The Mineral Industry of Greece

By John D. Corrick [1]

Greece's strong economic growth in 1969 and 1970 continued through 1971. The Nation recorded a 7.6-percent increase in its gross national product (GNP). Substantial increases in invisible earnings (tourism), power generation, mining and construction, as well as an expansionary budget contributed to the growth. Greece's low birth rate helped the Nation avoid chronic unemployment and permitted the per capita GNP to grow from $378 in 1960 to $1,000 in 1971. Indications were that far-reaching structural reforms initiated by the Government were working. Improvements in the Greek mineral industry were evidenced by increased production of cement, ferronickel, aluminum, and the establishment of new mining facilities. The net industrial output, which expanded by 11.3 percent in 1969 and 10.9 percent in 1970, increased by more than 9 percent in 1971. Domestic prices remained relatively stable throughout 1971 as evidenced by the average consumer price index, which rose just over 3 percent. The Government's ability to control inflation was traceable, in part, to establishment of Greece's Price Control Committee in July 1971.

During 1971, the Greek Government authorized $102 million [2] in new foreign investments, $13.6 million came from the United States. However, many authorized projects failed to materialize. Notable among these were construction of a third refinery or expansion of existing refineries and construction of an aluminum smelter, both holdovers from the aborted Greek Government-Onassis agreement of 1970. Among other projects that failed to materialize although authorized by the Government were (1) a $200 million project by the Greek ship owner, Niarchos, which included a lubricating oil refinery and a possible steel mill, a dead-burned magnesite plant, and a refractory materials or magnesium metal plant; (2) a proposed $160 million petrochemical complex by the Greek ship owner, Vardinoyannis; and (3) an additional alumina plant utilizing extensive Greek reserves of bauxite.

PRODUCTION

Many segments of the Greek mineral industry made appreciable gains in 1971. Notable among these were increased production of alumina (49 percent), aluminum (33 percent), bauxite (35 percent), nickeliferous iron ore (34 percent), and zinc concentrates (46 percent). Decreased production occurred in chromium ores (6 percent), iron pyrites (23 percent), and manganese ore (7 percent). Significant increases in the production of nonmetal minerals were recorded in crude barite (34 percent), processed barite (83 percent), crude magnesite (20 percent), and dead-burned magnesite (22 percent), while decreases were recorded in production of caustic calcined magnesite (27 percent), crude perlite (5 percent), and pumice (11 percent). The development of new lignite fields to feed thermoelectric powerstations resulted in lignite production increasing 40 percent in 1971 over that of 1970.

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[1] Physical scientist, Division of Ferrous Metals.

[2] Where necessary, values have been converted from Greek Drachma (Dr) to U.S. dollars at a rate of G Drl = US$0.0333.

Table 1.—Greece: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1969	1970	1971 p
METALS			
Aluminum:			
Bauxite, gross weight—thousand tons	1,948	2,292	3,088
Alumina—do	287	313	467
Metal, primary	83,153	87,481	116,066
Chromium, chromite concentrates, gross weight	60,610	56,782	53,131
Iron and steel:			
Iron ore and concentrates	--	873	--
Pig iron and blast furnace ferroalloys [2]	290,000	300,000	291,633
Ferroalloys, electric furnace, ferronickel	18,473	NA	NA
Crude steel [2]	450,000	435,000	476,572
Steel semimanufactures [2]	450,000	400,000	719,721
Lead:			
Mine output, metal content	8,665	9,227	10,469
Smelter, primary (refined)	10,700	14,342	11,714
Manganese ore and concentrate, gross weight	6,464	6,590	6,127
Nickel:			
Mine output, metal content e	5,820	9,100	10,500
Metal, electrolytic	74	--	NA
Silver, smelter or refinery output—thousand troy ounces	258	420	462
Zinc, mine output, metal content	9,188	9,367	13,664
NONMETALS			
Abrasives, natural, emery	7,100	7,000	7,000
Barite, concentrates	83,141	54,091	98,865
Cement, hydraulic—thousand tons	4,840	4,900	5,546
Clays:			
Bentonite:			
Crude	206,861	192,941	--
Processed	2,979	10,542	--
Kaolin	61,405	48,274	53,966
Fertilizers, manufactured, gross weight:			
Nitrogenous—thousand tons	293	379	353
Phosphatic—do	648	617	642
Gypsum and anhydrite	271,654	308,553	330,000
Magnesite:			
Crude	570,725	755,176	902,708
Dead burned	168,518	219,366	267,382
Caustic calcined	51,114	57,338	42,019
Perlite, crude	148,616	168,508	160,614
Pumice	375,231	450,774	398,990
Pyrite:			
Gross weight	245,529	270,341	207,343
Sulfur content	114,000	117,600	93,140
Salt, all types—thousand tons	75	70	e 70
Stone, dimension, marble—cubic meters	57,000	59,000	62,000
Talc	6,074	2,744	1,855
MINERAL FUELS AND RELATED MATERIALS			
Coal, lignite—thousand tons	r6,735	7,858	10,975
Coke, gashouse—do	14	15	--
Fuel, briquets (lignite briquets)—do	90	81	88
Gas, manufactured—million cubic feet	343	388	388
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	4,420	4,947	5,542
Jet fuel—do	2,624	2,424	2,952
Kerosine—do	721	775	581
Distillate fuel oil—do	10,698	12,227	12,749
Residual fuel oil—do	10,643	11,668	12,940
Lubricants—do	126	119	112
Other—do	2,707	3,327	3,083
Refinery fuel and losses—do	1,731	1,503	1,504
Total—do	33,670	36,990	39,463

