



2006 Minerals Yearbook

GREECE

THE MINERAL INDUSTRY OF GREECE

By Harold R. Newman

The mineral industry, which consisted of the sectors that mine and process metallic and nonmetallic minerals and mineral fuels, was a small but important segment of the Greek economy. The majority of Greek mining companies were well organized and well developed, and they had a strong export orientation. High metal prices in world markets supported the Greek mineral industry in 2006. The industrial minerals sector was only slightly less well developed than the metallic mineral sector.

Minerals in the National Economy

The metallic minerals sector involved a relatively small number of large, capital-intensive companies that were, in some cases, vertically integrated and engaged in both mining and metallurgical processing. Typical examples were Aluminium de Grèce S.A., (AdG) a producer of bauxite, alumina and aluminum, and Larco G.M.M. S.A. (Larco), which mined laterite and operated the ferronickel plant at Larymna. Larco was the sole manufacturer of ferronickel in the European Union (EU).

Greece was a major global supplier of several key industrial minerals, notably bentonite, magnesite, and perlite. The country's position as a leading producer of these minerals was well-established. S&B Industrial Minerals S.A. (S&B) was Greece's—and one of the world's—leading producers of industrial minerals. Composed of five divisions (the Bauxite, Bentonite, Fluxes, Perlite, and Specialty Minerals Divisions), the company had facilities around the globe; its main mining and processing operations, however, were located in Greece (Industrial Minerals, 2006).

Production

Because northern Greece was thought to contain a significant amount of exploitable mineral resources, it received the most attention for exploration activity of anywhere else in the country. Mining companies renewed exploration funding in 2006, which indicated their optimism about future production. In 2006, activities continued to be directed toward the search for gold. The country's mineral production levels were more or less the same as in 2005. In terms of the value of production, bauxite was the most important of Greece's mineral commodities, although production declined by about 11% in 2006. Greece continued to be a leading producer of bauxite, magnesite, nickel, and perlite in the EU (table 1). Production of mineral commodities in Greece was closely tied to the export market. About 50% of the country's mineral production was exported.

Structure of the Mineral Industry

The major mineral commodities and the companies that produced them in 2006 are listed in table 2. There was little change from 2005, although the Government was continuing to move toward the privatization of some state enterprises.

Commodity Review

Metals

Bauxite and Alumina.—Greece was a leading bauxite producer in the EU. Bauxite is the principal raw material used in the production of alumina. The major bauxite deposits are located in central Greece within the Parnassos-Ghiona geotectonic zone and on Evoia Island. S&B leased and owned mines in these regions and controlled the most significant bauxite reserves, in terms of size, in Europe.

Greece's bauxite reserves were of the diasporic and boehmitic type. Although the bauxite ore had an average aluminum oxide content of 53%, it also had a high silica content that made it hard to process. Production was distributed between open pit and underground mining. The recovery rate for all the bauxite mined was about 85%. The bauxite was used as raw material for the production of alumina. About 10% of the production of bauxite was nonmetallurgical grade (S&B Industrial Minerals S.A., 2006a).

AdG and S&B announced that a new agreement was reached to supply the AdG alumina plant with bauxite from S&B's mines. The new 10-year agreement covered the period from January 1, 2007, to December 31, 2016. According to the agreement, AdG commissioned S&B to supply its plant with 700,000 metric tons per year (t/yr) of bauxite, a quantity significantly larger than the 400,000 t/yr provided under the existing contract. Moreover, the new contract included an option for an additional 70,000 t/yr of bauxite, depending on the needs of AdG (S&B Industrial Minerals S.A., 2006c).

Gold.—European Goldfields Ltd. held a 95% interest in Hellas Gold S.A., which owned three gold and base-metal deposits in northern Greece. These were the Olympias deposit, which contains gold, lead, silver, and zinc; the Skouries copper/gold deposit; and the polymetallic Stratoni deposit. Hellas Gold started production at Stratoni in late 2005 and continued in 2006, which resulted in higher production of lead and silver than in 2005. Hellas Gold sold an existing stockpile of gold concentrates at Olympias in July 2006. The company also applied for permits to develop the Olympias and Skouries projects (European Goldfields Ltd., 2006).

