



2020–2021 Minerals Yearbook

FINLAND [ADVANCE RELEASE]

U.S. Geological Survey, Reston, Virginia: 2025

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THE MINERAL INDUSTRY OF FINLAND

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Note: In this chapter, information for 2020 is followed by information for 2021.

Finland had a well-developed mineral industry and infrastructure, a good geological knowledge base, and ore potential. In 2020, the country was the world's second-ranked mica producer, accounting for an estimated 18% of world production; and the sixth-ranked (excluding United States production) selenium producer, accounting for 3% of world production. Finland was also one of the leading peat producers in the world (Fraserinstitute.org, 2021; Mining Finland, 2021; Anderson, 2022; Brioché, 2022; Jasinski, 2022).

Minerals in the National Economy

In 2020, Finland's real gross domestic product (GDP) decreased by 2.3%, and the nominal GDP was \$271.8 billion. The mineral sector had significant direct and indirect effects on Finland's national economy and employment. In the mining and quarrying sector, the number of employees decreased to 6,221 in 2020 from 6,229 in 2019 and represented 0.4% of total country employment, and the number of companies decreased to 1,147 from 1,179 in 2019. Sales in the mining and quarrying sector increased by 9.1% to \$2.56 billion¹ (EUR2.25 billion). Of this amount, sales from the mining of metallic ores amounted to \$1.29 billion (EUR1.13 billion) and sales from the extraction of peat amounted to \$525.2 million (EUR460.6 million) (Statistics Finland, 2022; World Bank, The, 2022a, b).

In 2020, 21 companies submitted mining reports to the Finnish Safety and Chemicals Agency (TUKES) about the mining activities at their 45 mines. The mines included 9 metallic ore mines and 36 industrial mineral mines and quarries. Total excavation at these mines increased to 115.4 million metric tons (Mt) from 115.1 Mt in 2019, and 82% of this amount was extracted from the Kevitsa (39.4 Mt), the Terrafame (33.4 Mt), and the Siilinjärvi (22.4 Mt) Mines. Included in this total, excavation of ore (metal ore, carbonate rock, industrial rock, and industrial minerals) increased to 48.6 Mt from 44.6 Mt in 2019, of which metal ore excavation accounted for 32.8 Mt. Investment in mining activities decreased to \$447 million (EUR392 million), or by 25% compared with that in 2019; however, it was still higher than in previous years. The major investments were focused on the Kevitsa copper-nickel mine, followed by the Kittilä gold mine, and the Kemi chromium mine (Kaivosteollisuus, 2020; Finnish Safety and Chemicals Agency (TUKES), 2021c; Liikamaa, 2021, p. 2, 4, 6; Mining Finland, 2021).

In 2020, 61 companies submitted exploration reports to TUKES compared with 46 companies in 2019. Investment in exploration in Finland increased to \$77.5 million (EUR67.9 million) or by

8%. The total exploration application area covered 4,387 square kilometers (km²) from which 219 kilometers (km) of ore was drilled—a 16% increase compared with that in 2019. The Government agency participating in exploration activities was the Geological Survey of Finland (GTK), which focused on assessing and modeling potential ore-rich areas (Liikamaa, 2021, p. 2, 4; Mining Finland, 2021).

Government Policies and Programs

The Government regulates the mineral industry through two main laws—the Land Extraction Act (555/1981 of July 24, 1981; effective January 1, 1982), which regulates the extraction of sand and gravel and the quarrying of natural stone, and the Mining Act (621/2011 of June 10, 2011; effective July 1, 2011), which regulates the mining of metallic and industrial minerals other than stone, sand, and gravel. The objective of the Mining Act is to ensure that exploration and mining activities are conducted in an environmentally, economically, and socially sustainable way. The Mining Act takes account of other key laws applicable to exploration and mining, including the Finnish Constitution and legislation concerning the regions inhabited by the Sami indigenous people in northern Finland. To promote research on raw materials and their production, in 2010, the Government issued the Minerals Strategy, which makes recommendations concerning the formulation of a sustainable mineral policy and the development of the mineral sector for the next few decades (Finlex, 1981, 2011, 2021; Geological Survey of Finland, 2010, p. 2; Ministry of Economic Affairs and Employment, 2021b).