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

[1] In addition to the commodities listed cobalt and a variety of crude construction materials such as clays sand, and gravel, and stone, are produced but output is unreported and available information is inadequate to make reliable estimates of output levels. Cobalt production is as a byproduct of iron-nickel ore processing.

[2] Erroneously reported as tons rather than thousand tons in previous chapter.

TRADE

Greece's balance of payments deteriorated further in 1971. Growing demand for consumer and capital goods and higher petroleum costs pushed imports up 11 percent whereas exports grew only 3 percent. However, a sharp rise in invisible earnings (tourism) in 1971 helped offset the widening trade gap. Some metals for export, especially nickel, were withheld from the market because of a sharp drop in metal prices in world markets. Whereas exports of industrial products, chemicals, and textiles continued to grow at a fast rate. During 1970, exports of mineral commodities showing increases were lead ore and concentrate (18 percent), zinc ore and concentrate (26 percent), and magnesite (26 percent).

Large capital inflows, mostly supplier credits and private deposits, prompted a dramatic rise in 1971's foreign exchange reserves. At yearend, official assets of gold and convertible foreign exchange were at an all-time high of $503 million. The relationship between mineral trade and total commodity trade in recent years follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1968	90.0	467.8
1969	110.0	553.6
1970	184.3	642.5
Imports:		
1968	218.3	1,393.2
1969	270.9	1,594.2
1970	310.8	1,958.3

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

Commodity	1969	1970	Principal destinations, 1970
METALS			
Aluminum:			
Bauxite and concentrate thousand tons	1,309	1,235	U.S.S.R. 615; West Germany 181; France 87; Netherlands 83.
Oxide and hydroxide do	119	170	United States 62; Italy 38; Poland 38; Yugoslavia 23.
Metal, including alloys:			
Unwrought	67,670	60,012	Italy 20,673; Belgium-Luxembourg 19,780; France 11,845.
Semimanufactures	5,804	9,277	Italy 5,352; Yugoslavia 1,600; Portugal 467; Cyprus 289.
Chromite	25,862	24,976	West Germany 17,115; Norway 7,861.
Copper:			
Metal, including alloys:			
Scrap	NA	152	Spain 80.
Semimanufactures	1,479	1,493	France 658; West Germany 410; United States 137.
Iron and steel:			
Roasted pyrite	59,235	74,841	West Germany 41,397.
Steel, primary forms	59,338	19,147	Netherlands 8,308; United Kingdom 3,224.
Semimanufactures:			
Universals, plates, and sheets	123,471	131,936	Yugoslavia 94,856; Bulgaria 31,143; Romania 3,348.
Tubes, pipes, and fittings	2,058	1,980	Cyprus 1,132; Libya 416.
Lead, ore and concentrate	11,618	13,750	Italy 7,750; France 4,000; West Germany 2,000.
Manganese, ore and concentrate	5,017	4,004	West Germany 2,640.
Nickel, metal, including alloys, all forms	261	--	
Silver, metal, including alloys value, thousands	NA	$172	France $172.
Zinc, ore and concentrate	17,095	21,612	France 11,120; Italy 9,242.
Other, ash and residues containing nonferrous metals	1,831	2,333	Belgium-Luxembourg 1,646; Spain 415.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	214,251	237,734	United States 228,820.
Cement	618,302	371,165	Libya 270,266; Yugoslavia 35,278; Italy 32,226.
Clays and products:			
Crude clays, n.e.s	156,771	157,867	Canada 50,515; France 30,040; Nigeria 17,711; Libya 15,045.
Products:			
Refractory (including nonclay bricks)	NA	79	West Germany 64.
Nonrefractory	2,630	3,537	Cyprus 756; West Germany 448.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1969	1970	Principal destinations, 1970
NONMETALS—Continued			
Fertilizer materials, manufactured:			
Phosphatic	NA	43,601	Bulgaria 43,601.
Other	29,839	72,393	Italy 27,190; India 24,893; Bulgaria 16,871.
Magnesite	235,721	296,940	West Germany 90,970; United States 89,161; United Kingdom 36,920.
Stone, sand and gravel:			
Dimension stone, crude and partly worked	28,430	32,993	Italy 12,749; West Germany 10,495; Netherlands 5,269.
Sulfur, elemental	25,076	9,542	Arab Republic of Egypt 4,000; Romania 3,810.
Other nonmetals, crude	106,035	126,134	France 48,520; United Kingdom 30,881; West Germany 26,770.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline, including natural thousand 42-gallon barrels	166	152	Cyprus 142.
Kerosine and jet fuel do	971	1,233	Lebanon 535; Switzerland 164; Cyprus 138; United States 117.
Distillate fuel oil do	647	371	West Germany 189; Cyprus 137.
Residual fuel oil do	233	358	Cyprus 106; France 86; Italy 52.