The total estimated proven and probable reserves at Stratoni in 2006 were 1.9 million metric tons (Mt) at grades of 8.1% lead, 190 grams per metric ton (g/t) silver, and 10.8% zinc. Production of ore was expected to reach 170,000 metric tons (t) by the end of 2006 and to increase steadily to 400,000 t/yr by 2010. Based on historical production levels, the Stratoni Mine was expected to produce at grades of between 8% and 10% lead, 200 g/t silver and 8% to 10% zinc, with concentrator metals recovery of about 90% (European Goldfields Ltd., 2007).

Nickel.—Larco was among the leading ferronickel producers in the world and the only producer of nickel in Europe that used domestic nickel ores. Larco had three main mining areas—Evia

(open pit), with annual production of about 1.5 Mt of ore; Agios Ioannis (underground), with an annual production of about 700,000 t of ore; and Kastoria (open pit), with annual production of about 300,000 t. The Larymna metallurgical plant consisted of four rotary kilns, five electric arc furnaces, and two converters with a metal production capacity of 50 t each. The 17,736 t of ferronickel produced in 2006 was sold to Acerinox S.A. of Spain, ArcelorMittal Group of Luxembourg, Outokumpu oyj of Finland, and ThyssenKrupp AG of Germany, based on long-term contracts. In 2006, Glencore S.A. was added to Larco's customer portfolio (Larco G.M.M S.A., 2006, p. 16.).

European Nickel plc announced in September that it had signed an agreement with Larco to deliver 200,000 t of nickel ore from its Çaldag Mine in Turkey to Larco's smelter at Larymna. Shipments to Larco would take place over a period of 12 months. Some 49,000 t had been shipped by year's end (European Nickel plc, 2006).

Industrial Minerals

Clay and Shale.—S&B Industrial Minerals S.A. was the leading bentonite producer in Europe, the world's second ranked producer after the United States, and the leading bentonite supplier worldwide. S&B remained focused on supplying bentonite for foundries and the drilling industry. S&B's reserves were located on the island of Milos (S&B Industrial Minerals S.A., 2006a).

Cement.—Heracles General Cement S.A., a member of the Lafarge Group, had three cement plants. One of these plants, located in Volos, was the largest-capacity cement plant in Europe [4.6 million metric tons per year (Mt/yr)]; the other plants were located in Halkis Evia and Milaki Evia. The total combined production capacity of the three plants was 9.6 Mt/yr. Heracles was the leading processor of raw material and producer of cement and clinker in Greece. Heracles was also active in the production and sale of ready-mix and aggregate products (Google Finance, 2006).

Gypsum.—Lava Mining and Quarrying Co.'s anhydrite and gypsum quarry is located at Altsi on the island of Crete. Quarrying was carried out using explosives, and the quarried material was fed to trucks by means of loaders and then transported to the crushing plant. The production capacity of the quarry was 500,000 t. The end product that came from the plant consisted of anhydrite and hydrate gypsum that was used in the production of cement (Lava Mining and Quarrying Co., 2006a).

Magnesium Compounds.—Grecian Magnesite S.A. (GM) was the leading magnesite exporter in Europe and the only active magnesite operation in Greece in 2006. GM's open pit mine and plant were located southeast of Thessaloniki in the Chalkidiki region. After mining, the material was processed, beneficiated, and fed into rotary or shaft kilns. GM produced and marketed caustic calcined magnesite, dead-burned magnesia, and raw magnesite. In 2006, GM extracted about 2.5 Mt of crude run-of-mine material to produce 200,000 t of magnesium oxide, about 97% of which was exported (Grecian Magnesite S.A., 2006).

Perlite.—With a production capacity of 650,000 t/yr, S&B was the leading producer of raw perlite worldwide and the leader in the European market for perlite used in building materials, cyrogenics, formed products, and horticulture, and as filter aids. S&B mined perlite at Provatas, Thachylas, and Tsigrado on Milos Island (S&B Industrial Minerals S.A., 2006d).

