

# 2016 Minerals Yearbook

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## NORTH KOREA

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# THE MINERAL INDUSTRY OF NORTH KOREA

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North Korea had various mineral resources in the form of metallic minerals (copper, gold, iron, lead, manganese, molybdenum, nickel, silver, tantalum, tungsten, and zinc), industrial minerals (graphite, limestone, magnesite, phosphate rock, and rare earths), and mineral fuels and related materials (coal and uranium). Mineral production in North Korea was insignificant relative to the country's reserves owing to a lack of infrastructure. The potential value of reserves has been estimated to be more than \$2.79 trillion; however, the country's mineral reserves could not be verified by outside sources owing to the confidential nature of the Government information. In 2016, North Korea accounted for about 18% of the world's magnesite reserves and 2.5% of magnesite production (excluding United States production) (Yoon, 2011, p. 3; Koh and others, 2013; Bray, 2017, 2018; Lee, 2017, p. 1, 2, 9; Yonhap News, 2017).

## Minerals in the National Economy

The mineral industry remained important to North Korea's economy. The real gross domestic product (GDP) of North Korea increased by 3.9% in 2016, which was the largest increase since 1999. This increase in GDP was mainly attributed to increases in electricity, gas, and water production (22.3%); mining production (8.4%, mainly in coal, lead, and zinc); and manufacturing (4.8%). North Korea's nominal GDP was valued at \$32.6 billion. The heavy and chemical industries combined accounted for 13.7% of the total GDP, followed by mining (12.6%) and light industry (6.9%) (Bank of Korea, 2017; Statistics Korea, 2017, p. 165).

The country's mineral industry has been dominated by coal and iron ore mining. Of the estimated 728 mines in North Korea, 241 were coal mines, 260 were metal mines, and 227 were industrial mineral mines. These mines employed a total of 1,093,700 people in 2016 (Yonhap News, 2016c).

The mineral resources law (Act No. 14 of 1993 and Amendment Act No. 2979 of 2013) provided the basic guidelines for the country's mineral exploration, development, and use. Coal-mining activities (coal exploration, development, production, supply, and use) were subject to the country's coal law (Act No. 3044 of 2009 and Amendment Act No. 2052 of 2012) (National Intelligence Service, 2017, p. 647, 655).

The country's total exports in 2016 were valued at \$2.8 billion, which was up by 4.6% from that of 2015. Exports of mineral fuels were valued at \$1.2 billion; ores, slag, and ash, \$225 million; iron and steel, \$74 million; nonmetallic minerals (salt, sulfur, stone, plaster, lime, and cement), \$39 million; and inorganic chemical and compounds of precious metals and rare-earth metals, \$8 million. China was North Korea's leading trade partner. Of North Korea's total exports, China received 100% of ores, slag, and ash; 99.5% of mineral fuels; 59.4% of iron and steel; and 46.2% of inorganic chemical and compounds

of precious metals and rare-earth metals (Statistics Korea, 2017, p. 126–135).

North Korea's total imports were valued at \$3.7 billion, which was up by 4.4% from that of 2015. Imports of mineral fuels were valued at \$439 million; iron and steel, \$116 million; nonmetallic minerals, \$26 million; inorganic chemical and compounds of precious metals and rare-earth metals, \$21 million; and ores, slag, and ash, \$0.6 million. Of North Korea's total imports, China supplied 99.6% of iron and steel; 99.3% of inorganic chemical and compounds of precious metals and rare-earth metals; 84.7% of mineral fuels; and 45.6% of ores, slag, and ash (Statistics Korea, 2017, p. 126–135).

Mineral commodities exported to China from North Korea were sold far below global commodity prices. From 2011 through 2015, coal was traded with China at 55% of the global price, and iron ore, at 78%. Sanctions placed by the United Nations (U.N.) Security Council on North Korea since 2006 had restricted trade activities, and North Korea's outdated infrastructure had led to a low mining operation rate (about 35%). Revenue lost owing to these reasons between 2011 and 2015 was estimated to be \$5.1 billion (Choi, 2017).