TUKES is the major governing body for the mineral industry and acts as the mining authority. TUKES grants and supervises permits and enforces compliance with the Mining Act. The Ministry of Economic Affairs and Employment provides guidance for monitoring and development activities related to the Mining Act. The Regional State Administrative Agencies (AVIs) grant the environmental permits required for mining. The Centers for Economic Development, Transport, and the Environment (ELY Centers) supervise and protect the public interest concerning environmental and water issues. The Government rules on matters related to mining reclamation permits and permits for mining thorium and uranium. The Radiation and Nuclear Safety Authority of Finland (STUK), which is under the Ministry of Social Affairs and Health, is responsible for matters related to radioactive substances (Kalliolaw Asianajotoimisto Oy, 2018; Finnish Safety and Chemicals Agency (TUKES), 2021a, b; Ministry of Economic Affairs and Employment, 2021a, c; Radiation and Nuclear Safety Authority, 2021).

¹Where necessary, values have been converted from euro area euros (EUR) to U.S. dollars (US\$) at the annual average exchange rates of EUR0.846=US\$1.00 for 2021 and EUR0.877=US\$1.00 for 2020.

Production

In 2020, mineral commodities that had significant production increases included lead (mine, Pb content), by 63%; silver (mine, Ag content), 36%; platinum (mine, Pt content), 34%; palladium (mine, Pd content), 23%; copper (refinery, primary), 22%; copper (smelter, secondary), 21%; copper (smelter, primary), 19%; peat (horticultural use), 17%; and copper (mine), 10%. The most significant decreases were those for palladium (refinery), by 69%; platinum (refinery), 67%; peat (fuel use), 43%; selenium (metal, S content), 27%; mica (concentrate), 23%; pyrite, 17%; talc, 16%; zinc (mine, Zn content), 12%; and feldspar (mine) and mica (biotite), 10% each. Data on mineral production are in table 1.

Structure of the Mineral Industry

Finland's metallic mineral mines were mostly privately owned by foreign enterprises, although the Government held an equity share in some of the major mineral producers. Most of the metallic mineral mining companies were subsidiaries of international mining companies from Australia, Canada, Russia, Sweden, and the United Kingdom. The Hannukainen iron mining project (owned by Hannukainen Mining Oy), the Hautalampi cobalt-nickel mining project (Alandra Oy), the Keliber lithium mining project (Keliber Oy), and the Otso gold mine (Otso Gold Corp.) were four new projects planning to start new mining operations. Another project under consideration was reopening the Pahtavaara gold mine (owned by Rupert Resources Ltd.). Several ore prospecting projects were underway as well (Ministry of Economic Affairs and Employment, 2017; Vasara, 2018, p. 10, 14; Otso Gold Corp., 2021b). Table 2 is a list of major mineral industry facilities.

Mineral Trade

In 2020, the total value of Finland's exports was \$65.4 billion (EUR57.3 billion), and the total value of its imports was \$67.8 billion (EUR59.4 billion). The country's leading export products were (in order of value) chemicals (18.5% of total exports), forest industry products (17.9%), and metals and metallic products (15.5%). The leading import products were chemicals (17.5% of total imports), electric and electronics industry products (14.9%), transport equipment (10.6%), machinery and equipment (10.1%), and mining and quarrying products (9.4%). Finland's leading export partners were Germany (which received 13.8% of the country's total exports), Sweden (10.5%), and the United States (8.5%). The leading import partners were Germany (which supplied 15.7% of the country's total imports), Sweden (11.0%), and Russia (9.8%) (Statistics Finland, 2021, p. 34–35).

Commodity Review

Metals

Copper.—Boliden Mineral AB (Boliden) of Sweden owned and operated the Kevitsa copper-nickel open pit mine and the Kylylahti polymetallic mine. In 2020, copper production at the Kevitsa Mine compared with that in 2019 increased by

38.7% to 27,402 metric tons (t), and at the Kylylahti Mine decreased by 25.2% to 3,609 t. The Kevitsa Mine produced cobalt, copper, gold, nickel, platinum, and palladium. In 2019 and 2020, Boliden was in the process of increasing the milled volume at the Kevitsa Mine to 9.5 million metric tons per year (Mt/yr). Owing to Boliden's investments in a new mill line and increased haulage capacity, the new milled volume production capacity was reached during the year. In 2020, Kevitsa's milled volume increased to 9.2 Mt of ore from 7.5 Mt in 2019. At the end of May, a fire broke out in Kevitsa's primary crusher plant. The production was not significantly affected, as mobile crushers were used during the repair period, which provided approximately 90% of normal capacity. The repairs were completed in August. The decrease in copper production at the Kylylahti Mine was owing to the lower milled volume, lower ore grades, and technical challenges related to the planned closure of the mine in 2020. After 10 years of operation, the mine ceased production in November (Boliden Group, 2021, p. 16, 18, 40–41, 113–114).

First Quantum Minerals Ltd. of Canada owned and operated the polymetallic Pyhasalmi Mine, which is an underground mine located in central Finland. In 2020, the mine produced 4,483 t of copper, 462,160 t of pyrite, and 2,536 t of zinc. Copper production decreased by 44% compared with the 8,003 t produced in 2019, owing mainly to lower throughput, which was caused by nearly depleted reserves. Although First Quantum had expected 2019 to be the final full year of operation for the Pyhasalmi Mine, the company extended the life of the mine to June 2021 and projected production of 2,000 t of copper in 2021 (First Quantum Minerals Ltd., 2020, p. 33; 2021a, p. 29; 2021b).

Gold.—In 2020, Agnico Eagle Mines Ltd. of Canada produced 5,900 kilograms (kg) of gold at its underground Kittila Mine, which is located in the Lapland region of northern Finland. The mine had one of the largest known gold deposits in Europe. As of December 31, 2019, the 192-km² property had proven and probable mineral reserves of 30 Mt grading 4.16 grams per metric ton (g/t) gold. Production at the mine started in 2009, and the mine life was estimated to continue through 2034. In 2020, Agnico Eagle Mines continued the processing plant expansion project at the mine. The project included a 25% expansion of the Kittila mill throughput to 6,000 metric tons per day, which was completed in 2020, an increase of the mill throughput to 2 Mt/yr from 1.6 Mt/yr, and the construction of a 1,044-meter deep shaft, which would have a hoisting capacity of 2.7 Mt/yr (2 Mt/yr of ore and 0.7 Mt/yr of waste). The expansion project was expected to be completed in 2022 (table 2; Agnico Eagle Mines Ltd., 2021).

In Finland, Dragon Mining Ltd. of Australia owned three gold mines: the Orivesi Mine, which ceased production in June 2019 owing to ore depletion; the Jokisivu Mine; and the Kaapelinkulma open pit mine, from which the first ore delivery to the Vammala plant located 65 km to the east took place in April 2019. As of December 31, 2019, the proven and probable mineral reserves at the Jokisivu Mine and the Kaapelinkulma Mine were 1.1 Mt grading 2.8 g/t gold and 0.61 Mt grading 4.3 g/t gold, respectively. According to the company, in 2020, the proven and probable mineral reserve data continued to apply and had not materially changed (Dragon Mining Ltd., 2021a–c).

In 2020, Otso Gold Corp. of Canada received all necessary approvals for the restart of operations at the Otso gold mine (known also as the “Laiva gold mine”). The mine had two open pits located near the town of Raahe. Production was expected to start in October 2021, and the mine would have a throughput of 2 Mt/yr of ore (Otso Gold Corp., 2021b).

Lead.—In 2020, mined lead production increased to 1,530 t from 937 t in 2019, or by 63%, owing to the startup of production in 2019 at the Hopeakaivos silver mine at Sotkamo; the mine was owned by Sotkamo Silver AB (table 1).

Nickel.—The Talvivaara Mine and metal production plant, located at Sotkamo in the Kainuu Region and owned by Terrafame Ltd., produced nickel, zinc, and byproduct cobalt and copper using a bioleach process. In 2020, the company produced 28,740 t of nickel compared with 27,468 t in 2019, which was below the company’s 30,000-metric-ton-per-year (t/yr) target level. The lower production than target output was owing to the production stoppage in the third quarter. During that time, the necessary connections between the battery chemicals plant and the existing production plant were implemented. The milled volume and metal production also decreased at Boliden’s Kylylahti Mine owing to technical challenges related to the mine’s planned closure in 2020. At Boliden’s Kevitsa Mine, the milled volume increased and led to higher nickel production. Production of nickel matte at Boliden’s Harjavalta smelter was stable and amounted to approximately 25,000 t (Boliden Group, 2021, p. 41, 114, 116; Terrafame Ltd., 2021, p. 4).

Platinum-Group Metals (Palladium and Platinum).—In 2020, Norilsk Nickel Harjavalta Oy’s (Norilsk’s) production of salable palladium and platinum in copper cake decreased by 69% and 67%, respectively, compared with that in 2019. The copper cake mined was mostly shipped to the Polar Division in Russia for further processing, which resulted in decreases in palladium and platinum output in Finland (MMC Norilsk Nickel, 2021, p. 94–95).

