



2017–2018 Minerals Yearbook

REPUBLIC OF KOREA [ADVANCE RELEASE]

THE MINERAL INDUSTRY OF THE REPUBLIC OF KOREA

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Note: In this chapter, information for 2017 is followed by information for 2018.

In 2017, the Republic of Korea was the world's second-ranked producer of refined indium, accounting for 32% of global production; the second-ranked producer (excluding United States production) of refined cadmium (22% of global production); the second-ranked producer of mined zeolites (11%); the second-ranked producer of refined zinc (7%); and the fifth-ranked producer of mined talc and pyrophyllite (8%). The country was the world's fifth-ranked producer of pig iron, the sixth-ranked producer of raw steel, and the third-ranked exporter of raw steel (World Steel Association, 2018b, p. 9, 18, 27; Anderson, 2019; Bolen, 2019; Flanagan, 2019; Tolcin, 2019; Tuck, 2019; Thomas, 2020).

In the global mineral industry, the Republic of Korea was a consumer rather than a producer of metallic ores and concentrates, particularly copper, iron, lead, and zinc. In 2017, the Republic of Korea was the third-ranked importer of metallic ores, slag, and ash, which together accounted for 6% of its global trades, by value, behind China (55%) and Japan (9%) (United Nations Statistics Division, 2020).

Minerals in the National Economy

In 2017, the Republic of Korea's real gross domestic product (GDP) increased by 3.1%. The country's nominal GDP was \$1.53 trillion, which ranked it as the world's 12th largest economy. The value of manufacturing activities accounted for 30.4% of the GDP; construction, 5.9%; and mining and quarrying, 0.2%. By value, limestone accounted for 76% of mineral production, followed by sulfur (9%), quartzite (5%), and clay minerals (2%) (Bank of Korea, 2018, p. 17; Lee and others, 2018, p. 17, 23, 46; World Bank, The, 2019).

The country's outward foreign direct investment (FDI) in the mineral industry decreased to \$1.6 billion in 2017 from \$2.8 billion in 2016; mineral fuels accounted for 87% of the country's outward FDI. The leading recipients were Peru (\$374 million), Australia (\$311 million), the Marshall Islands (\$213 million), and the Netherlands (\$133 million) (Export Import Bank of Korea, 2018).

Government Policies and Programs

The Ministry of Trade, Industry, and Energy (MOTIE) was responsible for implementing the country's mineral laws and policies. The Korea Mining Industry Act (No. 14990 of 2017) provides the basic guidelines for extraction of the country's mineral resources (National Law Information Center, 2017).

The Korea Institute of Geoscience and Mineral Resources provides data on the country's mineral industry annually. The state-owned Korea Resources Corp. (KORES) supports the development of domestic, North Korean, and overseas mineral resources and industries and analyzes the country's mineral reserves biannually. In the 2000s, KORES designated the

following six minerals as strategic: bituminous coal, copper, iron, nickel, uranium and zinc. KORES defined strategic mineral commodities as those minerals for which imports accounted for more than 90% of the country's consumption, whose annual import value exceeded \$100 million, and that could be refined in the country. Rare-earth elements and lithium were added to the list of strategic minerals in 2010 (Korea Resources Corp., 2018; Ministry of Trade, Industry, and Energy, 2020, p. 15).

To secure its mineral supply, KORES stockpiles the following 10 rare metals in Gunsan, North Jeolla Province: antimony, chromium, gallium, molybdenum, niobium, rare earths, selenium, titanium, tungsten, and zirconium. KORES maintains a 64.5-day supply of these metals, which are important to the country's manufacturing industry and are mostly from imports. For price stabilization, the Public Procurement Service (PPS) stockpiles aluminum, lead, nickel, other rare metals (such as bismuth, cobalt, indium, lithium, manganese, silicon, strontium, tantalum, and vanadium), tin, and zinc at nine sites. The PPS maintains a more than 50-day supply of each of these mineral commodities (Lee and Eom, 2018; Korea Resources Corp., 2019; Public Procurement Service, 2019).

Production

Production of diatomite increased by 550% to 133,741 metric tons (t) in 2017 from 20,564 t in 2016. Other substantial increases in production included that of gold, by 76%; zinc, 47%; fuller's earth, 41%; silica sand, 40%; pottery clay, 39%; silver and titaniferous magnetite, 34% each; lead, 33%; clay (unspecified) and refined copper (secondary), 31% each; refined bismuth, 29%; talc, 26%; liquefied petroleum gas (LPG), 21%; calcite (size and shape unspecified; high purity limestone), 19%; naphtha, 18%; crushed dolomite, 17%; quartzite, 15%; kaolin, 14%; mica, 13%; and feldspar, 10%.

