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FINLAND

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The Mineral Industry of Finland

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Finland is an industrialized country whose economy was based on trade, primarily exports. The country imported metal concentrates from various sources to feed its smelters. The Government encouraged foreign investment in mineral exploration and exploitation. Both domestic and foreign companies were active in exploring for mineral resources, which included gemstones, hydrocarbons, industrial minerals, and metals.

Minerals in the National Economy

The potential of the Fennoscandian Shield to host undiscovered mineral deposits continued to attract international mining and exploration companies to Finland. The geologic similarity to the shield areas of Australia and Canada was one reason for the exploration interest. Further, the country's political and economic stability, the mining and environmental legislation, and the pro-mining attitude were important factors drawing exploration investment. Other positive factors included good infrastructure and the excellent quality and coverage of geodata by the Geological Survey of Finland. There is significant potential for new discoveries as the region has not been thoroughly examined for many commodities. The country's total expenditure on mineral exploration in 2006, including that by the Geological Survey of Finland, was about €40 million ($56 million),[1] which was the highest in Europe (Mining Journal, 2006).

Production

The mine output of copper, nickel, and zinc decreased in 2006 and production of crude steel and silver metal increased. Industrial minerals production remained about the same or increased. The five most important nonpetroleum minerals, by value, were chalk, coal, crushed stone, sand and gravel, and stone (Geological Survey of Finland, 2007). Data on mineral production are provided in table 1.

Structure of the Mineral Industry

Some 43 mines and quarries covered by the Finnish Mining Act were in production and produced about 20 million metric tons (Mt) of ore. The following four metal mines were in production: the Hitura nickel mine, the Kemi chromite mine, the Pahtaavaara gold mine, and the Pyhäsalmi copper-zinc mine. Carbonate rock was produced from 16 mines and quarries (Mining Journal, 2006).

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

Commodity Review

Metals

Cobalt and Copper.—Vulcan Resources Ltd. of Australia was a base metals development and exploration company whose primary focus in 2006 was the completion of a feasibility study on its Kylylahti project 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 grams 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 1,300 t/yr of cobalt, 9,000 t/yr of copper, 224 kilograms per year (kg/yr) of gold in concentrate, and 1,200 t/yr of nickel (Vulcan Resources Ltd., 2006a).

Gold.—Gold deposits occur in Finland in both Archaean and Proterozic domains, in all orogenic belts, and in nearly all possible geologic settings of the igneous-metamorphic terrains. The main gold provinces are the Archaean greenstone belts in eastern Finland, the Palaeoproterozoic Karelian greenstone belts in Lapland, and the Palaeoproterozoic Svecofennian schist belts in central and southern Finland. About 200 hard-rock gold occurrences were known. Large parts of Finland were still underexplored for gold. The Pahtavaara Mine, which was operated by Scanmining Corp., was the only producer of gold in 2006 (Geological Survey of Finland, 2006).

Agnico-Eagle Mining Ltd. announced plans to construct the Kittila gold mine on the Suurikuusikko deposit for $135 million. The Kittila Mine would initially be mined by an open pit method, and then 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. Production was expected to start by midyear 2008 and to continue for 13 years (Agnico-Eagle Mining Ltd., 2006).

Nickel.—In 2006, Norilsk Nickel of Russia, which was a world-ranked nickel producer, announced its plan to buy the nickel business of OM Group, Inc. (OMG) for $408 million in cash on a debt-free basis. OMG's assets included a nickel refining operation in Harjavalta, the Cawse nickel mining and leaching operations in Western Australia, and a 20% stake in MPI Nickel Pty. Ltd., which operated the Black Swan and the Silver Swan nickel mines that supplied nickel concentrate to the Harjavalta refinery. Through this transaction, Norilsk Nickel was continuing to expand its operations internationally and strengthen its position in the global mining and metals industry (Norilsk Nickel, 2006).

Scandinavian Minerals Ltd. announced that it had applied for a mining permit for its Kevitsa nickel-copper property. The permit application was based on an open pit operation that

[1] Where necessary, values have been converted from EU euros (€) to U.S. dollars ($) at the rate of €0.71=$1.00.

would mine about 4.5 million metric tons per year (Mt/yr) of ore, with production of both nickel and copper concentrates. Scandinavian Minerals was also engaged in a metallurgical pilot plant project to optimize the metal grades and recoveries for production of smelter-grade nickel and copper concentrates (Scandinavian Minerals Ltd., 2006).

Vanadium.—Vulcan Resources Ltd. announced that it had acquired a major vanadium deposit and a number of vanadium prospects. The tenements encompass one former large iron-vanadium mine, Otanmaki, and are adjacent to the Mustavaara vanadium mine, which produced 10% of the world's consumption from the 1950s to the 1980s. Vulcan's Syote deposit is located 15 kilometers (km) from the Mustavaara Mine. Previous drilling had intersected vanadium-bearing magnetite gabbro horizons that were more than 130 meters (m) thick. Metallurgical testing produced a quality magnetite product with a grade of 1.78% vanadium oxide. Vulcan was to compile historical data, reassay the drill core, and reprocess magnetic data. Following completion of this work, a program of reconnaissance drilling would be undertaken to confirm the thickness and grade of the magnetite (Vulcan Resources Ltd., 2006b).

Mineral Fuels and Related Materials

Petroleum.—Neste Oil Corp.'s Porvoo oil refinery was an efficient and sophisticated refinery. Together with the refinery at Naantali, the company had a total refining capacity of 250,000 barrels per day. A new production line was completed at the Porvoo refinery. The new line would use residue oil to produce clean, sulfur-free motor fuels, particularly diesel fuel. Although the production of diesel fuel would increase, the overall capacity of the refinery would remain the same (Neste Oil Corp., 2006).

Uranium.—Agricola Resources plc, which was a uranium exploration company, completed initial drilling at the Hautajarvi deposit in northern Finland. The company reported that coring from two drill holes, HA 005 and HA 006, gave an average value of 0.33% uranium oxide (HA 005) and 0.19% uranium oxide (HA 006). Further drilling and geophysical studies would be done (Agricola Resources plc, 2006).

Mawson Resources Ltd. announced it had been granted five claim reservations covering three areas of known uranium mineralization in the north and east of the country. The Simonkorpi 1 claim is located within the Kuusamo Schist Belt, which is host to uranium occurrences and the Kouvervaara uranium deposit; the Saramaki 1 and 2 claim reservations are located in the Nilsia district of eastern Finland and cover a uranium mineralized boulder and outcrop trend that extends across 5 km. Fifteen uranium-bearing boulders and 25 uranium-bearing outcrops had been identified within the area. The host rock to the mineralization is an apatite-bearing gneiss. The Joensuunkyla 1 and 2 claim reservations are located in the Juuka district in eastern Finland within the principle uranium trend of the Paukkajanvaara sandstone-hosted uranium deposit. Fourteen uranium-bearing boulders and four uranium-bearing outcrops have been identified. The host rock to the mineralization is granite gneisss. Mawson had the sole right to apply for exploration claims in the area for 1 year, and exploration was allowed to be undertaken up to the point of ground disturbance (Mawson Resources Ltd., 2006).

Outlook

The operating environment in Finland was generally favorable for exploration and mining. It is expected to remain so. 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 geoscientific data. Mining and taxation laws are expected to remain favorable to the industry.

