



2008 Minerals Yearbook

REPUBLIC OF KOREA

THE MINERAL INDUSTRY OF THE REPUBLIC OF KOREA

By Lin Shi

The Republic of Korea largely relied on external resources for much of its mineral requirements. The country continued to import a significant percentage of the mineral and energy resources needed to support the country's consumption and robust manufacturing sector in 2008, including almost the entire domestic demand for bituminous coal and for ores and concentrates of copper, iron, lead and zinc, and some other minerals. The mining sector contributed very little to the country's gross domestic product (GDP).

In 2008, the Republic of Korea's real GDP grew by about 2.5% to about \$1.3 trillion based on purchasing power parity; of this amount, services accounted for about 57%; manufacturing 40%; and agriculture, about 3%. The population was estimated to be 48.5 million with a labor force of about 24.4 million, distributed as follows: services, 65%; manufacturing, 25%; and agriculture, about 7%. The unemployment rate was about 3%. The country's annual exports were valued at \$422 billion, and annual imports were valued at \$435 billion. The country's 2008 reserves of foreign exchange and gold totaled \$201.2 billion (U.S. Central Intelligence Agency, 2008; Bank of Korea, 2009, p. 130).

The Republic of Korea was the leading producer of cadmium, slab zinc, and steel in the world. It was also a major producer of cement, refined copper, pyrophyllite, talc, and zeolites in the Asia and the Pacific region and one of the region's significant consumers and importers of coal, natural gas, and crude petroleum; of ores and concentrates of copper, iron, lead, and zinc; and of nickel oxide sinter.

Because of its small supply of domestic mineral resources, the Republic of Korea relied heavily on imports to meet its domestic demand for most of the raw materials needed to supply its energy and manufacturing industries. It relied 100% on imports to meet its requirements for bituminous coal, ores and concentrates of copper, and fluorite and phosphate rock. It also relied on imports to meet most of its domestic requirements for iron ore and nonferrous metallic minerals, such as lead and zinc. According to Korea Resources Corp. (KORES), the Republic of Korea has relatively large reserves of such industrial minerals as kaolin, limestone, pyrophyllite, silica stone (quartzite), and talc. It has smaller reserves of antimony, copper, gold, iron ore, lead, molybdenum, silver, tin, tungsten, and zinc. It also has small reserves of coal and offshore natural gas.

To compensate for the small amount of mining activities on the domestic front, the Republic of Korea entered into partnerships worldwide to develop mining properties around the globe so it could import energy resources and minerals in exchange for commercial services and manufactured goods. According to the Korean National Statistical Office, the Korean construction sector's overseas orders more than doubled in 2008 from the previous year and were valued at a combined \$26.3 billion (32.7 trillion won¹), which was up by 102.9%,

or by \$13.39 billion (16.65 trillion won) from the previous year owing to a construction boom in Asia and the Middle East (Yonhap News Agency, 2009b). The Middle East was the principal source of energy supplies to the Republic of Korea; the region supplied 85% of the country's mineral fuels. In return, the Republic of Korea was one of the leading providers of manufactured goods and services to the Middle East region, including cars, consumer electronics, heavy construction equipment, liquefied natural gas tankers, and trucks. The Republic of Korea also provided services in the Middle East region as a construction contractor in the power sector, including the construction of nuclear powerplants, and in the water sector (Meed, 2009a-c).

The economy of the Republic of Korea was highly responsive to volatility in oil prices and fluctuations in the exchange rate. There was also a strong relationship between its GDP growth and its demand for energy. When the price of oil hit a high of \$147 per barrel in July 2008, the effect on the Government's treasury was felt almost immediately, and the country posted a current account shortfall of \$6.41 billion—its first shortfall in 11 years. State-run Korea Gas Corp. (Kogas) imported 2.18 million metric tons (Mt) of liquefied natural gas (LNG) in April 2008. The Government actively encouraged its leading energy companies to create agreements to help secure future supplies of oil and gas from the Middle East. The Republic of Korea and other Asian countries agreed to share their 10-year projections of oil supply and demand with the Gulf Cooperation Council (GCC) members. The Republic of Korea planned not only to continue to purchase oil and LNG from such Middle Eastern countries as Saudi Arabia and the United Arab Emirates (UAE) but was also looking for new suppliers in Iraq (Meed, 2009b).

Minerals in the National Economy

The mining and quarrying sector accounted for only 0.22% of the country's real GDP and thus was a relatively small sector compared with other sectors of the Republic of Korea's economy. The sector produced small quantities of anthracite coal, concentrates of ferrous metals, mineral ores, and nonferrous metals. According to the Bank of Korea, the value of production (at 2000 constant prices) of the mining and quarrying sector decreased by 7.0% in 2008 and the country's economy grew by 2.5%. The output of the industrial minerals (nonmetal) sector accounted for about 70% of the real value of the country's total mineral production (Bank of Korea, 2009, p. 188).

Government Policies and Programs

In 2008, state-owned KORES amended the corporate bylaws and increased its capital from \$600 billion to \$2,000 billion. Back in June 1967, the Government had established KORES to support the development of the domestic private sector mining

¹Where necessary, values have been converted from Republic of Korea won (W) to U.S. dollars (\$) at the rate of W1,102.59 = \$1.00.

industry, to conduct research, and to provide technical assistance in the acquisition and development of overseas mineral resources. KORES' Inter-Korea Mineral Resources Cooperation Department was engaged in various cooperative projects with North Korea, including collecting data on the mines in North Korea, establishing contacts and communications to assist in the development of the mines in North Korea, overseeing the operations of the South-North Collaboration Council for Resources Development to assist private enterprise projects in the North Korea, and so forth. KORES' policy was that endeavors to develop the mineral resources of North Korea would help the Republic of Korea secure a steady supply of minerals at a low price owing to North Korea's large reserves of various minerals and its proximity to the Republic of Korea (Korea Resources Corp., 2008a, b).

The Republic of Korea was considering opening new embassies in some energy-rich nations and relocating overseas diplomatic staff as part of its efforts to bolster its energy diplomacy. In late 2008, the President of the Republic of Korea approved the Foreign Ministry's plan to set up embassies in Bolivia, Cameroon, the Democratic Republic of Congo [Congo (Kinshasa)], Kyrgyzstan, and Trinidad and Tobago, and to establish a consulate general in Irkutsk, Russia. It also planned to support its national interests on the African continent, through signed memorandums of understanding (MOUs) to increase investment in natural gas, crude oil, and other resources and in exploration and development projects; to acquire contracts for construction of such infrastructure as roads and dams; and to acquire imports of mineral resources, such as cobalt, copper, diamond, and zinc. The country was competing with China and Japan to establish economic influence on the continent so as to secure oil and mineral resources to sustain its economy (Emerging Minds, 2008; Xinhua News, 2008).

Production

The Republic of Korea's mining sector produced ferrous and nonferrous metals, including copper, gold, iron ore, lead, silver, and zinc. The country mined industrial minerals, including diatomaceous earth, feldspar, graphite, limestone, mica, pyrophyllite, quartzite, salt, sand, talc, and zeolites. Mine output of ferrous and nonferrous metals was very small compared with the country's raw material requirements for its ferrous and nonferrous metal refining industries. Mined industrial minerals were mostly for domestic consumption. The country also produced anthracite coal and a small amount of natural gas from an offshore gasfield, but no crude petroleum (tables 1, 2).

In 2008, production of cadmium, ferromanganese, gold, iron ore, lead, pig iron, silver, crude steel, and zinc metal all increased whereas production of bismuth, mine output of copper and refined copper, refined gold, nickel, and mine output of zinc decreased. Among industrial minerals, production of clays, diatomaceous earth, graphite, mica, and salt all increased whereas production of cement, feldspar, limestone, quartzite, sand, and petroleum refinery products decreased (table 1).

Structure of the Mineral Industry

The Republic of Korea's large coal mining, natural gas, petrochemical, and petroleum refining companies were state owned and under the supervision of the Ministry of Commerce, Industry and Energy (MCIE). The rest of the mining, quarrying, and ferrous nonferrous metal processing companies were privately owned and operated.

Mineral Trade

In 2008, the value of the Republic of Korea's total annual exports increased by 13.6% to \$422 billion from \$371.5 billion in 2007 owing mainly to a 56.2% increase in exports of petroleum refinery products to \$37.8 billion from \$24.2 billion; a 20.6% increase in exports of iron and steel products to \$38.1 billion from \$31.6 billion; and a 13.9% increase in exports of chemicals to \$41.9 billion from \$36.8 billion (Bank of Korea, 2009, p. 130-131).

The value of the country's total annual imports increased by 22% to \$435.3 billion from \$356.8 billion in 2007 owing mainly to a 53.9% increase in imports of iron ore to \$37.1 billion from \$24.1 billion, and a 48.9% increase in imports of mineral fuels (coal, natural gas, and crude petroleum) to \$140.9 billion from \$94.6 billion (Bank of Korea, 2009, p. 130-131).

The Republic of Korea's major energy resources were coal, hydropower, natural gas, nuclear power, and other renewable energy sources. The country was a significant importer of LNG and the fifth ranked net importer of oil in the world. In recent years, the increased imports of coal and natural gas have gradually decreased the share of oil in the total energy usage; oil had previously accounted for the largest share of the country's energy consumption (U.S. Energy Information Administration, 2009).

Commodity Review

Metals

Aluminum.—The Republic of Korea's aluminum products included metal coil, plate, and sheet; extrusion products; foil; metal powders; wheels for automobiles; and other casting products. The country's domestic aluminum product manufacturers were also the major primary aluminum and aluminum alloy consumers. Imports of primary aluminum and aluminum alloys in 2008 decreased by 0.9% to 1,085,039 metric tons (t) from 1,190,456 t in 2007, of which 773,833 t was primary aluminum ingot and 311,206 t was primary aluminum alloys. The major suppliers of primary aluminum ingots and alloys were China (416,924 t, or 38.4% of the imported amount), Russia (262,271 t, or 24.2%), Australia (211,850 t, or 19.5%), South Africa (53,607 t, or 4.9%), and Canada (41,876 t, or 3.9%). Imports of scraps of aluminum and aluminum alloys increased by 7.6% to 503,154 t from 467,491 t in 2007. Domestic demand for and consumption of primary aluminum decreased by 10.8% to 963,812 t in 2008 from 1,080,620 t in 2007 (World Bureau of Metal Statistics, 2009, p. 26).

In June 2008, Novelis Korea Ltd. completed the installation of Novelis Fusion™ technology at its plant in Ulsan and began commercial production of multialloy aluminum sheet products. This was Novelis' second major investment in the Republic of Korea in the year after the completion of a \$30 million expansion of its aluminum rolling mill in Yeongju. Novelis Fusion™ is a technology that produces aluminum sheet ingots with multiple layers of different alloys, which are then rolled into premium sheet products with previously unattainable combinations of attributes, such as high strength and superior surface quality. The initial opportunity for Novelis Fusion™ sheet products in the Korean marketplace was to replace the conventional clad aluminum products used in heat exchanger applications. Novelis Korea was a joint venture of Novelis (68%), Taihan Electric Wire Co. Ltd. (31%), and the Hyundai Group (1%) (Novelis Inc., 2009).

Cadmium.—Young Poong Corp. produced cadmium metal at the Sukpo refinery, and the reported cadmium metal production capacity was 805 metric tons per year (t/yr). Cadmium is mainly used in batteries (predominantly in rechargeable nickel-cadmium batteries); for cadmium pigments, coatings, and plating; and as stabilizers for plastics. Owing to the high toxicity of cadmium, which is associated with health and environmental problems, the use of cadmium was generally decreasing in all other applications (Young Poong Corp., 2009). Korea Zinc was a major domestic cadmium producer in the country with an annual production capacity of about 2,000 t at its refinery in Onsan.

Copper.—Mined production of copper was very small, and was insignificant compared with the country's requirements for copper ore and concentrate. The country's copper smelters were located in Changhang and Onsan, which produced about 390,000 t of blister and anode copper and about 573,000 t of refined copper. In 2008, the country increased imported copper ore and concentrates by 5.8% to 1,483,914 t from 1,402,886 t in 2007. It decreased imported blister and anode copper by 41.8% to 58,283 t from 100,129 t; decreased imported refined copper by 3.2% to 406,475 t from 419,792 t; and decreased imported copper and copper alloy scrap by 1.8% to 217,008 t from 221,054 t. The country's refined copper consumption decreased by 0.6% to 852,115 t from 857,647 t in 2007 (World Bureau of Metal Statistics, 2009, p. 73).

Gold.—The Republic of Korea produced 37,989 kilograms (kg) of refined gold in 2008, which was a decrease of 19.3% from the 47,078 kg produced in 2007; of this amount, 1,593 kg was from domestic raw materials, including scrap, compared with 3,098 kg in 2007, which was a decrease of 48.6%. The volume of imports of refined gold, which totaled 48,382 kg, decreased by 20.2% from the 60,610 kg imported in 2007; the value of exports decreased by 2.2% to \$1,284.4 million from \$1,312.6 million in 2007. Domestic demand for refined gold was 41,235 kg compared with 44,527 kg in 2007, which was a decrease of 7.4%. The volume of exports of refined gold, which totaled 46,391 kg, increased by 26.8% from the 36,574 kg exported in 2007; the value of exports increased by 87.2% to \$1,270.8 million, from \$678.9 million in 2007. The major end users of refined gold were the manufacturers of coins, dental products, electrical communication parts, jewelry, and materials for semiconductors (Ministry of Commerce, Industry and Energy, 2008, p. 9).

Korean gold producing companies exported mainly to Japan and other Asian countries. Domestic demand decreased by two-thirds compared with that of 2007 owing to the weakness of the industrial sector, and new customers from overseas were being developed gradually (Korea Zinc Co. Ltd., 2008).

The Muguk Mine was historically the Republic of Korea's leading gold producer, with recorded production of 8.15 t of gold mined between 1934 and 1972. Muguk was reopened between 1987 and 1998. In 1998, Muguk was reported by KORES to contain a combined resource of 1,418,980 t at a grade of 13.5 grams per metric ton (g/t) gold and 72.8 g/t silver (MOLY Investing News, 2008).

The Gasado project is an epithermal gold-silver deposit held under mining title on Gasado Island, which is located 5 kilometers (km) off the southwest coast of the Republic of Korea. Historical exploration by Indochina Goldfields indicated the existence of robust gold and silver mineralization between 4 and 7 meters (m) wide (MOLY Investing News, 2008).

Indium.—In 2008, the Republic of Korea exported 192.63 t of indium metal, powder, and scrap to Japan. This amount accounted for 65.8% of Japan's annual indium metal imports (Roskill Information Services Ltd., 2009b, p. 3).

The Republic of Korea Government had plans to stockpile a 60-day supply of indium to support domestic indium tin oxide (ITO) producers. This stockpile amount was equivalent to 22 t of indium, and of that amount, 11 t was already purchased; the rest would be purchased between March 2008 and March 2009. ITO's most notable feature is its combination of electrical conductivity and optical transparency; it is used mainly to make transparent conductive coatings and various optical coatings (especially infrared-reflecting coatings), and as a sensor coating (Roskill Information Services Ltd., 2009a, p. 15).

Iron and Steel.—In 2008, mine production of iron ore, in gross weight, increased by 25.8% to about 365,883 t from 290,802 t in 2007. Domestic iron ore was produced from the Sinyemi Mine. The Republic of Korea relied mainly on imports to meet its iron ore requirements in 2008. Imports of iron ore increased by 7.3% to 49,542,331 t from 46,176,285 t in 2007 and were valued at about \$4.85 billion. The imported iron ore was mainly from Australia, Brazil, India, and South Africa; other suppliers of iron ore were Chile, Peru, and the United States. The average price of imported iron ore rose by 58.2% to \$97.82 per metric ton from \$61.85 per metric ton in 2007 (Ministry of Commerce, Industry and Energy, 2008, p. 9).

In 2008, the country's iron and steel industry consumed 48.65 Mt of iron ore and 28.1 Mt steel scrap. Crude steel production increased by 3.8% to 53.5 Mt from 51.52 Mt in 2007, of which 34.7 Mt (64.9%) was produced by POSCO; 9.9 Mt (18.5%), by Hyundai Steel Co. Ltd. (HSC); and the remaining 8.9 Mt (16.6%), by all other steel companies, among which were Dongkuk Steel Mill Co. Ltd., Korea Iron and Steel Co. Ltd., SeAH Besteel Corp., and Yamato Korea Steel Corp. The Republic of Korea was the world's sixth ranked steel-producing country and in 2008 its crude steel production was 4% of the world crude steel production. The country's two leading steelmakers—POSCO and HSC—were the world's 4th and 30th ranked steel-producing companies in 2008, respectively (Ministry of Commerce, Industry and Energy, 2008, p. 9; World Steel Association, 2009a-d).

According to the Korea Ministry of Commerce, the country's steel consumption increased by 1.8% to 48.65 Mt in 2008 from about 47.78 Mt in 2007 because of the increasing demand for steel in the manufacturing sector. Exports decreased by 49.9% to 4,971 t from 9,930 t in 2007 and the export value decreased by 55.0%, an amount equivalent to \$254,000. The country's steel imports had exceeded its steel exports for six consecutive years owing mainly to a steady increase in domestic demand; steel imports from China especially had increased (Ministry of Commerce, Industry and Energy, 2008, p. 9).

HSC, which was formerly known as Hyundai INI Steel, and before that, Inchon Iron & Steel Co., Ltd., intended to increase its rebar output by about 213,000 t to more than 4 Mt. In 2008, many small domestic construction firms had suffered from a shortage of rebar as well as financial difficulties. HSC agreed with the Construction Association of Korea's (CAK) approach of helping some of the country's small construction companies and agreed to provide some 5,000 t of rebar to the companies at wholesale prices. Meanwhile, HSC switched its 10,000 metric tons per month of rebar exports to the domestic market, and the company raised its H-beam price by \$48 per metric ton on July 1. The steel product price increases were caused by strong global demand for steel long products (Steel Insights, 2008). In July, HSC increased the price of its hot-rolled steel coils by 10.9% to \$984 per metric ton in response to the increased cost of raw materials, especially the increased prices of pig iron, scrap iron, and Russian and Chinese slabs (South East Asian Trade, 2008). In August, HSC signed contracts with two Australian mining firms—Rio Tinto Ltd. and BHP Billiton Ltd.—to help HSC secure a stable supply of coal. The contract allowed HSC to buy 1 Mt of coal annually from Rio Tinto for the next 10 years and 1.6 Mt of coal annually from BHP Billiton for the next 5 years (Yonhap News Agency, 2009a).

As global economies experienced a significant slowdown, automakers and home appliance makers were making fewer cars and products, respectively, and the demand for and prices of steel dropped sharply in the second half of 2008. POSCO was forced to cut production of crude steel in December 2008 for the first time in its 41-year history. The company expected to cut production of crude steel in 2009 to 29.8 Mt, or by approximately 2 Mt (Zacks.com, 2009).

Lead.—Lead smelter production increased by 25.2% to 244,137 t from 195,022 t in 2007, and lead mine (Pb content) output increased significantly by 36 times to 449 t from 12 t in 2007. Korea Zinc Co. Ltd (Korea Zinc) produced 198,000 t of refined lead in 2008, which was 23,498 t more than was forecasted. The company's 2009 objectives included production of 200,000 t of refined lead; the sales forecast was conservative, however, owing to decreased base-metals prices on the London Metal Exchange (LME) (Korea Zinc Co. Ltd., 2009).

In November 2008, Korea Zinc signed a licensing agreement with Australia based Ausmelt Ltd. (AET) for the construction of two new Top Submerged Lance (TSL)-technology furnaces in Onsan for lead smelting. The new furnaces were expected to have the ability to recover lead from up to 70,000 t/yr of lead-bearing materials, including secondary lead (AZoM.com, 2008).

Molybdenum and Tungsten.—Canada-based Oriental Minerals Inc. was the only western exploration company with

a diverse portfolio of precious and base-metals projects that was operating in the Republic of Korea. The company's projects included the Sangdong tungsten-molybdenum mine, which is located south of Seoul, and the Chongyang tungsten mine, which is located southeast of Seoul. Both tungsten and molybdenum prices had increased significantly during the past several years based on supply and demand, and made the reevaluation of these closed mines highly attractive (MOLY Investing News, 2008). On June 4, Oriental Minerals drilled an additional eight holes of the drill program at Sangdong (Oriental Minerals Inc., 2008d).

Nickel.—In 2008, the Republic of Korea imported 80,323 t of ferronickel (in gross weight), 16,985 t of refined nickel, 39,735 t of nickel oxide sinter (in gross weight), and 1,448 t of nickel powder and flake. The major suppliers of nickel oxide sinter, which contained 75% to 76% nickel, were Canada (43.8%), Australia (7.0%), and Japan (1.0%). The major suppliers of refined nickel were Australia (28.8%), Russia (22.5%), Canada (12.5%), and Norway (5.4%). The country exported 2,028 t of refined nickel and consumed smelter or refinery products containing of 73,317 t of nickel (World Bureau of Metal Statistics, 2009, p. 116).

Nickel was a critical input to the stainless steel industry and was one of the six strategic minerals identified by the Korean Government. POSCO and Société Minière du Sud Pacifique SA (SMSP) of New Caledonia jointly established the Nickel Mining Company (NMC) in New Caledonia and Société du Nickel de Nouvelle Calédonie et Corée (SNNC) in Korea. POSCO had a 49% stake in each company. On November 3, POSCO completed construction of the first ferronickel plant in the Republic of Korea. The SNNC plant, which was located at Gwangyang adjacent to the Gwangyang Steel Mill, was expected to help stabilize the country's supply of nickel. The new ferroalloy plant would refine nickel ore supplied from overseas and would have the capacity to process 30,000 t/yr of nickel in ferronickel. NMC was supplying all the nickel ore for the ferroalloy operation. The output of the Gwangyang ferronickel plant was expected to satisfy 68% of the annual nickel needs of POSCO's steelworks. SNNC supplied nickel to POSCO with a discount from the LME price. POSCO's investment of \$172.5 million in New Caledonia nickel mines was intended to secure a 30-year supply of nickel ore. The SNNC Gwangyang ferronickel plant would process about 1.8 million metric tons per year of ore with an average ore grade of 2.27%. The cost of nickel accounts for 70% to 80% of the cost of making stainless steel; by producing its own nickel, POSCO would save a significant amount of money by not having to buy imported ferronickel or cathode (POSCO, 2008; Société Minière du Sud Pacifique SA, 2008).

Korea Nickel Corp. (KNC) was another leading producer of primary nickel in the Republic of Korea. KNC operated a standalone nickel refinery that produced finished nickel at its Onsan plant. KNC produced 28,653 Mt nickel in 2008, which was a 0.1% decrease from the 28,675 Mt produced in 2007 (Korea Zinc Co. Ltd., 2008).

Zinc.—ZincOx Resources plc. specialized in the low-cost recovery of high-grade zinc compounds from unconventional sources. In June 2008, ZincOx signed a memorandum of understanding with Korea Iron and Steel Association (KOSA),

which was representing the steel industry in the Republic of Korea. KOSA assisted ZincOx in obtaining electric arc furnace dust (EAFD) supply commitments from various steel companies in the country, and together these companies generated approximately 380,000 t/yr of EAFD with a zinc grade of about 22% (ZincOx Resources Plc, 2009).

The Republic of Korea relied on imports for almost all the raw material requirements of its zinc-refining industry. In 2008, imports of zinc ore and concentrate, in gross weight, increased by 11.5% to 1,486,580 t from 1,333,481 t in 2007; the major suppliers were Peru, 454,927 t (or 30.6% of imports); Australia, 383,675 t (25.8% of imports); Russia, 201,022 t (13.5% of imports); Chile, 175,630 t (11.8% of imports); and Bolivia, 159,012 t (10.7% of imports). These imports contained about 743,290 t of zinc metal and were valued at about \$1 billion. Exports of slab zinc increased by 20.7% to 310,672 t in 2008 from 257,314 t in 2007. The major destinations for zinc slab exports were Singapore, 52,723 t (or 17.0% of exports), Taiwan/China, 40,931 t (13.2% of exports); Indonesia, 38,177 t (12.3% of exports); Malaysia, 24,648 t (7.9% of exports); and Vietnam, 22,770 t (7.3% of exports). According to the Korea Institute of Geoscience & Mineral Resources (KIGAM), production of zinc slab decreased by 8.2% to 406,542 t from 443,051 t (revised) in 2007. Consumption of zinc ore and concentrate decreased by 3.1% to 1.35 Mt from the 1.39 Mt produced in 2007, and consumption of zinc slab decreased by 7.6% to 449,022 t from the 486,195 t produced in 2007. Mine production of zinc (Zn content) decreased by 9.7% to 3,672 t from 4,067 t (revised) in 2007 in response to the country's decreased demand for zinc ore and slab and the decrease in the price of zinc (table 1; Ministry of Commerce, Industry and Energy, 2008, p. 9; World Bureau of Metal Statistics, 2009, p. 143).

Young Poong Corp. established the Sukpo zinc refinery in Bongwhagun, Gyung-sangbukdo, in 1970, and established a subsidiary—The Korea Zinc Co.—in Onsan, Gyung-sangnamdo, in 1974. The continued expansion at the Sukpo refinery and the completion of the Onsan zinc refinery secured Young Poong's position in the domestic zinc market, and it emerged as a leading manufacturer of nonferrous metals. The corporation had an annual capacity to produce more than 303,000 t of zinc, including 280,000 t of zinc ingots at its zinc recycling facilities (Young Poong Corp., 2009).

Korea Zinc produced 445,000 t of refined zinc and maintained more than 79% of the domestic market share for zinc metal in 2008. The average price of zinc in 2008 was \$1,875 per metric ton compared with \$3,242 per metric ton in 2007. The decline in zinc prices followed the onset of the global financial crisis. Zinc consumption had progressively decreased because of reduced demand for zinc for galvanizing by steel manufacturers, and the significant cutback in zinc metal demand by the automotive, construction, and shipbuilding sectors. Korea's total production of zinc in 2008 increased by 5,390 t to 948,000 t, compared with 900,000 t (revised) in 2007 (Korea Zinc Co. Ltd., 2008).

Industrial Minerals

Cement.—According to the Xinhua News Agency in Beijing, the Ministry of Science and Technology Education of

the Republic of Korea announced on November 4 that Korean scientists had invented a noncement concrete, which would help reduce greenhouse gas emissions. Korea's Yonhap News Agency reported the noncement concrete was produced by using blast furnace slag instead of cement and fine dust. Compared with ordinary concrete, noncement concrete was said to have better insulating ability, to weigh less, and to cost less to produce. The news agency suggested that it was expected to become the next competitive building material (Xinhua.com.cn, 2008).

Pyrophyllite.—Pyrophyllite was mined in two major areas in the Republic of Korea, both near the coast in the southern part of the peninsula. The largest volume of production was from the Wan-Do Mine in the Haenam area. Some of the major mines in the Haenam area were the Chin-Do, the Dae-Do, the Hwansan, the Okmesan, and the Sungsan Mines. The second major pyrophyllite-producing area was at Dong-Nae where the Kimhae, the Kyong-Nam, the Nilyang, the Pusan, and the Yangsan Mines were worked (Kennedy, 1990, p. 231-232).

Mineral Fuels and Related Materials

Coal.—According to the trade statistics of the Republic of Korea, the country's coal imports in 2008 increased by 12.8% to 99,584,479 t, which was an increase of 11,300,424 t from the 88,284,056 t produced in 2007. Imports from Australia amounted to 38,203,000 t and accounted for 38% of total imports. The average cost, insurance, and freight (CIF) import price increased by 74.6%, to \$124.11 from \$71.10 in 2007. Coal imports included about 73,957,727 t of thermal coal, about 19,671,484 t of metallurgical coal, and about 5,955,268 t of anthracite, which represented increases of 12.8%, 13.9%, and 9.4%, respectively. The country also imported 683,850 t of coal coke, which was a decrease of 8.2% from the 744,977 t imported in 2007; more than 90% of the coal coke was imported from China. These imports were used mainly to meet the country's overall coal requirements for general consumption and for industrial use in the cement, electric power, and iron and steel industries. In 2008, the major suppliers of imported coal were Australia (38,202,892 t), Indonesia (26,551,364 t), the Republic of China (17,876,980 t), Russia (7,495,910 t), Canada (6,521,453 t), Vietnam (1,207,455 t), and the United States (1,041,119 t). The Republic of Korea exported 112,799 t of green petroleum coke, which was a decrease of 45.6% from the 94,647 t exported in 2007; exports by destination included 95,000 t to Japan and 18,000 t to China (TEX Report, The, 2009b).

As of December 31, 2008, the Republic of Korea's electric power capacity from coal-burning thermal power stations increased by 15.8% to 23,705 megawatts (MW), which included 1,125 MW at anthracite-burning stations and 22,580 MW at bituminous-coal-burning stations. The significant increase in the capacity of bituminous coal-burning thermal power stations was based on the startup of the Boryeong No. 7 unit of Korea Midland Power (KOMIPO) and the Yonghung No. 3 unit of Korea South-East Power (KOSEP) in June; and the startup of the Boryong No. 8 unit of KOMIPO, the Hadong No. 7 unit of Korea South Power (KOSPO), and the Yonghung No. 4 unit of KOSEP in December. The output capacities of the new units

would be 500,000 kilowatts (kW) each at the Boryeong No. 7 and No. 8 units and the Hadong No. 7 unit; and 870,000 kW each at the Yonghung No. 3 and No. 4 units. As a result, coal consumption by the country's electric utilities in 2008 increased by 11.9% to 65,280,000 t (TEX Report, The, 2009c).

According to statistics released by the Ministry of Commerce, Industry and Energy of the Republic of Korea, the country's consumption of bituminous coal in 2008 was 93,983,000 t, which included 23,568,000 t of metallurgical coal and 70,415,000 t of thermal coal. The country's consumption of anthracite was 10,217,000 t, which included 4,134,000 t of domestic coal and 6,083,000 t of imported coal (TEX Report, The, 2009a).

Natural Gas and Petroleum.—S-Oil Corp., which was headquartered in Seoul, produced petroleum and lubricant products and exported more than 60% of its petroleum and petrochemical products. In 2008, S-Oil pushed forward the Alkylation project and the Onsan refinery expansion project. The company invested \$19 million (178 billion won) in building a new alkylation facility from 2007 to 2009. It selected Exxon Mobil Corp.'s PxMax® technology to replace a nonselective toluene disproportionate process (TDP) at the Onsan refinery (Exxon Mobil Corp., 2007; Reuters, 2007; S-Oil Corp., 2009). In March, S-Oil and France's Total S.A. signed an agreement to form a 50-50 joint venture, named S-Oil Total Lubricants Co. Ltd. (STLC), which would combine S-Oil's lubricant business division and Total's lubricant subsidiary in the Republic of Korea; STLC would be managed jointly by S-Oil and Total. The new joint venture would have a blending capacity of about 140,000 t/yr in two of Onsan plants—one from Isu Chemicals of Total and another from S-Oil. STLC was expected to combine the two plants into a single site along with the Onsan refinery expansion project; the complex would be expanded to a capacity of more than 2,500 barrels per day by 2009 and would become a leading company on the domestic lubricant market (Gill, 2008; OEM/Lube News, 2008).

Uranium.—Oriental Minerals was conducting two uranium projects in the Republic of Korea—the Dongjeum uranium project and the Ogcheon uranium project. Oriental Minerals had applied for mining rights to four areas covering 11.04 square kilometers (km²) of the Dongjeum uranium prospect; it had also applied for uranium and thorium mining rights for a total of 397.4 km² at Ogcheon (MOLY Investing News, 2008).

On May 28, 2008, KORES had agreed to fund Stage 1 drilling that would target part of Oriental Mineral's Ogcheon uranium project. Stage 1 drilling would consist of a 5-hole, 800-m drill program; Oriental Minerals and KORES would choose the hole locations jointly, and KORES would bear the drilling cost. The 800-m Stage 1 program was part of Oriental Minerals' previously announced 6-km diamond drill program (Oriental Minerals Inc., 2008a).

On July 9th, 2008, Oriental Minerals was granted three uranium exploration and mining licenses known as Daejeon 80 (Reg. No. 77073), Geumsan 81 (Reg. No. 77072), and Goisan 116 (Reg. No. 77074) in the Ogcheon region (Oriental Minerals Inc., 2008b, c).

Outlook

The International Monetary Fund forecasted that the 2009 projections for economic growth of the Republic of Korea would be reduced by about 4% compared with that of 2008 because of the worldwide economic downturn (NASDAQ Stock Market, Inc., The, 2009). As the mining sector accounted for only a minimal portion of the country's GDP in 2008 and because the country relies heavily on imports of raw materials, the Republic of Korea is not expected to be as affected as some other countries by the global decline of the mineral industry. However, there were several uncertain factors that could have a negative effect on the economy, such as the North Korea nuclear issue, the decrease in domestic industrial demand; commodity price and globe monetary exchange rate fluctuations, unemployment, and so forth. The country will most likely continue its commodity stockpile program; investing in Africa, the Middle East, and South America; and implementing its economic and diplomatic strategy to secure its supply of mineral resources.

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TABLE 1
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2004	2005	2006	2007	2008	
METALS						
Bismuth, metal	156	231	236	267	210	
Cadmium, smelter	2,362	2,582	3,320	2,846	3,090	
Copper:						
Mine output, Cu content	2	4	3	6 ^r	4	
Metal:						
Smelter, primary and secondary	442,500	486,500	484,000	515,000	544,000	
Refined, primary and secondary	496,000	519,300	575,500	566,400 ^r	514,243	
Gold:						
Mine output, Au content	kilograms	233	266	277	162	175
Metal, refined	do.	32,449	42,485	43,505	47,078	37,989
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand metric tons	226	213	227	291	366
Fe content	do.	127	119	155	163	205 ^e
Metal:						
Pig iron	do.	27,556	27,309	27,548	29,437	31,043
Ferroalloys:						
Ferromanganese		165,525	124,000	169,202	209,321	251,125
Ferrosilicomanganese		82,917	74,000	94,119	105,607	76,184
Total		248,442	198,000	263,321	314,928	327,309
Steel, crude	thousand metric tons	47,521	47,820	48,455	51,517	53,322
Lead:						
Mine output, Pb content		40	50	17	12	449
Metal, smelter		173,609	180,784	163,379	195,022	244,137
Nickel:						
Ferronickel		--	--	--	--	2,506
Metal		27,200	26,300	28,085 ^r	28,675 ^r	28,653
Silver:						
Mine output, Ag content	kilograms	5,059	3,515	1,521	1,400 ^e	1,462
Metal	do.	1,172,632	1,218,849	1,377,659	1,393,935	1,461,886
Zinc:						
Mine output, Zn content		14	77	16	4,067 ^r	3,672
Metal, primary		668,666	644,828	870,000 ^r	900,000 ^r	948,000
INDUSTRIAL MINERALS						
Barite		50	--	--	--	--
Cement, hydraulic	thousand metric tons	56,955	51,391	53,971	52,182 ^r	51,653
Clays, kaolin	do.	2,780	2,767	2,399	688 ^r	955
Diatomaceous earth		2,441	2,193	3,460	2,360	2,540
Feldspar		541,788	508,644	427,378	398,513	344,257
Graphite, all types		247	39	68	52	73
Lime, slaked lime ^e		3,574,000 ²	3,600,000	3,600,000	3,600,000	3,600,000
Mica, all grades		59,238	36,623	30,356	42,385	49,474
Nitrogen, N content of ammonia		163,400	165,000 ^e	90,000 ^e	-- ^r	--

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	2004	2005	2006	2007	2008	
INDUSTRIAL MINERALS—Continued						
Salt	340,828	378,887	285,568	249,515	384,304	
Soda ash, manufactured ^c	310,000	310,000	310,000	310,000	310,000	
Stone, sand and gravel:						
Limestone	thousand metric tons	87,881	81,432	79,404	82,655 ^r	82,254
Quartzite	do.	2,842	2,868	2,921	3,511	3,325
Sand, including glass sand	do.	554	461	1,437	22,227 ^r	1,757
Sulfur, byproduct: ^c						
Metallurgy	do.	796	800	660	670	660
Petroleum	do.	879	900	950	1,000	900
Total	do.	1,680 ^r	1,700	1,610	1,670	1,560
Talc and related materials:						
Pyrophyllite		827,895	885,559	677,465	798,054	892,625
Talc		79,313	83,471	64,118	9,557	6,438
Zeolites		142,401	173,435	160,056	157,408	217,691
MINERAL FUELS AND RELATED MATERIALS						
Carbon black		473,788	471,716	484,302	497,191	484,000 ^e
Coal, anthracite	thousand metric tons	3,191	2,832	2,824	2,886	2,773
Fuel briquets, anthracite briquets	do.	1,385	2,010	2,327	2,400 ^e	2,320 ^e
Petroleum, refinery products ³	thousand 42-gallon barrels	695,652	727,234	717,493	770,523 ^r	747,827

^cEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. ^rRevised. do. Ditto. -- Zero.

¹Table includes data available through September 30, 2009.

²Reported figure.

³Includes bunker oil C-type, diesel oil, gasoline, kerosene, LPG, and naphtha.

Sources: Ministry of Commerce, Industry and Energy, Korea Institute of Geoscience and Mineral Resources, 2008 supply and demand balance by mineral, p. 9; U.S. Geological Survey Minerals Questionnaire 2004-08; World Bureau of Metal Statistics, May 2009; The Bank of Korea Monthly Statistical Bulletin, Table 41, Exports by principal commodity, and Table 42, Imports by principal commodity, February 2009, p. 130-131.

TABLE 2
REPUBLIC OF 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
Bismuth, metal	metric tons	Korea Zinc Co. Ltd.	Onsan refinery	100
Cadmium	do.	do.	do.	2,000
Do.	do.	Young Poong Corp.	Sukpo refinery	805
Cement		Ssangyong Cement Industrial Co. Ltd.	Plants at Tonghae, Kwang Yang, Munhyung, Pukpyong, and Yeongwol	15,040
Do.		Sung Shin Cement Manufacturing Co. Ltd.	Tanyang plant	13,700
Do.		Tong Yang Major Corp.	Plants at Pukpyong and Samchok	11,580
Do.		Lafarge Halla Cement Corp.	Plants at Kwang Yang and Okkye	9,500
Do.		Hyundai Cement Co. Ltd.	Plants at Tanyang and Yongwol	8,600
Do.		Hanil Cement Manufacturing Co.	Plants at Chungbuk and Tanyang	7,200
Do.		Asia Cement Manufacturing Co. Ltd.	Plants at Daegu and Jaechon	4,600
Coal		Korea Coal Corp.	Mines at Changsung, Dogae, and Hwasoon	2,000
Copper, metal, primary		Korea Zinc Co. Ltd.	Onsan	20
Do.		LS-Nikko Copper Inc.	Changhang	60
Do.		do.	Onsan	510
Gas, natural		Korea National Oil Corp. (KNOC)	Ulleung Basin	NA
Gold:				
In concentrate	kilograms	Hangum Co. Ltd.	Haenam, Cholla Province; Muguk Mine	1,600
Refined	do.	Korea Zinc Co. Ltd.	Onsan	50,000
Do.	do.	LS-Nikko Copper Inc.	do.	60,000
Graphite		Kaerion Graphite Ltd.	Kangwon	NA
Do.		Wolmyong Mining Co.	do.	NA
Indium, metal	kilograms	Korea Zinc Co. Ltd.	do.	55,000
Iron Ore		NA	Mines at Sinyemi, Gangwon-do Province	300
Lead, metal, primary		Korea Zinc Co. Ltd.	Kangwon	200
Molybdenum	metric tons	Korea Resources Corp. (KORES)	Mine at Uljin; Smelter at Yeosu, South Jeolla Province	6,000
Nickel:				
Metal		Korea Nickel Corp.	Onsan nickel refinery plant	48
Ferronickel		POSCO	Gwangyang ferronickel plant	30
Petroleum, refinery products	thousand 42-gallon barrels per day	SK Corp.	Ulsan	817
Do.	do.	LG-Caltex Corp.	Yocheon (Yosu)	650
Do.	do.	Hyundai Oil Refinery Co.	Daesan and Incheon	589
Do.	do.	S-Oil Corp.	Onsan	520
Pyrophyllite		NA	Wan-Do, Sungsan, Hwasan, Okmesan, Dae-Do, and Chin-Do Mines in Haenam	446
Do.		NA	Nilyang, Yangsan, Kimhae, Pusan, and Kyong-Nam Mines in Dong-Nae	446
Silver:				
In concentrate	kilograms	Hangum Co. Ltd.	Haenam, Cholla Province	3,700
Refined	metric tons	Korea Zinc Co. Ltd.	Onsan	1,000
Do.	do.	LS-Nikko Copper Inc.	do.	370
Steel, crude		Pohang Iron and Steel Co. Ltd.	Kwangyang (Gwangyang) Works	15,000
Do.		do.	Pohang Works	13,000
Do.		Hyundai Steel Co. Ltd. (HSC)	Inchon Plant	4,800
Do.		do.	Pohang Plant	3,200
Do.		Dongkuk Steel Mill Co. Ltd.	Inchon Works	1,450
Do.		do.	Pohang Works	3,600
Do.		Korea Iron and Steel Co. Ltd.	Masan and Changwon Works	1,200
Talc		IL Shin Industrial Co. Ltd.	Choong Ju, Chungcheongbuk Province	160
Do.		Korea Zinc Co. Ltd.	Onsan	430
Do.		Young Poong Corp.	Sukpo	280
Zinc		Korea Zinc Co. Ltd.	Onsan refinery	445
Do.		Young Poong Corp.	Sukpo refinery	303

NA Not available. Do., do., Ditto