

THE MINERAL INDUSTRY OF FINLAND

By Chin S. Kuo

Finland has a highly industrialized market economy. The economy was gradually recovering from a slump in 2001 and registered a gross domestic product (GDP) growth of only 1.6% owing to the global slowdown in 2002. Per capita income in purchasing power parity was \$26,200. The inflation rate was low at 1.9%. The metals industry, which included copper refining, was a key economic sector that contributed to the country's exports. Total exports accounted for about 30% of the GDP. The forest industry was also important to the economy as an export earner in terms of paper, pulp, and timber. The country's mineral industry in production consisted of 16 limestone quarries; 10 industrial mineral mines; and 4 metallic (chromite, copper, gold, nickel, and zinc) mines (U.S. Central Intelligence Agency, 2002§¹).

Riddarhytan Resources AB of Sweden and Troy Resources NL of Australia formed a joint venture to start a comprehensive drilling on the Kylmäkangas prospect in the Oijärvi greenstone belt in northern Finland. The drilling indicated gold and silver mineralization in a quartz vein. Future exploration would include detailed geologic appraisal of the structural setting of the Kylmäkangas zone and prospecting and step-out drilling along an associated shear zone (Troy Resources NL, 2002).

Riddarhytan received full environmental permits for its Suurikuusikko gold project. The permits covered open pit and underground mining and ore processing by bio-oxidation, flotation, and leaching. The company completed a drilling program and was investigating financing alternatives for the project. The initial capital costs were estimated to be \$69 million, plus \$30 million for underground development. The plan would mine 6 million metric tons per year (Mt/yr) of ore at an average grade of 6.16 grams per metric ton (g/t) gold and produce 3,900 kilograms per year (Mining Journal, 2002c). The indicated and inferred reserve estimate was 11.5 million metric tons of ore at an average grade of 5.4 g/t gold within five main zones. The drilling program was continuing.

Belvedere Resources Ltd. of Canada completed the second stage of its exploration on the Susineva/Kaskela claims in central Finland. Two diamond drill holes that totaled 706 meters (m) were completed in the zinc and copper massive sulfide mineralization. In one hole, 0.5 m of brecciated massive pyrite mineralization was encountered. In another, 2 m of massive pyrite, pyrrhotite, sphalerite, and chalcopyrite mineralization was encountered. A program of downhole geophysics was planned in April to help delineate additional drill targets (Canada NewsWire, 2002§).

European Diamonds plc of the United Kingdom reported intersection of rocks with a kimberlite chemical signature together with abundant smectite clay minerals at its Lentiira property in central Finland. An extensive, deeply weathered kimberlite breccia complex was discovered. An early geophysical survey identified overlapping electromagnetic and gravity anomalies in a 15-hectare (ha) area. Preliminary chemical analysis of the material suggested a link with the diamondiferous kimberlites in Russia's Arkhangelsk area (Mining Journal, 2002a). A percussion drilling program was begun to recover larger samples for analysis and would be followed by an extensive grid drilling program. European Diamonds signed a letter of intent with Gold Fields Ltd. of South Africa for a gold exploration joint venture in the same area. Gold Fields will hold a 75% interest and commit up to \$4.25 million during the next 3 years; European Diamonds will have a 25% interest and retain 100% ownership of the diamond exploration interests (Mining Journal, 2002b).

Inmet Mining Corp. of Canada completed its acquisition of the Pyhasalmi copper and zinc mine in central Finland from Outokumpu Oyj. Inmet also acquired more than 3,000 ha of other exploration claims in the country. Inmet and Outokumpu entered into agreements to cooperate in the area of mining and mineral processing, technology, smelting, and refining and the development of future mining projects (Canada NewsWire, 2002).

