

THE MINERAL INDUSTRY OF

GREECE

By Harold R. Newman

The mineral industry, which consists of the sectors that mine and process metallic and nonmetallic minerals, was a small but important part of the national economy. Mineral concentrates of lead and zinc were produced from processing base-metal massive sulfides ores from northern Greece; alumina and aluminum from karstic bauxite resources; and ferronickel alloy from laterite-derived sedimentary nickeliferous iron ores. These were the main products of metal mining and processing. Steel production was from imported scrap.

In terms of value of production in the national economy, the industrial mineral sector was more important than was the metal sector. Production of mineral commodities in Greece was closely tied to the export market. Exports of minerals, such as bauxite, bentonite, nickel, and perlite, made up a major share of total revenues. About 50% of the country's mineral production was being exported. A relatively small industrial base, the lack of adequate investment in the past, and the distance from the European Union (EU) market have restricted the export potential of the country. The emerging Balkan markets, however, could offer opportunities for export growth. Greece is the only Balkan country that is member of the EU (U.S. Department of State, Bureau of Economic Policy and Trade Practices, 2002, p. 9). In terms of value of production, bauxite was the most important of Greece's mineral commodities. Greece was the largest producer of bauxite, magnesium, nickel, and perlite in the EU (table 1).

Because northern Greece was thought to contain a significant amount of exploitable mineral resources, it received the most attention in exploration activities. In 2002, most activities were directed toward gold. Only a few foreign companies had invested in Greek mines. Of these, TVX Hellas S.A. (an affiliate of TVX Gold Inc. of Canada) bought the Cassandra Mines assets; United Kingdom-based Microfine S.A. operated mines that extracted huntite/hydromagnesite, which is unique for its flame-retardant properties; and Germany-based Otavi Minen Hellas S.A. operated perlite mines. Selected companies with major equity owners are listed in table 2.

Environmental concerns are the responsibility of the Ministry of Environment, Town Planning, and Public Works. The Government takes an active role in environmental protection. The general laws enacted by the Government include Law 1360/76 (Site Arrangement and Environment), Presidential Executive Order 1180/81, and Law 1650/86 (Environmental Protection); these formed the basis of the active legislative framework. To comply with EU Order 88/609 concerning emission limitations, the Government executed Ministry Decision 58751/2370/15.4.93, which included the limits of the main pollutants from electricity-generating plants.

Greece officially joined the EU Economic and Monetary Union (EMU) on January 1, 2001, and became a part of the EMU single currency (euro) club. The drachma ceased to exist as an independent currency at that time, although the drachma and the euro were both circulated until February 28, 2002.

Greece was among the smallest of the economies in the EU but has enjoyed fairly strong growth with relatively low inflation during the past few years. For 2002, Greece's gross domestic product grew by 2.9%; the unemployment rate has been trending downward to an estimated 9.9% in 2002 from 11.9% in 1999. Interest rates have declined sharply, and the general Government budget experienced a surplus in 2001 for the first time in more than three decades. The economic growth was being driven in part by infrastructure construction (and foreign investment) for the 2004 Olympic games, which will be held in Athens. Greece has embarked on a series of macroeconomic and structural reforms that included measures to slash bureaucracy and to attract foreign investment. The Government was also near completion of its privatization program that aimed to privatize or sell minority stakes in some 20 Government enterprises and organizations (U.S. Energy Information Administration, 2002¹).

The only producer of primary aluminum in Greece was Aluminium de Grèce S.A. (a subsidiary of Pechiney of France). The company established its plant in 1960 at Agios Nikolaos on the northern coast of the Gulf of Corinth. This was to take advantage of the important bauxite deposits for the production of alumina and aluminum. The site combines proximity to the large bauxite deposits of Boeotia and Phocis and sea transportation facilities. The production capacity of the industrial complex is 750,000 metric tons per year (t/yr) of alumina and 160,000 t/yr of aluminum. Aluminium de Grèce has been a significant force behind the development of the aluminum-processing sector in Greece (Aluminium de Grèce S.A., 2002²).

Bauxite mining and processing continued into 2002. Delphi-Distomon S.A. (the bauxite mining subsidiary of Aluminium de Grèce) produced about 1 million metric tons per year (Mt/yr), which was sold to Aluminium de Grèce's operation at Boeotia. Although the bauxite ore has an average alumina content of 53%, it also has a high silica content that makes it hard to process. The company maintained its refinery's production of 750,000 t/yr by mixing the local ore with other bauxite.

