

The Mineral Industry of Cuba

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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:

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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 tons³ (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 ₂ O 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 ₂ O 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 significant volume; they are small but not quantitatively 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	13,000	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	-----	-----	-----	-----
Natural naphtha..... do.....	2,990	108,000	80,000	90,000	72,000
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	1,023	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	12,440	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	Total-----	22,730
China-----	5,000		
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
Ferrous alloys-----	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 (51 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.

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—

	<i>Quantity (thousand barrels)</i>
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:					
Bucurano-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:					
Jatibonico-----	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:

		<i>Barrels</i>
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
Refinería Cabaiguán	Cabaiguán, Las Villas	2,500
Corporacion General de Petroleo	Jatibánico, 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.