Production of mined copper, as a byproduct from the Guk-jeon lead-zinc mine, decreased by 94% to 7 t in 2017 from 108 t in 2016. Other notable decreases in mineral production included that of marble, by 62%; iron, 30%; pyrophyllite, 27%; bentonite, 26%; refined silver, 19%; ferromanganese, 15%; coal (anthracite), 14%; silicomanganese, 13%; and refined gold, 11%. Data on mineral production are in table 1.

Structure of the Mineral Industry

In 2017, there were 375 active mines owned by private or state-owned companies (349 for industrial materials, 21 for metals, and 5 for anthracite), up from 362 in 2016. The mining industry employed 6,715 people, which was a decrease from the 6,826 (revised) people employed by the industry in 2016 (Korea Institute of Geoscience and Mineral Resources, 2018b, p. 34). Table 2 is a list of major mineral industry facilities.

Korea Coal Corp., Korea Gas Corp., Korea National Oil Corp. (KNOC), and KORES were state-owned under the MOTIE. In 2017, KNOC was involved in petroleum exploration, development, and production projects in oilfields in the North Sea and shale gasfields in North America; its reserves and production totaled nearly 1.4 billion barrels (Gbbbl) and 170,000 barrels per day, respectively. KORES had foreign investments in 26 projects across 15 countries to supply high-demand minerals to the country, such as coal from Australia; copper from South America; and nickel from Africa (Korea National Oil Corp., 2018; Korea Resources Corp., 2018).

Mineral Trade

In 2017, the Republic of Korea's exports of metallic concentrates and industrial minerals increased in value by 118% to \$166 million and by 16% to \$154 million, respectively. Coal exports increased in value to \$3.3 million from \$0.44 million (Korea Institute of Geoscience and Mineral Resources, 2018b, p. 24–25).

In 2017, the Republic of Korea imported metallic concentrates (or ores), coal, and industrial minerals to supply 99.5%, 98.6%, and 25.0%, respectively, of domestic demand. The value of imported metallic concentrates, coal, and industrial minerals increased by 31% to \$14.1 billion, by 63% to \$15.1 billion, and by 15% to \$710 million, respectively, owing to the increase in the volume of imported minerals. Imports of major metallic concentrates included about 1.7 million metric tons (Mt) of copper, of which Chile supplied 34%; 1.2 Mt of manganese (Australia, 52%); 3.4 Mt of nickel (New Caledonia, 99.96%); and 43 t of silver (Mexico, 56%) (Korea Institute of Geoscience and Mineral Resources, 2018b, p. 24–25, 160–167; Lee and others, 2018, p. 13, 15; United Nations Statistics Division, 2020).

In 2017, the country's exports of mineral fuels and their products to the United States increased by 11% to \$3.3 billion, and those of nonfuel minerals increased by 122% to \$191 million. Imports of mineral fuels and their products from the United States were valued at \$4.3 billion compared with \$1.9 billion in 2016 owing to a significant increase in the import volume. The nonfuel mineral imports from the United States increased by 10% to \$583.5 million (Lee and others, 2018, p. 19, 21; U.S. Census Bureau, 2018a, b).

Commodity Review

Metals

Gold.—GoldenSun Co. Ltd. operated the country's two gold mines—the Eunsan Mine and the Gasa-Do Mine in South Jeolla Province. In 2017, gold production increased to 361 kilograms (kg) from 205 kg in 2016 owing to new output from gold-bearing veins at the Gasa-Do Mine; the veins were discovered in 2016 and were reported to contain 628 kg of gold (Korea Institute of Geoscience and Mineral Resources, 2018a, p. 33; Lee and others, 2018, p. 10).

Refined gold output decreased by 11% to about 52,800 kg in 2017 owing to lower gold contents in imported copper and zinc concentrates. LS-Nikko Copper Inc. and Korea Zinc Co. Ltd.—the two major gold refining companies in the country—

produced refined gold mostly as a byproduct of imported copper and zinc concentrates (Korea Institute of Geoscience and Mineral Resources, 2018a, p. 35).

In 2017, imports of gold in unwrought and semimanufactured forms increased greatly, to about 57,000 kg from 25,000 kg in 2016. The major suppliers were the United Arab Emirates (50%), Japan (14%), and Hong Kong (8%); the imports from the United Arab Emirates increased to 28,100 kg in 2017 from 2,700 kg in 2016. The increase in gold imports was because India, the world's second-ranked gold consumer after China, reduced the tariff on gold imports to 3% from 12.5% under the Free Trade Agreement (FTA) between the Republic of Korea and India. India's imports of gold from the United Arab Emirates by way of the Republic of Korea became profitable because of the tariff cut. The Republic of Korea's gold-silver fabrications exports to India increased to \$1.4 billion in 2017 from \$102 million in 2016. In August 2017, however, India restricted imports of gold items from the Republic of Korea to prevent misuse of the FTA (Jadhav, 2017; United Nations Statistics Division, 2020).