NA Not available.

Table 3.—Greece: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1969	1970
METALS		
Aluminum metal, including alloys:		
Unwrought	1,053	454
Semimanufactures	2,539	1,817
Copper metal including alloys:		
Unwrought	9,931	11,791
Semimanufactures	454	556
Iron and steel:		
Ore and concentrate	471,084	552,732
Metal:		
Pig iron including cast iron	26,119	22,397
Ferroalloys	3,522	4,686
Steel, primary forms thousand tons	176	136
Semimanufactures:		
Bars, rods, angles, shapes, sections do	201	212
Universals, plates, and sheets do	122	130
Hoop and strip do	35	24
Rails and accessories do	1	4
Wire do	9	11
Tubes, pipes, fittings do	18	19
Castings and forgings do	1	2
Lead:		
Ore and concentrate	14,717	16,362
Oxides	217	165
Metal, including alloys:		
Unwrought	4,783	8,530
Semimanufactures	NA	121
Mercury 76-pound flasks	261	87
Nickel, metal, including alloys, all forms	47	63
Platinum-group metals and silver, including alloys:		
Platinum group value, thousands	$32	$67
Silver do	$533	$734
Tin, metal, including alloys, all forms long tons	195	197
Titanium oxides	3,183	3,565
Tungsten metal, including alloys, all forms value, thousands	$140	$213
Zinc, metal, including alloys:		
Unwrought	10,763	8,315
Semimanufactures	230	437
Other base metals, including alloys, all forms	56	48

See footnote at end of table.

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

Commodity		1969	1970
NONMETALS			
Abrasives, natural, n.e.s.: Grinding stones		239	321
Asbestos		11,614	17,811
Cement		1,159	1,334
Clays and products (including refractory brick):			
Crude, refractory		r34,259	54,350
Products:			
Refractory (including nonclay bricks)		24,540	55,654
Nonrefractory		4,044	6,429
Diatomite and other infusorial earths		1,343	1,051
Feldspar and fluorspar		2,498	3,498
Fertilizer materials:			
Crude phosphatic	thousand tons	319	179
Manufactured:			
Nitrogenous	do	115	74
Potassic	do	32	23
Other, including mixed	do	2	3
Ammonia	do	8	13
Magnesite		688	875
Pigments, mineral, including processed iron oxide		1,102	1,190
Pyrite (gross weight)		26,380	12,971
Salt and brines		47,483	57,959
Sodium and potassium compounds, n.e.s		21,780	14,505
Stone, sand and gravel:			
Dimension stone		114	1,074
Dolomite, chiefly refractory grade		1,686	862
Sand, excluding metal bearing		47,160	76,933
Sulfur:			
Elemental, all forms		144,792	43,986
Sulfuric acid, oleum		9,839	NA
Talc, steatite, soapstone and pyrophyllite		1,947	3,915
Other nonmetals, n.e.s.: Building materials of asphalt, asbestos and fiber, cement and unfired nonmetals, n.e.s		2,974	1,051
MINERAL FUELS AND RELATED MATERIALS			
Carbon black		1,987	1,851
Coal and coke, including briquets	thousand tons	370	448
Gas, hydrocarbon		20,632	13,481
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	33,991	36,989
Refinery products:			
Gasoline, including natural	do	613	786
Kerosine and jet fuel	do	65	686
Distillate fuel oil	do	2,523	2,140
Residual fuel oil	do	6,128	5,545
Lubricants	do	390	544
Other	do	258	253

rRevised. NA Not available.

COMMODITY REVIEW

METALS

Aluminum.—Bauxite mine operators continued extensive exploration and improvements to their mining facilities in order to provide increased supplies of ore for an expanding domestic alumina-aluminum industry. Production of bauxite in Greece increased from 2.3 million tons in 1970 to 3.1 million tons in 1971. The Greek Minister of National Economy announced in 1971 that recent prospecting of lands in Greece had proven large additional bauxite deposits which could easily support three aluminum smelters. The Eliopoulos Brothers group reportedly found a 100-million-ton reserve in its concession area. Officials of Parnassos Bauxite, S.A., a member of the Eliopoulos group, which produced approximately 60 percent of the domestic bauxite, stated that its output of bauxite could be raised 2 million tons within a 3-year period. Bauxite presently being mined by the company assays 57 to 59 percent Al_2O_3, 18 to 22 percent iron, 4 percent minimum SiO_2, and less than 1 percent calcium oxide. Parnassos obtained approval from the Greek Government to expand its operations. The project called for investment of $6.3 million to prospect for and mine bauxite in the unexplored areas of Parnassos and Ghiona and construct a concentrating plant in the area. The project would increase present bauxite output from 0.9 million tons per

year to 1.5 million tons per year in the first stage and to 2 million tons at a later date. Known Greek reserves of bauxite were estimated at 84 million tons with 100 million tons probable.

The Greek Ministry of Commerce lowered the bauxite export quota from 1.376 million tons in 1970 to 1.295 million tons in 1971. Export quotas for bauxite in 1971 by country of destination were European Economic Community (EEC)—420,000 tons; U.S.S.R.—450,000 tons; Great Britain—125,000 tons; United States—75,000 tons; Japan—20,000 tons; Czechoslovakia—50,000 tons; Sweden—55,000 tons; and Spain—60,000 tons.

Greece's alumina and aluminum output came from the St. Nicolas smelter of Aluminium de Grèce, S.A. (ADG). Early in 1971, the nominal capacity of the St. Nicolas smelter was increased to 150,000 tons. However, the recession in the aluminum market during 1971 made it necessary to defer the startup of some of the furnaces, thereby limiting the year's production to 116,000 tons. Production of alumina was 467,000 tons in 1971, against 313,000 tons in 1970.

Greek aluminum consumption in 1971 was estimated at 21,000 tons, approximately 8,000 tons less than the previous year. Reduced consumption was due to a heavy reduction in sales of fabricated products for export. Greek fabricators ran into unexpected difficulties when they tried to export their products. Viohalco Aluminum, S.A., was expanding the capacity of its aluminum semifabricating plant near Athens in order to raise output 5 tons per 8-hour shift.

The Greek Government announced in 1971 abandonment of the $600 million investment package deal, ratified early in 1970 with Aristotle Onassis, calling for establishment of a major integrated aluminum complex in Greece. Deputy Prime Minister Makerezos announced a compromise settlement whereby Onassis was to turn over to the Hellenic Industrial Development Bank (ETVA) his shares of "Omega" Industrial Investment Corp. worth approximately $1 million, and deliver to the Government feasibility reports made for Omega which were estimated to be worth $3 million. In exchange, the Government would release without prejudice Onassis' $7 million performance bond. At yearend the Government, divested of the Onassis agreement, was considering proposals from Aluminum Co. of America (Alcoa), Reynolds Metals Co., and Kaiser Aluminum and Chemical Corp. of the United States for establishment of an alumina-aluminum plant in Greece. Late in the year, the Greek Government and Alcoa announced agreement in principle. The agreement was expected to be concluded in the early part of 1972. The plant's initial annual capacity was estimated at 300,000 tons of alumina and 150,000 tons of aluminum. Construction costs were estimated at $300 million. Reliable sources reported Alcoa would obtain a favorable power rate, comparable to ADG's 4.375 mills per kilowatt hour. The proposed plant probably will be located between the ports of Galaxidi and Naupactus on the north coast of the Gulf of Corinth. In connection with the proposed plant, Alcoa reportedly was negotiating with Helicon Bauxite of the G. L. Barlos Co. for rights to their 45- to 50-million-ton reserve of bauxite.

Reynolds International's joint plans with Parnassos to invest $100 million in an alumina plant with an initial annual capacity of about 250,000 tons may be jeopardized by the Government's acceptance of Alcoa's plans. At yearend, the Reynolds plan was being evaluated by the Greek Government. Also being evaluated by the Government at yearend was a plan from the Niarchos group and Kaiser Aluminum and Chemical Corp. of the United States to establish a 60,000-ton-per-year aluminum plant in Greece. Establishment of a third smelter will depend on availability of Greek bauxite reserves.

Copper.—The Ermioni mines of the Hellenic Chemical Products and Fertilizer Co., part of the Podossakis group, reportedly were producing 50,000 tons of copper pyrite per year (3 percent copper). The ore was processed locally to make fertilizer and sulfuric acid. The copper was shipped to West Germany. A new mine was opened in 1971, approximately one-half mile from the main mine. Plans called for the mine to be 600 meters in length with branching galleries. The Ermioni mines are a relatively small operation. The lifespan of known reserves was estimated at 20 years. Test drilling was underway during the year to find additional copper. Péchiney reportedly was taking over exploitation of the Chalkidike Peninsula copper deposits from the Noranda group's Placer Development.

Iron and Steel.—Company officials of Hellenic Steel Co., Inc., announced that they had reached technical agreement with the Japanese firms, Nippon Kokan K. K. and C. Itoh Co., Ltd., for expansion of Hellenic's steelworks at Thessaloniki. The Japanese firms were to prepare a feasibility study for expansion of the works. Also discussed was an equity participation and arrangement whereby the Japanese would undertake international marketing of Hellenic's products. According to Hellenic officials, the tentative expansion was to be completed by 1975 at a cost of $150 million and would employ 1,500 people compared with 600 presently employed. The expansion plans were under consideration for approval by the Government at yearend.

The Greek Government authorized Anninos Vlassis to import steel and equipment worth $3.8 million for construction of new works at Platamon. Total cost of the project was estimated at $7 million. The plant's designed capacity will be 60,000 tons per year of merchant bars, of which 40 percent will be exported. The plant will process either scrap or sponge iron.

The Ministry of Industry also authorized establishment of two other small steel mills. One mill costing $5.8 million was to be at Stilis on the eastern coast of central Greece and would be operated by Metallourgiki Athinon S.A. A second $2 million steel mill was to be in the Patras area and would be operated by Patraiki Halyvourgia S.A. Both plants will have electric arc furnaces and will use scrap iron, pellets, and cinder as raw materials.

Halyvourgia Voriou (formerly Viohalco Sanitas, S.A.) started a three-strand continuous casting machine at its Salonica works in 1971. According to the company, this machine was part of their plan to increase raw steel capacity to 200,000 tons per year. A second 35- to 40-ton-per-day-capacity electric arc furnace was to be commissioned in December 1971.

The Government appointed a committee to examine the Greek steel industry. The committee was to review legislation relating to imports of steel products and submit recommendations on new incentives to stimulate future investments in the steel industry.

Nickel.—Nickel ore production in Greece increased 34 percent in 1971 over 1970. Production during the past 3 years had risen from 501,409 tons in 1969 to 882,693 tons in 1970 and 1,182,000 tons in 1971. The Société Minière et Métallurgique de Larymna S.A. (LARCO) smelter at Larymna produced ferronickel with a nickel content of 10,680 tons, compared with 8,642 tons in 1970. LARCO's exports of ferronickel, which totaled 7,210 tons nickel content in 1970, were nearly stopped in 1971 as a result of market conditions throughout the world. Nevertheless, LARCO continued its planned expansion program. In April, the company obtained Government approval to invest $16 million in its mines and processing plant at Larymna and mines at Psachna. Improvements to facilities at Psachna included installation of a 1.5 million ton ore grinding mill, a rotary kiln, and ore loading and port facilities. LARCO expected to increase annual production capacity to between 15,000 and 18,000 tons of nickel when these projects are completed. LARCO established a company, Mining of Northern Greece S.A., in April to engage in nickel prospecting and development. Moreover, LARCO concluded a cooperative agreement with Société Générale des Minerais (SGM) of Brussels for the sale of LARCO's ferronickel on world markets. The agreement called for the formation of a new company to be located in Brussels and capitalized equally by LARCO and SGM.

LARCO treated ore from the original mine at Agios Ioannis, 12 kilometers from Larymna, which was an underground operation yielding nickeliferous iron ore containing an average of 1.32 percent nickel. Future mine development was to be concentrated on the company's properties at Psachna on the Island of Euboea. Three hundred thousand tons of ore averaging 1.1 percent nickel were mined by open pit methods during 1970. Because of lower mining costs associated with open pit mining, the Psachna mines supplied the major tonnage of ore mined in 1971 with lesser amounts coming from the Agios Ioannis mine. LARCO's proven reserves of nickel-bearing laterite ore amounted to some 30 million tons, with an additional 40 million tons of probable ore.

Other significant nickel developments during 1971 included the reported decision of Elevsís Bauxite S.A. to exploit nickel laterite deposits on Euboea. Mineral research carried out by private interests and State agencies during 1971 proved deposits of nickeliferous ore at Kalabaka, Pella, and

on Euboea. Greek deposits of nickeliferous ore were estimated at 100 million tons. Intercontinental Mining and Abrasives Inc. (ICON) of New York, in a joint venture with the Australian company, Southland Mining Ltd., reportedly applied to the Ministry of Coordination for approval of a $30 to $50 million investment in nickel mining and manufacturing in Greece. Planned capacity of the nickel plant would be 10,000 tons of contained nickel as ferronickel. At yearend, ICON announced it had completed a preliminary agreement with Airco Alloys Carbide Co. for the construction of a ferronickel plant near Athens. This was the second of two proposed refineries by ICON. This plant was scheduled for completion by early 1974 with an expected annual production capacity of 6,000 tons of contained nickel. ICON held leases on nickel-bearing properties near the Yugoslavian border and was reportedly in the early exploration stages at this site. Preliminary findings indicated a potential for chrome, manganese, and other materials including nickel. ICON also reported locating nickel-bearing ore in an area west of Thessaloniki. Meanwhile, the Scalistiris group was reportedly proceeding with plans to establish a nickel plant in northern Euboea for the production of pure nickel metal through a chemical process. The cost of the proposed plant was estimated at $50 million with completion scheduled for 1975. The Scalistiris group conducted an exploratory search for nickel and claimed to have outlined 50 million tons in proven reserves, 80 million tons in probable reserves, and 200 million tons in possible reserves.

Uranium.—Following approval by the United Nations of an uranium exploration program for eastern Macedonia and Thrace, a joint work team of Greek and foreign geologists was established in April 1971 to carry out prospecting, surveying, and mapping. The team was to complete its work in 18 months. The project was expected to provide basic data related to the number, extent, and broad significance of uranium and other radioactive occurrences in this area and enable the Greek Government to plan its subsequent mineral development program.

NONMETALS

Asbestos.—Following an agreement in 1970 between the U.S. Cerro Corp. and the local firm Hellenic Asbestos Mining and Industrial Corp. to mine Greece's only known asbestos deposits at Zindanion near Kozani, northern Greece; a new corporation was formed, Asbestos Mines of Northern Greece Mining S.A. (MABEM). MABEM had $550,000 of capital and was controlled by Cerro (90 percent) and ETVA (10 percent). In March 1971, MABEM completed a pilot plant at a cost of approximately $550,000. The plant was built by Kilborn Engineering of Toronto, Canada, and had a designed capacity for treating 100 tons of ore per day. Samples of chrysotile fibers were sent to laboratories in Canada, England, and Belgium for testing. The tests were designed to determine the quality of the asbestos fibers and the production level at which the proposed mine could operate. If test results prove satisfactory, MABEM will put the Zindanion mines into commercial production and establish a fiber plant with an annual production capacity of 40,000 to 45,000 tons. Total cost of the plant was estimated at $16 to $17 million, with completion scheduled for 2½ years from the start of construction. Approximately one-half of the plant's output was to be consumed locally by manufacturers of asbestos-cement products. The remainder was to be shipped to Eastern Europe, Turkey, Lebanon, Syria, and the southwest Pacific. The Zindanion asbestos deposit was estimated to contain 50 million tons and with the exception of asbestos deposits near Milan, Italy, and an undeveloped low-grade deposit in Cyprus, the Zindanion mine was the only asbestos mine in the Mediterranean area.

Cement.—The Greek cement industry planned to increase in 1972 total annual production capacity of cement plants to 8 million tons. Titan Cement Co. commissioned a third unit at its cement plant at Elevsís in the fall of 1971. The new unit was estimated to have cost $8.3 million and had a production capacity of 450,000 tons per year. The new plant would increase the total annual production capacity to 1 million tons. During 1971, the company inaugurated a cement distribution station at Alexandroúpolis and had a second station under construction at Herákleion, Crete. The company also purchased two ships to facilitate transportation of its output. When the company's expansion program is completed, production is expected to reach 3 million tons per year.

In May 1971, Chalkis Cement Co., S.A. obtained Government approval for a $14.7 million expansion of its plant at Avlis, near Chalkis. The new unit to be completed in 1975 will raise the company's production capacity from the current 660,000 tons to 1.1 million tons per year. Equipment was to be supplied by French and West German firms.

The Hellenic Cement Co., formerly owned by Titan Cement Co. (55 percent) and the American Cement Corp. of the United States (45 percent), became all Greek-owned in March 1971 when Titan bought out American. Titan's development plans called for an investment of an additional $6 million for a second kiln. Halyps S.A. was planning a $1.7 million expansion and modernization of its plant at Skaramanga by 1973. The company was reportedly negotiating with a German firm for crushers.

Fertilizers and Fertilizer Materials.—Hellenic Chemical Products and Fertilizers Co., Ltd., contracted the construction of a new ammonium phosphate-based complex fertilizer plant to Coppee-Rust S.A. of Belgium. The new plant was to be built at Drapetsona, Piraeus, and cost $2 million. Production capacity was rated at 750 tons per day. Construction was to start in 1971 and was to be completed by the end of 1972. Fertilizers already produced in the Drapetsona complex include ammonium phosphate and sulfate, single superphosphate, and around 135,000 tons per year of complex fertilizers. A new 200,000-ton-per-year sulfuric acid plant was being constructed in the area by Krebs and was to be commissioned early in 1972.

Magnesite.—Increased world demand for magnesite, as well as the high quality of Greek magnesite, has resulted in important developments in this Greek industry over the past several years. Production of Greek magnesite showed no indications of slowing in 1971. Greece produced 902,708 tons of crude magnesite, 42,019 tons of caustic calcined magnesite, and 267,382 tons of dead-burned magnesite in 1971; the respective figures for 1970 were 755,176 tons, 57,338 tons, and 219,366 tons.

The Société Financière de Grèce, S.A. (SFG) (a Scalistiris group company), one of the largest producers of dead-burned magnesite in the world, with a yearly production of approximately 140,000 tons in 1970, reportedly produced 210,000 tons in 1971. The company operated two dressing plants and four rotary kilns on Euboea Island. An affiliated company, Macedonian Magnesite S.A. had under construction in Ormylia (Chalkidiki) a magnesite dressing plant with an annual capacity of 120,000 tons of dressed ore and a rotary kiln for dead-burned magnesite with an annual capacity of 40,000 tons. The company also had under construction at Mantoudi (Euboea) another rotary kiln with an annual capacity of 70,000 tons. Both kilns were expected to be producing magnesite by the middle of 1972. Total magnesite production by the Scalistiris group would then be 250,000 tons by 1972 and 320,000 tons by 1973. The company also had under construction a new plant for the production of refractory bricks and expected to have it operational by the middle of 1972. The plant was designed to produce 40,000 annual tons of fire-tar-impregnated and tar-bonded bricks of high quality for use in lining basic oxygen furnaces, cement kilns, and for vessels used in the glass industry.

An agreement between the Greek Pyrite Mining Co., Hellenic Chemical Products and Fertilizer Co., and D. P. Papastratis and Co. was expected to expand magnesite production on Euboea. Papastratis held rights to extensive magnesite deposits on the Island of Euboea through its subsidiary, Mining, Trading, and Manufacturing Ltd. The Papastratis group had supplied a high-quality caustic calcined magnesite suitable for production of fused magnesia refractories in the past; however, the company is presently expanding its production of dead-burned magnesite. As a result of the strong demand for refractory magnesite, Papastratis was constructing a rotary kiln capable of producing 50,000 tons per year of low-iron, dead-burned magnesite. A new dressing plant employing heavy media separation was to be built and mining operations were to be extended in order to provide suitable feed for the kiln.

Although magnesite production on the Island of Euboea had received a major portion of attention recently, the Chalkidiki Peninsula was still of considerable importance to the Greek magnesite mining industry. During 1971, the Grecian Magnesite Co. brought into operation a new 50,000-ton-per-year-capacity rotary kiln for production of dead-burned magnesite at its plant at Yerakini in the Chalkidiki area. The kiln was supplied by the West German company, Polysius A.G. A new grinding

and treatment plant also was commissioned during the year. Other companies producing calcined magnesite in Greece during the year were Magnomin S.A., a subsidiary of OEAMAG—the Austro-American Magnesite Co. and Macedonian Magnesite S.A., an affiliate of SFG.

MINERAL FUELS

Lignite and Peat.—Demand for lignite in Greece continued to increase in 1971. The increase was a direct result of increased electrification of the country, as 76 percent of the lignite consumed went for the production of electricity. Production of raw lignite in 1971 totaled 10,975,000 tons, a 40-percent increase over that of 1970. Principal reason for Greece being able to increase production of lignite was because the country's largest open pit lignite mine at Ptolemaís increased its production capacity from 2 million to 6 million annual tons in 1971. The increased production at Ptolemaís resulted from the installation of large continuous excavators and a high-capacity belt-conveyor system. The mine was operated by Ptolemaís Mining and Industrial Co., Ltd. (LIPTOL), a subsidiary of the State-owned Electricity Commission (DEI). LIPTOL's minable coal reserves were estimated at 350 million tons in 1962. Two grades of lignite were mined: grade A, suitable for briqueting, having a maximum ash content of 9 percent in the wet condition, and grade B, suitable for boiler firing, with up to 13 percent ash content. The mine overburden thickness varies from 0 to 150 feet and the lignite seam thickness fluctuates around 160 feet, increasing in the northern regions to a maximum thickness of 210 feet. The Ptolemaís plant is centrally controlled and monitored by a control station provided with a mosaic illuminated indicator panel with signal devices, indicators for belt weigher readings, and remote recorders for car weigher readings. The efficiency of the continuous mining method, using bucket wheel excavators for mining and belt conveyors for transporting, was demonstrated by the fact that the targeted capacity for lignite handling has been exceeded by 30 percent.

During 1971, an agreement was signed between the Public Power Corp. (PPC) and a foreign consortium for the construction of a third lignite-fired 300-megawatt power station at Megalopolis. The agreement called for the unit to become operational in March 1975. Installation of this unit will necessitate the opening of a new coalfield at Thoknia, in the Megalopolis area, as well as a field at Choremi. The new unit was designed to consume some 5 million tons per year of lignite and produce 2,000 million kilowatt hours of energy. Cost, including extensions to the coalfields, were estimated at $115 million. The PPC also signed a contract with the French firm, Constructions Électriques and Méchaniques Alsthom for the supply and installation of a second 300-megawatt lignite-fired powerplant at the newly developed Kardia coalfield in the Ptolemaís area. The cost of the second unit was estimated at $58 million, including civil engineering works of $8 million. This project was to be partly financed by two French banks which will make available $35.5 million repayable in 10 years at 7-percent interest. The unit was scheduled to go into commercial operation in April 1975.

An agreement was signed late in 1971 between the PPC and the Soviet corporation, Energomas Export, for the construction of two power-generating stations at Philippi utilizing local peat deposits. The Philippi plan specified two power stations with a capacity of 125,000 megawatts each. In addition to the powerplant, there will be a dam at the convergence of the Drama and Angittis rivers, a water purification plant, a pumping station, and a railway line or conveyor belt to transport the peat. Peat will be mined by opencast methods to a depth of 11 meters. Test drilling showed peat deposits extending to a depth of 70 meters. Sufficient reserves were estimated to provide the electric generating facilities with a life span of 25 years. The installation will necessitate importation from the U.S.S.R. of approximately 100,000 tons of steel and 25,000 tons of machinery. Remaining equipment and machinery will be supplied by local sources.

Officials of PPC stated that electric power production in 1971 totaled 10.6 billion kilowatt hours compared with 9 billion in 1970, an increase of approximately 18 percent. Installed power-generating capacity was increased from 2,500,000 kilowatts to 2,667,000 kilowatts, or 7 percent over that of the previous year. PPC stated its long term objective was to reduce dependence of the national electrification grid on oil-fired powerplants. To this end, emphasis was to be given the development of the country's

own power resources of lignite, peat, and water.

Petroleum.—Greek petroleum exploration continued the momentum started in 1970. Since September 1968, eight United States firms have signed 14 exploration contracts with the Greek Government involving commitments to spend $71,125,000 on oil rerearch. While seismic and other preparatory work was underway with some contracts, only Texaco (Overseas Petroleum Co.) undertook a drilling program. The Davis Oil Corp. International S.A. of Geneva, Switzerland, a corporation controlled by Davis Oil Co. of Denver, Colo., and Petro-Search Co. of Delaware concluded two oil exploration and development agreements in 1971 with the Greek Government. These agreements provided for onshore and offshore petroleum exploration in (1) a 2,000-square-kilometer area at Rhodes and (2) a 3,200-square-kilometer area at Kyparissia, western Peloponnesus. Total investments under these two agreements were placed at $12.4 million over a 5-year period. Another company, Anschutz Overseas Corp. of Denver, Colo., also concluded an oil exploration and development agreement in 1971 with the Greek Government providing for petroleum exploration in an area of about 2,400 square kilometers on the Kassándra Peninsula in waters of Kassándra Gulf, Chalkidiki, northern Greece. Total costs under the agreement were placed at $3.2 million to be invested over a period of 5 years. Under the provisions of the agreement, Anschutz was to conduct seismological, geological, and geophysical research as well as drillings to a minimum depth of 2,615 meters.

Although termination of the agreement between the Greek Government and Onassis for establishment of a refinery in Greece dealt a severe blow to the Government's plans in this area, progress was made. Greece's two oil refineries, the Esso-Pappas refinery in Thessaloniki and the Greek-owned refinery at Aspropyrgos, processed a total of 5,337,000 tons of crude in 1971 against 5,031,000 tons in 1970 and 4,568,000 tons in 1969. Esso-Pappas completed improvements to its Thessaloniki refinery and increased annual processing capacity from 2.5 million tons to 3.2 million tons in 1971. Work was also underway on modernizing the Aspropyrgos refinery and expanding its annual processing capacity from 1,850,000 to 4,500,000 tons. This project was part of Stavros Niarchos' $2 million investment plan and was scheduled to be completed by May 30, 1972. Early in 1971, Greek shipowner John Latsis obtained the Government's approval to establish a 1-million-ton-per-year crude petroleum refinery at Elevsís, near Athens. The output of the Latsis refinery, scheduled for completion late in 1971, will be entirely for export. The new Latsis refinery will operate on Arabian crude using a new refining method.

Motor Oil (Hellas) S.A., owned by Greek shipowner Nicholas Vardinoyannis, had under construction a 75,000-ton-per-year-capacity lubricating oil refinery near Corinth. Motor Oil signed an agreement in 1971 to obtain its crude petroleum requirements from Shell Oil Co. In exchange, Shell will obtain its requirements for lubricating oil for the Greek market and for bunkering oil at Greek ports. Motor Oil obtained Government approval to expand its $17 million lubricating oil refinery to a $30 million facility, and will produce annually (1) 75,000 tons of lubricating oil; (2) 300,000 tons of heavy fuel oil; (3) 100,000 tons of marine diesel oil; (4) 310,000 tons of gas oil; and (5) 350,000 tons of naphtha. The project was to be completed by August 1972. Motor Oil also announced plans to establish a $160 million petrochemical complex in association with the French firm, Société Chimique des Chardonnages. The French firm was to prepare the studies, design and supervise construction of the project, provide technical assistance and know-how, and handle marketing. The plant would produce ethylene—300,000 tons; propylene—100,000 tons; butadiene—30,000 to 40,000 tons; gasoline (by steam cracking)—120,000 to 140,000 tons; polyvinyl chloride—50,000 tons; polyethylene (low density)—60,000 tons; polyethelene (high density)—60,000 tons; polypropylene—30,000 tons; polyacrilonitril—45,000 tons; styrol—90,000 tons; and fuels—50,000 tons. Motor Oil proposed to obtain raw materials for its petrochemical complex from its lubricating oil, fuel oil, and naphtha refinery presently under construction at Aghioi Theodoroi near Athens.

A new $2.5 million corporation, Hellenic Lubricating Oil Co. S.A., was established to own and operate a lubricating oil refinery costing $25 million. Capitalization for the company was contributed by the General Investments Co. ($250,000) and by the Reagent Investment Corp. Co., Inc., of Liberia ($2,250,000).