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TABLE 1
FINLAND: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006
METALS						
Aluminum, metal, secondary	metric tons	31,076	32,619	39,266	34,127 r	35,773 3
Cadmium, metal, refined	do.	4	--	--	--	--
Chromite:e						
Gross weight:						
Lump ore		216	210	240	235	219
Concentrate		340	329	330	326	320
Foundry sand		10	10	10	10	10
Total		566	549	580 3	571 3	549
Cr_2O_3 content:						
Lump ore		75	76	84	82	80
Concentrate		125	125	127	126	125
Foundry sand		5	5	5	5	5
Total		205	206	216 3	213 3	210
Cobalt, metal, powder and salts	metric tons	4,292	4,574	5,246	6,158	5,903
Copper:						
Concentrate, gross weight	do.	50,494	50,875	52,864	51,319 r	44,663 3
Mine output, Cu content	do.	14,400	14,900	15,500	15,600 e	15,000 e
Metal:						
Smelter	do.	160,900	176,384	168,577	177,216	192,235
Refined	do.	127,136	135,160	132,133	124,994 r	136,674
Gold, metal, mine output	kilograms	4,666	5,409	6,222	3,747	5,292
Iron and steel, metal:						
Pig iron		2,828	3,092	1,042	3,056 r	3,158
Ferroalloys, ferrochromium		248	250 e	264	235	243
Steel, crude		4,004	4,766	4,833	4,738	5,052
Semimanufactures, rolled[e]		3,850	3,900	3,950	4,000	4,200
Mercury	kilograms	51,000	25,000	24,000	34,200 r	22,820
Nickel:						
Mine output, Ni content	do.	3,120 r	3,640 r	3,700 r	3,386 r	2,985
Metal, electrolytic	do.	49,151	45,417	40,088	34,709	42,299
Platinum	kilograms	508	461	705	678	1,000 e
Selenium, metal	do.	39,237	49,163	61,250	57,208	70,458
Silver, metal	do.	29,404	31,115	37,413	24,822	50,843 e
Zinc:						
Mine output, Zn content	metric tons	61,580	70,652	69,333	72,474	66,109
Metal	do.	235,337	265,853	284,524	281,905	282,238
INDUSTRIAL MINERALS						
Cement, hydraulic		1,198	1,493	1,628 r	1,537 r	1,684 3
Feldspar	metric tons	46,715	48,353	57,149	52,383 r	43,187 r
Lime		350	434	432	470 r	502
Mica	metric tons				9,473	8,097
Nitrogen, N content of ammonia	do.	87,000	77,100	60,600	73,592 r	91,356
Phosphate rock apatite concentrate:e						
Gross weight	do.	800	799	838	823 3	858 3
P_2O_5 content	do.	270	290	306	300 3	325 3
Pyrite, gross weight		727	677	702	489	495
Sodium sulfate		30	28	27	26	27
Stone, crushed:						
Limestone and dolomite:						
For cement manufacture		1,400 e	1,411	1,628	1,537	1,550 e
For agriculture		1,000 e	626	555	566	657
For lime manufacture		400 e	424	316	342	328
Fine powders		400 e	579	670	629	625 e
Metallurgical[e]		1	1	1	1	1
Total		3,200 e	3,041	3,170	3,075	3,161
Quartz silica sand		148	112	285	286	275

See footnotes at end of table.

TABLE 1—Continued
FINLAND: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006
INDUSTRIAL MINERALS—Continued						
Sulfur:						
S content of pyrite		359	341	336	270 [r, e]	250 [e]
Byproduct:						
Metallurgy		308	305	301	300 [e]	300 [e]
Petroleum		55	60	65	70 [e]	70 [e]
Total		363	365	366	370 [e]	370 [e]
Sulfuric acid		951	1,036	1,141	1,057	1,276
Talc		416	460	492	508 [r]	547
Wollastonite	metric tons	20,000 [e]	17,300	16,763	15,950	16,200
MINERAL FUELS AND RELATED MATERIALS						
Peat:						
For fuel use		6,515	8,415	8,159	7,696	6,919
For agriculture and other uses		759	929	905	778	896
Petroleum, refinery products	thousand 42-gallon barrels	54,801	54,956	61,037	78,796	79,835

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

[1]Table includes data available through December 2007.

[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 2006

(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 Siilinjarvi	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
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 Oyj (Government, 98%)	Mine at Siilinjarvi	700
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 (SKF, 50%; Wartsila, 25%; Fiskas, 20%)	Plant at Imatra	600
Stainless		AvestaPolarit	Plant at Tornio	550
Talc		Mondo Minerals Oy (BHP Billiton, 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