In August, Outokumpu placed a temporary suspension on copper anode production at its Harjavalta smelter to allow for repair work on a gas line heat exchanger at the sulfuric acid plant. The temporary stoppage resulted in the loss of 10,000 metric tons (t) of copper anode and 6,000 t of copper cathode. The stoppage did not affect the operation of the nickel smelter at Jarjavalta (Metal Bulletin, 2002c).

Outokumpu was to build a pilot plant in Pori that will use a new hydrometallurgical technology for the processing of copper concentrates. The technology had been tested during the past 2 years at Outokumpu's research center also in Pori. The "HydroCopper" process used chloride solution instead of sulfide solution to leach copper from concentrates. The process would have lower investment and operating costs than traditional solvent extraction and electrowinning processing. The plant would produce 1 metric ton per day of high-quality copper powder and be ready for testing by the end of 2002 (Metal Bulletin, 2002d).

OM Group of the United States' Kokkola plant in Finland, which received alloys from the Big Hill cobalt smelter in the Democratic Republic of the Congo, started up its germanium dioxide facility. It had a design capacity of 20 metric tons per year (t/yr), which was approximately one-fifth of total world capacity. OM Group cut cobalt production at its Kokkola plant, which produced cobalt and nickel products, by 20% owing to depressed cobalt prices. It had a cobalt refining capacity of 10,000 t/yr (Metal Bulletin, 2002b).

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

The Arctic Platinum Partnership, which was a joint venture between Gold Fields Ltd. and Outokumpu, acquired South Atlantic Ventures Ltd. of Canada's Nordic platinum project, which was located within the Penikat-Portimo layered intrusive belt in Finland. The belt hosted significant platinum-group metal (PGM) deposits and prospects. The Nordic platinum project encompassed approximately 69 square kilometers. The Arctic Platinum Partnership's total PGM resources in the belt exceeded 345,000 kilograms (kg) within three separate deposits (CCNMatthews, 2002). The SK Reef had an estimated resource of 159,000 kg. The Ahmavaara and the Konttijärvi deposits had 186,000 kg. Completion of a feasibility study of the project, which involved open pit mining and production of a concentrate for offsite treatment, was expected in September.

The blast furnace at Fundia AB's Koverhar works was shut down. Rautaruukki Oy shut its No. 1 blast furnace for repairs in the third quarter. Rautaruukki sold more than 90% of its products to Western Europe. In November, a 1-day strike shut down Rautaruukki's Halikko, Hämeenlinna, Kankaanpää, and Raahe works, as well as Rautaruukki Metform's tubes works at Hämeenlinna. The metal workers' and electricians' unions called the stoppages in response to the company's staff reduction policy. The company was to cut annual costs by \$56 million by the end of 2003 (Metal Bulletin, 2002f).

AvestaPolarit Oyj Abp planned to increase the capacity of its Steckel hot-rolling mill at Tornio in northern Finland to 1.7 Mt/yr from 1 Mt/yr with an investment of \$189 million. The main components of the investment were three additional rolling stands from SMS Demag of Germany. The engineering group ABB, which was part of a consortium that included Mitsubishi Engineering Co. Ltd., was awarded a \$17 million contract to electrify the expanded plant and to install a power system that would control the rolling mills and roller tables. The new capacity was scheduled to be available by the end of 2004. In addition, a new cold-rolling mill with 750,000 t/yr capacity was due to start in December (Waymaker, 2002§).

Corus of the United Kingdom sold its 23% stake in AvestaPolarit for \$589 million to Outokumpu, which already owned 52%. Outokumpu then offered to buy out independent shareholders for \$633 million. To acquire 100% control for \$1.22 billion represented a premium of about 25% more than AvestaPolarit's share price. When AvestaPolarit was formed in January 2001, it was the second largest stainless steel producer in the world. In 2001, it ranked fifth in terms of shipments of finished products. AvestaPolarit's \$1.1 billion expansion plans were on schedule, and after completion, it was likely to become the world's largest stainless steel producer with a capacity of 2.75 Mt/yr (Metal Bulletin, 2002a).

