



2013 Minerals Yearbook

GREECE

THE MINERAL INDUSTRY OF GREECE

By Lin Shi

The mineral industry of Greece was composed of the sectors that mine and process metallic and industrial minerals and mineral fuels. Coal production dominated the Greek mining industry; it was followed, in terms of tonnage of output, by the production of industrial minerals, such as bentonite, cement, perlite, pumice, and magnesite; and metallic minerals, such as bauxite and nickel. Some of Greece's other mineral resources include copper, gold, and gypsum (Industry Review, 2012).

Greece was a global supplier of several industrial minerals, and production of these mineral commodities was closely tied to the export market. In 2013, Greece was the world's first-ranked perlite producer (tied with Turkey) and the world's eighth-ranked pumice producer. The country also produced about 8% of the world's bentonite and about 1% of the world's bauxite. Bauxite, which is used to produce aluminum, was one of the most important Greek mineral commodities based on its production value. Lignite was used as a fuel in powerplants. Greece also produced huntite, which is a magnesium carbonate mineral used as a fire retardant additive for polymers (Bolen, 2015; Bray, 2015; Crangle, 2015; Virta, 2015).

Geologic studies in Greece were done primarily by the Institute of Geology and Mining Exploration Management (IGMEM), which was formerly the Institute of Geology and Mining Exploration. The IGMEM conducts applied geochemical analysis, basic geologic research, exploration and evaluation of ore deposits and industrial minerals, and hydrogeologic surveys. Most exploration activity was focused in northern Greece, which was thought to contain a significant amount of exploitable minerals (Institute of Geology and Mineral Exploration Management, 2014).

Minerals in the National Economy

Although mineral industry activities have traditionally been an important segment of Greek industry, the significance of the mineral industry to the Greek economy has decreased gradually over time. The mineral industry produced and processed metals, industrial minerals, and mineral fuels. Greece was a supplier of several industrial minerals, notably bentonite, cement, magnesite, and perlite. Most of the Greek companies that dealt in metal fabrication, mining of minerals, and refined metal production and processing were well established and had a strong export orientation.

Greece's economy had been shrinking since the 2008 global financial crisis. By the end of 2013, the country's economy had contracted by 26% compared with that of 2007. The country's deficit, including Government debt payment and tax revenues, has been reduced to about 4% of the gross domestic product (GDP) from 15% of the GDP in 2009. The European Union (EU) Growth and Stability Pact limits the deficit of Greece's annual Government expenses to no more than 30% of the country's GDP, and Greece was not in compliance with this criterion. Greece was a major beneficiary of EU aid,

which was valued at about 3.3% of the country's annual GDP. Since 2010, the International Monetary Fund and European Governments had provided the Greek Government with emergency short- and medium-term loans worth \$147 billion to make debt payments to the country's creditors (U.S. Department of State, 2013; U.S. Central Intelligence Agency, 2014).

In 2013, Greece's real GDP was valued at \$242.2 billion, which was a decrease of 3.9% compared with that of 2012. The value of output in Greece's mining sector also decreased in 2013, owing to increasing energy prices, decreasing raw materials and metal prices, and declining market demand across the EU countries. In 2013, Greece's unemployment rate was 27.3% (Industry Review, 2012; Global Finance, 2014; Tzeferis, 2014, p. 2; World Bank, The, 2014).

About 700 projects were active at mining and (or) quarrying sites in Greece, which together covered only about 0.3% of the country's land area in 2013. The demand for mineral products decreased mainly in the domestic construction sector and in southeastern European markets owing to the reduction in domestic building and construction projects and modest economic growth in other European countries (Tzeferis, 2014, p. 2).

Production

In 2013, mined silver production increased by 24% from that of the previous year, magnesite mine output increased by 2.5%, huntite production decreased by 37%, and lignite production decreased by 13% (table 1) (Bolen, 2015; Bray, 2015; Crangle, 2015; Virta, 2015).

Structure of the Mineral Industry

The majority of Greece's mining companies were privately owned. Government ownership was limited primarily to the mineral fuels sector. The major mineral commodities and the companies that produced them in 2013 are listed in table 2.

Mineral Trade

Mineral trade continued to be important to the Greek economy. In 2013, Greece's total exports were valued at about \$30 billion and total imports were valued at about \$51 billion. The exported commodities included petroleum products, and the imported commodities included fuels. The country's major export destinations were Turkey, which accounted for about 12% of total exports, by value; Italy, about 10%; Germany, about 7%; and Bulgaria, about 5%. The country's major import partners were Russia, which accounted for about 14% of the value of total imports; Germany, 10%; Italy and Iraq, 8% each; and China, France, and the Netherlands, 5% each. The total value of Greece's exports to the United States in 2013 was about \$954 million, which included aluminum and bauxite valued at about \$65 million;

cement, lime, and stone valued at about \$52 million; and fuel oil valued at about \$21 million. The total value of Greece's imports from the United States in 2013 was about \$739 million, which included fuel oil valued at about \$58 million, copper valued at about \$19 million, and iron and steel products valued at about \$2 million (U.S. Census Bureau, 2013a, b; U.S. Central Intelligence Agency, 2014).

Commodity Review

Metals

Aluminum and Bauxite and Alumina.—Greece was a leading bauxite producer in the EU. Its major bauxite deposits are located in central Greece within the Parnassos-Ghiona geotectonic zone and on Evia Island. The three producers of bauxite in Greece were Delphi-Distomon S.A., Hellenic Mining Enterprises S.A., and S&B Industrial Minerals, S.A. The leading bauxite producer was S&B, which had an output capacity of 2 million metric tons year (Mt/yr) exclusively from underground sites located in the areas of Amfissa and Distomon. Delphi-Distomon and Hellenic Mining Enterprises supplied bauxite to the nonmetallurgical markets. Greece produced about 1.8 million metric tons (Mt) of bauxite in 2013. Domestic demand included both metallurgical use in producing aluminum and nonmetallurgical use in the steel and cement industries. The Aluminum S.A. produced 169,480 metric tons (t) of aluminum, which used about 75% of the country's 2013 bauxite production. The production of alumina hydrate reached 811,600 t and was used to manufacture ceramics and filters (Tzeferis, 2014, p. 3).

Lead, Silver, and Zinc.—Eldorado Gold Corp. of Canada owned the Stratoni Mine, which was an underground operation located on the Chalkidiki Peninsula in northern Greece. The mineralization in the Stratoni deposit included galena, pyrite, and sphalerite. Resources at the Stratoni Mine were contained within the Mavres Petres ore body, of which estimated proven and probable reserves were 1.8 Mt grading 8.5% zinc, 6.3% lead, and 177 grams per metric ton (g/t) silver. Eldorado Gold operated the mine at a mining rate of about 18,000 metric tons per month of ore by a conventional underground drift-and-fill method and produced a lead-silver concentrate and a zinc concentrate. The concentrates were shipped to European facilities using the Port facilities of either Stratoni or Thessaloniki. Eldorado Gold was exploring the Stratoni mineral deposit, and the company planned to conduct a drilling test in the area between Stratori and Piavitsa. Piavitsa is located 2 kilometers (km) west of Stratori (Eldorado Gold Corp., 2014).

Nickel.—Nickel laterite mineral resources were spread across three areas: central Euboea; Neo Kokkino and the County of Viotia; and northern Greece in the area of Kastoria. Larco G.M.M. S.A., which was a leading producer of nickel and ferronickel in Europe and the only European user of domestic nickel ores, mined sedimentary-type nickel laterite by open pit and underground methods. The company operated the Agios Ioannis and the Evia Mines at Neo Kokkino near Larymna, which includes one underground mine and three surface mines; the Kastoria Mine at Kastoria near the Albanian border, which includes three main deposits and can only be mined during the summer because of the altitude; and the Servia lignite mine

at Servia, which is a surface mine at the Lava deposit. The company's smelting plant, which is located in Larymna near Athens, processed about 2.5 Mt/yr of domestic mined laterites to produce about 18,000 to 20,000 metric tons per year (t/yr) of ferronickel with 18% to 24% nickel content, which was used as a raw material for manufacturing stainless steel in Europe. Larco mined 2,220,790 t of nickeliferous laterite ore in 2013 compared with 2,256,686 t in 2012, which was a decrease of about 2%. The company produced 16,890 t of nickel in ferronickel and exported 17,054 t of nickel in 2013 compared with 18,632 t produced (a decrease of about 10%) and 19,071 t exported in 2012. Because of a pretax financial loss in both 2012 and 2013, compared with a profit in 2011, the Government was looking for a strategic investor for Larco and was attempting to restructure the company (Larco G.M.M. S.A., 2014; Tzeferis, 2014, p. 2–3).

Industrial Minerals

Bentonite and Perlite.—Greece was the world's second-ranked country in the production of bentonite. Extraction was conducted primarily on Milos Island by S&B Industrial Minerals, S.A. Bentonite deposits have also been found on the islands of Chios and Lesbos. S&B ranked first in the production of bentonite in Europe and was the leading exporter of bentonite in the world. In 2013, the country produced about 1 Mt of bentonite, about 890,000 t of crude perlite, and about 435,000 t of treated perlite (Industrial Minerals, 2012; Virta, 2015).

Cement.—Titan Cement Co. S.A. was a significant cement producer in Greece, and its four plants produced a combined total of up to about 7 Mt/yr. Domestic and export cement sales continued to decrease in response to the decrease in construction activity and the economic slowdown in southeastern European markets. The company's net loss in 2013 increased to EUR36 million (\$47.9 million¹) from EUR24.5 million (\$32.6 million) in 2012; however Titan reported that its revenues in 2013 increased by 4% from 2012, which was the first time that the company had reported improved operating results in 7 years. Domestic cement demand in Greece continued to decline but at a slower pace than in previous years. Cement plants in Greece, however, depended on exports for their sustainability (Global Cement, 2012; Titan Cement Co. S.A., 2014).

Magnesite.—In 2013, the country mined and produced 360,000 t of crude magnesite and produced 85,890 t of magnesium compounds, which included 61,120 t of caustic-calcined magnesia and 24,770 t of dead-burned magnesia (DBM). Production of crude magnesite increased by 2% to about 360,000 t from 351,266 t in 2012; production of caustic-calcined magnesia increased by 1% from 60,625 t in 2012; and production of DBM decreased by 8% from 26,832 t in 2012. Grecian Magnesite S.A. (GM), which employed 367 people in 2013, had mines and production facilities at Chalkidiki, Halkidiki, and Yerakini, in northern Greece. The company's annual production capacity was 200,000 t of calcined products and 50,000 t of basic monolithic

¹Where necessary, values have been converted from euro area euros (EUR) to U.S. dollars (US\$) at an annual average rate of EUR0.76=US\$1.00 for 2013.

refractories. GM operated three rotary kilns for crushed calcined magnesite (CCM) or DBM with a combined capacity of 420 metric tons per day (t/d), a 50-t/d shaft kiln for CCM, and a 100-t/d double inclined shaft kiln. GM produced more than 50 different grades of CCM, DBM, and basic monolithic refractories for a wide range of applications (Grecian Magnesite S.A., 2012, 2014; Tzeferis, 2014, p. 3, 6).

Terna Magnesite (Terna Mag) was exploring magnesite deposits at Gerorema and Kakkavos in northern Evia to supply its plant that produced magnesium compounds. In 2013, the company employed 100 people, and began underground mining at Plakarias-Mourititsa north of Evia and produced about 23,600 t of raw magnesite (Terna Mag, 2014; Tzeferis, 2014, p. 3).

Mineral Fuels

Coal.—In 2013, the predominant fuel used in electricity generation in Greece was lignite, and Public Power Corp. S.A. (PPC) was Greece's major energy and lignite producer. PPC's leading lignite mines, which were located in Megalopolis and Ptolemais, provided lignite for power generation. PPC's lignite-powered electricity-generating plants and hydroelectric powerplants represented about 68% of the country's total installed capacity. The total installed capacity of the combined PPC generation plants was 12.5 gigawatts. PPC produced about 54 Mt of lignite in 2013, compared with about 62 Mt in 2012, which was a decrease of 13.4%. In 2013, Greece's energy supplies were composed of lignite (46%), natural gas (24%), renewable energy systems (15%), hydropower (11%), and imports (4%) (Public Power Corp., 2012; Tzeferis, 2014, p. 4).

Petroleum.—Petra Petroleum Inc. of Canada announced that it had submitted an application in the Greece Open Door invitation process for hydrocarbon exploration rights. Petra Petroleum joined with Energean Oil & Gas S.A. to bid for the Ioannina Contract Area, which is a 4,187-square-kilometer area located onshore in northwestern Greece. Energean Oil and Gas was the only natural gas and petroleum exploration and production company in Greece and operated three petroleum fields—Epsilon, Prinos, and Prinos North in the Prinos Development Area. Kavala Oil S.A., which was a subsidiary of Energean Oil & Gas, announced an investment program to initiate production of 3,000 barrels per day of crude oil in 2013 (Petra Petroleum Inc., 2012; Tzeferis, 2014, p. 5).

Outlook

Greece is expected to remain a major supplier of bentonite, perlite, and pumice in the international market. The industrial minerals sector will likely continue to be a small but important part of the country's revenue earnings. Development of mineral resource projects in the northern part of Greece is likely to continue along with offshore mineral fuel exploration. Demand for cement is expected to increase for the first time since 2006 because of increasing domestic infrastructure spending. Cement exports to the United States are expected to increase because of increased demand (Global Cement, 2014; Titan Cement Co. S.A., 2014; Tzeferis, 2014, p. 5).

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TABLE 1
GREECE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2009	2010	2011	2012	2013 ^e
METALS					
Aluminum:					
Bauxite	1,935,000	1,902,000	2,300,000 ^e	1,816,000	1,844,000 ³
Alumina, Al ₂ O ₃	718,797	725,000	809,700	784,400	811,600 ³
Metal, primary	134,737	136,765	167,490	165,046	169,480 ³
Chromite, ore, crude ^e	1,400	1,400	1,200	1,200	1,200
Gold, mine output, Au content kilograms	500	500	500 ^e	600 ^e	823 ³
Iron and steel:					
Iron ore and concentrate, nickeliferous, Fe content ^e	560,000	560,000	550,000	550,000	550,000
Steel, crude thousand metric tons	2,082	1,839	1,993	2,000	2,000
Lead, mine output, Pb content	17,027	12,200 ^e	16,592	18,062	18,000 ³
Nickel:					
Ni content of laterite ore	10,203	13,837	21,710 ^r	23,060 ^r	22,200
Metal, Ni content of ferronickel	8,269	13,960	18,527	18,632	16,890 ³
Silver, mine output, Ag content ^e kilograms	30,177 ³	29,000	30,000	32,000	39,759 ³
Zinc, mine output, Zn content	18,126	19,967	19,564 ^r	20,912	21,000 ³
INDUSTRIAL MINERALS					
Cement, hydraulic ^e thousand metric tons	11,160 ³	11,000	11,000	11,000	11,000
Clays, bentonite, crude	926,186	1,381,643	1,188,442	1,235,105	1,000,000 ³
Feldspar	55,737	23,050	10,200	12,000	12,000
Gypsum and anhydrite	730,000	700,000	587,000	700,000 ^r	760,000 ³
Magnesite:					
Ore, crude	380,834	396,000	541,813	351,266	360,000 ³
Huntite, crude ^e	10,652 ³	12,000	23,800	24,200	15,200 ³
Perlite:					
Crude	862,935	760,000 ^e	842,870	680,000 ^r	890,000 ³
Screened	398,451	400,000 ^e	507,235	400,000 ^r	435,000 ³
Pozzolan, Santorin earth ^e	830,000 ³	850,000	350,000	285,000	266,000 ³
Pumice	381,000	400,000 ^e	468,960	385,917	420,000 ³
Salt, all types	189,000	190,000 ^e	174,500	191,970	190,000
Silica	37,905	40,000 ^e	1,671	1,800 ^e	2,000
Stone, marble cubic meters	255,516	250,000 ^e	285,000 ^e	500,000 ^r	520,000 ³
Sulfur, S content of mixed sulfide ore	225,054	230,000 ^e	214,943	227,197	230,000
MINERAL FUELS AND RELATED MATERIALS					
Coal thousand metric tons	61,800	53,600	58,400	62,368 ^r	54,000 ³
Petroleum:					
Crude thousand 42-gallon barrels	628	636	676	662	700
Refinery products:^e					
Liquefied petroleum gas do.	7,519 ³	8,030 ³	8,000	8,000	8,000
Gasoline do.	34,419 ³	36,865 ³	32,000	32,000	32,000
Naphtha do.	8,400	8,400	8,400	8,400	8,400
Jet fuel do.	12,410 ³	12,775 ³	14,000	14,000	14,000
Kerosene do.	438 ³	146 ³	200	200	200
Distillate fuel oil do.	46,691 ³	51,468 ³	47,000	47,000	47,000
Refinery gas do.	4,800	4,800	4,800	4,800	4,800
Residual fuel oil do.	38,435 ³	37,814 ³	42,000	42,000	42,000
Bitumen do.	3,960 ³	4,000	4,000	4,000	4,000
Other do.	1,876 ³	1,800	1,800	1,800	1,800
Total do.	159,000 ^r	166,000 ^r	162,000 ^r	162,000	162,000

^eEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. ^rRevised. do. Ditto.

¹Table includes data available through October 31, 2014.

²In addition to the commodities listed, copper, dolomite, lignite briquets, manganese, and crude construction materials are produced, but available information is inadequate to make reliable estimates of output.

³Reported figure.

TABLE 2
GREECE: STRUCTURE OF THE MINERAL INDUSTRY IN 2013¹

(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 S.A. (Mytilineos Holdings S.A., 53%)	Agios Nikolaos, Boeotia area	1,100
Aluminum		do.	do.	180
Barite, BaSO ₄		S&B Industrial Minerals, S.A. (Eliopoulos-Kyriakopoulos Group)	Mines at Adamas, Milos Island	NA
Bauxite		do.	Mines at Amfissa and Distomon, plants at Phocis and Itea	2,000
Do.		Delphi-Distomon S.A. (Mytilineos Holdings S.A.)	Mines at Amfissa and Distomon	800
Do.		Hellenic Mining Enterprises. S.A.	Mines at Aga Marina, Lamia	500
Bentonite:				
Crude		Mediterranean Bentonite Co. S.A. (Industria Chimica Mineraria S.p.A.)	Surface mines on Milos Island	20
Do.		Mykobor 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 Voudia Bay, Milos Island	400
Cement		Halkis Cement Co. S.A. (Lafarge Group, 89%)	Micro-Vathi plant, west-central (closed)	3,000
Do.		Halyps Cement S.A. (Ciments Français Group)	Paralia Aspropyrgos plant, Athens	800
Do.		Heracles General Cement S.A. (Lafarge Group)	Plants at 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
Chromite		Financial-Mining-Industrial and Shipping Corp. (FIMISCO)	Tsingeli Mine, Volos	25
Ferroalloys, ferronickel, Ni content		Larco G.M.M. S.A.	Larimna metallurgical plant	25
Gold, Au in concentrate	kilograms	Eldorado Gold Corp., Canada	Kassandra Mines (Olympias)	1,200
Gypsum		Lava Mining and Quarrying Co. S.A.	Altsi, Crete Island	500
Do.		Titan Cement Co. S.A.	do.	280
Lead, mine, Pb in concentrate		Hellas Gold S.A. (Eldorado Gold Corp.)	Kassandra Mines (Olympias and Stratoni, northeastern Chalkidiki)	30
Lignite		Public Power Corp. S.A. (PPC)	Megalopolis and Ptolemais Mines	63,000
Magnesite:				
Concentrate		Grecian Magnesite S.A. (GM)	Mine and production facilities at Chalkidiki, Halkidiki, and Yerakini, northern Greece	250
Do.		Terna Magnesite (Terna Mag)	Gerorema Mine	100
Huntite, hydromagnesite		Microfine S.A.	Mines in Kozani Basin	100
Manganese, battery-grade MnO ₂		Eleusis Bauxite Mines Mining, Industrial and Shipping S.A. [National Bank of Greece (OAE)]	Nevrokopi, Drama	10
Marble, slab and tile	cubic meters	Aghia Marina Marble Ltd.	Various areas of northern Greece	NA
Do.	do.	Michelakis Marble S.A.	Kavala	NA
Do.	do.	Gourlis Group	Quarries at Levadia, Neurokopi, and Tiseo	NA
Natural gas	million cubic meters per day	Hellenic Petroleum S.A.	Prinos offshore gasfield and oilfield, east of Thasos Island	125
Do.	do.	Enegean Oil and Gas S.A.	South Kavala gasfield, east of Thasos Island	NA
Nickel, ore		Larco G.M.M. S.A.	Agios Ioannis Mine, Evia Mine, at Neo Kokkino near Larymna; and Kastoria Mine, near Albanian border	2,500
Do.		do.	Larymna smelter, near Athens	2,500
Nitrogen, N content of ammonia		Phosphoric Fertilizers S.A.	Nea Karvall	150

See footnotes at end of table.

TABLE 2—Continued
GREECE: STRUCTURE OF THE MINERAL INDUSTRY IN 2013¹

(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 Milos Island; plant at Pireaus	650
Do.		Otavi Minen Hellas S.A. (Otavi Minen AG)	Milos Island	150
Petroleum, crude	42-gallon barrels per day	Enegean Oil and Gas S.A.	Prinos offshore oilfield, east of Thassos Island	NA
Petroleum, refined	do.	Hellenic Petroleum S.A.	Aspropyrgos	95,000
Do.	do.	do.	Eleusis	100,000
Do.	do.	do.	Thessaloniki	76,000
Do.	do.	Motor Oil (Hellas) Corinth Refineries S.A.	Aghii Theodori, Corinth	170,000
Pozzolan (Santorin earth)		Lava Mining and Quarrying Co. (Heracles General Cement Co.)	Xylokeratia, Milos Island	600
Do.		Titan Cement Co. S.A.	do.	300
Pumice		Lava Mining and Quarrying Co. (Heracles General Cement Co.)	Yali Island	1,000
Quartz (microcrystalline)		do.	Adamas, Milos Island	150
Steel, crude		Hellenic Halyvourgia	Volos plant	1,000
Do.		Sidenor Steel Products Manufacturing S.A.	Thessaaloniki and Almyros plants	2,800
Do.		Halyvourgiki S.A.	Eleusis plant	1,200
Do.		Hellenic Steel Co. S.A.	Thessaloniki plant	1,000
Steel products		Corinth Pipeworks S.A. (CPW)	Thisvi plant, Viotia, near Athens	800
Zinc, mine, Zn in concentrate		Hellas Gold S.A. (European Goldfields Ltd.)	Kassandra Mines (Olympias and Stratoni), northeastern Chalkidiki	30

Do., do. Ditto. NA Not available.

¹Table includes data available through October 31, 2014.