2007 Minerals Yearbook

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The Mineral Industry of Finland

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Finland, which is a member country of the European Union (EU), has mining laws that encourage exploration and development, metallurgical expertise, a well developed infrastructure, and geology similar to that of Western Australia. The Government provides access to excellent geologic databases and other exploration services. The country's close proximity to the large EU market was a major competitive advantage for some raw materials, particularly aggregate, natural stone, and certain other industrial minerals. Several significant mining projects were underway in 2007.

Minerals in the National Economy

The geology of the Fennoscandian (or Baltic) Shield extends across much of Finland. Exploration in Finland was largely driven by the need to support the existing mining and mineral extraction infrastructure, although mining contributed less than 1% to the national economy. Investment in exploration increased to €50 million ($67 million) in 2007 from €38 million ($50 million)[1] in 2006. Among the companies that were most active in exploration were Edomines AB, Lappland Goldminers AB, Scandinavian Minerals Ltd., and Vulcan Resources Ltd. of Australia. The increase in investment of Nordic exploration was higher than the increase in investment of total world exploration. This investment was significant to the national economy of Finland, and the Government continued to encourage foreign investment in mineral exploration and investment (International Mining, 2007c).

The metal industry was one of the key sectors of the national economy. Copper refining and the production of other metals, although decreasing, continued to be significant. The output of the metal industry was largely exported.

Production

In 2007, metals were mined from 8 mines that produced 3.7 million metric tons (Mt) of ores; industrial minerals were mined from 34 mines and quarries that produced 16 Mt of ores.

Production of mine output copper content, mine output nickel content, and mine output zinc content increased whereas production of crude steel and silver metal decreased. Finland was the leading talc producer in Europe and the fifth ranked producer of wollastonite (Geological Survey of Finland, 2007a). Data on mineral production are in table 1.

Structure of the Mineral Industry

The mineral resource companies were mostly privately owned. However, the Government held an equity position in some of the major mining companies. The mineral industry operated on a free market basis. The country's mineral commodities, the locations of the companies that produce them, and the annual capacities of the companies' major facilities in Finland are listed in table 2.

Commodity Review

The Suurikuusikko gold deposit, which had an estimated inferred gold content of about 120 metric tons (t), was expected to become Europe's leading gold mine. The Talvivaara nickel deposit was the largest nickel deposit in Western Europe. Based on estimated proven reserves, the deposit had the potential to produce about 3% of the world's nickel during its scheduled 25-year operating life. A second important nickel project, the Kevitsa Mine, was under construction near Sodankylä. The nickel–platinum-group elements ore body is almost as extensive as that of Talvivaara. There was significant potential for new discoveries because the region had not been thoroughly examined for many commodities (Geological Survey of Finland, 2007b).

Metals

Cobalt and Copper.—Vulcan Resources was a base-metals development and exploration company whose primary focus in 2007 was the completion of a feasibility study on its Kylylahti project, which is located in eastern Finland. The project had an estimated resource of 7.8 Mt grading 0.24% cobalt, 1.17% copper, 0.22% nickel, 0.70 gram per metric ton (g/t) gold, and 0.49% zinc. Projected production during the expected 12 years of mine life was 600,000 metric tons per year (t/yr) of ore to produce 9,000 t/yr of copper, 1,300 t/yr of cobalt, 1,200 t/yr of nickel, and 224 kilograms per year (kg/yr) of gold in concentrate (International Mining, 2007b).

Gold.—Construction of Agnico-Eagle Mining Ltd.'s Kittila gold mine on the Suurikuusikko deposit was continuing. Production was planned to begin by yearend 2008 and to continue for 13 years. The Kittila Mine would initially be mined by an open pit method followed by underground mining using ramp access. The mining operation would feed a 3,000-metric-ton-per-day (t/d) surface processing plant. The mine was expected to produce 4,200 kg/yr of gold. Estimated probable reserves were 18.2 Mt at a grade of 5.1 g/t gold (Agnico-Eagle Mining Ltd., 2007).

Dragon Mining Ltd. of Australia (formerly Dragon Mining N.L.) was engaged in the exploration, development, and mining of gold projects in Finland. Dragon Mining owned the Vammala processing facility, which included the Jokisivu Mine, the Orivesi Mine, and the Vammala plant, Dragon Mining also had interests in the Hanhimaa deposit in the Central Lapland region of northern Finland; the Kuusamo deposit in northern Finland; and the Pampalo deposit in east-central Finland. In 2007, the

[1]Where necessary, values have been converted from European Union euros (€) to U.S. dollars (US$) at a rate of €1.00=US$1.33.