Indium.—Indium is usually produced as a byproduct of zinc refining. It can be used to produce indium-tin oxide (ITO), which is an essential material in the manufacturing of liquid crystal displays and plasma display panels. The Republic of Korea was a notable producer and consumer of indium. Major consumers were the ITO producers Heesung Metal Ltd. and Corning Precision Materials Korea (formerly Samsung Corning Precision Material Co. Ltd.). In 2017, the country imported 113 t of indium (metal, powder, and scrap), produced an estimated 225 t of indium by Korea Zinc Co., Ltd. and Young Poong Corp., and exported 246 t of indium (table 1; Korea Institute for Rare Metals, 2018).

Iron and Steel.—Handok Iron & Steel Co. Ltd. operated the country's sole iron ore mine, the Sinyemi Mine in Gangwon Province. In 2017, the Sinyemi Mine's iron ore production decreased to 311,000 t from 445,000 t in 2016 because the lower grade ore from the mine was less profitable to produce. The country produced about 47 Mt of pig iron, making it the fifth-ranked world producer after China (711 Mt), Japan (78 Mt), India (67 Mt), and Russia (52 Mt); and 71 Mt of raw steel, after China (832 Mt), Japan (105 Mt), India (101 Mt), the United States (82 Mt), and Russia (71.5 Mt). The Republic of Korea's production amounts of these mineral commodities remained at about the same level as in 2016 (Korea Iron and Steel Association, 2018; Lee and others, 2018, p. 11, 43; World Steel Association, 2018a, p. 1, 2, 89, 90).

In 2017, imports of iron ore—mainly from Australia (75%), Brazil (13%), and South Africa (7%)—totaled 72.4 Mt compared with 71.7 Mt in 2016, making the Republic of Korea the world's third-ranked importer of iron ore after China and Japan. The country exported 31.4 Mt of steel and was the world's third-ranked steel exporter. China was the leading destination (13%, or about 4 Mt) for the Republic of Korea's steel exports, followed by Japan (13%, or 3.98 Mt), the United States (11%, or 3.5 Mt), and India (9%, or 2.7 Mt) (U.S. International Trade Administration, 2018, p. 1, 3; World Steel Association, 2018b, p. 27).

Lead.—The Republic of Korea relied largely on imports of lead-zinc concentrates for its lead-refining industry, although the country mined a small amount of lead and zinc domestically. In 2017, mine production of lead increased by 33% to 3,762 t owing to the increased production of the Kumho Mine and the Guk-jeon Mine. The country's imports of lead concentrate decreased by 10% to about 572,600 t owing to the decline in refined lead exports. The major suppliers were Peru (31%), Mexico (15%), the United States (14%), Bolivia (13%), and Australia (11%) (Korea Institute of Geoscience and Mineral Resources, 2018a, p. 83; Lee and others, 2018, p. 11, 38–39).

In 2016 (the latest year for which data were available), the Republic of Korea was the world's third-ranked producer of refined lead, after China and the United States, accounting for about 8% of world production. In 2017, Korea Zinc Co. Ltd. produced about 423,320 t of primary lead. Lead recycling companies produced 380,000 t of secondary lead. Imports and exports of refined lead decreased by about 3% to 130,000 t and by 11% to 339,000 t, respectively (Korea Nonferrous Metal Association, 2018; Lee and others, 2018, p. 41; Klochko, 2020).

Zinc.—In 2017, mine production of zinc increased by 47% to 3,321 t. The country's imports of zinc concentrate totaled 2.08 Mt. The major suppliers were Peru (29%), Australia (24%), Mexico (11%), Bolivia (9%), and the United States (8%). Korea Zinc Co. Ltd. and Yong Poong Corp. produced about 611,000 t and 360,000 t of refined zinc, respectively. Exports and imports of refined zinc decreased by 7% to 534,000 t and increased by about 8% to 63,600 t, respectively (Korea Nonferrous Metal Association, 2018; Lee and others, 2018, p. 11, 38, 39, 41).

Industrial Minerals

Cement and Limestone.—The Republic of Korea produced about 48.7 Mt of clinker and 57.4 Mt of hydraulic cement in 2017, which were at about the same amounts as in 2016. In 2017, about 2.3 Mt of clinker and 1.1 Mt of hydraulic cement were exported; the country imported 37,000 t of clinker and 854,000 t of hydraulic cement (Korea Cement Association, 2018).

The Republic of Korea produced 92.3 Mt of limestone in 2017, which accounted for 98% of domestic consumption. The production increased by nearly 2% on average for each year since 2011 owing to increased domestic demand by the cement industry. Cement production, the chemical industry, and the manufacture of steel consumed 74%, 13%, and 12% of the limestone produced, respectively (Lee and others, 2018, p. 46).

