THE MINERAL INDUSTRY OF

FINLAND

By Jozef Plachy[1]

Geologically, ore deposits in Finland are limited, poor, not easily accessible, and difficult to mine and enrich. Consequently, the mineral industry's contribution to the gross domestic product is only about 0.3%.[2] However, inspite of the relative scarcity of natural resources, Finland wields considerable influence on the global mining industry. Because of Outokumpu Oy and Finnminers, Finland is a world leader in underground mining technology, ore processing, and metallurgy.

Government Policies and Programs

According to the 1992 and 1994 amendments to the Finish Mining Law, any individual, corporation, or foundation having its principal place of business or central administration within the European Union (EU) will enjoy the same rights to explore and exploit deposits of minerals and ores as any Finnish citizen or corporation. This will take effect on January 1, 1995, when Finland becomes a member of EU. Already in 1994, the increased foreign activity in exploration resulted in discovery of a major diamond field in northern Finland by Ashton Mining of Australia.

At the end of 1994, Government involvement in the mineral industry of Finland was considerably higher than in any of the other EU countries. Government-owned companies—Finnminers Group, Kemira Oy, Outokumpu Oy, and Rautaruukki Oy—dominated the domestic mineral industry, while Government-founded organizations, the State Geological Research Institute and the State Technological Research Center, were active in exploration and research.

Production

In 1994, the mining of ores and minerals amounted to about 17.9 million metric tons (Mmt), the same production as 1993. The slight decline of metallic ore production was offset by increased output of industrial minerals. Extraction of metallic ores totaled 4.6 Mmt compared with 4.9 Mmt in 1993. Of the eight metallic active mines, three closed during 1994, while two new ones were opened. Thirty mines and quarries produced 13.1 Mmt of industrial minerals, an increase from 12.8 Mmt in 1993, of which 3.9 Mmt was limestone. The number of limestone quarries in operation was 17. The remaining 13 mines produced apatite, feldspar, quartz, soapstone, talc, and wollastonite. *(See table 1.)*

Trade

In view of the diminishing supply of indigenous metalliferous raw materials, most of the feed for smelters in 1994 had to be imported (100% of iron ore concentrate, 80% of zinc concentrate, and 60% of nickel matte and concentrate).

Given the relatively small size of Finland's mining industry, sales of mining technology and equipment expanded beyond the Finnish borders. In 1994, between 80% to 90% of Finnminers' business was with foreign countries. Similarly, about 90% of Outokumpu's sales are generated in markets outside of Finland.

Structure of the Mineral Industry

Most of Finland's mineral industry was dominated by the four major Finnish companies: Outokumpu Group, Finnminers Group, Rautaruukki Group, and Kemira.

The Outokumpu Group is a vertically integrated company, which employed about 15,000 people in 25 countries and generated about $3.2 billion[3] in sales in 1994, according to its 1994 Annual Report. It is divided into four subgroups: Base Metals, Copper Products, Stainless Steel, and Technology Sales. As reserves in existing Finnish mines are diminishing, Outokumpu has become increasingly active in overseas mining projects. In addition to domestic mines (Hitura, Kemi, Orivesi, Pyhasalmi, Saattopora, and Vammala), Outokumpu has mining interests in Australia (Forrestania and Thalanga), Chile (Zaldivar), Ireland (Tara), Norway (Grong), and Sweden (Viscaria). The domestic construction industry uses about 59% of Outokumpu's production of zinc, 36% of copper, and between 10% and 15% of stainless steel.[4] The rest is exported.

Rautaruukki Group is a highly integrated steel corporation which, in 1994, employed about 9,100 people and had a $200 million operating profit, according to the 1994 annual report. It manufactures steel and processes it into plates, sheets, tubes, pipes, sections, and building products. Production plants are in six European countries. Exports and international operations account for 70% of sales. Rautaruukki sells more than 90% of its steel products in Europe.

Kemira, the largest chemical enterprise in Finland, specializes in agricultural products (55%), pigments (17%), paints (15%), and fibers (6%). In 1994, it had production

plants in 13 countries. Most of the sales was generated by Kemira Argo, a producer of fertilizers. During its 34 years, the Kemira titanium oxide (TiO_2) division became the fifth largest producer of TiO_2 in the world.

Finnminers Group is a promotional organization used by the major Finnish manufactures of mining equipment. It functions under the auspices of the Finnish Foreign Trade Association. The Finnminers Group is known for hardrock drilling and loading machinery, designed especially for underground mining, manufactured by Tamrock; specially designed support vehicles made by Normet; crushing and grinding equipment by a number of different manufacturers, called the Nordberg Group; and screening and materials handling implements by Roxon Oy. *(See table 2.)*

Commodity Review

Metals

Chromium.—The only chromite mine in Finland, Outokumpu's Kemi Mine on the Gulf of Bothnia coast, has proven and probable reserves of about 70 Mmt, while estimated additional mineral resources amount to 150 Mmt. Roughly 20 Mmt of the deposit can be excavated by the open pit method, company officials reported. The ore grade was about 26% chromium trioxide and the chromium-iron ratio was reportedly 1.55-to-1.[5] Despite the low metal content, production proved to be economical, because of the open pit operation and the location, 40 kilometers (km) from the Tornio ferrochrome plant and 20 km from Ajos port. Run-of-mine production in 1994 was about 1.1 Mmt.

Chromite deposits have been discovered in the Kukkola, Tornio, Penikat, Koitelain, and Burakovski intrusions. All are in northern Finland, where most of the exploration efforts have been focused.

Cobalt.—Outokumpu ceased cobalt refining when it sold its entire 96% interest in the Outokumpu-Mooney Group (OMG) to international investors in October 1993. In order to refine 200 mt to 300 mt of cobalt hydroxide sludge, a byproduct of nickel smelting, Outokumpu decided in 1993 to renovate its Harjavalta plant. According to the project schedule, production will start in fall 1995 and will amount to about 500 mt/a of cobalt powder, depending on the cobalt content of imported nickel ore. As part of the expansion and upgrade, Outokumpu designed a cobalt circuit to refine cobalt from hydroxide sludge formerly sent to OMG's Kokkola plant.

Copper.—Although it has no copper mines, three copper-bearing polymetallic mines operate in Finland, including two adjacent, primarily zinc mines at Pyhasalmi with a total capacity of 1.1 million metric tons per year (Mmt/a), and a gold mine at Saattopora producing 0.3 Mmt/a. Owing to diminishing copper resources at existing mines, Outokumpu has invested heavily in domestic and overseas exploration. The most promising polymetallic deposit was found in Keivitsa, northeast of the town of Sodankyla in Finnish Lappland. According to the Geological Survey of Finland, the preliminary results show recoverable reserves of up to 100 Mmt averaging 0.3% nickel, 0.4% copper, and small amounts of precious metals. The Finnish Government has invited foreign companies to bid for exploitation of this deposit.

In overseas exploration, the primary recipient of investment was Chile, where Outokumpu is co-owner of the Zaldivar copper deposit. Proven reserves amount to 316 Mmt of ore grading 0.9% copper, Outokumpu reported. A solvent extraction and electrowinning plant with a production capacity of 125,000 mt/a was expected to be ready by yearend 1995. Outokumpu reported it was also involved in two other Chilean exploitation ventures, one in Relincho (100 Mmt indicated reserves of 0.8% copper and 0.03% molybdenum) and the other in Santa Catalina (109 Mmt indicated reserves of 0.7% copper and 0.1% molybdenum).

All copper concentrates, domestic and imported, were smelted and refined at Outokumpu's Harjavalta or Pori plants, both in the southwestern part of Finland. To process the increased imports, Outokumpu initiated an expansion and upgrade for both plants. Blister copper capacity at Harjavalta would be increased to 160,000 mt/a and cathode copper capacity at the Pori electrolytic refinery will rise to 125,000 mt/a, the company stated. While the unit cost of production will be reduced by 20% to 30%, total sulfur emissions at Harjavalta will be reduced to 25 kilograms (kg) per metric ton of metal produced and dust emissions are expected to be less than 50 mt/a, a 95% reduction from the 1990 level. The $362 million project should be completed by 1996.[6]

Ferrochromium.—All ferrochromium in 1994 was produced at the Outokumpu's plant in Tornio, 40 km from the Kemi chromite mine. The plant feeds molten ferrochrome into the adjacent Polarit stainless steel plant, contributing about 40% of its total requirement. The company reported that production in 1994 was 229,000 mt, 5% higher than that in 1993.

