

THE MINERAL INDUSTRY OF NORTH KOREA

By John C. Wu

The Democratic People's Republic of Korea (North Korea), which occupies the northern half of the Korean Peninsula, is located east of the Korean Bay, west of the Sea of Japan (the East Sea), south of China, and north of the Republic of Korea. The country's total area is about 120,540 square kilometers, or about the size of Pennsylvania. In 2004, its population was about 22.7 million. Its economy remained tightly controlled and centrally planned by the North Korean Government. The country's gross domestic product (GDP) and the GDP per capita based on purchasing power parity were estimated to be \$30.9 billion and \$1,400, respectively, in 2004 (U.S. Central Intelligence Agency, 2005§¹).

The country's identified mineral resources are coal, copper, fluorspar, gold, graphite, iron ore, lead, limestone, magnesite (magnesium carbonate), pyrite, salt, silver, tungsten, and zinc. Reserves of coal, iron ore, limestone, and magnesite are large. The country, however, has very few known reserves of natural gas and crude petroleum (National Intelligence Service of the Republic of Korea, 2004§; U.S. Central Intelligence Agency, 2005§).

North Korea's real GDP was estimated to have grown by 2.2% in 2004. On the basis of North Korea's economic structure in 2004, the primary sector, which included agriculture and fishing, accounted for 26.7% of North Korea's GDP; the secondary sector, which included heavy industry (11.8%), construction (9.3%), mining (8.7%), light industry (6.7%), and public utilities (4.4%), accounted for 40.9%; and the tertiary service sector, which included Government (22.6%) and others (9.7%), accounted for 32.3% (Bank of Korea, 2005§).

The mining sector, which was dominated by the production of coal, iron ore, limestone, and magnesite, was important to the North Korean economy because of its significant contribution to the country's GDP. It provided fuel and raw materials to the country's manufacturing sector and also earned considerable amounts of foreign exchange.

Government Policies

The North Korean Government's economic policy guidelines were to build up a self-reliant national economy, promote the economic development with heavy industry as the top priority for development, and implement the policy of developing the national economy in parallel with strengthening the military (National Intelligence Service of the Republic of Korea, 2004§). In pursuing these policy goals, general consumption has been tightly controlled. As a result, the people have been forced to endure a shortage of goods and services. During the past several years, the shortages of food and electricity supply appear to have been severe, especially (with respect to electricity) because of

the country's outdated thermal-power-generating facilities and insufficient coal supply.

The Government has been implementing its economic reform since July 2002. The reform measures included introducing market economy elements; phasing out the Government food rationing system; establishing general markets in major cities; designating Gaesong, Mount Geumgang, and Shinuiju as special economic zones; and sending professional groups abroad to learn about market economies. The Government has simultaneously implemented such supplementary measures as establishing state-owned food stores and wholesale department stores to stabilize the prices of rice and other daily necessities (Ministry of Unification of the Republic of Korea, 2004c§).

North Korea's environmental protection law was first passed in April 1986. The country was concerned about pollution and promoted environmentally friendly and antipollution policies. Section 11 of the Foreign Investment Law stipulated that foreign investments that are not environmentally friendly would be prohibited (Digital Kotrassistant, 2003b§).

Production

Production of coal and iron ore was mostly for domestic consumption by the iron and steel and utility industries. Considerable amounts of anthracite coal and iron ore, however, were exported. Limestone production was for consumption by the domestic cement and construction industries. Magnesite production was for further processing into magnesia clinker, which, in turn, was for consumption by the domestic metal manufacturing industries and for export. North Korea's other important minerals production included such nonferrous metals as copper, gold, lead, silver, tungsten, and zinc and such industrial minerals as barite, cement, fluorspar, graphite, phosphate rock, salt, sulfur, and talc (table 1). Most of the country's mining and mineral-processing activities have been operated at below their design capacity during the past several years because of outmoded facilities, a shortage of spare parts and energy (electricity and coking coal), and lack of capital for renovation and modernization.

Trade

North Korea's major export mineral commodities were cement, iron and steel products, iron ore, magnesia clinker, refined lead, and zinc metal. Additionally, certain percentages of the barite, refined copper, graphite, iron and steel, and sands production were exported during the past 5 years. North Korea's major import commodities were coking coal (metallurgical-grade bituminous coal), crude petroleum, and salt. Coking coal was imported mainly for consumption by the iron and steel industry, and salt was imported to supplement domestic production to meet the country's salt requirements. North Korea relied entirely on imports of crude petroleum to

¹References that include a section mark (§) are found in the Internet References Cited section.

meet the raw material requirements of its two oil refineries. The country's major trading partners were China, Japan, the Republic of Korea, and Russia.

North Korea's eight major trade ports for handling minerals were Chongjin for coal and steel, Nampo for cement and coal, Hungnam for fertilizers and magnesia clinker, Najin for coal and fertilizer, Haeju for limestone, Sonbong for crude petroleum and refined petroleum products, Wonsan for cement, and Songnim for coal and iron ore. North Korea's three major operating domestic railroad networks were the Kaesung-Sariwon-Pyongyang-Shinuiju Line along the west coast; the Wonsan-Hungnam-Chongjin-Najin Line along the east coast; and the Pyongyang-Wonsan Line, which linked the east and west on the Korean Peninsula. Most of the North Korean railroads were linked with China and Russia (AsiaTradeHub.com, 2004§).

North Korea's major trading companies were all state-owned. Korea Ferrous Metals Export & Import Corp. exported iron ore, pellet, pig iron, and steel and imported cokes, ferroalloys, graphite electrodes, and steelmaking supplies and materials. Korea Nonferrous Metals Export & Import Corp. exported such nonferrous minerals as copper, lead, tungsten, and zinc concentrates; such nonferrous metals as electrolytic zinc and cadmium; and such nonmetallic minerals as barite, granite, and talc. The company imported a wide variety of chemical products, machinery, equipment and supplies for mining and smelters. Korea Magnesia Clinker Export & Import Corp. exported bentonite, cyanite, magnesia bricks, magnesia clinker, magnesite, and talc and imported alloys, chromite, cokes, industrial oils, and mining machinery and supplies. Korea Building Materials Trading Corp. exported cement, ceramics products, and nonmetallic minerals. The company imported asbestos; caustic soda; cement-plant machinery, equipment, and supplies; fuels for the production of building materials; gypsum; and raw materials (Digital Kotrassistant, 2003a§).

Commodity Review

Metals

Gold.—Gumsan (Kumsan) Co., which was a joint-venture company of investors from Australia, England, and Singapore, started mining gold in October 2004. According to Singaporean investors, the joint-venture company mined ore from the Sierra deposit near Changjin, which is located northwest of Hamhung in the northeastern part of North Korea. The mined ore was milled near the mining site at an elevation of 2,000 meters. The milled ore was then transported through pipes to a processing plant that was located about 6 kilometers from the mine. The mine was to operate only 9 to 10 months per year because of the harsh weather conditions in the area and would produce about 220 kilograms (kg) of gold in 2004 and 530 kg in 2005 at full capacity. The proven ore reserves of the Sierra deposit were estimated to be in excess of 1 million metric tons (Mt), which contain about 4,700 kg of gold (Metal Bulletin, 2004; Ministry of Unification of the Republic of Korea, 2004b§).

Iron and Steel.—The iron and steel industry, which was the most important industry in the North Korean manufacturing

sector, remained stagnant. Production of iron ore, pig iron, crude steel, and rolled steel was below design capacity because of the shortage of energy (coking coal and electricity) and the lack of spare parts and financial resources to renovate and modernize the outmoded iron and steel making facilities, which used equipment and technology of the 1970s and 1980s.

Iron ore production from the Musan Mine in North Hamgyong Province (Hamgyongbuk-Do), the Unryul Mine in South Hwanghae Province (Hwanghaenam-Do), the Tokhyong Mine in North Pyongan Province (Pyonganbuk-Do), and other smaller mines totaled about 4.6 Mt in 2004 (Bank of Korea, 2005§). Production of pig iron and crude steel was estimated to be 1 Mt and 1.1 Mt, respectively, in 2004. The major production facilities for iron and steel products were the Kimchek Iron Works, which was North Korea's largest, in Chongjin, North Hamgyong Province; the Hwanghae Iron Works, which was North Korea's second largest, in Songnim, North Hwanghae Province (Hwanghaebuk-Do); the Sungjin Steelworks in Kim Chek, North Hamgyong Province; and the Chullima Steelworks in Nampo, South Pyongan Province (Pyongannam-Do). Iron and steel remained one of North Korea's major export products (National Intelligence Service of the Republic of Korea, 2004§; Bank of Korea, 2005§).

Lead and Zinc.—Lead and zinc mining operations were mainly at the Komdok mining complex, which is located west of Tanchon in South Hamgyong Province (Hamgyongnam-Do); at the Sankok Mine near Kowon also in South Hamgyong Province; and at the Nakyon Mine in South Hwanghae Province. Lead and zinc smelting and refining operations were mainly at the Nampo complex in Pyongan Province, the Munpong complex in Kangwon Province, and the Tanchon complex in South Hamgyong Province. The Nampo zinc smelter reportedly was dismantled in 2001 because of its pollution problems.

The country's combined production capacity of lead and zinc was estimated to be 380,000 metric tons per year (t/yr). Because of insufficient mining capacity that resulted from the shortage of electricity and spare parts, actual combined production of lead and zinc was estimated to be between about 80,000 and 82,000 metric tons (t). In recent years, exports of refined lead and zinc, which were valued at about \$24 million per year, were exported to China, Japan, and the Republic of Korea. Exports of lead and zinc to the Republic of Korea were valued at about \$22 million; and to China, Japan, and other countries, about \$2 million (National Intelligence Service of the Republic of Korea, 2004§).

Industrial Minerals

Cement.—North Korea has abundant resources of limestone for cement production. Limestone resources were estimated to be 60 billion metric tons (Gt). Gypsum, which is the other main raw material, however, was mostly imported from overseas. Most cement plants were located near the limestone mines. The large-scale cement plants were located at Soonchun in South Pyongan Province with the capacity of 3 million metric tons per year (Mt/yr) and at Samgwon in Kangwon Province (Kangwon-Do) with the capacity of 2 Mt/yr. The country's cement industry comprised 30 plants and had a total capacity of about 12 Mt/yr. Actual cement production during the past 5 years was estimated

to be between 4.6 Mt and 5.6 Mt owing to the shortage of coal and electricity (Ministry of Unification of the Republic of Korea, 2004a§; National Intelligence Service of the Republic of Korea, 2004§; Bank of Korea, 2005§).

Magnesium.—North Korea has the largest and some of the best quality magnesite deposits in the world (U.S. Library of Congress, 1993§). The country's magnesite resources, which were concentrated in North Hamgyong Province and South Hamgyong Province, were estimated to be 22 Gt. The two major magnesite mines in South Hamgyong Province were the 1.3-Mt/yr-capacity Dae Hung Mine (open pit) and the 1-Mt/yr-capacity Ryong Yang Mine (underground). The 200,000-t/yr-capacity Paek Bai Mine (underground) is located in the southern part of North Hamgyong Province. Most of the magnesite ore produced from the Dae Hung Mine and the Ryong Yang Mine was delivered by rail to a 750,000-t/yr-capacity plant in Tachon, South Hamgyong Province for processing into magnesia clinker. Some portion of magnesite ore produced from the Dae Hung Mine was processed at the 150,000-t/yr clinker plant near the mine. Magnesite ore produced from the Paek Bai Mine was delivered to a 250,000-t/yr clinker plant in Song Jin, North Hamgyong Province for processing into magnesia clinker.

Magnesia clinker produced from the area contained a minimum magnesia oxide (MgO) content of 90% and a maximum silica (SiO₂) content of between 4.0% and 4.5% (Muk and others, 2003; National Intelligence Service of the Republic of Korea, 2004§).

Mineral Fuels

Coal.—North Korea has substantial reserves of anthracite coal, which were estimated to be 1.8 Gt, but fewer reserves of lignite (brown coal). The reserve of metallurgical-grade bituminous coal (coking coal), however, was small. The major coal resources are located in the Anju, the Kangdon, and the Sunchon areas of South Pyongan Province; the Paegam area of Yanggan Province (Yanggang-Do); and the Saebiyol area of North Hamgyong Province (U.S. Library of Congress, 1993§).

The country produced 68 Mt of anthracite coal and 22 Mt of lignite in 1990 (U.S. Library of Congress, 1993§). Owing to the shortage of spare parts and the lack of financial resources to modernize the outmoded mining equipment and facilities, coal production during the past 5 years was much below that of 1990. Coal production stagnated at about 16 Mt/yr for anthracite and 7 Mt/yr for lignite during the past 5 years, but rebounded in 2004. Coal production was mostly consumed domestically for power generation; some coal, however, was exported to China and Japan to earn foreign exchange.

According to a local press report, exports of anthracite coal to China totaled 1.18 Mt for the first 9 months of 2004, which was more than double that for the same period in 2003. During the first 9 months of 2004, North Korea also exported 530,000 t of anthracite coal to its neighboring countries. Because of higher export prices, coal export earnings for the first 9 months of 2004 totaled \$34.7 million compared with \$1.08 million for the same period in 2003 (Korea Is One, 2004§).

Natural Gas and Petroleum.—North Korea has no documented reserves of natural gas and crude petroleum, although in the late 1990s, the Government claimed that it has enormous oil and gas reserves. Beach Petroleum of Australia, Soco International of the United Kingdom, and Taurus Petroleum of Sweden were allowed to explore for oil and gas offshore in the West Korea Bay basin, which is geologically analogous to China's Bohai Bay, but they failed to find viable oil reserves. In 2001, Petrolia Nasional Bhd. of Malaysia took over Block A, which had been held by Soco International. The Government awarded its first onshore block in the Tachon-Rajin area near the Chinese border to Sovereign Ventures of Singapore in November 2001. In September 2002, Sovereign Ventures reported its initial seismic survey results, which indicated the probable presence of oil and natural gas. Sovereign Ventures began exploratory drilling in 2003. In October 2003, Global GeoService (GGS) of Norway reportedly signed an agreement with the Government for offshore surveys and planned to begin initial survey in the first half of 2004. In June, state-owned Korea National Oil Corp. of the Republic of Korea reportedly was to participate in GGS's exploration project off North Korea's west coast (Oil & Gas Journal, 2004; Petroleum Economist, 2004; U.S. Energy Information Administration, 2004§).

In September 2004, Aminex Plc of the United Kingdom announced that it had signed a 20-year petroleum agreement with the Government of North Korea in June 2004 to assist in the development of the petroleum industry onshore and offshore North Korea. Under the terms of the agreement, Aminex would initially provide technical assistance to North Korea by assessing existing data, obtaining new data, advising with the drawing up of a framework for licensing exploration areas and for marketing the country's potential to the international oil industry, and providing training for the country's oil and gas specialists. In return, Aminex would receive a royalty on hydrocarbons produced from new drilling anywhere onshore or offshore North Korea and would be entitled to a carried working interest in any wells drilled by incoming companies. Aminex also would have a prior right to explore in its own name, either alone or with international industry partners, anywhere in the territory covered by the agreement (Petroleum Economist, 2004; Aminex PLC, 2004§).

Outlook

For the next 4 to 5 years, the North Korea mining sector will continue to be dominated by coal, iron ore, limestone, and magnesite. The opening of onshore and offshore oil and gas exploration to foreign companies in 2004, however, may lead to discovery of hydrocarbons in the Tachon Rajin area and offshore North Korea's west coast. The iron and steel industry is expected to remain stagnant, but the coal industry is expected to trend upward in the next 2 years because of rising energy prices.

North Korea's real GDP growth is expected to stay within the narrow range of between 2% and 3% during the next 2 years.

References Cited

- Metal Bulletin, 2004, North Korean gold venture set to commission new plant: Metal Bulletin, no. 8850, July 12, 2004, p. 14.
- Muk, O.H., Copley, David, Wu, Rocky, and Wilson, Ian, 2003, North Korean magnesite, in 16th Industrial Minerals International Congress, Montreal, Quebec, Canada, April 6-9, 2003, Speaker Papers: London, United Kingdom, Metal Bulletin, 58 p.
- Oil & Gas Journal, 2004, Exploration off N. Korea might include S. Korean participation: Oil & Gas Journal, v. 102, no. 21, June 7, p. 43.
- Petroleum Economist, 2004, A door creaks open: Petroleum Economist, v. 71, no. 11, November, p. 32.

Internet References Cited

- Aminex PLC, 2004 (September 20), Aminex signs 20-year agreement to develop North Korea's petroleum industry, Press Release, accessed September 22, 2004, at URL [http://www.aminex-plc.com/press release/20_9_04korea.html](http://www.aminex-plc.com/press%20release/20_9_04korea.html).
- AsiaTradeHub.com, 2004, North Korea's policies, energy, and infrastructure, Asian E-Hub for Global Commerce, accessed October 28, 2004, at URL <http://www.asiatraderhub.com/n.korea/eco.asp>.
- Bank of Korea, 2005 (May 31), Gross domestic product of North Korea in 2004, News, accessed June 2, 2005, via URL <http://www.bok.or.kr/index.jsp>.
- Digital Kotrassistant, 2003a, Company list—Trading companies, KOTRA NK Team, accessed February 2, 2005, at URL <http://crm.kotra.or.kr/main/info/nk/news2003/company/company01.html>.
- Digital Kotrassistant, 2003b, Investment—Anti-pollution legislation, KOTRA NK Team, accessed February 2, 2005, at URL http://crm.kotra.or.kr/main/info/nk/new2003/invest/2_4.html.
- Korea Is One, 2004, Exports of North Korean anthracite coal up sharply, accessed February 14, 2005, at URL http://www.korea-is-one.org/article.php?id_article=1152.

- Ministry of Unification of the Republic of Korea, 2004a, Facts and figures—Major national index, North Korea, accessed January 13, 2005, via <http://www.unikorea.go.kr>.
- Ministry of Unification of the Republic of Korea, 2004b, Major developments—Adoption of the latest science & technology this year, accessed February 1, 2005, via <http://www.unikorea.go.kr>.
- Ministry of Unification of the Republic of Korea, 2004c, Major developments—Overview of North Korea in 2004 & Prospects for 2005, North Korea, accessed January 27, 2005, via <http://www.unikorea.go.kr>.
- National Intelligence Service of the Republic of Korea, 2004, North Korea, accessed August 5, 2004, via URL <http://www.nis.go.kr/eng/north/index.html>.
- U.S. Central Intelligence Agency, 2005, North Korea, World Factbook 2005, accessed June 27, 2005, at URL <http://www.odci.gov/cia/publications/factbook/geos/kn.html>.
- U.S. Energy Information Administration, 2004 (January), North Korea, Country Analysis Briefs, accessed January 12, 2004, at URL <http://www.eia.doe.gov/emue/cabs/nkorea.html>.
- U.S. Library of Congress, 1993, North Korea—Industry, A Country Study, accessed October 28, 2004, at URL <http://countrystudies.us/north-korea/48.htm>.

Major Source of Information

The Ministry of Unification
77-6 Sejong 2-ga, Jongno-gu
Seoul 110-760
Republic of Korea
Telephone: 82-2-3703-2433
Fax: 82-2-739-5047
Internet: <http://www.unikorea.go.kr>

TABLE 1
NORTH KOREA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES^{1,2}

(Metric tons unless otherwise specified)

Commodity ³	2000	2001	2002	2003	2004
METALS					
Cadmium metal, smelter	200 ^r	200 ^r	200 ^r	200 ^r	200
Copper:					
Mine output, Cu content	12,000 ^r	12,000 ^r	12,000 ^r	12,000 ^r	12,000
Metal:					
Smelter, primary and secondary	12,000 ^r	12,000 ^r	12,000 ^r	12,000 ^r	12,000
Refinery, primary and secondary	15,000 ^r	15,000 ^r	15,000 ^r	15,000 ^r	15,000
Gold, mine output, Au content kilograms	6,600 ^r	6,600 ^r	6,600 ^r	6,300 ^r	6,000
Iron and steel:					
Iron ore and concentrate, marketable:					
Gross weight thousand metric tons	3,800	4,200	4,100	4,430	4,580
Fe content do.	1,100	1,200	1,150	1,260	1,300
Metal:					
Pig iron do.	800	800	800	900	900
Ferroalloys, unspecified do.	10	10	10	10	10
Steel, crude do.	1,000	1,000	1,030	1,090	1,070
Lead:					
Mine output, Pb content	9,000 ^r	9,000 ^r	10,000 ^r	20,000 ^r	20,000
Metal:					
Smelter, primary and secondary	9,000 ^r	9,000 ^r	10,000 ^r	20,000 ^r	20,000
Refinery, primary and secondary	7,000 ^r	7,000 ^r	6,000 ^r	7,000 ^r	7,000
Silver, mine output, Ag content	20 ^r	20 ^r	20 ^r	20 ^r	20
Tungsten, mine output, W content	500	500	600	600	600
Zinc:					
Mine output, Zn content	60,000 ^r	60,000 ^r	60,000 ^r	60,000 ^r	62,000
Metal, primary and secondary	65,000 ^r	65,000 ^r	65,000 ^r	65,000 ^r	67,000
INDUSTRIAL MINERALS					
Barite	70,000	70,000	70,000	70,000	70,000
Cement, hydraulic thousand metric tons	4,600	5,160	5,320	5,540	5,630
Fluorspar	12,000 ^r	12,000 ^r	12,000 ^r	12,000 ^r	12,000
Graphite	30,000	25,000	25,000	25,000	25,000
Magnesite, crude thousand metric tons	1,000	1,000	1,000	1,000	1,200
Nitrogen, N content of ammonia do.	100	100	100	100	100
Phosphate rock	350,000	350,000	300,000	300,000	300,000
Salt, all types	500,000	500,000	500,000	500,000	500,000
Sulfur thousand metric tons	41	41	42	42	42
Talc, soapstone, pyrophyllite	60,000 ^r	60,000 ^r	50,000 ^r	50,000 ^r	50,000
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite thousand metric tons	16,000	16,000	17,000	16,000	16,300
Lignite do.	6,500	7,000	7,000	6,300	6,500
Total do.	22,500	23,000	24,000	22,300	22,800
Coke do.	2,000	2,000	2,000	2,000	2,000

^rRevised.

¹Estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Table includes data available through July 29, 2005.

³In addition to the commodities listed, crude construction materials, such as sand and gravel and other varieties of stone, and petroleum products presumably are produced, but available information is inadequate to make reliable estimates of output levels.