Pyrophyllite.—In 2017, the leading pyrophyllite-producing mine in the country was the Wan-Do Mine (which produced more than 100,000 t for the year), followed by the Nohwa-Do Mine and the HyunMoo Mine (less than 100,000 t each). Total production decreased by 27% to 431,458 t owing to decreased domestic demand by the cement industry. The export of pyrophyllite increased by 22% to 110,100 t. Japan was the leading export destination (accounting for 66%, or 72,800 t, which it purchased for use in glass fiber products), followed by Taiwan (22%) and Indonesia (10%), purchased by both the countries for use in ceramic products (Korea Institute of Geoscience and Mineral Resources, 2018a, p. 160, 165).

Mineral Fuels and Related Materials

In 2017, coal accounted for 43% of electric power generation (up from 40% in 2016); nuclear energy, 27% (down from 30% in 2016); LNG, 22% (the same level as in 2016); and renewable energy, 5.0% (up from 4.2% in 2016) (Korea Energy Economics Institute, 2018, p. 182, 183).

Coal.—The Government continued to restructure the country's coal industry and downsize Korea Coal Corp. In 2017, anthracite production from five active mines decreased by 14% to 1.5 Mt. The country imported 7.0 Mt of anthracite (a 26% decrease from that of 2016), mainly from Russia (46%), Australia (29%), and China (17%). The country lacked reserves of bituminous coal and thus relied on imports to meet domestic demand. Imports of bituminous coal increased by 11% to 131 Mt. The major suppliers were Australia (34%), Indonesia (26%), Russia (17%), and Canada (8%) (Korea Resources Corp., 2017, p. 185; Korea Institute of Geoscience and Mineral Resources, 2018b, p. 81–82; Korea Coal Corp., 2020).

Petroleum and Petroleum Refinery Products.—In 2017, imports of crude petroleum increased by 4% to 1.12 Gbbl. Imports were mainly from Saudi Arabia (29%), Kuwait (14%), Iran (13%), and Iraq (11%). The Republic of Korea was the world's sixth-ranked petroleum refiner. In 2017, the country's four major petroleum refinery companies (SK Energy, GS-Caltex Corp., S-Oil Corp., and Hyundai Oil Refinery Co., in order of capacity) had a combined throughput of about 3 million barrels per day. The country produced 1,230 million barrels (Mbbbl) of petroleum refinery products in 2017; domestic consumption was 939 Mbbbl, exports were 509 Mbbbl, and imports were 315 Mbbbl (table 2; BP p.l.c., 2018, p. 22; Korea Energy Economics Institute, 2018, p. 84–85, 88, 96–103).

MINERAL INDUSTRY HIGHLIGHTS IN 2018

Minerals in the National Economy

In 2018, the Republic of Korea's nominal GDP was \$1.62 trillion; the real GDP increased by 2.7%. The country's exports and imports totaled \$604.9 billion and \$535.2 billion, respectively; the exports and the imports of minerals (excluding crude petroleum) were \$508 million and \$32.1 billion, respectively (Bank of Korea, 2019, p. 16; Lee and others, 2019, p. 14; World Bank, The, 2019).

The Republic of Korea's leading mineral import was crude petroleum, for which imports totaled \$80.4 billion (1.12 Gbbl), followed by bituminous coal (\$14.7 billion, 131.5 Mt), iron ore (\$5.4 billion, 73.3 Mt), copper concentrate (\$4.0 billion, 1.8 Mt), zinc concentrate (\$2.1 billion, 2.16 Mt), and lead concentrate (\$1.5 billion, 0.6 Mt). The leading suppliers of crude petroleum, in terms of quantity, were Saudi Arabia (which supplied 29%) and Kuwait (15%); bituminous coal, Australia (32%) and Indonesia (25%); iron ore, Australia (71%) and Brazil (15%); copper concentrate, Chile (39%) and Peru (15%); zinc concentrate, Australia (34%) and Peru (23%); and lead concentrate, Peru (28%) and the United States (15%) (United Nations Statistics Division, 2020).

Production

In 2018, significant changes in production included that of mined iron (Fe content), which increased by 23%; mica, 14%; zeolites, 13%; smelted copper (secondary) and crushed dolomite, 12% each; mined zinc and silica sand, 10% each. The increase in silica sand production was likely due to the Government's permission to dredge sea sand (table 1; Lee and others, 2019, p. 13).

The production of diatomite decreased by 81%; marble, 60%; mined lead, 38%; clays (unspecified), 47%; mined gold, 34%; bentonite and talc, 33% each; quartzite, 25%; pottery clay, 23%; pyrophyllite, 20%; mined silver and coal (anthracite), 19% each; feldspar, 14%; kaolin, 13%; and ferromanganese, 11%. The slowdown in construction activity likely caused the decline in production of mineral construction materials (table 1; Lee and others, 2019, p. 13).

Commodity Review

Metals

Gold.—After the Government of India's abolishment of tax benefits between the Republic of Korea and India in August 2017, the Republic of Korea's gold-silver fabrications exports to India decreased in value to \$1,200 million in 2018 from \$1.4 billion in 2017. For this reason, the Republic of Korea's gold imports in unwrought and semimanufactured forms decreased by 51% to 28,000 kg in 2018, which was similar to the level in 2016 (Lee and others, 2019, p. 11; United Nations Statistics Division, 2020).

Nickel.—Nickel sulfate from high-purity class I nickel (extracted from nickel sulfide ore) is used in battery cathodes. Of the more than 300,000 t of global nickel sulfate produced in 2017, about 50% was used for electric vehicle (EV) batteries. Korea Energy Materials Co. (KEMCO), a subsidiary of Korea Zinc Co., Ltd., started to produce nickel sulfate at a new facility at the Onsan smelter in 2018 and produced 11,000 t during the year. The company planned to increase its production to 80,000 metric tons per year (t/yr) of nickel sulfate by 2021 and expected to become the world's leading producer of nickel sulfate. LG Chem Ltd., which was one of the Republic of Korea's leading EV battery manufacturers, had invested \$897,000 for a 10% share in KEMCO in 2017 and would have priority in receiving KEMCO's nickel sulfate (Campagnol and others, 2017, p. 4, 9; Kang and Lee, 2017; Jung, 2018).

Lithium.—Owing to the high demand for rechargeable batteries, the country's imports of lithium carbonate increased by 60% to 33,171 t in 2018; and lithium hydroxide, by 75% to 12,301 t. The major suppliers of lithium carbonate were Chile (77%), China (15%), and Argentina (8%); and of lithium hydroxide, China (67%) and Chile (32%) (Korea Institute of Geoscience and Mineral Resources, 2019, p. 20; United Nations Statistics Division, 2020).

The Government-owned steelmaker POSCO started to produce lithium hydroxide in its Gwangyang Works plant in 2018. The manufacturing line had a production capacity of 1,500 t/yr of lithium hydroxide. The plant also had the capacity to produce 1,000 t/yr of lithium carbonate, which POSCO had started to produce in 2017. Both commodities were produced

by enriching lithium phosphate from recycling lithium batteries (Woo and Lee, 2018).

In 2018, POSCO agreed to receive 240,000 t/yr of lithium concentrate from Pilbara Minerals starting in 2020. Pilbara Minerals, which owned the Pilgangoora Mine in Western Australia, had the capacity to produce 800,000 t/yr of lithium concentrate. POSCO aimed to expand its capacity to produce 30,000 t/yr of lithium carbonate and lithium hydroxide using lithium concentrate near the Gwangyang Works plant starting in 2020. POSCO expected to supply the lithium compound products to such battery manufacturers as LG Chem, POSCO ESM, Samsung SDI, and SK Innovation in the Republic of Korea and to POSCO's joint venture with Chinese Huayou Cobalt Co. Ltd. in China (Lee, 2018).

Tungsten.—Almonty Industries of Canada commenced drift development at the Sangdong tungsten mine in Yeongwol, Gangwon Province, in 2018. The company expected to reopen the mine in 2020 and to produce up to 2,400 t/yr of WO₃. The Sangdong Mine stopped mining in 1992 and had been closed since 1993 owing to low commodity prices (Gleeson, 2018).

Outlook

Investment in facilities and construction is expected to slow in coming years owing to the Government's budget plan to increase social spending but reduce infrastructure spending. The infrastructure spending is expected to decrease to \$15.7 billion in 2021 from \$19.6 billion¹ in 2017. The anticipated decrease in domestic demand from the construction industry will likely lead to decreased production of such industrial minerals as cement, feldspar, limestone, and pyrophyllite. This situation is also expected to have a negative effect on the country's steelmakers; however, China's capacity cuts to steel production and more stringent environmental regulations may continue to create a favorable environment for the Republic of Korea to export steel products (Chosun Ilbo, The, 2018; Kim, 2018).

The Republic of Korea is likely to increase its imports of nickel sulfide and lithium concentrates and increase its domestic production of nickel sulfate, lithium carbonate, and lithium hydroxide in response to increasing demand in the battery market. Nuclear energy has been a major electric power source. The new Government elected in May 2017 planned to phase out nuclear energy and reduce the dependence on coal. The use of other energy sources—renewable energy, liquefied natural gas (LNG), and (or) LPG—is expected to increase (World Nuclear Association, 2018).

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¹Where necessary, values have been converted from Republic of Korea won (KRW) to U.S. dollars at an annual average exchange rate of KRW1,130=US\$1.00 for 2017 and 2021.

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TABLE 1
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons, gross weight, unless otherwise specified)

Commodity ²	2014	2015	2016	2017	2018
METALS					
Bismuth, refinery, Bi content ³	500	500	700	900	880
Cadmium, refinery, primary	5,645	5,600 ^e	5,273 ^r	4,960	4,905
Copper:					
Mine, concentrate, Cu content	--	--	108 ^r	7	--
Smelter:					
Primary	500,000	511,200	510,000	510,000	530,000
Secondary	120,000	125,000	125,000	125,000	140,000
Total	620,000	636,000	635,000	635,000	670,000
Refinery:					
Primary	491,200	515,300	522,400	501,300	500,500
Secondary	110,500	134,400	124,800	163,000	174,000
Total	602,000	650,000	647,000	664,000	675,000
Ferrous alloys:					
Ferromanganese	535,000 ^r	500,000 ^r	425,000 ^r	360,000	320,000
Ferronickel:					
Gross weight	114,000 ^r	195,000 ^r	228,000 ^r	237,000	223,000
Ni content	22,799 ^r	39,005 ^r	45,600 ^r	47,400	44,500
Ferrosilicon ^e	30,000	30,000	30,000	30,000	30,000
Silicomanganese	235,000	175,000	135,000	117,000	117,000
Gallium ^e kilograms	1,000	2,500	3,000	3,000	3,000
Gold:					
Mine, Au content do.	282 ^r	269 ^r	205	361	238
Refinery do.	46,207	55,963	59,411	52,768	48,626
Indium, refinery, primary, In content do.	195,000	195,000	210,000	225,000 ^e	235,000 ^e
Iron ore, mine:					
Gross weight thousand metric tons	693	445	445	311	383
Fe content do.	388	249	249	174	214
Iron and steel:					
Pig iron do.	46,909	47,639	46,336	47,071	47,124
Raw steel do.	71,542	69,670	68,575	71,030	72,463
Lead:					
Mine, Pb content	2,764	2,921	2,839	3,762	2,341
Refinery:					
Primary	299,000	291,000	441,000	423,320	410,294
Secondary	340,000	350,000	390,000	380,000	390,000
Total	639,000	641,000	831,000	803,000	800,000
Molybdenum, mine, Mo content	492 ^r	259 ^r	--	--	--
Silver:					
Mine, Ag content kilograms	3,289	4,586	6,579	8,788	7,090
Refinery, primary, metal do.	3,117,010	2,967,119	3,270,000	2,642,007	2,653,486
Titanium, titaniferous magnetite	240,892	204,082	166,903	223,039	213,184
Zinc:					
Mine, Zn content	1,918	2,070	2,257 ^r	3,321	3,656
Smelter, primary	900,943	934,949	1,012,763	970,455	988,695
INDUSTRIAL MINERALS					
Cement:					
Clinker thousand metric tons	44,816	47,015	49,148	48,657	48,000
Hydraulic do.	47,048	52,044	56,747	57,400	57,500 ^e

See footnotes at end of table.

TABLE 1—Continued
 REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons, gross weight, unless otherwise specified)

Commodity ²	2014	2015	2016	2017	2018
INDUSTRIAL MINERALS—Continued					
Clay:					
Bentonite	71,850	78,439 ^r	63,834	47,306	31,824
Fuller's earth	54,001	87,094	81,688	115,568	118,177
Kaolin	429,081	356,866	366,511	416,648	364,249
Pottery	253,668	230,921	220,840 ^r	307,546	237,242
Unspecified	719,390	862,339	773,381	1,013,026	533,661
Diatomite, diatomaceous earth	65,893	15,310	20,564	133,741	25,902
Feldspar	528,958	601,030	654,398 ^r	717,177	617,166
Lime ^e thousand metric tons	5,100	5,100	5,100	5,200	5,200
Mica, all grades	24,205	17,405	12,934	14,567	16,559
Salt, sea salt	309,000 ^r	332,000 ^r	323,000	308,847	283,000
Sand and gravel, industrial, silica:					
Quartzite thousand metric tons	4,057	3,569	3,778	4,334	3,247
Sand do.	732	661	682	952	1,048
Stone:					
Crushed:					
Dolomite do.	2,558	2,626	2,593	3,021	3,374
Limestone do.	86,191	88,199	91,241	92,276	86,255
Marble do.	8	5	13	5	2
Stone, size and shape unspecified, calcite do.	2,426	2,221	2,051 ^r	2,431	2,462
Sulfur, byproduct of natural gas and petroleum, S content	1,200,000	1,450,000	2,000,000	2,000,000 ^e	2,000,000 ^e
Talc and related materials:					
Pyrophyllite	622,865	596,860	590,000	431,458	346,761
Talc	5,484	6,371	2,247	2,834	1,887
Zeolites	203,051	191,207	121,730	127,685	144,330
MINERAL FUELS AND RELATED MATERIALS					
Coal, anthracite thousand metric tons	1,748	1,764	1,727	1,486	1,202
Coke, metallurgical do.	17,193 ^r	17,817 ^r	16,096 ^r	16,000 ^e	16,000 ^e
Petroleum, refinery:					
Diesel thousand 42-gallon barrels	314,495	333,415	338,517	344,827	355,878
Fuel oil do.	55,174	57,973	70,694	67,999	69,018
Gasoline do.	145,055	157,320	153,557	157,992	165,966
Kerosene do.	16,743	18,492	19,520	19,905	21,246
Liquefied petroleum gas do.	24,341	25,367	26,026	31,567	33,302
Naphtha do.	218,092	249,931	259,814	307,635	313,839
Other ⁴ do.	256,170	274,461	289,214	297,822	296,545
Total do.	1,030,000 ^r	1,120,000 ^r	1,160,000 ^r	1,230,000	1,260,000

^eEstimated. ^rRevised. do. Ditto. -- Zero.

¹Table includes data available through October 17, 2019. All data are reported unless otherwise noted. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²In addition to the commodities listed, carbon black, natural gas, crude petroleum, phosphate rock, secondary iron, iron and steel semimanufactures, sulfur (byproduct of metallurgy), and thorium may have been produced, but available information was inadequate to make reliable estimates of output.

³Refined bismuth was produced as a byproduct of zinc production.

⁴Includes bitumens, fuel oil byproducts, jet fuel, lubricants, paraffin waxes, petroleum coke, refinery gas, and solvents.

TABLE 2
REPUBLIC OF KOREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2018

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bismuth, metal	metric tons	Korea Zinc Co. Ltd.	Onsan refinery in Ulsan	950
Cadmium	do.	do.	do.	5,100
Do.	do.	Young Poong Corp.	Sukpo refinery in North Gyeongsang Province	1,750
Cement		Asia Cement Co. Ltd.	Plants in Daegu and Jecheon	4,600
Do.		Daehan Cement Co. Ltd. (subsidiary of Ssangyong Cement)	Plants in Gwangyang	1,600
Do.		Halla Cement Corp.	Plants in Gwangyang and Okkye	9,500
Do.		Hanil Cement Manufacturing Co.	Plants in Tanyang and other three cities	7,200
Do.		Hankook C&T Co. Ltd.	Plant in Pohang	4,700
Do.		Hyundai Cement Co. Ltd.	Plants in Tanyang and Yeongwol	8,600
Do.		Korea Cement Co. Ltd.	Plant at Jangsung, South Jeolla Province	2,300
Do.		Sampyo (formerly Tong Yang) Cement	Plants at Pukpyong and Samchok	11,600
Do.		Ssangyong Cement Industrial Co. Ltd.	Plants at Tonghae, Gwangyang, Munhyung, Pukpyong, and Yeongwol	16,749
Do.		SungShin Cement Manufacturing Co. Ltd.	Plant at Tanyang	13,700
Coal		Korea Coal Corp.	Mines at Dogye, Hwasoon, and Jangsung	2,500
Copper, metal, primary		Korea Zinc Co. Ltd.	Onsan refinery in Ulsan	25
Do.		LS-Nikko Copper Inc.	do.	685
Do.		Young Poong Corp.	Sukpo refinery in North Gyeongsang Province	5
Gallium	kilograms	Korea Zinc Co. Ltd.	Onsan refinery in Ulsan	10,000
Gas, natural	thousand cubic meters per day	Korea National Oil Corp.	Donghae-1 gasfield in Ulleung Basin	1,300
Gold:				
Concentrate, Au content	kilograms	GoldenSun Co. Ltd. (Sun Cement Co. Ltd.)	Eunsan Mine, Gasa-Do Mine, Haenam, South Jeolla Province	500 ^c
Refined	do.	Korea Zinc Co. Ltd.	Onsan refinery in Ulsan	50,000
Do.	do.	LS-Nikko Copper Inc.	do.	60,000
Ferroalloys, ferronickel		SNNC Co. Ltd. (SMSP S.A., 51%, and POSCO Ltd., 49%)	Gwangyang ferronickel plant in Gwangyang	54
Indium, metal	kilograms	Korea Zinc Co. Ltd.	Onsan refinery in Ulsan	200,000
Do.	do.	Young Poong Corp.	Sukpo refinery in North Gyeongsang Province	110,000 ^c
Iron ore		Handok Iron & Steel Co. Ltd.	Sinyemi Mine, Jeongseon, Gangwon Province	600
Lead:				
Concentrates, gross weight		Shin DongYang Corp.	Guk-jeon Mine in South Gyeongsang Province	1
Do.		SungAn-Jawon Corp.	Kumho Mine in North Gyeongsang Province	5
Refined		Korea Zinc Co. Ltd.	Onsan refinery in Ulsan	423
Lithium:				
Carbonate	metric tons	POSCO Ltd.	Gwangyang Works in Gwangyang	1,000
Hydroxide	do.	do.	do.	1,500
Molybdenum:				
Mine, Mo content	do.	Korea Resources Corp. (KORES) (Government, 99.85%, and Korea Development Bank, 0.14%)	Keum-eum Mine, Uljin	260 ¹
Do.	do.	NMC Resource Corp.	Moland Mine at Daejang-ri, Jecheon, North Chungcheong Province	900 ²
Refined	do.	SeAH M&S Corp.	Smelter in Yeosu, South Jeolla Province	6,000
Nickel:				
Metal		Enertec Co. Ltd.	Refinery at Hamam, South Gyeongsang Province	6
Do.		Korea Nickel Corp. (Vale Canada Ltd., 25%; Korea Zinc Co. Ltd., 19%; POSCO, 14%)	Onsan nickel refinery in Ulsan	50
Sulfate		Korea Energy Materials Co. (KEMCO) (Korea Zinc Co. Ltd., 55%; Young Poong Corp., 15%; LG Chem, 10%; others, 20%)	do.	30

See footnotes at end of table.

TABLE 2—Continued
REPUBLIC OF KOREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2018

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum:				
Crude	42-gallon barrels per day	Korea National Oil Corp.	Donghae-1 oilfield in Ulleung Basin	600
Refinery products	thousand 42-gallon barrels per day	GS Caltex Corp.	Refinery in Yeosu	785
Do.	do.	Hyundai Oil Refinery Co.	Daesan plant in Seosan	520
Do.	do.	SK Energy Corp.	Refineries in Ulsan and Incheon	1,115
Do.	do.	S-Oil Corp.	Refinery at Onsan, Ulsan	669
Pyrophyllite		Hankook Mineral Powder Co. Ltd.	Wan-Do, Sungsan, Hwansan, Okmesan, Dae-Do, and Chin-Do Mines in Haenam	400 ^c
Do.		HyunMoo Mining	HyunMoo Mine at Tanyang, North Chungcheong Province	100
Do.		Jinhae Pyrophyllite	Nilyang, Yangsan, Kimhae, Pusan, and Gyeongnam Mines in Dong-Nae	50 ^c
Do.		Minkyong Corp.	Nohwa-Do Mine, South Jeolla Province	100
Silver:				
Concentrate, Ag content	kilograms	GoldenSun Co. Ltd. (Sun Cement Co. Ltd.)	Eunsan Mine and Gasa-Do Mine, Haenam, South Jeolla Province	9,000 ^c
Refined	metric tons	Korea Zinc Co. Ltd.	Onsan refinery in Ulsan	2,400
Do.	do.	LS-Nikko Copper Inc.	do.	1,200
Steel, raw		Dongkuk Steel Mill Co. Ltd.	Incheon Works in Incheon	1,450
Do.		do.	Pohang Works in Pohang	3,600
Do.		Hyundai Steel Co. Ltd.	Incheon plant in Incheon	4,800
Do.		do.	Pohang plant in Pohang	3,200
Do.		do.	Dangjin plant in Dangjin	23,000
Do.		Korea Iron and Steel Co. Ltd.	Masan and Changwon Works	1,200
Do.		POSCO Ltd.	Gwangyang Works in Gwangyang	21,200
Do.		do.	Pohang Works in Pohang	17,400
Titanium, ore		Dongwon Resources Corp.	Gwan-in Mine in Pocheon, Gyeonggi Province	250 ³
Zeolites	metric tons	Dong-sin Co. Ltd.	Dong-sin Zeo Mine in Gyeongju, North Gyeongsang Province	150,000
Do.	do.	Private owner	Guryong Baekto Mine in Pohang	50,000
Do.	do.	do.	Woo-il Zeolite Mine in Pohang	21,000
Zinc:				
Concentrates, gross weight		Shin DongYang Corp.	Guk-jeon Mine in South Gyeongsang Province	1
Do.		SungAn-Jawon Corp.	Kumho Mine in North Gyeongsang Province	7
Smelter, primary		Korea Zinc Co. Ltd.	Onsan refinery in Ulsan	700
Do.		Young Poong Corp.	Sukpo refinery in North Gyeongsang Province	400

^cEstimated. Do., do. Ditto.

¹Production suspended since August 2015.

²Production suspended since 2016.

³Titaniferous magnetite.