Gold exploration in Greece has seen a further slowdown. Since the mid-1980s, the exploration for gold has resulted in the discovery of significant resources in the northern part of the country. There was much uncertainty, however, if gold-processing plants that use cyanidation would get permits to operate. Two projects for gold production from epithermal deposits were still in the permitting stage, but the permit for the development of TVX Hellas's Olympias gold project was denied (Skarpelis, 2002³).

Kassandra Mines S.A.'s assets included the Stratoni mines and mill, the Olympias Mine and mill, and the Skouries deposit, were owned by Hellenic Chemical Products and Fertilizer Co. Kassandra Mines have produced arsenopyrite-gold, lead, silver, and zinc

¹References that include a section mark (§) are found in the Internet References Cited section.

concentrates for more than 30 years. The assets were bought by TVX Hellas in 1996 to exploit the refractory gold ores in the arsenopyrite stockpiles and the surface tailings by incorporating pressure oxidation technology into the ore-processing stage.

Greenwich Resources plc of the United Kingdom increased its interest in the Sappes gold project to 100%. Development of an underground mine in the high-grade Viper high-sulfurization epithermal ore deposit and an open pit mine on the St. Demetrious ore body was the main focus. Estimated mineral reserves were 1.3 million metric tons (Mt) of ore at a grade of 16.3 grams per metric ton gold. Because cyanidation has been excluded from the project, gold will be recovered by gravity and flotation techniques only. Gravity techniques will recover 15% of the gold that occurs as free gold, and 66% of the gold associated mainly with enargite will be recovered to a gold-copper concentrate by using flotation techniques and will be exported (Skarpelis, 2002§).

General Mining & Metallurgical Co. S.A. (Larco) was the only producer of nickel in Europe who only uses domestic nickel ores. Larco has three main mining areas, Agios Ioannis (underground), Evvia (open pit), and Kastoria (open pit). The ore is from a lateritic type of deposit and is part of a belt of mineralization that extends from Turkey to Albania. The ore grade ranges from 1.0% to 1.5% nickel. Around 80% to 85% of the ore is mined from open pit operations. Reserves have been estimated to last 40 more years at the current (2002) rated production (Larco, 2002§).

Corinth Pipeworks S.A. (CPW) was initially established to produce spiral-welded pipe for water transport. The oil and gas sector, however, has become its prime focus. CPW's plant at Corinth produces and coats externally and/or internally with anticorrosive materials medium- and large-diameters welded steel pipes as well as hollow sections. The plant has two spiral submerged arc weld lines with a capacity of 55,000 t/yr to produce pipe from 559 to 2,032 millimeters (mm) in diameter and wall thickness of 4.8 to 14 mm in lengths of up to 12 meters (m). A longitudinal electric resistance welding line with a 190,000-t/yr capacity can produce pipe from 114.3mm to 533.4 mm in diameter and from 4mm to 12.7 mm in wall thickness in lengths up to 16 m. CPW expects increased demand for line pipe because it is the best and safest way of transporting oil and gas (Corinth Pipeworks S.A., 2002§).

In the industrial minerals sector, Hellenic Mineral Mining Co. S.A. continued asbestos mining operations at the mines at Zidani near Kozani. Most of the various grades of asbestos fibers produced were exported. The fibers are suitable for mixed applications, such as asbestos cement pipes and roofing applications.

Greece was the world's second largest producer of bentonite after the United States. Bentonite is extracted from Milos Island by open pit mining. Mykobar Mining Co. S.A. and Silver and Barite Mining Co. (S&B) were the major producers and accounted for almost all bentonite production. Mykobar's facility has the capacity to produce more than 200,000 t/yr, and S&B's capacity was 600,000 t/yr. The major applications for bentonite were cat litter, civil engineering applications, drilling mud, foundry applications, and iron ore palletizing.

Lava Mining & Quarrying Co. S.A. specialized in extracting industrial minerals—gypsum from the island of Crete, pozzolan from Milos, and pumice from the island of Yali.

Grecian Magnesite S.A. was one of the leading magnesite producers in the Western World. Its open pit mine was at Yerakini in northern Greece. After mining, the material was processed, beneficiated, and fed into rotary or shaft kilns for conversion to caustic or dead-burned magnesia.