Gold.—Investment in gold exploration in the 1990's by the Finnish Government resulted in identification of widespread gold anomalies. One of the largest discovered was the Kutemajarvi gold deposit at Orivesi, near the city of Tampere, in south-central Finland. It has proven and probable reserves of 290,000 mt with a grading of 7 grams per metric ton (g/mt), according to Outokumpu. Underground operations began in October 1994, and will continue until the end of 1996, at which time the total planned production should reach 2,100 kg of gold in concentrate. Production in 1994 was 100,000 mt of ore with a gold content of 480 kg. The mine will benefit from the close proximity of the Vammala nickel mine, 85 km to the southwest. After planned closure of mine in early 1995, the Vammala concentrator will be modified to treat the Orivesi

ore. Terra Mining Oy completed studies for the exploitation of a gold deposit in Pahtavaara, near Sodankyla. Production should start in mid-1996. The deposit amounts to 2 Mmt of ore with 3.15 g/mt gold content.[7] The planned annual production is 40,000 mt of ore yielding 900 kg of gold.

The Pampalo gold deposit (0.8 Mmt grading 7 g/mt) in Ilomantsi discovered by the Geological Survey of Finland was sold to Outokumpu.[8]

The only gold mine that produced during 1994 was Outokumpu's Saattopora Mine. Production totaled 300,000 mt of ore yielding 800 kg of gold in concentrate, nearly double the 1993 production. The mine is expected to close in spring 1995.

The 1994 production of gold metal at the Pori smelter, from domestic and imported concentrates, was 1,370 kg, the same as in 1993, Outokumpu reported.

Nickel.—After the closure of Enonkoski and Vammal mines in 1994, the only remaining domestic nickel mine was Outokumpu's Hitura Mine. After 9 years of continuous production, extraction at the Enonkoski underground mine in southern Finland amounted to 7 Mmt of ore with an average grade of 0.76% nickel and 0.22% copper. Production at the Vammala Mine, 170 km north of Helsinki, started in 1978. Total extraction of ore was 7.4 Mmt and the average grade was 0.7% nickel and 0.5% copper.[9]

Because of the high magnesia content of the Hitura ore (11% magnesium), the concentrate has been used by the nearby Kokkola plant for manufacturing nickel-based chemicals. The total 1994 production of nickel-copper ore amounted to 2 Mmt resulting in 6,800 mt of nickel in concentrate, of which 0.6 Mmt of ore with 2,700 mt of nickel content was produced by the Hitura Mine, according to Outokumpu.

Outokumpu's Harjavalta smelter processed domestic and foreign concentrates as well as matte. Concentrate was smelted in a flash furnace and Pierce-Smith converters. Matte was granulated, acid-leached, and refined by electrowinning. As a part of the Harjavalta expansion and modernization, the nickel-smelting capacity was expected to nearly double to 32,000 mt/a (18,000 mt/a cathode nickel and 14,000 mt/a nickel briquets). The planned expansion is geared to accommodate increased imports from Australia.

The new plant was scheduled to open in June 1995, reaching full capacity by yearend. The new technology will enhance efficiency, and reduce unit costs by about 20%.

Steel.—All 1994 steel production in Finland was from imported concentrates and iron pellets. Two-thirds of the raw material came in the form of fines from Sweden's Luossavaara-Kiirunavaara AB (LKAB). The balance came from Russia in the form of iron pellets from Kostamus and fines from Olenogorsk. The largest producer of steel in Finland was the highly integrated corporation, Rautaruukki Oy. The Steel Division is based at Raahe Steel Works. The 2.3-Mmt/a-capacity steel works was made up of sintering and coking plants, blast furnaces, steel plant, rolling mills, and prefabricated product lines. About 55% of its production, 2,267,000 mt in 1994, was for other Rautaruukki plants, the company stated. The Thin Sheet Division manufactures cold-rolled and color-coated sheets mainly at the Hameenlinna Works. The 1994 production of 860,000 mt was about 15% higher than that of 1993. Outokumpu's Stainless Steel is a fully integrated mine-to-mill operation consisting of three business sectors: Outokumpu Chrome, Outokumpu Polarit, and JA-RO. The molten ferrochromium from the Tornio plant was used at the adjacent Polarit stainless steel plant. Production in 1994 increased by 15% to 426,000 mt of stainless steel slabs. Output of stainless steel will further increase with the installation of a new ferrochrome converter and inauguration of a third cold-rolling mill in 1995. Besides saving energy, the new converter will raise the melting shop capacity by 100,000 mt to about 540,000 mt/a and will enable the hot-rolling mill to achieve a higher utilization rate.

Zinc.—The only mine producing zinc in 1994 was the Pyhasalmi Mine at Pyhajarvi, 380 km north of Helsinki. Mine officials reported that proven reserves of the polymetallic sulfide ore deposit amounted to 5.4 Mmt grading 0.9% copper, 2.1% zinc, and 38.4% pyrite. The 1994 production reportedly was 1.1 Mmt of ore, resulting in 8,700 mt of copper and 16,900 of zinc in concentrates. The zinc concentrate is shipped by rail to the Kokkola smelter while copper concentrate is transported to the Harjavalta smelter. The Pyhasalmi Mine, together with Outokumpu's wholly owned Tara Mine in Ireland, supplied about 80% of the feed for the Kokkola smelter.

The Kokkola smelter came on-line in 1969. The 1994 production was 173,000 mt of zinc, plus 580 mt of cadmium, 89 mt of mercury, and 29 mt of selenium. The smelter is close to the Baltic Sea, an important asset because 85% to 90% of output is exported.

Exploration in the vicinity of existing mines led in 1994 to a discovery of small zinc deposit in Mullikkorame, just north of the Pyhasalmi Mine.

Industrial Minerals

Cement.—After the closure of the Virkkala plant, the only plants still operating in 1994 were in Pargas (0.7-Mmt/a-capacity) and Lappeenranta (0.5-Mmt/a-capacity). Both were near limestone quarries and processing plants, and were owned by Partek Cement Oy. About 30% of the cement production was used by two sister companies, Partek Vetonit and Partek Betonila, to manufacture concrete products.

Diamond.—According to industry sources, Malmikaivos Oy, a subsidiary of Ashton Mining of Australia since the beginning of 1994, has discovered a diamond deposit in northern Finland. Altogether, 22 kimberlite pipes have been located, about half of which contained diamonds, although only four are of economic interest. The average grade varied

from 10 to 45 carats per 100 mt. The most productive pipe (No. 7) is oval shaped and covers 1.8 hectares. Composite drill samples have returned diamond grades in the range of 21.4 to 45.3 carats per 100 mt with an average of 26 carats of diamond of more than 8 millimeters in size.[10]

Mica.—Kemira Oy was the only producer of mica in 1994. The 1994 production at its Siilinjarvi apatite mine, 20 km north of Kuopio, was 7.6 Mmt of ore and 2.1 Mmt of waste rock. The 31% increase in production was caused by inauguration of phosphoric acid production. Ore was transported by trucks to a nearby plant 3 km away, while most of rock was used by the local building industry. Mica was extracted during the beneficiation of apatite from crude ore. Reserves amounted to about 60 Mmt and contained 65% phlogopite, 16% calcite, 10% apatite, 3% dolomite, and other silicates.

Talc.—Finnminerals Oy was the largest producer of paper-grade talc in Europe. It operated three production facilities at Kaavi (60,000-mt/a-capacity), Sotkamo (180,000-mt/a-capacity), and Vuonos (130,000-mt/a-capacity). About 75% of its total output, 350,000 mt/a to 360,000 mt/a, was used in the domestic paper industry. Of this amount, 40% was used for coating, 35% for filler, and 25% for pitch control. At the beginning of 1994, United Paper Mills of Finland bought a 40%-share from Metra Oy AB, thus becoming the sole owner of Finnminerals Oy.[11]

Mineral Fuels

Finland was one of the largest energy consumers in Western Europe. Only about one-third of its energy requirements were covered by indigenous sources, namely hydro and nuclear power, peat, and wood. All the other energy sources—coal, natural gas, and petroleum—were imported. Most of the energy is used by industry (46%), followed by heating (23%), and transportation (13%). About 60% of industry's need for energy is used to produce pulp and paper.

Nuclear Power.—Finland operated four nuclear reactors, two in Olkiluoto in western Finland and two at Loviisa in the eastern part of the country. Nuclear power supplied about 29% of the electricity generated in Finland.

An additional 3,500 megawatts (MW) of electric generation capacity will be needed by 2005, according to a recent survey by the Ministry of Trade and Industry. Because of Finland's lack of indigenous energy resources and minimal potential for additional hydropower plants, nuclear power and timber gasification have been viewed as the best alternatives for future powerplants.

Peat.—Despite a small contribution to total energy consumption (5%), peat played a major role in Finland's economy. More than 10 million hectares, about one-third of the total surface area of the country, was classified as peatland. However, only about 5% to 6% of this area is suitable for large-scale peat production, amounting to about 70 billion cubic meters (m^3).[12] About 85% of the production was milled peat; the rest was sod peat.

Because of favorable weather conditions, the 1994 production of peat exceeded 27 billion m^3, twice that of 1993. Of the total production, about 95% was used for fuel, while the remainder went for agriculture.

Petroleum.—All crude oil in 1994 was imported, mainly from Norway (44%) and the United Kingdom (33%). The Government-owned Neste Oy operated two refineries on Finland's southern coast. Finnish industries were gradually replacing oil with natural gas and electric energy; thus the proportion of oil in the total energy consumption during the last 20 years decreased by 26%.

Reserves

Known metalliferous ore reserves in Finland are slowly being depleted. Only the Pyhasalmi and Kemi Mines have enough reserves to last beyond the end of the century. Most of new discoveries, like chromite, are not of commercial quantities. Reserves may be increased with the future participation of foreign companies in mineral exploration. Presently, only reserves of industrial minerals are abundant, mainly apatite, limestone, and talc. *(See table 3.)*

Infrastructure

Finland had a total 5,924 km of railroads, of which 1,445 km was electrified and 480 km had multiple track. Nearly 99% was state-owned and operated by the Finnish State Railways. Most of the 103,000 km of highways were in the more densely populated southern part of the country. Out of the total 6,675 km of inland waterways, about 3,700 km were suitable for steamers. The merchant marine consisted of 80 ships, including 26 roll-on/roll-off, 17 cargo, 18 tanker, and 7 bulk ships. There were five major ports (Helsinki, Oulu, Pori, Rauma, and Turku), six secondary ports, and numerous minor ports.

Outlook

During the past few years, the Geological Survey of Finland has identified a number of mineral deposits. The likelihood of additional discoveries may be enhanced with the entrance of foreign companies into the Finnish mineral industry. It already has resulted in discovery of a major diamond deposit.

Despite recent discoveries, the future of the Finnish mineral industry rests mainly on metallurgy, as evidenced by the current expansion of the Harjavalta and Pori smelters. In order to utilize the increased capacity, Outokumpu is involved in new foreign ventures, mainly in Australia and Chile.

[1]Text prepared June 1995.
[2]Salo, J. U., Finland. Mineral Annual Review 1994, Western Europe 10. V. 84, No. 867.
[3]Where necessary, values have been converted from markka (FIM) to U.S. dollars at the rate of FIM5.22=US$1.00.
[4]Cook, M. Industry Views. Mining Magazine. Oct. 1992, pp. 281-282.
[5]Outokumpu Chrome Oy. Kemi Mine, Finland. pp. 24-25.
[6]Mining Environmental Management. Harjavalta Investment. Dec. 1994, p. 33.
[7]Mineralmarknaden. Terra Mining. Mar. 1995, p. 29.
[8]Mining Journal. Focus and Comment: Nordic Opportunities. V. 322, No. 8267, Mar. 1994, pp. 198-199.
[9]Outokumpu Finnmines Oy. Hitura Mine, Finland. pp. 25-27.
[10]Mining Magazine. Ashton Mining's Diamonds from Finland. V. 172, No. 1, p. 57.
[11]Industrial Minerals. UPM Buys Finnminerals Talc. No. 318, Mar. 1994, pp. 11-12.
[12]Lappalainen. V. The Importance of Finland's Raw Materials Policy. Vuoriteollisuus Bergshanteringen. V. 51, No. 2, 1993, pp. 72-75.

Major Sources of Information

Central Statistical Office of Finland
SF-00101 Helsinki, Finland
Geological Survey of Finland
SF-02150 Espoo, Finland
Ministry of Commerce and Industry
SF-00101 Helsinki, Finland

Major Publications

Bulletin of Statistics, Central Statistical Office.
Outokumpu, Annual Report, 1994.
Outokumpu News, Quarterly.
Rautaruukki, Annual Report, 1994.

TABLE 1
FINLAND: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1990	1991	1992	1993	1994
METALS						
Aluminum metal, secondary		23,900	22,100	27,300	29,900 r/	45,400
Cadmium metal, refined		569	593	590	785 r/	580
Chromite:						
Gross weight:						
Lump ore e/	thousand tons	347	320	250	191 r/	225
Concentrate e/	do.	137	133	229	300	341
Foundry sand e/	do.	20	20	20	20	7
Total	do.	504	473	499	511 e/	573
Cr_2O_3 content:						
Lump ore e/	do.	80 r/	65 r/	54	45	76
Concentrate	do.	64	120 r/	130 r/	170 r/	150
Foundry sand e/	do.	13 r/	5 r/	3	3	3
Total	do.	157 r/	190 r/	187 r/	218 r/	229
Cobalt, metal, powder, and salts		1,300	1,500	2,100	2,150	--
Copper:						
Concentrate, gross weight		45,000 e/	43,900	37,400	44,200	34,400
Mine output, Cu content		12,600	11,700	9,270	11,100 r/	8,740
Metal:						
Smelter		90,200	90,100	111,000 r/	107,000	98,200
Refined		65,100	64,500	70,900 r/	73,400 r/	69,200
Gold metal	kilograms	2,810	2,240 r/	1,600	1,390 r/	1,380
Iron and steel: Metal:						
Pig iron	thousand tons	2,280	2,330	2,450	2,540 r/	2,600
Ferroalloys, ferrochromium	do.	157	190	187	218 r/	229
Steel, crude	do.	2,860	2,890	3,080	3,260 r/	3,420
Semimanufactures, rolled	do.	2,490	2,480	2,300 e/	2,300 e/	2,200 e/
Lead: Mine output, Pb content		1,700	1,400	576	-- r/	--
Mercury		141	74	85	98 r/	89
Nickel:						
Concentrate, gross weight		130,000 e/	121,000	135,000	127,000	107,000
Mine output, Ni content		11,500	9,900	9,870	8,290 r/	7,250
Metal, electrolytic		16,900	13,800 r/	14,800	14,800 r/	15,900
Platinum-group metals: e/						
Palladium	kilograms	100	100	100	100	100
Platinum	do.	60	60	60	60	60
Selenium metal	do.	31,200	35,200 r/	30,000 r/	30,400 r/	29,000
Silver metal	do.	28,500	30,300 r/	27,200 r/	29,300 r/	26,000
Zinc:						
Concentrate, gross weight		100,000 e/	108,000	59,500	42,400	32,700
Mine output, Zn content		51,700	55,500	30,800	22,000 r/	16,900
Metal		175,000	170,000 r/	171,000 r/	171,000 r/	173,000
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand tons	1,670	1,320	1,130	835 r/	870
Feldspar		52,600	53,300 r/	47,500 r/	51,500 r/	41,400
Lime e/	thousand tons	225	225	241 3/	250	315
Mica		4,500 r/ e/	4,690 r/	5,130 r/	4,490 r/	5,600
Nitrogen: N content of ammonia		23,300	23,600	10,000 e/	10,000 e/	10,000 e/
Phosphate rock, apatite concentrate:						
Gross weight	thousand tons	546	472	555	628 r/	647
P_2O_5 content	do.	201	171 r/	201	227 r/	236
Pyrite, gross weight	do.	672	724	653	691 r/	775
Sodium sulfate e/	do.	33	33	30	30	30

See footnotes at end of table.

TABLE 1--Continued
FINLAND: PRODUCTION OF MINERAL COMMODITIES1/ 2/

(Metric tons unless otherwise specified)

Commodity		1990	1991	1992	1993	1994
INDUSTRIAL MINERALS--Continued						
Stone, crushed:						
Limestone and dolomite:						
For cement manufacture	thousand tons	2,400	1,710 r/	1,550	1,010 r/	1,050
For agriculture	do.	1,270	1,120 r/	796	1,040 r/	954
For lime manufacture	do.	439	397 r/	364	348 r/	317
Fine powders	do.	648	634 r/	475	568 r/	565
Metallurgical	do.	1	4 e/	2	2 e/	2 e/
Total	do.	4,750	3,870	3,190	2,960 r/	2,890
Quartz silica sand	do.	276	201	169	167 r/	162
Soapstone	do.	28 e/	28	28	27	38
Sulfur:						
S content of pyrite	do.	357	369	350	350 e/	355
Byproduct:	do.					
Of metallurgy	do.	237	227	225	225 e/	47
Of petroleum	do.	42 e/	40 e/	32	32 e/	34
Total	do.	636	636	607	607 e/	436
Sulfuric acid	do.	1,330	1,300 e/	1,320	1,300 e/	1,350
Talc	do.	385	361	371	399 r/	453
Wollastonite		29,800	27,800 r/	27,800 r/	26,800 r/	27,800 e/
MINERAL FUELS AND RELATED MATERIALS						
Peat:						
For fuel use	thousand tons	4,500	2,310	5,100	3,950 r/	9,000 e/
For agriculture and other uses	do.	330	220	355	350	550 e/
Petroleum refinery products e/	thousand 42-gallon barrels	72,500	73,000	73,000	73,000	73,000

e/ Estimated. r/ Revised
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.
2/Table includes data available through May 1995.

TABLE 2
FINLAND: STRUCTURE OF THE MINERAL INDUSTRY FOR 1994

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Ammonia	Kemira Oy (Government 98%)	Plant at Oulu	75
Cadmium, metal	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Smelter at Kokkola	1
Cement	Partek Cement Oy (Partek Corp. 50% and Metra Corp. 50%)	Plants at Lappeenranta and Pargas	1,200
Chromite	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Mine at Kemi	730
Copper:			
Ore, Cu content	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Mines at Pyhasalmi, Saattopora, and Hitura	10
Metal	Do.	Smelters at Harjavalta and Pori	160
Feldspar	Lohja Oy (Metra Corp. 100%)	Mines and plants at Haapaluoma, Kemio, and Peraseinajok	50
Ferrochrome	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Smelter at Tornio	230
Gold:			
Ore, Au content tons	Do.	Mines at Orivesi and Saattopora	4
Metal do.	Do.	Smelter at Pori	4
Limestone	Partek Minerals Oy (Partek Corp. 100%)	Mines at Kolari, Lappeenranta, and Pargas	1,900
Do.	Lohja Oy (Euroc, 100%)	Mines at Mustio and Sipoo	1,650
Do.	Rauma-Repola Oy	Mine at Turnio	300
Mercury tons	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Smelter at Kokkola	150
Mica	Kemira Oy (Government 98%)	Mine at Siilinjarvi	10
Nickel:			
Ore, Ni content	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Mine at Hitura	3
Metal	Do.	Smelter at Harjavalta	32
Phosphate-apatite	Kemira Oy (Government 98%)	Mine at Siilinjarvi	700
	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Mine at Pyhasalami	800
Quartz and quartzite	Lohja Oy (Euroc, 100%)	Mines at Kemio and Nilsia	250
Selenium tons	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Smelter at Pori	35
Silver do.	Do.	Do.	30
Steel	Rautaruukki Oy (Government 68.76%)	Plant at 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%, and Fiskas 20%)	Plant at Imatra	600
Talc	Finnminerals Oy (United Paper Mills 100%)	Mines at Lahnaslampi, Lipsavaara, Luikanlahti, and Poljivari	500
Wollastonite	Partek Minerals Oy (Partek Corp. 100%)	Mine at Lappeenranta	30
Zinc:			
Ore, Zn content	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Mine at Pyhasalami	25
Metal	Do.	Smelter at Kokkola	175

TABLE 3
FINLAND: ESTIMATED RESERVES OF MAJOR MINERAL COMMODITIES FOR 1994

(Million metric tons unless otherwise specified)

Commodity		Reserves
Apatite		350
Chromium		70
Clay	billion cubic meters	100
Copper, metal content	thousand tons	49
Gold, metal content	tons	1
Nickel, metal content	thousand tons	8
Peat	billion cubic meters	70
Phosphate rock		90
Talc	tons	40
Wollastonite		24
Zinc, metal content	thousand tons	113