Silver.—The production of silver (mine, Ag content) in Finland increased to 54,833 kg in 2020, or by 36% compared with that in 2019, owing to the commissioning of the Hopeakaivos silver mine at Sotkamo, which was the first silver mine in Finland. The mine started production in March 2019 and reached its production capacity of 45,000 kilograms per year of silver in September. In 2020, the mine milled 546,000 t of ore compared with 343,000 t in 2019 and produced about 112 kg of gold, 44,790 kg of silver, 1,532 t of lead, and 3,254 t of zinc in concentrates (tables 1, 2; Kajastie, 2019; Sotkamo Silver AB, 2021a; 2021b, p. 11).

Zinc.—Zinc production at First Quantum Minerals’ Pyhasalmi Mine decreased to 2,536 t, or by 79% compared with 12,080 t produced in 2019. The decrease was owing to lower throughput, lower grades, and a lower recovery rate associated with the depletion of mineral reserves. The mine was one of the oldest and deepest underground mines in Europe. For 2021 (the final one-half year of operation of the Pyhasalmi Mine), the company forecasted 500 t of zinc production. Also, as discussed in the copper section, zinc production at the Talvivaara Mine and the Kylylahti Mine decreased as well. The Talvivaara Mine produced 55,100 t of zinc compared with 55,222 t in 2019, which was a slight decrease, and the Kylylahti Mine produced

325 t of zinc compared with 851 t in 2019, which was a 61.7% decrease (Boliden Group, 2021, p. 113; First Quantum Minerals Ltd., 2021a, p. 29; Terrafame Ltd., 2021, p. 4).

Production at Boliden’s Kokkola zinc smelter increased by 2.2% to 297,257 t in 2020 from 290,844 t in 2019. The smelter also produced silver concentrate and sulfuric acid. The Kokkola smelter was one of the world’s major zinc producers (table 1; Boliden Group, 2021, p. 46, 116).

Vanadium.—In July 2020, Strategic Resources Inc. of Canada finalized the acquisition of the Mustavaara Mine and deposit. Mustavaara is a large vanadium-iron-titanium deposit that was mined by Rautaruukki Oy (a Finnish state-owned company) from 1976 to 1985. Operations were ceased owing to low metal prices. At that time, the vanadium produced from the Mustavaara deposit accounted for approximately 10% of the world’s vanadium production. The previously mined area included vanadium-rich magnetite zones located along an 18-km-long magnetic anomaly, raising the possibility of large-scale potential along the strike. The area had estimated probable reserves totaling 97 Mt, containing 13.8% magnetite and 0.91% vanadium in concentrate (Strategic Resources Inc., 2021a, b; 2021c, p. 12).

Industrial Minerals

Limestone and Wollastonite.—Nordkalk Corp., which was owned by Rettig Group Ltd., was the leading limestone, limestone powder, and wollastonite producer in Finland. The company was the only European producer of high-quality wollastonite with its own deposit, which was extracted and processed in Lappeenranta. Lappeenranta was Nordkalk’s largest production site in Finland, in terms of output; it included a quarry, a grinding plant, and two flotation plants (Nordkalk Corp., 2021a; 2021b, p. 4, 41).

MINERAL INDUSTRY HIGHLIGHTS IN 2021

Minerals in the National Economy

In 2021, Finland’s real GDP increased by 3.5%, and the nominal GDP was \$299.2 billion. In the mining and quarrying sector, the number of employees decreased to 5,682 in 2021 from 6,221 in 2020 and represented 0.4% of total country employment; the number of companies increased to 1,157 in 2021 from 1,147 in 2020. Sales in the mining and quarrying sector increased by 7.5% to \$2.86 billion (EUR2.42 billion). Of this amount, sales from the mining of metallic ores amounted to \$1.54 billion (EUR1.30 million), and sales from the extraction of peat amounted to \$517.3 million (EUR437.6 million; Statistics Finland, 2022; World Bank, The, 2022a, b).

In 2021, 21 companies submitted mining reports to TUKES about the mining activities at their 44 mines. Total excavation at these mines amounted to 115.5 Mt, which was about the same as in 2020, and 85% of this amount was extracted from Terrafame (40.9 Mt), the Kevitsa (33.7 Mt), and the Siilinjarvi (23.0 Mt) Mines. Included in this total, excavation of ore (metal ore, carbonate rock, industrial rock, and industrial minerals) decreased to 47.9 Mt or by 2%, from 48.5 Mt in 2020, of which metal ore excavation accounted for 32.1 Mt. Investment in mining activities

decreased to \$367 million (EUR311 million) or by 20% compared with that in 2020. The major investments were focused on the Kevitsa copper-nickel mine, followed by the Kemi chromium mine and the Kittila gold mine (Finnish Safety and Chemicals Agency (TUKES), 2022; Liikamaa, 2022, p. 2, 4).

