

THE MINERAL INDUSTRY OF FINLAND

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Finland's economy, which was still recovering from the global slowdown of 2002, had a slight growth of 1.3% in the gross domestic product (GDP). The unemployment rate was very high at 9.3%. Per capita GDP in purchasing power parity, however, increased by 21% to \$30,496. The country's mineral resources were mostly in metals and industrial minerals; chromite, copper, gold, nickel, and zinc were produced. Finland had to import iron ore, nickel matte, crude oil, petroleum products, and zinc concentrates. Exploration for base metals, diamond, and gold was active. Finland was a world leader in the technology of underground mining, mineral processing, and metallurgy (International Monetary Fund, 2003§¹).

Outokumpu Oyj, which was the Finnish metals and technology group, was to reduce its workforce by 260 at its European copper products division. The cutbacks represented 13% of the division's total workforce. About 200 of the jobs were to come from Outokumpu Poricopper at Pori. The other 60 job cuts would be made throughout all other locations of the division. The economic downturn in Europe hit key industrial sales areas of the division with construction, electronics, and telecommunications being the hardest hit (Metal Bulletin, 2003b).

Outokumpu signed a licensing agreement with Ilinor S.p.A. of Italy, which was a copper alloy strip producer, to supply copper products to the connector industry. These products would be used in electronic applications in the automotive, data communication, telecommunication, and other industries. Outokumpu's connector business had two plants in the United States and one in the Netherlands (Metal Bulletin, 2003c).

Outokumpu and Boliden AB of Sweden signed a letter of intent whereby Boliden intended to acquire Outokumpu's copper and zinc mining and smelting operations and to sell its fabrication (copper tubes and brass products) and technology sales (Boliden Contech) units to Outokumpu. As a result, Boliden would become one of the world's leading smelting companies and the fourth largest zinc mining company in the world. The assets involved in Finland were the copper smelter at Harjavalta, the copper refinery at Pori, and the zinc smelter in Kokkola. Outokumpu would focus on its main area of activities—stainless steel and value-added copper products (PrimeZone, 2003§).

Inmet Mining Corp.'s Pyhasalmi Mine was a highly efficient underground copper and zinc mine in central Finland. Inmet acquired it from Outokumpu in 2002. In 2003, the mine was expected to mill 1.27 million metric tons (Mt) of ore from 19 stopes; the average stope size was 70,000 metric tons (t). The mine also was scheduled to produce 710,000 t of pyrite. Inmet and Outokumpu formed a strategic alliance that provided Inmet access to Outokumpu's technology and ensured access to Outokumpu's nearby copper and zinc smelters for 13 years

of life for the Pyhasalmi Mine. At yearend 2002, Pyhasalmi had reserves of 17.2 Mt at an average grade of 1.2% copper and 2.6% zinc (Inmet Mining Corp., 2003).

Belvedere Resources Ltd. of Canada acquired a number of gold properties in Finland. In addition to the Antinoja and Kopsankangas claims, the company added gold reservations at Antinija, Kuusamo, and Vehka. A claim is valid for 5 years and can be renewed for an additional 3 years. It entitles the claimant to carry out exclusive exploration activities with no expenditure commitments. A reservation is valid for 1 year and enables the prospective claim holder to investigate larger areas of land. Geologic and geophysical measurements can be taken with no expenditure commitments. The company also had two claims for base-metals exploration at Arkala and Kaskela, but did not intend to commit any substantial exploration funds on these two properties (Belvedere Resources Ltd., 2003a).

During the summer field season, Belvedere concentrated on the Kopsankangas and Kuusamo properties. The Kopsankangas claim covered the area of the Kopsa intrusive-related gold-copper deposit. A 1,000-meter diamond drill program that consisted of 10 shallow drill holes was planned, followed by till sampling. The Kuusamo property had the potential for hosting an iron oxide-copper-gold deposit. A low-level aerial geophysical survey was being conducted in the Kuusamo area (Belvedere Resources Ltd., 2003b).

Tertiary Minerals Plc was awarded a key claim over a series of gold deposits at Kaaresselka in northern Finland. The project area had well-developed infrastructure and was accessed by a network of logging roads. The company planned to start a drilling program to define mineral resources. It also applied for six claims in the explored area that was part of the prospective shear zone; the shear zone was associated with gold mineralization in Central Lapland (Tertiary Minerals Plc., 2003).