Vammala facility produced about 15,800 kilograms (kg) of gold at a grade of 7.7 g/t gold (Dragon Mining Ltd., 2007).

Dragon Mining was continuing work to reopen the Orivesi Mine and reported that delineation drilling had intercepted high-grade ore, including 2.35 meters (m) grading 56.95 g/t gold and 3.65 m grading 106.70 g/t gold. The company extended the 285 access drive from the Kutema decline to the Sarvisuo area and advanced the Sarvisuo decline at a rate of about 70 meters per month. The object was to reach the 420-m level by yearend. Mining was continuing at the Kutema stopes and pillars. The ore produced was processed at the Vammala plant (International Mining, 2007a).

In 2007, Lappland Goldminers acquired the Haveri gold project from Northern Lion Gold Corp. of Vancouver, British Columbia, Canada. Haveri is located in the Tampere Schist Belt on the continuation of the Gold Line across the Bottnian Gulf to southwest Finland. Extensive exploration work had been carried out during the past few years, including the drilling of 126 diamond drill holes totaling 30,000 m. Haveri was considered to have the potential to become an important gold mine. The gold reserves at Haveri had previously been estimated to be 22,260 kg, but this estimate was not calculated in compliance with National Instrument 43-101 Standards of Disclosure for Mineral Projects, which was developed by the Canadian Securities Administration (Lappland Goldminers AB, 2007).

Iron and Steel.—The European market for processed iron ore was about 200 Mt, of which about 30 Mt was produced within Europe, mostly from the Kiruna Mine in Sweden. The balance was sourced mainly from Australia and Brazil. Production within the European market could result in significant savings on the cost of importing iron ore from the southern hemisphere.

Tertiary Minerals plc's Kolari iron ore project was focused on a magnetite iron ore target, Sivakkalehto, which is located in Kolaria at the heart of Finland's main iron ore district. Sivakkalehto was the most significant known magnetic anomaly in the Kolari iron district. Magnetic iron ore was last worked there in the 1980s by the Finnish company Rautaruukki Oy. A drilling and magnetic separation program conducted by Tertiary confirmed that wide intervals of near-surface magnetite iron mineralization with a magnetite content of about 30% was present over a significant strike length. The material was capable of being upgraded to a commercial product grading 68% iron with the potential for the production of sinter feed or high-grade pellets. The material would be mined by open pit (Tertiary Minerals plc, 2007).

Nickel.—Kevitsa, which is located in northern Finland, was one of the world's major undeveloped nickel sulfide deposits. In April 2007, Scandinavian Minerals commenced a feasibility study for the Kevitsa project. The study was based on an open pit operation mining about 5 Mt/yr with the production to be sold to local or foreign smelters. Scandinavian Minerals was also engaged in a metallurgical pilot plant project to optimize the metal grades and recoveries. The average grades of a 575 bulk sample were 0.44% copper, 0.186 g/t gold, and 0.36% nickel. Scandinavian Minerals announced that it had ordered grinding mills for the Kevitsa nickel property. The grinding mills would be designed to process about 5 Mt/yr of ore and would be fully autogenous (Scandinavian Minerals Ltd., 2007).

The nickel deposits of Talvivaara Mining Co. Ltd. were located in the southern part of the Kainuu schist zone. The deposits comprise two ore bodies—the Kolmsoppi and the Kuusilampi. Three mineralogical ore types include fine-grained dissemination, metacarbonate, and sulfide mineral content. The sulfide mineral content consisted mainly of chalcopyrite, pentlandite, pyrite, pyrrhotite, and sphalerite. The Talvivaara deposits were estimated to have 340 Mt of resources with average grades of 0.14% copper and 0.27% nickel. The ore bodies are well suited to open pit mining owing to a thin overburden and favorable resource geometry. The Talvivaara mine life was estimated to be 25 years, and production could account for more than 2% of the world's nickel production when the mine becomes operational (Wiklund, 2007).

Mineral Fuels

Natural Gas.—The Government gave the Nord Stream consortium approval to start exploratory work in Finland's economic exclusion zone. The natural gas pipeline project came under criticism from countries bordering the Baltic Sea, including Portugal and Sweden, which were worried about the impact on the marine ecosystem and the security of their energy supply. Latvia asked for the pipeline to pass underground rather than through its waters. Nord Stream, which was controlled by Gazprom of Russia, planned to lay the 1,200-km pipeline along the bottom of the Baltic Sea between Vyborg, Russia, and Greifswald, Germany (Rigzone.com, 2007).

Outlook

The operating environment for mining companies in Finland is generally favorable for exploration and mining. It is expected to remain so. There is a significant potential for new mineral commodities to be discovered as exploration is expected to continue at a strong pace. The country has a long mining history and a traditional focus on primary resources. The Geological Survey of Finland will continue to identify mineral deposits and compile geosciences data. Mining and taxation laws are expected to remain favorable to the industry (Geological Survey of Finland, 2007a).

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TABLE 1
FINLAND: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2003	2004	2005	2006	2007[e]
METALS						
Aluminum, metal, secondary	metric tons	32,619	39,266	34,127	35,773 r	44,223 3
Chromite:[e]						
Gross weight:						
Lump ore		210	240	235	219	221
Concentrate		329	330	326	320	325
Foundry sand		10	10	10	10	10
Total		549	580 3	571 3	549	556
Cr_2O_3 content:						
Lump ore		76	84	82	80	80
Concentrate		125	127	126	125	125
Foundry sand		5	5	5	5	5
Total		206	216 3	213 3	210	210
Cobalt, refined	metric tons	4,574	5,246	6,158	5,903	9,158 3
Copper:						
Concentrate, gross weight	do.	50,875	52,864	53,489 r	44,663	47,798 3
Mine output, Cu content	do.	14,900	15,500	15,600 e	13,000 r	13,600 3
Metal:						
Smelter	do.	176,384	168,577	177,216	192,235	144,705 3
Refined	do.	135,160	132,133	124,994	136,674	109,837 3
Gold, metal, mine output	kilograms	5,409	6,222	3,747	5,292 r	4,261 3
Iron and steel, metal:						
Pig iron		3,092	3,037	3,056	3,158	2,915 3
Ferroalloys, ferrochromium		250 e	264	235	243	242
Steel, crude		4,766	4,833	4,738	5,052	4,431 3
Semimanufactures, rolled[e]		3,900	3,950	4,000	4,200	4,000
Mercury	kilograms	25,000	24,000	34,200	22,879 r	45,195 3
Nickel:						
Mine output, Ni content	do.	3,640	3,700	3,386	2,985	3,465 3
Metal, electrolytic	metric tons	45,417	40,088	34,709	47,469 r	54,964 3
Platinum	kilograms	461	705	678	711 r	461
Selenium, metal	do.	49,163	61,250	57,208	70,458	52,459 3
Silver, metal	do.	31,115	37,413	24,822	38,428 r	33,447 3
Zinc:						
Mine output, Zn content	metric tons	70,652	69,333	72,474	66,109	72,118 3
Metal	do.	265,853	284,524	281,905	282,238	305,543 3

See footnotes at end of table.

TABLE 1—Continued

FINLAND: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2003	2004	2005	2006	2007[e]
INDUSTRIAL MINERALS						
Biotite		65,150	59,577	59,381	62,959	57,720 [3]
Cement, hydraulic		1,493	1,628	1,537	1,685 [r]	1,743 [3]
Feldspar	metric tons	48,353	57,149	52,383 [r]	43,187	48,980 [3]
Lime		434	432	470 [r]	502	517
Mica	metric tons	9,337	9,225	9,473	8,097	11,449 [3]
Nitrogen, N content of ammonia	do.	77,100	60,600	73,592 [r]	91,356	100,623 [3]
Phosphate rock apatite concentrate:[e]						
Gross weight		799	838	823 [3]	858 [3]	860
P_2O_5 content		290	306	300 [3]	325 [3]	325
Pyrite, gross weight		677	702	489	495	509 [3]
Sodium sulfate		28	27	26	27	20
Stone, crushed:						
Limestone and dolomite:						
For cement manufacture		1,411	1,628	1,537	1,569 [r]	1,764 [3]
For agriculture		626	555	566	657	547 [3]
For lime manufacture		424	316	342	328	310
Fine powders		579	670	629	625 [e]	625
Metallurgical[e]		1	1	1	1	1
Total		3,041	3,170	3,075	3,161 [r]	3,247
Quartz silica sand		112	285	286	275 [r]	296
Sulfur:						
S content of pyrite		341	336	270 [e]	250 [e]	250
Byproduct:						
Metallurgy		305	301	300 [e]	300 [e]	300
Petroleum		60	65	70 [e]	70 [e]	70
Total		365	366	370 [e]	370 [e]	370
Sulfuric acid		1,036	1,141	1,057	971 [r]	904 [3]
Talc		460	492	508	559 [r]	536 [3]
Wollastonite	metric tons	17,300	16,763	15,950	16,200	16,364 [3]
MINERAL FUELS AND RELATED MATERIALS						
Peat:						
For fuel use		8,415	8,159	7,696	6,919	8,100
For agriculture and other uses		929	905	778	896	1,000
Petroleum refinery products	thousand 42-gallon barrels	54,956	61,037	78,796	79,835	80,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto.

[1]Table includes data available through November 30, 2008.

[2]In addition to the commodities listed, granite and soapstone were produced, but available information is inadequate to make reliable estimates of output.

[3]Reported figure.

TABLE 2
FINLAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2007

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Ammonia		Kemira Oyj (Government, 98%)	Plant at Oulu	75
Apatite		Kemira Agro Oy (Government, 98%)	Mine and plant at Nivala	8,000
Cadmium, metal		Outokumpu Oyj (Government, 40%, and private investors, 12.3%)	Smelter at Kokkola	1
Cement		Finncement Oy (Irish Cement Ltd., 100%)	Plants at Lappeenranta and Parainen	1,020
Chromite		Outokumpu Oyj (Government, 40%, and private investors, 12.3%)	Mine at Kemi	1,000
Copper:				
Ore, Cu content		Inmet Mining Corp.	Mines at Pyhasalmi, Saattopora, and Hitura	10
Metal		Outokumpu Oyj (Government, 40%, and private investors, 12.3%)	Smelter at Harjavalta	160
Do.		do.	Refinery at Pori	125
Feldspar		SP Minerals Oy (Partek Corp., 50.1%, and SCR-Silbeco SA, 49.9%)	Mine and plant at Kemio	50
Ferrochrome		Outokumpu Oyj (Government, 40%, and private investors, 12.3%)	Smelter at Tornio	250
Gold:				
Ore, Au content	metric tons	do.	Mine at Orivesi	4
Do.	do.	Scanmining	Pahtavaara Mine near Sodankyla	3
Metal	do.	Outokumpu Oyj (Government, 40%, and private investors, 12.3%)	Smelter at Pori	4
Limestone		Partek Nordkalk Oy (Partek Corp., 100%)	Mines at Lappeenranta, Pargas, and Parainen	1,500
Do.		Rauma-Repola Oy	Mine at Tornio	300
Mercury	metric tons	Outokumpu Oyj (Government, 40%, and private investors, 12.3%)	Smelter at Kokkola	150
Mica		Kemira Oyj (Government, 98%)	Mine at Siilinjarvi	10
Do.		Minelco Oy	Plant at Siilinjarvi	10
Nickel:				
Ore, Ni content		Outokumpu Oyj (Government, 40%, and private investors, 12.3%)	Mine at Hitura	3
Metal		do.	Smelter at Harjavalta	32
Do.		OM Group, Inc.	Refinery at Harjavalta	50
Petroleum products	thousand barrels per day	Fortum Oil and Gas Oy	Plants at Naantali and Porvoo	250
Phosphate-apatite		Kemira GrowHow Oyj (Yara International ASA)	Mine at Siilinjarvi	850
Do.		Outokumpu Oyj (Government, 40%, and private investors, 12.3%)	Mine at Pyhasalmi	800
Quartz and quartzite		SP Minerals Oy (Partek Corp., 50.1%, and SCR-Silbeco SA, 49.9%)	Mines at Kemio and Nilsia	250
Selenium	metric tons	Outokumpu Oyj (Government, 40%, and private investors, 12.3%)	Smelter at Pori	35
Silver	do.	do.	do.	30
Steel:				
Crude		Rautaruukki Oy (Government, 41.8%)	Plants at Halikko, Hameenlinna, Kankaanpaa, and Raahe	2,100
Do.		Fundia AB (Norsk Jenverk AS of Norway, 50%, and Rautaruukki, 50%)	Plants at Aminnefors, Dalsbruk, and Koverhar	850
Do.		Ovako Oy (AB SKF, 50%; Wartsila Corp., 25%; Fiskas, 20%)	Plant at Imatra	600
Stainless		AvestaPolarit	Plant at Tornio	550
Talc		Mondo Minerals Oy (BHP Billiton plc, 50%, and Plüss-Staufer AG, 50%)	Mines at Lahnaslampi, Lipsavaara, and Horsmanaho	500
Wollastonite		Partek Minerals Oy (Partek Corp., 100%)	Mine at Lappeenranta	30
Zinc:				
Ore, Zn content		Inmet Mining Corp.	Mine at Pyhasalmi	25
Metal		Outokumpu Oyj (Government, 40%, and private investors, 12.3%)	Smelter at Kokkola	260