Production

In 2021, mineral commodities that had significant production increases included feldspar, by 227%; palladium (refinery) and platinum (refinery), 76% each; peat (horticultural use), 49%; mica (concentrate), 40%; copper (refinery, secondary), 27%; raw steel, 24%; pig iron, 23%; palladium (mine, Pd content), 21%; selenium (metal, Se content), 19%; platinum (mine, Pt content), 13%; and copper (smelter, primary), 11%. The most significant decreases were those for peat (fuel use), by 59%; cobalt (mine, Co content), 30%; nickel (refinery), 25%; nickel (smelter, matte), 24%; mica (biotite) and silica sand, 21% each; silver (mine, Ag content), 17%; copper (concentrate, gross weight), 14%; and copper (concentrate, Cu content) and zinc (mine, Zn content), 11% each. Data on mineral production are in table 1.

Commodity Review

Finland's lower production of refined cobalt, copper, gold, nickel, and zinc was influenced by, among other factors, the closure of Boliden's Kylylahti Mine at the end of 2020. In 2021, copper (Cu content) production decreased by 11% to 32,384 t. Boliden's copper production at the Kevitsa Mine increased by 4.6% to 28,725 t compared with that in 2020. Kevitsa's milled volume increased to the planned 9.5 Mt of ore owing to Boliden's investments in 2019 and 2020. First Quantum Minerals' Pyhasalmi Mine produced 3,292 t of copper and 434,148 t of pyrite. The company's copper production decreased by 27% compared with production in 2020 owing mainly to lower throughput and copper grade, which were caused by nearly depleted ore reserves. The company extended the life of the mine to the first quarter of 2022 and projected production of 500 t of copper in 2022 (Boliden Group, 2022, p. 43, 119; First Quantum Minerals Ltd., 2022, p. 67).

Refined nickel production decreased to 47,198 t from 63,352 t, or by 25.5%, owing to lower supplies of nickel concentrate to Norilsk's Harjavalta refinery. The Harjavalta refinery was Finland's only nickel refinery and was one of the leading nickel producers in Europe; the refinery had a production capacity of 66 t/yr of nickel products (MMC Norilsk Nickel, 2022, p. 89).

Mined gold production increased by 4.7% to 9,082 kg. Agnico Eagle Mines produced 7,440 kg of gold at its Kittila Mine. In 2021, the company continued the processing plant expansion project at the mine, which was expected to be completed in the second half of 2022. In April 2021, Dragon Mining ceased mining at Kaapelinkulma open pit mine. The company commenced open pit mining at the Kaapelinkulma Mine in February 2019. In September 2021, Otso Gold Corp. started gold production at the Otso gold mine (Otso Gold Corp., 2021a, c; Agnico Eagle Mines Ltd., 2022; Dragon Mining Ltd., 2022).

Nickel and zinc production from Terrafame's Talvivaara Mine was stable and amounted to 28,582 t and 54,353 t, respectively. Boliden's production of nickel in matte at Harjavalta's smelter decreased by approximately 24% to 19,000 t owing to a lower nickel feed (Boliden Group, 2022, p. 54, 121; Terrafame Ltd., 2022, p. 12).

Peat production for fuel use decreased by 59% to 2.3 Mt. The decrease in the demand for peat for fuel use was owing to the increase in the price of emission rights to more than \$70 per metric ton of carbon dioxide (CO₂) equivalent, as Finland aimed to become carbon-neutral by 2035. This price increase, together with the increase in the energy tax, made peat for energy use a much more expensive option than the use of wood chips and commercial timber for fuel. In Finland, peat had been an important fuel. Finland was one of the last countries in the world to still use peat as a significant energy source (Neova Group, 2021; Yle News, 2022).

In September 2020, Neste Oyj announced that it was planning to restructure its refinery operations in Naantali and Porvoo to ensure the competitiveness of its petroleum products business. The decision was based on the lower demand for fossil-based petroleum products and the expected growth in the share of renewable energy in the country's energy solutions in the coming years. In March 2021, Neste Oyj shut down its petroleum refinery operations in Naantali. The company was going to focus the Naantali site on the terminal and harbor operations, while the Porvoo refinery would be developed towards coprocessing renewable and circular (recovered from prior use-phase) raw materials (Fuelsandlubes.com, 2020; Neste Oyj, 2022).

Outlook

Finland possesses strong technological expertise in mining machinery along with significant metal refining activities. In the long term, Finland's goal for its mineral sector is to become an active, globally competitive sector that secures raw material supply and supports regional development. Therefore, the Government continues to work on providing an optimal regulatory and business environment for the mining and mineral processing sector. The Pyhasalmi copper-zinc mine is expected to cease production in 2022, and fuel peat production is expected to continue to sharply decrease. The coronavirus 2019 (COVID-19) pandemic is likely to continue to affect mineral exploration, new mining projects, and the use of international specialists' expertise in the near term; however, in the long term, mining activities are expected to remain at a high level and be supported by extensive exploration and investment.

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TABLE 1
FINLAND: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons, gross weight, unless otherwise specified)

Commodity ²	2017	2018	2019	2020	2021
METALS					
Chromium, mine, chromite, ore	1,954,282	2,211,284	2,415,287	2,293,330	2,273,857
Cobalt, Co content:					
Mine, ore, including non-recoverable	1,600	1,377	1,454	1,559	1,084
Refinery, metal powder and salts	13,585 ^r	14,295 ^r	14,283 ^r	15,148	14,287
Copper:					
Mine, concentrates:					
Gross weight	207,264	193,091	138,140	152,122	130,769
Cu content	53,144	46,674	32,861	36,278	32,384
Smelter:					
Primary	112,400 ^r	123,500 ^r	109,700 ^r	130,000 ^e	144,000
Secondary	5,900	6,500	5,800	7,000 ^e	7,500
Refinery:					
Primary	126,500 ^r	132,100 ^r	114,727 ^r	139,888	143,761
Secondary	6,700	7,000	5,642	5,959	7,545
Ferroalloys, ferrochromium	416,285	492,774	505,000	498,000	515,000
Gold, mine, Au content kilograms	9,102	8,732	7,927	8,668	9,082
Iron and steel:					
Pig iron thousand metric tons	2,604	2,976	2,260 ^r	2,275	2,800 ^e
Steel, raw steel do.	4,004	4,100 ^r	3,511	3,482	4,322

See footnotes at end of table.

TABLE 1—Continued
FINLAND: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons, gross weight, unless otherwise specified)

Commodity ²		2017	2018	2019	2020	2021
METALS—Continued						
Lead, mine, Pb content		--	--	937	1,530	1,494
Nickel, Ni content:						
Mine		34,641	43,572	38,530	41,429	42,163
Smelter, matte		25,000	31,000	26,000	25,000	19,000
Refinery, all forms, including metal and chemicals		59,716	60,765	62,422	63,352	47,198
Platinum-group metals:						
Mine, primary:						
Palladium, Pd content	kilograms	1,021	1,157	699	858	1,036
Platinum, Pt content	do.	1,418	1,576	953	1,277	1,447
Refinery:						
Palladium	do.	1,306 ^r	1,804 ^r	1,680 ^r	529	933
Platinum	do.	311 ^r	342 ^r	373 ^r	124	218
Selenium, metal, Se content	do.	100,198	108,918	115,236	84,213	99,851
Silver, mine, Ag content	do.	13,654	12,849	40,461	54,833	45,338
Zinc:						
Mine, Zn content		66,284	85,335	69,800 ^r	61,213	54,353
Smelter, primary		284,992	295,029	290,844	297,257	292,648
INDUSTRIAL MINERALS						
Cement, hydraulic ^c	thousand metric tons	1,510	1,460	1,430	1,470	1,500
Feldspar		14,926	17,469	17,997	16,137	52,706
Mica:						
Biotite		47,123	50,456	64,505	57,861	45,757
Concentrate		10,740	12,122	9,440	7,247	10,138
Phosphate rock, apatite, concentrates:						
Gross weight		978,613	989,073	994,572	995,066	990,261
P ₂ O ₅ content ^c		420,000	410,000	410,000	410,000	400,000
Sand and gravel, industrial, quartz, silica sand	thousand metric tons	72	81	213	197	156
Stone, crushed, limestone, including dolomite	do.	3,565	3,726	3,312	3,335	3,640
Sulfur:						
Compounds, sulfuric acid	do.	1,803	1,793	1,750 ^{r, c}	1,900 ^c	1,840 ^c
Pyrite:						
Gross weight	do.	692 ^r	646 ^r	554 ^r	462	434
S content	do.	370 ^r	345	296 ^r	247	232
Talc		354,819	374,398	329,891	278,331	296,833
MINERAL FUELS AND RELATED MATERIALS						
Peat:						
Fuel use	thousand metric tons	8,366	17,306	10,077	5,735	2,342
Horticultural use	do.	1,409	2,272	1,763	2,071	3,083

^cEstimated. ^rRevised. do. Ditto. -- Zero.

¹Table includes data available through November 26, 2022. All data are reported unless otherwise noted. Estimated data are rounded to no more than three significant digits.

²In addition to the commodities listed, refined gold, lime, refined silver, refined petroleum, and wollastonite may have been produced, but available information was inadequate to make reliable estimates of output.

TABLE 2
FINLAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2021

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Finnsementti Oy (Irish Cement Ltd., 100%)	Plants at Lappeenranta and Parainen	1,700
Chromium, chromite, ore		Outokumpu Chrome Oyj (Solidium Oy, 21.69%)	Mine at Kemi	2,700
Cobalt:				
Ore, Co content	metric tons	Boliden Kevitsa Mining Oy (Boliden Mineral AB, 100%)	Kevitsa Mine at Petkula	600
Do.	do.	Boliden Kylylahti Oy (Boliden Mineral AB, 100%)	Kylylahti Mine near Polvijarvi ¹	280
Do.		Terrafame Oy [Finnish Minerals Group, 71.8% (Government owned)]	Talvivaara Mine at Sotkamo	NA
Metal		Freeport Cobalt Oy [Freeport-McMoRan Inc., 56%; Lundin Mining Corp., 24%; La Générale des Carrières et des Mines Sarl (Gécamines), 20%]	Plant at Kokkola ²	NA
Do.	metric tons	Umicore N.V.	Refinery at Kokkola	15
Copper:				
Ore, Cu content		Boliden Kevitsa Mining Oy (Boliden Mineral AB, 100%)	Kevitsa Mine at Petkula	30
Do.		Boliden Kylylahti Oy (Boliden Mineral AB, 100%)	Kylylahti Mine near Polvijarvi ¹	12
Do.		Pyhasalmi Mine Oy (First Quantum Minerals Ltd., 100%)	Pyhasalmi Mine at Pyhakumpu	18
Do.		Terrafame Oy [Finnish Minerals Group, 71.8% (Government owned)]	Mine at Talvivaara, Sotkamo	NA
Metal		Boliden Harjavalta Oy (Boliden Mineral AB, 100%)	Smelter at Harjavalta	210
Do.		do.	Refinery at Pori	155
Feldspar		Sibelco Nordic Oy Ab	Mine and plant at Kemionsaari	50
Ferrochromium		Outokumpu Oyj [Solidium Oy, 15.5% (Government owned)]	Smelter at Tornio	530
Gold:				
Ore, Au content	metric tons	Agnico Eagle Finland Oy (Agnico Eagle Mines Ltd., 100%)	Mine at Kittila	6
Do.	do.	Boliden Kevitsa Mining Oy (Boliden Mineral AB, 100%)	Kevitsa Mine at Petkula	1
Do.	do.	Boliden Kylylahti Oy (Boliden Mineral AB, 100%)	Kylylahti Mine near Polvijarvi ¹	1
Do.	do.	Dragon Mining Ltd.	Mines at Jokisivu, Kaapelinkulma, ³ and Orivesi ⁴	4
Do.	do.	Endomines AB	Mine at Pampalo, Ilomantsi ⁵	2
Do.		Otso Gold Corp.	Otso Mine (Laiva) near Raahe ⁶	NA
Do.	metric tons	Rupert Resources Ltd.	Pahtavaara Mine near Sodankyla ⁷	2
Do.		Sotkamo Silver Oy (Sotkamo Silver AB)	Hopeakaivos Mine at Sotkamo	NA
Metal	metric tons	Boliden Harjavalta Oy (Boliden Mineral AB, 100%)	Smelter at Harjavalta	4
Iron and steel:				
Raw steel		Ovako AB (Sanyo Special Steel Ltd., 100%)	Plant at Imatra	300
Do.		Rautaruukki Oyj (SSAB AB, 41.3%, and Government, 39.7%)	Plants at Hameenlinna, Kankaanpaa, and Raahe	2,100
Stainless steel		Outokumpu Oyj [Solidium Oy, 15.5% (Government owned)]	Plant at Tornio	550
Lead	metric tons	Sotkamo Silver Oy (Sotkamo Silver AB)	Hopeakaivos Mine at Sotkamo	NA
Mica		Yara Suomi Oy (Yara International ASA)	Mine and plant at Siilinjärvi	10
Nickel:				
Ore, Ni content		Boliden Kevitsa Mining Oy (Boliden Mineral AB, 100%)	Kevitsa Mine at Petkula	15
Do.		Boliden Kylylahti Oy (Boliden Mineral AB, 100%)	Kylylahti Mine near Polvijarvi ¹	1
Do.		Terrafame Oy [Finnish Minerals Group, 71.8% (Government owned)]	Talvivaara Mine at Sotkamo	30
Metal		Boliden Harjavalta Oy (Boliden Mineral AB, 100%)	Smelter at Harjavalta	32
Do.		Norilsk Nickel Harjavalta Oy (MMC Norilsk Nickel "Nornickel," 100%)	do.	32
Do.		do.	Refinery at Harjavalta	66
Petroleum, products	thousand 42-gallon barrels per day	Neste Oyj (Government, 35.91%)	Refinery at Naantali ⁸	58
Do.	do.	do.	Refinery at Porvoo	206
Phosphate rock		Yara Suomi Oy (Yara International ASA)	Mine and plant at Siilinjärvi	1,000
Platinum-group metals:				
Ore		Boliden Kevitsa Mining Oy (Boliden Mineral AB, 100%)	Kevitsa Mine at Petkula	NA
Metal		Norilsk Nickel Harjavalta Oy (MMC Norilsk Nickel "Nornickel," 100%)	Plant at Harjavalta	NA
Quartz		Sibelco Nordic Oy Ab	Mines at Kemio and Nilsia	250
Do.		SMA Mineral Oy	Mine at Tornio	NA

See footnotes at end of table.

TABLE 2—Continued
FINLAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2021

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Selenium	Boliden Harjavalta Oy (Boliden Mineral AB, 100%)	Refinery at Pori	NA
Silver:			
Ore, Ag content	Agnico Eagle Finland Oy (Agnico Eagle Mines Ltd., 100%)	Mine at Kittila	NA
Do.	Boliden Kylylahti Oy (Boliden Mineral AB, 100%)	Kylylahti Mine near Polvijarvi ¹	NA
Do. metric tons	Sotkamo Silver Oy (Sotkamo Silver AB)	Hopeakaivos Mine at Sotkamo	45
Metal	Boliden Harjavalta Oy (Boliden Mineral AB, 100%)	Smelter at Harjavalta and refinery at Pori	NA
Stone:			
Dolomite	Juuan Dolomiittikalkki Oy	Mines at Juuka and Paltamo	NA
Do.	SMA Mineral Oy	Mine at Pieksamaki and Tornio	NA
Limestone	Nordkalk Oy Ab (Nordkalk Corp.) (Rettig Group Ltd., 100%)	Mines at Lappeenranta and Parainen	1,500
Do.	SMA Mineral Oy	Mines at Pieksamaki and Tornio	300
Sulfur	Boliden Harjavalta Oy (Boliden Mineral AB, 100%)	Smelter at Harjavalta	NA
Do.	Pyhasalmi Mine Oy (First Quantum Minerals Ltd., 100%)	Pyhasalmi Mine at Pyhakumpu	NA
Talc	Elementis Minerals B.V.	Hormanaho-Pehmytkivi and Karnuka Mines at Polvijarvi and Punasuo and Uutela Mines at Sotkamo	500
Wollastonite	Nordkalk Oy Ab (Nordkalk Corp.) (Rettig Group Ltd., 100%)	Mine and plant at Lappeenranta	40
Zinc:			
Ore, Zn content	Boliden Kylylahti Oy (Boliden Mineral AB, 100%)	Kylylahti Mine near Polvijarvi ¹	2
Do.	Pyhasalmi Mine Oy (First Quantum Minerals Ltd., 100%)	Pyhasalmi Mine at Pyhakumpu	25
Do.	Sotkamo Silver Oy (Sotkamo Silver AB)	Hopeakaivos Mine at Sotkamo	3
Do.	Terrafame Oy [Finnish Minerals Group, 71.8% (Government owned)]	Talvivaara Mine at Sotkamo	60
Metal	Boliden Kokkola Oy (Boliden Mineral AB, 100%)	Smelter at Kokkola	315

Do., do. Ditto. NA Not available.

¹In November 2020, Boliden Kylylahti Oy ceased production at the Kylylahti Mine.

²In December 2019, the refinery in Kokkola and related cobalt cathode precursor activities were sold to Umicore N.V. Freeport Cobalt Oy retained the cobalt fine powders, chemicals, catalyst, ceramics, and pigments operations.

³In April 2021, Dragon Mining Ltd. ceased production at the Kaapelinkulma Mine.

⁴In 2019, Dragon Mining Ltd. ceased production at the Orivesi Mine.

⁵In 2018, the Pampalo Mine was put on care-and-maintenance status.

⁶In September 2021, Otso Gold Corp. started production at the Otso gold mine.

⁷In 2021, Pahtavaara Mine was not in operation.

⁸In March 2021, Neste Oyj shut down petroleum refinery operations in Naantali.