Outokumpu shut down its Kokkola zinc smelter for a month in June because of the low zinc price. The shutdown did not affect delivery volumes during 2002 because the reduction in production was covered from stocks. Zinc production capacity was 260,000 t/yr after an expansion in 2001. The shutdown reduced production to 230,000 t for 2002. Around 10% of Kokkola's feed came from the Tara Mine in Ireland (Metal Bulletin, 2002e).

The Government was to sell an additional 9% of Fortum Oil & Gas Oy, which reduced the state's holding to 61%. Fortum sold its 35% interest in Oman's gas-producing Block 9 in June; the buyers were Mitsui Mining Co. Ltd. and its Moeco subsidiary (Petroleum Economist, 2002).

References Cited

- Canada NewsWire, 2002, Inmet Mining completes Pyhasalmi purchase: Canada NewsWire, March 19, p. 1.
CCNMatthews, 2002, Arctic Platinum Partnership to acquire South Atlantic's Nordic platinum project in Finland: CCNMatthews, April 29, p. 1.
Metal Bulletin, 2002a, Corus sells stainless stake to Outokumpu: Metal Bulletin, no. 8688, July 4, p. 3.
Metal Bulletin, 2002b, George Forrest quizzed over germanium dispute in DRC: Metal Bulletin, no. 8713, October 7, p. 23.
Metal Bulletin, 2002c, Outokumpu halts Harjavalta copper smelter: Metal Bulletin, no. 8698, August 12, p. 5.
Metal Bulletin, 2002d, Outokumpu plans shutdown at Kokkola pilot plant: Metal Bulletin, no. 8658, March 18, p. 5.
Metal Bulletin, 2002e, Outokumpu plans shutdown at Kokkola smelter: Metal Bulletin, no. 8647, February 7, p. 5.
Metal Bulletin, 2002f, Rautaruukki faces more one-day strike: Metal Bulletin, no. 8723, November 11, p. 18.
Mining Journal, 2002a, Finnish kimberlite discovery: Mining Journal, v. 338, no. 8678, March 29, p. 232.
Mining Journal, 2002b, Gold Fields extends Finnish search: Mining Journal, v. 339, no. 8703, September 20, p. 201.
Mining Journal, 2002c, Suurikuusikko permits: Mining Journal, v. 339, no. 8710, November 8, p. 326.
Petroleum Economist, 2002, News in brief: Petroleum Economist, v. 69, no. 7, July, p. 41.
Troy Resources NL, 2002, Drill results from the Cornishman and Oijärvi projects, in Troy Resources NL interim report: Troy Resources NL, January 17, 2 p.

Internet References Cited

- Canada NewsWire, 2002 (March), Belvedere Resources Ltd. exploration update at Kaskela, accessed March 12, 2002, at URL <http://www.newswire.ca/releases/March2002/11/c9516.html>.
Waymaker, 2002 (April), AvestaPolarit to expand Tornio hot rolling mill, accessed April 30, 2002, at URL <http://www.waymaker.net>.
U.S. Central Intelligence Agency, 2002, Finland, in World Factbook 2002, accessed May 14, 2003, at URL <http://www.cia.gov/cia/publications/factbook/geos/fi.html>.

Major Source of Information

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TABLE 1
FINLAND: ESTIMATED PRODUCTION OF MINERAL COMMODITIES ^{1,2}

(Metric tons unless otherwise specified)

Commodity ³	1998	1999	2000	2001	2002	
METALS						
Aluminum metal, secondary	40,500 ⁴	43,989 ⁴	44,824 ⁴	34,488 ⁴	30,000	
Cadmium metal, refined	520 ⁴	700	683 ⁴	604 ⁴	4 ⁴	
Chromite:						
Gross weight:						
Lump ore	thousand tons	220	225	230	215	216
Concentrate	do.	380	400	390	350	340
Foundry sand	do.	10	10	10	10	10
Total	do.	610 ⁴	635	630	575 ⁴	566
Cr ₂ O ₃ content:	do.					
Lump ore	do.	75	75	80	75	75
Concentrate	do.	150	150	150	130	125
Foundry sand	do.	5	5	5	5	5
Total	do.	230 ⁴	230	235	210	205
Cobalt, metal, powder, and salts	5,250 ⁴	6,200 ⁴	3,864 ⁴	3,908 ⁴	4,292 ⁴	
Copper:						
Concentrate, gross weight	25,000	28,000	43,062 ^{r,4}	41,146 ^{r,4}	50,494 ⁴	
Mine output, Cu content	9,500	10,500	14,354 ^{r,4}	13,715 ^{r,4}	14,400 ⁴	
Metal:						
Smelter	156,000	149,600 ⁴	155,400 ⁴	169,300 ⁴	160,900 ⁴	
Refined	123,000	114,700 ⁴	114,035 ⁴	119,677 ⁴	127,136 ⁴	
Gold metal	kilograms	5,000	5,900	4,951 ⁴	5,552 ⁴	4,666 ⁴
Iron and steel, metal:						
Pig iron	thousand tons	2,912 ⁴	2,954 ⁴	2,983 ⁴	2,900	3,000
Ferroalloys, ferrochromium	do.	231 ⁴	256 ⁴	261 ⁴	237 ⁴	248
Steel, crude	do.	3,932 ⁴	3,956 ⁴	4,096 ⁴	3,938 ^{r,4}	4,004 ⁴
Semimanufactures, rolled	do.	3,682 ⁴	3,700	3,750	3,800	3,850
Mercury		54 ⁴	40	76 ⁴	71 ⁴	51 ⁴
Nickel:						
Mine output, Ni content		1,967 ⁴	70 ⁴	2,600 ^r	2,000 ^r	2,500 ⁴
Metal, electrolytic		46,200 ⁴	51,948 ⁴	50,087 ⁴	51,275 ⁴	49,151 ⁴
Platinum-group metals:						
Palladium	kilograms	150	150	-- ⁴	-- ⁴	--
Platinum	do.	500	500	441 ⁴	510 ⁴	508 ⁴
Selenium metal	do.	28,000	26,000	36,293 ⁴	38,913 ⁴	39,237 ⁴
Silver metal	do.	29,700	31,500	25,364 ⁴	23,998 ⁴	29,404 ⁴
Zinc:						
Mine output, Zn content		30,700	20,000	30,493 ⁴	36,253 ⁴	61,580 ⁴
Metal		199,000	225,200 ⁴	222,881 ⁴	247,179 ⁴	235,337 ⁴
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand tons	1,098 ⁴	1,310 ⁴	1,422 ⁴	1,325 ⁴	1,198 ⁴
Feldspar		40,000	40,000	33,200 ⁴	34,298 ⁴	46,715 ⁴
Lime	thousand tons	400	305 ⁴	320 ⁴	333 ⁴	350 ⁴
Nitrogen, N content of ammonia		60,000	60,000	75,344 ⁴	80,000	87,000
Phosphate rock, apatite concentrate:						
Gross weight	thousand tons	716 ⁴	724	750	750	760
P ₂ O ₅ content	do.	260 ⁴	268	277	277	280
Pyrite, gross weight	do.	900	800	706 ⁴	632 ⁴	727 ⁴
Sodium sulfate	do.	35	30	31 ⁴	30 ⁴	30 ⁴
Stone, crushed:						
Limestone and dolomite:						
For cement manufacture	do.	1,200	1,350	1,300	1,400	1,400
For agriculture	do.	900	1,000	1,000	1,000	1,000
For lime manufacture	do.	300	350	350	350	400
Fine powders	do.	300	350	350	350	400
Metallurgical	do.	2	1	1	1	1
Total	do.	2,700	3,050	3,000	3,100	3,200
Quartz silica sand	do.	30 ⁴	73 ⁴	73	148 ⁴	148 ⁴

See footnotes at end of table.

TABLE 1-Continued
FINLAND: ESTIMATED PRODUCTION OF MINERAL COMMODITIES ^{1,2}

(Metric tons unless otherwise specified)

Commodity ³	1998	1999	2000	2001	2002
INDUSTRIAL MINERALS--Continued					
Sulfur:					
S content of pyrite thousand tons	430	380 ^r	377 ⁴	337 ⁴	340
Byproduct:					
Of metallurgy do.	296 ⁴	299 ^r	300	300	300
Of petroleum do.	40	42 ^r	50	45	50
Total do.	766	721 ^r	727 ^r	682 ^r	690
Sulfuric acid do.	1,200	819 ⁴	854 ⁴	923 ^{r,4}	914 ⁴
Talc do.	350	469 ⁴	-- ⁴	-- ⁴	--
Wollastonite	22,000	22,000	20,000	20,000	20,000
MINERAL FUELS AND RELATED MATERIALS					
Peat:					
For fuel use thousand tons	1,700 ⁴	4,140 ⁴	3,932 ⁴	5,368 ⁴	6,450 ⁴
For agriculture and other uses do.	150 ⁴	1,595 ⁴	1,174 ⁴	834 ⁴	770 ⁴
Petroleum refinery products thousand 42-gallon barrels	83,370 ⁴	83,000	80,000	85,000	85,000

⁶Estimated. ^rRevised. -- Zero.

¹Table includes data available through July 15, 2003.

²Estimated data are rounded to no more than three significant digits; may not add to totals shown.

³In addition to commodities listed, granite and soapstone are produced, but available information is inadequate to make reliable estimates of output levels.

⁴Reported figure.

TABLE 2
FINLAND: 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
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%; private investors, 12.3%)	Smelter at Kokkola	1
Cement		Finn cement Oy (Irish Cement Ltd., 100%)	Plants at Lappeenranta and Parainen	1,020
Chromite		Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Mine at Kemi	1,000
Copper:				
Ore, Cu content		do.	Mines at Pyhäsalmi, Saattopora, and Hitura	10
Metal		do.	Smelter at Harjavalta	160
Do.		do.	Refinery at Pori	125
Feldspar		SP Minerals Oy (Partek Corp., 50.1%; SCR-Silbeco SA, 49.9%)	Mine and plant at Kemiö	50
Ferrochrome		Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Smelter at Tornio	250
Gold:				
Ore, Au content	metric tons	do.	Mine at Orivesi	4
Do.	do.	Williams Resources Inc.	Pahtavaara Mine near Sodankylä	3
Metal	do.	Outokumpu Oyj (Government, 40%; 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%; 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%; 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 Siilinjarvi	700
Do.		Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Mine at Pyhäsalmi	800
Quartz and quartzite		SP Minerals Oy (Partek Corp., 50.1%; SCR-Silbeco SA, 49.9%)	Mines at Kemiö and Nilsia	250
Selenium	metric tons	Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Smelter at Pori	35
Silver	do.	do.	do.	30
Steel		Rautaruukki Oy (Government, 41.8%)	Plant at Raahе	2,100
Do.		Fundia AB (Norsk Jenverk AS of Norway, 50%; Rautaruukki, 50%)	Plants at Aminnefors, Dalsbruk, and Koverhar	850
Do.		Ovako Oy (SKF, 50%; Wartsila, 25%; Fiskas, 20%)	Plant at Imatra	600
Stainless		Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Plant at Tornio	500
Talc		Mondo Minerals Oy (Western Mining Corp. Holdings Ltd., 50%; 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		Outokumpu Oyj (Government, 40%; private investors, 12.3%)	Mine at Pyhäsalmi	25
Metal		do.	Smelter at Kokkola	260

NA Not available.