, also in Tangyang County, financed through a U.S. Development Loan. Completion of the Sangyang plant was scheduled in December 1963, and the others were to be completed in April 1964. During 1963, Hyun-Dai Construction Co. placed a US$3.3 million contract with Allis-Chalmers International to modernize the Tangyang plant. Under consideration at yearend was whether to construct a sixth plant of 400,000-ton capacity or expand an existing plant by this amount. With all plans realized, total annual capacity would be about 2 million tons.

Fertilizers.—Two compound fertilizer plants were to be constructed, one at Ulsan and the other at Changhang, the cost to total an estimated US$100 million, according to agreements reached in October 1963, by the Korean Government and AID. The plants would require imported phosphate, since no domestic source was known. Production, equally divided between the two plants, would total 289,000 tons per year of contained nitrogen, phosphate, and potash compounds; the phosphate component would be 100,000 tons and the potash, 22,000 tons. In negotiating with foreign concerns for equipment and construction, priority was to be given to companies offering direct investment or credit assistance.

As a first step in plans to establish a 75,000-ton triple superphosphate plant, a Korean company (name unknown) was building a sulfuric acid plant on the east coast at Samchok. Scheduled for completion in January 1964, the plant was to produce 180 tons per day of 98 percent H_2SO_4. Inability of the seaport to handle oceangoing ships carrying phosphate rock and sulfur appeared to be a problem.

Korean fertilizer requirements were estimated for 1963, in terms of plant nutrients as follows: 200,565 tons nitrogen, 117,385 tons phosphorus (P_2O_5), and 29,110 tons potash (K_2O).

Fluorspar.—A custom fluorite-processing mill rated at 9,000 tons per year of concentrates grading plus 95 percent calcium fluoride was completed in March 1963 at Kumsan (Keum San), Cholla Pukto Province. Ores containing 50 percent fluorspar were supplied from a dozen or so nearby mines to this mill, and all output was exported. This operation produced less than one-fourth of South Korea's total fluorite in 1963.

Graphite.—South Korean graphite, mainly a low-quality amorphous mixture, generally occurs associated with anthracite and often is very similar to it. Production was primarily from four mines in 1963, chiefly by hand labor. The only important crystalline graphite operation was Sihŭng; its concentrator had a feed capacity of 200 tons per day. Its production in 1962 was reported at 183,879 tons of amorphous and 1,216 tons of crystalline graphite valued at US$2,010,000 and $147,000 respectively. Exports of graphite went mostly to Japan and possibly some of this material was exported under the classification for anthracite.

MINERAL FUELS

Coal.—Coal production, essentially all anthracite, increased in 1963 by 1.4 million tons, in accordance with the 5-year plan to boost output to 11.6 million tons in 1966. Of the 1963 production, 53 percent came from government-controlled Daihan Coal Corp. mines, with the following shares, in percent: Changsong, 22; Togye, 10; Hwasun, 8; Hambaek, 5; Unsong, 4; and Yongwol, 4. Anthracite was the country's main energy source for electric power, transportation, domestic heating, and fertilizer production. About 3 percent of the coal production was exported, mainly to Japan. Imported bituminous coal, mainly from Taiwan (coking) and Japan, was used in the iron and steel industry and for special purposes.

Inefficient rail transport in some mining areas limited movement of coal to markets, and coal shortages occurred despite rising production, particularly in industries depending on steam for power. Increased purchasing of bituminous coal from abroad was expected in order to meet growing demands, especially for the iron and steel industry.

The Korean Government was granted a US$9.5 million loan by AID in December 1963 for development work, to include the sinking of two deep shafts at the Changsong mine, Korea's largest and most important coal mine. Reserves at this deposit were estimated at 26 million tons.

Under the Mining Development Assistance Act of 1962, Daihan Coal Corp. took part in organizing small holdings in coal-mining areas into districts of potential economic size. As of May 31, 1963, six coal mine districts had been established—Rachon, Hwedong, Kuchol, Samchok, and Wongdong, all in the northeast, and Songju, in the west. Hwasun was proposed for a seventh district in the southwest.

Petroleum.—Consumption of petroleum products, all imported, was somewhat higher in 1963 than in 1962. The value in 1963 was estimated at US$31 million, excluding imports for military uses.

The Ministry of Commerce and Industry signed a US$16 million contract in October 1962 with Fluor Corp., California, for construction of a 35,000-barrel-per-day petroleum refinery at the Ulsan industrial site, following a favorable feasibility report by Universal Oil Products Co., a U.S. firm. The latter company signed a letter of intent with the Ministry in September 1962 to fulfill a US$783,000 contract covering design and supervision of construction. Construction progressed rapidly during 1963 and the plant, to be operated by the government-owned Korea Oil Co., was expected to be in full production by mid-March 1964.

The government in October 1963 approved terms of an agreement for a 25-percent equity investment by Gulf Oil Co. in the Korea Oil Co., under which Gulf was to release US$5 million in equity and US$6 million in loans to the company by the end of 1963.

The Mineral Industry of Laos

By K. P. Wang [1]

THE SMALL land-locked neutral Kingdom of Laos, with only two and a half million people, did not produce or consume any mineral product of significance by world standards during 1963. The nominal amounts of minerals extracted were of little consequence to the domestic economy.

Laos' premium mineral product has been a 50-percent grade tin concentrate produced for export. During the first half of 1963, tin concentrate output was about 650 metric tons, somewhat less than in 1962. The country's tin production in 1963 was about 0.2 percent of the world total and was valued at roughly US$700,000 which was equivalent to 0.5 percent of the gross national product.

As in earlier years, by far the most important mineral product consumed in 1963 was imported gasoline, roughly half of which was for aviation. All told, Laos acquired US$2 to 3 million worth of foreign refined petroleum products during 1962–63.

In 1963, extensive reserves of iron ore in Xieng Khouang Province were confirmed. The resource will be of little use to Laos unless it is developed for the export market; transport facilities through Vietnam probably would be required.

General conditions in 1963 were not conducive to mineral exploitation. The unstable political and security situation caused tin production from the existing mine to drop below the 1962 level and prevented the development of a second tin property. Also, a nearly completed cement plant in Thakhek may have to use local charcoal because coal cannot be obtained from a now "unsafe" area. The general economic situation was critical in 1963. Although a monetary stabilization program was initiated late in the year, there was no assurance that it would effectively curb runaway inflation. Under these circumstances, it was difficult to implement any effective mineral development program.

PRODUCTION

Tin is the only mineral product of Laos for which production statistics are available. Output of concentrates, and their approximate tin content have been as follows:

Year:	*Concentrates long tons*	*Metal content long tons*
1957	550	274
1958	601	301
1959	588	294
1960	765	383
1961	667	335
1962	709	367
1963	650	326

Source: Service de la Statistique du Laos. Bulletin de Statistiques du Laos, January, February, and March, 1963: Royaume du Laos.

[1] Chief specialist, East Europe-Far East, Division of International Activities.

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Laos also produced 1,000 to 2,000 tons of salt, small quantities of lime, and unreported quantities of construction quarry products.

TRADE

Tin was the leading export item of Laos in 1962–63. However, total mineral exports were only a fraction of mineral and metal imports.

During 1962, mineral and metal imports represented about 30 percent of the value of all imports by Laos. Refined petroleum occupied a major position among the mineral product imports, accounting for more than half the value. Metals, cement, and salt headed the lesser mineral imports.

TABLE 1.—Imports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:[1]			
Aluminum	30	78	Japan 31; Thailand 32.
Copper	16	55	United States 49.
Iron	2,800	3,700	Japan 2,000; United States 700; Thailand 600.
Lead	14	38	Thailand 21; Hong Kong 15.
Nonmetals:			
Asphalt	845	206	Singapore 155.
Cement	11,776	34,811	Thailand 34,640.
Salt	1,363	15,259	Thailand 15,252.
Mineral fuels:			
Petroleum:			
Aviation gasoline	thousand 42-gallon barrels 100	155	Indonesia 155.
Motor gasoline	do 114	130	Indonesia 124; United States 6.
Kerosine	do 18	20	Indonesia 19; United States 1.
Distillate fuel oil	do 64	36	Indonesia 32; United States 4.
Residual fuel oil	do 14	16	Indonesia 16.
Lubricants	do 8	7	United States 6; Indonesia 1.
Other	do 8	5	United States 1.
Total	do 326	369	Indonesia 347; United States 18.

[1] Estimated by the Bureau of Mines. Metallic ore imports are insignificant.

COMMODITY REVIEW

METALS

Iron Ore.—As of 1963, Laos reportedly had discovered two large high-grade iron deposits in Xieng Khouang Province. One was on a hilltop between the cities of Xieng Khouang and Phong Savan, with up to 1 billion tons of reserves, most of which can be mined by opencut methods; a second, of possibly similar magnitude, was 50 kilometers south of Xieng Khouang, according to French experts who examined both properties in a cursory manner. Systematic surveys on the first deposit were initiated late in 1963.

Tin.—The tin mining industry of Laos had a mediocre year in 1963, producing slightly less than in 1962. The only producer, the French concern of SEMMI (Société d'Étude et d'Exploitations Minières de l'Indochine) with an open pit mine at Phontiou in Savannakhet, Nam Patene Valley, still was not able to make any headway either in expanding production or improving product quality. The ore grade

at 0.2 to 0.8 percent tin is good; however, much of the tin-bearing mineral occurs in so fine a state that it cannot be recovered efficiently in the existing mill. In 1962, SEMMI exported 593 metric tons of 50-percent concentrate to the Penang smelter in Malaysia for smelting.

Adjoining Phontiou are Boneng and other properties that have not been worked since World War II. Apparently, extensive new reserves that can support an annual output of several thousand tons of mine tin were found in these properties during the last few years. A plan to exploit the newly discovered reserves by a joint French-Laotian tin mining company was not implemented in 1963 on account of the uneasy political situation.

Other.—During the last few years, SEMMI located lead, copper, and gold prospects in the Tchepone, Saravane, and Vientiane areas but again did no development on them in 1963 because of the general Laotian situation.

NONMETALS

Cement.—Laos has been intermittently building a 25,000-ton portland cement plant in the Thakhek area since 1954 with Swiss equipment and Swiss engineers. The latest word is that the plant was to have been substantially if not fully completed at the close of 1963.[2] Small quantities of lime made by burning wood were produced in 1963. The plant has five main units—lime burning, clay processing, kiln firing, clinker grinding, and gypsum blending. All raw materials will come from within 10 kilometers of the plant, except gypsum which is scheduled to be trucked in from extensive deposits at Dong Heng near Savannakhet. Coal from the now unsafe area of Saravane, if used in place of local charcoal, would make the plant more efficient. Local demand for cement has been met by imports from Thailand.

Salt.—One to two thousand tons of salt have been produced in Laos each year from brine operations (rock salt) in the Vientiane and Phong Saly areas. Although domestic production could be increased, imports supplement supplies of domestic origin at present. Laos imported 1,363 metric tons of salt in 1961 and 15,259 tons in 1962, all from Thailand.

MINERAL FUELS

Coal.—Internal security conditions apparently continued to be a factor in preventing development of several coal deposits, such as those north of Saravane.

Petroleum.—SEMMI was active in oil exploration near Vientiane and Thakhek. However, much more work needs to be done before the possibilities can be evaluated. Meanwhile, imports of refined oil products are relied upon to meet demand. As noted, aviation and motor gasoline are the main petroleum products consumed.

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[2] See Department of State Incoming Airgram AID/W–TOAID A–516 from Vientiane, Nov. 23, 1963, pp. 1–8, for details of the Thakhek cement plant.

The Mineral Industry of Malaysia[1]

By J. M. West [2] and K. P. Wang [3]

MALAYSIA, the new Commonwealth nation established on September 16, 1963, through consolidation of the 11 States of Malaya, the Colony of Singapore, Sarawak, and Sabah (North Borneo), has a population of 10 million—three-fourths in Malaya and one-fifth in Singapore. One-half of the population is Chinese. Rubber, tin, and iron ore, solely from the Malayan Peninsula, traditionally have been the three most important products. [4]

Malaysia was the world's foremost tin producer in 1963 and provided slightly less than one-third of total mine production and about two-fifths of total smelter output. The country was the second largest iron ore producer in the Far East, surpassed only by mainland China. Bauxite output, from southern Malaya and Sarawak, was about 2 percent of the world total. A little crude oil and sizable quantities of refined oil were produced in the northern tip of Sarawak. The bulk of the crude came from nearby Brunei, still a sultanate independent of Malaysia. Brunei and Sarawak together supplied about 0.4 percent of the world's oil.

The mineral industry was responsible for about one-eighth of the US$2 billion gross national product estimated for Malaysia in 1963. Tin contributed two-thirds of the mineral output value, and iron ore about one-fourth; other mineral products included cement, oil, gold, and byproducts of tin such as columbite-tantalite, monazite, ilmenite, and zircon. Tin was marketed worldwide, with one-third going to the United States. Iron ore went exclusively to Japan.

Since tin contributes so heavily to Malaysia's national income and foreign exchange position, price fluctuations have always been of great concern. U.S. stockpile tin releases in 1963 had an initial stabilizing effect, but rising world demand subsequently forced prices up to US$1.29 per pound on December 19, 1963, the highest since June 1951. Tin resources appeared capable of supporting the 1962–63 output levels indefinitely. Tin recovery techniques were improved, and potential tin lands in national and State reservations were being released in 1963 for prospecting.

Two sizable iron mines and some smaller ones were operated during the year. Iron mining depended on Japanese demand; reductions of purchases and boosting of specifications by Japanese buyers were serious matters. In early 1963, a Japanese steel mission visited Kuala

[1] Includes data on petroleum production of the Independent Sultanate of Brunei.
[2] Physical scientist, Division of International Activities.
[3] Chief specialist, East Europe–Far East, Division of International Activities.
[4] Owing to the change in political status, most 1963 figures apply to individual Commonwealth members rather than to Malaysia as a whole.

Lumpur to explain to Malayan iron producers why Japan wanted to reduce purchases and prices. The long-term outlook for new iron discoveries was considered only fair as of 1963; search was aided by aerial surveys but hampered by the dense jungle growth covering four-fifths of the country.

An oil refinery by Shell Refining Co., Ltd., at Port Dickson on the Malaccan Straits and an aluminum mill at Petaling Jaya near Kuala Lumpur were completed in 1963. Projects well underway included a tin smelter at Kulan near Kuala Lumpur which was being built to supply the Japanese market; steel mills at Prai near Penang and at Singapore; a second Port Dickson oil refinery by Esso Standard, Ltd.; and cement plants at Ipoh and Singapore. Another new refinery, by Socony Mobil Oil Co. at Singapore, was in the planning stage, with an operational date set tentatively for 1966. The Buket Ibam (Rompin) iron mine in Pahang was approaching full-scale production, and initial development began on the Bera Mukim iron deposit in southwestern Pahang.

GOVERNMENT POLICIES AND PROGRAMS

Malaysia, a relatively stable southeast Asian country, has a free enterprise system with minimum Government direction and a relatively favorable investment climate. Although the Government supports private enterprise, which provides the main source of capital, through the Economic Planning Unit, the Malayan Industrial Development, Ltd., and other agencies, it has taken the initiative to accelerate industrialization. One step is its "pioneer industry" program offering 5-year tax writeoffs and other inducements. Many subsidiary and wholly foreign-owned companies have been established in the absence of regulations limiting foreign ownership and employment.

Following consolidation, the Government continued with fair success the second 5-year plan (1961–65) of the old Federation of Malaya, which was aimed at increased private and public investment, industry diversification, rural development, and social improvements. Emphasis has been on establishing industrial estates such as at Singapore (Jurong), Kuala Lumpur (Petaling Jaya), Ipoh (Tasek), Johore Bahru, and Butterworth. The first stage (105,000 kilowatts) of the Malayan Central Electricity Board's Cameron Highlands hydroelectric project, north of Kuala Lumpur, was completed in 1963. The World Bank approved a loan for the second stage to provide an added 163,000 kilowatts of generating capacity by 1968. A thermal plant was completed at Johore Bahru, and another was under construction at Prai. Adequate electricity was essential to the mining industry, which consumed about one-third of the total power output.

The Government was forced to combat scattered insurgent fighting attributed to Indonesian-supported infiltrators. Indonesia announced an economic confrontation policy when Malaysia was formed and immediately ceased tin-ore shipments to Malayan smelters, rerouting ores to the Netherlands for treatment. Singapore, which derives about one-fourth of its gross domestic product from entrepôt trade, was faced with serious effects from the overall Indonesian trade ban.

With establishment of oil refineries at Port Dickson, the Malayan Government in 1963 levied excise duties on locally refined oil products equal to existing import duties so that petroleum revenues, a major source of income, would not be lost. It also revised in March 1963 the system of calculating tariff on imports of galvanized sheets from 10 percent ad valorem to 3 Malayan cents per square foot, about four times the old rate. Export duties continued on iron ore at 5 percent ad valorem and on tin at about 15 percent ad valorem plus excise tax.

The Malayan Government's Mineral Investigation Drilling Unit prospected for tin in Malaya reservations, completing studies of 56,000 acres in Perak and 5,000 acres in Selangor State. Removal of a prospecting ban on State and Federal reservations opened new areas for exploration.

The British Territories in Borneo Geological Survey Department became a branch of the Geological Survey, Malaysia, in September 1963. Detailed mineral information was given on the Sarawak, Brunei, and Sabah areas in the Department's 1962 annual report.[5]

PRODUCTION

Malaysia's mineral output in 1963 was valued at about US$250 million, about 5 percent higher than in 1962, owing mainly to increases in tin and iron-ore production and to higher tin prices. Tin and iron ore accounted for nine-tenths of the total production, the balance largely comprising cement, bauxite, and petroleum. Sarawak, with its Lutong oil refinery, minor oil production, and bauxite, was credited with about 6 percent of Malaysia's output.

Production of tin concentrate rose 2 percent and tin metal output rose 3 to 4 percent. Iron ore increased 12 percent. Bauxite output jumped 27 percent in Malaya, while in Sarawak it fell by nearly one-third, compared with 1962. Ilmenite and monazite recoveries (reported as exports) were higher in 1963 by 44 and 28 percent, respectively, and gold increased several thousand ounces. Comparing 1963 with 1959, output of tin rose by half, iron ore and cement by nearly 100 percent, and bauxite by one-sixth; gold production dropped radically, and the coal industry went out of business.

[5] British Territories in Borneo Geological Survey Department. Annual Report 1962. 269 pp.

TABLE 1.—Production of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Bauxite:					
Malaya thousand tons	388	459	417	355	451
Sarawak do	210	289	257	229	157
Total do	598	748	674	584	608
Columbite-tantalite concentrate, columbium-tantalum ratio 4:1, 70 to 80 percent pentoxides	122	94	[2] 100	112	89
Copper, flotation concentrate	1,854	1,864	[2] 2,000	[2] 2,000	[2] 2,000
Gold:					
Malaya (crude) troy ounces	26,739	20,745	12,486	6,923	9,116
Sarawak (fine) do	2,450	3,326	4,132	2,835	2,773
Iron ore, 60 to 64 percent iron thousand tons	3,821	5,731	6,842	6,612	7,381
Manganese ore, 30 to 40 percent manganese	----------	2,923	6,468	309	6,982
Tin:					
Mine (contained 75 to 76 percent tin concentrate) long tons	37,525	51,979	56,028	58,603	59,947
Smelter [3] do	45,729	76,130	79,114	82,073	[2] 85,000
Titanium concentrate (ilmenite) (exports)	74,020	119,980	108,585	103,289	149,366
Tungsten ore and concentrate (wolframite and scheelite)	22	42	37	10	6
Zirconium concentrate (zircon) (exports)	118	57	57	65	206
Nonmetals:					
Cement thousand tons	193	286	331	318	362
China clay do	1	1	2	4	1
Monazite (exports)	239	43	708	637	899
Xenotime (yttrium mineral) (exports)	[2] 5	[2] 5	[2] 5	5	5
Mineral fuels:					
Coal, bituminous, low-grade thousand tons	77	7	----------	----------	----------
Petroleum:					
Crude, Sarawak thousand 42-gallon barrels	[2] 450	[2] 450	435	418	[2] 420
Refined products:					
Sarawak [2 4] do	15,376	15,123	16,877	17,500	17,500
Malaya-Singapore [5] do	----------	----------	[2] 13,337	[2] 39,931	[2] 55,057

[1] All production from Malaya unless otherwise shown.
[2] Estimate.
[3] Includes metal smelted from imported tin concentrates.
[4] Processed at Lutong refinery; mostly from crude supplied by pipeline from Brunei.
[5] Includes reprocessing of sizable quantities of oil products imported in unfinished form.

TRADE

Malaysia's trade has two major components—the trade of Singapore, and the trade of what formerly was Malaya. The volume of Singapore's trade was slightly greater than that of Malaya in 1962–63. An important entrepôt center, Singapore consumes less than two-thirds of the goods it imports and serves as an entry for products destined for southern Malaya.

The value of mineral exports in 1962 exceeded that of mineral imports by about one-third. Virtually all of Malaysia's tin and iron ore are exported, providing by far the bulk of the mineral exports. Japan imported the iron ore, and the United States was the largest purchaser of tin, with imports of US$87 million in 1962. The pattern of tin and iron ore shipments was about the same in 1963. Singapore exported some $2 million worth of silver in 1962. This was possibly to cover trade deficits attributed to mainland China, which Malaysia recognizes.

TABLE 2.—Exports of metals and minerals in 1962

(Metric tons unless otherwise specified)

Commodity	1962	Principal destinations
MALAYA		
Metals:		
Bauxite—thousand tons	320	Japan 297.
Columbite-tantalite concentrate	65	United States 57.
Copper concentrate	1,250	All to Singapore.
Gold bullion—troy ounces	2,314	Singapore, 1,983.
Ilmenite concentrate	103,000	Japan 70,300; France 31,400.
Iron ore—thousand tons	6,540	Japan 6,490; Taiwan 50.
Iron and steel scrap	14,900	Japan 11,400.
Manganese ore	1,400	All to Japan.
Monazite concentrate	637	United States 465; Japan 172.
Tin:		
Ore—long tons	711	All to Singapore.
Metal—do	81,358	United States 34,481; Japan 10,318; Belgium-Luxembourg 5,855; Italy 4,735; India 4,476; France 4,363.
Slag and hardhead—do	911	All to United States.
Zircon concentrate	65	All to Japan.
SINGAPORE		
Metals:		
Aluminum, all forms	1,330	Malaya 1,190.
Copper, all forms	790	Malaya 525.
Iron and steel:		
Pig iron	1,280	Malaya 650; Brunei 620.
Steel bars and rods	27,600	Malaya 23,100.
Angles and shapes	7,300	Malaya 2,400.
Plates and sheets	[1] 23,100	Malaya 13,900.
Other semimanufactures	21,900	Malaya 17,300.
Lead, all forms	433	Denmark 274 (metal); Malaya 118 (products).
Silver—thousand troy ounces	1,892	All to United Kingdom.
Tin metal—long tons	1,409	Turkey 583; North Borneo 159; South Korea 158.
Zinc, all forms	992	Malaya 722.
Nonmetals: Cement (reexports)	78,000	Malaya 59,000.
Mineral fuels:		
Petroleum:		
Crude (reexports)—thousand tons	1,225	Sumatra 1,041.
Refinery products:		
Gasoline—do	[2] 962	Thailand 229; New Zealand 193; North Viet Nam 171; Malaya 137.
Kerosine—do	[3] 730	Thailand 134; Malaya 89; North Viet-Nam 65.
Distillate fuel oil—do	1,091	Malaya 262; Thailand 260; North Viet-Nam 187.
Residual fuel oil—do	1,075	Japan 470; Hong Kong 134; North Viet-Nam 119.
Lubricants—do	13	Malaya 9.
Other—do	5	Malaya 2.

[1] Includes 15,700 tons of galvanized sheets and 1,800 tons of tinplate.
Includes 182,000 tons of aviation gasoline.
Includes 308,000 tons of aviation jet fuel.

Malaysia's net mineral import for consumption in 1962 was estimated at US$170 million. Excluded from this figure was approximately $87 million in tin concentrate imported for smelting and $64 million in crude oil piped from Brunei into Sarawak for refining; both products were reexported after processing. The largest import item in 1962 was a net 3.6 million tons of oil (half crude and half refined) entering Singapore, two-thirds of which went into bunkering for ships and planes. Iron and steel products constituted the second-ranking import item for Malaysia.

TABLE 3.—Imports of metals and minerals in 1962

(Metric tons unless otherwise specified)

Commodity	1962	Principal sources
MALAYA		
Metals:		
Aluminum, all forms	4,460	United Kingdom 1,360; Finland 1,180.
Copper and alloys	1,920	Rhodesia-Nyasaland 884; United Kingdom 542.
Iron and steel:		
Pig iron	2,810	Mainland China 1,240.
Steel bars and rods	74,500	Japan 41,000.
Angles and shapes	22,400	United Kingdom 14,800.
Plates and sheets	[1] 62,100	Japan 50,900.
Other products	59,100	United Kingdom 20,900; Japan 15,900.
Lead, all forms	709	Australia 260; United Kingdom 105.
Tin:		
Ore—long tons	34,518	Indonesia 17,785; Thailand 12,837; Burma 1,982.
Metal and alloys—do	357	Sumatra 189; Singapore 85.
Slag and hardhead—do	1,636	Indonesia 751; Singapore 529.
Zinc, all forms	2,126	United Kingdom 1,060; Rhodesia-Nyasaland 203.
Nonmetals:		
Alkaline and rare-earth minerals	690	United Kingdom 408.
Cement—thousand tons	199	Japan 81; Hong Kong 27; Thailand 13.
Gypsum and plasters	18,650	Belgium-Luxembourg 18,350.
Lime	3,360	Japan 2,690.
Phosphates	70,000	Christmas Islands 56,200.
Sulfur	1,820	France 903.
Mineral fuels:		
Coal	30,400	North Vietnam 17,900; Australia 12,500.
Coke	3,520	Netherlands 2,210.
Petroleum, refined products:		
Gasoline—thousand tons	220	Sumatra 137; Singapore 63.
Kerosine—do	118	Sumatra 71; Singapore 36.
Distillate fuel oil—do	462	Sumatra 313; Singapore 99.
Residual fuel oil—do	516	Sumatra 258; Iran 172.
Lubricants—do	31	Netherlands 11; United States 11.
Others—do	5	Sumatra 1.
SINGAPORE		
Metals:		
Aluminum, all forms	2,440	United Kingdom 710; Japan 680.
Copper, all forms	1,470	United Kingdom 356.
Iron and steel:		
Pig iron	7,780	Mainland China 3,360; Republic of South Africa 3,140.
Steel bars and rods	68,900	Japan 33,000.
Angles and shapes	18,500	Japan 6,050; Belgium-Luxembourg 4,950.
Plates and sheets	[2] 61,800	Japan 53,700.
Other semimanufactures	63,700	United Kingdom 19,300; Japan 16,300.
Lead and products	2,420	United Kingdom 618; Netherlands 334.
Tin metal—long tons	1,375	Malaya 1,375.
Zinc and products	775	Australia 465.
Nonmetals:		
Cement—thousand tons	336	Japan 255, mainland China 23.
Lime	3,680	Japan 1,840.
Mineral fuels:		
Coal	9,000	Australia 7,580.
Coke	3,140	Netherlands 1,200.
Petroleum:		
Crude oil—thousand tons	3,005	Kuwait 2,460; Iran 297; Iraq 161.
Refinery products:		
Gasoline—do	[3] 755	Sumatra 322; Iran 92.
Kerosine—do	[4] 905	Sumatra 464; Aden 114.
Distillate fuel oil—do	1,540	Sarawak 687; Sumatra 492.
Residual fuel oil—do	2,510	Sumatra 740; Bahrain 380; Australia 356
Lubricants—do	30	United States 14; Netherlands 9.
Other—do	4	Sumatra 2.

[1] Includes 23,500 tons of galvanized sheets and 4,300 tons of tinplate.
[2] Includes 25,000 tons of galvanized sheets and 16,100 tons of tinplate.
[3] Includes 165,000 tons of aviation gasoline.
[4] Includes 278,000 tons of aviation jet fuel.

COMMODITY REVIEW

METALS

Bauxite and Aluminum.—Both Malaya and Sarawak produced bauxite for export, mostly to Japan. Total output in 1963, valued at nearly US$4 million, was about three-fourths from Malaya and one-fourth from Sarawak. The production represented a 4-percent increase from that of 1962.

Malaya has two adjoining bauxite deposits, both on the Panggerang Peninsula in Johore State. Since closing of the Telok Ramunia mine of Ramunia Bauxite, Ltd., in 1961, Southeast Asia Bauxite, Ltd., with a new washing plant built in 1961–62 has been the sole producer.

In Sarawak, bauxite was mined at Sematan near Kuching by Sematan Bauxite, Ltd. Production has totaled nearly 1.1 million tons since commencement of operations in 1958. Mining has been confined to the Munggu Belian lease. Several deposits were under investigation in 1962–63, including the Buket Gebong, with an estimated 1.5 million tons in washed bauxite, and Tanjong Serabang, considered too low in grade for current use. Bauxite exports from Sarawak in 1962 totaled 232,000 metric tons valued at US$1.5 million, shipped to Japan (80 percent) and Taiwan (20 percent).

Malaysia's first aluminum rolling mill was opened in September 1963 at Petaling Jaya near Kuala Lumpur by Alcan Malayan Aluminium Co., Ltd., a subsidiary of Aluminium Co., Ltd., of Canada. The mill's capacity was rated at 2,000 metric tons per year of aluminum sheet. The company planned to use aluminum pig from Canada. Apparent consumption of aluminum in 1963 was estimated at 6,000 metric tons, of which about four-fifths was consumed in Malaya.

Gold.—Since closing of the Bukit Koman (Raub) lode mine in Pahang during 1961, virtually the only gold produced in Malaya has been the byproduct of tin mining (see Tin). Gold is mined on a small scale in Sarawak. Exploratory drilling in western Sarawak in 1963 at the foot of Gunong Krian Peak near Bau disclosed a marginal-grade gold-quartz orebody extending to a depth of nearly 300 feet; however, prospects of development were poor.

Iron Ore.—Iron ore, Malaysia's second-ranking mineral product, came from 2 sizable and about 20 small mines in 7 States of Malaya. Output in 1963, valued at about US$65 million, was one-eighth higher in tonnage than in 1962 and nearly double the 1959 level. The industry was fully dependent upon the market in Japan, which relied upon Malaya for one-fourth of its 1962–63 requirements. Despite available workable reserves for at least 10 years,[6] output levels may be cut back because of changes in Japanese demands.

About three-fourths of the country's 1963 iron ore output was produced by Eastern Mining & Metals, Ltd.; Eastern operated the Buket Besi (Dungan) mine, with an established capacity exceeding 3 million metric tons annually, and a subsidiary, Rompin Mining Co., operated the new Buket Ibam (Rompin) mine, which was expected to produce 1.5 million metric tons in 1963 and 3 million metric tons in 1964.

[6] Pearson, G. E. Malaya's Iron Future. Far Eastern Economic Review, v. 40, No. 8, June 6, 1963, pp. 552–553.

Small high-grade mines supplying the balance of iron ore output were troubled by low reserves, weak financing, and fluctuating Japanese quotas and grade requirements. Increased production in 1963 was due to renewed Japanese demand, following recovery from a 1962 recession in Japan, and to the opening of the Buket Ibam mine. Iron ore exports increased to 6.7 million metric tons valued at US$58.8 million in 1963.

The US$30 million Buket Ibam mine, largely U.S.-financed, represents probably the biggest single private investment in Malaya. Located deep in the jungle of Pahang State, it was connected in 1962 with the seaport of Jurong by a 50-mile railroad, permitting initial ore shipment. Ore reserves at Buket Ibam have been estimated at 20 million metric tons, but the mine has a peculiar quality control problem; although iron content is high, the ore contains troublesome nonferrous elements, such as copper, zinc, and bismuth. A nearby undeveloped deposit, Pasaki, containing 10 to 20 million additional tons of ore grading about 55 percent iron with little nonferrous impurity, was being explored in 1963 and was expected to provide ore for blending with that from Buket Ibam.

Buket Besi in Trengganu State supplied iron ore to the east coast port of Sura for shipment to Japan. Owing to foresight in installing a 3.5- to 4-million-ton-per-year concentrating plant in 1958 and to surprise development of additional reserves, the mine was expected to continue operating at least another 10 years at 1963 production rates. The deposit is unique because tin occurs both as an objectionable impurity and in separate tin-rich veins. Sufficient tin was recovered from portions of the deposit to make the mine the 12th largest tin producer in Malaya.

Investigations based on aeromagnetic surveys disclosed a potentially rich iron deposit estimated to contain at least 10 million tons of ore grading 66 to 68 percent iron in the Bera Mukim district, southwestern Pahang. The Malayan Government-sponsored National Investment Co., Ltd., acquired mining rights and was starting development jointly with a Japanese steel company to include a 25-mile jungle railway from the mine to Bahau, Negri Sembilan. The Perak State government issued 300-acre prospecting rights at another location, designated as magnetic anomaly 341, where a 10-million-ton iron deposit was indicated.

Iron and Steel.—Malaysia was slated to have several iron and steel plants operating in 1963–64.[7] The US$20 million Malayawata steel mill, a joint venture by Malayan interests and the Japanese Yawata Iron & Steel Co. at Prai, near Penang in northern Malaya, neared completion at yearend. The mill was scheduled to produce 120,000 metric tons of sponge iron and 60,000 metric tons of small bars annually. Sponge iron smelted from domestic ores was to be shipped to Japan for further smelting and returned in the form of ingots for final processing. The US$4 million National Iron & Steel Mill, to produce 70,000 metric tons of rolled products annually, was opened at the Jurong Industrial Estate, Singapore, in August 1963. A ship-breaking yard connected with the plant was under construction.

[7] Nathan, Andrew. Slow Pace for Malaysia. Far Eastern Economic Review, v. 42, No. 13, Dec. 26, 1963, pp. 678–679.

Similpan Steel Industries and Malaysia Steel Pipe Manufacturing Co., Ltd., both planned steel pipe and galvanizing plants at Singapore.

Net imports of iron and steel into Malaysia were estimated at 0.4 million metric tons in 1963, half from Japan and about 10 percent higher than in 1962. Sabah and Sarawak imported and consumed about 10,000 tons each. The Malaya-Singapore consumption was forecast to reach 1.2 million metric tons by 1980, compared with an estimated 306,000 metric tons in 1960.[8] Imports, comprising the bulk of consumption in 1960, were expected to provide only about 15 percent of requirements in 1980; the balance is to be supplied by rising domestic steel production.

In 1962, Singapore imported as much steel as all 11 Malaya States. About one-third was accounted for by entrepôt trade, mainly with Malaya. Singapore shipyards were responsible for a sizable consumption of steel plates and sheets, and there was a fair consumption of tinplate by local canneries. Apparent consumption of steel in the Singapore area was 100,000 to 150,000 metric tons in 1963.

Manganese.—A few thousand tons of manganese ore is produced yearly from deposits in Kelantan State, which were brought back into production in 1960 after being unworked since World War II.

Tin and Byproducts.—Malaya, with its famous Kinta Valley, is the world's foremost producer of tin. Mine-tin production in 1963 was 2 percent higher than in 1962 and slightly lower than the post-World War II peak of 62,295 long tons recorded in 1956. Deliveries of domestic ores to smelters totaled 60,879 tons of tin-in-concentrates in 1963, or 5 percent more than in 1962. However, imports declined by about 20 percent to 20,172 tons of contained tin, owing mainly to discontinuance of Indonesian shipments during the last quarter of 1963. Out of the 27,965 tons of tin concentrates (averaged 72-percent-tin content) imported in 1963, Indonesia provided 12,671 tons; Thailand 12,288 tons; Burma 1,996 tons; and Laos 554 tons.

Malaya's 1963 output of refined tin was about 3 to 4 percent more than in 1962. All output was from Malaya. Because of the decline of overall tin ore supply, substantial stocks had to be drawn upon in 1963, leaving only about 7,000 long tons of contained tin on hand at yearend. As in the past, all the tin metal produced was exported. According to company reports, Malaysia exported a record of 85,873 long tons in 1963: 35,615 tons to the United States, 20,883 tons to Europe, and 13,476 tons to Japan.

As of December 1963, 66 dredges and 643 other tin-mining units were in operation, employing nearly 34,000 workers in 9 of the 11 Malayan States. Dredges, mainly in Perak and Selangor, accounted for half the tin output; gravel pumps, two-fifths; lode mines, less than 5 percent; and hydraulic and opencast mines, the balance. Anglo-Oriental (Malaya) Ltd., with 13 subsidiary companies, worked 28 dredges and produced one-fourth of Malaya's mine tin. Pacific Tin was the only U.S. tin producer of any size. Berjuntai Tin Dredging, Ltd., was building a US$4 million dredge at its Batang Berjuntai property; the dredge will have a capacity of 500,000 cubic yards per month and a 135-foot digging depth.

[8] Yawata News (Tokyo). 20-Year Forecast of Southeast Asian Steel Demand. V. 2, No. 3, June 1963.

Two of the largest tin smelters of the world were in operation—the Penang smelter of Eastern Smelting Co., Ltd., subsidiary of Consolidated Tin Smelters, Ltd. (London), and, across the bay, the newer Butterworth smelter of Straits Tin Corp., Ltd. These two smelters, of nearly equal size, can smelt more than all the tin ore produced in southeast Asia. A 750-ton-per-month tin smelter was being built by Ishihara Sangyo Industrial Co. of Japan at Kulan near Kuala Lumpur for initial production in early 1964; this smelter is to supply the Japanese market.

World tin consumption was such that tin prices climbed 18 percent during 1963, despite release of 9,325 tons from the U.S. stockpile, and reached nearly US$1.30 per pound by the end of the year. Relatively high but unstable prices held back expansion plans.

Depletion of Malaya's richer tin reserves forced greater capital investment in large-tonnage, low-grade mining operations. Some relief was seen in the 1962 removal of Government bans on prospecting and mining on Malay Reservations, where rich finds were expected. In line with this policy, the Perak State government granted a mining lease to Société des Étains de Kinta on part of a railway reservation at Kampar, which contains US$25 million in tin.

Byproducts of tin mining included significant amounts of ilmenite, gold, columbite-tantalite, monazite, wolframite-scheelite, zircon, and copper concentrate. All byproducts except part of the gold were exported. Ilmenite went mainly to Japan and France, monazite and columbite-tantalite to the United States, and zircon to Japan. A few deposits in the Bakri area produced columbite-tantalite exceeding tin in value. Copper exported through Singapore was probably from the Sungei Lembing tin mine of Pahang Consolidated Co., Ltd. Tin slags containing about 5 percent combined columbium and tantalum oxides were shipped to the United States.

NONMETALS

Cement.—Malaysia's building industry enjoyed an unprecedented boom, particularly in Kuala Lumpur and Singapore, boosting cement consumption to an estimated 1 million metric tons in 1963. Apparent consumption during 1962 totaled 825,000 tons divided as follows, in tthousand tons: Malaya 515; Singapore 260; and Sabah and Sarawak 25 each. Cement consumption more than doubled in 1959–63; production was far short of demand, and black market prices rose to nearly twice the normal price of about US$1.30 per bag (about 110 lbs.). The great shortage of cement was met by imports, about two-thirds from Japan.

Cement production in 1963 came mostly from the 250,000-ton-rated-capacity Rawang plant of Malayan Cement, Ltd.; the balance presumably came from a small plant operated by Malayan Industrial & Mining Corp., Ltd., at Batu Caves. Both plants are near Kuala Lumpur. Singapore Cement Industrial Co., Inc., operated a clinker-grinding-and-packing plant in the Singapore harbor area, using cement imported from Onoda Cement Co. in Japan. Conversion of clinker to finished cement started in 1962, with output of 122,000 metric tons, rising to 194,000 tons in 1963.

The 500,000-ton Pan Malaysia Cement Works, a joint venture of Japan's Ishikawajima-Harima Co. and Malaya's Lew Yat Construction Co., was under construction at Kantan near Ipoh and due for completion in mid-1964. A subsidiary company, Pan-Malaysia Cement Works, secured a plant site at the Jurong Industrial Estate in Singapore and began work on a 250,000-ton cement plant due for completion in 1964; doubling of capacity was planned during the second year's operation of this plant.

MINERAL FUELS

Petroleum.—Expansion in petroleum refining was underway during 1963. Two refineries were being built at Port Dickson in Malaya, and another was being planned for Singapore. Oil refineries already in existence included Lutong in northern Sarawak and two in Singapore. These were operated by Shell Refining Co., Ltd., in Sarawak (45,000-barrel-per-day capacity) and by Shell and Maruzen Toyo Oil Co. in Singapore (about 15,000 and 30,000 barrels per day, respectively).

Shell Refining Co., Ltd., brought its US$17 million 20,000-barrel-per-day Port Dickson plant on stream in May 1963,[9] and Esso Standard, Ltd., was due to complete its US$15 million, 24,500-barrel plant, also at Port Dickson, in early 1964. Socony Mobil Oil Co. announced plans to complete construction of a US$13 million, 18,000-barrel refinery at the Jurong Industrial Estate in Singapore by 1966, through a new subsidiary, Mobil Refining Co. (Malaysia), Ltd.

Sarawak is Malaysia's only domestic source of crude oil, with less than 500,000 barrels produced annually. However, the small independent sultanate of Brunei, wedged between Sarawak and Sabah, is comparatively oil rich. During 1962, Brunei produced 28.5 million barrels (nearly 4 million metric tons) of crude oil valued at US$63.8 million, mainly from the Seria field; 645,000 barrels of natural gasoline; and 1,280 million cubic meters of natural gas. Its crude oil was piped to the Lutong area, partly for refining along with the Sarawak crude from Miri and partly (about half in 1962) for transshipment abroad. A little Brunei gas also went to Lutong and Miri. During 1962–63, the Brunei Shell Petroleum Co., Ltd., with exclusive prospecting rights in Brunei, concentrated exploration on offshore sites through the use of the Orient Explorer mobile drilling platform.

Malaysia apparently consumed 5.5 to 6 million metric tons (38 to 43 million barrels) of petroleum products in 1963, primarily the heavier refined oils. On an area basis in 1962, Singapore consumed about 3.5 million metric tons of oil; Malaya, 1.4 million tons; Sarawak, 300,000 tons; and Sabah, 100,000 tons. Actual consumption in Singapore, and therefore in all of Malaysia, was much lower because of large tonnages used for bunkering of foreign ships and planes. Malaysia's internal consumption of oil in 1963 was only 3 to 3.5 million tons. However, oil requirements were steadily rising, in line with increased industrial development and construction activities.

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[9] Crane, David. First Malayan Refinery. Far Eastern Economic Review, v. 40, No. 9, June 13, 1963, pp. 605–606.

Total oil imports for the Malaysian area in 1962 exceeded 13 million metric tons. Sarawak took nearly 4 million tons of Brunei crude; it reexported half of this, two-thirds to Australia, and refined the rest. Nearly half of the refined oil was shipped out of Malaysia. Singapore imported about 5 million tons of refined petroleum (excluding that from Brunei via Sarawak), mainly from Indonesia, and reexported 3.1 million tons to Far East countries; Singapore also imported 3 million tons of crude oil, mainly from the Near East, and reexported at least 1.2 million tons, mostly to Indonesia. Malaya imported more than 1 million tons of petroleum products in 1962, primarily from Indonesia. Singapore's importance as an oil trading and transportation center is obvious.

The Mineral Industry of Mongolia

By K. P. Wang [1]

MONGOLIA or Outer Mongolia, a land-locked Alaska-sized nomad country with only 1 million people and much of its economic and industrial activity centered around the capital city of Ulan Bator, has never produced any mineral commodity of international significance, except for fluorspar which constituted about 2.5 percent of the 1963 world output. However, various other mineral commodities have been produced, and a number of resource projects are being constructed with the aid of other Communist countries, in an effort to industrialize. Coal has been the most significant mineral product, but production has been far short of potential from the viewpoint of reserves. Although Mongolia's coal reserves of billions of tons could support a much expanded production, geographical problems related to resources and markets have restricted mine development; only a few new coal mines have been developed in recent years and those completed have been small.

However, construction of an important industrial complex based on easily accessible local coal, iron ore, clays, limestone, and sand resources was well underway in 1963 [2] at Darkhan (Darhan) a railhead on the Ulan Bator-Peking Railroad. Much overburden was removed at the Sharyn Gol coalfield of the Darkhan complex during 1963, in preparation of eventual production of a million tons of coal yearly from a "50-year reserve." The U.S.S.R. was helping to build the coal mine, a 100,000-kilowatt powerplant, a 300,000-ton steel mill, and a glass plant; Czechoslovakia was assisting in construction of a 100,000- to 200,000-ton cement plant located southeast of the Burbantyn Plain; and Poland was aiding Mongolia in the erection of a large brick plant, planned primarily to produce ordinary white bricks, but also to manufacture fire bricks.

PRODUCTION

Mongolia's mineral production for 1959–63 is estimated. It is apparent that coal, petroleum, and nonmetallics are important. However, metals should not be ignored despite the lack of statistics, since several million dollars worth of such products might have been produced. All told, the country's mineral output value is very low, even by Far East standards.

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[1] Chief specialist, East Europe-Far East, Division of International Activities.
[2] U.S. Department of Commerce. The Darhan of the Future. OTS, JPRS, Translations on Mongolia No. 18, Jan. 3, 1963, pp. 22–29.

TABLE 1.—Production of minerals[1]

(Metric tons)

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Alabaster (gypsum)	10,000	10,000	10,000	10,000	15,000
Fluorspar (fluorite)	34,000	40,300	38,000	40,000	53,000
Lime	8,000	10,000	13,000	21,000	25,000
Salt	5,000	6,100	7,000	8,000	8,000
Mineral fuels:					
Coal[2]	603,000	618,800	748,600	700,000	800,000
Petroleum:					
Crude oil	30,000	40,000	50,000	50,000	50,000
Refined oil:					
Gasoline	15,000	17,800	18,000	18,000	20,000
Diesel oil	5,000	7,040	7,280	7,300	8,000
Residual fuel oil	25,000	28,600	30,000	30,000	32,000

[1] All figures are estimated, except fluorspar for 1960–61, lime for 1961–62, salt for 1960, coal for 1959–61 gasoline for 1960, diesel fuel for 1960–61, and residual fuel oil for 1960. Other metals and nonmetals known to be produced include gold, lead-zinc, wolframite, clays, dolomite, limestone, and sand.
[2] Mainly so-called brown coal.

TRADE

Detailed data on Mongolian trade are lacking, but value of annual imports has been on the order of US$130 million to US$150 million and value of annual exports has been in the range of US$70 million to US$90 million. Most of Mongolia's trade has been with the U.S.S.R., and for this reason, in the absence of complete official Mongolian statistics, recorded Soviet imports from and exports to that country have been used as a measure of the country's trade. Only a few percent of Mongolian exports involve mineral products, and perhaps 15 percent of the country's imports consist of commodities in this group. Fluorspar has been Mongolia's only significant mineral export; Soviet imports from Mongolia totaled 37,500 tons in 1962 and 37,100 tons in 1961. Virtually negligible quantities of metallic ores and nonmetals from Mongolia have also been imported by the U.S.S.R. Recorded Soviet metal and mineral exports to Mongolia have consisted chiefly of iron and steel and mineral fuels.

TABLE 2.—Imports of metals and minerals from the U.S.S.R.

(Metric tons)

Commodity	1961	1962	Commodity	1961	1962
Metals:			Mineral fuels—Continued		
Iron and steel:			Coke	1,000	1,000
Pig iron	800	1,000	Petroleum:		
Rolled steel	12,900	22,500	Crude	24,300	30,900
Iron and steel pipes	4,900	4,900	Refinery products:		
Wires and nails	1,900	2,500	Gasoline	62,500	75,400
Nonferrous metals	90	140	Diesel fuel	47,500	48,000
Mineral fuels:			Lubricants	7,800	9,600
Bituminous coal	29,000	180,000	Other	600	800

Source: Official trade returns of the Soviet Union.

COMMODITY REVIEW

METALS

In 1963, the country's production of wolfram concentrate, from the Ih Hairhan and Burentsogt mines, probably totaled about 50 to 100 tons. Gold has been a traditional product, but no output statistics are available. Some lead-zinc ore was produced for export.

NONMETALS

Fluorspar.—According to the Mongolians,[3] output of fluorspar, presumably from the Berkh or Berhiyn mine 70 kilometers east of Ondor Haan, increased 36 percent in 1963 compared with 1962, which means that the 50,000-ton level was exceeded and roughly half of the ultimate target achieved. Virtually all Mongolian fluorspar has been exported to the Soviet Union.

Other Nonmetals.—A 10,000-ton per annum alabaster plant in the Dundgob Aymak was placed in operation in 1963; this is the second alabaster plant in Mongolia. The Tsagaan Bula lime plant in the Darkhan area was expanded during the year.

Sizable tonnages of clay, sand, dolomite, and salt were produced for domestic consumption.

MINERAL FUELS

Coal.—Coal,[4] mostly so-called 4,900-kilocalorie brown coal from the Nalaikha mine 35 kilometers east of Ulan Bator, has been the country's foremost exploited mineral resource, but Mongolia's coal production has not satisfied the demand by the power and other industries. Thus, imports have been necessary, as for example the 180,000 tons of bituminous coal obtained from the Soviet Union in 1962.

Petroleum.—As of 1963 Mongolia's small petroleum industry[5] was still far from achieving the basic objective of self-sufficiency. A Soviet-built refinery, turned over to the Mongolians in 1957, is in existence at Dzuun Bayan near the Sayn Shanda oilfield in the Gobi Desert. With an annual capacity of possibly 100,000 metric tons of crude oil this refinery may have processed approximately 30,000 tons of Soviet crude and 50,000 tons of local crude oil during 1963. In recent years, the deficiency in refined petroleum products has been met by annual imports of 110,000 to 140,000 tons from the Soviet Union.

[3] U.S. Department of Commerce. The 1964 Economic and Cultural Development Plan of the Mongolian People's Republic. OTS, JPRS, Translations on Mongolia No. 46, Feb. 26, 1964, pp. 22–42.
[4] U.S. Department of Commerce. Briefly About Certain Fuels. OTS, JPRS, Translations on Mongolia No. 29, July 3, 1963, pp. 11–24.
[5] Work cited in footnote 4.

The Mineral Industry of Pakistan

By L. Nahai [1]

PAKISTAN'S production of each of the major mineral fuels—coal, petroleum, and natural gas—increased in 1963, continuing the trend of the past several years. The country's scrap-based steel plants also showed production gains over 1962 output, as did the cement plants; but neither of these segments of the mineral industry was able to meet Pakistani requirements for their products, and significant imports of these commodities continued.

Pakistan did not contribute significantly to other nations' supplies of minerals. Production of chromite, Pakistan's foremost (and only significant) mineral export commodity has not exceeded 1 percent of the world total and in 1963 declined by nearly one-third from output in 1962 owing to poor market conditions.

The total value of crude minerals produced in 1962 (the last year for which reasonably complete data are available) totaled about US$47 million. The value of cement output raised the total to about US$90 million. Value added by the steel rerolling industry altered this figure only slightly. The contribution of the mineral industry to the gross national product (GNP) was quite small; mineral and mineral product output value was about 1.1 percent of the GNP. Of the total value of mineral and mineral product output in 1962, cement accounted for about 48 percent, petroleum for about 20 percent, coal for about 14 percent, natural gas for about 11 percent, and all other commodities for about 7 percent.

Pakistan is not well endowed with mineral resources. Except for natural gas, known deposits are almost entirely in West Pakistan. Natural gas reserves of West and East Pakistan, estimated to total at least 10,430,000 million cubic feet, are Pakistan's most important mineral asset. The total reserve of coal in all categories of depth, thickness, and reliability is estimated to be about 150 million tons. Coal reserves are in three areas of West Pakistan: Salt-Range-Trans Indus, Baluchistan, and Sind. Much of the coal is subbituminous, and relatively high in ash and sulfur; practically none is of metallurgical grade.

Iron formations in Pakistan are estimated to contain about 400 million tons of ore, however, all but 1 percent of the total is apparently low-grade. Nearly 75 percent of the total is in the sedimentary deposits in the Kalabagh-Makarwal area. The low iron content, complex mineralogy and nonamenability to beneficiation of the iron-bearing material here militate against its use as an iron ore. Sedimentary deposits of Hazara are similarly low grade.

[1] Near East-South Asia specialist, Division of International Activities.

Occurrences of antimony, copper, lead, and some other metals are known but owing to one or more unfavorable factors such as poor location, low grade, and presence of deleterious minerals, only a few have been worked; most are not commercial deposits at the present time.

Pakistan's nonmetallic mineral resource supply position is somewhat better. Limestone, gypsum, and salt are abundant in West Pakistan. Deposits of barite, bentonite, celestite, fuller's earth, magnesite, marble, and glass sand also are known in West Pakistan and have been exploited to some extent. However, resources of a number of nonmetallic minerals such as asbestos, boron minerals, fluorspar, phosphate rock, potash, and sulfur are inadequate or nonexistent.

Lack of building stones and aggregate materials is serious in East Pakistan.

Pakistan's second 5-year plan for economic development (July 1960 to July 1965) reportedly will include the expenditure of the equivalent of US$4,830 million of which US$210 million will be allotted to fuels and minerals, distributed approximately as follows: Petroleum exploration and transmission and distribution of natural gas, US$170 million; development of coal mines and increased coal production, US$25 million; exploration and development of other minerals, over US$1 million; and Geological Survey of Pakistan, about US$14 million. The consortium of governments and institutions interested in development assistance to Pakistan has pledged, subject as appropriate to legislative action or other necessary authorization, US$425 million for the fourth year of the plan, which began July 1, 1963. Previous commitments totaled US$1,175 million.

Although accomplishments in the first 3 years of the plan related to fuels and minerals cannot be fully assessed, industrial and urban construction and water and power schemes in the Indus Basin have increased demand for raw materials of the building industry. Increased industrial production in 1963, particularly in the private sector, has resulted in a record rate of natural gas consumption. Development of the paint and chemical industry has influenced production of some nonmetallic minerals such as barite, sulfur, salt, and evaporite deposits. Exploration and development has been accelerated by foreign technical assistance programs. A staff of U.S. geologists and engineers continued to operate under a 5-year Mineral Exploration and Development Project financed by the U.S. Agency for International Development (AID). Foreign private companies and Soviet Government technicians carried out petroleum exploration projects.

PRODUCTION

For the majority of mineral commodities produced in Pakistan no significant trend is apparent; however, substantial increases in the output of coal, natural gas, crude petroleum, petroleum products, limestone, cement, and rock salt are noted between 1959 and 1963. The near doubling of petroleum product output in 1962 compared with that of previous years resulted from operation of a new refinery in Karachi. The rise in natural gas production was the principal factor in increas-

ing the index of overall mineral production in the latter half of 1962 to 140, compared with 100 in 1959–60.

Pakistan does not have any primary metal producing industry except for a small antimony operation in Swat. Reported crude steel output was from small electric furnaces using imported and local scrap. Imported ingots and scrap continued to be rolled into bars, shapes, hoops, and wire in some 100 steel mills with 100,000 to 150,000 tons total annual capacity, but data on total output are not recorded.

TABLE 1.—Production of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Antimony:					
Concentrate	154	90	20	107	(2)
Metal content of concentrate [3]	108	63	14	75	75
Bauxite	2,173	583	412	----------	(2)
Chromite	16,280	18,384	25,506	[4] 21,474	[4] 14,536
Iron and steel:					
Iron ore [5]	2,286	5,508	3,865	----------	[4] 68
Crude steel	10,897	11,503	11,842	[6] 10,706	[6] 11,776
Lead ore	336	17	63	114	73
Manganese ore	29	297	350	14	----------
Nonmetals:					
Barite	516	643	444	2,870	[3] 2,900
Bentonite	(2)	1,355	982	407	(2)
Celestite	675	1,354	418	[4] 293	[4] 385
Cement [7] thousand tons	1,002	[4] 1,138	1,243	1,395	1,498
China clay	(2)	74	717	20	(2)
Dolomite	(2)	16	352	482	(2)
Fire clay	14,589	16,329	16,323	10,005	35,900
Fullers earth	(2)	1,505	9,698	8,708	(2)
Gypsum	98,804	90,978	101,197	[4] 182,184	[4] 160,731
Limestone thousand tons	942	1,081	1,195	1,156	1,441
Magnesite	402	441	163	940	[3] 1,000
Marble	2,841	5,329	5,000	2,259	7,289
Salt:					
Rock thousand tons	160	184	201	[4] 195	242
Other do	133	252	188	257	[3] 200
Silica sand	21,958	26,288	13,359	17,287	23,870
Talc (reported as soapstone)	2,378	3,424	1,235	1,120	1,870
Mineral fuels:					
Coal	735	831	921	995	[4] 1,243
Natural gas [8] million cubic feet	22,365	29,842	34,665	42,076	49,459
Petroleum:					
Crude thousand 42-gallon barrels	[4] 2,335	[4] 2,638	[4] 2,832	[4] 3,341	[4] 3,517
Refinery products:					
Gasoline do	708	731	776	1,089	(2)
Kerosine do	111	140	189	507	(2)
Distillate fuel oil do	498	512	685	1,137	(2)
Residual fuel oil do	735	693	762	1,695	(2)
Lubricants do	42	56	73	63	(2)
Other do	97	181	157	494	(2)
Total do	2,191	2,313	2,642	4,985	(2)

[1] Except where otherwise noted, output is all from West Pakistan.
[2] Data not available.
[3] Estimate.
[4] Revised figure; does not agree with that reported in Commodity Chapter of v. I or v. II; revised data not available in time for inclusion in other volume.
[5] Officially reported as iron ore, but consists of test lots obtained during exploration which were not used to recover iron.
[6] Includes East Pakistan as follows in metric tons: Ingot steel; 162, 139, 1963, 2,118.
[7] Includes East Pakistan as follows in thousand metric tons: 1959, 44, 1960, 70, 1961, 96, 1962, 90, 1963, 77.
[8] Includes East Pakistan.

TRADE

Pakistan's principal mineral export has been chromite which has been exported at rates varying from about 10,000 to 35,000 tons during

1955–61. Owing to market conditions, very little chromite was exported in 1963.

Pakistan has been dependent on imports to supply almost all requirements for iron and steel, nonferrous metals, and many industrial minerals such as abrasives, asbestos, and fertilizer raw materials. A substantial part of its coal, petroleum, and sulfur requirements also have been imported. In 1960–61 the total value of these imports was approximately US$255 million (nearly 26 percent of total imports) distributed as follows: Iron and steel, US$110 million; petroleum, US$94 million; nonferrous metals, US$21 million; coal and coke, US$16 million; construction materials, US$9 million; and ores and minerals, US$4 million.

The total for iron and steel may include some manufactures, but probably the bulk of the imports comprised rolled steel products such as beams, rails, wires, and construction steels. Among the nonferrous metals, in terms of value, aluminum ranked first (US$9,762,000) followed by copper (US$6,533,000).

TABLE 2.—Exports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity [1]	1961	1962 [2]	Principal destinations, 1961
Metals:			
Aluminum ore (bauxite)	127	(3)	All to Japan.
Chromite	13,150	9,803	United Kingdom 7,343; Japan 5,906.
Iron and steel:			
Iron ore [4]	559	(3)	All to Japan.
Scrap	2,737	(3)	Mainly to Japan.
Lead ore and concentrate	127	(3)	All to Japan.
Nonmetals:			
Aragonite	25	(3)	All to Italy.
Cement	35,801	(3)	India 32,327; Afghanistan 3,473.
Salt, all types	130,119	90,738	Japan 111,475; Ceylon 9,918; Spain 6,503.
Stone, worked and unworked:			
Marble	1,853	(3)	Italy 1,631.
Other	310	(3)	Italy 269.
Mineral fuel:			
Petroleum refinery products:			
Kerosine—42-gallon barrels	100	(3)	All to Afghanistan.
Distillate fuel oil—do	111	(3)	Do.

[1] In addition to items listed, Pakistan exports small quantities of a wide variety of metals and minerals in semifabricated forms; quantitative data for these exports are not given, but in 1961 they were valued at about PRs750,000 in total, compared to a value for items listed here of PRs6,952,844; of which salt accounted for 30 percent, chromite for 24 percent, marble for 16 percent, and cement 12 percent. 1 PRs equals US$0.21.
[2] Data from Statistical Summary of the Mineral Industry World Production, Exports and Imports 1957–62. Overseas Geological Surveys, Mineral Resources Division. London, 1964, 416 pp.
[3] Data not available.
[4] Test shipments.

Source: Except as noted, official foreign trade returns of Pakistan.

In 1960–61 suppliers of iron and steel to Pakistan, ranked in order of importance by value of material supplied were Japan, Belgium-Luxembourg, West Germany, United Kingdom, and United States. Nearly half of the nonferrous metals originated from Canada and United Kingdom. Iran supplied a little less than half of the petroleum imports with Saudi Arabia, United States, and Bahrain each supplying about 10 percent of the imports. Coal imports were largely from India. As a result of a number of nonproject, low-interest, long-term loans which U.S. Agency for International Development has made to Pakistan, the relative share of Pakistan's metal imports sup-

plied by the United States has increased since 1960–61. The latest loan was for US$70.5 million, and was agreed upon in September 1963. Of this total, US$46.5 million has been allocated for iron and steel industry development.

TABLE 3.—Imports of selected metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1960	1961	1962
Metals:			
Aluminum and its alloys:			
Unwrought	4,699	5,947	(2)
Semimanufactures	941	5,533	(2)
Arsenic and its oxides	61	45	33
Copper and its alloys:			
Unwrought	160	2,146	2,512
Scrap	19	266	148
Semimanufactures	1,821	3,362	(2)
Iron and steel:			
Scrap	147	526	50
Pig iron	64,902	43,609	77,569
Ferroalloys	365	1,163	945
Ingots and equivalent primary forms	40,388	231,878	233,393
Rolled steel	[3] 292,839	(2)	(2)
Lead:			
Ore	311	445	237
Semimanufactures, including alloy semimanufactures	556	1,471	(2)
Mercury 76-pound flasks	112	416	294
Tin and its alloys, unwrought long tons	457	489	461
Zinc and its alloys, unwrought	1,929	3,631	224
Monmetals:			
Asbestos (cement sheets)	104	403	1,683
Barite	3,804	398	83
Borax	654	410	292
Chalk and lime	[3] 259	(2)	(2)
China clay	3,797	5,721	9,211
Graphite	783	305	397
Nitrates:			
Sodium nitrate	56,111	162	245
Ammonium sulfate	30,160	105,528	108,885
Ammonium chloride	130	531	450
Potash salts	1,303	(2)	(2)
Salt	[3] 2,554	5,868	9,053
Sulfur	3,843	5,724	9,053
Mineral fuels:			
Coal thousand tons	2,096	1,260	1,333
Coke	28,751	(2)	(2)
Petroleum: [4]			
Crude oil thousand 42-gallon barrels	----------	----------	2,461
Refinery products:			
Gasoline do	856	1,504	1,273
Kerosine, including jet fuel do	1,842	3,253	3,300
Distillate fuel oil do	3,072	4,287	4,169
Residual fuel oil do	5,030	6,345	6,009
Lubricants do	656	254	----------
Other do	----------	246	174
Total do	11,456	15,889	14,925

[1] Except where otherwise noted, data are derived from: Statistical Summary of the Mineral Industry World Production, Exports and Imports 1957–62. Overseas Geological Surveys, Mineral Resources Division, London, 1964, 416 pp.
[2] Data not available.
[3] Data from official Pakistan trade returns.
[4] Based on data from various dispatches from the U.S. Embassy, Karachi.

COMMODITY REVIEW

METALS

Iron and Steel.—The Government of Pakistan plans to establish a steel plant in each province, and the one for East Pakistan approached realization in 1963. Kobe Steelworks, Ltd. of Japan bid successfully

to build a 150,000-ton-ingot-capacity plant in Chittagong to operate on imported pig iron and scrap. The plant will cost US$61 million, including US$38 million foreign exchange. In September the Governments of Pakistan and Japan signed a US$30 million loan agreement, and the Chittagong steel plant was one of the projects to be financed under the loan. Local currency requirements will be met by East Pakistan Industrial & Development Corp., an agency of Government of Pakistan. Construction was to begin in late 1963, and was tentatively planned for completion in 1966. Principal facilities of the plant and annual production targets, in metric tons, are as follows: Three open-hearth furnaces, 150,000 tons of ingots; three bloom, billet, and sheet-bar mills, 129,000 tons of billets and sheet bars; one bar mill, 43,000 to 45,000 tons of bars; one sheet mill, 50,000 tons of sheets; and one plate mill, 15,000 tons of plates. The plant will require the following raw materials which, except for limestone, dolomite, and fluorspar obtainable from West Pakistan, would have to be imported:

Commodity	Quantity (metric tons)	Commodity	Quantity (metric tons)
Pig iron	70,500	Ferroalloy	2,085
Steel scrap	62,500	Refractory bricks	6,024
Iron ore	600	Dolomite	5,250
Limestone	30,000	Rolls	719
Fluorspar	225	Fuel oil	40,000

The plan for the establishment of a steel plant in Karachi with 350,000 tons steel ingot capacity per year was in abeyance at yearend pending a feasibility study for the Export-Import Bank which received a US$67 million loan application for financing the steel mill. The design and construction of this plant, if approved, will be carried out by Swindell-Dressler Corp. & Associates (SDA), a consortium of five American companies that was selected in 1961 by the Government of Pakistan after international competition. The member companies of the consortium are expected to invest in the plant. SDA and a consortium of seven Pakistani industrialists have organized National Steel of Pakistan, which will be the owner of the plant. This company has authorized capital equivalent to US$105 million.

Current consumption of iron and steel is estimated at 350,000 tons per year and is predicted to exceed 500,000 tons by 1965. These requirements have been met largely by imports of rolled products and ingots for rerolling in Pakistan. Less than 15,000 tons of ingot steel was produced in Pakistan in 1963, all from scrap melting. Ingot imports increased 12 times between 1950 and 1960, while imports of all categories of iron and steel increased 2.5 times in the same period, indicating the enhanced importance of the rerolling industry in supply of iron and steel products.

Although very limited quantities of Pakistani iron-bearing materials continued to be produced for metallurgical testing, there has been no indication that commercial mining may be expected in the near future, if at all.

Other Metals.—Pakistan does not produce nonferrous metals from domestic or imported ores, except for a small tonnage of antimony.

Similarly, there are no plants for refining and rolling of nonferrous metals, although small shops make brass and aluminum sheets and circles for utensils. In absence of other information, import statistics provide the best indication to consumption and size of the market for principal nonferrous metals.

Pakistan's 1963 chromite output was obtained from workings near Hindubagh, about 100 kilometers northeast of Quetta. Poor market conditions resulted in a pronounced decline in output between 1962 and 1963, and by yearend productive operations were reportedly shut down or nearly so. Mine production of other metals was inconsequential.

NONMETALS

Cement.—In spite of record production, cement shortage was experienced in both Provinces, particularly in East Pakistan. In September barter agreements were signed for 100,000 tons of cement from the U.S.S.R., 70,000 tons from Poland, and 100,000 tons from mainland China in exchange for Pakistani jute and other products. In West Pakistan a fourth kiln was fired in the Zeal-Pak plant near Hyderabad, and construction of three plants in the private sector continued. These plants, located at Gharibwal, Manghoopir, and Hattar, will add 1,020,000 tons to the current 1,500,000-ton annual capacity.

Gypsum.—On the basis of a report by a Japanese survey team, the Pakistan Industrial Credit & Investment Corp., an organization established in 1957 as an industrial development bank to assist the private industry, has approved plans for Pakistan's first gypsum board factory, to be located between Lahore and Rawalpindi. Japan will provide the necessary foreign exchange. Ample gypsum is available in the Salt Range near the plant location.

Sulfur.—To assist a local firm which started producing sulfur in 1962, the Government in 1963 banned import of sulfur for the match, rubber, and sugar industries, but acid and other plants were permitted to continue imports. Current requirements are estimated at about 7,000 tons per year, 80 percent of which is used by the acid industry. Therefore, the ban on imports does not affect the bulk of imports. Consumption is estimated to triple by 1964 to 65 tons per day.

MINERAL FUELS

Pakistan's energy requirements were met by coal, petroleum, natural gas, hydroelectric power, and animal and agricultural waste. Total production of energy in 1961 from commercial sources was 2.54 million tons of standard coal equivalent. Consumption was 6.54 million tons; domestic output supplied 39.4 percent of the commercial energy. Petroleum and natural gas were the principal sources of domestically produced energy.

Atomic energy is not yet produced in Pakistan, but tenders were called for the construction of a megawatt atomic energy plant at Ruppur near Ishurdi in East Pakistan. A reactor-laboratory complex is also being built in Islamabad.

Coal.—Production was obtained from the Salt Range and Makarwal fields in Sargodha Division, the Sor Range-Dagari, Khost-Sharigh,

Mach and Pir Ismail fields in Quetta and Kalat Divisions, and from Meting-Jhimpir and Lakhra fields in Hyderabad Division. The bulk of the Makarwal production is used for generation of synthesis gas for the Daud Khel ammonium sulphate fertilizer plant.

Diamond drilling by the Geological Survey of Pakistan in the Lakhra anticline during 1961–63 proved the existence of a coalbed 0.8 to 2.5 meters thick, commonly at depths less than 45 meters, with a reserve of 130 million tons.

A drilling program financed by the United Nations Special Fund struck a 30-centimeter seam of coal at 913 meters, a 1.8-meter seam at 940 meters, a 6-meter seam at 1,000 meters, and a 20-meter seam at a further but unspecified depth. The site of the drilling is near the village of Jaipurnat, in the Bogra district, 10 kilometers from the Indian border. Apparently these seams are related to seams of the Gondwana field in India.

It is believed that in 1963 the West Pakistan Industrial Development Corp. signed an agreement with Lurgi to establish a low-temperature carbonization plant in Quetta. The plant, using a Lurgi process, will produce about 40,000 tons of coke briquets and 17,000 tons of char sinter from Sor Range, Dagaré, and Sharigh coal fines.

Natural Gas.—Production from the Sui Gasfield during 1963 was at a daily rate of 85 million cubic feet—55 million to the Karachi pipeline and 30 million to the Multan line. This field, discovered and developed by Pakistan Petroleum, Ltd., is the largest in West Pakistan; with a reserve of 5,000,000 million cubic feet, it has been in production since 1955. A loan application for US$70 million was submitted by the Sui-Northern Gas Pipeline Co. (a joint company of Burmah Oil Co. and West Pakistan Industrial & Development Corp.) to the International Bank for Reconstruction and Development to finance extension of the Sui-Multan line beyond Multan by addition of 580 kilometers of trunk line and 177 kilometers of distribution line. These lines would supply gas to Lyallpur, Lahore, Gharibwal, Rawalpindi, Wah, and the new capital of Islamabad. As of yearend 1963, the application had not been acted upon.

The Mari field of Esso Standard Eastern, Inc., also in West Pakistan, is not being utilized.

In East Pakistan the Chhatak and Sylhet fields of Pakistan Petroleum, Ltd., are currently exploited. These fields have reserves of 20,000 and 280,000 million cubic feet of gas and supply natural gas to a cement plant and the Fenchuganj fertilizer plant, respectively. Pakistan Shell Co. has also discovered three fields within 40 kilometers of one another: Rashidpur (740,000 million cubic feet reserves); Kailas Tila, and Brahmanbaria. The latter, discovered in late 1962, is considered to be a large field and may be utilized for production of power, petrochemicals, and fertilizers.

Petroleum.—Domestic output of crude petroleum in 1963 was equal to about 15 percent of the total needed to produce Pakistan's refinery product requirements. Petroleum exploration was carried out by the Oil & Gas Development Corp., an agency of the Government of Pakistan, assisted by the Soviet Union and by private companies. The Soviet aid, in form of equipment and services, was supplied under a loan equivalent to US$30 million granted by the Soviet Union to

Pakistan in March 1961 for oil exploration. The loan is to be paid within 12 years and bears 2.5 percent interest.

Activity of the Pakistan-Soviet teams in West Pakistan was in the Potwar plateau area and had the objective of developing information on the complex geology of the area. The Oil & Gas Development Corp. announced that Chharat, 40 kilometers west of Rawalpindi, was selected for drilling, but at yearend actual drilling was not reported. In East Pakistan, five Pakistan-Soviet parties were reported to be active, and drilling in this province was expected in early 1964, probably near Cox's Bazaar.

Pakistan Sun Oil Co. completed offshore seismic survey in the Indus delta region, and Pakistan Petroleum, Ltd. completed its survey in Sanghar area of West Pakistan. After abandoning its test well in Baluchistan with no indication of commercially exploitable gas or oil, Tidewater Oil Co. surrendered its oil exploration license. Pakistan-Shell activity was in the Brahmanbaria area of East Pakistan where the company has discovered three gasfields.

Pakistan Oilfields, Ltd. (70 percent Attock Oil Co. and 30 percent Government of Pakistan and private investors) continued its operation in Pakistan's only producing fields of Dhulian, Balkassar, Joya Mair, and Khaur fields. The bulk of production was obtained from the first two fields. Balkassar was operated jointly with Pakistan Petroleum, Ltd. (70 percent Burmah Oil Co. and 30 percent Government of Pakistan and Pakistani private investors). These two companies were drilling a deep test well, Chak Beli Khan 3, 22 miles southwest of Rawalpindi.

The most significant development in petroleum refining was the announcement in December 1962 of an agreement between the Government of Pakistan and Regie Autonome des Petroles (RAP.) of France to build a refinery in Chittagong with 70 percent capital participation by Pakistanis and 30 percent by RAP. The daily throughput capacity of the refinery will be 20,000 barrels expandable to 30,000 barrels. The refinery's cost is estimated at US$14.1 million (US$9.1 million to be foreign exchange) and it is due to come on stream in 1965.

In September 1963 National Refinery, Ltd., a Pakistani firm managed by Amin Agencies, and the American International Oil Co. signed an agreement for the construction of a US$17 million refinery in Karachi to produce principally bitumen, lubricating oils, jute batching oil, light diesel oil, and small quantities of wax and weed killers. When completed in 1966, the installation will handle 8,000 to 10,000 barrels of crude oil per day. In return for providing technical assistance to the refinery and helping to arrange a US$10 million loan through the Bank of America, the American International Oil Co. will supply crude to the refinery.

Pakistan's largest existing refinery is also in Karachi. This refinery, owned by Pakistan Refinery, Ltd., had a throughput of 30,000 barrels per day. It was officially opened in November 1962 and was built by Esso, Shell, Caltex, and Burmah Oil Co. who together supplied 60 percent of the capital while private Pakistani capital provided the remaining 40 percent. At yearend, it was announced that plans had been laid for expansion of capacity to 42,000 barrels per day.

The Mineral Industry of the Philippines

By K. P. Wang [1]

THE PHILIPPINE production of crude minerals amounted to about US$110 million or roughly 2.7 percent of the gross national product in 1963. Half of the output, including most of the base metal ores, was exported, earning 7 to 8 percent of the country's foreign exchange. In terms of value, copper was the leading product and gold was the second. Virtually all of the chromite is produced for export and, in terms of volume, the shipments of iron ore rank first and chromite second among mineral exports.

Among the diversified mineral products extracted in the Philippines, only refractory chromite is of major significance by international standards. In 1963 the country was, however, the leading gold producer and the third-ranking mine copper producer in Asia. Philippine outputs of copper, gold, and mercury represent about 1 percent of the world total in each case.

The Philippines is a favorable mineral province, except for fuels, and has had a long tradition in mining. The mining industry of the country has been established and expanded primarily by foreign capital and technology, largely from the United States and Japan. However, in recent years, Filipinos have participated to an increasing degree in mineral development.

There is increasing sophistication in the type of mineral commodities produced, such as the recovery of more pyrite for making fertilizers, extraction of molybdenum and zinc from copper and gold ores, and plans to establish integrated steel, refined copper, and more ferroalloy facilities. Many mineral concerns also are branching into other lines of industrial endeavor.

The reserve position for refractory chromite was improved. During 1963, Philippine Iron Mines Inc. made considerable headway on a new concentrator. Two new cement plants—Teresa on Luzon and Iligan on Mindanao—were under construction. Two additional oil refineries came into being in 1962–63: Shell's 25,000-barrel-per-day plant and Filoil's 10,000- to 15,000-barrel plant.

GOVERNMENT POLICIES AND PROGRAMS

The economy of the Philippines, a country of 30 million people, showed much improvement in 1963 compared with 1962. The 1963–67

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5-year socio-economic development plan was initiated. Decontrol of the peso (started in January 1962) continued to have a stimulating effect on economic growth and helped to stabilize the general environment for establishing industries. The upturn in economic activity was supported by greater willingness of Japanese and U.S. firms to develop Philippine enterprise through investment and commercial contracts.

The Government initiated the 1963–67 5-year development plan based primarily on private enterprise. This plan envisages US$6 billion in fixed investments, including roughly 3 percent for the fairly well established mining industry and 15 percent for the metal and metal products industry. This differential should narrow the gap between these two industries.

A new foreign investments bill was introduced in Congress in 1963. It reflected the Philippine preference for joint ventures with the necessary incentives in the form of exemptions from capital gains tax, reduction of income tax, tax-free importation of equipment, deductible losses in the first 3 years of operations, accelerated depreciation losses, and loan preferences from the Development Bank of the Philippines. According to the Filipinos, capital and profits can be freely remitted and foreign investors will have an informal voice in formulation of national economic policies.

A serious effort was made in 1963 to modify the Corporation Law, which limits capital participation by any firm in mining enterprises. The legislation introduced would allow any legal body to own 40 percent of three or four mining corporations. Furthermore, it was proposed that, although a U.S. mining company could have only one mining subsidiary in the Philippines, this subsidiary would have the same rights as other Philippine mining companies. The intent of the legislation is to attract more Filipino and U.S. mining investment capital.

Philippine Government grants of special privileges to U.S. citizens will be effective only until 1974, but other nationals such as the Japanese can hold minority interest in Philippine firms. The substantial Japanese contribution to Philippine mineral development, motivated by the need to acquire raw materials, has been principally in the form of technical advice, equipment, loans, and advance of funds for future deliveries. Mitsubishi Metal, Mitsui Mining & Smelting, and Nippon Mining had, for example, extended significant assistance during 1962–63. Thus, the Japanese have not been seriously restrained by the Corporation Law.

Government mineral officials are acutely aware of resource development problems, but some Filipinos consider ore reserves in the ground as valuable assets that should only be exploited by citizens. An attempt was made in 1963 to make the Nickel Bill (concerning Surigao laterites) more atractive to foreign investors, but it was not successful.

The effect of the decontrol (of the peso exchange rate) on the Philippine mining enterprise became clearer in 1963. Overall, the change favored the exporter and dollar earner, that is, most of the mineral concerns. Although costs of imported equipment and labor rose, the increased values obtained for the minerals exported more than compensated for the rise. Decontrolled, 20 percent of mineral export

receipts had to be turned over to the Philippine Central Bank at the rate of 2 pesos to the dollar whereas the rest was realized at the free market rate of 3.90 pesos to the dollar.

PRODUCTION

The value of crude mineral production in 1963 is estimated at about US$110 million. In 1962 it totaled about US$105 million and was equivalent to about 2.7 percent of the gross national product evaluated at US$3,900 million. The value of crude mineral production cited covers primarily mine output and does not include the added value derived from processing ores and other mineral products.

Output of many mineral products of the Philippines was somewhat lower in 1963 than in 1962; gold, silver, iron ore, chromite, cement, manganese ore, and coal among other commodities showed declines of varying magnitude. Of major mineral products, only copper ore and pyrite showed production gains.

The gain in copper output was attributable to expansion programs and other new projects, some of which were still underway at yearend. The gold output decline occurred in spite of price supports. Chromite producers were in a depressed condition because of sluggish world demand. The sharp decline in manganese output resulted from difficulties in upgrading the ore. The search for oil yielded no worthwhile results in 1963. Increases in refined oil production from imported crude during 1959–62 reflected increasing Philippine consumption.

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TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Cadmium, content of zinc concentrates kilograms	----------	----------	----------	600	(1)
Chromite:					
Metallurgical thousand tons	119	128	144	98	74
Refractory do	535	606	496	433	382
Total do	654	734	640	531	456
Copper, content of concentrate, largely 22 to 29.5 percent copper	49,521	44,010	51,875	54,728	63,685
Gold troy ounces	402,615	410,618	423,983	423,394	376,036
Iron and steel:					
Iron ore and concentrate, 55 to 58 percent iron thousand tons	1,230	1,139	1,171	1,387	1,360
Ferroalloys (mainly ferrosilicon)	(1)	2,049	288	1,475	1,296
Steel ingots (from scrap)[2] thousand tons	60	80	100	120	(1)
Lead, metal content of 50 to 60 percent concentrate	355	122	101	82	71
Manganese ore	34,804	17,381	19,038	11,939	6,141
Mercury, estimated content of concentrate 76-pound flasks	3,520	3,086	3,167	2,767	2,649
Molybdenum, metal content of 94 percent MoS_2 concentrate	44	28	113	113	106
Nickel, content of concentrate	----------	----------	9	11	----------
Palladium, content of nickel concentrate troy ounces	----------	----------	215	141	----------
Platinum, content of nickel concentrate do	----------	----------	177	172	----------
Silver do	504,085	1,133,343	812,793	675,570	774,917
Zinc, content of concentrate[3]	5	4,978	3,313	4,460	4,265
Nonmetals:					
Asbestos	51	33	75	941	382
Asphalt rock	11,787	18,371	6,651	6,933	5,186
Barite, 85 to 90 percent $BaSO_4$	169	5,623	1,913	416	914
Cement thousand tons	727	795	1,019	961	951
Clays, white	(1)	24,837	10,823	(1)	6,703
Dolomite	----------	12	7,252	4,995	5,089
Feldspar	1,711	3,958	14,759	15,571	6,669
Gypsum	1,767	9,077	8,404	14,453	31,843
Lime	46,071	19,152	25,282	[2] 43,000	(1)
Limestone thousand tons	6,251	994	1,454	[2] 1,400	1,480
Phosphatic materials:					
Guano	379	10,035	402	95	1,473
Phosphate rock	----------	355	----------	3,773	1,251
Pyrite	25,189	25,400	51,591	7,725	58,055
Salt, sea thousand tons	175	95	93	96	70
Silica sand (ordinary glass sand)	34,917	88,365	106,229	(1)	111,472
Sulfur	----------	44	161	941	48
Talc	----------	5	190	118	382
Mineral fuels:					
Coal thousand tons	140	148	152	163	157
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	3,348	3,585	6,264	6,903	8,660
Kerosine do	625	666	1,943	2,139	2,509
Distillate fuel oil do	1,736	1,896	4,083	4,893	5,872
Residual fuel oil do	2,817	2,894	4,873	5,942	7,561
Refinery fuel (including losses) do	402	588	892	1,005	1,374
Other products do	14	462	429	1,455	1,545
Total do	8,942	10,091	18,484	22,337	27,521

[1] Data not available.
[2] Estimate.
[3] Includes zinc content of copper-zinc concentrates containing 46 percent zinc and 3 percent copper.

TRADE

Mineral trade, particularly in base metal ore exports, is fundamental to the Philippine economy. Japan was again by far the leading market in 1963 and the United States was second. Philippine mineral exports were essentially controlled by metal prices and demand in these two

countries. Japan recovered from its 1962 recession in mid-1963 and started to buy more Philippine raw materals again. Japanese demand for nonferrous ores has been particularly steady, but purchases of Philippine ferrous ores are carefully scrutinized according to quality and price considerations in comparison with supplies from other sources. The United States regularly takes only a small portion of Philippine copper, specifically mine copper from Lepanto that is shipped to the Tacoma, Wash., smelter. The Philippines has long been the principal supplier of refractory chromite to the U.S. steel industry.

In many instances, mineral imports are tantamount to apparent consumption. By far the most important mineral import is crude petroleum for domestic refining; the value of crude imports in 1963 appeared to be a little higher than that of ₱161.5 million in 1962. The origins of the crude were mainly Indonesia, Saudi Arabia, Iraq, and Borneo. Scrap, refined metals, and semimanufactures for processing and consumption in the Philippines represent another leading general category of imports. Japan and the United States were the principal metal suppliers. Some Philippine copper minerals are smelted in bond in Japan and the refined metal is returned to the Philippines for fabrication. The country imports sizable amounts of chemical and fertilizer raw materials from the United States.

TABLE 2.—Exports of selected metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destination, 1962
Chromite: [2]			
Metallurgical	99,547	71,868	All to Japan.
Refractory	531,892	370,423	United States 233,730; United Kingdom 67,523; Italy 33,915; Japan 18,593.
Copper:			
Ore	31,447	25,855	All to Japan.
High-gold concentrate	23,163	35,737	United States 35,737.
Ordinary concentrate	215,880	156,604	All to Japan.
Scrap	2,904	1,733	Do.
Total metal content [3]	52,000	51,000	Japan 43,500; United States 7,500.
Gold:			
Bullion troy ounces	167,068	276,254	All to United States.
Concentrate and matte	21,178	29,984	Do.
Iron ore or equivalent:			
Ore	1,255,073	1,247,981	All to Japan.
Concentrate	54,825	86,921	Do.
Pyrite cinder	7,700	11,400	Do.
Total	1,317,598	1,346,302	Do.
Manganese ore	25,116	8,504	Japan 4,440; United States 4,064.
Mercury 76-pound flasks [4]	1,690	3,444	Japan 3,444.
Molybdenum concentrate	[3] 240	239	United Kingdom 218; Japan 21.
Zinc concentrate	3,100	7,550	All to Japan.

[1] Exports of nonmetallic minerals and fuels were of little consequence.
[2] Company figures for 1962 are much higher: Refractory exports, 424,500, metallurgical exports, 94,180.
[3] Estimate.
[4] Although mercury is final product, figures reported represent estimated metal content of concentrate.

Source: Official trade returns of the Philippines.

TABLE 3.—Imports of selected metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals and metallic ores:			
Aluminum:[2]			
Metal and alloys	2,600	2,000	United States 1,900.
Products	500	600	United States 200; Japan 200.
Copper:			
Ingots and bars	2,109	1,217	Japan 1,172.
Products [2]	2,000	3,500	Japan 2,500; United States 350.
Iron and steel:			
Pig iron	14,323	11,121	South Africa 3,744; Rhodesia 2,133.
Products thousand tons	320	300	Japan nearly 200.
Ferroalloys	153	1,150	Japan 670; Norway 250.
Lead:			
Metal and alloys	1,664	3,665	Australia 2,980; United States 189.
Products [2]	500	400	Australia 100; United Kingdom 100.
Pigments [2]	1,400	500	Australia 200; United States 100.
Tin metal and alloys	241	480	Malaya 323; Australia 152.
Titanium oxide	1,551	2,194	United States 746; Belgium 272; Italy 264.
Zinc:			
Metal and alloys	5,667	7,806	Australia 3,776; United States 2,020.
Products [2]	850	1,200	Australia 940; Belgium 110.
Pigments [2]	2,400	1,200	Netherlands 300; United Kingdom 200.
Nonmetals:			
Abrasives including diamond	(3)	2,080	(3).
Asbestos	843	946	Canada 834.
China clay	2,892	1,352	Japan 742; United States 433.
Diatomaceous earth	5,130	1,892	United States 1,481; Japan 411.
Dolomite	(3)	2,300	Japan 1,390; Austria 400.
Gypsum and plasters	35,593	39,854	Mexico 26,998; Australia 11,088.
Phosphate rock	10,348	12,489	All from United States.
Sulfur	530	2,612	United States 1,452; Canada 1,021.
Talc powder	1,829	1,737	Japan 525; Italy 415; United States 405.
Mineral fuels:			
Coke from coal	7,643	12,387	Japan 5,394; United States 2,417.
Petroleum:			
Crude oil thousand 42-gallon barrels	16,838	22,437	Indonesia 9,380; Saudi Arabia 7,927; Iraq 2,195; Borneo 1,186.
Refinery products:			
Gasoline	1,199	365	Malaya 85; Japan 80; Taiwan 75; United States 21.
Kerosine thousand 42-gallon barrels	316	144	Japan 105; Malaya 8; Taiwan 5.
Distillate fuel oil do	1,052	421	Japan 344; Malaya 48; Taiwan 29.
Residual fuel oil do	362	402	Taiwan 211; Japan 83; Malaya 75; United States 30.
Lubricants do	459	322	United States 295.
Other do	486	683	Taiwan 337; Japan 218; United States 79.
Total	3,874	2,337	Japan 830; Taiwan 612; United States 425; Malaya 261.

[1] Values for some major categories of imports in 1962 were as follows, in million pesos: Petroleum products 216.4 (including 161.5 for crude oil); iron and steel products 162.6; and nonferrous metal products 33.
[2] Estimate.
[3] Data not available.

Source: Official trade returns of the Philippines.

COMMODITY REVIEW

METALS

Chromite.—In 1963, the Consolidated Mines, Inc., Coto open pit the sole Philippine producer of refractory chromite, was exhausting its reserve of good-grade ore but the adjoining Zambales Reservation extension appeared to offer a significant reserve. Although Acoje Mining Co., Inc. does not have a similar monopoly in metallurgical chromite, it was the country's foremost producer by far. The metal-

lurgical chromite from Acoje's Zambales underground property was shipped almost entirely to Japan, which purchased slightly less in 1963 than in 1962.

Acoje Mining has diversified activities, including oil drilling. In 1963, it was considering the building of a ferrochrome plant. Nickel-platinum ores analyzing 0.87 percent nickel and 0.086 ounce platinum occur at the Zambales property, and a 200-ton-ore-per-day mill may be built to process this material. This company also has a glass plant and a manganese-copper property elsewhere.

Copper.—Philippine copper producers ranked as follows during the first half of 1963 on the basis of percentage shares of the approximately 30,000 metric tons of mine copper produced by the country as a whole: Atlas Consolidated Mining & Development Corp.—46; Marinduque Mining & Industrial Corp.—23 (Sipalay mine—13 and Bagacay Mine—10); Lepanto Consolidated Mining Co.—21; Philex Mining Corp.—7; and other—3.

Atlas Consolidated, associated with Mitsubishi Metal Mining Co. (Japan), after delineating additional reserves at its Toledo mine on Cebu—the largest copper mine in the Far East—expanded the new Biga Road pit in 1963 and made preparations to work underground in the Lutopan section.

Marinduque Mining, associated with Mitsui Mining & Smelting Co. Ltd. (Japan) discovered an important new open-pit orebody (Cansibit) at its Sipalay copper mine on Negroes with a reserve exceeding 100 million metric tons of 0.8-percent copper ore which also contains byproduct molybdenum. The Sipalay mill was expanded to about 5,500 tons of ore per day in 1963, roughly half the optimum future capacity.

The competitive position of the Bagacay copper-zinc-pyrite open-pit mine on Samar, also belonging to Marinduque Mining, was improved as a result of a long-term contract signed with ESSO Standard Fertilizer & Chemical Co. Inc., to provide the latter's Bataan plant now under construction with 180,000 tons of pyrite (1 percent copper) yearly beginning in mid-1965. A 19.5-kilometer aerial tramway was being constructed in 1963 to transport the pyrite. The sulfur, copper, and eventually iron values of this pyrite, together with the mine copper and zinc now extracted, should place Bagacay on a sound financial footing. The complex ores of Bagacay occurring in Tertiary tuff and with associated barite and gypsum resemble the widespread "black ores" of northern Japan although they contain hardly any lead.

The Amex-Nippon pit, a US$20- to US$30-million project financed by American-Canadian capital in association with Nippon Mining, was being developed during 1963 on Marinduque and is a potentially significant copper producer. The first half of a 8,000-ton-ore-pre-day mill was scheduled to be in operation by mid-1964 to work the presently known reserve of 20 million to 50 million tons of 0.5- to 0.9-percent copper ore, at least half of which is 0.8-percent grade.

Lepanto Consolidated, taking a conservative stand on working a bonanza underground copper-gold mine in Mountain Province, had another highly profitable year in 1963. Philex Mining, with its relatively new Santo Tomas block-caving mine, increased copper output slightly during the year. The ore analyzes about 0.74 percent copper

with additional gold values. The company's mill was modified and may be moved to a new site and expanded to 6,000 tons.

In 1963, Marinduque Mining was still seriously considering the construction of an integrated copper smelter. The original plan was to build a Sherritt Gordon process (direct smelting) copper-zinc-fertilizer plant near Iligan on Mindanao. Planning went as far as getting approval of a US$13 million loan from the U.S. Export-Import Bank. Subsequently, plans for the fertilizer plant were dropped because of ESSO Fertilizer's Bataan plant. A new feasibility study for copper, probably on the basis of a conventional process, was being made in mid-1963 by Western Knapp Engineering.

The Phelps Dodge Copper Products Corp., 35 percent owned by Atlas Consolidated, ceased to qualify as a protected new industry and had to contend with high-raw-material-cost problems in 1963; Atlas Consolidated's mine copper, returning from Japan as refined metal, was the raw material used in making rolled copper products.

Gold.—The gold industry was not quite able to hold its own in 1963. Benguet Exploration Inc., the producer normally accounting for nearly half the Philippine gold output, had a 2-month labor strike at its underground operation beginning in early March. This company managed the refractory chrome mine of Consolidated Mines and was branching into other lines of business including copper. Itogan-Suyoc Mines worked lower grade gold ore in 1963 at reduced milled tonnages. Baguio Gold Mining Co. was only able to develop enough new reserves to sustain operations. However, Benguet Exploration's small but very rich underground gold mine near Baguio continued to pay big dividends in 1963. Daily ore output was only 40 to 50 tons, but this ore contained about 1.25 ounces of gold and 8 ounces of silver per ton, 12 percent zinc, 0.8 percent each of copper and lead, and some byproduct cadmium. Recovery of the zinc from newly mined ore and 4 years of accumulated tailings was initiated.

Byproduct gold output from copper producers showed a 15-percent-plus increase in 1963 over that of 1962 and approached 100,000 ounces, or nearly one-fourth of all gold produced by the Philippines. Among the big three, the production of Lepanto declined slightly, that of Atlas nearly doubled, and that of Philex rose by more than one-fourth.

Iron Ore and Steel.—Iron ore for export and steel made from scrap were still unrelated activities in the Philippines in 1963; however, an integrated steel industry was in the process of formation. At Philippine Iron's Larap open-pit mine—the country's largest iron ore producer—construction of a 4,500-ton-per-day concentrate mill with a US$5 million loan from the U.S. Export-Import Bank was well underway in 1963. At the Sibuguey mine of Samar Mining Co. Inc. on Mindanao, the second-ranking iron ore producer, an 11-kilometer aerial tramway was being considered in 1963, possibly in anticipation of providing ore to the proposed steel plant nearby.

The latest and probably most feasible integrated steel project envisages the construction of an electric smelting Linz-Donawitz (LD) converter steel works of 320,000-ton-steel-ingot-yearly capacity at Iligan City, Mindanao, to use domestic iron ore (possibly first converted into sponge iron) and imported and/or local coals. The Jacinto interests (through Iligan Integrated Steel Mills Inc.) already a pro-

ducer of steel products and recipient of a US$62.3 million loan from the U.S. Export-Import Bank, is to head up a consortium to manage the operations. Eventual construction of such a plant remained contingent upon hydropower generating capacity yet to be built.

Manganese.—General Base Metals, Inc., affiliated with the management of Acoje Mining, was a leading manganese ore producer and sold manganese to Japan and to domestic ferromanganese and dry battery manufacturers. In 1963, General Base Metals considered building a flotation plant to beneficiate 140 tons of low-grade ore per day in order to gain marketing advantages.

Other Nonferrous Metals.—Mine zinc output in 1963 was about the same as in 1962, with production of Bagacay Mine (see under Copper) a little lower and Benguet Exploration (see under Gold) somewhat higher. Bagacay had difficulty in cleanly separating copper and zinc. Mine lead production continued to be nominal, and lead battery plants had an uneventful year in 1963. Molybdenum output showed no great change despite expanded milling capacity at the Sipalay copper operation where molybdenum concentrate is produced.

Elsewhere in the nonferrous field, mercury production by the sole producer Palawan Quicksilver Mines Inc. was down slightly in 1963, because of price decline, grade problems, and increased cost brought about by the "decontrol" of the peso exchange rate.

NONMETALS

There were few new developments in the nonmetallic field during 1963. Demand for cement was such that efficient plant capacity was well utilized; high-cost, coal-fired kilns found it difficult to meet competition. The possibility of using lightweight aggregates, including perlite, was explored.

Plans to recover and use more pyrite as a source of sulfur was a significant event in 1963, because significant quantities of pyrite are associated with copper. Atlas Consolidated discards or stockpiles the surplus pyrite from copper ore when it is not sold or consumed at the subsidiary fertilizer plant. In addition, the company has an undeveloped pyrite deposit at Toledo. The Bagacay pyrite tie-up with ESSO has been mentioned.

MINERAL FUELS

In 1963 the large and rising demand for liquid fuels continued to be met by imports. Extensive exploration for oil has taken place in the hope of overcoming this striking and costly deficiency, with no significant results as yet. However, self-sufficiency in oil refining capacity was achieved in the Philippines during 1963 with the completion of the fourth plant. Some natural gas finds may prove economically feasible for development. ESSO's interest in byproduct fertilizer is significant.

The coal market showed no improvement in 1963. Another survey of the Malangas coalfield on Mindanao was being considered, and this might prove useful in connection with the proposed integrated steel plant.

The Mineral Industry of Taiwan

By J. M. West[1]

TAIWAN'S mine production index advanced 5.2 percent in 1963 despite a devastating September typhoon. Earlier in the year, some mineral processing plants, such as aluminum, carbide, and fertilizers, had temporarily shut down because dry weather had caused a shortage of hydroelectric power. Mine output, largely coal, provided 2.5 to 3 percent of the 1963 gross national product of approximately US$1.5 billion. By including the added values derived from smelting and processing, however, the total mineral share of the GNP was closer to 10 percent. Although of little consequence by world standards, Taiwan produced about a third of the cement and coal plus a fair share of the steel in the free world Far East, excluding Japan. In the past decade, coal output had doubled and cement quadrupled. Except for coal, limestone, and natural gas, the Island's mineral resources had little to offer the economy.

The steel industry, based largely on electric smelting of scrap, was in a precarious condition due to the small and marginal nature of operations. Taiwan was able to compete with Japan for cement exports, because of low-priced coal (but high in mining cost) and U.S. AID marketing connections that counterbalanced high freight rates. A sizable oil refinery processing imported crude was in existence, and the feasibility of establishing a large integrated iron and steel complex based upon local coal and imported iron ore was under study.

The most significant mineral development in 1963 concerned natural gas. Deep wells in several fields near Miaoli in northwestern Taiwan struck commercial reserves of gas large enough for supporting industrial plants and possibly also for piping to various urban centers for household use. As a result of these discoveries, a gasoline plant at Touwu and two fertilizer plants (one urea-ammonia and the other ammonium sulfate) at Miaoli were being constructed. To meet the new demand for sulfur in making fertilizers, plans were made to increase domestic production of pyrite and mixed pyrite-sulfur ores.

The Chinkuashih gold-copper mine of the Taiwan Metal Mining Corp. was also in the news in 1963; exploitation began on the rich gold ore shoots discovered and a separate mill was being constructed. A government-run pilot coal cleaning and research facility neared completion at Chin-mei. Sinking of an incline at the Chien-chi coal mine was started to mine offshore coal seams in the Keelung area. At Kaohsiung, construction started on a lubricating oil plant, aluminum plant expansion was completed to 20,000 tons per year, and Universal Cement Corp. began operation of its new 200,000-ton cement plant. Detailed information on Taiwan's mineral deposits, resources, and production was published.[2]

[1] Physical scientist, Division of International Activities.

[2] Ho, C. S., and Lee, Chin-nan. Economic Minerals of Taiwan, Geological Survey of Taiwan, Taipei, 1963. 495 pp.

GOVERNMENT POLICIES AND PROGRAMS

Taiwan, with a balanced agricultural-industrial economy supporting a 12 million population and a large standing army, has achieved a fairly high level of economic development by Far Eastern standards, despite restrictive measures on the part of the government. The U.S. AID program, mainly in the military and agricultural fields was due to be phased out, had contributed significantly to the island's progress. The Chinese Government, while stressing the development of the relatively poor mineral resources, placed more emphasis on building up mineral processing, industrial, and power facilities to use imported as well as indigenous minerals.

Although private investment was encouraged, most of the major mineral enterprises were still in government hands as of 1963, with the coal and cement industries as the only major exceptions. The coal industry, however, was regulated according to requirements and price offerings of government-controlled industries which consumed most of the product. Some new fertilizer and steel plants were privately owned. On the other hand, the government ran the oil refining, natural gas, salt, aluminum manufacture, and gold-copper industries as well as most of the important plants in fertilizers and power. Government policy in 1963 was clearly to rely more heavily on private enterprise for industrial development in the future.

The third 4-year plan ending in 1964 had called for total expenditures of US$34 million on mineral resource development; final targets for coal, gold, and silver were already surpassed by 1963. Efforts to relax import controls resulted in abolishment in September 1963 of the foreign exchange certificate system whereby traders had been required to deposit the full value of goods when applying for import licenses. Importation of mineral and industrial equipment was thus made easier.

The Mining Research and Service Organization (MRSO), under the Ministry of Economic Affairs, performed technical aid and planning functions with the assistance of the U.S. AID Mission to Taiwan. Initial work was primarily in coal mining and economic geology. MRSO started in March 1963 to publish a monthly periodical in Chinese entitled "Mining Technical Digest."

With a thriving economy, relatively low corporate taxes, and few restrictions regarding convertibility of profits, Taiwan had one of the most favorable investment climates in the Far East. Natural gas and its potential for wider use attracted the interest of U.S. investors during the year. Japanese investors were looking at possibilities to participate in gas distribution, steel, and chemical industries but were restrained, at least temporarily, by a government move in November stopping any further approvals of Japanese investments. The action was retaliatory after reported Japanese trade talks with mainland China.

PRODUCTION

Cement and coal, Taiwan's main mineral products, were valued at about US$40 million each in 1963, with iron and steel products worth an estimated US$20 to 25 million. Fertilizer manufacture, mainly nitrogen-based but including large quantities of ammonium sulfate utilizing domestic pyrite and imported sulfur, was about even with steel at roughly US$25 million. Coal provided part of the basic ingredients plus electric power for making fertilizers. Salt, gold, copper, and sulfur values ranged downward from US$1.8 million to US$0.7 million. Other minerals included limestone, clays, dolomite, and talc. Petroleum refining was dependent on crude imports and supplied most domestic needs for refined products; crude oil production was insignificant. Natural gas output and sales neared US$1 million, and prospects were good for sizable expansion based on new discoveries. Cement and coal in 1963 were up 21 and 6 percent, respectively, over 1962. Steel and natural gas jumped about one-third. Gypsum used in cement was produced as a byproduct of salt evaporation and was supplemented by imports. Aluminum output, although 9 percent ahead of 1962, was considerably less than capacity owing to power shortage.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum	7,485	8,261	9,016	11,117	11,928
Copper:					
Ore, 0.69 to 0.77 percent Cu	182,681	192,062	195,900	166,849	117,618
Concentrates, 13 to 14 percent Cu	8,718	[1] 10,000	10,922	12,167	8,272
Mine	1,627	2,100	2,232	2,107	1,619
Cement copper, 30 to 40 percent Cu	1,425	1,687	1,710	[1] 1,700	[1] 1,500
Electrolytic copper	1,802	1,780	2,268	2,491	1,481
Gold:					
Gold-copper ore [2]	102,872	157,024	189,503	196,433	170,392
Gold ore	33,593	37,308	([3])	([3])	1,553
Refined gold, troy ounces	13,497	15,699	17,490	24,029	31,710
Iron and steel:					
Iron ore:					
Limonite, 35 percent Fe	([3])	([3])	557	515	576
Magnetite, 50 percent Fe	9,202	8,143	12,488	5,814	4,705
Pig iron, thousand tons	33	24	53	63	54
Steel ingots and castings, do	159	200	[1] 170	182	275
Silver, troy ounces	60,974	52,579	77,303	80,129	61,440
Nonmetals:					
Asbestos	136	440	40	476	548
Cement, thousand tons	1,067	1,183	1,505	1,841	2,239
Clays:					
Ceramic and pottery, do	[1] 40	[1] 40	40	40	40
Paper filler, do	2	3	3	3	3
Used in cement, do	155	183	207	372	460
Brick and tile, do	[1] 500	[1] 500	500	500	500
Total, do	[1] 700	[1] 730	750	915	1,003
Dolomite (about 19 percent MgO)	14,479	15,008	22,182	29,837	30,904
Graphite (20 to 70 percent fixed carbon, amorphous)	563	300	133	[1] 300	[1] 300
Gypsum (75 to 96 percent gypsum)	10,341	10,629	11,934	16,285	26,588
Lime	42,548	44,105	[4] 43,675	[4] 43,219	[1 4] 45,000
Limestone, thousand tons	1,872	2,073	2,479	3,292	3,680
Used in cement, do	1,421	1,556	2,021	2,418	2,899
Pyrites, 25 to 43 percent sulfur	33,776	42,997	47,467	45,490	46,760
Salt, sea, thousand tons	430	441	432	595	626
Sand, glass, do	18	53	40	68	80
Sulfur:					
Refined, 97 to 99 percent sulfur	5,622	4,874	5,560	7,582	7,259
Contained in pyrites [1]	11,800	15,000	16,600	16,000	17,200
Recovered from refinery gases, 99 percent sulfur	823	890	2,000	2,164	2,347
Total [1]	18,300	20,800	24,200	22,300	25,300
Talc, mostly soapstone grade	6,422	10,557	12,415	13,409	14,787
Mineral fuels:					
Coal, subbituminous to high-volatile bituminous:					
Dust and lump, thousand tons	2,779	2,992	3,220	3,618	3,878
Coking, do	784	970	1,017	936	932
Total, do	3,563	3,962	4,237	4,554	4,810
Coke:					
Coke ovens and beehive (including semicoke), thousand tons	172	193	200	109	199
Gas plants, do	16			119	34
Natural gas, million cubic feet	930	898	1,309	1,356	[1] 1,630
Petroleum:					
Crude, thousand 42-gallon barrels	13	14	17	14	19
Refined products:					
Gasoline, do	1,470	1,880	1,970	2,001	[1] 2,040
Kerosine, do	26	22	22	24	[1] 25
Distillate fuel oil, do	1,178	1,362	1,453	1,609	[1] 1,420
Residual fuel oil, do	2,273	2,663	2,916	3,578	[1] 3,830
Asphalt, thousand tons	43	47	61	68	[1] 56

[1] Estimate.
[2] Average grade about 0.1 ounce of gold per ton, 3.2 ounces of silver per ton, and 0.4 percent copper.
[3] Data not available.
[4] Revised figure; supersedes that given in commodity chapter, volume 1.

TRADE

Mineral imports in 1963 were valued at an estimated US$60 to $65 million, about twice that of mineral exports. Crude petroleum and iron and steel products, about the same level as in 1962, led the imports comprising about two-thirds of the total value. Fertilizers and sulfur also were impressive. Nearly one-fifth of the total 1963 mineral import value was in chemical fertilizers. Tonnages of fertilizers, while large in 1963, were off nearly 30 percent from those in 1962. Sulfur valued at US$1.3 million was about three times the 1962 value and quantity.

The United States and Japan were principal trading partners of Taiwan. Crude oil was supplied from the Middle East, metals chiefly from Japan and Australia, and fertilizers from Japan, except for phosphatic and potassic types imported from the United States. The main source of iron ore was Malaya; of bauxite, Sarawak; of sulfur, Canada; and of steel scrap, United States. Part of Taiwan's imports were provided through U.S. AID.

Cement and iron and steel products were the leading exports, with cement worth about US$14 million in 1963. Tonnage of iron and steel exports was higher than in 1962 and came close to half of that imported. The majority of cement and iron and steel appeared to be going to South Viet-Nam and Hong Kong in 1963 as in 1962. Coal, mainly coking grade, was exported to Japan and South Korea; salt, copper ores, and copper products to Japan; and gasoline and fuel oil to the Philippines.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal destinations, 1962
Metals:			
Aluminum and alloys:			
Metal	2,442	2,626	United States 1,000; Netherlands 700; West Germany 500; South Korea 407.
Products [1]	1,272	1,510	South Viet-Nam 1,290; Hong Kong 100.
Copper:			
Ore and concentrate	8,800	12,800	Japan 10,600; Singapore 2,200.
Metal	4,430		
Products [1]	2,176	4,420	Japan 4,400; South Viet-Nam 20.
Iron and steel:			
Pig iron	2,260	1,879	South Viet-Nam 1,854; Ryukyu Islands 25.
Ingots	150	25	South Viet-Nam 30.
Products [1] thousand tons	78	54	South Viet-Nam 27; Hong Kong 15.
Ferroalloys	60	590	South Korea 530; Philippines 50.
Nonmetals:			
Cement:			
Hydraulic thousand tons	276	488	South Viet-Nam 283; Hong Kong 144; Sabah 19; South Korea 13; Malaya 12.
White	113	5,029	South Viet-Nam 3,797; Philippines 1,182.
Fertilizers, chemical	20,245	15,327	South Korea 14,300.
Salt thousand tons	294	237	Japan 222; Malaya 7; Ryukyu Islands 6.
Mineral fuels:			
Coal do	241	128	Japan 78; South Korea 41.
Coke, petroleum and others	1,888	3,498	Philippines 1,273; Hong Kong 746; Singapore 682.
Petroleum:			
Gasoline, naphtha and benzine thousand tons	11	27	All to Philippines.
Fuel oil do			
Pitch and asphalt do	32	37	South Korea 15; Hong Kong 9; South Viet-Nam 4.

[1] Estimate.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Aluminum and alloys:			
Metal	10	333	United States 301; Canada 22.
Products [1]	113	119	Japan 54; Canada 42.
Bauxite	57,176	57,185	Sarawak 52,555; India 2,540; Malaya 2,090.
Chromium ore and concentrate	100	250	All from Japau.
Copper and alloys:			
Metal	1,263	2,443	Japan 2,084; United States 359.
Products [1]	1,375	707	Japan 590; Australia 80.
Iron and steel:			
Ore and concentrate	72,687	10,452	All from Malaya.
Billets, blooms, and other unworked.	10,223	11,132	Main sources unspecified.
Products [1] thousand tons	120	156	Japan 118; United States 28.
Ferroalloys	1,044	609	Japan 370; Belgium 185; West Germany 50.
Scrap thousand tons	183	113	United States 59; Hong Kong 8.
Lead and alloys:			
Metal	1,224	1,903	Australia 1,551; Mexico 90; United States 90.
Products	51	25	All from West Germany.
Mercury	5	9	United States 4; Mexico 3.
Nickel:			
Metal	93	101	United States 49; Canada 48.
Products	2	4	United States 2.
Tin and alloys	108	167	Malaya 161.
Titanium dioxide	380	534	Japan 392; United States 94.
Zinc:			
Metal	1,946	3,048	Australia 1,860; Canada 950; Austria 200.
Products [1]	284	270	West Germany 138; Belgium 95.
Nonmetals:			
Abrasives	1,818	655	Japan 548; United States 93.
Asbestos	834	1,423	Canada 894; United States 361; Republic of South Africa 155.
Fertilizers:			
Ammonium sulfate	190,840	235,265	All from Japan.
Nitrogenous	47,421	73,133	Do.
Phosphatic	44,066	6,158	All from United States.
Potassic	19,118	33,297	United States 31,297; Japan 2,000.
Graphite	995	1,570	South Korea 1,210; Hong Kong 194; Japan 163.
Gypsum	25,221	35,991	Egypt 26,500; Mexico 5,310; United States 4,140.
Sulfur	12,106	15,497	Canada 12,728; United States 2,429; Cambodia 340.
Mineral fuels:			
Coke, petroleum and others	2,994	10,136	United States 9,415.
Petroleum: [2]			
Crude oil thousand tons	1,362	1,259	Iraq 644; Kuwait 369; Saudi Arabia 197; Iran 48.
Lubricants do	16	26	United States 17; Japan 9.
Paraffin	1,543	1,876	Japan 1,725.
Pitch and asphalt	2,039	3,712	Japan 1,956; United States 1,218.

[1] Estimate.

[2] Lubricants and aviation gasoline imported under U.S. military aid program are omitted.

COMMODITY REVIEW

METALS

Aluminum.—Taiwan had the only aluminum reduction plant among the smaller countries of the Far East. Taiwan Aluminum Corp., the Island's sole aluminum producer, recorded a 9-percent production increase from 1962. About half of the production was in sheets and strips and the rest extrusions, foils, and other shapes. The company's new Pechiney-design potline at Kaohsiung was completed in June 1963 raising ingot capacity to 20,000 metric tons per year. Bauxite,

imported mainly from Sarawak, was processed in the plant's Bayer alumina section. Also some 2,500 tons of bauxite went to firebrick and related industries. An estimated 60,000 tons of bauxite was imported in 1963 with 90,000 tons expected in 1964. Aluminum exports, over half in the form of ingots, totaled about 4,100 tons in 1962 and were probably higher in 1963.

Copper, Gold, and Silver.—Chinkuashih, together with the nearby Chiufen and Wutankeng mines in northern Taiwan, supplied nearly all the copper, gold, and silver production. Taiwan Metal Mining Corp. extracted ores at Chinkuashih averaging less than 0.8 percent copper, mainly in the form of enargite, with abundant pyrite recovered as a byproduct for its sufur. Output of copper in 1963 fell about one-third from that in 1962 owing to Typhoon Gloria which caused an estimated US$250,000 damage to mine facilities. The value of gold and silver produced in 1963 slightly exceeded that of copper.

At Chinkuashih 10 or so pipelike ore bodies were mined and cement copper was recovered from mine waters by collection on iron scrap. Gold was more important than copper in some of the ores. Cyanidation was used to treat the gold ores, flotation-cyanidation for gold-copper ore, and flotation for copper ore. Concentrates and most of the cement copper were shipped to Japan for smelting. Bonanza gold ore shoots discovered in October 1962 between the second and main sublevels of Adit No. 4 were being mined, and during the 6 months following discovery 200 tons was extracted averaging 31.8 ounces per ton in gold. Preliminary estimates placed the reserve at 800,000 tons of ore but grade was very erratic. A 24 ton-per-day mill was due in operation by mid-1963 to treat the rich ore. Copper mining was largely confined to Adit No. 7, while efforts were underway to pump out the No. 8 main level extending 420 feet below sea level, with mining to start there in 1964. Sand filling, begun in 1962, helped support stopes and effectively reduced mining costs. Scrap and some cement copper were processed in a small smelter-electrolytic refinery at Chinkuashih but the plant was considered uneconomical to operate on mine production.

Iron and Steel.—Production, which had been expanded tenfold from a decade ago, was not very large. Output of ingots and castings was 75,000 tons greater in 1963 than in 1962. Roughly a dozen small capacity plants produced ingots and castings; about 30 others produced ingots and rolled products. The most important plant, also the Island's largest private enterprise, was the 90,000 ton per year Tang Eng Ironworks at Kaohsiung.

Pig iron was produced by Taiwan Iron Manufacturing Co. at Sitze, using a 50-ton-per-day blast furnace and local ores. Taiwan had no important iron ore deposits; the only production came from magnetite beach placers on the northern coast, mined by retired servicemen, and a small quantity of limonite bog iron that supplied local demand. Iron ore was also imported from Malaya, averaging about 40,000 tons per year in 1961–63. Scrap mainly from the United States and Hong Kong supplied a third to a half of the iron requirements.

Steel product imports were estimated at 150,000 tons in 1963, about the same as in 1962, but exports were higher at about 70,000 tons. Exports in 1962 were valued at US$12 million and went mostly to South Viet-Nam and Hong Kong. Ferroalloy exports showed a significant

rise from 590 tons in 1962 to an estimated 4,300 tons in 1963, nearly half ferromanganese and the rest ferrosilicon. The government was urged to remove an existing ban on bringing old ships to Taiwan for scrapping. A project was under study by Kaiser Engineering Co. (United States) to build an integrated iron and steel mill costing on the order of US$50 million. Such a plant was strongly encouraged by the government, but market justification appeared to be lacking.

NONMETALS

Asbestos.—Commercial asbestos production came from one deposit, Fengtien, in the Hualien area of eastern Taiwan. The asbestos was mostly brittle and weak, comprised of actinolite and tremolite varieties. Mining was intermittent, 40 to 50 tons of asbestos powder being produced per month. Serpentine also had been mined at Fengtien for flux in making phosphate fertilizers at Taiwan Fertilizer Co.'s Lotung plant but production was stopped in 1960 when it was found farmers were reluctant to use such compounds.

Cement.—Fears of overproduction were dispelled by brisk export sales mainly to South Viet-Nam and Hong Kong. Domestic consumption in 1963 was estimated 1.3 to 1.4 million metric tons and per capita was second only to Japan among Asiatic countries. Production, 21 percent higher than in 1962, surpassed the 4-year plan's 1964 target of 2,160,000 tons as facilities were operated at maximum levels. Ranked about fifth in world cement exports, Taiwan shipped abroad an estimated 900,000 tons of cement including 70,000 tons of white cement in 1963. Exports were nearly double those of 1962. The rise in white cement exports from a few thousand tons in 1962 was significant in view of competition from Japan.

Taiwan Cement Corp., a former government enterprise transferred to private ownership, was the largest producer, with one plant each at Kaohsiung, Suao, and Chutung, plus a new plant completed in 1962 at Hualien. With startup of a new kiln at Kaohsiung in November 1962 the company's annual capacity rose to 1.2 million tons, over half of the Island's total. Company profits were reported at US$3.93 million in 1962. The same company announced investment in a new Hong Kong cement plant under construction in 1963 on Tsing Yi Island and received approval to export 20,000 tons of cement to Hong Kong as part payment. Plans were to utilize Taiwan clinker.

Taiwan manufacturers prepared to supply cement clinker to new finishing plants in South Korea and South Viet-Nam. Producers were awarded contracts in 1963 to supply 250,000 tons of finished cement to the Philippines and 100,000 tons of clinker to South Korea. The new US$6.3 million 200,000 ton plant of Universal Cement Corp. at Kaohsiung began operation in May 1963. A major portion of its production was marked for export.

As new foreign plants in underdeveloped countries reached production stage, Taiwan's export markets were expected to fall. Hence, a three point program was drawn up by the Ministry of Economic Affairs' Planning and Coordination Group advocating temporary halt in cement plant expansion and construction, assignment of export controls and promotion to Taiwan Cement Corp., and more effort to

reduce cost and increase sales. Objectors viewed the plan as contrary to government policy to encourage free competition also complaining that lack of surplus capacity would result in shortages during high demand periods of the year.

Dolomite.—Most of Taiwan's 1963 production of dolomite came from the Hualien area on the east coast. Small quantities were dead-burned by Taiwan Metal Mining Corp. in a vertical kiln pilot plant, and the product was used successfully as furnace bottom by Keelung Iron & Steelworks. Taiwan Mineral Resources & Industry Co., Ltd. completed a US$250,000 plant at Hualien to calcine dolomite making plaster and magnesian fertilizer partly for export markets. The plant was supplied with a small tonnage of the mineral imported from Japan in 1963. Detrital dolomite was obtained from stream sediments renewed by annual floods in the Hualien area although extensive but poorly accessible bedded deposits existed nearby at Chingchang Shan and Chingchangchi.[3] The only dolomite quarry in Taiwan was along the Suao-Hualien Highway where three operators produced about 2,000 tons per month, half going to iron smelters, chiefly the Tang-Eng Ironworks in Kaohsiung.

Graphite.—The main graphite producer was the Paileng deposit at Taichung-hsien. Used chiefly in crude paints, roofing compounds, and pencil leads, the graphite was associated with altered and recrystallized coal and was poor quality amorphous, perhaps better described as graphitic slate.

Marble.—At Hualien, Vocational Assistance Commission for Retired Servicemen operated a marble processing plant and was planning to build a second plant costing about US$500,000 during 1964 to meet increasing demands. Yu Hwa Industrial & Mining Marble Corp. also operated a marble plant and quarry at Hualien.

Salt.—Record output in 1963, made possible by favorable weather, exceeded the production target and was 5 percent higher than in 1962. The important salt fields were along the southwest coast. Nearly one-half of the production, about 283,000 tons, was exported mainly to Japan providing US$1.5 million in foreign exchange.

Crude salt was processed by the Taiwan Saltworks and Taiwan Alkali Co. Taiwan Salt also treated residual bitterns in plants at Putai and Anping extracting byproducts such as gypsum for cement, sodium sulfate for glass and paper making, and magnesium compounds for paper, refractory, and fertilizer industries. About 50,000 tons of washed salt and 1,200 tons of refined salt per year were produced mainly at Anping. Industrial salt consumption was nearly six times higher than a decade ago. Salt went into making caustic soda, chlorine, and soda ash. Estimated 1963 production of caustic soda totaled 44,400 tons and soda ash 12,400 tons. Government-owned Taiwan Alkali Co. operated electrolytic caustic-chlorine plants at Kaohsiung and Anshin, producing three-fourths of the caustic output. Eighteen or so private manufacturers also produced alkalis.

Sulfur, Pyrites, and Fertilizer.—Native sulfur, pyrites, and petroleum refinery off-gases provided about two-thirds of the Island's sulfur re-

[3] Matsuo, Tadayoshi and Shigeo Takeuchi. Report on the Development and Utilization of Dolomite in Taiwan (in Chinese). Mining Research and Service Organization, Ministry of Economic Affairs, Taiwan, December 1963, 28 pp.

quirements in 1962 but less than half in 1963 as demand went up; sulfur imports largely from Canada supplied the balance. Apparent consumption of sulfur doubled from about 35,000 tons in 1962 to 70,000 tons in 1963; meantime, imports nearly tripled in 1963 to an estimated 45,000 tons while production rose only a few thousand tons. Most of the sulfur was used in making paper and fertilizers. Ammonium sulfate fertilizers were highly popular with Taiwan farmers, and efforts were being made to expand production and thus cut import expense. Estimates of demand in 1964 were placed at 55,500 tons for sulfur and 145,700 tons for pyrites, both considerably higher than projected outputs. The government called on sulfur and pyrite miners to increase production and proposed guaranteed markets. In late 1963 the Central Trust announced invitations to bid on supply of 55,000 tons of sulfur.

Natural sulfur was produced from solfatara deposits of the Tatun Volcanic Group in northern Taiwan at low yield 50 percent extraction rates. Major producers were Tekke Mining Co., San Chin Mining Co., and San Li Mining Co. Pyrites, however, were a more important source of sulfur, the output totaling 46,760 tons (about one-third sulfur) in 1963. Most of this came from flotation plants at the Chinkuashih and Chiufen mines where the mineral comprised about 8 percent of gold-silver tailings. Several small plants (10 ore-tons per day) for floating "black pyrites" that occur with sulfur in the Tatun deposits, were operated in the Chihsing-Shan region. Taiwan Metal Mining Corp. ran tests during 1962 with a pilot flotation mill at the Chihsing-Shan mine to determine best treatment for such ores.[4] The company considered building a plant (200 ore-ton-per-day) at either Payen or Chiku for precessing the mixed ores of nearby deposits. Ore reserves in the surrounding area were estimated to total 2.6 million tons averaging about 13 percent native sulfur and 772,000 tons of sulfur in pyritic ores in which the pyrite contained 15 percent or more sulfur.

Production of fertilizers in thousand metric tons were as follows:

Fertilizer	1962	1963	Fertilizer	1962	1963
Calcium cyanamide	79	64	Urea	75	76
Nitrochalk	58	55	Calcium superphosphate	144	172
Ammonium sulfate	68	108			

Phosphate rock for making superphosphate was imported from the United States and Morocco (estimated 30,000 and 12,000 tons, respectively, in 1962). Fertilizer imports, largely from Japan, fell 29 percent to 258,294 tons in 1963, with ammonium sulfate, the most important, dropping to only about half of that imported in 1962. Imports were expected to drop still further in 1964 with completion in December 1963 of a large natural-gas based urea-ammonia plant built by Mobil China Allied Chemical Industries, Ltd. at Miaoli. A 120,000-ton-per-year ammonium sulfate plant using ammonia from the Mobil

[4] Mining Research and Service Organization, Ministry of Economic Affairs, Taiwan. Design of Flotation Plant for the Beneficiation of Low Grade Sulfur and Pyrite Ore in Chihsingshan Region. MRSO Report 1, October 1962, 56 pp.

plant and due for completion by Taiwan Fertilizer Co. (TFC) also at Miaoli in early 1964 was being equipped with a Japanese-made 300-ton-per-day sulfuric acid pyrite roaster. Central government-controlled TFC, with seven of the country's eight fertilizer plants, produced 466,168 tons of chemical fertilizers in 1963 and aimed at 497,000 tons in 1964. The eighth plant, run by Provincial Government-owned Kaohsiung Ammonium Sulphate Corp., was being expanded. TFC was laying plans to build a US$1 million phosphoric acid plant, part of the production to go into superphosphate and mixed fertilizers.

MINERAL FUELS

Coal.—Coal, exceeded only by cement in mineral production value, provided about four-fifths of Taiwan's mine output in 1963. Production was 6 percent higher than in 1962, this, despite extensive mine damage by the typhoon that hit in September. About one-fifth of the production was coking grade. Operating coal mines at the beginning of 1963 totaled 315, of which about 175 produced more than 1,000 tons per month. Demand was rising, especially for thermal power use, but coal seams were mostly thin and mines could not readily be expanded; hence, the necessity of opening new mines to push production higher.

The industry was burdened with high mining costs, hazardous operations, health problems, and low prices set by the major consuming government enterprises. The death rate from coal mine accidents was 30 to 50 persons per million tons of coal, almost 100 times higher than most other countries. There were 88 fatalities in the first half of 1963 mostly from gas explosions that resulted from failure to provide adequate ventilation. Hookworm disease seriously reduced mine workers efficiency. Coal producers requested increases in basic coal prices but were turned down in the interest of price stability; however, some relief was given by increased credit. Severe competition had depressed coal prices 4 percent in 1963. To ease the burden of large inventories Taiwan Power Co., the principal consumer, agreed to take advance 1964 deliveries of 200,000 tons of coal. The company's requirements for 1965 were estimated at 1.75 million tons rising to 2.58 million tons by 1970.

Main markets for coal exports were Japan and South Korea. Shipments of 90,735 tons in 1963 were almost two-thirds less than in 1961. Losses on shipments to Korea doubled as competition with Australian and Japanese suppliers dropped Korean coal prices from US$11 in 1962 to US$9.30 in mid-1963.

Taiwan's coal requirements for 1967 were estimated at 6 million tons; it appeared there would be a deficiency from 1964 on, so no surplus would be available for export. Electric generating capacity was growing. The third unit of the Kaohsiung thermal plant was due in service by the end of 1963, and a 200,000 kilowatt thermal plant was scheduled for operation at Shen Ao in 1965–66. Also, the government was planning two 300,000 kilowatt thermal units to be completed in 1968–69. Taiwan Railway Administration, the largest consumer of lump coal sizes, was replacing steam with diesel locomotives, so some excess lump was predicted.

To boost coal production the government was developing six new mines to open in 1964–65 and planned opening of seven others as demand indicated. Few mines had coal washing facilities, and to improve mining and coal preparation methods, Taiwan's Mining Research and Service Organization and Provincial Coal Adjustment Commission was establishing a pilot coal cleaning plant and research laboratory at Chin Mei. Equipment installation was nearly complete at yearend. One project was to reduce sulfur content of coal below the 2.5 percent maximum set by Taiwan Power Co. Mine operators were anxious to get mechanical equipment suitable for complex local mining conditions. In general the new mines had seams only 12 to 28 inches thick. Arrangements were being made to obtain on trial from West Germany a Westfalia-Lunen Co. Ram Plough for use in the Yungting mine of Taiyang Mining Co. Yielding steel props were purchased for trial use in long-face mining at the Chien Chi mine. Prestressed concrete roof supports were used experimentally in several mines.

Offshore coal mining was of growing importance. Seven coal belts have been proven to extend off the northern shores of Taiwan and drilling of three holes was proposed to test extension underwater of two other belts. Three suboceanic mines were planned: Chien Chi, Taipei-hsien; Masu, northwest of Keelung; and Yungchiu, north of the Chinkuashih mine. Work began and Chien Chi in February 1963 on a 2-year project to sink a 3,900-foot incline dipping 18 degrees to reach a seam containing an estimated 16 million tons of coal 1,085 feet below sea level.

Coking coal went chiefly to the Pioneer Chemical Corp. byproduct coke oven plant at Nankong, Taipei-hsien, in operation since October 1961. More wasteful beehive ovens were being phased out over several years. Pioneer operated at about two-thirds of its 150,000 tons coke and 1.6 billion cubic feet of gas annual capacity, producing besides coke, ammonium sulfate, coal tar and pitch, light oils, and other products. Some of the pitch was exported to South Korea for use in making briquets.

Natural Gas.—The 1,630 million cubic feet of natural gas used in 1963 was nearly one-third greater than in 1962 resulting from new supplies developed at the Chinshui field, northwestern Taiwan. Gas finds came on the heels of growing criticism of unsuccessful explorations: China Petroleum Corp. had completed 11 producing gas wells at Chinshui by early 1963. In November its Chinshui Well No. 53 reached a producing horizon that provided an additional 8 million cubic feet daily potential output and brought Taiwan's overall capacity up to 42 million cubic feet of gas daily. The most productive zone was about 8,000 feet in depth. Deep drilling at 11,000 to 14,000 feet also disclosed commercial gas in the old Chuhuangkeng oilfield and the Tiehchenshan anticline; explorations were planned of favorable oil and gas structures at Tatushan and Paishatun.

Encouraging news brought a flurry of interest in gas distribution and utilization.[5] China Petroleum hired an American engineering consultant firm to conduct a survey for a natural gas pipeline from Miaoli

[5] Chang, Stanley S. L., and David K. Y. Chen. Substantial Gas Reserves Reward Taiwan Exploration Campaign. World Petroleum (London). April 1963, pp. 46–49.

to Kaohsiung in the south and Keelung in the north. The US$22.5 million fertilizer plant of Mobil China Allied Chemical Industries, Ltd. utilizing gas from the Chinshui field was completed at Miaoli in December 1963. This was a joint venture of China Petroleum Corp., Socony Mobile Oil Co., Inc., and Allied Chemical Corp. and had capacity of 100,000 and 45,000 tons per year of urea and ammonia respectively. A gasoline absorption plant at Touwu due for completion in 1963 was to supply the fertilizer plant with gas, processing 35 million cubic feet daily, and extracting about 100,000 barrels of gasoline per year. Construction was expected to start in late 1964 on a natural gas pipeline from Chinshui to Hsinchu, and gas distribution facilities at Hsinchu were being planned.

Petroleum.—About 1.49 million metric tons of crude and diesel fuel oil was imported for refining and use in 1963. Taiwan had a small production of oil, in 1963, mostly from the Chinshui field, and this was processed in a small refinery with a few hundred barrels per day capacity at Miaoli.

Petroleum product consumption, excluding the military, was estimated at 4.2 million barrels in 1963 compared with 3.7 million barrels in 1962. For bunkering in 1963, 500,000 barrels of fuel and diesel oils went to commercial ships while civilian aircraft consumed 44,000 barrels of aviation gas and 72,000 barrels of turbine fuel. With exception of lubricants all domestic civilian requirements were met by the 35,000 barrel-per-day Kaohsiung refinery of China Petroleum Corp. (CPC) operating on Middle East crudes. About two-thirds of the lube oil needed was imported and the balance produced in a CPC blending plant. Construction was started in September 1963 on a US$7.7 million 1,500 barrel-per-day lubricant plant being built by Gulf Oil Co. in partnership with CPC. The plant, to use partly reduced crude from CPC, was due for operation in 1965, with half or more of the output intended for export markets.

An American oil exploration group negotiated with the government but apparently was short of an agreement for oil and gas exploration rights in the southern half of Taiwan.

The Mineral Industry of Thailand

By J. M. West[1]

THE mineral sector of the Thai economy was far less important than agriculture, the principal source of livelihood for the country's 30 million people. However, the mineral industry showed an interesting potential. Minerals, largely tin, contributed only 1 to 1.5 percent of the approximate US$3.1 billion gross national product (GNP) but accounted for 8 percent of the value of the total exports. The GNP was estimated to be 6 percent higher than in 1962. Tin was an important source of foreign exchange, as Thailand was the world's fifth-largest tin producer, with 7 to 8 percent of world production. Most of the tin came from the peninsula leading south into Malaya. Besides tin, Thailand produced 1 to 2 percent of the world's antimony, about 1 percent of the fluorspar, and slightly less than 0.5 percent of the tungsten. The year brought sharp rises in antimony and fluorspar production, appearing to mark Thai entry as a world producer of some importance for these minerals.

Among the few significant developments during 1963 were two oil refineries nearing completion: one a 36,000-barrel-per-day plant at Sriracha to supply commercial distributors and to operate under Shell International Oil Co. management; the other a 5,000-barrel-per-day Government-built plant near Bangkok. The lignite-burning Krabi powerplant, approaching completion in southern Thailand, was to be supplied from newly developed mines. Oil exploration concessions in the north were granted to at least two companies. Five or more companies held concessions and searched for iron ore. The following were planned or considered: a tin smelter, integrated iron and steel making, a nitrogenous fertilizer plant, a cement plant for southern Thailand, and at Bangkok a steel rolling mill, a pipe plant, and electric furnace installations.

GOVERNMENT POLICIES AND PROGRAMS

In recent years, the Thai Government embarked on the policy of encouraging foreign investment in local mineral exploitation. For example, potential investors were offered inducements under the Industrial Investment Promotion Act passed in 1962 that granted special benefits for priority industries.[2] In 1963 this fast-developing country with a fairly promising mineral resource base also has political stability, a sound monetary structure, and favorable atmosphere for con-

[1] Physical scientist, Division of International Activities.
[2] U.S. Department of Commerce, Bureau of International Commerce. Establishing a Business in Thailand. Overseas Business Reports. OBR–63–27, January 1963, 10 pp.

tinuing economic growth. The 1961–66, 6-year plan sought to raise GNP by 4 to 5 percent annually, but the figure was subsequently revised upward to the 6 percent rate achieved in 1963. Greater emphasis was to be placed on rural development in the revised plan. A program was in effect to boost tin output at least 5 percent a year. This was possible since the Thai export quota under the International Tin Agreement was raised July 1, 1963.

Thailand maintained a small but active Department of Mines, which handled leases and concessions, regulated tin production and sales, supervised the purchase, transport, and sales of certain minerals, and conducted geological, mining, and metallurgical tests and studies. An Agency for International Development-backed program, started in 1960 to assist the Department in training personnel and investigating sedimentary rocks in the northeast provinces, was dropped in 1963.

In a far-reaching reorganization, the Thai Cabinet decided in April 1963 to consolidate 13 departments and 3 state enterprises under a Ministry of National Development. With the changes, the Department of Mines and Ministry of Industry were combined to form the Department of Land Resources. Several separate electricity authorities were merged into one National Electricity Authority, giving promise of simplified power-rate structure.

The Government was building power projects and linking electrical distribution lines. The Yan Hee 560,000-kilowatt hydroelectric project with its Bhumibol Dam, seventh largest in the world, neared the initial operating stage due in 1964. A 40,000-kilowatt thermal powerplant was being built in conjunction with the Krabi lignite mine project in southern Thailand to serve an important tin mining area. Bids were invited in late 1963 to build the 25,000-kilowatt Nam Pong hydroelectric project in Khon Kaen Province.

Political unrest in neighboring Laos and the break in diplomatic relations with Cambodia limited geological studies in eastern Thailand, and insurgent activities along the Burmese border also held back mineral development in western Thailand.

PRODUCTION

Tin accounted for about 60 percent of the 1963 mineral output by value, cement about 30 percent, salt about 3 percent, and lignite, fluorspar, petroleum, antimony, manganese, lead, tungsten, and iron ore less than 1 percent each in about that order. Marl and gypsum were produced for local use mainly in cement. Lignite, poor in quality, was used mostly for generating electric power locally at Mae Moh. About half of the salt (produced from sea water) and nearly half of the manganese ore mined found domestic markets. Tin production showed a significant 6-percent increase in 1963. Antimony output, including ores and some metal, rose sharply because of activity at one mine. Again as a result of expansion of one mine, fluorspar production jumped to nearly three times that of 1962.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Antimony:					
Ore	19	----------	61	87	1,357
Mine	10	----------	33	44	622
Metal, plus 99 percent Sb	----------	----------	----------	35	105
Iron and steel:					
Iron ore, 55 percent Fe----thousand tons	6	11	56	45	16
Pig iron----do	7	6	5	5	6
Steel ingots and castings----do	6	7	8	7	[1] 7
Lead, mine	1,320	1,840	2,211	2,359	2,260
Manganese ore	410	528	533	2,898	6,520
Tin:					
Ore and concentrate----long tons	13,160	16,493	18,096	19,997	21,276
Mine----do	9,684	12,080	13,270	14,680	15,600
Tungsten concentrate	463	407	474	394	189
Zinc, mine (in lead-zinc ore)	760	1,060	900	[1] 950	[2]
Nonmetals:					
Cement----thousand tons	510	526	797	963	996
Fluorspar, 80 to 85 percent CaF_2	----------	3,460	4,755	10,710	29,230
Gypsum	8,000	14,080	12,040	21,000	23,890
Marl (used for cement)----thousand tons	459	434	[2]	936	[2]
Salt, sea, 85 to 90 percent NaCl----do	459	335	250	150	200
Mineral fuels:					
Coal, lignite----thousand tons	141	149	108	135	137
Petroleum, crude----thousand 42-gallon barrels	[1] 30	[1] 40	[1] 50	[1] 50	[1] 45

[1] Estimate.
[2] Data not available.

TRADE

Minerals comprised about 8 percent of Thailand's total exports, ranking fourth after rice, rubber, and corn. Mineral exports were valued at US$37.5 million, 90 percent accounted for by tin. Cement and salt together brought in US$3 million, with the balance of less than US$1 million derived from fluorspar, antimony, manganese, tungsten, lead, and iron ores. Two-thirds of the tin went to Malaya. Japan was the main buyer of other ores, except lead which went mainly to West Europe and managanese to Hong Kong. South Viet-Nam received most of the cement.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1962	1963	Principal destinations, 1962
Metals:			
Antimony:			
Ore and concentrate	73	1,032	Japan 48; West Germany 25.
Metal	6	20	Mainly to Japan.
Iron ore----thousand tons	28	7	Japan 28.
Lead ore and concentrate	4,331	4,555	West Germany 2,081; Belgium 1,000; United Kingdom 650; Italy 600.
Manganese ore	301	2,760	Hong Kong 250; Philippines 50.
Tin ore and concentrate--long tons	19,523	21,400	Penang-Malaya 12,728; Netherlands 3,895; Brazil 1,652.
Tungsten ore and concentrate	243	289	Japan 68; Netherlands 55; Penang 50.
Nonmetals:			
Cement----thousand tons	179	139	South Viet-Nam 115; Laos 34; Singapore 21.
Fluorspar	[1] 6,962	14,970	Japan 5,862; Taiwan 1,100.
Salt, sea----thousand tons	135	102	Japan 39; Malaya 33; Singapore 23; Hong Kong 19.

[1] Listed with feldspar, leucite, nephelite, and nepheline syenite but believed to be all fluorspar.

Petroleum imports valued at an estimated US$55 to US$60 million came mainly from Indonesia and Iran. Imports of steel products based on 10-month 1963 figures appeared to be about 50 percent greater than 1962 imports and were estimated at 410,000 tons for the year. Most of the steel was supplied by Japan. Some white and other special types of cement were imported. Because of agriculture's leading role, fertilizers formed an expanding part of Thai trade. In 1963, about 100,000 tons of fertilizers were imported, half again higher than in 1962. Makeup of the 1962 imports was ammonium sulfate, 43 percent; ammonium phosphate, 25 percent; mixed, 16 percent; and other, 16 percent. Value was about US$4 million, with Japan, West Germany, and the Netherlands being the main suppliers.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1962	Jan.–Oct. 1963 [1]	Principal sources, 1962
Metals:			
Aluminum:			
Metal	1,189	941	West Germany 710; Canada 468.
Products [2]	3,857	2,789	Japan 1,005; Hong Kong 516; Austria 377.
Copper:			
Metal and alloys	219	147	United States, 170.
Products [2]	1,842	1,786	Japan 1,348; Italy 198.
Iron and steel:			
Pig and cast iron	303	----------	West Germany 260.
Ferroalloys	612	528	Norway 366; Japan 160.
Products [2] thousand tons	277	344	Japan 187; Hong Kong 23; United States 19.
Lead:			
Metal	1,040	553	United States 593; Burma 396.
Products [2]	70	122	Netherlands 14.
Zinc:			
Metal and alloys	7,205	8,634	Canada 3,611; Australia 1,895.
Products [2]	1,793	1,335	Australia 578; Poland 540.
Nonmetals:			
Abrasives	658	519	Netherlands 456.
Andalusite, kyanite, and sillimanite	379	----------	India 374.
Asbestos	5,391	7,385	Union of South Africa 1,969; Canada 1,473; Cyprus 1,361.
Cement	34,885	15,594	Japan 24,690; Taiwan 9,700.
Clay and kaolin	1,234	1,902	United Kingdom 431; Japan 391.
Fertilizers (chemical)	66,468	82,232	Japan 26,991; West Germany 17,667; Netherlands 10,266.
Graphite	460	398	Japan 305; Hong Kong 70.
Marble	352	146	Italy 346.
Sulfur	3,404	3,807	Belgium 1,600; West Germany 762; Italy 515.
Talc	1,393	699	Japan 792; South Korea 365.
Mineral fuels:			
Coke from coal	2,295	1,413	Japan 1,611; Netherlands 499.
Petroleum:			
Crude 1,000 42-gallon barrels and partly refined.	----------	1,016	All from Saudi Arabia (1963).
Refinery products:			
Gasoline-benzine:			
General use ---do---	8,290	6,770	Indonesia 6,290; Iran 1,690.
Aviation ---do---	800	1,010	Indonesia 642; Iran 94.
Kerosine ---do---	2,280	1,970	Indonesia 1,800; Iran 398.
Jet fuel ---do---	2,960	1,950	Indonesia 2,100; Iran 448; Singapore 338.
Distillate fuel oil ---do---	9,640	8,970	Indonesia 7,710; Iran 1,760.
Residual fuel oil ---do---	5,910	5,770	Indonesia 3,060; Iran 2,770.
Lubricants ---do---	910	710	United States 437; Netherlands 206.
Waxes and jellies ---do---	32	21	Indonesia 20.
Petroleum asphalt ---do---	312	196	Japan 230; Iran 30.
Asphalt-bituminous do--- mixtures.	99	85	Iran 66; Saudi Arabia 12.

[1] Port of Bangkok only.
[2] Estimate.

COMMODITY REVIEW

METALS

Aluminum.—Aluminum consumption, about 5,000 tons in 1962 and 1963, was supplied from imports. Kaiser Aluminum & Chemical Corp. took a 35-percent interest in Thai Metal Works Co., Ltd., with a 2,500-ton-per-year aluminum sheet rolling plant in Bangkok, in contemplation of a wider range of sheet products. Aluminum Co. of Canada, Ltd., planned a sheet (2,500 tons) and cable (1,500 tons) plant.

Antimony.—Antimony suddenly rose to prominence, contributing about US$400,000 to the Thai economy. Production jumped owing to greatly increased output at the Bansong mine of Siamerian Mining Enterprise Co., Ltd., and the 1964 production was projected at about 1,200 tons. The greatest part of 1963 output was exported to Japan. Handpicked ores and concentrates grading plus 45 percent antimony comprised about three-fourths of the output. Two 1-ton-per-day volatilizing furnaces at Bansong produced about 100 tons of antimony metal; two more similar-size furnaces were under construction. Mining Products Co., Ltd. (Bangkok), American-owned, signed a contract in early 1963 to manage operations.

Iron Ore.—Thailand's iron ore production, never large, dropped in 1963 because of depletion after less than 2 years' operation of the Eastern Mining Development Co. mines on Kao Samui Island off Surajthani, southern Thailand. The company produced 37,612 tons of ore in 1962 and 3,607 tons in 1963 before closing the mines in March. Operations moved in June to another deposit in Nakorn Sawan Province. Siam Cement Co. with a 20-year-old mine in Lopburi Province produced 12,134 tons of iron ore in 1963. Ore all went to the company's Tha Luang iron smelter-cement plant facility.

The Government continued to strongly encourage exploration for large enough iron deposits to supply a medium-tonnage, integrated iron and steel plant. Two firms acquired concessions to explore and mine iron ore; Thai Pin Petch Co., Ltd., in Trang Province, and Stella (Thailand) Co., Ltd., in Amphur Phayuhakiri, Nakorn Sawan Province. The Prime Minister's office in mid–1963 announced iron deposits containing an estimated 10 million tons of ore had been discovered in the northeastern Province of Loei. Two leading Japanese steel companies reportedly signed agreements to purchase in 3 years 400,000 tons of iron ore on a guaranteed-59-percent-iron dry basis from the Thesala mines in southern Thailand. Thailand Steel Co., Ltd., a Thai-Japanese combine, conducted a survey for iron deposits in Nakhon Srithamarat, southern Thailand, under a 1-year concession granted in August 1962.

Iron and Steel.—Except for a few thousand tons of pig iron produced annually by Siam Cement Co.'s small charcoal-fired blast furnace at Tha Lusang and minor scrap smelting, Thailand relied on imports for its iron and steel requirements. Apparent consumption in 1963 was estimated at about 420,000 tons, nearly half again higher than in 1962. Japan supplied about two-thirds of the tonnage consumed. Main imports in 1962 were sheets and plates 99,779 tons, concrete

reinforcing rounds 77,456 tons, and tubes and pipes 28,539 tons. Included was 14,621 tons of tinned sheet and plates, 84 percent from the United States.

Forty to fifty foundries operated in the Bangkok area. The Japanese, having completed three sheet-galvanizing plants, planned jointly with a Thai firm to build at Bangkok a 70,000-ton-per-year reversing sheet mill to supply the plants. Mill startup was scheduled for early 1965. Japanese Mitsui Bussan and Mitsubishi Shoji planned electric furnace installations at Bangkok. Monthly production of 7,000 tons of bars and wire rods was expected at the Mitsubishi plant. Castle & Cooke, a Hawaiian-based company, together with Chue Chin Hua, maker of Thai aluminumware, acquired machinery for a US$1 million 15,000-ton, welded-steel-pipe plant, also at Bangkok.

The Thai Government intensified efforts to establish an integrated domestic iron and steel plant calling attention to the discovery of iron ore deposits in the Loei area. Officials of Koppers International, C.A. (United States) and Krupp Co. (West Germany) conferred with the Government over technical planning assistance and financing of a feasibility survey.

Lead-Zinc.—The Nong Phai (Nong Bhai) mine in Kanchanaburi Province continued to provide the bulk of the country's lead-zinc, totaling 2,260 tons of lead-in-ore and probably half as much zinc. Virtually the entire output was exported in 1963, in the form of hand-picked lead ore containing 40 to 45 percent lead, mostly to West Europe. Zinc ores went to domestic consumers as did an estimated 10,000 tons of imported zinc metal and alloys. Imports supplied several galvanizing plants in Bangkok. A large oxide deposit, the Mae Sot in Tak Province, stayed unmined, although a Japanese company, Sumitomo Metal Mining Co., Ltd., maintained an interest in it.

Manganese.—Output of manganese ore, better than half of which was battery grade, more than doubled the 1962 level in response to increased demand by Bangkok's growing dry-cell-battery industry and the export trade, largely to Hong Kong. Until late 1961 most ores had been produced at the Huai Muang mine, Loei Province; subsequently, a second potentially larger mine, the Ban Mae Jong, started up in Lampoon Province. Another manganese discovery in the southern jungles near the Kumoon River was being readied for production in 1963 by Nara Mining Co., Ltd., Thai subsidiary of a Malayan company, Ma-Thai Mining Corp., Ltd. The deposit was estimated to contain over 250,000 tons of ore, one-fourth of which was high-grade.

Tin and Tungsten.—Tin output was 6 percent higher than in 1962. While rising steadily, output was still below the record 17,400 tons of tin-in-concentrates established in 1940. Several hundred tons of tin metal were produced in a pilot reverberatory furnace smelter (1,000-ton-tin-metal-yearly capacity) operated in Bangkok by the Department of Mines for meeting the bulk of domestic tin needs. During 1963 tin exports, all in the form of concentrates and averaging 73.25 percent tin, rose 10 percent in tonnage and 9.5 percent in value to US$35.7 million. Concentrates were exported mainly to Penang in Malaya and the Netherlands.

Approximately 24 bucket dredges, mainly British owned and operated, produced half of the tin, lode mines less than 5 percent, and most of the rest came from gravel pump and hydraulic mining. As many as 400 individual mine units were worked in 1963. By far the richest tin area was peninsular Thailand from Ranong south to the island of Phuket that provided over 80 percent of the national output. Offshore deposits near Phuket accounted for about one-fifth of all tin production.

Three companies had dredges working in Phuket Bay: Ao Kam Tin, Ltd., Tong Kah Harbour Tin Dredging, Ltd., and Ngan Tavi Bros. (Nai Chaisin), Ltd. Ao Kam operated a converted oil-tanker grab dredge and was rebuilding a 110-foot-digging-depth bucket dredge from Tronah Mines for seagoing duty. These two dredges were due to start work off the west coast of Phuket Island on the Bang Tao Bay properties acquired from Tromal Prospecting, Ltd., where deposits were estimated to total 32 million cubic yards averaging 0.626 pounds of tin concentrates per yard. Tong Kah Harbour purchased nine mining leases adjoining its Outer Harbour leases thus extending its sea dredge's life about 3 years. Average grade though was expected to be substantially lower than in the sea leases being worked.

Thai Smelting & Refining Co., a joint venture of Union Carbide Ore Co. (United States) and Eastern Mining Development Co., Ltd. (Thailand), proposed to build a 10,000- to 15,000-ton-tin-metal-per-year smelter costing about US$6 million on Phuket Island. Such a smelter had been under consideration for some years as part of the Government's promotion of industries program. Although the decision to build appeared firm, the project was delayed while negotiations were being completed. Union Carbide was also engaged in another venture in which offshore deposits extending southward from Ranong into Phuket Bay were to be prospected for tin.

Although no production of heavy mineral sands was recorded large tonnages lay potentially recoverable in tin mine tailings and dumps. The Department of Mines as well as private companies—Thai Sin Chan Co. for one—sought markets and studied upgrading methods. Lack of an ilmenite market was a basic problem. Thai Sin had stockpiled about 150 tons of monazite and 40 tons of 20 to 40 percent columbium-tantalum concentrates in 1963.

Tungsten concentrates averaging about 65 percent WO_3 were mainly the byproduct of tin mining, and totaled less than half of the 1962 output, while exports gained about 20 percent. Probably some production still came from once-important lode mines in northwestern Thailand's Ban Mae Sariang district, Mae Hong Son Province, and the Pilok district, Kanchanaburi Province, where deposits were being worked mainly by tributers. Low tungsten prices, difficult access, and restrictions on foreign company operations in the area north of the 10°-latitude line combined to discourage lode mining activity.

NONMETALS

Cement.—Two companies produced Thailand's entire 1963 output of cement, which was 3 percent more than in 1962. The larger, Siam Cement, Ltd., operated a 4-kiln wet process plant at Tha Luang, near Saraburi, and a 2-kiln plant at Bangsue, Bangkok. Although rated

capacity was 800,000 tons, the company produced 836,000 tons in 1963, about 618,000 tons going to the domestic market and the rest exported. A fourth mill was being installed at Ta Luang; meanwhile, surplus cement clinker was shipped by barge to the Bangsue plant for finishing. Construction of a new plant with 300,000 tons capacity was scheduled by the company to begin in 1964 at Tungsong, southern Thailand.

The Royal Irrigation Department-operated plant of Cholprathen Cement Co. at Talki, Nakon Sawang, built mainly to supply cement for the Yan Hee power project, produced 160,533 tons of cement in 1963. Since dam construction was nearing completion, other potential markets were sought.

Domestic sales of cement in 1963 totaled 759,444 tons value at about US$17.3 million. Exports were 22 percent less than in 1962 and went mostly to South Viet-Nam under U.S. Operations Mission procurement.

Fluorspar.—Fluorspar production, beginning in 1960 after discoveries in the Ban Phu Krood (Khao Chom Thai) district, Rat Buri Province, and the Doi Tai district, Chiang Mai Province, rose to 29,230 tons in 1963. Handpicked ore grading 80 to 85 percent CaF_2 was produced for export, with Japan the main purchaser. India reportedly received 2,920 tons of Thai fluorspar, nearly one-third of its needs in 1963. Most if not all 1963 production was from the Ban Phu Krood deposits mined by Siam Ore Co., Ltd. Only about half of the output was exported, and the rest apparently stockpiled awaiting markets or perhaps transportation since access was difficult in the back country.

Gem Stones.—Gem stone deposits along the Burma border and in southeast Thailand have been important sources of sapphire, ruby, topaz, zircon, and spinel, but since the loss of natural stone markets to synthetics, mining has been sporadic with no production recorded. However, gem cutting is $1-million-yearly industry in Bangkok, largely due to the good labor market, and a sizable trade goes on in cut and uncut stones; the value of 1962 exports was about US$1.2 million, compared with imports of US$130,000. Switzerland and the Republic of South Africa supplied most of the uncut gems, largely synthetic, and the United States and West Germany were the main customers for cut stones.

Gypsum.—Thai Gypsum Co., Ltd., produced high-quality and high-cost gypsum from its Dammern mine, near Lampang, with nearly all of the output going to the cement industry. The company was scheduled to complete a 16-ton-feed-per-day gypsum products plant in 1963, and plans were being considered for plasterboard manufacturing. A sizable deposit was being mined, with a 90-foot thickness of gypsum overlying 30 feet of anhydrite.

Salt.—Sea salt was produced at widely scattered coastal points by thousands of individual Thai "salt farmers," the main production coming from the north coast of the Gulf of Siam. Output had been falling and hit a low of 150,000 tons in 1962 but rose to 200,000 tons in 1963. Poor production was attributed to lack of foreign demand (usually about two-thirds of the output was exported) and availability of better grade salt elsewhere. Much of the Japanese market in particular had been lost because of Thai salt's high water content

(nearly 9 percent). Studies were being made at an experimental saltern set up by the Department of Science seeking better salt farm methods and moisture reduction.

What could prove to be one of the world's great rock salt deposits has been discovered on the Khorat Plateau, in southeast Thailand.[3] The area was first explored in 1955 after the salt was intercepted during drilling under a U.S. Operations Mission ground water exploration program. Salt reserves were roughly estimated at 3 billion tons, assuming an average thickness of 100 meters, with depth to top of salt generally 300 to 500 feet. The Royal Department of Mines continued a program of geologic studies in the area.

MINERAL FUELS

Lignite.—Lignite was mined in 1963 at Mae Moh, near Lampang, in northern Thailand, and processed in one 1,200-ton-per-day plant provided by Australia in 1961 under the Colombo plan. Coal went to the 12,000-kilowatt Mae Moh powerplant, to the Tha Luang cement plant, and some to consumers in the Bangkok area, including the northern Bangkok powerplant. Coal transportation was improved in 1962 when the Australian Government furnished 100 rail hopper cars through the Colombo plan. In southern Thailand, deposits containing an estimated 5.5 million tons of lignite were being developed to supply the nearly completed Krabi powerplant with 600 tons of coal daily.

Owing to rapid rise in price of charcoal (quoted at US$2.25 per hundredweight in mid-1963), an important Thai fuel, interest was renewed in a Husky Oil Co. (United States) process for briquetting lignite, and plant feasibility studies were recommended. Possibilities were discussed for using Thai lignite to produce nitrogenous fertilizers,[4] and although proposals had been offered by both Standard Vacuum Oil Co. and a West German firm to construct such a plant, the Government delayed approval pending further studies.

Oil Shale.—An oil shale project, to include a US$30 million to US$35 million refinery, was being considered as a joint venture by Japanese and American investors. The plant, probably to be located at Tak, would process shales with fairly high oil content from the Mae Sod field, overlapping the Burma border near Moulmein. Byproducts would include coke, ammonium sulfate, and hydrocarbon gas.

Petroleum.—Consumption of petroleum products in Thailand was estimated at 35,000 barrels per day (13 million barrels yearly) in 1963, about 9 percent higher than in 1962 and 43 percent above that of 1960.[5] Nearly all requirements were imported, mainly from Indonesia and partly from Iran. Probably 90 percent or more of the imports entered the country through the port of Bangkok, and these were valued at US$50 million in 1963.

The country's only crude oil was produced by the small Farng Basin field in northern Thailand at 100 to 125 barrels per day and processed

[3] Thailand Department of Mines. Rock Salt of the Khorat Plateau. Paper given at Seminar on the Development of Basic Chemical and Allied Industries in Asia and the Far East, Oct. 3–13, 1962, Bangkok, 7 pp.

[4] Natasilpa, S. Production of Chemical Fertilizers from Lignite in Thailand. Paper given at Seminar on the Development of Basic Chemical and Allied Industries in Asia and the Far East, Oct. 3–13, 1962, Bangkok, 3 pp.

[5] Petroleum Press Service (London). Diversifying Thailand's Economy. September 1963, pp. 343–344.

in the overbuilt Farng refinery rated at 1,800 barrels per day. Established on wishful promise of discoveries and operated since 1959, the refinery ran only a few days a month as sufficient oil became available. In July 1963 a new exploratory well struck oil at a depth of 2,200 feet flowing about 30 barrels per day. This was followed by 9 other holes; 2 hit oil at 5,000 feet, 1 flowing 25 barrels per day while the other just oozed. The new-found oil was lighter than that previously discovered, had a high wax content, and was expected to require different processing, perhaps involving major plant revisions. The combined 1963 crude production and refinery throughput were estimated at 45,000 barrels.

Over 1 million barrels of crude or partly refined oil was imported from Saudi Arabia; in 1962 there were no unrefined imports. A 3,000-barrel-per-day refinery operated by Thai Asphalt Manufacturing Co., at Sriracha, on the Bay of Bangkok 75 miles southeast of Bangkok, apparently was the recipient.

Thai Oil Refining Co., Ltd., a consortium of West Europe and United States companies, was completing a US$33 million, 36,000-barrel-per-day refinery at Sriracha. Scheduled for operation in August 1964, this refinery, the largest on the southeast Asia mainland, would have overall capacity roughly equal to domestic consumption. Shell International supervised construction, was to supply the crude, and operate the plant for a management fee. Although basically a private enterprise, the refinery was to pay the Government one-fourth of yearly net profits and relinquish ownership after 10 years.

A US$18 million, 5,000-barrel-per-day Government refinery at Bangchak, near Bangkok, scheduled for completion in 1962 was still unfinished at the end of 1963. Its small size and expense cast doubts about economic operation. Contractors had received their fourth extension and a new deadline of April 1, 1964. Esso signed a 2-year contract to supply the plant with 3.3 million barrels of crude from the Middle East. Products were to be distributed by the Oil Fuel Organization of the Military Energy Department, Ministry of Defense.

Union Oil Co. of California was granted a 5-year concession to explore about 21,000 square miles of the Khorat Plateau in northeast Thailand, south of the Mekong River, and planned an oil survey to begin in late 1963.[6] Monet Knock, a California-based company, acquired a concession to survey a small area of the Ubon district in the northeast.

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[6] World Oil (Houston, Texas). Thailand: Khorat Plateau Potential Evaluated in Search for Domestic Fuel Sources. V. 157, No. 3, Aug. 15, 1963, pp. 203, 206.

The Mineral Industry of North Viet-Nam

By K. P. Wang [1]

NORTH VIET-NAM, with about 16 million people, inherited the bulk of French Indochina's mineral wealth. Great emphasis has been placed on basic industries by the Vietnamese Communists, as shown by the projects undertaken in the 1958–60 plan and the 1961–65 5-year plan. As a result, the relative importance of industry in North Viet-Nam's economy reportedly had increased about 150 percent in 1961 compared with 1955. The share of mineral contribution to industry is hard to assess, however, North Viet-Nam's 1963 mineral output value of approximately US$90,000,000 was more than that of any other country in the Malayan Archipelago except Malaysia.

North Viet-Nam has been producing an increasing variety of mineral products from its promising mineral potential, however, only a few items were significant by international standards. The country's anthracite has been well known in oriental markets, particularly in terms of quality. Production of phosphate ores in 1963 was about 1.5 percent of the world total. The third product of some consequences during the year was high-grade metallurgical chromite, perhaps 1 percent of the world supply.

Under the present low-consumption conditions, the country has a fairly strong mineral self-sufficiency position. Additional mineral resources exist and can be developed as industrialization advances. Large iron deposits have been discovered; a variety of nonferrous metals exist in commercial quantities; and chemical and fertilizer resource base is good. Construction materials can be developed according to need, and many useful nonmetallics occur. However, there is little coking coal, the abundant mineral fuel being anthracite. So far, petroleum is entirely lacking. Fuel deficiencies are compensated by hydropower potential. North Viet-Nam produced about 440 million kilowatt-hours of electricity in 1963.

The most important mineral development during 1963 was in the field of iron and steel. The first blast furnace of the newly created Thai Nguyen integrated steelworks built with Chinese Communist assistance was completed, and a mine supplying the necessary iron ore became a commercial operation. Apatite mines were being greatly expanded to meet primarily foreign demand, and additional chemical fertilizer facilities were completed. During the year, the Ru-

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manians were engaged in building a new section of the Haiphong Cement Plant. The Hon Gay-Cam Pha anthracite district was being readied in 1963 for a large increase in production; exports to Western Europe were greater in 1963 than in previous years.

PRODUCTION

Mineral output value of North Viet-Nam roughly doubled between 1959 and 1963. Ores and concentrates still constitute the main type of nonfuel mineral products, but ground work has been laid for making mineral and metal products. About one-third of the 1963 total mineral output, including fuels, was exported.

Coal, primarily anthracite, was by far the most important mineral product in 1963, accounting for more than half of the total output value. Cement represented possibly one-sixth, followed by apatite which has steadily gained in relative significance. Metals and metallic ores were not yet important, but future emphasis was clearly indicated.

In addition to commodities for which production statistics are available or for which estimates of production have been made, many other items are known to have been produced in 1963, including 20,000 to 30,000 tons of cast iron and steel, probably more than 100,000 tons of iron ore, 400 to 500 tons of refined tin, thousands of tons of zinc concentrate, significant amounts of gold, large quantities of ordinary clay for brick and tile, 1,000 to 2,000 tons of kaolin for ceramic use, some 50,000 tons of dolomite, 20,000 to 30,000 tons of glass sands, a modest quantity of pyrite, and some asbestos and mica. Systematic extraction of lead, antimony, copper, manganese ore, and mercury was about to commence.

TABLE 1.—Production of minerals and metals [1]

(Metric tons)

Commodity	1959	1960	1961	1962	1963 [2]
Metal:					
Chromite	6,600	19,400	29,500	32,600	32,000
Nonmetals:					
Apatite	260,600	490,000	563,600	678,000	750,000
Cement	381,200	408,000	457,500	462,000	500,000
Phosphate rock	50,800	51,000	58,100	34,000	50,000
Salt	130,000	117,100	106,100	144,000	150,000
Mineral fuels:					
Coal [3]	2,201,700	2,595,000	2,829,400	3,468,000	4,000,000

[1] In addition to commodities listed, North Viet-Nam is known to have produced the following commodities: Gold, iron ore, cast iron, steel, refined tin, zinc concentrates, asbestos, clays (for brick and tile), dolomite, glass sand, kaolin, mica, and pyrite.
[2] Estimate.
[3] Predominantly anthracite.

TRADE

Since official trade statistics are not available for North Viet-Nam, details on mineral exports are not clear. However, based on imports of other countries, anthracite exports are significant, Japan alone having imported 651,895 metric tons in 1962 and 475,704 metric tons

in the first 11 months of 1963. The Soviet Union and Japan took respectively 118 long tons and 153 long tons of refined tin from North Viet-Nam during 1961–62; Czechoslovakia was also among tin importers in 1963. Japan obtained 12,900 metric tons of salt and 747 metric tons of phosphate rock from North Viet-Nam in 1962. Mainland China acquired sizable tonnages of North Vietnamese apatite, anthracite, and chromite in recent years. However, Rumania and Poland have been the main purchasers of apatite.

Soviet mineral exports to North Viet-Nam are presented in lieu of official Vietnamese imports, recognizing that Japan and mainland China are also suppliers although of lesser consequence. Principal Soviet shipments have been in two main categories, petroleum and metal products. No doubt the Soviet Union was North Viet-Nam's main source of petroleum, there being none produced locally. Soviet supplies of rolled steel products were essential, but North Viet-Nam is building a small steel industry and imports tinplate from Japan and other steel products from mainland China. Nominal amounts of nonferrous metal products have been imported for some years from these three countries.

TABLE 2.—Imports of metals and minerals from the Soviet Union [1]

(Metric tons)

Commodity	1961	1962	Commodity	1961	1962
Metals:			Metals—Continued		
Aluminum and duralumi-num, semimanufactures	320	160	Iron and steel—Continued		
Copper:			Semimanufactures:		
Unalloyed semimanufac-tures	368	223	Pipes	1,300	2,200
Alloyed semimanufac-tures	215	275	Other	22,800	25,800
Iron and steel:			Lead, semimanufactures	44	50
Pig iron	4,300	2,600	Mineral fuels:		
Ferroalloys	(2)	300	Petroleum refinery products:		
			Gasoline	30,300	41,600
			Kerosine	15,800	24,400
			Diesel oil	22,700	24,900
			Lubricants	3,000	5,500

[1] Data on imports from other countries are not available.
[2] Data not available.

Source: Official trade returns of the Soviet Union.

COMMODITY REVIEW [2]

METALS

Chromite.—During recent years, North Viet-Nam has developed a fair sized stabilized chromite industry, capable of producing 30,000 to 35,000 metric tons of high-grade alluvial concentrate per year. There is only one mine—Co Dinh—located amidst the Nong Cong ricefields, 30 kilometers from Thanh Hoa. The chromite occurs as placers in the Malayan Peninsula and is mined in a manner similar to some tin operations. Information in 1963 indicated the use of hydraulic monitors and water troughs. All told, there were about 2,000 workers mining chromite. North Viet-Nam's chromite was shipped to the Soviet Union and to mainland China during 1963.

[2] U.S. Department of Commerce. Mineral Reserves in North Viet-Nam. Office of Tech. Services, JPRS 17769, North Viet-Nam Economy No. 40, Feb. 21, 1963, pp. 22–25.

Iron and Steel.—North Viet-Nam's almost complete dependence on foreign iron and steel products may come to an end in a few years' time. Construction on a new 200,000-ton iron and steel complex at Thai Nguyen, 75 kilometers north of Hanoi, began in September 1960, and the complex is now taking shape. The first of two blast furnaces was commissioned in December 1963, and the plan is to complete the whole project by 1966. A 24,000-kilowatt powerplant was already supplying power to the steelworks as well as to the cities of Hanoi and Viet Bac. The nearby Tri Cau iron mine, with an initial 300,000-ton annual capacity and 10 to 60 million tons of high-grades reserves, started to furnish ore to Thai Nguyen late in the year. Several small cast iron and steel plants were in operation during 1963, partly using anthracite as fuel.

Other iron deposits were reported in 1963, the most promising being Bao Ha, said to be capable of supporting a second iron and steel complex in North Viet-Nam.

Tin.—North Viet-Nam's 1963 refined tin output estimated at 400 to 500 metric tons was derived primarily from facilities in the Tinh Tuc district near the Chinese border in Cao Bang Province. Tinh Tuc has a smelter with annual capacity exceeding 1,000 tons of 99.75 to 99.85 grade refined tin.

A dozen properties with promising reserves surround Tinh Tuc, a fairly modern open pit mine as of 1963, which was equipped with Soviet excavators, Czech trucks, and locally made rolling stock. A light railway connects the mine with the nearby refinery, and electric power is supplied by a small hydroelectric plant. Resuming operations in 1955, Tinh Tuc began to produce at relatively high levels only since 1958. Recent information on North Viet-Nam's tin industry has been spotty. Available output and trade data are tabulated below, in metric tons of refined tin:

Year	Output	Japanese imports	Soviet imports	Year	Output	Japanese imports	Soviet imports
1955	15			1959	[1]		36
1956	50			1960	[2] 430	155	45
1957	104		[1]	1961	[1]	110	40
1958	223		[1]	1962	[1]	45	80

[1] Data not available.
[2] Target.

Other Metals and Metallic Ores.—No recent reliable reports on the status of North Viet-Nam's zinc industry are available. There was once a 6,000-ton horizontal retort smelter at Quang Yen and a mine at Cho Dien in Bac Kan capable of fully supplying the smelter with calamine concentrate containing 40 percent zinc. As of 1963, it appeared that the smelter had not been reactivated but zinc concentrate, possibly on the order of 10,000 tons per annum, was produced at Cho Dien. A second zinc mine, the Mo Thiec operation in Cao Bang, was also in operation.

North Viet-Nam has many small lead deposits, and one deposit at Tu Le of Yen Bai with lead-zinc ore may be fair-sized. Scores of copper showings have been discovered in recent years, the most

promising deposit reportedly being Me Kien in the northeast mountain area. Antimony deposits have been discovered at Bong Mie and Ta Soi in Thanh Hoa and elsewhere. Mercury is found in Ha Giang, and manganese ore in Ha Tinh. Bauxite occurs in Lang Son and near Haiphong, but known reserves are small and the grade is generally low. Few of these findings have been worked on a systematic basis. However, gold was produced on a commercial scale in 1963 at the Tso-pien mine of Hoa Binh, the Tso-lung mine of Bac Kan, the Tinh Tuc tin mine, and elsewhere.

NONMETALS

Cement.—Haiphong, North Viet-Nam's only cement plant of note in 1963, had about 500,000-ton annual capacity. The Rumanians are helping to build a new section which, when completed in 1965, will have an additional 700,000-ton capacity. Because of the rapidly growing demand for cement, a number of small vertical kiln plants have also been constructed in recent years including Nghe An and Sai Son. Even Haiphong, whose four main kilns are of the horizontal rotary type, was reactivating its 2.5-meter-diameter vertical kilns in 1963. North Viet-Nam's cement plants are anthracite-fired, but the use of low grade coals was being investigated. The country sells a little cement to Cambodia.

Glass Sand.—The country's second glass plant (the first is at Hanoi) was completed in Haiphong during 1963 with the help of East Germans. The glass sand for these plants came from Van Hai in Hong Quang and elsewhere. The Haiphong plant may need about 20,000 tons of glass sand annually.

Phosphates.[3]—North Viet-Nam's phosphate industry comprised mainly of apatite facilities but with lesser phosphate rock mines and phosphatic fertilizer plants of different kinds, achieved notable success in 1963. Apatite output (probably about 35-percent P_2O_5 grade) surpassed 700,000 metric tons for the first time, and the 1965 plan was to double this tonnage. The 100,000-ton Soviet-equipped Lam Thao superphosphate plant finally attained regular production status. Surplus North Vietnamese apatite was exported to Eastern Europe and mainland China during the year.

All apatite came from the Laokay (or Lao Cai or Cam Duong or Lao Kay) mine in the northeast where reserves have been variously estimated at 300 to 1,000 million tons of 10- to 40-percent P_2O_5 ore. Development of mine and railroad to Haiphong has been under the direction of Rumanians who hope to get 630,000 tons of apatite yearly by 1965 for the credit and technical aid extended. Laokay mine had electric and diesel power shovels working rich zones of pits and some 50 trucks moving the material to railroad in 1963.

The Lam Thao superphospsate plant, designed to use about 60,000 tons of apatite yearly, is the first of several such plants to be built. It has a 40,000-ton sulfuric acid unit and produces 20- to 21-percent P_2O_5 grade superphosphate. The phosphate rock mines near Ham

[3] U.S. Department of Commerce. Changes in the Lao Kay Apatite Mine. Office of Tech. Services, JPRS 22255, North Viet-Nam Economy No. 74, Dec. 13, 1963, pp. 46–51.

Rong and Vinh Tinh in the north-central district and their corresponding processing plants (ground and chemical phosphates) apparently had operating difficulties during 1962–63.

Salt.—North Viet-Nam's sea water salt output exceeded 150,000 tons per annum for the first time in 1963. Nam Dinh is the leading field, providing nearly half of the national output. Small scale solar evaporation methods, most using hand labor are used. Recent efforts to raise salt production have centered around consolidation of operations, basic construction, and planning technical measures for year-round business. Some surplus salt went to Japan during 1962–63.

MINERAL FUELS

Anthracite.—Anthracite is by far the most important mineral commodity produced in North Viet-Nam. North Vietnamese anthracite is not only indispensable in the industrialization program, but also important as an export item. In 1963 more than 1 million tons were exported, about one-half to Japan and 10 to 15 percent each to France and the Netherlands. A sizable tonnage also went to mainland China, and lesser amounts went to Italy and Hong Kong. North Vietnamese anthracite commanded a price of $12 to $15 per metric ton f.o.b.

During the year, the Hon Gay-Cam Pha District, with reserves exceeding 1 billion tons and with about 20 mines including three large pits in operation, clearly retained its position as the foremost anthracite district in North Viet-Nam. The coal is 20 to 80 meters thick, usually occurring near the surface. Crushing and sorting are done at the mine site, whereas grading is carried out at the port of Cam Pha where more than 10,000 tons can be handled daily and at least four 12,000-ton ships can be loaded simultaneously.

An important project for the Hon Gay enterprise during 1963 was to raise the proportion of lump coal from about 25 to 30 percent so as to derive more income. Overburden was stripped in preparation for expanded production. Methods were devised to raise the efficiency of drilling and blasting, better the development and operation of pits, improve equipment maintenance, streamline transport, and make best use of available equipment.

The Mineral Industry of South Viet-Nam

By J. M. West[1] and K. P. Wang[2]

SOUTH VIET-NAM is far less richly endowed with mineral resources than neighboring Communist North Viet-Nam. The only mineral products of any consequence produced in South Viet-Nam in 1963 were coal, salt, and silica sand. Value of output was an insignificant part of the estimated US$1.4 billion gross national product. Continued Vietcong guerrilla activities limited mineral exploration. Many areas were insecure. There was little mining except for coal at Nong Son in the north, where capacity was being expanded to meet future demands of a large coal-based chemical and nitrogenous fertilizer manufacturing complex to be built at An Hoa, an industrial site near the mine.[3]

Since four-fifths of the country's 15 million people derive a livelihood from agriculture, the government has been particularly interested in developing fertilizers. The An Hoa facilities together with a phosphate fertilizer plant planned at Tan Thuan, near Saigon, were expected to supply 30 percent of the country's fertilizer requirements by 1966.[4] The Tan Thuan plant, with capacity of 48,000 metric tons per year of phosphate products, would process phosphate rock from deposits being developed on the Paracel Islands, South China Sea. A plant proposed for Chanh Hung, near Saigon, would make fertilizer from city refuse, processing about 10 tons per day. Nhatrang was scheduled to receive an oil refinery.

Shortages of electrical power handicapped industrial growth. Construction of a 33,000-kilowatt thermal powerplant, to burn coal from Nong Son, was started at Thu Duc, a few miles north of Saigon. First power from the Japanese-built 160,000-kilowatt Da Nhim River hydroelectric project near Phan Rang, northeast of Saigon, was delivered on a trial basis to a substation at Thu Duc in December 1963; generators with capacity totaling 80,000 kilowatts were in service at yearend, together with 155 miles of transmission lines to the Saigon area.

GOVERNMENT POLICIES AND PROGRAMS

The government issued a new investment law (retroactive to January 1, 1963) guaranteeing all business enterprises protection from nationalization for 12 years and providing for repatriation of original investment after this period. Foreign enterprises were exempted

[1] Physical scientist, Division of International Activities.
[2] Chief specialist, East Europe-Far East, Division of International Activities.
[3] Nitrogen (London). Nitrogen Fertilizer Plant for South Viet-Nam. No. 21, January 1963, pp. 7–9.
[4] Fertilizer Development Council (Israel). Increasing Fertilizer Consumption in South Viet-Nam. V. 3, No. 11, November 1963, p. 11.

from taxation on profits during the first 3 years of operation. Firms were allowed to employ foreign technicians.

PRODUCTION

Mineral production included coal, salt, silica sand, and a small quantity of china clay. The coal was mined from the Nong Son deposit near Tourane (Da Nang); salt produced by evaporating sea water was recovered from salinas along the central and southern coasts, and silica sands were excavated in the Baria region near Cap St. Jacques and the port of Saigon. Large quantities of briquets were produced. Although information was lacking, at least part of the briquets were composed of Nong Son coal with a clay binder.

TABLE 1.—Production of metals and minerals

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Clay----thousand cubic meters--	(1)	28	16	27	135
Salt----thousand metric tons--	156	144	100	193	128
White sand----thousand cubic meters--	(1)	20	27	107	255
Mineral fuels:					
Coal, anthracite----thousand metric tons--	20	27	57	71	105
Fuel briquets [2]----do----	55	55	55	55	(3)

[1] Reported as 22,750 metric tons for clay and 8,000 tons for white sand.
[2] Estimate.
[3] Data not available.

TRADE

South Viet-Nam depended on foreign sources for all supplies of iron and steel, petroleum products, chemical fertilizers, cement, and miscellaneous metals. Minerals accounted for 10 to 15 percent of all South Viet-Nam imports in 1962. Imports of iron and steel during the first 10 months of 1963 totaled 153,406 metric tons, indicating a sizable increase over the 78,840 tons reported for the same period of 1962. Imports for 1963 may be about 180,000 metric tons. No data are available on petroleum imports for military purposes. The civilian market was supplied mainly by oil from Indonesia. Imports of all types of fertilizers were estimated at 220,000 metric tons in 1963, nearly double the total of 115,554 tons in 1962. Of 103,085 metric tons of phosphate fertilizers imported in 1963, 71,103 tons were from Tunisia and 27,644 tons were from the United States. Taiwan was the principal source in 1962–63 of urea, industrial chemicals, cement, and aluminum and supplied about one-third of all iron and steel mill products. Anthracite imported from the United States was mixed with higher ash domestic coals and burned in Saigon area powerplants.

In 1962, Japan imported 20,250 metric tons of salt and 94,294 tons of silica sand from South Viet-Nam. Silica sand shipments received by Japan were 80,065 metric tons in 1961 and 46,476 tons in 1960.

TABLE 2.—Imports of selected metals and minerals

(Metric tons unless otherwise specified)

Commodity	1961	1962	Principal sources, 1962
Metals:			
Iron and steel	(1)	[2] 63,950	United States; Taiwan.
Gold—troy ounces	2,740	2,090	Japan 1,110.
Nonmetals:			
Cement—thousand tons	368	401	Taiwan; Thailand.
Phosphate fertilizers	(1)	52,666	United States 26,495; Tunisia 20,898.
Mineral fuels:			
Coal	5,267	15,513	All from United States (anthracite).
Cokes and semicokes		575	Taiwan 570.
Petroleum products: [3]			
Gasoline—thousand 42-gallon barrels	1,115	1,085	Mainly from Indonesia.
Kerosine—do	524	516	Do.
Distillate fuel oil—do	1,156	1,106	Do.
Residual fuel oil—do	1,189	1,150	Do.
Lubricants—do	95	113	Mainly from United States.
Other—do	88	189	Mainly from Indonesia.
Total—do	4,167	4,159	

[1] Data not available.
[2] January to July only.
[3] Civilian sales reported by oil companies. Excludes quantities used in military operations and in bunkering foreign ships and planes.

Source: Official Trade Returns of South Viet-Nam; Annual Statistical Bulletin, U.S. Operations Mission; Kinh-Te, Tap-San, Economic Bulletin, National Bank of Vietnam.

COMMODITY REVIEW

METALS

Iron and Steel.—During 1963 the Industrial Development Center of Viet-Nam, a government agency, invited foreign bids to supply and invest in a steel-rolling mill with 25,000 metric tons annual capacity of reinforcing bars and rods.[5] Association for Development Assistance, Inc., a Pittsburgh firm, was employed by the Agency for International Development (AID) to make a feasibility study for an iron and steel and/or metalworking plant. This represented South Viet-Nam's first serious effort to build a steel plant.

Lateritic iron ore samples were collected at several sites in Quang Ngai Province and sent to the U.S. Bureau of Mines for analysis during 1963. Samples were found to contain 18 to 59 percent iron. No information was received to indicate extent of the deposits.

NONMETALS

Asbestos.—A new asbestos-cement products plant was scheduled to begin operation in 1963 in the Bien Hoa industrial zone. Imported asbestos was required because no domestic material was available.

Caustic Soda and Chlorine.—Viet-Nam Chlorine & Alkali Co., a private venture, planned to use locally produced salt in making caustic soda (1,080 metric tons per year) and chlorine (930 metric tons per year) by electrolysis at a plant to be constructed on the Dong Hai River near Saigon. The plant was scheduled for operation in 1963.

[5] International Commerce. Steel Rolling Mill Planned in South Viet-Nam. U.S. Department of Commerce, v. 69, No. 42, Oct. 21, 1963, p. 28.

Cement.—Grinding operations in the Thu Duc section of the French-built Ha Tien-Thu Duc cement plant started in November on a trial basis using imported clinker. The clinker-producing portion of the plant, at Ha Tien on the Gulf of Siam, was expected to begin operation about yearend. Its capacity of about 300,000 metric tons was adequate to supply three-fourths of 1963 domestic demands. Clinker would be shipped by barge to Thu-Duc for finish grinding. There was no report on progress in construction of the Long Tho cement plant in Thua Thien Province, which had been delayed in 1962 pending a decision to raise its planned capacity from 25,000 to 60,000 tons annually.

Sand.—Sand from the Baria region near the port of Saigon was used by the Vietnamese Glass Corp. (completed in 1960) for making a variety of glassware including laboratory equipment. The plant's yearly capacity was estimated at 20,000 metric tons. Most of South Viet-Nam's glass sands, which are of very high quality, have been sold to Japan during recent years.

Sulfur.—A proposal was studied to establish a sulfuric acid plant, to be supplied initially with imported sulfur and later with byproduct sulfur produced by the proposed Nhatrang refinery. An aluminum sulfate plant which would require imported aluminum hydrate was proposed simultaneously.[6] The demand for aluminum sulfate was mainly for water treatment and in the paper industry. Proposed capacity of the acid plant was 4,200 metric tons per year, of which 1,445 would be used to produce aluminum sulfate, leaving a surplus of acid for other purposes.

MINERAL FUELS

Coal.—Contracts were signed early in 1963 with French and German firms to begin the first stage of construction on an industrial complex at An Hoa, about 40 miles southeast of Tourane, which would consume coal from the nearby Nong Son deposits. The development was to include plants for producing thermal electric power, sulfuric acid, urea (42,000 metric tons per year), ammonium sulfate (48,000 tons), and calcium carbide (8,000 tons), and plants to manufacture gas from coal, liquefy air, and synthesize ammonia. The calcium carbide plant would supply a calcium cyanamide plant (8,000 metric tons per year) scheduled for a second stage of construction. The Nong Son mine was under intensive development, and studies by the Paul Weir Co. (Chicago) under an AID contract resulted in coal reserve figures being increased from 3 million to 4 million tons at the beginning of 1963. After reopening the mine in 1957, production rose to 71,000 metric tons in 1962 and was scheduled to jump to 150,000 tons in 1963. With output at only 95,000 tons in the first 11 months of 1963, the year's total was expected to fall considerably short of the goal. A washing plant built with French aid in 1960–61 was operating, and a rail spur connected from a point near the mine to the main north-south railroad.

Petroleum.—Since there were no domestic petroleum resources all of the country's requirements were imported. A contract signed in April

[6] U.S. Embassy, Saigon, South Viet-Nam. State Department Airgram A–1100, Nov. 22, 1963, 10 pp.

1962 by Esso Standard Eastern, Inc. (successor to Standard Vacuum Oil Co.), Shell Co., Viet-Nam, and the Government provided for construction of a refinery on the coast at Nhatrang with sufficient capacity to meet projected demands by 1968. Initial production was scheduled early in 1965. Travel restrictions due to security problems caused sales of motor fuels to decline, while increased air traffic resulted in increasing consumption of jet fuel and aviation gasoline.

The Mineral Industry of Australia

By Lester G. Morrell [1]

UPTREND in value of mineral production in the Commonwealth of Australia continued in 1963, again pacing the country's general economic growth rate. Increases occurred in output of most raw and processed mineral products, including bauxite, copper, iron ore, pig iron, steel, lead, zinc, cement, gypsum, pyrite, coal, and refined petroleum products.

Although the economy of Australia has been traditionally based on wool and agricultural products, in recent years the country has become highly industrialized. Nearly one-third of the 3.6 million total civilian labor force is engaged in manufacturing. Employment in mines and quarries occupies 1.4 percent of the national labor force.

The value of mine and quarry products in 1963 has been estimated at A£205 million.[2] This is the highest on record and represents a threefold increase since 1950. Expansion in the minerals industry has kept pace with the overall national economic growth as indicated by rise in gross national product (GNP) from A£2.7 billion in 1950 to A£7.8 billion in 1963. Although the ex-mine value of minerals has amounted to only 2.5 to 3.0 percent of the GNP, primary and secondary processing, manufacture of finished products from domestic raw materials and supply as well as communications and transport services—all add up to a far greater relative importance.

Absolute value of Australia's mineral products on the basis of mine output and including initial processing such as milling, smelting, or refining in Australian facilities has been estimated for recent years as follows:

Year	Mine output value		Total value including domestic primary treatment	
	Million Australian pounds	Million U.S. dollars	Million Australian pounds	Million U.S. dollars
1959	165	370	214	479
1960	181	405	234	524
1961	181	405	238	533
1962	192	430	256	573
1963	205	459	285	638

In 1962, the most recent year for which detailed data are available, metals accounted for 38.5 percent of the total ex-mine output. Non-

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[2] One Australian pound (A£1) = US$2.24.

metals included 16.7 percent construction materials and 9.7 percent industrial minerals. Coal made up the remaining 35.1 percent. Black coal has traditionally been Australia's most valuable mineral product, accounting for nearly one-third of the national total. The 10 principal product categories in 1962 in percentage of total national value were: Black coal 31.0, construction materials 16.7, copper 12.8, lead 10.2, gold 8.2, brown coal 4.1, iron ore 2.8, zinc 2.4, limestone 2.0, and titanium concentrates 2.0. The base metals values include contained silver which, if considered separately, would approximate 5.0 percent of the national total.

The value added to mineral products as a result of treatment has ranged from about A£49 million in 1959 to A£64 million in 1962 and to an estimated 80 million in 1963.

Generally, over half of the total addition results from processing of iron ore. The value added to various mineral commodities through primary treatment in 1961 and 1962 in millions of Australian pounds is condensed as follows:

	1961	1962		1961	1962
Copper concentrate	4.1	5.6	Iron ore	35.4	39.0
Lead concentrate	7.3	6.8	Bauxite	----	.5
Zinc concentrate	9.6	11.5			
Tin concentrate	.5	.5	Total	56.9	63.9

Among the free world countries, Australia is the leading producer of lead (mine basis) and of rutile; it is an important supplier of ilmenite, monazite, zinc, silver, and beryl. As a result of recent discoveries and developments, Austrialian iron ore, bauxite, and possibly alumina, may also become important in future years.

Domestic resources supply many of the minerals required by Australia's consuming industries. National self-sufficiency exists in crocidolite asbestos, barite, bauxite, cement and other construction materials, copper, lead, zinc, the precious metals, iron ore, manganese, tungsten, and salt. More than half the required diatomite, ferroalloys, magnesite, elemental sulfur and tin are also domestically produced. Among Australia's principal deficiencies are petroleum, phosphate and other fertilizer materials, fluorspar, nickel, and chrome ore.

The outstanding mineral developments in the 1962–63 period revolved around earlier discoveries of iron ore in the Pilbara region of Western Australia, and the bauxite occurrences on both Cape York and Gove Peninsulas on the northern tips of Australia. Several new production records were attained in 1963, notably in iron ore, pig iron, steel, ferromanganese, bauxite, lead ore, and silver. And following many years of exploration, the Moonie field in Queensland was brought in as Australia's first petroleum producer. A pipeline to carry the field's output to Brisbane was completed in 1963.

GOVERNMENT POLICIES AND PROGRAMS

New minerals legislation enacted in 1962 and early in 1963 applied primarily to taxation. The Income Tax and Social Services Con-

tribution Assessment Act 1962 provides moderate benefits in taxation on new mills and processing facilities. The Gold Mining Industry Assistance Act was extended for a further 3 years from July 1, 1962. Further modifications were applied in June 1963 to the 1960 relaxation of iron ore export controls. Since June 1963, export of any iron ore deposit containing less than 5 million long tons has been authorized. Amendments announced in 1963 to the Income Tax Act provide for deductions in respect to expenditures on rights to prospect or exploit petroleum and on certain types of technical information related to petroleum concessions.

The Bureau of Mineral Resources, Canberra, and the various counterpart State agencies, the Commonwealth Scientific and Industrial Research Organization (C.S.I.R.O.), the Australian Mineral Development Laboratories, and the Australian Atomic Energy Commission all render technological assistance to the minerals industry. The New South Wales and Queensland coal industries are assisted by the Commonwealth through, respectively, the Joint Coal Board and Queensland Coal Board. Through Subsidy Acts, the Commonwealth Government has financed part of the nationwide search for petroleum and rendered direct assistance to the gold mining industry. Assistance in the form of a tariff and bounty is paid to producers of copper; and under a 1962 provision, bounty benefit is now extended to include copper and brass strip manufactured for Australian consumption. The Pyrites Bounty Act and the Sulphuric Acid Bounty Act provide bounty payment for these products from certain indigenous raw materials.

Export controls are exercised on beach sands and minerals containing zircon, titanium, lithium, beryllium, manganese and iron ores, fertilizer materials, and various atomic energy raw materials.

SOURCE MATERIAL

Production and technologic data presented in this review are based primarily on information contained in quarterly and annual issues of The Australian Mineral Industry prepared and published by the Department of National Development, Bureau of Mineral Resources, Geology and Geophysics, Mineral Economics Section. The 1962 annual review and March 1964 quarterly review (vol. 16, No. 3) were the basis of the current review. Supplementary details were gleaned from many sources. These included reports of the official Australian States mining and geological agencies, various industrial and financial journals, and dispatch accounts submitted by the Minerals Officer assigned to the U.S. Embassy in Canberra.

Australia's foreign trade statistics presented herein are from the official Bulletin: Oversea Trade, Commonwealth Bureau of Census and Statistics, Canberra. Attention is drawn to the noncalendar annual fiscal period July 1 to June 30. The quantitative trade tabulations accompanying this review are from Bulletins Nos. 59 and 60, respectively, covering the 1961–62 and 1962–63 fiscal years.

PRODUCTION

In both value and volume, Australia's production of minerals in 1963 has maintained the growth trend that has been the rule throughout the past decade. The economic index of mine output, calculated at constant prices, has risen 11 percent in each of the last 2 years. Since 1951 the average annual increase was 6.9 percent.

Of more than 50 mineral commodities produced in 1963, approximately 40 recorded increases over 1962. A tenfold increase was recorded in bauxite. Other noteworthy increases were in gypsum, lead, pyrites, and titanium concentrates. Small declines were recorded in barite and in a few other nonmetallics, columbium-tantalum, and tungsten concentrates as a result of marketing or price conditions. The drop in uranium oxide output is accounted for by sales contract termination, and despite government assistance, gold mine closures continued to depress production of gold.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Aluminum:					
Bauxite	15,226	70,549	16,232	30,021	355,600
Refined metal	11,552	11,842	13,416	16,460	41,925
Antimony, metal content	638	156	119	67	[1] 70
Beryl	322	193	311	227	[1] 140
Bismuth (in ore)—kilograms	420	120	410	44	----
Cadmium, refined metal—thousand kilograms	346	305	307	359	371
Chromite	122	537	----	375	----
Cobalt (recoverable cobalt in zinc concentrate)	14	13	13	16	16
Columbium and tantalum concentrate—kilograms	8,596	10,740	14,428	19,549	[1] 13,600
Copper:					
Mine (content of ore)	96,474	111,191	97,161	112,354	116,288
Blister	69,593	72,177	63,500	88,739	89,880
Refined (primary)	52,421	71,786	64,748	80,725	85,734
Gold—troy ounces	1,085,104	1,086,709	1,076,292	1,068,837	1,023,400
Iron and steel:					
Iron ore—thousand tons	4,207	4,425	5,428	4,921	5,776
Pig iron—do	2,546	2,928	3,210	3,489	3,658
Ferroalloys: [2]					
Ferrochromium, high carbon	620	607	716	580	([3])
Ferro and silico manganese	17,954	8,268	2,448	22,393	([3])
Ferronickel	----	656	1,449	----	([3])
Ferrosilicon	1,690	7,316	8,275	7,557	([3])
Steel ingots and castings—thousand tons	3,450	3,753	3,947	4,234	4,572
Steel semimanufactures [2]—do	2,225	3,015	2,374	2,716	([3])
Lead:					
Mine (content of ore)	321,370	313,109	273,987	376,056	416,422
Refined lead	188,787	192,947	164,868	193,177	228,210
Lead bullion, for export	51,117	53,569	48,862	74,285	82,533
Manganese ore	91,415	61,619	88,814	73,557	[1] 36,700
Selenium—kilograms [1]	1,400	1,600	1,400	1,600	1,600
Silver:					
Mine (content of ore)—thousand troy ounces	15,161	15,216	13,062	17,554	18,900
Refined—do	7,805	8,085	7,099	7,378	([3])
Tin:					
Mine (content of ore)—long tons	2,351	2,202	2,745	2,714	3,085
Smelter—do	2,226	2,254	2,546	2,704	2,626
Titanium concentrates:					
Ilmenite	84,918	108,297	169,071	185,067	203,200
Rutile	83,220	90,060	103,059	121,107	184,900
Tungsten ores and concentrates (60 percent WO_3 basis)	1,105	1,882	2,600	1,765	1,607
Uranium oxide (U_3O_8) [1]	1,000	1,200	1,300	1,247	1,100
Zinc:					
Mine (content of ore)	279,831	322,585	316,151	342,954	357,727
Smelter	118,330	122,160	140,859	170,623	182,661
Zirconium concentrate	114,154	104,004	138,671	135,958	184,290

See footnotes at end of table.

TABLE 1.—Production of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Nonmetals:					
Asbestos:					
Chrysotile, fibre and fines	1,300	1,035	879	839	[1] 748
Crocidolite	14,916	13,129	14,313	15,868	[1] 11,387
Barite	6,314	11,600	19,525	12,735	[1] 6,000
Cement—thousand tons	2,615	2,792	2,857	2,933	3,119
Clays:					
Bentonite and bentonite clay	290	581	908	797	(3)
Brick clay and shale—thousand tons	4,376	4,619	4,414	4,357	(3)
Cement clay and shale—do	176	212	191	316	(3)
Fire clay—do	178	160	205	200	(3)
Kaolin and ball clay—do	38	49	52	37	(3)
Other—do	435	472	477	398	(3)
Diatomite	5,171	4,734	5,504	7,429	[1] 4,300
Feldspar	6,858	8,549	8,341	8,650	[1] 7,700
Fluorspar	479	7			
Gypsum	525,085	590,201	619,696	641,036	[1] 701,575
Limestone, including shell and coral.—thousand tons	5,390	5,760	6,245	6,479	[1] 6,650
Lithium, minerals [4]	25	16	127	137	[1] 250
Magnesite	61,558	63,164	100,381	63,189	[1] 65,000
Mica:					
Block	15	4			
Scrap	85	294	84	[1] 100	
Damourite	499	568	516	493	[1] 500
Monazite concentrate	364	367	1,572	827	[1] 2,000
Phosphate rock	4,852	2,358	4,952	4,455	[1] 5,000
Pyrites, including cupreous pyrites	226,583	242,460	216,848	150,950	[1] 222,000
Salt—thousand tons	475	471	517	544	(3)
Talc and soapstone	16,991	16,431	15,071	15,232	[1] 13,000
Mineral fuels:					
Coal:					
Bituminous [5]—thousand tons	20,624	22,931	24,391	24,855	25,096
Lignite—do	13,244	15,207	16,540	17,412	19,051
Coke:					
High-temperature—do	2,274	2,675	2,756	2,818	2,896
Low-temperature—do	829	771	777	774	725
Fuel briquets—do	683	1,537	1,871	1,816	1,917
Petroleum refinery products:					
Gasoline—thousand 42-gallon barrels	28,262	31,963	34,347	35,089	37,872
Kerosine and jet fuels—do	2,633	3,352	3,537	3,448	3,673
Distillate fuel oils—do	15,573	19,950	19,319	19,077	20,369
Residual fuel oils—do	19,458	21,241	25,067	28,582	32,151
Lubricants—do	215	208	152	106	551
Other products—do	2,904	3,045	5,194	5,285	4,767
Refinery fuel and loss—do	6,688	6,871	6,442	8,398	9,435

[1] Estimate.
[2] Ferroalloys and steel semimanufactures are reported for fiscal years ending Nov. 30.
[3] Data not available.
[4] Petalite, amblygonite and spodumene.
[5] Includes semianthracite and subbituminous.

TRADE

According to Bureau of Mineral Resources data, the value of primary mineral exports, totaling A£94.1 million in 1962 fell short of the previous year, and was substantially lower than the record of A£113.1 million established in 1960. However, more than one-third of the 1960 record total was accounted for by gold. Exclusive of gold, the total value of exports in 1961 and again in 1962 was approximately 20 percent above the 1960 level. On the basis of calculated constant prices, the index of mineral exports has risen 56 percent in the 1959–62 period. In the overall picture, mineral exports comprise 10 percent of total exports and account for 1.3 to 1.5 percent of GNP.

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Since 1960, Japan has been Australia's largest export market for minerals. In 1962, over one-fourth of the total value of exported mineral products went to Japan. The United Kingdom took about 20 percent, and the United States and Europe each took about 10 percent.

TABLE 2.—Value of metal and mineral exports

(Thousand A£)

Commodity	1960	1961	1962
Asbestos, all types	784	801	980
Coal, black	6,327	11,505	11,694
Copper:			
Ore and concentrate	8,721	6,470	4,984
Refined	4,158	6,698	4,827
Gold, metal shipments	39,280	17,265	4,932
Iron and steel:			
Pig iron	2,199	6,588	3,514
Ingots, blooms	380	3,102	3,210
Lead:			
Ore and concentrate	4,172	4,590	5,596
Pig and bullion	16,238	15,857	19,411
Manganese ore	659	690	999
Opal	1,036	1,404	2,106
Titanium concentrate	4,367	3,834	4,313
Tungsten concentrate	901	1,019	476
Uranium oxide [1]	11,300	14,000	11,900
Zinc:			
Concentrate	5,395	5,056	4,072
Slabs, blocks	3,066	4,482	7,459
Others	4,089	4,354	3,659
Total	113,072	107,715	94,132

[1] Estimate.

TABLE 3.—Exports of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1961–62	1962–63	Principal destinations, 1962–63
Metals:			
Aluminum:			
Bauxite	25	69,933	Japan 26,216; Italy 22,165.
Scrap	494	250	Japan 192.
Unwrought	72	1,871	United Kingdom 1,314; United States 519.
Semimanufactures	239	346	New Zealand 199; Hong Kong 50.
Beryllium ore and concentrate	223	118	All to United States.
Cadmium, refined metal [2]	200	260	United Kingdom 213.
Copper:			
Ore and concentrate	107,753	41,112	Japan 41,078.
Blister, cement, etc	1,038	1,347	All to Japan.
Scrap	665	354	Japan 213; Spain 56.
Ingots, blocks, billets	12,949	23,780	Japan 9,285; United Kingdom 3,665.
Semimanufactures	3,133	2,987	New Zealand 2,934.
Pipe, tubes and wire	936	2,366	New Zealand 2,287.
Gold:			
Ore and concentrate, content	troy ounces 39,835	44,166	[3].
Crude bullion, content	do 7	16,018	All to Hong Kong.
Mint bullion	do 572,052	386,768	Hong Kong 384,908.
Sheet, strip, dust	do 1,054	8,182	New Zealand 7,675.
Iron and steel:			
Iron ore and concentrate	112	115	[4].
Iron pyrites and cinder	174,415	120,236	All to Japan.
Scrap	170,693	221,665	Japan 190,746; West Germany 8,322.
Pig iron	229,270	161,918	Japan 58,355; United States 20,791.
Steel ingots, blooms, slabs, etc	161,831	55,510	United Kingdom 31,948; India 11,298.
Steel semimanufactures	479,060	256,774	Mainly to New Zealand.
Lead:			
Ore and concentrate	84,529	136,859	United States 44,823; United Kingdom 34,004.
Refined pig	203,153	171,982	United Kingdom 81,516; United States 43,268.
Bullion, lead and silver-lead	47,207	79,330	United Kingdom 60,603; West Germany 7,621.

See footnotes at end of table.

TABLE 3.—Exports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1961-62	1962-63	Principal destinations, 1962-63
Metals—Continued			
Manganese ore	88,796	25,484	Japan 25,383.
Platinum-group metals:			
Ore and concentrate—kilograms	248	1,882	(4).
Platinum metals—troy ounces	383	896	United Kingdom 484; United States 412.
Silver:			
Ore, concentrate, crude bullion, content.—thousand troy ounces	6,460	7,970	(3).
Mint bullion.—thousand troy ounces	732	239	United Kingdom 231.
Sheet, strip, dust—do	7	4	Mainly to New Zealand.
Tantalite-columbite concentrate	17	12	United States 7; Canada 4.
Tin:			
Ore and concentrate—long tons	17	114	United States 67; Malaya 24.
Unwrought—do	1	5	(4).
Titanium concentrates:			
Ilmentite, minimum 45 percent TiO_2.	151,126	146,472	United Kingdom 66,193; United States 42,210.
Rutile, TiO_2—minimum 90 percent	108,911	121,155	United States 47,258; Netherlands 11,859.
Tungsten concentrates:			
Scheelite	989	300	France 142; United States 102.
Wolframite	772	460	United States 269; United Kingdom 129.
Zinc:			
Ore and concentrate	262,657	280,735	United Kingdom 165,080; Japan 66,536.
Ingots, blocks, slabs, etc	74,323	100,315	United Kingdom 22,550; India 16,652.
Semimanufactures	1,854	788	Singapore 427; New Zealand 252.
Other forms	297	339	India 85; Other Commonwealth 101.
Zircon concentrate, minimum 30 percent $ZrSiO_4$	135,826	132,200	United Kingdom 28,886; Netherlands 23,877.
Nonmetals:			
Abrasives:			
Industrial diamond—carats	59,975	43,149	United Kingdom 39,778; Netherlands 2,389.
Other natural abrasives	37	38	New Zealand 21.
Asbestos:			
Crocidolite	8,896	5,646	United States 2,223; Singapore 1,456.
Other, amphibole and chrysotile	29	132	Singapore 45.
Cement, portland	4,511	5,480	Nauru 3,150; Christmas Island 864.
Clays, fire, sillimanite and others	655	707	New Zealand 562.
Gem stones:			
Opal—value, thousand A£[5]	1,691	2,347	Japan 1,831; United States 182.
Diamond—carats	9,852	1,601	United Kingdom 634; West Germany 502.
Other, cameo, talgio.—value, thousand A£[5]	79	118	United Kingdom 77; France 14.
Graphite	3	11	(4).
Gypsum	95,517	159,902	New Zealand 78,431; Japan 43,501.
Magnesite	2,672	323	New Zealand 206; Japan 117.
Mica, crude	28	27	All to New Zealand.
Monazite concentrate	938	1,842	France 720; United States 663.
Salt	74,984	76,065	Japan 39,988; New Zealand 31,496.
Stone, construction.—value, thousand A£[5]	4	12	(4).
Talc and steatite	5,001	3,762	New Zealand 1,131; Sweden 1,062.
Mineral fuels:			
Coal and lignite [6]—thousand tons	3,525	2,719	Japan 2,511; Republic of Korea 76.
Coke	79,617	31,483	New Caledonia 22,515; Philippines 3,666.
Petroleum products:			
Gasoline.—thousand 42-gallon barrels	1,416	1,302	New Zealand 1,283.
Kerosine and jet fuel—do	846	762	New Zealand 315; India 187.
Distillate fuel oil—do	4,517	5,997	New Zealand 2,417; Mozambique 649.
Residual fuel oil—do	8,383	9,459	Japan 3,460; Singapore 3,211.
Lubricants—do	43	115	Singapore 61; New Zealand 14.
Other products—do	5	143	Singapore 109; New Caledonia and Fiji 18.

[1] Periods shown are fiscal years, July 1 to June 30.
[2] Data not available on quantities of cadmium exported in lead and zinc concentrates.
[3] Destination not available. Quantities given are for 1961 and 1962 calendar years.
[4] Data not available.
[5] One Australian pound (A£1)=US$2.24.
[6] Lignite (brown coal) exports are negligible. Bulk of exports is New South Wales bituminous coal.

Aside from petroleum, Australia's balance of trade in mineral products has been highly favorable. The value of nonpetroleum mineral imports has ranged from about A£15 million to A£30 million in the past 10 years, thereby representing 20 to 30 percent of the value of exported minerals. The necessity for importing the entire national requirement of petroleum resulted in an adverse imbalance in Australia's mineral trade for most years prior to 1960. Overall favorable mineral trade balances were recorded for the first time in 1960 and 1961. The situation reversed itself in 1962, but with the planned expansion of bauxite and iron ore exports and the advent of petroleum production a favorable future appears assured.

The bulk of crude petroleum is imported from Indonesia and Middle East countries, aluminum and nonferrous metals are mostly from Canada, the United States, and the United Kingdom.

TABLE 4.—Value of metal and mineral imports

(Thousand A£)

Commodity	1960	1961	962
Aluminum, pig, ingot	6,448	3,882	7,443
Asbestos	2,507	2,310	2,437
Copper, refined	1,566	1,130	1,599
Diamond, industrial	657	515	491
Gold, unrefined	2,238	2,282	2,107
Iron ore	310	321	291
Lead, including alloys	53	354	364
Magnesite	287	428	251
Nickel, metal	1,435	629	928
Petroleum, crude	74,661	78,286	78,341
Phosphate rock	4,075	4,768	4,484
Potash fertilizers	619	1,004	889
Sulfur, elemental	2,284	1,920	2,389
Tin ingot	1,685	836	1,993
Other	4,743	3,656	4,474
Total	103,568	102,321	108,481

TABLE 5.—Imports of metals and minerals [1]

(Metric tons unless otherwise specified)

Commodity	1961–62	1962–63	Principal sources, 1962–63
Metals:			
Aluminum:			
Scrap	404	2,005	United States 818; Canada 393.
Pigs, ingots, blocks, etc	17,194	28,805	Canada 17,782; United States 10,022.
Semimanufactures	2,142	2,774	United Kingdom 1,388; United States 1,115.
Pipe, tubes, powder, wire	874	1,037	United States 239; West Germany 236.
Antimony:			
Ore and concentrate, gross weight.	34	45	(2).
Metal	158	399	Mainland China 206; Netherlands 139.
Bismuth metal	12	17	United Kingdom 16.
Chromium ore and concentrate	16,079	11,246	Federation of Rhodesia and Nyasaland 6,152; Philippines 5,080.
Cobalt and cobalt base alloys	38	69	Federation of Rhodesia and Nyasaland 54; Belgium-Luxembourg 9.
Copper:			
Scrap	25	88	New Zealand 39.
Ingots, blocks, billets	5,470	1,258	United States 728; Canada 508.
Semimanufactures	4,401	967	United Kingdom 883; United States 51.
Pipe, tubes, wire	78	128	Canada 61; United Kingdom 46.
Gold:			
Matte, gold content	troy ounces	710	138	Mainly from Fiji.
Crude bullion, gold content	do	135,003	155,294	Fiji 95,384; New Guinea 41,642.
Refined bullion	do	2	169	West Germany 165.

See footnotes at end of table.

TABLE 5.—Imports of metals and minerals[1]—Continued

(Metric tons unless otherwise specified)

Commodity	1961–62	1962–63	Principal sources, 1962–63
Metals—Continued			
Iron and steel:			
Ore and concentrate, includes pyritic materials.	277,870	298,177	New Caledonia 298,146.
Scrap	16	84	United Kingdom 24.
Ferroalloys:			
Ferrochromium	2,232	2,150	Japan 1,184; Republic of South Africa 510
Ferromanganese	31,803	6,466	Republic of South Africa 5,262; Japan 1,088.
Ferromolybdenum	75	78	U.S.S.R. 38; United Kingdom 36.
Ferrosilicon	6,307	5,721	Republic of South Africa 4,278; Norway 1,166.
Other	1,593	2,517	Sweden 739, New Caledonia 729.
Ingots, blooms, etc	2,246	569	Mainly United States and United Kingdom.
Semimanufactures	135,339	218,323	Mainly from Japan and United Kingdom.
Lead and lead base alloys	4,365	2,319	West Germany 737; United Kingdom 572.
Magnesium and magnesium base alloys.	127	207	United States 150; Canada 40.
Manganese ore:			
Battery grade	1,118	1,195	Ghana 1,016; Japan 131.
Metallurgical grade	11,262	54,071	Republic of South Africa 53,256; mainland China 800.
Mercury—76-pound flasks	1,700	1,837	Spain 916; Mexcio 258.
Nickel:			
Matte, and other crude products.		305	All from Canada.
Pigs, ingots, granulated	360	634	United Kingdom 340; Canada 289.
Bars, rods, anodes	564	702	Canada 376; United Kingdom 300.
Platinum group troy ounces—metals.	1,737	3,536	United Kingdom 3,512; West Germany 16.
Silver:			
Matte, silver troy ounces—content.	25,203	5,635	All from Fiji.
Crude bullion, silver do—content.	64,719	93,653	Fiji 35,268; New Guinea 23,281.
Refined bullion—do	5,459	13,073	United States 12,720; United Kingdom 353.
Tin and tin-base alloys—long tons	1,313	1,911	Malaya 1,806; Switzerland 40.
Tungsten and tungsten-base alloys	10	16	United Kingdom 11; West Germany 3.
Zinc and zinc-base alloys	1,206	1,868	Congo (Léopoldville) 1,626; United Kingdom 140.
Nonmetals:			
Abrasives:			
Industrial diamond—carats	277,734	303,549	Republic of South Africa 194,749; United States 46,579.
Pumice and tripoli	1,496	1,606	New Zealand 862; United States 459.
Garnet	43	45	United States 41.
Flintstone and pebbles	531	599	Canada 220; United States 159.
Asbestos:			
Chrysotile	23,648	25,822	Canada 22,048; Republic of South Africa 3,463.
Crocidolite	41	34	[2].
Amosite	6,555	6,749	Republic of South Africa 6,388; Canada 274.
Other	923	2,671	Canada 2,545; United Kingdom 63.
Barium:			
Barite, ground	398	[2]	[2].
Lithopone	1,477	1,521	United Kingdom 854; West Germany 312.
Boron minerals, crude and concentrate.	1,862	1,942	United States 1,925.
Cement, portland	44,155	28,818	United Kingdom 16,615; Formosa 3,850.
Clays:			
China, kaolin, pottery	8,831	18,271	United Kingdom 15,188; United States 2,993.
Fire and ball	1,532	4,045	Republic of South Africa 2,143; United Kingdom 1,846.
Bentonite	7,419	9,587	United States 9,467; United Kingdom 119.
Other	5,093	6,197	United States 5,507; United Kingdom 427.
Cryolite, natural and synthetic	2,724	5,006	Denmark 2,379; United States 1,588.
Diatomite	4,386	4,327	United States 4,092; West Germany 188.
Fertilizer materials:			
Phosphate rock—thousand tons	1,865	1,722	Nauru 1,079; Christmas Island (Indian Ocean) 410.
Basic slag		2,066	Mainly from West Germany.
Nitrogenous, all types	28,774	52,560	Canada 24,239; West Germany 8,146.
Potassic, all types	67,847	59,263	West Germany 27,223; United States 21,120.
Mixed and others	31,454	24,490	West Germany 11,490; Italy 6,010.
Fluorspar	2,735	7,707	Republic of South Africa 3,681; Mexico 2,149.

See footnotes at end of table.

TABLE 5.—Imports of metals and minerals[1]—Continued

(Metric tons unless otherwise specified)

Commodity	1961–62	1962–63	Principal sources, 1962–63
Nonmetals—Continued			
Gem stones:			
Gem diamond.....carats	20,608	21,964	Republic of South Africa 9,129; Belgium-Luxembourg 4,105.
Cameos, intaglios, etc. value, thousand A£[4]	381	475	Australia reimports 320; India 48; West Germany 26.
Graphite:			
Colloidal	131	54	United Kingdom 31; Ceylon 7.
Flake	176	315	Malagasy 189.
Crystalline	27	104	Ceylon 54; United Kingdom 25.
Amorphous	515	770	Ceylon 482; mainland China 122.
Iodine, crude	3	2	(2).
Iron oxide pigments	3,171	4,325	Spain 1,584; West Germany 1,046.
Kyanite	36	331	(2).
Magnesite, crude, calcined and fused	12,760	3,925	United Kingdom 2,926; United States 894.
Mica:			
Block or sheet	9	18	Mainly from India.
Splittings	65	81	Mainly from India.
Ground and scrap	442	529	India 261; United Kingdom 146.
Quartz crystals	26	47	(2).
Salt	8,264	7,331	United Kingdom 7,318.
Sillimanite	64	195	United Kingdom 125.
Stone, construction. value, thousand A£[4]	220	241	Italy 176; Sweden 15.
Sulfur, elemental	179,773	227,340	United States 143,124; Mexico 55,854.
Talc, steatite, and chalk	1,491	3,206	Mainland China 1,779; Italy 838.
Vermiculite	1,809	1,738	All from Republic of South Africa.
Mineral fuels:			
Asphalt, bitumen and pitch:			
Natural minerals	1,297	1,805	Trinidad and Tobago 1,327; United States 363.
Petroleum derivatives	553	6,274	Iran 5,310; Formosa 550.
Coal tar and coal tar pitch	376	8,477	United States 4,735; United Kingdom 3,742.
Coal, principally anthracite	4,869	8,056	Republic of South Africa 5,794; United States 1,700.
Coke	45	29,518	United States 29,511.
Carbon black	3,490	3,924	United States 3,445; United Kingdom 471.
Petroleum, crude. thousand 42-gallon barrels	91,095	105,374	Kuwait 27,276; Indonesia 25,638; Saudi Arabia 22,396
Petroleum products:			
Gasoline.....do	5,123	6,911	Iran 2,316; Saudi Arabia 1,210.
Kerosine and jet fuel.....do	2,784	2,802	Singapore 901; Iran 832.
Distillate fuel oil.....do	1,100	929	Saudi Arabia 250; Netherlands Antilles 194.
Residual fuel oil.....do	837	440	United States 256; Venezuela 153.
Lubricants.....do	1,924	1,730	United States 923; United Kingdom 322.
Petroleum turpentine.....do	375	392	Indonesia 134; United States 44.
Other products.....do	178	253	United States 109; Iran 32.

[1] Periods shown are fiscal years, July 1 to June 30.
[2] Data not available.
[3] Principal sources 1961–62: United States 264; West Germany 82.
[4] One Australian pound (A£)=US$2.24.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—The first aluminum was produced in Australia from imported raw materials in 1955 at the 12,000-ton-per-year Bell Bay, Tasmania, plant.

Australia has one of the world's richest bauxite resources with a reserve estimated to exceed 3 billion tons. A fully integrated aluminum industry has been developed involving numerous Australian and foreign enterprises aligned for the most part in two multicompany groups. Comalco Industries Pty., Ltd. (Comalco), successor to Commonwealth Aluminum Corp., Ltd., is owned one-half by Kaiser Aluminum & Chemical Corp. (U.S.A.) and one-half by Conzinc Rio Tinto

of Australia, Ltd. Comalco owns two-thirds and the Tasmanian Government owns one-third of Comalco Aluminum (Bell Bay), Ltd., the subsidiary that operates the Bell Bay works. Comalco is also sole owner of the bauxite mines at Weipa, a principal partner in the Gladstone, Queensland, alumina project, owner of several aluminum fabricating companies, and a principal in the proposed 100,000-ton-capacity aluminum reduction plant and in the hydropower development on South Island, New Zealand.

Alcoa of Australia Pty., Ltd. was organized in June, 1961, and immediately acquired the Darling Range bauxite properties of Western Aluminum, no liability, in Western Australia. Alcoa of Australia is held 51 percent by Alcoa (U.S.A.) and 49 percent by the Australian companies: Western Mining Corp., Ltd., 20 percent; Broken Hill South, Ltd., 17 percent; and North Broken Hill, Ltd., 12 percent. The company's operating facilities include the bauxite mines, the alumina plant at Kwinana, and an aluminum smelter on Point Henry, near Geelong in Victoria. Eventual plans call for fabricating mills adjacent to the smelter.

Although bauxite had previously been produced for chemicals as well as for refractory and fluxing purposes, it was not until 1962 that Australian resources were used for aluminum reduction. The potential of extensive deposits on Gove and Cape York peninsulas, flanking the Gulf of Carpentaria on the north coast of Australia, became apparent shortly after 1950. Since 1955 exploration and development of these resources by several large Australian and foreign mining companies has been virtually continuous. In 1957 and 1958, prospecting disclosed a third vast bauxite area, in the Darling Range, near Perth in Western Australia.

Though not yet fully appraised, the deposits on Gove Peninsula, to the west of the Gulf of Carpentaria, in Northern Territory, are presumed to contain more than 100 million tons of bauxite. Concession negotiations and required development programs had not been definitely finalized at yearend. Initial testing of the Gove bauxite deposits was conducted on leases held by Comalco, Péchiney of France, Duval Holdings Pty., Ltd., and British Aluminum Company, Ltd. The British Aluminum Co.'s lease was canceled in May 1963.

The deposits of bauxite at Weipa, Queensland, developed by the Comalco organization, are estimated to contain in excess of 1 billion tons, half of which has been delimited by drilling. The grade averages 46 to 52 percent Al_2O_3. A townsite and port facilities which included the dredging of an 8-mile access channel were completed in 1962. The initial plant is designed for annual output of 400,000 metric tons. Shipments in 1963 totaled about 280,000 tons. Mining is by opencut methods. The bauxite is simply crushed and screened prior to loading for export. In addition to supplying the Bell Bay alumina plant, the company has contracted to ship 600,000 long tons of bauxite to Japan during the 3 years beginning in 1963.

The Darling Range bauxite field, near Perth, in Western Australia, extends over a belt 200 miles long by 25 miles wide. Alcoa of Australia Pty., Ltd., started production from the Jarrahdale-Dwellingup area in July 1963. This area has been estimated to contain 80 million long tons, averaging 30 to 45 percent Al_2O_3. Production of 300,000

tons was expected in 1963. The bauxite is mined by opencut, trucked about 10 miles to a crushing plant at Mundijong, and rail-shipped 17 miles to a new alumina plant at the seaport town of Kwinana, on the Freemantle harbor.

Since April 1963, the Comalco alumina plant at Bell Bay has treated Weipa bauxite exclusively. The capacity of this plant recently has been increased from 38,000 to 50,000 long tons per year. Throughout 1963 it operated at full capacity.

An alumina plant built by Alcoa of Australia Pty., Ltd. at Kwinana, 15 miles southwest of Perth, was to commerce operation early in 1964 using bauxite that had been stockpiled since July 1963 from the company's Darling Range mines. The 210,000-ton annual capacity of this plant will supply about 90,000 tons per year to the Point Henry, Victoria, smelter leaving 120,000 tons available for sale under an existing contract to Mitsubishi Chemical Industries of Japan.

Comalco Industries Pty., Ltd. and Aluminium, Ltd. of Canada in November 1963 announced affiliation with Péchiney Co. in forming a new company, Queensland Alumina, Ltd., which will build and operate an alumina plant at Gladstone, 60 miles southeast of Rockhampton, Queensland. The plant will be designed for 600,000 long tons alumina output per year, which will call for about 2 million tons of bauxite, beginning in 1967, from the Weipa mines.

Between 1961 and the close of 1963 Australia's aluminum production capacity has been raised from 16,000 to over 73,000 metric tons per year. Recent expansion and additions at Bell Bay have raised the rated capacity of that plant to approximately 53,000 tons. However, restrictions imposed by low water for hydroelectric power temporarily limited actual capacity to 40,000 tons in 1963.

The first stage of the new Alcoa of Australia Pty., Ltd. aluminum smelter at Point Henry was placed in operation and first ingots were poured on April 17, 1963. The present capacity of 20,000 tons per year will be doubled when the plant is fully completed in 1964. For the initial operation, alumina was imported from the United States. Use of domestic alumina, from the Darling Range, Western Australia, commenced in February 1964.

Cadmium.—Recorded mine production of cadmium in Australia consists of that contained in lead and zinc concentrates from Broken Hill, New South Wales, and Read-Rosebery, Tasmania. The cadmium zinc and lead-zinc ores from other Australian producers is not recorded. Accordingly, mine production of cadmium in recent years is summarized as follows:

Mine	Quantity (metric tons)			
	1960	1961	1962	1963
Broken Hill	907	858	935	1,041
Read-Rosebery	57	63	73	89
Total	964	921	1,008	1,130

Cadmium is produced as refined metal in the metallurgical plants of Broken Hill Associated Smelters Pty. Ltd. at Port Pirie; Electro-

lytic Zinc Co. of Australasia Ltd. at Risdon, Tasmania; and Sulphide Corporation Pty. Ltd. at Cockle Creek, New South Wales. Production by these plants was:

Plant	Quantity (metric tons)	
	1961	1962
Port Pirie	64	16
Risdon	243	266
Cockle Creek	9	77
Total	316	359

Consumption of refined cadmium by Australian industries, for plating, manufacture of alloys, chemicals and pigments has totaled up to 187 metric tons annually. In addition to the recorded exports of refined metal a substantial quantity of cadmium is contained in base metal concentrates that are shipped abroad for treatment. Lead-zinc concentrates exported in 1962 from New South Wales contained 442 metric tons of cadmium. Similar data for other States are not available.

Copper.—Although Australia's mine copper production constituted only about 2.5 percent of the 1963 world supply, it has been that country's principal metallic mineral from a value viewpoint. In 1962 copper in ore and concentrate was valued at A£24.7 million, to which A£5.6 million was added by reason of primary treatment. In 1962 and again in 1963 mine output and production of blister and refined copper were at record levels. Over 90 percent of the national production was by four companies; however, eight important mines, four smelters, and three refineries comprise the copper industry.

TABLE 6.—Major copper industry facilities by area

Area and facility	Production (metric tons of copper [1])	
	1961	1962
Mines:		
Queensland:		
Mt. Isa Mines Ltd	58,644	75,975
Mt. Morgan Ltd	8,201	7,483
New South Wales: Broken Hill field	2,449	3,522
Tasmania:		
Mt. Lyell Mining and Railway Co. Ltd	11,847	13,408
Electrolytic Zinc—Rosebery	1,011	1,307
Western Australia: Ravensthorpe Copper Mines, N.L	1,484	995
Northern Territory:		
Peko Mines N.L.—Tennant Creek	7,712	7,639
Territory Enterprises Pty. Ltd.—Rum Jungle	3,069	744
Smelters, blister:		
Queensland:		
Mt. Isa Mines Ltd	39,580	64,534
Mt. Morgan Ltd	6,926	7,811
New South Wales:		
Electrolytic Refining and Smelting Co. of Australia Pty. Ltd.—Port Kembla	5,814	2,971
Tasmania: Mt. Lyell Mining and Railway Co. Ltd	11,180	13,106
Refineries, electrolytic:		
Queensland: Mt. Isa Mines Ltd.—Townsville	41,255	57,664
New South Wales: Electrolytic—Port Kembla	12,875	11,156
Tasmania: Mt. Lyell Mining and Railway Co. Ltd	10,618	11,905

[1] Metal content of ore for mines; blister copper for smelters; and refined copper for refineries.

In addition to the copper reported as mine production in 1963, Mt. Isa Mines Ltd. accumulated 10,000 metric tons of copper in oxide ore from the new open pit development. The oxide orebody has been outlined by diamond drilling. Production from this work is expected to provide a substantial increase in Mt. Isa output beginning in 1965 or 1966. Total Mt. Isa ore reserves as of June 30, 1962, were estimated at 27 million tons: 1.5 million of oxide ore averaging 4.2 percent copper and 25.5 million of sulfide ores averaging 3.6 percent copper. Because of the closing of the Captains Flat and Rum Jungle mines, the supply of concentrate to the Electrolytic Refining and Smelting Co. customs smelter at Port Kembla has decreased in recent years. This shortage will be relieved beginning in 1966 when annual shipments of about 80,000 tons of concentrate are expected from Cobar.

Mineable reserves at Cobar, New South Wales, are reported to total 18 million tons of ore averaging 3.54 percent copper. The mine is being developed for underground operation, employing mechanical cut-and-fill methods by Cobar Mines Pty. Ltd., which is owned jointly by Broken Hill South Ltd. (77 percent) and Conzinc Rio Tinto of Australia Ltd. (23 percent).

Gold.—In 1962, 14 principal producers of gold are listed by the Bureau of Mineral Resources;[3] however, the total number, including very small operations, may approximate 295 as reported officially in 1961. Total mine output of gold has decreased an average of about 1 percent per year since 1959. The current annual production level is approximately half the peak of 2,065,000 ounces recorded in 1903. Historically, nearly two-thirds of Australia's total gold production through 1962, estimated at 182 million ounces, was from the eastern States of Queensland, New South Wales, and Victoria, with Victoria alone accounting for 41 percent of the historical total. In recent years, however, Western Australia's mines have yielded over 80 percent of the national output of gold. In 1962 and 1963 mine production was from the following regions:

Area	Quantity (thousand troy ounces)		Area	Quantity (thousand troy ounces)	
	1962	1963		1962	1963
New South Wales	11.2	11.6	Western Australia	860.0	802.9
Victoria	28.3	24.7	Tasmania	32.1	36.2
Queensland	67.7	67.5	Northern Territory	69.4	79.7

[3] Department of National Development, Bureau of Mineral Resources, Geology and Geophysics (Canberra). The Australian Mineral Industry, 1962 Review. 1963, 316 pp.

Principal company sources, all in Western Australia, were as follows in 1962:

Company	Location	Ore treated 1962 (long tons)	Gold produced 1962 (troy ounces)
Central Norseman Gold Coporation N.L.	Norseman	181,834	109,506
Gold Mines of Kalgoorlie (Australia) Ltd.	Fimiston and Coolgardie	514,594	139,649
Great Boulder Gold Mines Ltd	Fimiston	455,399	121,799
Great Western Consolidated N.L	Bullfinch, Southern Cross, Nevoria	390,462	61,352
Hill 50 Gold Mine N.L	Mt. Magnet	165,698	87,196
Lake View and Star Ltd	Fimiston	694,054	181,195
North Kalgurli (1912) Ltd	do	368,350	84,559

The bulk of Australia's gold, virtually all from Western Australia and from the several small mines that contribute to the Victoria production, was recovered by amalgamation and cyanide treatment of gold ores. The production credited to Tasmania is largely from auriferous lead-copper concentrates. The bulk of Queensland's gold is from the Mt. Morgan copper-gold ore; New South Wales' gold is associated with lead and zinc concentrates from Broken Hill. In 1962 and 1963 national production contained in the mine or mill products included:

Type of mine or mill product	Quantity (troy ounces)		Type of mine or mill product	Quantity (troy ounces)	
	1962	1963		1962	1963
Copper concentrate	78,581	90,899	Lead concentrate	12,286	13,814
Copper ore	223	134	Lead-copper concentrate	18,021	18,820
Bullion [1]	955,285	894,424	Zinc concentrate	4,441	4,486

[1] Includes alluvial and retorted gold.

Three gold mines, two in Western Australia and one in Victoria, were closed during 1963. A development program at Mt. Charlotte, near Fimiston, Western Australia, by Gold Mines of Kalgoorlie (Australia) Ltd. is expected to add an output of 20,000 ounces per year when production commences in 1964.

Payments of subsidy under the Gold Mining Industry Assistance Act total A£748,509 in 1962. The act was extended for 3 years, to May 1965.

The new Gold Mines Development Assistance Act of 1962, assented to on December 14, 1962, is designed to stimulate mine development in mines that do not receive subsidy.

Iron and Steel.—In 1963, production records were established in Australia for iron ore, pig iron, and steel. The strong domestic demand for iron and steel products and the added output of new steelmaking facilities that came into use late in 1962 and early in 1963 at Newcastle, New South Wales, were the principal contributing factors. The testing and development of recently discovered iron ore deposits continued throughout the year, particularly in Western Australia.

Iron Ore.—Production of iron ore in 1963, as in previous years, was almost entirely from the Broken Hill Pty. Co. Ltd. (BHP) mines on the Middleback Range, near Whyalla in South Australia, and from Cockatoo Island, Yampi Sound in Western Australia. The State of Western Australia owns and operates a small iron mine at Koolyanobbing (200 miles east of Wundowie) that supplies the Charcoal Iron and Steel Industry works at Wundowie. By regions, quantities of iron ore mined for iron and steel making, during 1961 and 1962 were as follows:

Area	Quantity (thousand metric tons)		Area	Quantity (thousand metric tons)	
	1961	1962		1961	1962
South Australia: Middleback Range	4,046	3,495	Western Australia: Cockatoo Island, Yampi Sound	1,305	1,342
			Koolyanobbing	76	85

A scree [4] ore treatment plant of 800,000 tons per year capacity was placed in operation at Iron Knob in the Middleback Range in August 1962. The bulk of the ore produced in the range is high-grade hematite, 65 to 68 percent iron, mined by opencut methods. It is shipped 30 to 40 miles by rail to Whyalla and thence by sea to Newcastle and Port Kembla. Ore reserves in 1960 were estimated at 200 million metric tons of hematite carrying 65 percent iron and 5 billion tons of hematite-jaspilite ore with up to 40 percent iron.

The Yampi Sound hematite deposits on Cockatoo and Koolan Islands were estimated in 1957 at 70 million tons, above water, averaging about 64 percent iron. The hematite-limonite orebody at Koolyanobbing was recently estimated to contain 70 million tons, carrying from 50 to 63 percent iron.

Under the liberalized iron ore export policy announced by the Commonwealth Government in December 1960, and further relaxed in June 1963, exploration as well as geological and economic developments have moved forward at a very rapid rate. In November 1962, reserves of iron ore in the newly investigated areas of Western Australia were estimated to total about 8 billion tons. Most of the reserve is in the Hammersley and Ophthalmia Ranges of the Pilbara District. More than 100 temporary exploration concessions for iron ore were granted by the Western Australian Government in 1962 to various interests. Six approvals have been granted by the Commonwealth Government for export of various quantities of iron ore; the largest contract for 200 million tons to be delivered during a period of 21 years. Several negotiations being considered early in 1964 involved an additional quantity of more than 300 million tons.

Exploration and testing of the Savage River area in northwest Tasmania has been by the Bureau of Mineral Resources, Geology and Geophysics, and the Tasmanian Mines Department. Mining rights are currently held by private industrial interests. Preliminary studies

[4] Scree—talus, in this locality low-grade, siliceous, hematite-jaspilite type ore.

indicate a possible 200 million tons of magnetite ore containing about 45 percent iron and 1.7 percent titania.

A comprehensive status résumé of recent Australian iron ore prospecting and development activities in addition to commercial negotiations was published early in 1964.[5]

Pig Iron.—The blast furnaces of Broken Hill Pty. Ltd. and its subsidiary companies [6] account for all of the pig iron produced in Australia with the exception of about 50,000 tons of charcoal pig produced annually by the Wood-Distillation, Charcoal-Iron & Steel Industry at Wundowie, Western Australia, which is State-owned. Pig and foundry iron output in 1961 and 1962 was by the following producers:

Company	Location	Quantity (thousand metric tons)	
		1961	1962
Broken Hill Pty. Ltd	Newcastle	939	997
Do	Whyalla	251	220
Do	Port Kembla	1,949	2,226
Wood-Distillation, Charcoal-Iron & Steel Industry	Wundowie	52	47

The outstanding development in 1963 was commissioning of the new No. 4 blast furnace at the Newcastle plant in July. As a result of this increase, national pig iron production capacity has been raised to approximately 4 million metric tons per year.

Steel and Steel Products.—By the close of 1963, steelmaking capacity in Australia was approximately 5 million metric tons per year. All but a few thousand tons of this was the product of Broken Hill Pty. Co. Ltd. and its wholly owned subsidiaries; Australian Iron and Steel Pty. Ltd.; and Commonwealth Steel Co. Ltd. Production of various items during the company's annual fiscal periods ending May 31, 1962, and May 31, 1963, were reported as follows:

Commodity	Quantity (thousand metric tons)		Commodity	Quantity (thousand metric tons)	
	1962	1963		1962	1963
Steel ingots	4,127	4,325	Rod	147	153
Blooms and slabs	3,471	3,772	Cold rolled strip	32	60
Sheet bars, billets, etc	1,976	1,997	Tinplate	108	214
Plate and strip	1,119	1,458	Steel castings	10	10
Merchant	1,257	1,310	Spun pipes	64	36

Capital expenditures by the BHP Company in its industrywide expansion and modernization program has exceeded A£125,000 during the past 3 years. At Newcastle, major units associated with the basic oxygen steelmaking processes have been completed. The first and second basic oxygen furnaces, including the electrostatic precipitators,

[5] Ives, D. J., Development Toward Exports of Australian Iron Ore. The Australian Mineral Industry, Canberra, Australia, v. 16, No. 3, March 1964, pp. 65–71.

[6] Subsidiaries include Commonwealth Steel Co. Ltd., plants at Waratah and Wollongong, New South Wales, and Australian Iron and Steel Pty. Ltd. plants at Port Kembla, New South Wales.

were put into service; one bloom mill, two improved continuous mills, and one new rod mill were commissioned during the period from October 1962 to February 1963. Principal installations completed at Port Kembla during 1962–63 included an oxygen plant, a central laboratory, and a narrow cold-rolled products plant. Construction is currently proceeding on additional soaking pits and on a 140-inch plate mill at Port Kembla as well as on an extensive additional steelmaking facility at Whyalla.

Lead and Zinc.—Since 1957 when Australia's output of lead surpassed that of the United States, Australia has been the free world's leading producer of lead. In zinc, Australia ranks third after the United States and Canada. Throughout 1963 production of lead and zinc was at full scale, with the result that records were established for mine output of both metals. Between June 1959 and March 1962 voluntary curtailment had been applied by the industry in cooperation with International Lead Zinc Study Group schedules.

The zinc and nearly all of the lead produced in Australia is mined in lead-zinc multimetal ore containing varying quantities of gold, silver copper, cadmium, manganese, and other elements. Virtually all production has been from the four localities of Broken Hill and Captain's Flat, New South Wales; Mt. Isa, Queensland; and Reed-Rosebery, Tasmania. The principal mine sources for 1961 and 1962 production were as follows:

Mine	Quantity (metric tons)			
	1961		1962	
	Lead	Zinc	Lead	Zinc
North Broken Hill	49,393	39,984	57,556	47,235
Broken Hill South	31,476	27,350	36,704	31,168
Zinc Corporation	70,067	71,078	108,285	81,093
New Broken Hill Consolidated	54,809	85,995	92,830	86,303
Captain's Flat	9,125	17,087	1,646	2,993
Mt. Isa	45,727	33,752	63,648	45,421
Reed-Rosebery	11,859	40,750	14,365	48,687

The lead-zinc industry comprises a total of about 25 mines, which in 1963 shipped 12,200 metric tons of ores, 603,113 tons of lead and lead-copper concentrates, and 605,641 tons of zinc concentrates. Because of the exhaustion of reserves, Lake George Mines Pty. Ltd. at Captain's Flat and Barrier Central Pty. Ltd. at Broken Hill ceased operations in 1962.

All Mt. Isa lead concentrates are smelted in the company's lead smelter, the metal being exported to the United Kindom for refining. Except for a very small quantity of zinc concentrate which has been shipped in some years to Risdon, Tasmania, the bulk of Mt. Isa zinc concentrate is exported.

The new lead-zinc smelter complex at Cockle Creek operated by Sulphide Corporation Pty. Ltd.[7] is entirely supplied by Broken Hill. Its rated capacity is 40,000 long tons each metal per year, and products

[7] Mining World. V. 25, No. 1, January 1963, pp. 16–19.

are all exported. The great bulk of the Broken Hill concentrates are processed in the Broken Hill Associated Smelters Pty. Ltd. 200,000 ton-per-year capacity lead smelter at Port Pirie, New South Wales, and in the 120,000-ton-per-year Electrolytic Zinc Company of Australasia Ltd. plant at Risdon, Tasmania.

Manganese Ore.—Reflecting world market conditions, in 1963 Australian production of manganese ore declined to approximately half of the 1962 level. Decreased demand for Australian metallurgical grade ore by the Japanese steel industry was a major influence.

The domestic pattern of manganese consumption has been altered by the commissioning of the new ferroalloy plant of Tasmanian Electrometallurgical Co. Pty. Ltd. at Bell Bay, Tasmania. Consumption of metallurgical grade ore in Australia in 1962 was estimated at 45,000 metric tons, of which a third was from domestic sources. Imports of ferromanganese fell in 1962 to 8,863 tons, compared with an average of nearly 36,000 tons in the previous 2 years.

Silver.—The successive 1962 and 1963 records for silver production in Australia reflect the high level of lead-zinc production in the Broken Hill area of New South Wales, Mt. Isa, Queensland, and Reed-Rosebery, Tasmania. In 1961 and 1962, these areas accounted for 94.6 and 96.7 percent, respectively, of the total Australian silver production. In both years, more than half of the total was from Broken Hill. Since 1960 all silver mined in Australia has been associated with ores of other metals; the mine products of 1962, for example, contained the following quantities of silver:

Mine product:	*Silver content (troy ounces)*
Copper ore	12,369
Copper concentrate	831,561
Gold, bullion, retorted, etc	225,323
Lead ores	40,037
Lead concentrate	14,751,653
Lead-copper concentrate	994,880
Zinc concentrate	697,868

Most of the silver refined in Australia is recovered from lead concentrate smelted by Broken Hill Associated Smelters Pty. Ltd. at Port Pirie, South Australia. Smaller quantities are also refined by Electrolytic Refining and Smelting Company of Australia Pty. Ltd. at Port Kembla, New South Wales, and by the Royal Mint facilities in Melbourne and Perth.

Domestic sales normally absorb less than half of the national output. Exports of silver in unrefined bullion, concentrates and other raw products have ranged from 6.4 to more than 8.0 million ounces annually in recent years. Refined silver exports have been relatively small, with much variation in quantity.

Tin.—With the addition of new production from the opencut operation at Ardlethan, New South Wales, and increases from the Pilbara field in Western Australia and Finches area in northern Queensland, mine production of tin in 1963 was the highest in recent decades but is far short of the 8,000- to 10,000-ton annual peaks of the 1870–90 period. Total Australian production of tin metal to date (1963) has been estimated at 465,000 long tons. Production has been reported from all Australian states except South Australia. More than 200

mines normally contribute to the total tin production from various types of mine workings. Sluicing and dredges are used on surface alluvial deposits; underground methods are used on numerous lode occurrences.

The various States as well as the Commonwealth Government encourage and assist in the exploration and development of tin prospects. The Ardlethan development was largely the result of drilling, a type of assistance rendered by the New South Wales Mines Department, and the result of metallurgical research conducted in Commonwealth and Tasmania Mines Department laboratories. In mid-1962 the Northern Territory Administration opened a government mill at Mt. Wells to treat tin ore produced by small operators.

Four companies, two in Queensland and two in Tasmania, account for more than half of the national total. Principal producers of tin in 1962 were as follows:

Area and Company:	*Concentrates (long tons)*
Queensland:	
Ravenshoe Tin Dredging Ltd	568
Tableland Tin N.L	397
Tasmania:	
Aberfoyle Tin N.L	777
Renison Associated Tin Mines N.L	362
Storey's Creek Tin Mining Co. N.L	123
Endurance Tin Mining Co. N.L	51
Western Australia:	
Mineral Concentrates Pty. Ltd	121
Northern Minerals Syndicate	72
J. A. Johnson	111
H. V. Leonard	99

Virtually all domestic tin is smelted and refined in Sydney, New South Wales, by either O. T. Lempriere and Co. Ltd. or by the Sydney Smelting Co. Pty. Ltd.[8] The rated capacities of these two tin smelters are 2,500 and 1,500 long tons per year respectively.

Titanium Concentrates.—Australia in 1962 accounted for 8.9 percent of the ilmenite and 88.3 percent of the rutile produced in the free world.

Production of ilmenite concentrate from beach sands has increased at a phenomenal rate since 1954, the initial year of recorded Australian production. With the exception of a few thousand tons from east coast beaches, the ilmenite industry is dominated by four companies situated 100 to 125 miles south of Perth, Western Australia: Western Titanium, N.L., and Western Mineral Sands Pty. Ltd. at Capel, Westralian Oil Ltd. at Yoganup, and Cable (1956) Limited at Bunbury.

In addition to ilmenite, the beach sand resources yield other products as illustrated by Westralian Oil Ltd., which in 1963 reported production of 75,000 metric tons ilmenite, 9,214 tons zircon, 1,300 tons monazite, and 6,440 tons leucoxene.

Ilmenite concentrate output from Western Australia is expected to more than double because of expansion of existing facilities and the added production from a new 100,000-ton capacity plant of Western Mineral Sands Pty. Ltd. that will be put into operation early in 1964.

In 1963 rutile production, nearly all from New South Wales and

[8] Subsidiary of Consolidated Tin Smelters Ltd.

Queensland, was 40 percent above the previous record of 131,000 metric tons in 1957. The principal stimulant has been contract purchases totaling more than 80,000 tons annually by U.S. pigment manufacturers including E. I. du Pont de Nemours & Co., Inc., American Potash & Chemical Corp., Godfrey Cabot Corp., and American Cyanamid Co.

The east coast beach sands industry that numbered about 30 separate companies during 1956–58 has emerged in 1961–63 with Consolidated Gold Fields (Aust.) Pty. Ltd. in control of more than half the east coast production capacity. The Du Pont contract which currently amounts to 50,000 long tons per year is with Rutile and Zircon Mines (Newcastle) Ltd. Smaller scale producers include the long-established N.S.W. Rutile Mining Company Pty. Ltd. and Cudgen R. Z. The principal centers of production are the coastal regions adjacent to Newcastle, New South Wales, and Brisbane, Queensland.

Uranium Oxide.—Since 1944 a large number of uranium occurrences have been reported in Australia but only five were developed and brought to production. Of these, the South Alligator Uranium N.L. mine in Northern Territory and the Radium Hill Mine, South Australia, suspended operations in 1961 and 1962, respectively, because ore reserves of both companies were exhausted. Mary Kathleen Uranium Ltd., the largest Australian producer, completed its 9-million-pound contract with United Kingdom Atomic Energy Authority and closed in November after producing 728 metric tons U_3O_8 in 1963, a decrease compared with 907 metric tons produced during the previous year.

The United Uranium N.L. at Moline, Northern Territory, has continued operation to satisfy a A£5 million contract with the United Kingdom Atomic Energy Authority. Completion of this contract is scheduled for July 1964. The Rum Jungle operation of Territory Enterprises Pty. Ltd. will continue to treat stockpiled ore from the Rum Jungle Creek South opencut. Products will be stockpiled pending development of a favorable market. At the present treatment rate—274 metric tons U_3O_8 in 1963—the stockpile operation will continue until about 1971.

Total Australian production of uranium oxide when all contracts are complete will total about 9,000 metric tons. Known reserves according to a 1964 estimate are 8,000 tons, of which about 1,800 tons are at Rum Jungle and 6,200 tons at the Mary Kathleen mine.

Zircon.—While output data for zirconium concentrate are not available for many producer countries, Australia is the uncontested leading producer in the free world, accounting for about 60 percent of the supply. In 1963 output of zirconium concentrate was at a record high, reflecting increases in production of ilmenite and rutile beach sands from which the zirconium concentrate is recovered. Virtually all zirconium concentrate is exported. U.S. imports increased to over 55,000 metric tons in 1963; this is more than double the quantity imported in 1962.

NONMETALS

Asbestos.—The bulk of Australia's asbestos production is of crocidolite (blue) variety, mined at Wittenoom Gorge, Western Australia, by Australian Blue Asbestos Pty. Ltd. In 1962 this company milled

304,073 metric tons of ore, yielding 15,867 tons of marketable product. However, reflecting a highly competitive market, exports including completion of a U.S. stockpile contract for 4,536 tons (5,000 short tons), fell to 8,800 tons in 1962 and to less than 3,000 in 1963.

Chrysotile asbestos was produced in 1963 by Asbestos Mines Pty. Ltd. at Baryulgil, New South Wales, and by L. G. Hancock at Lionel, Western Australia. However, this output, amounting to less than 1,000 tons annually since 1958, continued to decline in 1962 and 1963.

With the nationwide expansion in construction activity, asbestos consumption, supplied by imports mainly in raw form from Canada, has risen from about 26,000 tons in 1952 to 43,000 tons in 1963. Although statistics of consumption of asbestos byproducts are not published, consumption of Australian-made asbestos cement products, chiefly wallboard, was 41,354 metric tons in 1960–61 and 35,408 tons in 1961–62.

Gem Stones.—Opal and sapphire are produced in small commercial quantities in Australia. Production of opal, most of which came from Coober Pedy, Andamooka, and Mintabee fields in South Australia, was valued at record A£1.14 million in 1963. Smaller amounts have been produced in past years in Queensland and New South Wales. In 1962 opal mining activities at Lightening Ridge in New South Wales occupied 200 men and production was valued at A£100,000. The A£2.7 million value of opal exported in 1963 was also a record. Export value includes the benefit of cutting, trimming, or otherwise processing the run-of-mine products.

The sapphire produced in New South Wales and Queensland in 1962 was valued at A£35,819. The principal producers were Sapphires Pty. Ltd. and Gaukroger, Dawes, and Williams in the Glenn Innes and Inverell mining divisions in New South Wales. The Anakie district in central Queensland accounted for most of the A£4,690 value of sapphire credited to Queensland in 1962.

Gypsum.—Production of gypsum has grown steadily for the past 10 years. The 1963 record output was 10 percent higher than in 1962, and in both years approximately 20 percent of the total production was exported. The Bureau of Mineral Resources lists 23 companies engaged in producing gypsum in South Australia, Victoria, New South Wales, and Western Australia. Two-thirds of the total is normally produced in South Australia.

The bulk of production is controlled by two companies that also manufacture and market gypsum products. Australian Gypsum Industries Ltd. (A.G.I.) accounts for over half of the total annual production. Its mining subsidiaries are located at Kowulka and Stenhouse Bay, South Australia; Ivanhoe, New South Wales; and at Yaapeet, Victoria. The Colonial Sugar Refining Co. Ltd. (C.S.R.) produces nearly one-third of the total from subsidiary mines on Kangaroo Island and at Lake MacDonnell in South Australia; at Conoble and Manara, New South Wales; Nowingi, Victoria, and at Yellowdine in Western Australia.

Apparent consumption of gypsum in 1963 was on the order of 555,000 metric tons, compared with about 500,000 tons in 1962. The largest industrial usage in 1963 was for plaster of paris—252,000 tons—and portland cement—about 150,000 tons. Details are not avail-

able on the large quantities consumed in manufacture of plaster sheets, acoustic tiles and other construction materials.

Monazite.—Australia is one of the world's leading producers of monazite. Official statistics report sales or shipments rather than actual production; accordingly, although for both 1962 and 1963 output records were established, 1963 is credited with an outstanding 2,096 tons of concentrate containing 1,973 tons of monazite. The concentrates are recovered as a byproduct of beach sands operations. The largest production, about 70 percent of the total, is from ilmenite beach sands in Western Australia. Smaller quantities are byproducts of rutile and zircon sands from Queensland and New South Wales.

The recent increase in monazite production reflects the high level of activity in Australian ilmenite and rutile beach sands. The additional new recovery plants for titanium minerals, which were completed in 1962 and 1963, are expected to yield still greater quantities of byproduct monazite in 1964 and 1965. The entire output of monazite concentrate is exported.

Phosphate Fertilizers.—Australian production of phosphate is insignificant in the national requirement picture. Production from South Australia has accounted for about 5,000 metric tons annually in 1961, 1962, and 1963, and in some years a few tons have also been reported from Western Australia.

Interest has been stimulated with two recent discoveries of phosphate rock in Northern Territory. The first discovery, in 1961, was in the Castlemaine Hill and Stapleton areas near Rum Jungle. Reports of preliminary tests by the Bureau of Mineral Resources have shown that this phosphate bed, considered unsuitable for production of superphosphate, extends to a depth of 200 feet and averages about 12 percent P_2O_5. The second discovery was in the Amadeus Basin, west of Alice Springs, in 1962, where the phosphate occurs in thin beds which yield analyses up to 22 percent P_2O_5.

Production of superphosphate fertilizer, based on rock imports from Christmas, Nauru, and Ocean Islands was a record 3,142,000 metric tons in 1963, compared with 2,823,000 in 1962. In addition to general economic prosperity, the expansion is largely the result of the superphosphate bounty of A£3 per ton to the consumer which was initiated by the Commonwealth Government in mid-1963.

Sulfur.—Occurrences of native sulfur are unknown in Australia. Nearly all requirements of elemental sulfur, which exceeded 225,000 tons annually in 1962 and 1963, were imported from the United States, Mexico, and Canada. Sulfur recovery plants at two oil refineries, the 40-ton-per-day plant at Altona, Victoria, and the 30-ton plant at Port Stanvac, South Australia, both owned by Petroleum Refineries (Australia) Pty. Ltd., have been producing since 1960 and May 1963, respectively.

Under the Sulphuric Acid Bounty Act of 1960, A£3 per ton has been paid by the Commonwealth on acid produced from indigenous pyrites; and since a 1963 amendment to this Act, A£1 2s per ton is now payable on sulfur in gas from sintering lead concentrate.

Pyrite is mined as a source of sulfur by Nairne Pyrites Ltd. at Nairne, South Australia, and by Norseman Gold Mines, N.L., at Norseman, Western Australia. It is also recovered commercially as a

byproduct of base metal ore milling at Mt. Morgan, Queensland, Mt. Lyell, Tasmania, and from gold ores at Kalgoorlie, Western Australia. Total production of pyrite concentrates from these sources in 1962 amounted to 150,950 metric tons with a sulfur content of 66,107 tons.

Most of the recoverable sulfur contained in indigenous pyrite and other sulfide materials as well as most of the imported elemental sulfur goes into the manufacture of sulfuric acid. About 12,000 tons of elemental sulfur were used for nonacid purposes, whereas more than 200,000 tons went into the manufacture of sulfuric acid. The source materials used and quantities of sulfuric acid produced from each in 1962 were in thousand metric tons:

Source material	Amount used	Acid produced	Source material	Amount used	Acid produced
Elemental sulfur	217	630	Lead concentrate	292	63
Pyrite	239	304	Other materials	35	49
Zinc concentrate	235	203			
			Total		1,249

Production of sulfuric acid, stimulated by the heavy demand for manufacture of superphosphate, rose to a record of 1,336,700 metric tons in 1963, compared with 1,249,000 tons in 1962. Consumption of acid in 1963 totaled 1,332,000 tons. Approximately 80 percent of this was for superphosphate.

Salt.—Favorable marketing conditions for Australian salt spurred production to records in all five producing States in 1962 (data for 1963 are not available). National output in 1962 was 5 percent above the previous year's total. All production is from solar evaporation pans and dry lakes. In 1962, approximately 83 percent of the total production was from solar evaporation of sea water. The Bureau of Mineral Resources lists 18 producing companies. Among the largest saltworks are: I.C.I. Alkali (Australia) Pty. Ltd. at Dry Creek, South Australia; Broken Hill Proprietary Co. Ltd. at Whyalla, South Australia; Central Queensland Salt Industries Ltd. near Port Alma, Queensland; Cheetham Salt Ltd. at Laverton, Lara and Geelong in Victoria; and Garrick Agnew Pty. Ltd. near Port Gregory, Western Australia. The State of South Australia usually accounts for more than two-thirds of the national production. In 1962 South Australia produced 396,000 tons of salt.

No details concerning consumption of salt are available. Official estimates of apparent consumption for the 3 years 1960–62 were 471,900, 468,300 and 475,700 tons, respectively. Recorded consumption in metric tons by the two principal industries for recent fiscal years (July 1 to June 30) are given:

	1959–60	*1960–61*
Industrial chemicals	278,157	272,676
Salt refining	149,569	162,961

MINERAL FUELS

The role of mineral fuels in the national energy pattern of Australia is summarized in annual reports of the Joint Coal Board. For recent fiscal periods, July 1 to June 30, consumption of energy from various sources and percentage of total has been as follows:

	1960–61		1961–62		1962–63	
	Thousand metric tons SCE [1]	Percent	Thousand metric tons SCE [1]	Percent	Thousand metric tons SCE [1]	Percent
Black coal	19,063	42.7	18,909	41.3	18,948	39.3
Lignite	5,453	12.2	5,851	12.8	6,114	12.7
Petroleum products	16,914	37.9	17,689	38.7	19,142	39.7
Firewood	1,030	2.3	977	2.1	894	1.9
Hydropower	2,173	4.9	2,312	5.1	3,110	6.4
Total	44,633	100.0	45,738	100.0	48,208	100.0

[1] Standard coal equivalent.

Coal.—*Black Coal.*[9]—For the fourth successive year, Australian production of black coal established a new record in 1963. While the bulk of the output, as usual, was from New South Wales, increases in South Australia and Queensland were primarily responsible for the national total passing the 25-million-ton milestone.

TABLE 7.—Black coal production distributed by type and State

(Thousand metric tons)

State	Bituminous			Subbituminous			Semianthracite		
	1961	1962	1963	1961	1962	1963	1961	1962	1963
New South Wales	19,326	19,335	19,245						
Queensland	2,693	2,691	3,126	76	84	110	58	69	60
South Australia				1,133	1,414	1,536			
Tasmania	258	275	208				2	2	3
Victoria	67	58	52						
Western Australia				778	934	915			
Total	22,344	22,359	22,631	1,987	2,432	2,561	60	71	63

According to 1962 lists published by the Bureau of Mineral Resources, there were 19 companies in Queensland, each producing more than 50,000 tons per year; 10 companies in New South Wales, each producing more than 400,000 tons per year; 6 companies in Tasmania, 2 companies in Western Australia, and 1 company each in South Australia and Victoria. The total tonnage of coal mined by opencut methods was 3.2 million tons in 1962, compared with 2.9 million in 1961. Productivity in the principal producing States for these 2 years was:

State	Production per man-shift [1] (Long tons)			
	Underground mines		Opencut mines	
	1961	1962	1961	1962
New South Wales	6.23	6.57	22.99	22.42
Queensland	3.46	3.57	11.43	10.42
South Australia			14.91	19.78
Western Australia	4.0	4.35	9.63	10.32

[1] On the basis of all employees.

[9] Includes bituminous, semianthracite, and subbituminous varieties.

Estimates of Australian black coal reserves summarized in the Report of the Coal Utilization Research Advisory Committee, published by Bureau of Mineral Resources in 1962, were:

State	Quantity (million long tons)		State	Quantity (million long tons)	
	Measured and indicated	Inferred		Measured and indicated	Inferred
New South Wales	3,050	10,000+	Victoria	20	10
Queensland	950	10,000+	Western Australia	274	1,600
South Australia	130				
Tasmania	Small	137	Total	4,424	22,000+

Domestic consumption of black coal has increased only slightly in the past 4 years. Distribution of black coal consumed in the 1961–62 and 1962–63 fiscal years was:

Consumer	Consumption (thousand metric tons)		Consumer	Consumption (thousand metric tons)	
	1961–62	1962–63		1961–62	1962–63
Iron and steel	5,221	5,259	Ships bunkers	128	119
Electricity	7,609	7,935	Other	2,699	2,684
Railways	1,680	1,567			
Town gas	1,626	1,486	Total domestic consumption	20,138	20,260
Cement	869	867			
Metallurgical coke	306	343			

Exports of black coal in 1963 were about 3.2 million tons of which 2.7 million was from New South Wales, largely from the Southern field. A number of new contracts to supply coking coal were recently negotiated with Japan. The contracts, which involve four companies, call for a total of more than 1 million tons annually for 3 years to be supplied from the South Coast area of New South Wales. The announced estimates of Japanese total requirements for 10 million metric tons of coking coal in the financial year beginning April 1, 1964, anticipate 3.9 million tons from Australia. Filling this order should raise Australian coal exports to new records in 1964.

Early in 1964 the Queensland Government announced that investigating companies had established reserves of 1 billion tons of coking and steaming coal in the Blackwater-Nebo coalfield of Central Queensland.

Coke.—Production of metallurgical coke was at a record level of 2.9 million metric tons in 1963, thus continuing the increase that throughout recent years has been the trend of iron and steel. According to 1962–63 data, 26 percent of all black coal produced in Australia has been used by the iron and steel industry, mainly for production of metallurgical coke. A relatively small quantity of coal, 343,000 tons in 1962–63, is used to make metallurgical coke for iron foundries, nonferrous metal smelters and other consumers.

The steel industry's coke making installation include the Port Kembla works of Australian Iron and Steel Co. Ltd. rated at 2.5 million metric tons carbonizing capacity and the Broken Hill Proprietary plant at Newcastle rated 1.7 million tons. In 1962 these plants produced 1,817,000 and 1,047,000 metric tons of coke, respectively. Byproducts included tar, motor benzol, toluol, naphtha, ammonium sulphate, ammonia, and pyridine. In contrast to previous years when up to 100,000 tons of Australian-made coke was available for export in 1963 all but about 30,000 tons was used domestically.

Metallurgical coke for industries other than steel was made in beehive ovens by four companies in the Southern coalfield and ore in the Northern coalfield of New South Wales. In Queensland, beehive coke oven plants are operated by the State Coalworks at Bowen and Haighmoor. The Queensland plants produced 11,000 metric tons in 1961, and 17,270 in 1962.

Consumption of beehive metallurgical coke by Australia's nonferrous smelters has been estimated by the Coal Utilization Research Advisory Committee 118,000 metric tons in 1962 and 131,000 tons in 1963. The iron foundry industry, numbering 400-odd establishments normally used over 100,000 tons per year.

Brown Coal.—Production and consumption of brown coal (lignite) in Australia are approximately equal, since none is exported. The only production is from southern Victoria, although small deposits are also found in South Australia. The value of brown coal produced in 1962 represented 80 percent of the total mineral production of the State of Victoria. The State Electricity Commission, operating open pits at Yallourn and Morwell in the Latrobe Valley, accounted in 1962 for 96.5 percent of the national production. Four private companies supplied the balance. To accommodate the expanding demand primarily for generation of electrical energy in Victoria, production of lignite has increased at an average rate of nearly 10 percent per year throughout the last decade. Completion of the Hazelwood power station, the first third of which is scheduled to begin in 1965, will call for an additional 13 million tons by 1971.

Reserves of brown coal, according to estimates in 1962 by the Coal Utilization Research Advisory Committee are impressive: 54.7 billion long tons measured and indicated, and 43.0 billion inferred.

While the great bulk of these reserves are in Victoria the figures include 530 million tons of measured and indicated reserves at Clinton and Inkerman-Balaklava in South Australia.

Relatively small quantities of brown coal are used for purposes other than power generation. In 1962 about 11 million tons was used directly for generation of electric power. More than half of the 4.5 million tons that went into manufacture of lignite briquets was also used in generation of power. The remainder was used for town gas, paper manufacture, and other industries.

Crude Petroleum.—Since the discovery strike at Moonie, Queensland, in December 1961, the Union-Kern-A.O.G. group [10] by the end of 1963 has drilled 17 wells of which all but 2 were potential producers. Developments throughout 1962 and 1963 have brought the field to

[10] Comprising Union Oil Development Corporation, Kern County Land Company, and Australian Oil and Gas Corporation Ltd.

production early in 1964. The 15 producers range from 5,817 to 6,918 feet in depth and drill stem tests total 16,561 barrels per day. Three of the wells produce from two zones. The wells have been connected by 3-inch pipe to the fully automated pump station that feeds 191 miles of 10-inch pipeline to carry 7,000- to 10,000-barrels-per-day to refineries at Brisbane. The initial production rate is small by world standards and will furnish less than 5 percent of Australia's crude petroleum requirement.

In retrospect, the discovery of oil in Australia has taken 70 years and expenditure of over A£100 million. The Australian Government assistance has totaled about A£14 million.

The success at Moonie appears to have stimulated nationwide interest in the search for oil and gas. In December 1963 more than 130 companies, syndicates, or individuals held petroleum exploration authorizations to almost 2.7 million square miles. All of Queensland including its offshore areas and most of the land and coastal areas of New South Wales, Victoria, South Australia, and Western Australia have been taken up. At the end of 1962 about 50 geophysical parties were in the field. Well footage drilled in 1962 and 1963 was 150,000 feet more than the total footage of the previous 10 years:

	Feet
1952–61, inclusive	920,775
1962, 70 wells completed	408,511
1963, 128 well completed	662,707

Nearly two-thirds of the 1963 drilling activity—82 holes totaling 405,237—was in Queensland although some drilling was done in all states and territories except Tasmania. Of the 16 wells successfully completed during the year as commercial or potential producers, all were in Queensland, 7 were gas wells and 9 were oil wells.

Petroleum Refinery Products.—Demand for petroluem products has increased at an annual rate of nearly 8 percent in the past decade. To meet this, the refining industry, based on crude petroleum imported mostly from Kuwait, Indonesia, and Saudi Arabia has likewise grown at a rapid rate. Capital investment in marketing and refining facilities was estimated at A£472.7 million to June 1963, an increase of 14.5 percent over the previous year. In 1962 and 1963, domestic refineries supplied nearly 90 percent of the Australian requirement for petroleum products, compared with about 17 percent in 1952. With the added output of the new Amoco Australia Pty, Ltd. and Ampol Petroleum Ltd., refineries near Brisbane, Queensland, and the BP Australia Ltd. refinery at Crib Point near Melbourne, Victoria, domestic production is expected to meet Australian demand for almost all petroleum products.

TABLE 8.—Crude distillation capacity of refineries as of December 31, 1963

Company and location:	*Capacity (thousand metric tons per year)*
Australian Oil Refining Pty. Ltd.: Kurnell, New South Wales	4,470
Australian Lubricating Oil Refinery Ltd.: Kurnell, New South Wales	[1] 142
Boral Ltd.:	
Matraville, New South Wales	914
Hamilton, Queensland	102
BP Refinery (Kwinana) Pty. Ltd.: Kwinana, Western Australia	4,044
Petroleum Refineries (Australia) Pty. Ltd.:	
Altona, Victoria	2,520
Adelaide, South Australia	1,707
Shell Refining (Australia) Pty. Ltd.:	
Geelong, Victoria	2,540
Clyde, New South Wales	996

[1] Capacity for finished lubricants.

The Mineral Industry of the Fiji Islands

By J. M. West [1]

THE BRITISH Crown Colony of Fiji produced relatively small quantities of several metals in 1963.

Gold and silver, although less significant than sugar and copra, were important to the economy, contributing about 95 percent of the US$4 million mineral output value in 1963. Other products of minor importance included manganese, iron, and copper ores. Mining and quarrying operations employed about 2,200 persons in 1963.

The Government through its Mines Division and Geological Survey encouraged prospecting and mineral development. The agencies had explored the Sigatoka sand dune area in 1962 outlining an estimated 2 million tons of magnetite in sand. Low-grade lateritic bauxite deposits in the Wainumu Bay-Sarowaqa River district of Vanua Levu were also studied but their potential appeared limited. Bauxite prospecting rights covering more than 100 square miles of the district were held by a subsidiary of Aluminum Co. of Canada Ltd. Banno Bros. of Japan was exploring the Udu mine, a base metal sulfide deposit in the Nukudamu area of Vanua Levu. Reports indicated a sizable copper-zinc orebody had been found.

PRODUCTION

The only mining operation of any size in the islands was the Emperor mine, owned by Emperor Gold Mining Co., Ltd., and located on the edge of a caldera in the Vatukoula goldfield. During 1963 the mine's gold output rose 23 percent and silver rose 20 percent compared with 1962. Elsewhere small tonnages of iron ore were mined in the form of magnetite boulders. A little copper ore was produced from sulfide deposits at Wainivesi, Viti Levu, and manganese ore was mined from diminishing deposits.

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[1] Physical scientist, Division of International Activities.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Copper ore, 10 percent copper	183	98	152	130	30
Gold—troy ounces	72,565	72,203	83,417	87,354	107,262
Iron ore, 55 to 60 percent iron—thousand tons	12	24	10	6	1
Manganese ore, 40 to 50 percent MnO_2	13,214	11,860	3,510	1,090	3,285
Silver—troy ounces	23,652	31,319	37,712	38,935	46,870
Nonmetals:					
Lime	4,750	2,898	3,542	2,592	5,438

TRADE

Gold and silver mill products were shipped to Australia for refining and metal ores to Japan. Mineral imports included petroleum, cement, and steel products. In 1962 about 1 million barrels of petroleum products was imported, largely from Indonesia, Australia, and Singapore. About one-fourth of this was jet fuel. Bunker loadings in 1962 totaled 441,000 barrels including 281,000 barrels of jet fuel. Completion of a new airport at the capital city of Suva and increasing tourist travel was pushing petroleum consumption upward.

COMMODITY REVIEW

Gold and Silver.—During the year Emperor Gold Mining Co., Ltd., continued efforts to operate on a larger scale to overcome a cost-price squeeze. The Government had subsidized mining to the extent of US$5.10 per fine ounce until mid-1961. Mill improvements were made in 1963 which raised gold recovery by several percent. The outlook for reserves was better following new geologic interpretation of the form and extent of mineral deposition. The mine had produced about 2 million ounces of gold and silver through 1963. Eighty percent of the gold value was in telluride-type ore, and the mill used the cyanide process to recover an estimated 91 percent of the gold content of the ore. In 1962 the average mill head was 0.443 ounce gold per ton of ore. A lower average was expected in 1963 as large tonnages of low-grade open-cut ore were being fed to the mill during the year.

The Mineral Industry of New Caledonia

By J. M. West [1]

NICKEL ores and products comprised New Caledonia's most important exports in 1963, amounting to US$44.4 million of a total US$50 million. The country's economy was almost completely dependent on the nickel industry that was dominated by the French company Société Le Nickel. The company operated the mines on the island and a large nickel smelter in the capital city of Noumea. Small quantities of iron ore and chromite also contributed to the country's income. France was the principal trading partner and had the advantage of duty-free exchange of trade goods. Purchases of U.S. mining equipment were below normal in 1963. Mining activities and statistics were reported in the annual statement published by the New Caledonia Service Des Mines.

PRODUCTION

In 1963, output of nickel ore was about one-third higher and production of nickel metallurgical products, matte and ferronickel, nearly 50 percent more than in 1962. Iron ore production remained about the same as in 1962. No chromite mining was reported in1963.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Chromite (51 to 53 percent chromium oxide)	43,965	39,160	36,662	15,455	----------
Iron ore (55 to 56 percent iron)--thousand tons	287	276	277	303	299
Nickel:					
Ore [1] (3.0 to 3.1 percent nickel)--------do	1,381	2,274	2,310	1,458	1,931
Metal in ore	32,800	53,500	53,300	34,000	44,500
Metallurgical products: [2]					
Ferronickel (nickel-cobalt content)	4,921	11,440	13,367	5,506	8,332
Matte (nickel-cobalt content)	6,945	10,429	12,034	9,858	14,146
Total (nickel-cobalt content)	11,866	21,869	25,401	15,364	22,478
Nonmetals:					
Giobertite [3]	3,017	----------	----------	1,176	12

[1] Mine-run ore about ¼ water; nickel content by dry analysis.
[2] Ferronickel grading 24 to 28 percent nickel-cobalt, mattes about 77 percent nickel-cobalt.
[3] Magnesian mineral used for refractories.

Source: Mines Service of New Caledonia.

[1] Physical scientist, Division of International Activities.

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TRADE

Five mineral products, nickel ore, ferronickel (four grades), nickel matte, iron ore, and chromite, were exported in 1963, accounting for over 95 percent of New Caledonia's total value of exports. As in previous years, France was the principal destination of the metallurgical products. Japan as usual purchased nickel ore and for the first time also bought relatively large quantities of nickel matte and ferronickel. Australia and the United States took small tonnages of ferronickel. All iron ore went to Australia, and chromite, shipped from stocks, went mostly to France.

Imports consisted of petroleum products, coal, coke, cement, limestone, and gypsum; most of these going to Noumea and the nickel smelting operations. Total value of mineral products imported in 1963 was about US$6.5 million. About half of the value of mineral imports was in coal and coke from Australia. An estimated 30,000 tons of gypsum was imported from Mexico.

TABLE 2.—Exports of metals and minerals

(Metric tons)

Commodity	1962	1963	Principal destinations, 1963
Chromite	15,009	17,955	Mainly to France.
Iron ore	282,202	294,148	All to Australia.
Nickel:			
Ore	596,008	639,913	All to Japan.
Metallurgical products: [1]			
Ferronickel:			
Electric grade (25.1 percent nickel-cobalt).	1,219	1,704	Mainly to France and Japan.
Sulfur extracted (24.5 percent nickel-cobalt).	203	552	
Refined (26.3 percent nickel-cobalt).	42	141	
Overrefined (27.5 percent nickel-cobalt).	3,677	5,759	
Matte:			
Nickel, iron extracted (79 percent nickel-cobalt).	9,025	14,129	
Cobalt [2] (65 percent nickel-cobalt).	90	----------	

[1] Data in terms of contained nickel plus cobalt.
[2] Matte exceeding 2 percent in cobalt.

Source: Mines Service of New Caledonia.

COMMODITY REVIEW

Iron Ore.—Mines at the extreme southern end of New Caledonia produced iron ore averaging 55.8 percent iron in 1963 for export to the Broken Hill Proprietary Co. Ltd., steelworks in Australia. Extraction, started in 1955–56, was at a consistent level of about 300,000 tons annually.

Nickel and Cobalt.—Nickel ore containing 2.8 to 3.5 percent nickel and about 0.02 percent cobalt on a dry basis was mined by some 15 companies. Over half was mined by the French firm, Société Le Nickel (SLN), which also operated a metallurgical plant at Noumea (Doniambo plant) on the southeast coast. Ore output was higher than in 1962 but fell short of the record set in 1961. Ores came from 15 or

more districts, the most important being Thio, on the northeast coast, where SLN operated the Plateau and Bornet group mines. Sizable outputs also came from the Poya, Kouaoua, Ouaco, Tontouta, and Houailou districts. About one-third of the ore mined in 1963 was exported to Japan; the rest went to Noumea for smelting. Exported ores were mainly from the Tomo mines, Tantouta district, and from SLN's Plateau mines.

Maintaining the grade of exports was a special problem, partly due to the 25-percent moisture content of the ore. The refusal point for ore landed in Japan had been 3.0 percent nickel. Because of the clayey ore's moisture pickup in shipment, however, it was necessary to supply a somewhat higher grade, about 3.2 percent nickel. Selective mining to achieve such grade was prematurely depleting reserves. Considering this and generally declining grades in most mines, the Japanese lowered the refusal point to 2.80 percent nickel plus cobalt (dry basis) in their purchase contracts for 1962–63. An f.o.b. price of 50 cents per kilogram (about US$0.23 per pound) of contained nickel plus cobalt was continued for ore assaying 3.20 percent, with differentials applied to higher or lower grades.

SLN's Noumea smelter produced matte containing 77 percent nickel and 23 percent sulfur, and ferronickel in grades ranging 24 to 28 percent nickel. Output was nearly 50 percent higher in 1963 than in 1962 as two new furnaces were fired up. Plant operations had been slowed during 1962 by changes in the matte smelting section involving replacement of four water jacket furnaces with two 20-ton Bessemer converters. An oxygen plant of 150-cubic-meter-per-hour capacity supplied the converters. The company generated its own power with a hydroelectric plant and two thermal plants having capacities of 68,000, 25,000, and 4,000 kilowatts, respectively. Australian coal was imported and converted to coke for smelting. Most nickel matte went to the SLN plant in Havre, France, for reduction to nickel metal. In 1963, however, 4,135 tons of matte was exported to Japan. Most ferronickel also went to France in 1963, except for 1,543 tons exported to Japan, 712 tons to Australia, and 34 tons to the United States. Cobalt was recovered from matte shipped to France.

Others.—A few tons of a magnesian mineral, giobertite, used as a refractory material in nickel smelting was the only other mineral produced in New Caledonia in 1963. Chromite mining stopped at the end of 1962 but shipments continued from stocks, all exported to France. The United States had been a principal buyer of New Caledonian chromite until prices became too high owing to increased mining costs. Tiebaghi, on the northwest coast, was the chief deposit area.

The Mineral Industry of New Zealand

By Lester G. Morrell [1]

THE SMALL mineral industry is basically coal mining and production of construction and chemical nonmetallic minerals. Production of gold and other metallic ores has declined to virtual insignificance, although recent studies of the iron-producing potential of beach sands are encouraging.

The Dominion of New Zealand, comprising the main North and South Islands and adjacent smaller islands, lies about 1,200 miles southeast of Australia. Smallest of the Dominions, its total area of 104,000 square miles is approximately equal to the American State of Colorado. Population, in 1963 was estimated at 2.57 million, including 184,000 native Maoris.

The record NZ£20.3 [2] million value of mineral production in 1963 represents an increase of 10 percent from 1962. The value of New Zealand mineral output has approximately doubled in each decade since 1940. Nonmetals have accounted for more than half of the total value of minerals produced since the early 1950's. The category relationship and total value of minerals produced in selected recent years is as follows:

Year:	*Metals*	*Nonmetals,[1] percent*	*Fuels*	*Total value, millions [1]*	
1950	10.8	22.5	66.7	NZ£9.38	US$26.07
1955	2.3	54.8	42.9	15.85	44.07
1960	2.2	55.2	42.6	19.90	55.33
1961	1.8	56.6	41.6	19.80	55.07
1962	1.5	59.7	38.8	18.44	51.28
1963	1.0	59.4	39.6	20.33	56.53

[1] Exclusive of cement and manufactured fertilizers.

The industrial economy of New Zealand is dominated by agriculture, which accounted for 47 percent of the total NZ£749 million value of New Zealand products, compared with 35 percent for manufacturing and less than 3 percent for mineral industries. In 1963 the minerals industry contributed about 1.4 percent of the gross national product. Employment by mining and quarrying industries in 1963 totaled 7,866 or less than 1 percent of the national labor force, which in that year was estimated at 939,000. Employment during 1961–63 was distributed to the following commodity categories:

	1961	*1962*	*1963*
Metals, including gold	157	127	117
Nonmetals	3,791	3,927	3,977
Coal	4,044	3,852	3,660
Petroleum	147	153	112
Total	8,139	8,059	7,866

[1] North America-South Pacific specialist, Division of International Activities, Bureau of Mines.

[2] NZ£1 = US$2.78.

GOVERNMENT POLICIES AND PROGRAMS

Although the Central Government owns and operates most of the coal production facilities, control of New Zealand mineral industries is predominantly by private owners. For many years the Government has encouraged minerals development and fostered education in minerals sciences. The Mines Department and Geological Survey have rendered technical and research assistance. Financial aid furnished as subsidies, grants, and loans to the mining industry has been more than NZ£70,000 since 1949.

Interest in prospecting and investing in mineral projects is reflected in the record of 293 mineral rights granted in 1963. This included 23 claim grants, 141 prospecting licenses, 64 mineral licenses, 28 water rights, and 37 mining privileges of other types.

Minerals legislation has been related mainly to health and safety and conservation. The early mineral land rights were granted under laws similar to the California formula of claims. More recently, concession systems, particularly to accommodate the needs of petroleum prospecting, have been adopted. Basic laws include the Coal Mines Act of 1925, the Mining Act of 1926, the Petroleum Act of 1937, and the Quarries Act of 1944. Numerous modifications have been added. In 1962 and 1963 amendments provided for controlling mining in national parks and other reserved areas. New regulations were applied to qualifications for coal mine surveyors and for using electricity underground.

The major mineral developments of 1962–63 related to new industrial projects:

An integral part of a vast Australian plan of Commonwealth Aluminium Corp., Pty., Ltd., (COMALCO) was a 1960 agreement with the New Zealand Government. This called for harnessing the hydroelectric energy of Lake Manapouri, near the southern end of South Island, and reducing about 90,000 tons of aluminum annually in a plant to be built at Bluff, 17 miles south of Invercargill.

A comprehensive Government-sponsored development program formulated by the New Zealand Steel Investigating Committee plans to establish an integrated 150,000-metric-tons-per-year steel industry based on electric smelting of titaniferous beach sands by early 1967. The black sand resource found on the west coast of both North and South Islands is believed adequate to supply New Zealand steel needs for more than 50 years.

The country's first petroleum refinery, costing NZ£10 million is scheduled to open in May 1964 at Marsden Point, near Whangarei. It will produce 90 percent of the domestic requirement for petroleum products from imported crude. Initial throughput capacity is expected to be 35 million barrels per year.

SOURCE MATERIAL

Production statistics and progress data have been taken from the mines statement for the year ended December 31, 1963, and previous annual reports of this series. Trade data are from the Statistical Report on the External Trade of New Zealand, compiled and published by the Customs Department, Wellington.

PRODUCTION

The high-record value of minerals production in 1963 was achieved largely as a result of economic conditions favorable to the coal-mining industry. Coal output in 1963 was 7.5 percent higher than in 1962 but below the levels of many previous years. Among the 34 mineral commodities produced in 1963, increases were recorded for 20—largest gains being cement, manufactured fertilizers, and silica sand. Production of 11 commodities, including gold and silver, asbestos, structural types of clay, pumice, and coke declined in 1963.

TABLE 1.—Production of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1959	1960	1961	1962	1963
Metals:					
Copper ore, gross weight				104	234
Gold, troy ounces	36,758	33,326	28,294	21,742	14,206
Iron ore, gross weight	1,529	2,031	1,773	1,525	3,123
Silver, troy ounces	4,873	1,353	805	416	286
Tungston ore, gross weight	9	9	5	8	5
Nonmetals:					
Asbestos	581	289	338	415	398
Bentonite	2,183	2,200	1,688	1,512	1,687
Cement	562,000	616,564	651,085	631,000	722,000
Clay:					
Pottery, etc	6,791	6,140	4,703	7,335	7,837
Structural types	284,482	338,083	418,183	321,214	293,859
Diatomite	7,395	6,343	3,593	1,904	1,629
Dolomite	3,216	3,444	3,607	5,840	4,457
Fertilizers, manufactured superphosphate	1,007	1,224	1,306	1,249	1,480
Kauri gum	(1)	[2] 145	(1)	[2] 44	[2] 44
Limestone:					
Agricultural and industrial, thousand tons	1,065	946	960	901	929
For cement, do	1,130	1,108	1,232	1,111	1,206
Magnesite		808	590	645	794
Perlite	384	354	393	393	573
Pumice	28,851	44,637	33,237	33,044	16,873
Salt	20,626	17,293	5,098	9,043	11,177
Sand, rock and gravel, thousand tons	13,763	16,383	15,988	18,394	20,071
Serpentine, do	109	144	159	142	167
Silica (glass) sand	47,386	63,540	56,122	63,318	128,313
Stone, dimension	10,132	28,614	16,388	16,270	12,681
Mineral fuels:					
Coal:					
Anthracite, thousand tons	2	1	([3])	1	([3])
Bituminous, do	852	812	769	711	671
Subbituminous, do	1,828	2,084	2,044	1,728	1,951
Lignite, do	173	163	159	151	164
Total, do	2,855	3,060	2,972	2,591	2,786
Coke:					
High-temperature, thousand tons	6	6	6	6	6
Low-temperature, do	78	73	78	88	78
Fuel briquets, do	16	15	15	12	13
Natural gas, million cubic feet	5.5	5.3	5.1	4.1	4.6
Condensate, thousand 42-gallon barrels				3.3	3.5
Petroleum, crude, do	5.4	5.5	4.4	4.0	4.0

[1] Data not available.
[2] Estimate.
[3] Less than 300 tons.

TRADE

Minerals exports from New Zealand were limited to a few thousand ounces of gold to Australia, a small surplus of pumice also to Australia and supplies of semimanufactured and manufactured metal and mineral products to Fiji and other Pacific Islands.

Imported mineral fuels and processed or manufactured mineral products comprise about one-third of the nation's total imports as indicated by the following values of mineral product categories for the 1960–63 period.

Category:	*Value in millions*			
	1960	*1961*	*1962*	*1963*
Mineral fuels	NZ£ 20.7	NZ£ 21.6	NZ£ 22.1	NZ£ 23.2
Chemicals and fertilizers	20.3	22.7	22.2	26.6
Metals and manufactures thereof	39.3	46.4	40.0	44.3
All other	172.9	197.6	160.1	202.2
Total imports	253.2	288.3	244.4	296.3

Nearly all of the mineral-product imports originated in Australia and the United Kingdom. Principal destination and source countries by commodities are indicated in the accompanying trade tables.

TABLE 2.—Exports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	1962 [1]	Principal destinations [2]
Metals:				
Copper scrap	1,882	1,309	377	Japan 541; United Kingdom 315 Australia 201.
Gold, refined troy ounces	25,947	24,056	5,900	All to Australia.
Iron and steel:				
Iron ore and concentrate	----------	241	119	Norway 225; United Kingdom 109; Japan 16.
Iron and steel scrap	56,121	15,218	2,814	Japan 13,589; Netherlands 3,041 West Germany 906.
Tungsten ore, scheelite	15	6	2	All to United Kingdom.
Nonmetals:				
Asbestos, crude	4	6	(3)	All to Singapore.
Cement	----------	3	(3)	All to Pitcairn Island.
Fertilizers: Superphosphates	100	77	(3)	Fiji 67; Samoa 10.
Gypsum	----------	2	(3)	All to Samoa.
Kauri gum	145	92	18	United Kingdom 40; West Germany 20.
Pumice	985	1,124	453	Australia 1,378; Fiji 159.
Mineral fuels:				
Coal	18,448	13,777	46	Japan 13,531; United Kingdom 34.
Coke	5	34	11	Fiji 22; Tonga 18.

[1] January through June.
[2] Principal destinations quantities apply to 1961 and January through June 1962 combined.
[3] Data not available.

TABLE 3.—Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1960	1961	1962 [1]	Principal sources [2]
Metals:				
Aluminum:				
Ingots, pigs, etc	677	2,119	1,798	Canada 3,192; United States 561.
Semifabricated	3,934	3,024	979	United Kingdom 2,701; United States 582.
Foil	582	818	419	United Kingdom 899; United States 119.
Pipes and tubes	200	219	67	United Kingdom 182; Australia 102.
Antimony, metal	93	165	75	Mainland China 130; U.S.S.R. 100.
Copper:				
Ingots, pigs	65	91	45	All from United Kingdom.
Semifabricated	2,988	3,534	1,589	United Kingdom 2,524; Australia 1,773.
Wire	3,758	3,634	1,875	United Kingdom 3,270; Australia 2,080.
Gold, refined troy ounces	6,187	5,256	3,741	Australia 8,487; United Kingdom 489.
Iron and steel:				
Pig iron	8,252	9,440	4,166	Australia 13,590.
Steel ingots	333	2,984	4,146	Australia 6,683; United Kingdom 276.
Ferroalloys	164	270	216	Republic of South Africa 305; United States 52.
Semifabricated	121,270	161,521	51,778	United Kingdom 108,562; Australia 57,780.
Lead, metal: Ingots, pigs, etc	4,406	5,289	2,460	Australia 7,690; United Kingdom 59.
Mercury 76-pound flasks	139	77	19	Spain 55; United Kingdom 30.
Nickel, metal	24	27	18	United Kingdom 40; Canada 4.
Platimum group troy ounces metals, refined.	2,067	2,884	990	United Kingdom 3,800.
Silver, refined do	82,776	41,672	50,004	Australia 64,260; United Kingdom 27,416.
Tin metal long tons	374	314	205	Malaya 474; United Kingdom 29.
Zinc:				
Ingots, slabs, etc	2,590	2,605	1,444	Australia 3,938; United Kingdom 70.
Plate, sheet, wire, dust	339	741	274	Australia 692; United Kingdom 248.
Nonmetals:				
Asbestos, crude	4,754	5,271	2,107	Republic of South Africa 2,086; Canada 1,194.
Barite	4,086	5,317	860	Australia 5,633; West Germany 478.
Cement, portland	3,268	3,857	1,370	United Kingdom 3,583; Denmark 733.
Clay:				
Ceramic and chemical types	2,827	2,785	1,004	United Kingdom 1,414; Australia 838.
Fire clay	44	113	16	United Kingdom 119.
Diatomaceous earth	1,570	1,523	1,195	United States 1,842; Australia 710.
Feldspar	793	568	388	Sweden 915; United Kingdom 52.
Fertilizer materials:				
Rock phosphate, crude	617,946	615,627	329,598	Nauru 634,959; French Oceania 164,720.
Basic slag	29,855	31,298	17,993	All from Belgium.
Other phosphates	2,613	8,083	4,884	France 7,077; French West Africa 4,594.
Ammonium nitrate	5,905	5,714	1,493	West Germany 2,815; Netherlands 2,277.
Ammonium sulfate	7,662	8,165	2,549	West Germany 4,891; Netherlands 3,037.
Other nitrates	1,348	3,327	2,825	West Germany 4,050; Japan 608.
Potassium chloride	92,108	132,671	54,704	United States 72,046; France 66,315.
Fuller's earth	108	264	76	United Kingdom 306; United States 34.
Gypsum:				
Crude	66,411	77,751	41,199	Australia 118,134; United Kingdom 778.
Plaster of paris	14,363	16,830	3,285	Australia 7,323; United Kingdom 6,579.
Magnesite	26	47	224	Australia 107; India 102.
Salt	45,067	54,098	22,366	United Kingdom 36,931; Australia 33,603.
Sulfur, crude	135,157	146,771	57,300	United States 168,025; Mexico 35,642.
Titanium dioxide pigment	3,560	3,631	1,732	United Kingdom 3,685; Japan 979.

See footnotes at end of table.

TABLE 3.—Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1960	1961	1962 [1]	Principal sources [2]
Mineral fuels:				
Coal	134	9,944	4,740	Australia 14,643; United Kingdom 41.
Coke	56	363	12	Australia 282; United Kingdom 93.
Bitumen, natural	836	329	49	Trinidad and Tobago 188; United Kingdom 184.
Petroleum, refined products:				
Gasoline thousand 42-gallon barrels	8,009	8,681	4,572	Singapore, Australia, Venezuela, India, United Kingdom, United States, and other countries. Quantity details not available.
Kerosine and jet fuels do	528	645	314	
Distillate fuel oil do	2,936	3,498	2,110	
Residual fuel oil do	1,920	1,646	954	
Lubricants do	317	329	205	
Asphalt do	336	454	357	
Other do	112	105	67	
Total do	14,158	15,358	8,579	

[1] January through June.
[2] Principal sources, quantities apply to 1961 and January through June 1962 combined.

COMMODITY REVIEW

METALS

Copper Ore.—The 30 or more known occurrences of copper ore in New Zealand are considered uneconomic. Nevertheless more than 6,000 metric tons of copper ores have been produced in past mining efforts. In the early 1950's about 1,200 tons of copper sulfide ore was shipped to Australia from the Pakotai Copper mine in North Auckland. In 1962 and 1963, oxide and carbonate copper ores from near Parakao, also in North Auckland, were surface mined and used locally as a fertilizer additive.

Gold.—From 1860 through 1963, gold production amounted to more than 28 million troy ounces. However, with exhaustion of reserves, output has steadily declined from the 1906 peak of 5.5 million ounces to less than 15,000 ounces in 1963. For the 3 years 1959–61, gold production by types of mining was as follows:

	Quantity troy ounces		
	1959	*1960*	*1961*
Vein mining	953	342	336
Alluvial workings	700	486	501
Dredges	35,105	32,498	27,457
Total	36,758	33,326	28,294

Most 1963 production came from the Kanieri Gold Dredging, Ltd., operation on the Taramakay River near Kumara in Westland, South Island. Dredging 4.2 million cubic yards yielded 12,477 ounces. The Clutha dredge on the Earnscleugh Flats, near Alexandra recovered 1,226 ounces from 85,000 cubic yards before this operation was suspended in March 1963. The Kanieri dredge was the only commercial-scale gold operation in New Zealand at the yearend. Private individuals, employed part time, accounted in 1963 for about 500 ounces from small-scale sluicing operations.

Iron Ore.—A small quantity of limonite iron ore is produced each year to supply the needs of this type material in gas purification, stock licks, and manufacturing bricks and cement. The sources are small deposits in North Auckland and one larger deposit at Onekaka, near Nelson, on the South Island. The Onekaka deposit was mined intermittently to feed a small blast furnace between 1922 and 1935. Reserves reportedly consist of about 9.5 million tons, ranging from 35 to 49 percent Fe content.

The accumulation of iron-rich beach sands on the west coast of both the North and the South Islands is the subject of extensive Government investigation. The Government-established New Zealand Steel Investigating Co. in March 1961 designated Battelle Memorial Institute (United States) to conduct the investigation. Recommendations made public early in 1963 [3] called for establishment of an iron and steel industry in the South Auckland area. The initial plant was to be completed late in 1966, having an annual capacity of about 150,000 tons with provision for expansion by 1973 to 270,000 tons. The resource base for the plan was a 1955 estimate by J. Luke of the New Zealand Geological Survey [4] totaling nearly 800 million tons of titanomagnetite and ilmenite type ores. The New Zealand Steel Investigating Co., Ltd., recommended reservation of the major iron-sands deposits by legislation.

Silver.—Most of the silver produced in past years in New Zealand has been a byproduct of gold from the vein mines of the Hauraki field near Thames, North Auckland. The recent meager output of silver has been contained in gold recovered by the gold-dredging operations.

Tungsten Ore.—The Glenorchy field, on Lake Wakatipu, South Island, has been the source of all scheelite ore produced in recent years. Fewer than a dozen miners were employed mining tungsten ore in 1962 and 1963. The ores are treated locally in a small State-owned mill; concentrates are exported, usually to the United Kingdom.

NONMETALS

Asbestos.—Until the operation was closed in December 1963, the only important domestic source of chrysotile asbestos was the Hume Industries (N.Z.) Ltd., quarry and works in the Upper Takaka Valley, on the northwestern peninsula of South Island. The fiber which occurs in serpentine is relatively short, is mined by opencut, and is milled on the site. The bulk of the output, amounting to a few hundred tons annually, has been used locally in manufacturing wallboard and asbestos cement products. The domestic production supplies but a small part (approximately 10 percent) of the total requirement for crude asbestos. The principal sources of imports are the Republic of South Africa and Canada.

Bentonite.—Most of the bentonite production has been from deposits worked by New Zealand Bentonite (Porangahau), Ltd., at Porangahau, about 60 miles south of Napier, on the North Island. In 1962

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[3] New Zealand Steel Investigating Co., Ltd., Report presented to Hon. J. R. Marshall, Minister of Industries and Commerce, Dec. 11, 1962. Government Printer, Wellington, New Zealand, 1963, pp. 50.

[4] Luke, J. Iron Ore Resources of New Zealand. New Zealand Geol. Survey Information Series Bull. 6, New Zealand Dept. of Sci. and Ind. Res., 1955, pp. 28.

and 1963 bentonite of a nonswelling type that could be beneficiated was being investigated in the Hororata-Coalgate area, 40 miles east of Christchurch.

Clays.—The clay-products industry, based on domestic clay deposits, according to 1960–61 data comprises 51 establishments with 1,800 employees. The industry is organized into two trade groups: New Zealand Heavy Clay Product Manufacturers Association, and New Zealand Pottery & Ceramic Manufacturers Association. Quarries and plants are widely scattered throughout both islands. The majority of these facilities produce structural clay products, such as building bricks, tile pipes, roofing tiles, and firebrick. The seven pottery-clay plants produce insulators, crockery, artware, and sanitary ware.

Cement.—Since 1956, the number of cement producers in New Zealand has doubled and demonstrated annual production capacity has increased from 451,000 metric tons to more than 720,000 tons. This expansion has not only met the needs of the recent high level of industrial growth but has virtually eliminated the need for imports. Less than 3,000 tons, mostly special type cements, were imported in 1963, compared with 175,000 yearly in the 1952–57 period. Production of locally quarried limestone, marl, and sand ingredients for cement has approximately paced the growing output of cement. The necessary supply of gypsum is not found in New Zealand and must be imported. Imports of 80,000 to 90,000 tons of crude gypsum in 1962 and 1963 came from Australian quarries. About half would be used in cement. According to 1960–61 data, the 6 cement plants employed 793 workers. Raw materials consumed in that fiscal period included 542,000 tons limestone; 613,000 tons clay, marl, and cement rock; and 26,000 tons of gypsum.

The New Zealand cement industry includes the following producers:

Golden Bay Cement Co., Ltd., Tarakohe, near Nelson, West Coast District, which produced 149,000 tons in 1963.

Milburn Lime & Cement Co., Ltd., having quarries at Makareao, Milburn, and Burnside, near Dunedin, Southern District.

New Zealand Cement Co., Ltd., Cape Foulwind, Westport, West Coast District, which produced 72,000 tons in 1963.

Southland Cement Co., Ltd., Clifden, 40 miles northwest of Invercargill, Southern District.

Waitomo Portland Cement Co., Ltd., limestone quarried by Beros Bros., Ltd., Tekuiti, South Auckland District.

Wilson (N.Z.) Portland Cement Co., Ltd., Quarries at Portland and Waro, near Whangarei, North Auckland District.

Diatomite.—Production of diatomite has fallen steadily from more than 7,000 tons annually in 1958–59 to less than 1,630 tons in 1963. The previous production was mostly from two deposits operated by J. Mathis and W. J. Strevens, respectively, at Hunua and Papakura near Auckland. The diatomite from these workings was used in manufacture of light concrete. Since 1961 the principal supplier has been Pozzolan Products, Ltd., near Rotorua. Small quantities have also been reported from quarries at Ngakuru and Foulden Hill, near Middlemarch, on the South Island.

Pumice.—Production of pumice in 1963 was approximately half the average output recorded in the previous 4 years. According to 1958

data, principal producers were Gilberd & Son, Ltd., at Wanganui, 100 miles north of Wellington and the New Zealand Pumice Co., Ltd., at Horotiu near Hamilton. Smaller production was reported by Warnock Bros. at Horotiu and by A. F. Nicholson at Aramoho at Wanganui. Pumice is the principal nonmetallic mineral export of New Zealand.

Salt.—Since 1952, salt has been produced by solar evaporation of sea water by the Dominion Salt Co., Ltd., at Lake Grassmere, on the easternmost point of South Island. Production is subject to weather conditions and therefore varies widely from year to year. This source normally supplies from one-fourth to one-half of the national salt requirement. The remainder of the supply is imported from United Kingdom and Australia.

Silica Sand.—According to 1960–61 data, 56 establishments employing 1,320 persons comprised the New Zealand glass and glass products industry. The mineral resource base of this industry is high-grade silica sand quarried at Parengarenga on the northern tip of North Island and at Mount Somers, near Christchurch on the east coast of South Island. At Parengarenga, three companies—N.Z. Glass Manufacturing Co., Ltd.; Gulf Freighters, Ltd.; and Parry Bros. Ltd., produced 52,200 tons in 1962. At Mount Somers; Crown Crystal Glass Pty., Ltd.; Newburn Coal and Minerals, Ltd., and two smaller producers accounted in 1962 for 11,100 tons.

MINERAL FUELS

Coal.—For many years, coal has been the most valuable domestic mineral product. Before 1954 its importance outweighed all other mineral products. In 1963 the value of coal produced accounted for two-fifths of the total. The Dominion Government owns and operates 90 of the 142 mines that reported production in 1963. Eight mines are controlled jointly by Government and private interests, and 44 are owned by private individuals and companies. In 1963, 55 percent of the production was from State-owned mines. Although there has been some migration of activity among coalfields, national output since 1950 has been quite steady, varying only between 2.5 and 3.1 million metric tons per year. The trend has been up in recent years; the peak was recorded in 1960. Geographically, the coalfields of New Zealand are widely distributed. The bulk of the national output consists of subbituminous-rank coal from the Waikato and Taranaki fields in the west-center of North Island. Most of the bituminous, including coking varieties, is found in Buller and Keefton coalfields near Greymouth and Westport on the northern end of South Island. A few hundred tons of anthracite are reported each year from a mine at Lake Coleridge, west of Christchurch. The lignite occurrences are widely scattered in the southern half of South Island. Quantities of coal produced in 1962 and 1963, compared with 1950, from each of the principal coalfields were:

Coalfield:	Quantity, thousand metric tons		
	1950	1962	1963
North Auckland	55	3	3
Waikato and Taranaki	940	1,257	1,426
Nelson	8	18	18
Buller	481	287	262
Reefton	111	107	110
Grey	519	423	405
Canterbury	30	19	18
Otago	177	122	135
Southland	391	355	409
Total	2,712	2,591	2,786

In 1959 the New Zealand Mines Department and Geological Survey compiled national reserve data, using classifications accepted by the U.S. Bureau of Mines and the Commonwealth Mineral Resources Survey.[5] These data are summarized in the following table:

Rank:	Reserve, thousand metric tons		
	Measured	Indicated	Inferred
Bituminous	41,540	38,060	52,100
Subbituminous	63,230	156,180	309,700
Lignite	15,950	43,790	405,200
Total	120,720	238,030	767,000

The long-term trend of coal production statistics has recorded a growing proportion of output from strip (opencast) mines, a decline in the total employees, and an increase in the output per man. These developments are indicated in the 5-year annual intervals compared with 1963 data as follows:

	1945	1950	1955	1960	1963
Strip mines:					
Output thousand tons	460	724	780	1,138	1,138
Employees	332	439	342	467	364
Tons per man-year	1,384	1,649	2,279	2,436	3,126
Underground mines:					
Output thousand tons	2,419	1,988	1,818	1,922	1,648
Employees	5,260	5,149	4,187	3,834	3,296
Tons per man-year	459	386	434	501	500
Total all mines:					
Output thousand tons	2,879	2,712	2,598	3,060	2,786
Employees	5,592	5,588	4,529	4,301	3,660
Tons per man-year	515	486	573	711	761

According to 1961 figures, the manufacturing industries accounted for one-third of the total domestic consumption of coal. Percentage distribution to principal consumers was as follows: Electric power generation, 21.0; household, 18.7; dairy establishments, 10.0; gasworks, 9.7; railroads, 7.5; cement works, 6.0; meat establishments, 5.3; pulp and paper mills, 4.4; miscellaneous manufacturing, 7.5; and all others, 9.9.

Coke and Briquets.—The public utility companies that supply gas to the cities of Auckland, Wellington, and Christchurch, as well as sev-

[5] Mines Department. Mines Statement, for the Year Ended December 31, 1959. Gov't. Printer, Wellington, New Zealand, 1960, p. 154.

eral smaller towns, are the source of the low-temperature coke produced in New Zealand. Hard, or high-temperature coke is produced only by Smokeless Fuel Co., Ltd., of Sockburn.

Coal briquets, locally termed carbonettes, are manufactured by Waikato Carbonisation, Ltd., at Rotowaro.

Petroleum.—Occurrences of petroleum are known in North Auckland, in various parts of Taranaki County, and over wide areas along the east coast of North Island, as well as in several South Island areas, notably the vicinity of the coal measures near Greymouth. The only appreciable commercial production has been from the wells of Egmont Oil Wells, Ltd., at Moturoa, near New Plymouth, on North Island. Annual production of 4,000 barrels of crude petroleum and 4 to 5 million cubic feet of natural gas has been recorded from the 4 test wells of the company. Production potential of this field, for an expected life of 25 to 30 years, has been estimated at 60 million cubic feet of natural gas per day, from which 4,500 barrels of oil and 35 million cubic feet of treated gas can be separated. Pipelines to carry oil to the shipping port at New Plymouth, and gas to the consuming centers on the North Island are being planned.

Activity in the search for petroleum throughout New Zealand continued at a high level during 1963. More than 300 petroleum prospecting licenses were in force, covering a total of 51,340 square miles. Four-fifths of the land area of North Island and one-fourth of South Island were held under concession to 25 individuals and companies.

The first oil refinery in New Zealand, at Marsden Point, adjacent to Whangarei Harbor, is scheduled to come on-stream early in 1964. The refinery has been designed to meet the requirements of New Zealand for petroleum products until 1967 when further expansion will be considered. Initial annual production capacity is for 1,170,000 metric tons of gasoline, 498,000 tons of diesel oil, 528,000 tons of fuel oil, and 122,000 tons of bitumen. Feedstock for the refinery will come from countries of the Middle East and South East Asia. Eventually indigenous oil such as the condensate or crude from New Plymouth will also be processed at Marsden Point.

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