Vision Gate Ventures Ltd. of Canada began its Phase I exploration of the Haveri gold project, which is located 175 kilometers (km) north of Helsinki. The work consisted of compilation and analysis of the vast quantity of geologic and geophysical data acquired by previous operators. Additional work included geology mapping, alteration, and structure and ground geophysical surveying by using induced polarization, if required. Phase I work was expected to be completed by October. The company had an option to earn up to 70% interest in the Haveri property by spending \$1.7 million within 3 years (Vision Gate Ventures Ltd., 2003).

Phase II work, which consisted of a 3-dimensional induced polarization survey conducted by SJ Geophysics of Canada, was underway. Work to date confirmed an area of widespread gold and copper mineralization and would form the basis of target selection and direction for the drilling program in 2004 (Northern Lion Gold Corp., 2003).

Riddarhyttan Resources AB was granted a permit for mining (open pit and underground) at the Suurikuusikko gold deposit

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

in northern Finland. The environmental permit was granted in November 2002. The company was in the process of looking for potential financial partners for the operation. The deposit's gold resources at a cutoff of 2 grams per metric ton (g/t) gold amounted to 11.5 Mt at a grade of 5.4 g/t gold (Riddarhyttan Resources AB, 2003).

Scanmining of Sweden started gold mining with \$3.36 million at the Pahtavaara Mine in northern Finland. The company had planned to open the Blaiken gold and zinc mine in Sweden, but owing to lagging Swedish subsidies for the mine and a booming gold market, it shifted its focus to the Finnish mine. Scanmining aimed to develop the Pahtavaara Mine into an underground facility with production to start in 2003. Gold production was expected to be 1 t during the first year. Current (2003) ore reserves dictated a mine life of 3 years or longer with additional drillings (Reuters, 2003§).

Arctic Platinum Partnership (APP) discovered preserved portions of two new layered-intrusion bodies in the Ristiaapa and Saariaapa areas of the Portimo complex in northern Finland. Mineralization of copper-nickel-platinum-group metals was similar to other locations in the Narkaus intrusion of the Portimo complex. Exploration activities were centered 50 km south of Rovaniemi. APP was a joint venture between Gold Fields Ltd. of South Africa (51%) and Outokumpu (49%). Gold Fields was the operator of the exploration and acquired Outokumpu's share in September. South Atlantic Ventures Ltd. of Canada had a 20% back-in right for APP's mineral discovery carried to feasibility. South Atlantic Ventures' permits were in close proximity to these deposits. Gold Fields planned to begin operations of the APP project within 3 years, and APP was expected to produce 12,400 kilograms per year of gold, palladium, and platinum (South Atlantic Ventures Ltd., 2003).

Dragon Mining NL of Australia planned to acquire Outokumpu's precious-metals assets in Finland in September. These assets included a number of gold properties with drilled resources (Kuusamo with 1.4 Mt at a grade of 4.1 g/t gold, Pampalo with 0.9 Mt at a grade of 6.8 g/t gold, and Jokisivu with 150,000 t at a grade of 7.8 g/t gold), the 600,000-metric-ton-per-year (t/yr) Vammala mill, the Orivesi gold mine with exhausted lode, and an extensive portfolio of gold (Central Lapland and Kuhmo-Suomussalmi) and base-metal (Kylylahti) exploration properties. An exclusive due-diligence period of 30 days was set before the signing of the sale and purchase agreement in October, and the closing date was set at 30 days after (Dragon Mining NL, 2003§).

Around 1,600 workers at Rautaruukki's Halikko, Hameenlinna, Kankaanpää, and Raahe works went on strike in January in response to the company's plans to cut 565 jobs at several of its sites. The company decided to cut \$35 million from the wage bill as part of its plan to cut overall costs by \$59 million by yearend. It expected the stoppage to cut steel production at Hameenlinna by 5,500 t, but production at Raahe would not be affected (Metal Bulletin, 2003e). Rautaruukki planned to increase its own steel production to 2.8 Mt in 2003 from 2.6 Mt in 2002.

Rautaruukki was modernizing the hot-strip mill and cut-to-length line at its main flat products works in Raahe. The works'

2.3-million-metric-ton-per-year (Mt/yr) semicontinuous wide hot-strip mill was due for a revamp. It planned to modernize its automation systems and to build a second walking-beam furnace. Plantmaker ABB was awarded the contract to upgrade the automation systems on the cut-to-length line, which was scheduled for startup at yearend (Metal Bulletin, 2003d).

AvestaPolarit, which was a stainless steel producer, brought onstream its cold-rolling mill expansion at Tornio. The company spent \$1.2 billion to more than double the plant's capacity. A second 1-Mt/yr meltshop was added to the existing 700,000-t/yr facility. Capacity of the expanded cold-rolling mill was increased to 1.2 Mt/yr from 550,000 t/yr. Both were due to reach full production during 2004. Hot-rolling capacity would increase to 1.7 Mt/yr from 1 Mt/yr; commissioning of the expanded mill was due in early 2004 (Metal Bulletin, 2003a).

European Diamonds Plc began minibulk sampling from one of its kimberlite discoveries at Lentiira, which is located 500 km north of Helsinki. Drill samples contained high-chrome subcalcic pyropes, high-chrome chromites, and eclogitic garnets. This confirmed a major new zone of potentially diamondiferous kimberlite identified earlier. Drilling and sampling of these discoveries were ongoing with detailed ground geophysics to further define drill targets. The exploration program also resulted in a new discovery of kimberlitic rocks 50 km north of Lentiira (European Diamonds Plc., 2003).

Fortum Oil and Gas Oy planned to split off its crude oil business into a new company and list it on the Helsinki stock exchange. The company planned to complete the reorganization during the first half of 2004. The new company, Fortum Corp., would include refining, marketing, shipping, and production operations for its crude oil sector. Fortum also decided to invest \$542 million to upgrade the Porvoo crude oil refinery. The total production capacity would remain the same, but production of sulfur-free diesel would be increased. The project was expected to be completed by the end of 2006 (Hugin Online, 2003§).

The Port of Pori was close to completing a \$2.6 million program of upgrade and renewal at the facility. It planned to increase the handling capacity of its conveyors to 1,500 metric tons per hour (t/h) from 900 t/h with an investment of \$282,000. The conveyor systems were mostly used to transport ilmenite. VR Cargo was to take delivery of 25 wagons that would transport copper concentrates between Pori and Outokumpu's Harjavalta Smelter. The Port would handle more than 2 Mt of coal in 2003; the coal would be imported from Australia, China, Poland, and the United States. The Port of Naantali handled more coal but less grain and other dry bulk materials. Russian companies exported grain via Finland to western Europe (Bulk Materials International, 2003).

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Major Source of Information

Geological Survey of Finland
 Betonimiehenkuja 4
 02150 Espoo
 Finland

TABLE 1
FINLAND: PRODUCTION OF MINERAL COMMODITIES¹

(Thousand metric tons unless otherwise specified)

Commodity ²	1999	2000	2001	2002	2003
METALS					
Aluminum, metal, secondary tons	43,989	44,824	34,488	30,000 ^e	33,000 ^e
Cadmium, metal, refined do.	700	683	604	4	--
Chromite: ^e					
Gross weight:					
Lump ore	225	230	215	216	220
Concentrate	400	390	350	340	340
Foundry sand	10	10	10	10	10
Total	635	630	575 ³	566	570
Cr ₂ O ₃ content:					
Lump ore	75	80	75	75	76
Concentrate	150	150	130	125	125
Foundry sand	5	5	5	5	5
Total	230	235	210	205	206
Cobalt, metal, powder and salts tons	6,200	3,864	3,908	4,292	3,900 ^e
Copper:					
Concentrate, gross weight do.	28,000 ^e	43,062	41,146	50,494	44,700
Mine output, Cu content do.	10,500 ^e	14,354	13,715	14,400	14,900
Metal:					
Smelter do.	149,600	155,400	169,300	160,900	160,600
Refined do.	114,700	114,035	119,677	127,136	136,000
Gold, metal kilograms	5,900 ^e	4,951	5,552	4,666	5,600
Iron and steel, metal:					
Pig iron	2,954	2,983	2,852 ^r	2,828 ^r	2,800 ^e
Ferroalloys, ferrochromium	256	261	237	248	250 ^e
Steel, crude	3,956	4,096	3,938	4,004	4,766
Semimanufactures, rolled ^c	3,700	3,750	3,800	3,850	3,900
Mercury ^e tons	40 ^e	76	71	51	65 ^e
Nickel:					
Mine output, Ni content do.	70	2,600 ^e	2,000 ^e	2,500	2,700
Metal, electrolytic do.	51,948	50,087	51,275	49,151	52,300
Platinum-group metals:					
Palladium kilograms	150 ^e	--	--	--	--
Platinum do.	50 ^e	441	510	508	505 ^e
Selenium, metal do.	26,000 ^e	36,293	38,913	39,237	39,500 ^e
Silver, metal do.	31,500 ^e	25,364	23,998	29,404	34,000
Zinc:					
Mine output, Zn content ^c tons	20,000	30,500	36,300	61,600	38,900
Metal do.	225,200	222,881 ^e	247,179	235,337	265,900
INDUSTRIAL MINERALS					
Cement, hydraulic	1,310	1,422	1,325	1,198	1,360 ^e
Feldspar tons	40,000 ^e	33,200	34,298	46,715	36,000 ^e
Lime	305	320	333	350	360 ^e
Nitrogen, N content of ammonia ^c tons	60,000	75,344 ³	80,000	87,000	60,000
Phosphate rock apatite concentrate: ^e					
Gross weight	724	750	750	760	770
P ₂ O ₅ content	268	277	277	280	282
Pyrite, gross weight	800 ^e	706	632	727	600 ^e
Sodium sulfate	30 ^e	31	30	30	30 ^e
Stone, crushed: ^c					
Limestone and dolomite:					
For cement manufacture	1,350	1,300	1,400	1,400	1,450
For agriculture	1,000	1,000	1,000	1,000	1,000
For lime manufacture	350	350	350	400	400
Fine powders	350	350	350	400	400
Metallurgical	1	1	1	1	1
Total	3,050	3,000	3,100	3,200	3,250

See footnotes at end of table.

TABLE 1--Continued
FINLAND: PRODUCTION OF MINERAL COMMODITIES¹

(Thousand metric tons unless otherwise specified)

Commodity ²	1999	2000	2001	2002	2003
INDUSTRIAL MINERALS--Continued					
Stone, crushed ^e --Continued:					
Quartz silica sand	73 ³	73	148 ³	148 ³	155
Sulfur:					
S content of pyrite	380 ^e	377	337	340 ^e	340 ^e
Byproduct: ^e					
Metallurgy	299	300	300	300	300
Petroleum	42	50	45	50	60
Total	721	727	682	690	700
Sulfuric acid	819	854	923	914	900 ^e
Talc	469	--	--	-- ^e	-- ^e
Wollastonite ^e	22,000	20,000	20,000	20,000	20,000
MINERAL FUELS AND RELATED MATERIALS					
Peat:					
For fuel use	4,140	3,932	5,368	6,450	7,000 ^e
For agriculture and other uses	1,595	1,174	834	770	800 ^e
Petroleum refinery products ^e thousand 42-gallon barrels	83,000	80,000	85,000	85,000	86,000

^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 July 1, 2004.

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

³Reported figure.

TABLE 2
FINLAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2003

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners		Location of main facilities	Annual capacity
Apatite	Kemira Agro Oy (Government, 98%)		Mine and plant at Siilinjärvi	8,000
Ammonia	Kemira Oyj (Government, 98%)		Plant at Oulu	75
Cadmium, metal	Outokumpu Oyj (Government, 40%, and private investors, 12.3%)		Smelter at Kokkola	1
Cement	Finnacement 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	tons	do.	Mine at Orivesi	4
Do.	do.	Scanmining	Pahtavaara Mine near Sodankylä	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	tons	Outokumpu Oyj (Government, 40%, and private investors, 12.3%)	Smelter at Kokkola	150
Mica	Kemira Oyj (Government, 98%)		Mine at Siilinjärvi	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	Fortum Oil and Gas Oy		Plants at Naantali and Porvoo	NA
Phosphate-apatite	Kemira Oyj (Government, 98%)		Mine at Siilinjärvi	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	tons	Outokumpu Oyj (Government, 40%, and private investors, 12.3%)	Smelter at Pori	35
Silver	do.	do.	do.	30
Steel	Rautaruukki Oy (Government, 41.8%)		Plants at Halikko, Hameenlinna, Kankaanpää, 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 (Western Mining Corp. Holdings Ltd., 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

NA Not available.