In April 2016, China banned the import of coal, gold, iron ore and concentrate, rare earths, titanium, and vanadium from North Korea; however, the Chinese Foreign Ministry exempted coal imported for exclusively livelihood purposes or coal produced in a third country and exported through North Korea's Port of Rajin (Rason). Using these exceptions, China's imports of North Korea's coal increased by 6.5% to 15.0 million metric tons (Mt) (or 4.8% to \$761 million) from April through November 2016 compared with the same period in 2015 (Yonhap News, 2016a, b; Lawrence and Manyin, 2017).

## Production

Compared with estimated production in 2015, North Korea's estimated production of lead (lead content of mine production) increased by 67%; zinc (zinc content of mine production), 15%; bituminous coal, 13%; lignite, 13%; raw steel, 13%; and anthracite, 13%. The production of refined lead (primary) decreased by 66%; and mined tungsten, by 29% (table 1; Statistics Korea, 2017, p. 107–108; Tolcin, 2017, p. 12; World Bureau of Metal Statistics, 2017, p. 40).

## Structure of the Mineral Industry

The Ministry of Metallurgical Industry managed the country's iron ore and magnesite mines; the Ministry of Coal Industry managed the coal mines; and the Ministry of Extractive Industries managed all other mines. The Ministry of State Natural Resources Development engaged in the exploration of mineral resources. Chinese companies participated in joint ventures with North Korea to develop and operate mineral

production facilities in North Korea. Between 2004 and 2013, China signed a total of 33 contracts to develop and operate facilities for iron ore (contracts were signed in 2006, 2007, 2012, and 2013), coal (in 2005 and 2010), copper (in 2008), and gold and silver (in 2004), all for terms varying from 10 to 50 years (table 2; Koh and others, 2013; Joongang Ilbo, The, 2017; Yonhap News, 2017).

## Commodity Review

### Metals

**Iron Ore.**—North Korea's iron ore reserves were estimated to be more than 5 billion metric tons (Gt) at a grade of 50% iron. The open pit Musan Mine, in Musan, North Hamgyong Province, was North Korea's largest iron ore mine with reserves estimated to be more than 1.5 Gt at a grade of 25% to 35% iron and a capacity of 11 million metric tons per year (Mt/yr). Since 2005, Chinese companies had 50-year extraction rights for the mine. The Musan Mine temporarily halted all production in late 2014 and again in early 2015, likely owing to power shortages caused by drought conditions. The mine restarted operations and iron ore exports to China resumed in late 2015 (Yoon, 2011, p. 10–13; Chosun Ilbo, The, 2012; Koh and others, 2013; Gray, 2015; Lewis, 2016).

**Lead and Zinc.**—Total lead and zinc reserves were estimated to be 4.7 Mt and 15 Mt, respectively. The Komduck Mine, located in Tanchon, South Hamgyong Province, was North Korea's largest lead and zinc mine, with annual production of about 200,000 metric tons (t) of zinc concentrate at a grade of 52% zinc and 32,000 t of lead concentrate at a grade of 62% lead (Koh and others, 2013; South-North Korea Exchanges and Cooperation Support Association, 2016).

### Industrial Minerals

**Magnesite.**—North Korea's magnesite reserves were estimated to be 2.87 Gt at a grade of 95% magnesium oxide (MgO). The Ryong-yang Mine in Tanchon, South Hamgyong Province, which was the largest magnesite mine in North Korea, had ore reserves estimated to be 0.77 Gt at a grade of 45.82% MgO and a production capacity of 2.5 Mt/yr of concentrate (Koh and others, 2013; Lee, 2017, p. 7).

### Mineral Fuels and Related Materials

**Coal.**—The Government of North Korea considered coal to be a strategic energy resource because, since 2010, it had accounted for 43% to 66% of North Korea's primary energy supply. In 2016, coal supplied 43.2% of North Korea's primary energy, followed by hydroelectric power (32.3%) and petroleum (11.8%). Reserves were estimated to be 16 Gt of lignite, 4.5 Gt of anthracite, 20 Gt of stone coal, and 200 Mt of peat. Stone coal, which is combustible Precambrian sedimentary rock with a calorific value of 840 to 1,500 kilocalories per kilogram, was classified as one of the most important resources. It was used for supplementary cementing material, as residential fuel, and as a source material for extracting vanadium (Lee, 2017, p. 4–6; Statistics Korea, 2017, p. 106).

**Uranium.**—The Government considered uranium to be North Korea's most important strategic resource. The country's uranium reserves were estimated to total 4 Mt. The major uranium mines were the Pyongsan Mine in Pyongsan, North Hwanghae Province, and the Woonggi Mine in Woonggi, North Hamgyong Province (Koh and others, 2013).

## Outlook

In November 30, 2016, the U.N. Security Council passed new sanctions (Resolution 2321) on North Korea after the country's latest nuclear test. One new sanction set a cap on North Korea's coal exports of about \$400.9 million or 7.5 Mt (whichever is lower) for 2017, which was equivalent to 34% of the amount of coal exported in 2016. The sanctions included a ban on mineral exports, such as iron and iron ore (except those for livelihood purposes), copper, nickel, silver, and zinc.

In 2016, approximately 22.5 Mt of mineral fuels (mostly coal) and 1.6 Mt of iron ore were exported to China, accounting for 72.3% and 30.7%, respectively, of North Korea's total domestic production in 2016. By isolating North Korea from the global market, the sanctions contained in Resolution 2321 will likely lead to a significant reduction in mineral production in North Korea as well as make foreign companies reluctant to establish or expand joint ventures with North Korea (United Nations Security Council, 2016; Statistics Korea, 2017, p. 126–135; Information System for Resources of North Korea, 2018).

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TABLE 1  
NORTH KOREA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity <sup>2,3</sup>	2012	2013	2014	2015	2016
<b>METALS</b>					
Cadmium metal, smelter	200	200	200	200	200
Copper:					
Mine production, Cu content	16,000	17,000	19,300	20,000	20,000
Refinery production:					
Primary	10,000 <sup>r</sup>	10,000 <sup>r</sup>	10,000 <sup>r</sup>	10,000 <sup>r</sup>	10,000
Secondary	5,000 <sup>r</sup>	5,000 <sup>r</sup>	5,000 <sup>r</sup>	5,000 <sup>r</sup>	5,000
Smelter production, undifferentiated	15,000 <sup>r</sup>	15,000 <sup>r</sup>	15,000 <sup>r</sup>	15,000 <sup>r</sup>	15,000
Gold, mine output, Au content kilograms	2,000	2,000	2,000	2,000	2,000
Iron and steel:					
Pig iron thousand metric tons	250	250	250	250	250
Steel, raw do.	1,220	1,210	1,220	1,080	1,220
Iron ore:					
Gross weight do.	5,200	5,500	5,500	5,000 <sup>r</sup>	5,300
Fe content do.	3,220 <sup>r</sup>	3,400 <sup>r</sup>	3,400 <sup>r</sup>	3,000 <sup>r</sup>	3,300
Lead:					
Mine production, Pb content	38,400 <sup>r</sup>	58,800 <sup>r</sup>	36,000 <sup>r</sup>	32,400 <sup>r</sup>	54,100
Refinery production, primary	7,000 <sup>r</sup>	7,000 <sup>r</sup>	7,000 <sup>r</sup>	7,000 <sup>r</sup>	2,400
Silver, mine production, Ag content kilograms	50,000	50,000	50,000	50,300 <sup>r</sup>	50,400
Tungsten, mine production, concentrate, W content	100	65	70	70	50
Zinc:					
Mine production, Zn content	35,000	36,000	32,000	26,000	30,000
Smelter production, primary and secondary	35,000	35,000	30,000	20,000	20,000
<b>INDUSTRIAL MINERALS</b>					
Cement, hydraulic thousand metric tons	6,400	6,600	6,700	6,700	7,100
Graphite	30,000 <sup>r</sup>	30,000 <sup>r</sup>	30,000 <sup>r</sup>	30,000 <sup>r</sup>	30,000
Magnesite	500,000	700,000	700,000	700,000	700,000
Nitrogen, ammonia, N content thousand metric tons	70 <sup>r</sup>	70 <sup>r</sup>	70 <sup>r</sup>	70 <sup>r</sup>	70
Phosphate rock:					
Gross weight	300,000	300,000	300,000	300,000	300,000
P <sub>2</sub> O <sub>5</sub> content	90,000 <sup>r</sup>	95,000	95,000	95,000	95,000
Salt	500,000	500,000	500,000	500,000	500,000
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Coal:					
Anthracite thousand metric tons	11,700	12,000	12,200	12,400	14,000
Bituminous do.	10,900	11,200	11,400	11,600	13,100
Lignite do.	3,290	3,390	3,450	3,500	3,960
Coke, metallurgical do.	2,000	2,000	2,000	2,000	2,000

<sup>r</sup>Revised. do. Ditto.