Pumice and Pumicite.—Lava Mining and Quarrying's pumice deposit was located on the island of Yali and had been formed by volcanic action of the adjacent volcano at Nissiros. Quarrying of the deposit was performed without the use of explosives. Bulldozers fed a series of belt conveyors, screens, and crushers, which fed a graded product to stockpiles. Thereafter, a second series of belt conveyors fed ships with carrying capacities of up to 30,000 t, at a loading rate of 1,000 t per hour (Lava Mining and Quarrying Co., 2006c).

Silica.—Lava Mining and Quarrying extracted microcrystalline quartz from its quarry on Milos island. The quarry is located 12 kilometers (km) southeast of Adamas. Exploitation of the quarry was performed by bulldozer; the quartz was transported by track to the processing plant for screening and crushing to the required grades. The production capacity of the plant was 150,000 t/yr; reserves at the quarry were estimated to be 10 Mt. The medium-term objective of the company was to produce a fine grade size. A pilot plant was established near Athens for the production of pure, very fine graded material to provide samples to potential customers (Lava Mining and Quarrying S.A., 2006b).

Stone, Dimension.—In 2006, the Greek marble industry continued to play a leading role in the international market as a result of continued marble production in almost all areas of the country, the variety of possible uses of the marble, and the many colors available (ash, black, brown, green, pink, red, and multicolored). The marble industry was active in the quarrying, processing, and sale of blocks and finished products.

Mineral Fuels and Other Sources of Energy

Coal.—Lignite (brown coal) is Greece's only significant fossil fuel resource, with estimated reserves of 3,900 Mt. Public Power Corporation (PPC) was Greece's major producer of lignite, which was the predominant fuel used for electricity generation in Greece. Most PPC lignite was produced from the Ptolemais-Amyntaion Basin; lesser amounts were produced from the Megalopolis Basin. Because the country has no hard coal (black coal) reserves, it imported hard coal from, in descending order of amount imported, South Africa, Russia, Venezuela, and Colombia. Lignite accounted for about 65% of the raw material for the country's power generation (U.S. Energy Information Administration, 2006a).

Natural Gas and Petroleum.—With Greece's limited natural gas reserves and petroleum resources, production was negligible. Its Mediterranean location however, makes it conveniently close to several important producing regions, such as the Caspian Sea area, the Middle East, and North Africa.

The Bulgarian, Greek, and Russian Governments had signed a memorandum of understanding in 2005 for the construction of a pipeline that would stretch 280 km from the Bulgarian port

of Burgas on the Black Sea to Greece's Alexandroupolis on the Aegean Sea. An intergovernmental agreement to build the oil pipeline to bypass some of the world's busiest shipping lanes was expected to be signed by yearend 2006. The project, which was expected to cost about \$800 million, would allow Russia to export oil through the Black Sea, bypassing the busy Bosphorus Strait in Turkey. The annual initial throughput capacity would be 255 million barrels before rising to 370 million barrels, depending on demand requirements (Alexander's Gas & Oil Connections, 2006).

Renewable Energy.—To meet EU mandates, renewable electricity generation projects were on the rise in Greece. The country planned to have renewable energy sources make up 20% of its energy needs by 2010 compared with 10% in 2006. Greek wind farm operator Rokas S.A. announced that it would invest \$3.1 billion in a wind farm and power transmission system. Rokas planned to install 44 wind parks with a combined generating capacity of 1,363 megawatts (MW). The project would be one of the biggest investments in renewable energy in the world. In 2006, Greece had 475 MW of installed wind-power capacity, with Rokas accounting for 40% of that capacity (U.S. Energy Information Administration, 2006b).

Outlook

Greece is expected to remain a major supplier of industrial minerals in the international market. Mineral exploration activities in Greece will be intensified to secure additional high-quality reserves. The Government could be involved in planning investment programs to improve the existing installations and lower operating costs.

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TABLE 1
GREECE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2002	2003	2004	2005	2006 ^c
METALS					
Aluminum:					
Bauxite	2,468,865	2,442,312	2,396,065 ^r	2,441,443 ^r	2,162,900
Alumina, Al ₂ O ₃	749,500	758,800	786,000 ^r	782,000 ^r	775,000
Metal:					
Primary	165,262	167,797	167,300	163,286 ^r	164,800
Secondary ^c	2,000	3,000	3,000	3,000	3,000
Iron and steel:					
Iron ore and concentrate, nickeliferous, Fe content ^c	600,000	600,000	575,000	575,000	575,000
Metal:					
Steel, crude	1,835,000	1,701,000	1,967,000	2,266,000	2,416,000 ³
Ferroalloys, ferronickel, gross weight	97,761	95,376	95,230 ^r	102,162 ^r	100,000
Lead:					
Mine output, Pb content ^c	29,300	2,000 ^r	--	3,000 ^r	12,400
Metal, secondary	5	4	4 ^c	4 ^c	4
Manganese:^c					
Ore, crude:					
Gross weight	100	100	100	100	100
Mn content	16	15	15	15	15
Concentrate:					
Gross weight	20	20	20	20	20
Mn content	15	15	15	15	15
Nickel:					
Ore:					
Gross weight ^c	2,800	2,700	2,700	2,800	2,700
Ni content of nickeliferous iron ore	22,670	21,410	21,700	23,210 ^r	21,670
Metal, Ni content of ferronickel	19,230	18,000 ^c	18,115	19,235 ^r	17,700
Silver, mine output, Ag content	74,800	79,200	-- ^r	2,300 ^r	25,900 ³
Zinc, mine output, Zn content by analysis	33,000	30,400	-- ^c	1,300 ^r	16,414 ³
INDUSTRIAL MINERALS					
Abrasives, natural emery	8,000	8,000	8,000 ^c	8,000 ^c	8,000
Barite, concentrate ^c	100	100	50 ^r	30 ^r	--
Cement, hydraulic	14,282 ^r	14,638 ^r	15,039 ^r	15,166 ^r	15,000
Clays:					
Bentonite:					
Crude	1,056,598	1,156,642	1,030,556 ^r	1,124,795 ^r	1,125,000 ³
Processed	15,806	10,835	8,606 ^r	2,450 ^r	2,500
Kaolin:					
Crude	57,885	59,680	53,438 ^r	49,912 ^r	50,000
Processed ^c	300	300	300	300 ^r	300
Feldspar	124,100	102,800	88,274 ^r	100,586 ^r	100,000
Gypsum and anhydrite	850,786	731,785	856,606 ^r	865,216 ^r	865,000
Magnesite:					
Crude	558,057	549,049	499,474 ^r	475,670 ^r	500,000
Dead-burned	48,220	43,713	50,813 ^r	58,089 ^r	58,000
Caustic-calcined	105,234	98,357	89,095 ^r	68,065 ^r	70,000
Huntite, crude ^c	18,000	18,000	18,000	18,000	18,000
Nitrogen, N content of ammonia	66,100	123,300	131,500	130,000	130,000
Perlite:					
Crude	838,997	1,079,036	1,053,388 ^r	1,075,129 ^r	1,100,000
Screened	515,715	739,729	525,000 ^c	550,000	550,000
Pozzolan, Santorin earth	1,291,198	1,383,546	1,255,590 ^r	1,458,850 ^r	1,500,000
Pumice	810,000	893,000	835,000 ^r	852,000 ^r	850,000
Salt, all types	126,118	192,161	187,522 ^r	198,024 ^r	195,000
Silica ^c	125,000	130,000	125,000 ^r	125,000 ^r	125,000

See footnotes at end of table.

TABLE 1--Continued
GREECE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2002	2003	2004	2005	2006 ^c
INDUSTRIAL MINERALS--Continued					
Sodium compounds: ^c					
Carbonate	750	750	750	750	750
Sulfate	5,000	5,000	5,000	5,000	5,000
Stone: ^c					
Dolomite	90,000	90,000	40,000 ^r	60,000 ^r	60,000
Marble	178,839 ³	233,436 ³	144,860 ^{r,3}	151,180 ^{r,3}	150,000
Flysch	80,000	75,000	158,887 ^{r,3}	93,509 ^{r,3}	95,000
Quartz, microcrystalline	150 ^r	150 ^r	150 ^r	150 ^r	150
Sulfur: ^c					
S content of pyrites	9,500	9,500	9,500	9,500	9,500
Byproduct, natural gas and petroleum	157,000	162,000	160,000	160,000	160,000
Talc and steatite	670	500	200 ^r	250 ^r	250
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Lignite	71,074	69,411	71,237 ^r	73,585 ^r	74,000
Lignite briquets ^c	35,000	32,000	35,000 ^r	36,000 ^r	36,000
Gas: ^c					
Manufactured, gasworks	15	15	15	15	15
Natural	36	36	23 ^r	16 ^r	16
Natural gas plant liquids	350	350	140	140 ^e	140
Petroleum:					
Crude	1,417	1,026	997 ^r	756 ^r	760
Refinery products:					
Liquefied petroleum gas	8,909	8,932	8,900 ^e	8,900	8,900
Gasoline	32,300	32,725	33,150 ^r	32,725 ^r	32,000
Naphtha	8,075	7,905	8,245 ^r	8,330 ^r	8,400
Mineral jelly and wax ^c	20	20	20	20	20
Jet fuel	14,725	14,400	15,600 ^r	16,000 ^r	16,000
Kerosene	101	116	116 ^{r,e}	132 ^r	130
Distillate fuel oil	41,031	41,776	42,522 ^r	43,268 ^r	42,000
Refinery gas	3,640	3,710	4,200 ^r	4,900 ^r	4,800
Lubricants	1,225	1,260	1,225 ^r	1,260 ^r	1,200
Residual fuel oil	49,280	49,617	49,950 ^r	50,616 ^r	50,000
Bitumen	3,091	3,151	3,100 ^r	3,121 ^r	3,000
Petroleum coke	908	880	935 ^r	990 ^r	1,000
Other	770	756	770 ^r	980 ^r	900
Refinery fuel and losses	7,455	7,490	7,490 ^r	7,500	7,500
Total	171,530	172,738	176,223 ^r	178,742 ^r	176,000

^cEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. ^rRevised. -- Zero.

¹Table includes data available through October 2007.

²In addition to the commodities listed, other crude construction materials are produced, but no basis exists for estimation of production.

³Reported figure.

TABLE 2
GREECE: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina, Al ₂ O ₃		Aluminium de Grèce S.A.(AdG) (Mytilineos Holdings S.A., 53%)	Agios Nikolaos, Boeotia area	750
Aluminum		do.	do.	160
Asbestos		Hellenic Mineral Mining Co. S.A.	Mines at Zidani, near Kozani	100
Barite, BaSO ₄		S&B Industrial Minerals, S.A. (Eliopoulos-Kyriakopoulos Group)	Milos Island	1
Bauxite		do.	Mines at Phocis, plants at Phocis and Itea	2,000
Do.		Eleusis Bauxites Mines, S.A.	Mines near Drama, Itea, and Phthiotis-Phocis	300
Do.		do.	Plants in Aghia Marina, Drama, and Itea	400
Do.		Delphi-Distomon S.A.; Hellenic Bauxites of Distomon S.A. (Aluminium de Grèce S.A.)	Beotia and Phokifda mines, Delphi-Distomon area	500
Bentonite:				
Crude		Mediterranean Bentonite Co. S.A.	Surface mines on Milos Island	20
Do.		Mykobar Mining Co. S.A. (Silver & Baryte Ores Mining Co. S.A.)	Mines at Adamas, Milos Island	300
Do.		do.	Plants at Adamas, Milos Island	200
Do.		S&B Industrial Minerals, S.A. (Eliopoulos-Kyriakopoulos Group)	Mines at Adamas, Milos Island	600
Processed		do.	Plant at Vouidia Bay, Milos Island	400
Cement		Halkis Cement Co. S.A. (Lafarge Group)	Micro-Vathi plant, west-central Euboea Island	3,000
Do.		Halyps Cement S.A. (Ciments Français, France)	Paralia Aspropyrgos plant, Athens	800
Do.		Heracles General Cement Company S.A. (Lafarge Group)	Plants at Halkis Evia, Milaki Evia, and Volos	9,600
Do.		Titan Cement Co. S.A.	Elefsis plant, Athens area	400
Do.		do.	Kamari plant, Boeotia	2,600
Do.		do.	Patras plant, northern Peloponnesus	1,900
Do.		do.	Salonica plant, Salonica	1,650
Ferroalloys, ferronickel, Ni content		Larco G.M.M. S.A.	Larymna metallurgical plant	25
Gold, Au in concentrate	kilograms	Hellas Gold S.A. (European Goldfields Ltd.)	Kassandra Mines (Olympias and Stratoni)	5,000
Gypsum		Lava Mining and Quarrying Co. S.A.	Altsi, Crete Island	500
Do.		Titan Cement Co. S.A.	do.	280
Hunite/hydromagnesite		Microfine S.A.	Mines in Kozani Basin	100
Lead, mine, Pb in concentrate		Hellas Gold S.A. (European Goldfields Ltd.)	Kassandra Mines (Olympias and Stratoni), northeastern Chalkidike	30
Lignite		Public Power Corporation (Government)	Aliveri Mine, Euboea Island	420
Do.		do.	Megalopolis Mine, central Peloponnesus	7,000
Do.		do.	Ptolemais Mine, near Kozani	28,000
Magnesite, concentrate		Grecian Magnesite S.A. (GM)	Mine and plant at Gerakini and Kalives, Chalkidiki, northern Greece	200
Manganese, battery-grade MnO ₂		Eleusis Bauxite Mines Mining, Industrial and Shipping S.A. [National Bank of Greece (OAE)]	Nevrokopi, Drama	10
Marble, slab	cubic meters	Aghia Marina Marble Ltd.	Pallini	100,000
Do.	do.	Chris G. Karantanis & Sons Co.	Korinthos	60,000
Natural gas	million cubic meters per day	Public Petroleum Corporation (Government)	Prinos offshore gasfield and oilfield, east of Thasos Island	125
Nickel, ore		Larco G.M.M. S.A.	Agios Ioannis Mine, near Larymna	500
Do.		do.	Evia Mine, near Larymna	1,500
Nitrogen, N content of ammonia		Phosphoric Fertilizers S.A.	Nea Karvall	150

TABLE 2--Continued
GREECE: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Perlite		S&B Industrial Minerals, S.A. (Eliopoulos-Kyriakopoulos Group)	Mines on Kos and Milos Islands; plant at Pireaus	650
Do.		Otavi Minen Hellas S.A. (Otavi Minen AG, Germany)	Milos Island	150
Do.		Bouras Co.	Kos Island	50
Petroleum, refined	42-gallon barrels per day	Hellenic Aspropyrgos Refinery S.A.	Aspropyrgos	95,000
Do.	do.	Motor Oil (Hellas) Corinth Refineries S.A.	Aghii Theodori, Corinth	140,000
Do.	do.	Petrola Hellas S.A.	Eleusis	100,000
Do.	do.	Thessaloniki Refining Co. A.E.	Thessaloniki	76,000
Pozzolan (Santorin earth)		Lava Mining and Quarrying Co. (Heracles Group)	Xylokeratia, Milos Island	600
Do.		Titan Cement Co. S.A.	do.	300
Pumice		Lava Mining and Quarrying Co. (Heracles Group)	Yali Island	100
Quartz (microcrystalline)		do.	Adamas, Milos Island	150
Steel, crude		Halyvourgia Thessalias S.A. (Manassis Bros. and Voyatzis S.A., 65%, and National Investment Bank for Industrial Development, 35%)	Steelworks at Volos	1,500
Do.		Sidenor Steel Products Manufacturing S.A.	Steelworks at Thessaloniki and Almyros	2,800
Do.		Halyvourgiki, Inc.	Steelworks at Eleusis	1,200
Do.		Hellenic Steel Co.	Steelworks at Thessaloniki	1,000
Do.		Corinth Pipeworks S.A. (CPW)	Steelworks at Thisvi	700
Zeolite		S&B Industrial Minerals, S.A. (Eliopoulos-Kyriakopoulos Group)	Mine at Pentalofos; plant at Ritsona	100
Zinc, mine, Zn in concentrate		Hellas Gold S.A. (European Goldfields Ltd.)	Kassandra Mines (Olympias and Stratoni), northeastern Chalkidike	30