In 2002, the Greek marble industry continued to play a leading role in the international dimension stone market as a result of continued marble production in almost all areas of the country, variety of uses of the marble, and many colors (ash, black, brown, green, pink, red, and multicolored). The marble industry was active in the quarrying, processing, and sale of blocks and finished products.

S&B continued production of natural zeolite in northern Greece. The operation produces five grain sizes of clinoptilolite, which has a high cation exchange capacity owing to its honeycomb crystalline structure.

In an effort to become the energy hub of the Balkans, Greece will spend \$14.5 billion to modernize its energy network. The 8-year program included plans for Greece to link up with European energy grids and to boost imports of natural gas via Turkey; Greece and Turkey plan to connect their respective power grids by 2006. The two countries signed a \$300 million contract to extend an Iranian natural gas pipeline from Turkey to Greece (Alexandria's Gas and Oil Connections, 2002b§).

Greece has limited natural gas and petroleum resources, but its Mediterranean location makes it conveniently close to several important producing regions, such as the Caspian area, the Middle East, and North Africa.

The Public Power Corporation (PPC) was the major producer of lignite, which was the predominant fuel in electricity generation in Greece. Most PPC lignite was produced from the Ptolemais-Amyntaion Basin; lesser amounts were produced from the Megalopolis Basin. Lignite reserves were estimated to be 2.9 Mt (U.S. Energy Information Administration, 2002§).

The Government announced that it would privatize Public Gas Corporation (DEPA) through a sale of up to 35% equity holding in the company. DEPA, which was the leading natural gas transportation and wholesale supply company in Greece, was expected to attract widespread interest from a wide range of major energy companies given the overall high growth rate expected in the Greek energy sector (Alexander's Gas and Oil Connections, 2002a§).

Hellenic Petroleum SA, which was the state-controlled energy corporation, completed construction of a 230-kilometer pipeline to the refinery it acquired near Skopje, Macedonia. The \$100 million pipeline, which was completed in May 2002, was the first big infrastructure project in the Balkans since the end of the Kosovo conflict. The pipeline would have the capacity to carry 2.5 Mt/yr of crude oil from a storage depot in Thessaloniki to the Okta refinery outside Skopje (Alexander's Gas and Oil Connections, 2002c§).

Reference Cited

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- U.S. Energy Information Administration, 2002 (September), Greece, Country Analysis Brief, accessed September 23, 2002, at URL <http://www.eia.doe.gov/emeu/cabs/greece2.htm>.

Major Sources of Information

Institute of Geology and Mineral Exploration

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11527 Athens, Greece

Ministry of Development

Directorate of Raw Materials Mineral Policy, Section A

80 Michalakopoulou St.

10192 Athens, Greece

TABLE 1
GREECE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons, unless otherwise specified)

Commodity ²	1998	1999	2000	2001	2002 ^c
METALS					
Aluminum:					
Bauxite	1,823,000	1,882,505	1,965,561 ^r	1,931,497 ^r	2,052,000 ³
Alumina, Al ₂ O ₃	625,000 ^e	625,590	667,141	709,000 ^r	700,000
Metal:					
Primary	145,900	159,000	167,507	162,500 ^r	164,000
Secondary ^e	3,000	3,000	3,000	3,000	2,000
Chromite, run-of-mine	4,432 ^r	2,273 ^r	-- ^r	-- ^r	--
Iron and steel:					
Iron ore and concentrate, nickeliferous:					
Fe content ^e	700,000	600,000	575,000	575,000	575,000
Ni content	16,985	16,050	19,535	20,830 ^r	19,500
Metal:					
Steel, crude	1,109,000	951,000	1,088,000	1,281,000 ^r	1,835,000 ³
Ferroalloys, ferronickel, gross weight	60,020	59,545	81,662	65,000 ^r	65,000
Ni content	15,005	12,964	17,470	17,675 ^r	17,500
Lead, mine out, Pb content	18,000 ^e	22,001	18,235	28,619 ^r	29,300
Manganese:					
Ore, crude: ^e					
Gross weight	10,000	990	330 ^r	90 ^r	100
Mn content	2,500	353	63 ^r	17 ^r	16
Concentrate:					
Gross weight ^e	2,910	345	60 ^r	20 ^r	20
Mn content	1,440	149	49 ^r	13 ^r	15
Nickel, metal, Ni content of ferronickel	15,005	13,462	17,126 ^r	16,870 ^r	17,000
Silver, mine output, Ag content	45,000	45,771	37,145	61,500 ^r	74,800 ³
Tin, metal, secondary ^e	200	--	-- ³	--	--
Zinc, mine output, Zn content by analysis	29,100	19,619	20,336	20,461 ^r	30,000
INDUSTRIAL MINERALS					
Asbestos: ^e					
Ore	4,000,000	--	-- ³	--	--
Processed, fibers	50,000	--	-- ³	--	--
Barite: ^e					
Ore, crude	800	500	500	500	500
Concentrate	600	367 ³	300	300	300
Cement, hydraulic	14,757 ^r	14,365 ^r	15,463 ^r	15,500 ^{r,e}	15,500
Clays:					
Bentonite:					
Crude	950,000 ^e	1,049,657	1,148,694 ^r	1,150,000 ^e	1,150,000
Processed	750,000 ^e	186,716	41,367 ^r	26,297 ^r	27,000
Kaolin: ^e					
Crude	60,000	64,931 ³	54,226 ^{r,3}	55,000 ^r	55,000
Processed	300	300	300	300	300
Feldspar	65,000 ^e	78,500	94,700 ^r	126,400 ^r	125,000
Gypsum and anhydrite	600,000 ^e	686,416	801,025 ^r	820,000 ^r	800,000
Magnesite:					
Crude	650,000 ^e	495,144	442,785 ^r	483,296 ^r	500,000
Dead-burned	70,000 ^e	39,965	33,945 ^r	30,113 ^r	32,000
Caustic-calcined	125,000 ^e	117,817	109,730 ^r	113,355 ^r	115,000
Huntite, crude ^e	18,000	18,000	19,451 ^{r,3}	18,000	18,000
Nitrogen, N content of ammonia	177,600	119,697	121,200	57,000 ^r	58,000
Perlite:					
Crude	600,000	777,898	817,825 ^r	850,000 ^r	850,000
Screened	500,000	435,431	503,929 ^r	550,000 ^r	550,000
Pozzolan, Santorin earth	750,000	934,933	935,450 ^r	950,000 ^r	950,000
Pumice	850,000	885,000	852,000 ^r	860,000 ^r	850,000

See footnotes at end of table.

TABLE 1--Continued
GREECE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons, unless otherwise specified)

Commodity ²	1998	1999	2000	2001	2002 ^e
INDUSTRIAL MINERALS--Continued					
Salt, all types	150,000 ^e	176,867 ^r	244,709 ^r	250,000 ^{r,e}	250,000
Silica	90,000	126,000	125,000 ^e	125,000 ^e	125,000
Sodium compounds: ^e					
Carbonate	750	750	750	750	750
Sulfate	5,000	5,000	5,000	5,000	5,000
Stone:					
Dolomite ^e	90,000	90,000	90,000	90,000	90,000
Marble	200,000	178,199	191,130 ^r	200,000 ^e	200,000
Flysch ^e	80,000 ³	80,000	80,000	80,000	80,000
Quartz, processed ^e	6,500 ³	6,500	6,500	6,500	6,500
Sulfur: ^e					
S content of pyrites	9,500	9,500	9,600	9,500	9,500
Byproduct:					
Natural gas	55,000	55,000	60,000	55,000	55,000
Petroleum	7,500	7,500	8,000	7,500	7,500
Total	72,000	72,000	77,600	72,000	72,000
Zeolites ^e	4,000	3,000	3,000	3,000	3,000
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Lignite	60,400	61,861	64,026 ^r	66,987 ^r	65,000
Lignite briquets ^e	50,000	34,000	34,000	34,000 ^r	30,000
Coke, gashouse ^e	14,000	--	--	--	--
Gas: ^e					
Manufactured, gasworks	15	15	15	15	15
Natural	40	21 ³	36	36	36
Natural gas plant liquids	350	350	350	350	350
Petroleum:					
Crude	2,363	1,200 ^e	2,093	1,435 ^r	1,500
Refinery products: ^e					
Liquefied petroleum gas	5,000	6,415 ³	8,886 ³	9,000	9,000
Gasoline	30,000	27,243 ³	31,943 ³	30,000	30,000
Naphtha	4,500	7,480 ³	8,806 ³	9,000	9,000
Mineral jelly and wax	15	14 ³	28 ³	28	28
Jet fuel	12,000	15,152 ³	16,696 ³	17,000	17,000
Kerosene	150	62 ³	70 ³	70	70
Distillate fuel oil	26,000	36,300 ³	42,127 ³	42,000	42,000
Refinery gas	2,000	2,891 ³	3,416 ³	3,500	3,500
Lubricants	1,000	1,239 ³	1,120 ³	1,200	1,200
Residual fuel oil	36,000	41,532 ³	50,017 ³	50,000	50,000
Bitumen	1,500	2,491 ³	3,133 ³	3,200	3,200
Petroleum coke	500	721 ³	897 ³	900	900
Other	400	154 ³	462 ³	500	500
Refinery fuel and losses	5,500	5,922 ³	7,126 ³	7,000	7,000
Total	125,000	147,616 ³	174,727 ³	173,000	173,000

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

¹Table includes data available through May 2003.

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 2002

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina		Aluminium de Grèce S.A. (Pechiney of France, 60%)	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		Silver & Baryte Ores Mining Co. S.A. (S&B) (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.)	Open cast mines at Delphi-Distomon area	500
Bentonite:				
Crude		Mediterranean Bentonite Co. S.A. (Industria Chemica Mineraria S.p.A., Italy)	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 (Eliopoulos-Kyriakopoulos Group)	Mines at Adamas, Milos Island	600
Processed		do.	Plant at Vouidia Bay, Milos Island	400
Cement		Halkis Cement Co. S.A. (Blue Circle Industries Plc., 72.65%)	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 Co. S.A. (Blue Circle Industries Plc., 54.48%)	Plant at Milaki	1,900
Do.		do.	Plant at Volos	4,600
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) (IRO)	Tsingeli Mines and plant near Volos	25
Ferroalloys, ferronickel, Ni content		General Mining & Metallurgical Co. S.A. (Larco) (IRO)	Larymna metallurgical plant	25
Gold, Au in concentrate	kilograms	TVX Hellas (TVX Gold Inc., Canada)	Kassandra Mines, Olympias	5,000
Gypsum		Lava Mining & 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		TVX Hellas (TVX Gold Inc., Canada)	Kassandra Mines (Olympias, Stratoni) northeastern Chalkidiki	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		Viomagn-Fimisco Ltd. (Violignit S.A., 65%; Alpha Ventures, 35%)	Mines at Gerorema, Kakavos, and Mantoudhi, northern Euboea Island	250
Do.		Grecian Magnesite S.A.	Mine and plant at Yerakini, Chalkidiki	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 (IRO)	Agios Ioannis Mines near Larymna	500
Do.		do.	Mines at Euboea Island	2,500

TABLE 2--Continued
GREECE: STRUCTURE OF THE MINERAL INDUSTRY IN 2002

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Nitrogen, N content of ammonia	Phosphoric Fertilizers S.A.	Nea Karvall	150
Perlite	S&B (Eliopoulos-Kyriakopoulos Group)	Mines on Kos and Milos Islands; plant at Pireaus	300
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 & Quarrying Co. (Heracles General Cement Co. S.A.)	Xylokeratia, Milos Island	600
Do.	Titan Cement Co. S.A.	do.	300
Pumice	Lava Mining & Quarrying Co. (Heracles General Cement Co. S.A.)	Yali Island	100
Quartz	do.	Adamas, Milos Island	150
Steel, crude	Halyvourgia Thessalias S.A. (Manassis Bros. and Voyatzis S.A., 65%; National Investment Bank for Industrial Development, 35%)	Steelworks at Volos	1,500
Do.	Halyvourgiki, Inc.	Steelworks at Eleusis	1,200
Do.	Hellenic Steel Co.	Steelworks at Thessaloniki	1,000
Do.	Corinth Pipeworks	Steelworks at Thisvi	680
Do.	Sidenor S.A. (also known as Halivourgia Voriou Ellados S.A.)	Steelworks at Volos	600
Do.	do.	Stellworks at Corinth	245
Zeolite	S&B (Eliopoulos-Kyriakopoulos Group)	Mine at Pendalofos; plant at Ritsona	100
Zinc, mine, Zn in concentrate	TVX Hellas S.A. (TVX Gold Inc., Canada)	Kassandra Mines (Olympias and Stratoni), northeastern Chalkidiki	30