<sup>1</sup>Table includes data available through April 9, 2018. All data are reported unless otherwise noted. Estimated data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>In addition to the commodities listed, sand and gravel, sulfur, stone, and refined petroleum products may have been produced in North Korea, but available information was inadequate to make reliable estimates of output.

<sup>3</sup>Because of the lack of official reported data, mineral commodity production numbers have been estimated.

TABLE 2  
NORTH KOREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2016

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity <sup>c</sup>
Cement	Sunchon Cement Complex	South Pyongan Province	3,000
Do.	Sangwon Cement Complex	Gangwon Province	2,500
Do.	Gomusan Cement Factory	North Hamgyong Province	2,000
Do.	Cheonnaeri Cement Factory	South Hamgyong Province	1,000
Coal	Anju Coal Mining Complex	South Pyongan Province	10,000
Do.	Sunchon Coal Mining Complex	do.	4,500
Do.	Saebiyol Coal Mining Complex and Northern Coal Mine Enterprise	North Hamgyong Province	6,000
Copper, mine output, Cu content	Hyesan Youth Copper Mine (owned by Wanxiang Industrial Group, 51%, and Huizhong Mineral Industry, 49%)	South Ryanggang Province	15
Gold, mine output, Au content	kilograms Kumsan Joint Venture Co.	North Hamgyong Province	530
Do.	do. Daebong Mine	Hyesan, Ryanggang Province	300
Graphite	Jeongchon Mine (joint venture of Korea Resources Corp. and the Government of North Korea)	South Hwanghae Province	75
Iron ore, concentrate, gross weight	Ministry of Metallurgical Industry, Department of Mines, Muson Iron Ore Mine Complex	North Hamgyong Province	11,000
Do.	Eun-ryul Mine	South Hwanghae Province	1,600
Do.	Dukhyun Mine, Ministry of Metallurgical Industry	Uiju, North Pyongan Province	700
Lead:			
In concentrate	Komduck Mine, Korea Zinc Industrial Group	Tancheon, South Hamgyong Province	32
Refined	Moonpyong Refinery, Korea Zinc Industrial Group	Mooncheon, Gangwon Province	32
Magnesia clinker	Tancheon Magnesia Clinker, Korea Magnesia Clinker Industry Group (KMCIG) and Quintermina AG	Tancheon, South Hamgyong Province	2,000
Do.	Sunggjin Refractory Plant	Kim Chaek city, North Hamgyong Province	300
Magnesite:			
In concentrate	Ryongyang Mine (KMCIG)	Tancheon, South Hamgyong Province	2,500
Do.	Ssang-ryong Mine	Kim Chaek city, North Hamgyong Province	600
Do.	Namgye Mine and Saeng-jang Mine	Ryanggang Province	1,000
Ore	Daeheung Mine	Tancheon, South Hamgyong Province	1,000
Phosphate rock	Ministry of Extractive Industries	Kim Chaek city, North Hamgyong Province	50,000
Steel, raw	Kim Chaek Iron and Steel Complex	Chongjin, North Hamgyong Province	2,400
Do.	Hwanghae Iron Works	Songrim, North Hwanghae Province	1,500
Do.	Kangson Works	Kangseo District, South Pyongan Province	960
Do.	Chollima Steel Works (Nampo)	South Pyongan Province	760
Zinc:			
In concentrate	Komduck Mine, Korea Zinc Industrial Group	Tancheon, South Hamgyong Province	200
Do.	Seongcheon Mine, Eunpa Mine	South Pyongan Province and North Hwanghae Province	120
Refined	Moonpyong Refinery	Mooncheon, Gangwon Province	110
Do.	Tancheon Zinc Refinery	Tancheon South Hamgyong Province	100

<sup>c</sup>Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto.