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The Mineral Industry of North Korea

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North Korea's identified mineral resources included apatite (phosphate rock), barite, coal, copper, feldspar, fluorspar, gold, graphite, iron ore, kaolin, lead, limestone, magnesite, molybdenum, salt, silica, silver, tungsten, and zinc. Among these minerals were relatively large deposits of coal, iron ore, limestone, and magnesite. North Korea lacked economic resources of crude petroleum. The country used its minerals domestically for industrial and military purposes and also exported significant quantities to gain foreign currencies. The country's water resources provided significant hydroelectric power generation capacity (U.S. Library of Congress, 2007).

North Korea's predominant domestic sources of commercial energy were coal and hydroelectric power. The country produced hard coal, lignite, and peat and generated electricity through its coal-fired thermal powerplants and hydroelectric powerplants. About 6% of its primary energy consumption was from imported oil (U.S. Library of Congress, 2007).

Following elections in the Republic of Korea in 2008, inter-Korean relations went through an adjustment period. Dialogue between the Governments of North Korea and the Republic of Korea decreased; exchanges and cooperation in the private sector continued, however. The number of cross-border travelers in 2008 increased to 186,775, or by 17.3%, and the value of trade between the two Koreas increased to $1.82 billion, or by 1.2%. The number of factories operating in 2008 in the Gaeseong Industrial Complex (GIC) of North Korea increased by 43% to 93; also, the value of production increased by 36% to $250 million, and the number of North Korean employees increased by 72% to 39,000 (Ministry of Unification, 2008).

According to the Bank of Korea (BOK) of the Republic of Korea, North Korea's real annual gross domestic product (GDP) increased by 3.7% in 2008 following the negative growth experienced in 2006 (-1.1%) and 2007 (-2.3%). The mining and manufacturing sector grew by 2.5% in 2008, which was a significant increase compared with the decrease of 109% in 2007. Production in the mining sector increased by 2.3% compared with an increase of 0.4% in 2007 owing to expansions across the sector, including in the coal, metallic mineral, and nonmetallic mineral industries. Production in the heavy industries manufacturing sector increased by 3.3% compared with an increase of 2.3% in 2007 owing primarily to expansions in the base metals, chemicals, and machinery products industries. The 6.1% increase in production in the electricity, gas, and water sector was reflected in the increase in both the hydroelectric and the thermal power generation industries. The construction sector grew by 1.1% owing to increased housing construction. In 2008, contributions to the growth in the GDP were made by the mining and manufacturing sector (34.6%); the service sector (32.2%); the agriculture, forestry, and fisheries sector (21.6%); the construction sector (8.3%); and the electricity, gas, and water sector (3.4%) (Bank of Korea, 2009).

Minerals in the National Economy

The mining sector accounted for 12.1% of the country's total GDP in 2008 (Bank of Korea, 2009).

Production

In 2008, North Korea produced about 6.4 million metric tons (Mt) of cement, about 25.1 Mt of coal, about 5.3 Mt of iron ore, and about 1.3 Mt of steel. The country also produced about 479,000 metric tons (t) of fertilizer, and about 94,000 t of nonferrous metals. The BOK reported that the volume of power generation was about 255 billion kilowatts (Bank of Korea, 2009).

North Korea's major mineral mine production included coal, copper, graphite, iron ore, lead, limestone, magnesite, salt, tungsten, and zinc. Production of processed minerals included cadmium, cement, coke, refined copper, ferroalloys, refined lead, magnesia clinker, nitrogen fertilizer materials, pig iron, crude steel, and refined zinc. The domestic industries consumed most of the country's mineral production (table 1).

Structure of the Mineral Industry

North Korea's mineral industry comprised a coal mining sector, an industrial mineral mining and processing sector, and a ferrous and nonferrous metals mining and processing sector. Most of the large-scale mining and mineral-processing enterprises in North Korea were owned and operated by the central Government. Provincial and local governments owned and operated various small-to-medium-scale mining and mineral processing facilities. In the past 4 years, China, Egypt, the Republic of Korea, and other countries participated in joint ventures in North Korea for the development and operation of cement, coal, copper, gold, graphite, iron ore, lead and zinc, magnesite, and molybdenum production facilities in North Korea.

The country's nuclear energy generation industry was the subject of major international political discord because of suspicions about the militarization of this capability. Several agreements had been signed that led to the construction of light water reactors and training for technical staff to operate them. Disclosures about North Korea's nuclear weapons program raised international protests and have delayed development of this energy sector (U.S. Library of Congress, 2007).

Mineral Trade

In 2008, North Korea's overall trade volume (goods-based) increased by 29.9% and amounted to $3,820 million; its exports increased by 22.8% and amounted to $1,130 million, and its imports increased by 33.2% and amounted to $2,690 million. Imports from the Republic of Korea to North Korea were valued at $888.1 million, which was a decrease of 14% compared with

those of 2007. North Korean exports to the Republic of Korea increased by 21.8% to $932.3 million; the increase was owing to the increased cross-border trade in products processed on a commission basis, as well as to the increased imports from the GIC (Bank of Korea, 2009).

The Korean Friendship Association (KFA) of North Korea was founded in November 2000 to encourage the building of international ties between North Korea and other countries of the world. The KFA had members from 120 countries, and it had offices in North Korea, Norway, Spain, and Thailand. It was the only official North Korean organization that could conduct foreign trade. North Korea exported cement, coal, gold, graphite, iron ore, crude magnesite, magnesia clinker, pig iron, salt, steel products, and zinc through the KFA, and the exports earnings paid for the country's large imports of chemical fertilizers and crude petroleum. Base metals and zinc were exported principally to China and the Republic of Korea; coal, iron ore, and crude magnesite were exported mainly to China; gold was exported mainly to Thailand; and magnesia clinker was exported mainly to Japan and other countries worldwide. North Korean mineral producers exported their output through the KFA by way of China's Dandong Port or Dalian Port. Exports included caustic calcined magnesite, cement, granite and marble, high concentrated mercury, high concentrated tungsten oxide powder, and silicon metal. Shipbuilding, ship parts, and ship repair services were major sources of foreign currency earnings from East European and Southeast Asian countries. North Korea had trade offices in Dandong, China; Indonesia; and Vladivostok, Russia, to promote cooperation in shipbuilding industry activities with other countries. Crude petroleum and fertilizers were imported mainly from China (Korean Friendship Association, 2009).

North Korea's ability to attract foreign investments was limited because of its large amount of external debt. This impediment did not stop North Korea from pursuing new foreign investments, particularly for its first special economic, or free trade, zone at Najin–Sonbong in northeast North Korea. This zone was accessible to Russia by railroad and to China by road, but to the rest of North Korea only by air. The Sinuiju Special Administrative Region, which is located on the western end of the border with China, was a self-managed entity aimed at fostering bilateral trade. Two other economic zones—the Mount Kumgang scenic and sport-tourist zone and the Kaesong Special Industrial Zone—are located in southeast North Korea. International concern about nuclear proliferation also had a negative effect on the flow of foreign direct investment into the country (U.S. Library of Congress, 2007).

Commodity Review

Metals

Copper.—The Republic of Korea shipped 1,000 t of copper to North Korea in May 2008 in return for North Korea agreeing to disable its nuclear plants. The shipment had a value of $8.5 million (Thomas Financial News, 2008).

According to a report by the Institute for Far Eastern Studies, in 2008, there was no feasible way technically to restore North Korea's Chungnyun Mine, which was facing severe economic difficulties because of flooding. The mine is located in Hyesan, Ryanggang Province. Owing to the disabling of production at the mine, the country found it necessary to import a large amount of copper to meet the requirements of the manufacturing sector; the Government imported most of the required copper from Chile. Senior authorities in North Korea were demanding that the Chungnyun Mine be saved at any cost. The construction of a powerplant in Jangan-Ri, Hyesan, Ryanggang Province, was identified as causing the flooding of the mine (Institute for Far Eastern Studies, 2008).

Iron and Steel.—By the beginning of 2008, the Republic of Korea had provided 5,100 t of steel plates to North Korea, as part of the six-party deal that involved each participating country agreeing to provide energy or alternative compensations to North Korea in exchange for North Korea's disablement of its nuclear facilities (Korea Times, The, 2007; Thomas Financial News, 2008).

Jilin Newspaper of China reported that for the first half of 2008, North Korea exported 64,000 t of iron ore to Chinese entrepreneurs in Yanji, which was a 2.3% increase from the same period in 2007. The Chinese iron and steel corporations—Tonghua Steel Group, Yanbian Tianchi Trade Incorporated Co., and Zhonggang Group—purchased 50-year mining rights to North Korea's Musan Mine in 2005. In late 2007, these companies attempted to invest an additional $1 billion (¥7 billion) in the mine to increase the amount of iron ore that they received from the mine, but they could not make the additional investment (Daily NK, 2008).

Zinc.—The Komdok Mine, which is located near Tancheon in South Hamgyong Province (Hamgyongnam Do) was North Korea's major zinc production site. The country's zinc production and its exports of zinc to the Republic of Korea in 2008 were unchanged from 2007 (table 1).

North Korea's Komdok zinc mine was equipped with Siemens AG's process instrumentation. As planned, Siemens would supply a wide range of instruments for various applications in North Korea, including Sitrans F MAG 3100 and MAG 5000 magnetic-inductive flowmeters; Sipan 34 liquid analyzers with sensors for sulfuric acid, sodium hydroxide, and other compounds; Sipos 5 Flash electrical actuators; special control valves; MSI belt scales with BW 500 for zinc concentrate; and gas analysis cabinets with Ultramat 6 analyzers and the appropriate sampling and preparation systems (Siemens AG, 2006).

Industrial Minerals

Graphite.—According to Yonhap News Agency, at the end of December 2007, the Republic of Korea had plans to develop two resource-rich regions in North Korea that could benefit both the Republic of Korea and North Korea and fuel cross-border economic cooperation. Dacheon in North Korea had two or three graphite mines that hold promise for future development, and the area was planned to be built up as a special resources zone with emphasis being placed on constructing electricity-generating plants, power cables, and railways. The Haeju-Nampo region of North Korea offered support to local companies to obtain development rights for graphite, limestone,

and phosphate. The Republic of Korea's state-run Korea Resources Corp. held a 50% stake in a graphite manufacturing facility that shipped products to the Republic of Korea. The Republic of Korea planned to allocate about $1 billion to this effort in 2008, which was an increase from the $639 million that had been allocated in 2007 (Yonhap News Agency, 2008).

Magnesium Compounds.—North Korea's magnesite is found in Ryong Yang and Tancheon, where magnesite reserves are among the world's largest, together with adjacent deposits in China. Steel manufacturers use this refractory mineral to line blast furnaces (MSN Encarta, 2009).

Mineral Fuels

Coal.—North Korea produced about 25.1 Mt of coal in 2008, which was an increase of 4% from the 24.1 Mt produced in 2007. According to the 2008 BP Statistical Energy Survey, North Korea had coal reserves of 600 Mt at yearend 2007. The country's anthracite resources are located mainly in the Provinces of North Pyongan and South Pyongan. Bituminous coal is concentrated mostly in North Hamgyong Province and South Pyongan Province. According to an estimate by the North Korean Economy Watch in 2006, the number of coal mines in North Korea totaled about 600; 70 of those mines were anthracite mines; 30, bituminous coal mines; and more than 500, small- and medium-scale mines with various types of coal. The mines, which produced various grades of coal, were located in several coal-producing Provinces in the northern and southern parts of North Korea (table 1; MBendi Information Services (Pty) Ltd., 2009).

In September 2008, the Government distributed 200 t of wheat from the United States to the Northern Coal Mine Enterprise to feed the starving coal miners who had had no food for about a month in Saebyul County, North Hamgyong Province, and to keep the coal mines operating. By the end of October 2008, colder temperatures had led to an increase in the price of coal to $2.65 per cart from $1.76 per cart. The price then increased rapidly to $4.41 throughout Eunduk and Saebyul Counties in North Hamgyong Province. Residents who made their living by mining coal strived to increase mine production to take advantage of the increase in the price of coal (Good Friends, 2009a, b).

Although North Korea promoted raw material exports as a means of generating much-needed hard currency and exported about 200,000 metric tons per year of coal to the Republic of Korea's Pohang Iron and Steel Co. (POSCO), the Republic of Korea's investment in North Korea's rich mineral resources slowed in 2008 owing to the dispute concerning North Korea's nuclear program and mixed views on whether such investment would be profitable (Agence France Presse, 2008).

Crude Petroleum.—As a result of international negotiations that led to a landmark nuclear agreement that was made final in 2007, North Korea agreed to receive 1 Mt of heavy fuel oil in return for permanently disabling its Yongbyon reactor complex. In December 2008, the six-party group negotiating with North Korea suspended oil shipments because of Pyongyang's refusal to accept a plan for verifying its nuclear program; however, Russian oil deliveries that were already in process continued going forward. The group's action came 1 day after the breakdown of talks in Beijing on a verification protocol, and by that time, more than one-half of the volume of the fuel oil had been supplied by China, the Republic of Korea, Russia, and the United States (VOANews.com, 2008).

Outlook

Although North Korea's GDP of $16.7 billion in 2008 was a 3.7% increase compared with the previous year's output, it was still less than that achieved at the end of the 1980s. The increase in the country's overall production since 2007 was bolstered by increased output in coal, crops, and electricity.

The Republic of Korea paid $26.8 million in 2008 in wages to North Korean workers at a joint industrial complex just north of the border. The wages were directly wired to North Korean Government bank accounts. In reaction to the continued development of nuclear weapons and missile programs, however, the Republic of Korea began to cut off all economic aid to North Korea (UPI Asia Online, 2009a).

According to the BOK, the factors responsible for North Korea's 2008 economic growth—foreign aid and a boom year in grain production—were temporary and not necessarily an indication that North Korea's strength and ability to grow economically was improved internally. During the year, North Korea poured national resources into boosting its military capabilities, including nuclear missile tests; the country's command economy in the future will likely suffer contraction because of the wide-ranging international economic sanctions that have been imposed by the international community. The tough sanctions will most likely force outside donors to reduce their aid to North Korea and to cut trade with Pyongyang (UPI Asia Online, 2009b).

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TABLE 1
NORTH KOREA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
METALS						
Cadmium metal, smelter		200	200	200	200	200
Copper:						
Mine output, Cu content		12,000	12,000	12,000	12,000	12,000
Metal:						
Smelter, primary and secondary		15,000	15,000	15,000	15,000	15,000
Refinery, primary and secondary		15,000	15,000	15,000	15,000	15,000
Gold, mine output, Au content	kilograms	2,000	2,000	2,000	2,000	2,000
Iron and steel:						
Iron ore and concentrate, marketable:						
Gross weight	thousand metric tons	4,580	5,000	5,040	5,130	5,316 [4]
Fe content	do.	1,300	1,400	1,400	1,400	1,488
Metal:						
Pig iron	do.	900	900	900	900	900
Ferroalloys, unspecified	do.	10	10	10	10	10
Steel, crude	do.	1,070	1,070	1,180	1,230	1,279 [4]
Lead:						
Mine output, Pb content		13,000	13,000	13,000	13,000	13,000
Metal:						
Smelter, primary and secondary		13,000	13,000	13,000	13,000	13,000
Refinery, primary and secondary		9,000	9,000	9,000	9,000	9,000
Silver, mine output, Ag content		20	20	20	20	20
Tungsten, mine output, W content		280 [r]	650 [r]	900 [r]	250 [r]	350
Zinc:						
Mine output, Zn content		62,000	67,000	67,000	70,000	70,000
Metal, primary and secondary		67,000	72,000	72,000	75,000	75,000
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	5,630	5,700	6,160	6,130	6,415 [4]
Fluorspar		12,000	12,500	12,500	12,500	12,500
Graphite		30,000	30,000	30,000	30,000	30,000
Magnesium:						
Magnesite, crude		60,000 [r]	40,000 [r]	60,000 [r]	55,000 [r]	150,000
Magnesium compounds	thousand metric tons	300	346	345	350	350
Nitrogen, N content of ammonia	do.	100	100	100	100	100
Phosphate rock		300,000	300,000	300,000	300,000	300,000
Salt, all types		500,000	500,000	500,000	500,000	500,000
Sulfur	thousand metric tons	42	42	42	42	42
Talc, soapstone, pyrophyllite		50,000	50,000	50,000	50,000	50,000
MINERAL FUELS AND RELATED MATERIALS						
Coal	thousand metric tons	22,800	23,500	23,000 [r]	24,100	25,060 [4]
Coke	do.	2,000	2,000	2,000	2,000	2,000

[r]Revised. do. Ditto.
[1]Estimated data are rounded to no more than three significant digits; may not add to totals shown.
[2]Table includes data available through July 31, 2009.
[3]In addition to the commodities listed, crude construction materials, such as sand and gravel and other varieties of stone, and refined petroleum products and rare earths presumably are produced, but available information is inadequate to make reliable estimates of output.
[4]Reported figure.

TABLE 2
NORTH KOREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Cement	Sunchon Cement Complex	Sunchon, Pyongannam Province	3,000
Do.	Samgwong Cement Complex (Orascom Construction Industries of Egypt, 50%)	Samgwong, Kangwon Province	2,500
Do.	Gomusan Cement Factory	Cheongjin, Hamgyongbuk Province	2,000
Do.	Cheonnaeri Cement Factory	Cheonae, Hamgyongnam Province	1,000
Coal	Anju Coal Mining Complex and Sunchon Coal Mining Complex	Anju, Kaechon, Pukchang, Sunchon, and Tokechon, South Pyongan (Pyongannam) Province; North Pyongan (Pyonganbuk) Province	9,500
Do.	Saebyol Coal Mining Complex (Northern Coal Mine Enterprise)	Saebyo, North Hamgyong (Hamgyongbuk) Province	6,000
Copper, mine output, Cu content	Hyesan Youth Copper Mine (Luanhe Industrial Group and another unnamed Chinese Company, 50%)	Hyesan, Yanggang Province	13
Gold, mine output, Au content kilograms	Gumsan (Kumsan) Joint Venture Co.	Sierra near Changjin northwest of Hamgyongbuk Province	530
Graphite	Yeongchon Graphite Mine (Joint venture of Korea Resources Corp. and Government of North Korea)	Yeongchon, Yonan County, South Hwanghae Province	3
Iron ore, concentrate, gross weight	Ministry of Metal and Machinery, Department of Mines, Musan Iron Ore Mine Complex	Near the town of Musan, Hamgyongbuk Province	10,000
Do.	Unryul Mine	Unryul, Hwanghaenam Province	1,000
Lead:			
In concentrate	Korea Zinc Industrial Group	Komdok, near Tancheon, Hamgyongnam Province	20
Refined	do.	Munpyong, Kangwon Province	32
Magnesite, concentrate, gross weight	Korea Magnesia Clinker Industry Group	Dae Hung and Ryong Yang, Hamgyongnam Province; Paek Bai near Kim Chaeck, Hamgyongbuk Province	2,500
Magnesia clinker	do.	Tancheon and Dae Hung, Hamgyongnam Province; Song Jin, Hamgyongbuk Province	1,150
Steel, crude			
Do.	Kim Chaek Iron and Steel Complex (Ministry of Metal and Machinery)	Chongjin, Hamgyongbuk Province	2,400
Do.	Hwanghae (Hwanghai) Iron Works	Songnim, Hamgyongbuk Province	1,500
Do.	Kangson Works	Kangson, Hwanhaebuk Province	960
Do.	Chullima Steel Works	Nampo, Pyungnam Province	760
Zinc:			
In concentrate	Korea Zinc Industrial Group	Komdok near Tancheon and Sankok near Kowon, Hamgyongnam Province; Nakyong, Hwanhaenam Province	80
Refined	do.	Munpyong, Kangwon Province; Tancheon, Hamgyongnam Province	100

[e]Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto.