



2012 Minerals Yearbook

GREECE

THE MINERAL INDUSTRY OF GREECE

By Harold R. Newman

Mining has been a part of Greek civilization since about 1,000 B.C. In 2012, some of Greece's important mineral resources included bauxite, bentonite, copper, gold, gypsum, and perlite. The mineral industry was composed of the sectors that mine and process metallic and nonmetallic minerals and mineral fuels. The output of the Greek mineral industry declined in both value and tonnage owing to the global economic downturn that started in 2009 and was continuing in 2012. Greece also had a high budget deficit and the European Union's (EU's) second highest external debt burden after Ireland (Industry Review, 2012).

In 2012, the mineral industry was regulated by the Mining Code, Legislative Decree 210/1973, as amended by a number of laws and ordinances on technical and procedural issues, such as law No. 669/1977 on the exploitation of ornamental rocks and industrial minerals; law No. 428/84, as amended by law No. 2115/93 on the exploitation of aggregates; and the Regulation on Mining and Quarrying Activities, which included the Health and Safety Regulation on Mining and Quarrying. Greece's mineral industry was also subject to the EU's Environmental Impact Directive and the EU Mining Waste Directive 2006/21/EC (United Nations, 2012).

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, the exploration and evaluation of ore deposits and industrial minerals, hydrogeologic surveys, and water quality control. Most exploration activity was focused on northern Greece, which was thought to contain a significant amount of exploitable minerals (Institute of Geology and Mining Exploration Management, 2012).

The challenging financial situation in Greece continued. In 2011 (the latest year for which data were available), the Government's public debt increased to about 165% of the GDP, which resulted in higher borrowing costs and loss of market access. Growth in 2012 was minus 6.9% of the GDP and the unemployment rate was an estimated 24%. Governments within the euro area provided the Greek Government with emergency short- and medium-term loans worth \$147 billion so the country could make debt payments to its creditors (U.S. Central Intelligence Agency, 2012; U.S. Department of State, 2013).

Minerals in the National Economy

The mineral industry produced and (or) processed metals, industrial minerals, and mineral fuels. Greece was a supplier of several industrial minerals—most notably, bentonite, magnesite, and perlite. Most of the Greek companies that dealt in metal fabrication, mining of minerals, and refined metal production or processing were well established and had a strong export orientation. Although mineral industry activities have traditionally been an important segment of Greek industry, the

significance of the mineral industry to the Greek economy has gradually decreased in the past 20 years.

The export and import of minerals commodities, however, continued to be relatively important to the Greek economy in 2012. U.S. exports to Greece included petroleum products valued at \$59 million, copper valued at \$42 million, iron and steel mill products valued at \$1.5 million, and nonferrous metals valued at \$617,000. U.S. imports from Greece included bauxite and aluminum valued at \$54.5 million; cement, lime, and stone valued at \$41 million; other petroleum products valued at \$24.4 million; and fuel oil valued at \$24.3 million (U.S. Census Bureau, 2012a, b).

Production

Greece was a global supplier of several industrial minerals, and production of these mineral commodities was closely tied to the export market (table 1). In 2012, Greece was the world's second-ranked producer of perlite after the United States and the world's sixth-ranked producer of pumice. It also was estimated to have produced about 9% of the world's bentonite and 1% of the world's bauxite. Greece was the only country that produced huntite, which is a carbonate mineral used as a fire retardant for polymers. Bauxite, which is the raw material needed for aluminum production, and lignite, which is used as a fuel in powerplants, were the country's two most abundant minerals in terms of reserves. In terms of the value of production, bauxite was the most important of Greece's mineral commodities (Bolen, 2013; Bray, 2013; Crangle, 2013; Virta, 2013).

Structure of the Mineral Industry

The major mineral commodities and the companies that produced them in 2012 are listed in table 2. Nearly all companies were privately owned; Government ownership was limited mainly to the mineral fuels sector.

Commodity Review

Metals

Bauxite and Alumina and Aluminum.—All Greece's major bauxite deposits are located in central Greece within the Parnassos-Ghiona geotectonic zone and on Evvoia 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. (S&B). 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 (table 2).

Gold.—Glory Resources Ltd. of Australia announced in 2012 that it had identified mineral resources at its Sapes

gold project with a Joint Ore Reserves Committee (JORC) estimate of measured and indicated resources of 2.6 million metric tons (Mt) grading 9.8 grams per metric ton (g/t) gold. A JORC-compliant mineral resource estimate was to be completed following a proposed 6,000-meter (m) drilling program (Glory Resources Ltd., 2012).

Lead, Silver, and Zinc.—Eldorado Gold Corp. of Canada's Stratoni Mine was an underground operation located on the Chalkidiki Peninsula. It operated at a mining rate of about 18,000 metric tons per month of ore and produced lead, silver, and zinc concentrates. The Stratoni mineralization was classified as lead-silver-zinc carbonate replacement type mineralization, with galena, pyrite, and sphalerite as the main ore minerals. Resources at the Stratoni Mine were contained within the Mavres Petres ore body and had estimated proven and possible reserves of 1.8 Mt grading 8.5% zinc, 6.3% lead, and 177 g/t silver. The mine produced a lead-silver concentrate and a zinc concentrate by a conventional underground drift-and-fill method. The concentrates were shipped by sea to European facilities using either the Stratoni or the Thessaloniki port facilities (Eldorado Gold Corp., 2012).

Nickel.—Nickel laterite mineral resources were estimated to be about 250 Mt and were spread across three areas: central Evvoia, Neon Kokkinon, and northern Greece, in the area of Kastoria. Larco G.M.M. S.A., which was a leading producer of nickel in Europe and the only European user of domestic nickel ores, mined sedimentary-type nickel laterite by open pit and underground methods at its Agios Ioannis and Evia Mines near Larimna, and smelted the material at its plant in Larimna (Larco G.M.M. S.A., 2012).

Industrial Minerals

Cement.—Titan Cement Co. S.A. was a significant cement producer in Greece, and its four plants produced a combined total of about 6 Mt/yr. Domestic and export cement sales continued to fall in response to the decrease of construction activity and the slowdown in southeastern European markets. This resulted in a net €24.5 million (\$32.6 million¹) loss for 2012. Titan stated that it had no plans to move its headquarters from Greece (Global Cement, 2012).

Clay and Shale.—Greece was the world's second-ranked producer of bentonite after the United States. Extraction was conducted primarily on Milos Island by S&B. Bentonite deposits had also been found on the islands of Chios and Lesvos. S&B ranked first in the production of bentonite in Europe and was the leading exporter of bentonite in the world (Industrial Minerals, 2012).

Magnesium Compounds.—Grecian Magnesite S.A. (GM) operated three rotary kilns for crushed calcined magnesite (CCM) or dead-burned magnesite (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).

¹Where necessary, values have been converted from euro area euros (€) to U.S. dollars (US\$) at an average rate of €1.00=US\$1.32.

Mineral Fuels and Other Sources of Energy

Coal.—In 2012, the predominant fuel used in electricity generation in Greece was lignite, and Public Power Corp. S.A. (PPC) was Greece's major producer of lignite. PPC's leading lignite mines in Megalopolis and Ptolemais provided lignite for power generation. PPC's lignite-powered powerplants and hydroelectric powerplants had a combined capacity of 12.5 gigawatts and represented about 68% of the country's total installed capacity (Public Power Corp., 2012).

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 was a 4,187-square-kilometer area located onshore in northwestern Greece. The region was on trend with large discoveries and producing fields in Albania and is geologically similar to the producing regions of Italy. Energean Oil was the only natural gas and petroleum exploration and production company in Greece. It operated three petroleum fields—Epsilon, Prinos, and Prinos North in the Prinos Development Area (Petra Petroleum Inc., 2012).

Wind Energy.—According to Invest in Greece SA, the Government's Investment Promotion Agency, Greece's potential for wind power was among the largest in Europe. In 2012, about 1,400 megawatts (MW) was installed and operating, and the Government's target was for 7,500 MW to be installed by 2020. Wind energy was among the top energy priorities of the Government, which had indicated that it was committed to the increased usage of renewable energy (Invest in Greece SA, 2012).

Outlook

The economic outlook for 2012 is not expected to improve greatly, even though the Government is expected to continue its efforts to reform the economy and address the debt issue. 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 mineral fuel exploration efforts offshore Greece.

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TABLE 1
GREECE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2008	2009	2010	2011	2012 ^e
METALS					
Aluminum:					
Bauxite	2,176,300	1,935,000	1,902,000	2,300,000 ^{r,e}	1,816,000 ³
Alumina, Al ₂ O ₃	771,769	718,797	725,000	809,700 ^r	784,400 ³
Metal, primary	162,339	134,737	136,765 ^r	167,490 ^r	165,046 ³
Chromite, ore, crude ^e	1,400	1,400	1,400	1,200	1,200
Iron and steel:					
Iron ore and concentrate, nickeliferous, Fe content ^e	570,000	560,000	560,000	550,000	550,000
Metal:					
Ferroalloys, ferronickel, gross weight	83,200	41,300	42,000	40,000	40,000
Steel, crude	2,477	2,082	1,839	1,993	2,000
Lead:^e					
Mine output, Pb content	23,314 ³	17,027 ³	12,200	16,592 ³	18,062 ³
Metal, secondary	11	10	10	10	10
Nickel:					
Ore, Ni content of nickeliferous iron ore	16,640	10,203	13,837	14,100	14,000
Metal, Ni content of ferronickel	18,600	8,269	13,960	18,527 ^r	18,632 ³
Silver, mine output, Ag content ^e	35,500	30,177 ³	29,000	30,000	32,000
Zinc, mine output, Zn content by analysis	20,300 ^e	18,126	19,967	39,127 ^r	41,824 ³
INDUSTRIAL MINERALS					
Cement, hydraulic ^e	11,361 ³	11,160 ³	11,000	11,000	11,000
Clays:					
Bentonite, crude, includes attapulgite and sepiolite	1,389,800	926,186	1,381,643 ^r	1,188,442 ^r	1,235,105 ³
Kaolin, crude	4,360	--	--	--	--
Feldspar	62,000	55,737	23,050	10,200 ^r	12,000
Gypsum and anhydrite	865,000	730,000	700,000	587,000 ^r	746,000 ³
Magnesite:					
Ore, crude	361,165	380,834	396,000	541,813 ^r	351,266 ³
Huntite, crude ^e	19,600 ³	10,652 ³	12,000	23,800 ^r	24,200 ³

See footnotes at end of table.

TABLE 1—Continued
GREECE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2008	2009	2010	2011	2012 ^e
INDUSTRIAL MINERALS—Continued					
Nitrogen, N content of ammonia ^{c,4}	130,000	130,000	130,000	130,000	130,000
Perlite:					
Crude	1,100,000 ^e	862,935	760,000 ^e	842,870 ^r	876,396 ³
Screened	500,000 ^e	398,451	400,000 ^e	507,235 ^r	450,000 ³
Pozzolan, Santorin earth ^c	1,059,000 ³	830,000 ³	850,000	350,000 ^r	285,000 ³
Pumice	828,000	381,000	400,000 ^e	468,960 ^r	385,917 ³
Salt, all types	220,000	189,000	190,000 ^e	174,500 ^r	191,970 ³
Silica	64,521	37,905	40,000 ^e	1,671 ^r	--
Stone, marble ^c cubic meters	347,526 ³	255,516 ³	250,000	285,000 ^r	320,000 ³
Sulfur, S content of mixed sulfide ore	264,299	225,054	230,000 ^e	214,943 ^r	227,197 ³
MINERAL FUELS AND RELATED MATERIALS					
Coal, lignite thousand metric tons	64,521	61,800	53,600	58,400	62,335 ³
Petroleum:					
Crude thousand 42-gallon barrels	478	628	636	676	662 ³
Refinery products: ^c					
Liquefied petroleum gas do.	7,665 ³	7,519 ³	8,030 ^{r,3}	8,000	8,000
Gasoline do.	35,077 ³	34,419 ³	36,865 ^{r,3}	32,000	32,000
Naphtha do.	8,400	8,400	8,400	8,400	8,400
Jet fuel do.	14,600	12,410 ³	12,775 ^{r,3}	14,000	14,000
Kerosene do.	157 ³	438 ³	146 ^{r,3}	200	200
Distillate fuel oil do.	48,910 ³	46,691 ³	51,468 ^{r,3}	47,000	47,000
Refinery gas do.	4,800	4,800	4,800	4,800	4,800
Residual fuel oil do.	39,055 ³	38,435 ³	37,814 ^{r,3}	42,000	42,000
Bitumen do.	4,000	3,960 ³	4,000	4,000	4,000
Other do.	1,800	1,876 ³	1,800	1,800	1,800
Total do.	164,000 ^r	159,000 ^r	166,000 ^r	162,000 ^r	162,000

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

¹Table includes data available through October 30, 2013.

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

³Reported figure.

⁴Estimate based upon installed capacity (see table 2).

TABLE 2
GREECE: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(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)	Milos Island (closed)	1
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.		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 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 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
Chromite		Financial-Mining-Industrial and Shipping Corp. (FIMISCO)	Tsingeli Mine, Volos	25
Ferrous alloys, ferronickel, Ni content		Larco G.M.M. S.A.	Larimna metallurgical plant	25
Gold, Au in concentrate	kilograms	Hellas Gold S.A. (European Goldfields Ltd.)	Kassandra Mines (Olympias and Stratoni), northeastern Chalkidiki	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 Chalkidiki	30
Lignite		Public Power Corp. (PPC) (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 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	Public Petroleum Corp. (PPC) (Government)	Prinos offshore gasfield and oilfield, east of Thasos Island	125
Do.	do.	Energean Oil and Gas S.A.	South Kavala gasfield, east of Thasos Island	NA
Nickel, ore		Larco G.M.M. S.A.	Agios Ioannis Mine, near Larimna	700
Do.		do.	Evia Mine, near Larimna	1,500
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 2012

(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 Islands; plant at Piraeus	650
Do.		Otavi Minen Hellas S.A. (Otavi Minen AG)	Milos Island	150
Petroleum, crude	42-gallon barrels per day	Energean Oil and Gas S.A.	Prinos offshore oilfield, east of Thassos Island	NA
Petroleum, refined	do.	Hellenic Aspropyrgos Refinery S.A.	Aspropyrgos	95,000
Do.	do.	Motor Oil (Hellas) Corinth Refineries S.A.	Aghii Theodori, Corinth	170,000
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 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		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
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.