

JAPAN

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Japan has negligible mineral resources of energy and ferrous and nonferrous metals, although it has considerable resources of coal and industrial minerals, especially carbonate rocks, clays, iodine, and silica. The cost of production of coal, however, is too high, and Japan cannot compete with the major coal-producing countries of the world market. Japan relied heavily on imports of coal, natural gas, crude petroleum, and a wide variety of mineral ores and concentrates to produce inorganic chemicals and petrochemicals, electrical power, ferrous and nonferrous metals, industrial mineral products, and refined petroleum products for domestic consumption and exports. To maintain its position as one of the major industrial leaders in the market economies, Japan has developed a large minerals-processing industry within the manufacturing sector. This minerals-processing industry produces basic materials for manufacture of industrial and consumer goods for domestic and overseas markets. Japan's production capacities of cement, chemicals, iron and steel, nonferrous metals, and refined petroleum products were among the world's largest.

Japan was one of the world's top consumers and importers of primary aluminum, cadmium metal, chromite, coal, cobalt metal, copper ore and metal, diamond, ferrochromium, ferronickel, fluorspar, gallium metal, iron ore, ilmenite and rutile, indium metal, industrial salt, lead ore and metal, liquefied natural gas (LNG), lithium metal, manganese ore, nickel ore and metal, crude petroleum, potash, phosphate rock, precious metals, rare earths, silicon metal, steel, zinc ore and metal, and zircon. Japan was one of the world's major exporters of cement, mineral-related chemicals and fertilizer materials, iodine, electrolytic manganese dioxide, high-purity rare (minor) metal products, steel products, and titanium sponge metal and mill products.

Because of the small output from operating mines in 1999, the contribution of the mining sector to Japan's gross domestic product (GDP) was estimated to have remained at less than 0.2%. The contribution of the minerals-processing sector to the GDP, however, was estimated to be more than 5%. Japan's mineral industry, which includes the mining and mineral processing sectors, was important to the Japanese economy because of its vital role in supplying primary materials not only to its own construction and manufacturing sectors, but also to those sectors of the neighboring countries in northeast and southeast Asia.

The Japanese economy returned to a positive growth of 0.2% in 1999 from a negative growth of 2.5% in 1998 owing largely to a 7.8% increase in public spending through a Government economic stimulus package, which was introduced in November 1998, and a 1.2% increase in private consumption despite a 5.9% decrease in private business investment. Japan's GDP was estimated to be \$4,347 billion in 1999. The country's unemployment rate increased to 4.7% in 1999 from 4.1% in

1998 as a result of continued restructuring in the financial, manufacturing, and mining sectors. Japan's trade balance improved slightly to a surplus of \$123.4 billion in 1999 from a surplus of \$122.8 billion in 1998. The Japanese yen appreciated by 15% to 113.9 yen to 1 U.S. dollar in 1999. As measured by the Consumer Price Index, Japan experienced a 0.3% deflation in 1999 compared with a low inflation of 0.6% in 1998 (International Monetary Fund, 2000, p. 42).

Government Policies and Programs

In 1999, the Government continued to promote overseas mineral exploration through the Metal Mining Agency of Japan (MMAJ) by providing financial and technical assistance, which included the transfer of advanced exploration technology to the governments of mineral-rich developing countries for exploration and development of their mineral resources. The MMAJ also provided loans and exploration assistance to support private Japanese companies and their foreign partners involved in joint exploration works overseas.

As part of the Japanese Government's Official Development Assistance Program, the MMAJ, in cooperation with the Japan International Cooperation Agency (JICA), signed an agreement with the Government of Mongolia in May 1999 to conduct a 2-year reconnaissance survey for copper and gold deposits in central north Mongolia. Under the agreement, the MMAJ was to conduct a satellite image analysis and other geologic studies to identify the target area to be further explored and to transfer satellite image technology to the Mineral Resources Authority of Mongolia. The 2-year project, which is in a 200,000-square-kilometer survey area that covers Arkhangai, Bulgan, Hosgol, and Zavhan Aymags, was to be carried out between 1999 and 2000 (Nikkan Sangyo Shimbun, 1999a). In December, the MMAJ signed an agreement with Tunisia's National Office of Mines for the exploration and development of mineral resources in the northwestern part of Tunisia. Under the agreement, the MMAJ was to spend up to \$3 million to explore an area between the cities of El Krib and Mejez El Bab between 2000 and 2003 (Mining Journal, 1999d).

In 1999, the MMAJ's active overseas projects included two 2-year reconnaissance survey projects and twelve 3-year mineral exploration projects. The two reconnaissance surveys were for copper, gold, lead, and zinc in the Urubamba River area in Peru and for copper, gold, silver, and zinc in the southern Andes area in Argentina. The 12 mineral exploration projects were for copper and gold in the Oruro-Uyuni area in Bolivia; gold in the Alta Floresta area in Brazil; copper, gold, and molybdenum in region I in Chile; copper, gold, and molybdenum in the Telektynski-Uplift area in Kazakhstan; copper and gold in the Kichi-Sandyk area in Kyrgyzstan; gold in the Kekoro and Baoule-Banifing areas in Mali; copper, gold, lead, silver, and

zinc in the Inmaculada, Oregano, and Inde Uno areas in Mexico; copper and gold in the South Batinah coastal area in Oman; copper and gold in the Bico North area in the Philippines; copper, gold, and zinc in the Umm Ad Damar area in Saudi Arabia; lead and zinc in the Mae Sariang area in Thailand; and gold and silver in the Southern Nuratau area in Uzbekistan (Metal Mining Agency of Japan, 2000b).

The MMAJ provided financial and technical support for nine private overseas exploration projects conducted by Japanese companies in 1999. The exploration projects were for copper and gold by Mitsubishi Materials Corp. in the Los Dos Buhos area of Argentina; copper and gold by Sumitomo Metal Mining Co. Ltd. in the Orange area in Australia; gold by Mitsubishi Materials in the Bahia area in Brazil; copper, gold, and molybdenum by Mitsubishi Materials in the Amarillo-Sealeste and the El Miragro areas in Chile; copper, gold, lead, and zinc by Sumitomo Metal Mining in the eastern part of Kazakhstan; copper and gold by Nippon Mining and Metals Co. Ltd. in the Kainantu area in Papua New Guinea; lead and zinc by Mitsui Mining and Smelting Co. Ltd. in the central part of Peru; and copper and gold by Sumitomo Metal Mining in the Stone Boy property of Alaska in the United States (Metal Mining Agency of Japan, 2000b).

In August 1999, four Japanese geologists employed by the MMAJ and JICA were kidnapped by gunmen in Kyrgyzstan. The geologists were exploring for copper and gold near Osh in southwestern Kyrgyzstan (Mining Journal, 1999a). The gunmen, who had held the four Japanese geologists hostage in Kyrgyzstan's southern hills for more than 2 months, demanded a \$2 million ransom (Mining Journal, 1999c). The four Japanese geologists were, however, released by their abductors in late October 1999 without any ransom payment or conditions and were flown safely back to Japan (Mining Journal, 1999b).

To maintain economic stability in the event of an emergency or long-term supply disruption, the Government (through the MMAJ) and the private sector (through the Japan Rare Metals Association) continued to maintain their strategic stockpile of chromium, cobalt, manganese, molybdenum, nickel, tungsten, and vanadium in 1999. The MMAJ sold two lots of ferrovanadium to the steelmakers and vanadium converters in April and June 1998 because of the abnormally high vanadium prices. The total amount of national stockpile remained at 32.8 days of consumption, which is about 78.1% of the stockpile target in 1998 and 1999. The 60-day stockpile target comprised 42 days of national stockpile and 18 days of private stockpile (Metal Mining Agency of Japan, 2000a, p.11-12).

Environmental Issues

To protect the environment, the Japanese Government strengthened existing and issued new environmental laws in 1999. Of the new laws, the Environmental Impact Assessment Law makes environmental assessments for big construction projects mandatory. The Law Concerning Promotion of Use of New Energy provides financial assistance, such as interest-free loans, to developers and users of nonfossil fuel energy sources, such as solar, wind, and thermal generation systems. The Containers and Packing Recycling Law compels companies to recycle plastics, polyethylene terephthalate (PET), glass bottles, and papers. The Law for Recycling Specific Kinds of Home Appliances requires electric home appliances manufacturers to

collect and recycle their products and consumers to bear some costs (Nikkei Weekly, 2000). The law related to discharge of chemical substances, which was still waiting for approval by the Diet (Japanese Parliament), would require companies with 10 or more employees to provide data on discharged and transported amounts of chemical substances to the Central Government through the Prefectural government. The chemical substances list included about 300 chemicals harmful to humans or damaging to the ozone layer (Nikkan Sangyo Shimbun, 1999b).

In compliance with the new law for recycling certain home appliances, Mitsubishi Electric Corp. brought on-stream a metal recycling plant at Ichikawa in Chiba Prefecture in 1999 to dismantle and recover the ferrous and nonferrous metals from end-of-life electrical appliances and office automation equipment. The new plant was the first large-scale facility of its kind in Japan. Hyper Cycle Systems Corp. and Green Cycle Systems Corp., which were subsidiaries of Mitsubishi Electric, operated dismantling plants at Ichikawa. Hyper Cycle System's plant was capable of dismantling 300,000 units per year of home appliances, such as washing machines, refrigerators, televisions, and air conditioners. Hyper Cycle System planned to double its dismantling capacity by 2001. Green Cycle System's plant was capable of dismantling 400,000 units per year of office equipment, such as copiers, personal computers, and printers. Despite the fact that the new recycling law did not cover the office equipment, Mitsubishi Electric claimed that it can secure a steady quantity of end-of-life machines to be processed by Green Cycle System to improve economies of scale. The annual amount of aluminum, copper, steel, and other metals recycled at Mitsubishi Electric's plant was not reported. Sanyo Electric Co. Ltd. and Hitachi Electronics Ltd. reportedly were planning to build similar recycling facilities (Metal Bulletin, 1999a).

In July, Dowa Mining Co. Ltd. established a subsidiary called Eco-Recycling Co. Ltd. at Ohdate in Akita Prefecture to operate the metals recycling business. To recover nonferrous metals by dismantling about 132,000 units per year of end-of-life electrical appliance beginning in 2001, Dowa Mining was to spend about \$13 million to renovate its nonferrous metals smelting and refining facilities at Kosaka in Akita Prefecture (Japan Metal Review, 1999a).

Nippon Mining and Metals, through its wholly owned subsidiary Nikko Mikkaichi Recycle Co. Ltd., suspended secondary zinc production at Mikkaichi in Toyoma Prefecture in September and decided to spend \$8.8 million for a new furnace to process and recycle industrial waste, such as shredder residue from scrapped cars and electric appliances. The facilities were capable of handling 70 metric tons per day (t/d) of waste. Copper and other metals were also recovered (Metal Bulletin, 1999f).

Production

Mine production of most nonferrous metals and industrial minerals continued to decline in 1999 because of low domestic metal prices, depleting nonferrous ore reserves, and weak domestic demand for construction materials. Coal mine output increased slightly from that of 1998. The output of crude petroleum decreased to its lowest level in 10 years, and the output of natural gas remained at about the same level as that of 1998.

In the minerals-processing sector, nonferrous metals production was mixed. Production of copper, gold, electrolytic manganese dioxide, nickel, platinum-group metals, rare-earth oxides, silver, tin, tungsten, zinc, and such minor metals as antimony, bismuth, gallium, germanium, and indium increased. Metal production of primary aluminum, cobalt, ferroalloys, lead, high-purity silicon, tellurium, and titanium sponge decreased. Production of iron and steel increased slightly because of improved domestic and export market conditions, especially in the Asian market. Production of cement and other construction-related materials decreased slightly because of the continued low level of domestic construction activity. Production of most refined petroleum products was slightly higher because of improved economic conditions in 1999 (table 1).

Trade

Japan was a net importer of minerals mainly because of its large need for mineral fuels. Japan's mineral trade deficit increased to \$51.1 billion in 1999 from \$43.3 billion in 1998. The higher imports of mineral fuels and lower exports of iron and steel and cement resulted in a larger mineral trade deficit in 1999.

According to the Ministry of Finance (1999, imports p. 9-41), total imports of minerals were valued at \$81.7 billion and accounted for 26.4% of the total imports, which were valued at \$309.6 billion in 1999. Of the total minerals imports, \$49.9 billion was for such mineral fuels as coal, LNG, crude and partially refined petroleum, refined petroleum products, and other mineral fuels; \$6.2 billion, for ores and concentrates of ferrous and nonferrous minerals, other metals, metal compounds, and slag, scrap, and ash of iron and steel; and \$1.4 billion, for such industrial minerals as salt, sulfur, earths and stone, plastering materials, lime, and cement. Imports of processed minerals, mineral-related chemicals, and metals totaled \$24.2 billion, of which \$3.3 billion was for mineral-related chemicals and fertilizers; \$12 billion, for products of iron and steel and nonferrous, rare, and other base metals; \$6.4 billion, for precious and semiprecious stones and precious metals; and \$2.5 billion, for products of asbestos, cement, ceramics, glass, mica, and stone.

Total exports of minerals, mineral-related chemicals, and processed minerals products were valued at \$30.6 billion and accounted for 7.3% of Japan's total exports, which were valued at \$417.5 billion in 1999 (Ministry of Finance, 1999, exports p. 9-41). Exports of iron and steel products and nonferrous, rare, and other base metals totaled \$21.4 billion. Exports of processed mineral products of asbestos, cement, ceramics, glass, mica, and stone amounted to \$4.1 billion. Exports of salt, sulfur, earths and stone, plastering materials, lime, cement, mineral fuels, and nonferrous minerals were estimated to be \$1.6 billion. Exports of mineral-related chemicals and fertilizer totaled \$1.9 billion. Exports of precious and semiprecious stones and precious metals amounted to \$1.7 billion (table 4). Physical measures of exports and imports of mineral commodities in 1997 and 1998 are shown in tables 10 and 11.

Structure of the Mineral Industry

Japan's mineral industry consisted of a small mining sector of coal and nonferrous metals, a large mining sector of industrial

minerals, and a large minerals-processing sector of ferrous and nonferrous metals and industrial minerals. Mining and mineral-processing businesses were owned and operated by private companies incorporated in Japan.

In the mining sector, coal was produced from two major mines and several small-scale mines in Honshu (main island), Hokkaido, and Kyushu with a total capacity of about 4 million metric tons per year (Mt/yr). The workforce numbered 2,900, of which 2,000 were regular employees. In 1999, the number of operating nonferrous metals mines remained unchanged at 14, but the number of employees decreased to 1,139 from 1,151 in 1998. The number of operating industrial minerals mines declined to 522 from 539 in 1998, and the number of employees decreased to 11,655 from 11,709 in 1998. Because of the consolidation in the cement industry, the number of operating limestone quarrying companies decreased considerably in 1999 (Ministry of International Trade and Industry, 2000, p. 4-7).

In the mineral-processing sector, the steel industry continued to cut its employment to 202,059 from 214,190 in 1998. The industry's production capacity of pig iron decreased to 93.99 Mt/yr from 95.25 Mt/yr in 1998, and the production capacity of crude steel also decreased to 146.94 Mt/yr from 149.76 Mt/yr in 1998. To meet the growing demand, Japan expanded production capacity of nickel oxide at Tokyo Nickel Co. Ltd.'s Matsuzaka plant and production capacity of refined nickel at Sumitomo Metal Mining's Niihama plant. Japan was expanding production capacity of electrolytic manganese dioxide at Tosoh Corp.'s Hyuga plant. Japan's copper refining capacity had been expanded at Kosaka Smelting and Refining Co. Ltd.'s Kosaka plant, Mitsubishi Materials' Naoshima plant, and Nippon Mining and Metals' Hitachi and Saganoseki plants in 1999. The lead-refining capacity remained unchanged, but the zinc-refining capacity had been expanded at Akita Smelting Co. Ltd.'s Iijima plant in Akita Prefecture and Hachinohe Smelting Co. Ltd.'s Hachinohe plant in Aomori Prefecture in 1999. The copper smelting and refining industry's workforce decreased to 3,713 from 3,822 in 1998. The workforce in the lead smelting and refining industry increased to 830 from 822 in 1998 and that in the zinc smelting and refining industry decreased to 1,292 from 1,389 in 1998 (table 2; Ministry of International Trade and Industry, 2000, p. 30-31).

Commodity Review

Metals

Alumina.—Japan had three alumina refineries that used imported bauxite for production of alumina and aluminum hydroxide for domestic consumption and exports. In the domestic market, according to Japan Aluminum Association (2000, p. 53), alumina was consumed for manufacture of abrasive, ceramics, refractories, and welding rods. Aluminum hydroxide was consumed for manufacture of flocculant, fluoride, plastics, rubber, and synthetic zeolite. Exports of alumina went mainly to, in decreasing order, the Republic of Korea, Taiwan, Thailand, China, Indonesia, Malaysia, Australia, and the United States. Exports of aluminum hydroxide went mainly to, in decreasing order, the Republic of Korea, Taiwan, Thailand, Indonesia, and Australia.

According to the Japan Aluminum Association (2000, p. 30), production of alumina and aluminum hydroxide was by Nippon

Light Metal Co. Ltd. (NLM) at the Shimizu plant in Shizuoka Prefecture, Showa Denko K.K. (SD) at the Yokohama plant in Kanagawa Prefecture, and Sumitomo Chemical Co. Ltd. (SC) at the Ehime plant in Ehime Prefecture. In 1999, NLM produced 147,076 metric tons (t) of alumina and 344,398 t of aluminum hydroxide, SD produced 96,509 t of alumina and 204,642 t of aluminum hydroxide, and SC produced 91,472 t of alumina and 187,551 t of aluminum hydroxide. In October, SD stopped production of refractory-grade alumina at its Yokohama plant because of the high production cost and increased competition from low-cost producers in Australia, India, and the Republic of Korea. SD, however, continued to produce abrasive- and non-refractory-grade alumina (Industrial Minerals, 1999).

Imports of bauxite amounted to 1.95 million metric tons (Mt) and were valued at \$47.8 million in 1999. The major suppliers were Australia, 959,117 t; Indonesia, 766,563 t; and India, 159,907 t (Ministry of Finance, 1999, imports p. 162). Exports of alumina and aluminum hydroxide were 107,970 t and 199,347 t, respectively, and exports earnings from alumina and aluminum hydroxides totaled \$96.8 million in 1999 (Ministry of Finance, 1999, exports p. 108).

Aluminum.—NLM, which was Japan's sole producer of primary aluminum with a 20,000-metric-ton-per-year (t/yr) primary aluminum smelter at Kambara in Shizuoka Prefecture, produced less than 1% of Japan's requirements for primary aluminum. In 1999, about 99% of Japan's requirements for primary aluminum was met by imports. Imports of primary aluminum totaled 2.66 Mt, of which 1.83 Mt was regular-grade primary aluminum with purity of 99.99% or more but not less than 99% aluminum, and 826,224 t was primary aluminum alloys. The import bill for primary aluminum amounted to \$3.6 billion (Ministry of Finance, 1999, imports p. 623). Under an agreement with the World Trade Organization, Japan's tariff on primary aluminum was zero (duty free) in 1999 (Japan Tariff Association, 1999, p. 829).

Japan widely diversified its supply sources of primary aluminum because of its heavy reliance on imports. According to a report on Japan's primary aluminum imports for fiscal year 1999, about 47% of imported primary aluminum was supplied from Japan's nine overseas aluminum smelter projects in which the Japanese aluminum and major trading companies held a substantial portion of the equity interest in those smelters in Australia, Brazil, Canada, Indonesia, New Zealand, the United States, and Venezuela (table 5); about 51%, from 12 of the world's major primary aluminum producers with long-term supplying contracts; and about 2%, from suppliers in the spot markets (Marubeni Corp., 2000). According to the Ministry of Finance (1999, imports p. 623), among the primary aluminum overseas suppliers, the top 10 supplying countries were Russia, 23%; Australia, 20%; Brazil, 10%; New Zealand, 7%; Venezuela, 6%; Canada, 5%; China, 4%; and Indonesia, the United Arab Emirates, and the United States, 3% each.

To secure an additional captive supply of primary aluminum from overseas aluminum smelters, Mitsubishi Corp., which was a major trading company, acquired a 25% interest in Mozambique Aluminum Co. (Mozal) in 1999. Mozal reportedly was constructing a 295,000-t/yr primary aluminum smelter with 288 pots near Maputo in Mozambique and expected to complete about 70% of the construction work by yearend 1999. Mozal planned to bring on-stream the primary

aluminum smelter by December 2000. The smelter feed, alumina, would be imported from Australia. Other equity owners of Mozal were Billiton Plc. of the United Kingdom, 47%; Industrial Development Corp. of South Africa, 24%; and the Government of Mozambique, 4% (Mining Journal, 1999e).

According to the Ministry of International Trade and Industry (1999d, p. 128), domestic demand for primary aluminum increased by 1.4% in 1999 to 2.02 Mt, of which 1.72 Mt was for rolling and extrusion; 97,079 t, for casting; 49,262 t, for electric wire; 69,971 t, for secondary aluminum smelting; 26,508 t, for steelmaking (deoxidization); 30,256 t, for diecasting; and 35,910 t, for other uses. The yearend stocks of primary aluminum decreased to 307,173 t from 418,689 t in 1998, of which 195,746 t was dealer inventory; 96,292 t, consumer inventory; and 15,135 t, the single primary aluminum producer's inventory.

Exports of primary aluminum, which included aluminum alloys, totaled 10,515 t and were valued at \$21.6 million in 1999. The major buyers were the Republic of Korea, 24%; China and Hong Kong, 14% each; Indonesia, 12%; the Philippines, 9%; Malaysia, 4%; and Germany, Singapore, South Africa, and the United States, 3% each (Ministry of Finance, 1999, exports p.579).

Chromium.—Japan relied on imports to meet all chromium requirements for its iron and steel industry. According to the Ministry of Finance (1999, imports p. 162), Japan's imports of chromium ore and concentrate decreased by 9% to 380,115 t and were valued at \$31.4 million in 1999. The major suppliers were South Africa, 68%; India, 19%; and Iran, 9%. Consumption of chromite by the iron and steel industry decreased by 12% to 332,486 t, of which 226,149 t was consumed by the ferroalloy industry and 106,337 t by others. The iron and steel industry's yearend inventory of chromium ore amounted to 213,542 t, which was equivalent to a 7-month consumption stock (Ministry of International Trade and Industry, 1999c, p. 87).

Production of ferrochromium dropped by 16% to 119,777 t in 1999 owing to high production costs and low import prices. Between 1993 and 1997, several Japanese ferrochromium producers had closed or reduced their production capacity, shifted a portion of their production through equity participation and technology transfer to the production facilities in South Africa and Zimbabwe, and then shipped their output share back to Japan.

According to the Japan Ferroalloy Association (2000b, p. 1), Nippon Denko K.K. acquired a 50% interest in NST Ferrochrome Pty. Ltd., which was a joint-venture firm established with Samancor Ltd. of South Africa in 1993. NST Ferrochrome operated a 60,000-t/yr high-carbon ferrochromium plant (Samancor's no. 5 furnace) at Tubatse, which shipped about 30,000 t/yr of high-carbon ferrochromium to Japan. SD and Marubeni Corp. acquired equity interest of 20.7% and 13.8%, respectively, in Middleburg Technochrome Pty. Ltd., which was a joint-venture firm with Samancor in 1995. Middleburg Technochrome operated a 38,000-t/yr low-carbon ferrochromium plant and a 24,000-t/yr ferrosilicochromium plant at Middleburg, which shipped about 13,000 t/yr of low-carbon ferrochromium and about 8,300 t/yr of ferrosilicochromium to Japan. Japan Metals & Chemicals Co. Ltd. and Mitsui & Co. Ltd. acquired equity interests of 25%

each in Zimbabwe Alloys Ltd. of Zimbabwe in 1997. Zimbabwe Alloys operated a 35,000-t/yr low-carbon ferrochromium plant at Gweru, which shipped 14,000 t/yr of low-carbon ferrochromium to Japan.

Imports of ferrochromium, which included high- and low-carbon ferrochromium, decreased by 4.5% to 599,835 t. The top six supplying countries were South Africa (60.5%), Zimbabwe (12.3%), Kazakhstan (10.5%), India (8.5%), China (2.9%), and Russia (2.5%). Imports of ferrochromium were valued at \$287 million in 1999 (Ministry of Finance, 1999, imports p. 587).

According to the Japan Ferroalloy Association (2000a, p. 3), consumption of ferrochromium increased by 0.9% to 758,211 t, of which 717,927 t was high-carbon ferrochromium and 40,284 t was low-carbon ferrochromium. Exports of ferrochromium were 1,461 t, of which 79% went to the United States, 8% to Thailand, and 13% to other countries. Exports of ferrochromium were valued at \$3.2 million (Ministry of Finance, 1999, exports p. 496-497).

Cobalt.—Japan relied on imported cobalt matte and other intermediate products of cobalt for metal production. Sumitomo Metal Mining, which was Japan's sole producer of cobalt metal and chemicals, operated a cobalt refinery in Niihama, Ehime Prefecture, with a rated capacity of 500 t/yr. Japan also imported cobalt metal and chemicals to meet its annual requirements.

In 1999, imports of cobalt matte, other intermediate products of cobalt, cobalt ingots, and other articles of cobalt totaled 7,473 t. The major suppliers were Canada (21%), Zambia (19%), Australia (15%), Norway (14%), Finland (9%), Belgium (7%), the Democratic Republic of the Congo (7%), and Russia (2%). Japan also imported 2,489 t of cobalt oxide and 331 t of hydroxide. Belgium, which was the principal supplier of cobalt oxides accounted for 95%. The top three suppliers of cobalt hydroxide were Belgium, Finland, and the United States, which accounted for 53%, 31%, and 11%, respectively. Import bills for cobalt metal and chemicals were valued at \$241 million and \$89 million, respectively (Ministry of Finance, 1999, imports p. 174, 630-631).

According to the Ministry of International Trade and Industry (1999d, p. 138), domestic demand for cobalt metal in 1999 increased by 1.29% to 2,408 t, of which 532 t was for manufacturing of magnetic materials; 481 t, for specialty steel; 388 t, for pipe, plate, rod, and wire; 360 t, for ultrahard tool steel (cemented carbides); 197 t, for catalysts; and 450 t, for other end uses. The increased demand for cobalt was most significant in the magnetic materials sector, which rose by 62%. Demand for cobalt metal for manufacturing of specialty steel decreased by 27%. In addition to the Government statistics on demand for cobalt in the domestic market, domestic demand for cobalt for manufacture of batteries was estimated by Mitsui & Co. to have been about 2,900 t in 1998 (Industrial Rare Metals, 1999, p. 87). At the May 2000 Cobalt Conference in Tokyo, Mitsui & Co. Ltd. estimated that Japan's cobalt demand for battery application had risen to about 3,400 t in 1999 (Terada, 2000, p. 7).

Copper, Lead, and Zinc.—Mine production of copper, lead, and zinc was by the Kamioka Mining and Smelting Co. Ltd. at the Kamioka Mine in Gifu Prefecture and the Toyoha Mining

Co. Ltd. at the Toyoha Mine in Hokkaido Prefecture. Mine output of copper, lead, and zinc decreased in 1999. According to the Ministry of International Trade and Industry (1999d, p. 30-31, 51-53), domestic mine output of copper, lead, and zinc was equivalent to 0.07%, 2.67%, and 10.15%, respectively, of Japan's raw material requirements for its copper, lead, and zinc smelting and refining industry.

In 1999, Japan was the world's largest importer of copper concentrate and one of the world's major importers of lead and zinc concentrates. Because of expanded copper smelting and refining capacity, Japan's imports of copper concentrate increased to more than 4 Mt, which contained about 1.25 Mt of copper. According to the Ministry of Finance (1999, imports p. 162), Japan's imports of copper concentrate increased by 7.9% to 4.29 Mt and were valued at \$2.14 billion. The top six suppliers of copper concentrate were Chile, 41.7%; Indonesia, 19.4%; Canada, 12.3%; Australia, 8.2%; Papua New Guinea, 6.6%; and Argentina, 4.8%. Japan's imports of lead and zinc concentrates were 167,880 t and 1.12 Mt and were valued at \$46 million and \$289 million, respectively. The major suppliers of lead concentrate were Australia, 38.1%; the United States, 34.4%; Peru, 14.2%; and Russia, 6.6%. The major suppliers of zinc concentrate were Australia, 43.2%; Peru, 15.7%; the United States, 12.2%; and Chile, 8.3%.

To secure more captive copper concentrate from overseas nonferrous metals mines in which Japanese nonferrous metal mining and major trading companies held major or substantial portion of equity, Japanese companies reached three separate agreements in 1999 to invest in overseas exploration and development projects of nonferrous metals mines.

In February, Dowa Mining reached an agreement with Inco Ltd. of Canada for Dowa Mining to fund a 2-year exploration program on Inco's Murgul project (Pontid Belt properties) in northeastern Turkey and on Inco's Maluku project on the islands of Ambon, Haruku, Nusa Laut, and Saparua in Indonesia. Under the agreement, Dowa Mining would earn a 49% interest in Murgul as well as a 49% interest in Maluku (Northern Miner, 1999).

In April, Mitsubishi Corp. announced that it had acquired a 10% interest with a \$114 million investment and loan package in Compania Minera Antamina, which was developing the Antamina copper-molybdenum-zinc mine in Peru. In return, the Antamina Mine was to ship 200,000 t/yr of copper concentrate and 80,000 t/yr of zinc concentrate to Japan beginning in late 2001 (Nikkan Sangyo Shimbun, 1999c).

In May, Nittetsu Mining Co. Ltd. announced that it would take a 60% stake in the joint-venture company Atacama Mine Co. Ltd. with a Chilean partner, Inversiones Errazuriz (40%), for the development of a copper mine in the Tierra Amarilla region in the northern part of Chile. Under the company's development plan, construction work on the mine would take about 2 1/2 years and would cost about \$130 million. The mine was expected to produce 90,000 t/yr of copper concentrate, of which about 45,000 t/yr would be shipped to Japan (Nikkei Sangyo Shimbun, 1999b).

Metal production of copper and zinc increased by 5%, and metal production of lead decreased by 3% in 1999. Demand for copper and lead decreased, but demand for zinc increased in the domestic market. Exports of copper, lead, and zinc increased. Increased exports of copper, lead, and zinc had helped Japan's nonferrous metals smelting and refining industry to maintain the

high capacity utilization rates of 96.7% for copper, 82.9% for lead, and 90.4% for zinc.

In anticipation of the continued growth in demand for nonferrous metals in the Asian markets, Japan's major nonferrous metals companies completed expansion of their nonferrous metals smelting and refining facilities in 1999. According to the Ministry of International Trade and Industry (2000, p. 30), Nippon Mining and Metals expanded the copper smelting capacity to 451,200 t/yr from 350,000 t/yr and the refining capacity to 252,000 t/yr from 218,400 t/yr at its Saganoseki plant in Oita Prefecture. Nippon Mining and Metals also expanded the refining capacity to 168,000 t/yr from 132,000 t/yr at its Hitachi plant in Ibaraki Prefecture. Mitsubishi Materials expanded the refining capacity to 216,000 t/yr from 189,600 t/yr at its Naoshima plant in Kagawa Prefecture. Kosaka Smelting and Refining Co. Ltd., which was a wholly owned subsidiary of Dowa Mining, expanded the refining capacity to 72,000 t/yr from 60,000 t/yr at its Kosaka plant in Akita Prefecture. As a result of these expansions, Japan's copper smelting capacity was raised to 1.73 Mt/yr from 1.63 Mt/yr and copper refining capacity to 1.42 Mt/yr from 1.31 Mt/yr.

To balance its refining and smelting capacities, Nippon Mining and Metals announced in August that it would spend about \$5.3 million to expand its Saganoseki refining capacity to 270,000 t/yr by 2000 from 252,000 t/yr and its Hitachi refining capacity to 180,000 t/yr by 2000 from 168,000 t/yr. Nippon Mining and Metals also would spend about \$2.6 million to increase processing capacity of rare and precious metals at its Saganoseki facilities by 15% to 2,200 t/yr by March 2000 (Metal Bulletin, 1999d). Mitsubishi Materials announced in December that it planned to expand its Naoshima refining capacity to 270,000 t/yr from 216,000 t/yr to synchronize with its smelting capacity of 270,000 t/yr by 2002 (Metal Bulletin, 1999b).

In 1999, Akita Smelting, which was a joint venture of Dowa Mining, Nippon Mining and Metals, Sumitomo Metal Mining, and Mitsubishi Materials, completed expansion of its zinc-refining capacity to 195,600 t/yr from 186,000 t/yr at the Iijima plant. Hachinohe Smelting, which was a joint venture of Mitsui Mining and Smelting, Nippon Mining and Metals, and other companies, also completed expansion of its zinc refining capacity to 117,600 t/yr from 108,000 t/yr at the Hachinohe plant (Ministry of International Trade and Industry, 2000, p. 31).

In overseas copper smelting/refining projects, Furukawa Co. Ltd. and its partners completed expansion and renovations on the Port Kembla copper smelter-refinery complex in Australia, which they had acquired from Southern Copper Ltd. in 1996. The startup operation of the 120,000-t/yr smelter refinery complex was rescheduled to October from June 1999. The delay was caused by bad weather and the shortage of construction workers who were involved in a construction rush in the 2000 Sydney Olympics preparations (Nihon Keizai Shimbun, 1999). In July, Furukawa signed an agreement with P.T. Newmont Nusa Tenggara of Indonesia to import 80,000 t/yr of copper concentrate from the Batu Hijau Mine in Indonesia. About 40,000 t/yr of copper concentrate was to be delivered to the Port Kembla copper smelter-refinery complex (Japan Metal Review, 1999d).

Mitsubishi Materials and its partners completed construction of the \$738 million copper smelter/refinery complex at Gresik,

East Java, Indonesia in late 1998. P.T. Smelting Co., which was a joint-venture operating company, started test operation of the 200,000-t/yr copper smelter and refinery in 1999. Production of refined copper for the first year was expected to be about 150,000 t in 1999 and was expected to reach 180,000 t in 2000. At full capacity in 2001, the Gresik complex was expected to produce 200,000 t/yr of refined copper, 592,000 t/yr of sulfuric acid, and 480 t/yr of gold and silver slimes. Refined copper produced by P.T. Smelting was delivered mostly to southeast Asian markets, where demand for copper was forecast to grow by 3% to 4% per year (Japan Metal Review, 1999d).

To secure a long-term supply of refined copper from overseas sources, Mitsui & Co. signed an agreement with Southern Peru Copper Corp. in May 1999 for extending a \$100 million loan to Southern Peru Copper to upgrade its smelter in Peru. In return, Southern Peru Copper would supply 48,000 t/yr of refined copper to Mitsui & Co. for 15 years. Mitsui & Co. planned to market the refined copper to Japan and to other Asian countries (Nikkei Weekly, 1999b).

To create the world's leading refined copper producer, after 6 months of negotiations, Nippon Mining and Metals concluded the purchase of copper smelting and refining facilities in Changhang and Onsan from LG Metals Corp. of the Republic of Korea for \$638 million in July 1999. Following the agreement, a 50-50 joint-venture company called LG Nikko Copper Inc. was established in Onsan in the Republic of Korea to operate the two smelters and refineries. LG Nikko Copper was owned by the LG Group of the Republic of Korea, which was led by LG Cable Co. Ltd. (35%), LG Industrial Systems Co. Ltd. (10%), and LG International Co. Ltd. (5%), and by a Japanese consortium called Japan Korea Joint Smelting Co., which was led by Nippon Mining and Metals (80%), Marubeni and Mitsui & Co. (10% each) (Metal Bulletin, 1999c). The two smelters and the two refineries had a combined smelting capacity of 350,000 t/yr and refining capacity of 420,000 t/yr. LG Metals had been severely affected by the 1997 Asian financial crisis and had requested assistance from Nippon Mining and Metals in 1998 (Nikkei Sangyo Shimbun, 1999a).

According to the Ministry of Finance (1999, imports p. 617, 627-628), imports of refined copper decreased by 15.8% to 233,119 t and were valued at \$360.8 million. The major suppliers of refined copper were Chile (48.6%), Zambia (12.7%), Indonesia (10.1%), Peru (8.8%), the Philippines (8.3%), Burma (Myanmar) (5.8%), and Australia (3.4%). Imports of refined lead decreased by 49.5% to 13,818 t and were valued at about \$10 million. Imports of slab zinc decreased by 51.2% to 55,334 t and were valued at about \$61 million. The major suppliers of refined lead were China (79.7%), Peru (8.7%), Australia (7.7%), and Canada (3.5%). The major suppliers of zinc slab were China (62.4%), Peru (18.6%), Canada (9.3%), the Republic of Korea (3%), Kazakhstan (2.6%), and Australia (2.4%).

According to the Ministry of International Trade and Industry (1999d, p. 120), domestic consumption of refined copper decreased by 6.5% to 1.27 Mt in 1999. Domestic demand for refined copper, by sector, was 62.2% for wire and cable, 36.2% for brass mill, and 1.6% for copper alloys, casting, and others. The overall stocks of refined copper decreased by 40.5% to 89,389 t at the end of December. Exports of refined copper increased by 8.9% to 318,849 t and were valued at \$498.3 million. The major buyers of refined copper were Taiwan

(50.6%), China (20.6%), the Republic of Korea (6.1%), Thailand (4.9%), Indonesia (4.7%), Malaysia (3.5%), and the United States (2.2%). Most of the 38,542 t of copper anodes was exported mainly to the Republic of Korea, accounted for 97.8% of total, and were valued at \$86 million (Ministry of Finance, 1999, exports p. 571).

In 1999, domestic demand for refined lead decreased by 4.8% to 240,268 t, 73.8% of which was for storage batteries; 13.8%, for inorganic chemicals; and 12.4%, for solders and other uses. The overall stocks of primary lead dropped by 27.4% to 23,413 t at the end of December (Ministry of International Trade and Industry, 1999d, p. 122). Exports of refined lead rose sharply to 4,352 t from 1,056 t in 1998. The major buyers of refined lead were Malaysia, 39.1%; Thailand, 15.4%; Indonesia, 14.3%; and the Philippines, 14% (Ministry of Finance, 1999, exports p. 585). Domestic demand for zinc slab increased by 3.8% to 571,431 t, 47.2% of which was for sheet galvanizing; 18.3%, for other plating; 13.3%, for brass mill products; 9.4%, for zinc die-cast products; 7%, for inorganic chemicals; and 4.8%, for other uses. The overall stocks of zinc slab decreased by 13.6% to 103,262 t at the end of December (Ministry of International Trade and Industry, 1999d, p. 126). Exports of slab zinc increased by 51.7% to 70,836 t. The major buyers were Taiwan, 39.3%; the Philippines, 25.6%; Bangladesh, 14.2%; Indonesia, 9.2%; and Vietnam, 2.5% (Ministry of Finance, 1999, exports p. 585).

Gold and Silver.—Mine production of gold increased, but that of silver decreased slightly in 1999. Gold mine production was mainly by Sumitomo Metal Mining from the Hishikari Mine, Kagoshima Prefecture, Kyushu. The company, which was working on its Honko (main mine) and Yamada deposits in the Hishikari mining area, produced about 8 t/yr of gold. Ore production from the Honko deposit amounted to 105,000 t and averaged 59.6 grams per metric ton (g/t) gold. Ore production from the Yamada deposit amounted to 55,000 t and averaged 38.1 g/t gold (Bulletin of Japan Mining Industry Association, 2000, p. 140). Other small-scale productive gold and silver mines were the Kouryu Mine in the southwestern part of Hokkaido Prefecture and the Kasuga Akesi and Iwato Mines in Kagoshima Prefecture (Ministry of International Trade and Industry, 2000, p. 3). The Kamioka Mine in Gifu Prefecture and the Toyoha Mine in Hokkaido Prefecture produced substantial amounts of silver as a byproduct of their lead and zinc operations.

Overseas, Sumitomo Metal Mining began underground exploration in the Pogo area of its Stone Boy property in Alaska. Teck Corp. of Canada completed a \$28 million prefeasibility study in 1999. Teck Corp., which was to acquire a 40% interest in the Stone Boy property from Sumitomo Metal Mining and Sumitomo Corp., planned to spend an additional \$33 million to conduct a feasibility study by 2000. Exploration work in 1999 indicated that a gold vein at Liese in the Pogo area has estimated ore reserves of 9.7 Mt, averaging 17.8 g/t gold (Japan Metal Review, 1999e; Bulletin of Japan Mining Industry Association, 2000, p. 135).

Production of refined gold increased by 13.8% in 1999. According to the Ministry of International Trade and Industry (1999d, p. 50-51), refined gold produced from imported ore increased by 12.7% to 106,693 kilograms (kg); from domestic ore, 23.9% to 8,322 kg; from scrap, 22.4% to 9,491 kg; and

from other raw materials, 12.1% to 23,212 kg. Production of refined silver increased by 2.5%. Refined silver produced from imported ore increased by 2.9% to 1,474 t; from domestic ore increased by 7.2% to 59 t; from scrap decreased by 2% to 292 t; and from other materials increased by 3.3% to 432 t (Ministry of International Trade and Industry, 1999d, p. 50-51). Kosaka Smelting and Refining Co. Ltd., which was a wholly owned subsidiary of Dowa Mining, raised its Kosaka refining capacity of gold and silver to 24 t/yr and 780 t/yr, respectively, late in the year (Japan Metal Review, 1999b).

According to the Ministry of Finance (1999, imports p. 581), imports of gold ingots and powder rose by 25.2% to 104,776 kg owing mainly to increased domestic demand for industrial use and for private investment in 1999. Imports of silver ingots and powder increased by 33.1% to 1,208 t owing mainly to increased domestic demand for silver nitrate for photographic use. The major suppliers of gold ingots and powder were, in decreasing order, Australia, 24.3%; Switzerland, 23.3%; the United States, 16.3%; the United Kingdom, 12.1%; Papua New Guinea, 6.2%; Russia, 5.8%; Belgium, 2.4%; and South Africa and Canada, 1.9% each. The major suppliers of silver ingots and powder in 1999 were, in decreasing order, Mexico, 28.5%; the United States, 21.3%; Peru, 13.1%; Australia, 12.6%; the Republic of Korea, 7.2%; China, 3.7%; Poland, 3.3%; and Russia, 3%. Imports of gold ingots and powder amounted to \$921 million and of silver ingot and powder to \$184 million.

Overall demand for gold, which included industrial use, industrial arts and crafts, private investment, and other uses, increased by 17% to 265,460 kg in 1999. Of this overall domestic demand for gold, 123,908 kg was for private investment; 53,529 kg, for electronics and telecommunications; 23,292 kg, for jewelry; 14,235 kg, for dental and medical applications; 10,435 kg, for plating; 4,187 kg, for arts and crafts; 2,743 kg, for medals; and 33,131 kg, for other uses such as china and porcelain, clocks and watches, fountain pens, and gilding (Bulletin of Japan Mining Industry Association, 2000, p. 33).

According to the Ministry of International Trade and Industry (1999d, p. 144), domestic demand for silver increased by 0.5% to 3,102 t, 52.7% of which was for silver nitrate for photographic use; 8.8%, for silver nitrate for other uses; 6.4%, for electric contacts; 5%, for rolled products; 4.5%, for silver branning alloy; and 22.6%, for electroplating, jewelry, silverware, and other uses.

Exports of refined gold ingots and powder decreased by 80.5% to 3,091 kg and were valued at \$28 million in 1999. The major buyers of refined gold ingots and powder were Switzerland, 50.6%; Hong Kong, 19.8%; and the Republic of Korea, 9%. Exports of silver ingots and powder were unchanged at 185 t and were valued at \$18 million. The major buyers of refined silver and powder were Singapore, 44.8%; the United Kingdom, 11.7%; Malaysia, 9.6%; China, 6.7%; Hong Kong, 4.1%; and Taiwan, 3.4% (Ministry of Finance, 1999, exports p. 492-493).

Iron and Steel.—Japan's iron and steel industry relied on imports to meet virtually all its iron ore requirements. According to the Ministry of Finance (1999, imports p. 162, 586), imports of iron ore totaled 120.1 Mt and were valued at \$2.8 billion in 1999. The average cost, insurance, and freight (c.i.f.) import price per metric ton of iron ore was \$23.68. The

major suppliers of iron ore were Australia, 55.1%; Brazil, 19.8%; India, 12.6%; South Africa, 3.7%; the Philippines, 3.2%, and Chile, 2.5%. Imports of pig iron dropped by 52.9% to 143,000 t and were valued at \$18.9 million. The major suppliers of pig iron were China, 53.1%; North Korea, 18.9%; Brazil, 15.3%; and South Africa, 10.2%. The average c.i.f. import price per metric ton of pig iron was \$132.13.

According to the Ministry of International Trade and Industry (1999c, p. 80-83), consumption of iron ore by the iron and steel industry totaled 104.4 Mt in 1999. Consumption of other iron ore raw materials by the iron and steel industry included 3.4 Mt of imported pellets, 817,000 t of imported iron sand, 223,000 t of imported ferruginous manganese ore, and 10.1 Mt of other iron ore materials. Pig iron production decreased slightly to 74.5 Mt from 75 Mt in 1998, of which 73.9 Mt was for steelmaking and 0.6 Mt was for foundry (Ministry of International Trade and Industry, 1999c, p. 24). The total ironmaking capacity decreased to 94 Mt/yr from 95.2 Mt/yr in 1998, and the number of blast furnaces (39) and other furnaces (4) for ironmaking decreased to 43 from 46 in 1998 (Ministry of International Trade and Industry, 1999c, p. 114).

Japan, which was the world's second largest producer of pig iron and the world's third largest producer of crude steel, accounted for 13.8% and 11.9%, respectively, of the world totals in 1999. Japan's top five steelmakers ranked as follows in world production: Nippon Steel Corp., which produced 25.2 Mt of crude steel, was the second largest steel-producing company in the world; NKK Corp., which produced 12.8 Mt, ranked 10th; Kawasaki Steel Corp., which produced 11.1 Mt, ranked 12th; Sumitomo Metal Industries, Ltd., which produced 9.4 Mt, ranked 15th; and Kobe Steel Ltd., which produced 5.7 Mt, ranked 29th (International Iron and Steel Institute, 1999 Trends & statistics, accessed September 25, 2000, at URL http://www.worldsteel.org/trends_indicators/companies.html).

Crude steel output rebounded to 94.2 Mt from 93.5 Mt in 1998 but was still 10.3 Mt below the 104.5 Mt level of 1997. The increase in the output of crude steel in 1999 was largely the result of the increase in exports to the Asian market. Of the total crude steel produced in 1999, 69.5% was processed by basic oxygen furnaces (L.D. converter), and 30.5%, by electric furnaces (Ministry of International Trade and Industry, 1999c, p. 32-33). In the steelmaking sector, the number of basic oxygen furnaces decreased to 64 from 69 in 1998, and the number of electric arc furnaces decreased to 425 from 432 in 1998. The overall crude steel production capacity decreased to 146.9 Mt/yr from 149.7 Mt/yr in 1998 (Ministry of International Trade and Industry, 1999c, p. 115). The iron and steel industry continued its restructuring and had reduced its labor force by 12,131 to 202,059 workers by the end of 1999; between 1995 and 1999, the iron and steel industry had cut its workforce by more than 53,800 workers (Ministry of International Trade and Industry, 1999c, p. 116).

In 1999, Japan's domestic demand for steel remained sluggish, but exports of steel continued to move higher, especially to Asian markets. Japan's apparent steel consumption, in crude steel equivalent, declined to about 69 Mt from 71 Mt in 1998 (Japan Iron and Steel Federation, 2000a). According to the Japan Iron and Steel Federation (2000b, p. 5), the overall domestic demand for steel products increased by 0.5% to 60.2 Mt, of which 51.3 Mt were ordinary steel products, and 8.7 Mt, specialty steel products. Exports of iron and steel

products increased by 2.03% to 28.2 Mt. Japan's domestic demand for ordinary steel products declined in most of the end-use markets except construction. Domestic demand for specialty steel products also declined in most of the end-use markets except automobile and industrial machinery and equipment (table 6).

According to the Japan Iron and Steel Federation (2000a, p. 14-17), exports of iron and steel reached a 14-year high in 1999 following the 1997 upward trend. Exports of iron and steel products included 2.3 Mt of steel ingots and semifinished products, 19.7 Mt of ordinary steel products, 3.8 Mt of specialty steel products, and 2.4 Mt of other iron and steel products (Japan Iron and Steel Federation, 2000a, p. 12-13). According to the Ministry of Finance (1999, exports p. 37-38), export earnings from iron and steel and articles of iron and steel totaled \$16.8 billion in 1999. Exports of iron and steel products to Asian markets increased by 33.3% to 20.7 Mt in 1999 because of the recovery from the 1998 economic downturn in Asia and the Pacific region. Exports of iron and steel product to all other markets, however, decreased in 1999; the decline was especially significant for the Americas, where exports decreased by 51.6% to 4.3 Mt mainly because of reduced exports to the United States (table 7).

According to the Japan Iron and Steel Federation (2000b, p. 6), imports of iron and steel products decreased by 2.4% to 6.5 Mt in 1999; this was the lowest level in 13 years. Of the total imports, 4.4 Mt were ordinary steel products, and 2.1 Mt were pig iron, steel ingots and semimanufactured steel, and other steel products. Among the major suppliers of the ordinary steel products, the Republic of Korea accounted for 57.3%; Taiwan, 24.4%; and China, 7.8%. The import bill of iron and steel and articles of iron and steel products totaled \$4.6 billion (Ministry of Finance, 1999, imports p. 36-38).

Manganese.—All Japan's manganese ore requirements were met by imports. According to the Ministry of Finance (1999, imports p. 169), Japan imported 1,474 t of high-grade manganese dioxide ore, 952,889 t of high-grade manganese ore, 66,898 t of low-grade manganese ore, and 205,803 t of ferruginous manganiferous ore in 1999. The major suppliers of high-grade manganese dioxide ore were Gabon, 50.7%, and Australia, 45%. The major suppliers of high-grade manganese ore were South Africa, 61.9%, and Australia, 34%. The major suppliers of low-grade manganese ore were South Africa, 75.2%, and India, 24.7%. The major suppliers of ferruginous manganiferous ore were India, 57.3%; Ghana, 25.4%; and South Africa, 10.8%. The total import bill of manganese ore amounted to \$112.7 million.

According to the Ministry of International Trade and Industry (1999c, p. 86), consumption of manganese ore for production of ferroalloys decreased by 13.9% to 606,511 t; for steelmaking increased by 5.2% to 225,143 t; and for other uses increased by 10.9% to 112 t in 1999. Production of ferromanganese continued the 1997 downward trend owing mainly to decreased consumption for steelmaking. According to the Ministry of Finance (1999, imports p. 586), imports of ferromanganese decreased by 18.5% to 89,569 t, of which South Africa accounted for 49.8% and China for 33.4%. Of the total imports of ferromanganese from South Africa, about 15,000 t/yr of medium- and low-carbon ferromanganese were from Advalloy Ltd.'s Meyerton plant in South Africa, in which Japan Metals &

Chemicals Co. Ltd. (JMC) and Mitsui & Co. Ltd. of Japan had 35% and 15% equity shares, respectively, and another 15,000 t/yr of medium- and low-carbon ferromanganese were from Cato Ridge Alloys Ltd.'s Cato Ridge plant, in which the Kawasaki Steel subsidiary Mizushima Ferroalloy Co. Ltd. and Sumitomo Corp. of Japan had 40% and 10% equity shares, respectively (Japan Ferroalloy Association, 2000b).

According to the Ministry of International Trade and Industry (1999c, p. 30), consumption of domestically produced high- and low-carbon ferromanganese for steelmaking in 1999 continued the 1997 downward trend and registered another 4.8% decline to 326,416 t, of which 270,563 t was high-carbon ferromanganese and 55,853 t, low-carbon ferromanganese. According to the Japan Ferroalloy Association (2000a), overall consumption of high-, medium-, and low-carbon ferromanganese decreased by 5.4% to 349,111 t. Exports of ferromanganese decreased by 27.7% to 19,397 t. The major buyers were the United States, 43.6%; Australia, 12.5%; Taiwan, 14.4%; India, 9.4%; the Republic of Korea, 4.4%; and Indonesia, 3.5%. Export earnings from ferromanganese were about \$16.2 million in 1999 (Ministry of Finance, 1999, exports p. 496).

In 1999, Japan was the world's largest producer of electrolytic manganese dioxide (EMD). Japan's EMD producers were JMC at Takaoka, Toyama Prefecture, and at its joint venture Hunan plant in China; Mitsui Mining and Smelting at Takehara, Hiroshima Prefecture, and County Cork, Ireland; and Tosoh Corp. at Hyuga, Miyazaki Prefecture, and Thessaloniki, Greece. The country's EMD production capacity, which included three overseas plants, was raised to 124,600 t/yr from 121,600 t/yr in 1998. Its EMD production capacity accounted for about 44% of the world's production capacity of about 282,000 t/yr (Roskill's Letter from Japan, 1999).

Nickel.—In 1999, Japan was the world's largest importer and consumer of nickel and the second largest producer of nickel metal after Russia (International Nickel Study Group, 2000, p. 8). Nickel ores and nickel mattes were imported for production of ferronickel, refined nickel, and nickel oxide sinter. Additionally, ferronickel, refined nickel, nickel oxide sinter, nickel powder and flake, and nickel waste and scrap also were imported to meet the nickel requirements of the battery, magnetic materials, nonferrous alloys, and specialty steel industries, as well as other end-users.

According to the Ministry of Finance (1999, imports p. 162, 587, 622), imports of nickel ore decreased by 5.1% to 9.5 Mt and were valued at \$114 million in 1999. The major suppliers of nickel ore were New Caledonia, 45.4%; Indonesia, 28.5%; and the Philippines, 26.1%. Imports of nickel matte, in gross weight, increased by 10.1% to 86,371 t and were valued at \$305 million. The major suppliers of nickel matte were Indonesia, 63.9%, and Australia, 35.5%. Imports of ferronickel, in gross weight, decreased by 16.5% to 34,283 t and were valued at \$52 million. The three suppliers of ferronickel were New Caledonia, 79%; Indonesia, 14.8%; and the Dominican Republic, 6.2%. Imports of refined nickel increased by 23.7% to 48,282 t and were valued at \$261 million. The top nine suppliers of refined nickel were China (18.8%), Zimbabwe (16.2%), Russia (12.5%), Australia (12.4%), Norway (11.4%), South Africa (7.2%), Canada (6.9%), Brazil (6.6%), and the United Kingdom (5.7%). Imports of nickel oxide sinter totaled 1,449 t and were valued at \$6.8 million. Australia, which was the dominant

supplier of nickel oxide sinter, accounted for 99.7%. Imports of nickel powders and flakes increased by 11% to 11,167 t and were valued at \$94 million. The major suppliers were Canada, 49.1%, and the United Kingdom, 44.8%. Imports of nickel waste and scrap increased by 14.3% to 11,738 t and were valued at \$54 million. The major suppliers were Russia (24.4%), Zimbabwe (20.8%), the United States (14.5%), Taiwan (8.5%), South Africa (7.7%), and China (5.9%). On the basis of an agreement with the World Trade Organization, import tariffs on nickel oxide sinter, other intermediate products of nickel metallurgy, and refined nickel were 44 yen per kilogram. The import tariff on nickel oxide was 3% in 1999. Nickel ore, nickel mattes, and nickel waste and scrap were duty free (Japan Tariff Association, 1999, p. 825-826).

According to the Ministry of International Trade and Industry (1999c, p. 31, 86), consumption of nickel ore by the ferroalloy industry decreased by 5.1% to 3 Mt in 1999. Consumption of ferronickel for steelmaking decreased by 6% to 246,303 t because of reduced production of nickel-based stainless steel. Exports of ferronickel increased by 50% to 111,311 t, 68.6% of which went to Taiwan and 31.4% to the Republic of Korea. Export earnings from ferronickel were valued at \$115 million (Ministry of Finance, 1999, exports p. 497).

In 1999, production of refined nickel was solely by Sumitomo Metal Mining at its nickel refinery that used its matte chlorine leaching electrowinning process in Niihama, Ehime Prefecture. The company completed capacity expansion of its Niihama nickel refinery by 20% to 36,000 t/yr. Tokyo Nickel also completed capacity expansion of its Matsusaka nickel oxide sinter plant in Mie Prefecture to 60,000 t/yr from 36,000 t/yr. These expansions were based on increased raw material supply from P.T. Inco at Soroako in Indonesia, which had expanded its production capacity of nickel matte to 68,000 t/yr (International Nickel Study Group, 1999).

According to the Ministry of International Trade and Industry (1999d, p. 136), domestic demand for refined nickel increased by 5% to 68,683 t; of that total production of specialty steel accounted for 45,000 t; batteries, 4,490 t; magnetic materials, 3,676 t; nonferrous alloys, 3,522 t; galvanized sheet, 3,459 t; catalysts, 488 t; and other uses, 6,050 t. Exports of refined nickel were 317 t, 60% of which went to the Republic of Korea; 12.1%, to Indonesia; 7.2%, to the Philippines; 7%, to Singapore; and 5%, to Vietnam. Exports of nickel oxide sinter and other intermediate products of nickel metallurgy were 7,906 t, 61.2% of which went to Taiwan and 37.8%, to the Republic of Korea. Exports of nickel powders and flakes were 641 t, 36.7% of which went to France; 21.3%, to Hong Kong; 18%, to Taiwan; 9%, to China; and 6.7% to the United States. Exports of nickel waste and scrap were 488 t, 45.2% of which went to the United States and 38.4%, to the United Kingdom (Ministry of Finance, 1999, exports p. 578).

Titanium.—Japan was one of the world's top producers of titanium sponge metal and titanium dioxide pigment, but all the raw material requirements for production of titanium metal and dioxide pigment were met by imports. Rutile was consumed by the producers of titanium sponge metal. Ilmenite was consumed mainly by the manufacturers of synthetic rutile and titanium dioxide pigment. Small amounts of rutile and ilmenite were consumed as blast furnace additives in the steel industry.

According to the Ministry of Finance (1999, imports p. 162), Japan imported 96,150 t of rutile principally from Australia (63%), South Africa (27.6%), and India (8.8%). Japan also imported 365,117 t of ilmenite mainly from Australia (37.4%), Vietnam (24.8%), Canada (12.4%), Malaysia (11.2%), India (4.1%), and Thailand (3.6%).

Production of titanium sponge declined sharply in 1999 because of reduced demand by the aircraft and chemical plant manufacturers in Japan and the aircraft manufacturers in Europe and the United States. Sumitomo Sitix Corp. reportedly was operating at about 64% capacity at its Amagasaki plant near Osaka; production had resumed after a fire and explosions at the plant site in late 1998. The company reportedly was implementing cost-cutting measures and developing new markets. In 1999, Sumitomo Sitix began production of titanium metal with purity up to 99.999% for application in sputtering target material for integrated circuits and crystal displays. The company also produced titanium powder for application in metal injection molding for such items as watch components and electronic parts (Metal Bulletin, 1999e).

Total titanium sponge shipments declined slightly in 1998. According to the Japan Titanium Society (2000a), domestic shipments of titanium sponge decreased to 12,398 t from 15,188 t in 1998. Overseas shipments also decreased to 7,095 t from 8,630 t in 1998. Total shipments of titanium mill products decreased to 11,662 t from 12,740 t in 1998; domestic shipments of titanium mill products decreased to 5,479 t from 6,146 t in 1998, and overseas shipments decreased to 6,183 t from 6,594 t in 1998. In the domestic market, shipments of titanium mill products to manufacturers of chemical plants declined sharply to 1,368 t from 2,027 t in 1998. Shipments to manufacturers of power-generation and water-desalination plants increased slightly to 1,171 t from 1,021 t in 1998. Shipments to distributors increased to 988 t from 901 t in 1998. Shipments to manufacturers of consumer, medical, and sports and leisure goods increased to 1,042 t from 877 t in 1998. Shipments to aircraft manufacturers decreased sharply to 256 t from 567 t in 1998. Shipments to automobile manufacturers increased substantially to 248 t from 133 t in 1998. Shipments to manufacturers of architecture and civil engineering materials dropped sharply to 44 t from 176 t in 1998. Shipments to manufacturers of shipping, marine, and other materials decreased to 362 t from 444 t in 1998 (Japan Titanium Society, 2000b).

According to the Ministry of Finance (1999, exports p. 589), exports of titanium sponge decreased by 16.4% to 7,298 t, of which 51.9% went to the United Kingdom, 40.1% to the United States, 4.7% to the Republic of Korea, 2% to Taiwan, and 1.3% to other countries. Export earnings from titanium sponge were valued at \$55 million. Exports of titanium waste and scrap and titanium powder decreased by 21.5% to 2,427 t, of which 62.7% went to the United States, 28.1% to the United Kingdom, 3.2% to the Netherlands, and 2.7% to Taiwan. To meet the domestic requirements, Japan imported 3,289 t of lower grade titanium sponge, waste, scrap, and powder, which were valued at \$24 million. The principal suppliers in 1999 were Kazakhstan (39.5%), Russia (27.3%), the United States (18.4%), Finland (4.5%), and Taiwan (4.2%) (Ministry of Finance, 1999, imports p. 631).

In 1999, Japan imported 807 t of titanium mill products, principally from the United States (79.6%), China (11.9%), and

Russia (3.7%) (Ministry of Finance, 1999, imports p. 631). Exports of titanium mill products decreased to 7,077 t from 7,578 t in 1998. Export earnings from titanium mill products were valued at \$192 million in 1999. The major buyers were the Republic of Korea (13.7%), Sweden (13.6%), France (11.9%), the United States (9.6%), Italy (8.1%), Taiwan (7.4%), China (7.2%), Germany (5.4%), and the Netherlands (4.5%) (Ministry of Finance, 1999, exports p. 589).

Production of titanium dioxide increased owing to increased domestic demand in most of the end-use markets and to increased exports. In 1999, the industry was operating at about 78% capacity. According to the Japan Titanium Dioxide Industry Association (2000, p. 1), Fuji Titanium Industry Co. Ltd., which was the smallest producer, had raised its capacity to 17,400 t/yr from 16,200 t/yr in 1999. As a result, the industry's total capacity was raised to 345,600 t/yr in 1999.

Ishihara Sangyo Kaisha Ltd., which was Japan's largest producer of titanium dioxide, reportedly was to undertake a 4-year restructuring program (from April 1999 through March 2003) to cut its \$860 million debt by 33% to \$564 million and to maintain its titanium oxide operation and bioscience business. In August, Ishihara Sangyo raised about \$88 million capital through third-party allocation of new shares, mainly to Mitsui & Co., to slash its outstanding debt. Ishihara Sangyo also formed a business tie with Mitsui & Co., which owned 11% interest in Ishihara Sangyo. The company sold ISK Bioscience Co. Ltd., which was its U.S. subsidiary, to a British company for \$410 million in 1998 and cut its number of employees by about 24% to 1,331 between 1995 and 1999 (Nikkei Weekly, 1999a).

In 1999, shipments of titanium dioxide to domestic end users increased by 6% to 177,000 t in 1999, 44% of which was for manufacture of paints and coating materials; 19.9%, for printing inks and pigments; 11.3%, for synthetic resin (plastics); 10.3%, for papers; 2%, for chemical fibers; 1.5%, for rubber; 1.1% for condenser; and 9.2% for other end users (Japan Titanium Dioxide Industry association, 2000).

According to the Ministry of Finance (1999, exports p. 110), exports of titanium oxides increased by 6.8% to 31,235 t in 1999. The major buyers were Taiwan, 24.5%; the Republic of Korea, 22.6%; China, 20.8%; Indonesia and the United States, 4.1% each; Thailand, 2.7%; Malaysia, 2.6%; and Italy, 2.2%. Export earnings from titanium oxide were valued at \$80.7 million.

Industrial Minerals

Cement.—Japan's cement production decreased slightly in 1999 because of a decrease in domestic investment in plants and equipment. According to the Ministry of International Trade and Industry (1999a, p. 58-63, 126, 128), Japan's cement clinker capacity decreased to 94.1 Mt/yr from 94.6 Mt/yr in 1998, and the number of regular employees in the cement industry declined to 4,636 from 4,921 in 1998. Production of cement clinker decreased to 85.3 Mt from 85.6 Mt in 1998, and production of cement decreased to 80.1 Mt from 81.3 Mt in 1998. Of the cement produced in 1999, 58.6 Mt were ordinary portland cement; 3.3 Mt, high early strength portland cement; 0.5 Mt, moderate heat portland cement; 16.9 Mt, blast-furnace slag cement; 528,000 t, flyash cement; 93,000 t, white cement; and 228,000 t, other cement. The major raw materials consumed by the cement industry included 83 Mt of limestone,

14.7 Mt of clay, 5.7 Mt of silica stone, 3.8 Mt of blast furnace ore slag, and 2.9 Mt of gypsum (Ministry of International Trade and Industry, 1999a, p. 113-114).

Domestic demand for cement was estimated at 71 Mt in 1999, which was about the same level as that of 1998. Exports of cement, which included clinker, also remained at 7.6 Mt. According to the Ministry of Finance (1999, exports p. 97-98), exports of cement clinker decreased to 1.77 Mt from 1.79 Mt in 1998. Exports of portland cement increased to 5.89 Mt from 5.81 Mt in 1998. The major buyers of cement clinker were Taiwan (20.9%), China (20.4%), Côte D'Ivoire (11.9%), Hong Kong (8.8%), Australia (6.5%), and Costa Rica (5.8%). The major importers of portland cement were Taiwan (40.3%), Singapore (24.3%), Hong Kong (17.3%), Nigeria (7.9%), Kuwait (4.4%), and the Philippines (3.2%). Export earnings from cement clinker and portland cement were \$30.1 million and \$123.3 million, respectively. The average export free-on-board (f.o.b.) price of portland cement decreased to \$20.94 per metric ton from \$26.97 per ton in 1998. Imports of cement, including portland, white, and aluminous cement, increased to 1.09 Mt from 727,744 t in 1998. The major suppliers were the Republic of Korea (84.7%) and China (13.7%). The average import c.i.f. price of portland cement decreased to \$35.59 per ton from \$42.03 per ton in 1998 (Ministry of Finance, 1999, imports p. 160).

Iodine.—In 1999, Japan was one of the world's top iodine producers. In Japan, iodine was extracted from brine dissolved in natural gas. The subterranean brine associated with natural gas contains between 50 and 150 milligrams per liter of iodine in the form of iodide. Production of iodine from Chiba, Miyazaki, and Niigata Prefectures totaled about 6,200 t, of which Chiba Prefecture accounted for about 90% (Fumio Aiko, General Manager, Kanto Natural Gas Development Co. Ltd., Iodine, unpublished data, April 14, 2000). Crude iodine was produced mainly by Ise Chemical Industries Co. Ltd., Godo Shigen Sanyo Co. Ltd., Kanto Natural Gas Development Co. Ltd., Nihon Tennen Gas Co. Ltd., Nippon Chemicals Co. Ltd., and Toho Earthtech, Inc. (table 2). Teikoku Oil Co. Ltd. in Naruto, Chiba Prefecture, and Japan Energy Development Co. Ltd. in Nakajo, Niigata Prefecture, were two other small iodine producers. The industry's production capacity decreased to 8,844 t/yr from 9,324 t/yr in 1998 (Ministry of International Trade and Industry, 1999b, p. 294-295).

According to the Ministry of International Trade and Industry (1999b, p. 69), the in-plant consumption of iodine amounted to 728 t and shipments totaled 5,332 t in 1999. Domestic consumption was estimated to be 1,800. In the domestic market, iodine was consumed mainly for pharmaceuticals, chemicals and catalysts, food and feed additives, photosensitive materials, x-ray contrast media, and sanitizer. Exports of iodine decreased by 6.8% to 4,653 t and were valued at \$76 million in 1999. The major buyers were the United States (30.3%), France (14.8%), the United Kingdom (14%), Italy (10%), Norway (7.8%), India (6%), the Netherlands (6%), China (4%), and Germany (3.1%) (Ministry of Finance, 1999, exports p. 104).

Limestone.—In 1999, Japan was one of the world's top limestone producers, although production of limestone decreased slightly owing to decreased consumption by the cement and iron and steel industries. In Japan, most of the

major limestone quarries were owned and operated by cement, construction, or steel companies. According to the Ministry of International Trade and Industry (2000, p. 4-5), the number of major limestone quarries had decreased considerably because of the merger of Chichibu Onoda Cement Co. Ltd. and Nihon Cement Co. Ltd. in October 1998. Taiheiyo Cement Co. Ltd. owned and operated eight major limestone quarries that had been owned and operated separately by Chichibu Onoda Cement and Nihon Cement. Taiheiyo Cement accounted for about 24% of the total limestone output and was followed by Nittetsu Cement, which owned and operated three major quarries and accounted for 11.5%. The combined output of the top 30 limestone quarries accounted for about 79% of the limestone produced by a total of about 260 quarries (table 8).

Shipments of domestically produced limestone decreased to 184.1 Mt from 186.5 Mt in 1998; specifically, shipments to the manufacturing sector declined to 124.7 Mt from 126.3 Mt in 1998, to the construction sector declined to 54.1 Mt from 54.7 Mt in 1998, and to other users declined to 5.3 Mt from 5.6 Mt in 1998. Of the 124.7 Mt shipped to the manufacturing sector, the cement industry received 84.1 Mt; the iron and steel industry, 21.9 Mt; the lime industry, 9.7 Mt; the filler and fertilizer industries, 5.7 Mt; the soda and glass industries, 1.6 Mt; and others, 1.7 Mt. Of the 54.1 Mt shipped to the construction sector, concretemaking accounted for 33.7 Mt; road construction, 13.8 Mt; and other construction, 6.6 Mt (Ministry of International Trade and Industry, 1999d, p. 40-41).

In 1999, Japan was entirely self-sufficient in limestone. The country imported 234,240 t of limestone flux, limestone, and other calcareous stone principally from the Philippines (53%), Malaysia (25.9%), Vietnam (10.3%), and China (10.3%) (Ministry of Finance, 1999, imports p. 160). Japan exported 3.1 Mt of limestone flux, limestone, and other calcareous stone mainly to Taiwan, 41.8%; Hong Kong, 29.1%; and Australia, 27.4% (Ministry of Finance, 1999, exports p. 97).

Perlite.—In 1999, Japan was one of the world's top producers of perlite, which is a volcanic glass mineral. Perlite production remained steady at between 250,000 t and 270,000 t from 1991 to 1994. In 1995, the output began to move higher and reached a peak at 304,300 t in 1996, and then gradually declined to about 260,000 t in 1999 (Hideo Kase, Perlite Department General Manager, Mitsui Mining and Smelting Co. Ltd., Perlite production, unpublished data, April 13, 2000).

Japan's crude perlite production included about 66% perlite, 19% obsidian, and 15% pitchstone. Eight companies produced perlite. Asano Perlite Co. Ltd. operated a processing plant in Chiba Prefecture. Fuyolite Co. Ltd. operated a processing plant in Nagano Prefecture. Mitsui Mining and Smelting Co. Ltd. operated three mines in Kitakata, Fikushima Prefecture, in Mikata, Hyogo Prefecture, and in Sagayamauchi, Saga Prefecture, as well as four processing plants in Funabashi, Chiba Prefecture, in Kitakata, Fukushima Prefecture, in Omuta, Saga Prefecture, and in Osaka, Osaka Prefecture. Nippon Perlite Co. Ltd. operated a mine and a processing plant in Tsuruoka, Yamagata Prefecture. Shinano Perlite Co. Ltd. operated a mine and a processing plant in Shinano, Nagano Prefecture. Toko Perlite Co. Ltd. operated a processing plant in Utsunomiya, Tochigi Prefecture. Toho Perlite Co. Ltd. operated a mine and a processing plant in Wadatoge, Nagano Prefecture. Ube Perlite operated a processing plant in Ube, Yamaguchi Prefecture

(Kenichi Sodeyama, Materials Division Senior Researcher, Kagoshima Prefectural Institute of Industrial Technology, Expanded perlite in Japan, unpublished data, April 3, 1999).

Mitsui Mining and Smelting, which was Japan's top perlite producer, accounted for more than 45% of Japan's perlite production in 1999. The mine output at the Kitakata Mine was 61,600 t/yr; at the Mikata Mine, 26,800 t/yr; and at the Sagayamauchi Mine, 35,700 t/yr. The annual processing capacity at the Funabashi plant was 19,200 t; at the Kitakata plant, 32,000 t; at the Omuta plant, 21,000 t; and at the Osaka plant 38,000 t (Hideo Kase, Perlite Department General Manager, Mitsui Mining and Smelting Co. Ltd., Perlite production, unpublished data, April 13, 2000).

Virtually all perlite output was consumed domestically. About 40% of the expanded perlite was for manufacture of construction materials such as ceramic siding boards; 20%, for manufacture of industrial materials such as cleaning agents; 20%, for manufacture of thermal insulation materials; 15%, for manufacture of soil improving materials such as horticultural aggregate; and 5%, for other uses (Mitsui Mining and Smelting Co. Ltd.).

Mineral Fuels

Coal.—Japan's coal production increased by 6.6% in 1999. The two major operating companies were Taiheiyo (Pacific) Coal Mining Co. Ltd. at its Kushiro colliery in Hokkaido Prefecture and Matsushima Coal Mining Co. Ltd. at its Ikeshima colliery in Nagasaki Prefecture. The current national coal policy, which would expire in fiscal year 2001, allowed the two major coal mining companies to charge the domestic power companies about three times more than the price for imported coal. In its proposal for the new national coal policy (fiscal year 2002-2006) to the Ministry of International Trade and Industry in September, Japan's Coal Mining Council strongly recommended that the two major coal producers continue to operate through fiscal year 2006 to support development of coal mining technology and to facilitate transfer of that technology to foreign countries to secure overseas coal supply (Coal Age, 1999).

According to the Ministry of International Trade and Industry (1999e, p. 14, 123), Japan's coal production satisfied 2.8% of the domestic requirements for coal in fiscal year 1999. Japan relied on imports to meet 100% of its requirements for coking coal and anthracite and about 94.5% of its requirements for steam coal.

In 1999, Japan was the world's largest importer of coking and steam coal (U.S. Energy Information Administration, May 2000, Country analysis briefs—Japan, accessed October 25, 2000, at URL <http://www.eia.doe.gov/emeu/cabs/japan.html>). Overall coal imports increased by 3.3% to 133.2 Mt and accounted for about 23% of the world's total coal imports. Japan's coal imports were valued at \$5.4 billion in 1999 (Ministry of Finance, 1999, imports p. 164). According to the Ministry of International Trade and Industry (1999e, p. 124-129), imports of coking coal increased by 0.5% to 63.1 Mt. Imports of steam coal increased by 7.9% to 67.34 Mt. Imports of anthracite decreased by 25.9% to 2.8 Mt. The major suppliers of coking coal were Australia (60%), Canada (21.6%), Indonesia (5.6%), China (3.8%), Russia (3.5%), and the United States (3.3%). The major suppliers of steam coal were Australia (59.5%), Indonesia

(14.6%), China (12.8%), the United States (3.9%), South Africa (3.7%), and Canada (1.9%). The principal suppliers of anthracite were China (49.1%), Vietnam (38.5%), and North Korea (10%).

According to the Ministry of International Trade and Industry (1999e, p. 125), overall demand for coal in 1999 increased by 3.5% to 137.3 Mt in 1999, 71.3 Mt of which was steam coal; 63.1 Mt, coking coal; and 2.8 Mt, anthracite. Demand for steam coal increased by 8% in 1999 owing mainly to the continued growth in demand for steam coal by the electric power industries, which grew by 8.4% in 1999. Demand for coking coal increased slightly as demand by the iron and steel industry increased by 3.4%; demand by the coking industry decreased by 30.8%. Demand for anthracite decreased by 26.8% as demand by the cement, chemical, and iron and steel industries all declined in 1999 (table 9).

Natural Gas and Petroleum.—In 1999, Japan was the world's largest importer of natural gas and crude petroleum. Domestic production of natural gas and crude petroleum was very small. According to the Ministry of International Trade and Industry (1999e, p. 20), domestic production of natural gas and crude petroleum totaled about 2.3 billion cubic meters (Gm^3) and 4.6 million barrels (Mbbbl), respectively, compared with 79.5 Gm^3 and 1,518 Mbbbl of domestic consumption of natural gas and crude petroleum. Japan's natural gas and crude petroleum reserves were estimated to be 42.3 Gm^3 and 58.6 Mbbbl, respectively (Oil & Gas Journal, 1999).

Japan relied on imports to meet 97.1% of its domestic natural gas requirements and 99.7% of its crude petroleum requirements. According to the Ministry of International Trade and Industry (1999e, p. 28-29, 115, 166), Japan imported 77.2 Gm^3 of natural gas in the form of LNG and 1,575 Mbbbl of crude petroleum. The average c.i.f. import price of crude petroleum was \$17.08 per barrel compared with \$13.93 per barrel in 1998. The average c.i.f. import price of LNG was \$161.63 per ton compared with \$157.61 per ton in 1998. LNG imports were from Indonesia, 35.6%; Malaysia, 19.2%; Australia, 13.8%; Brunei, 10.7%; Qatar, 9.2%; the United Arab Emirates, 9.1%; and the United States, 2.4%. The import bills of LNG were valued at \$8.4 billion. Crude petroleum imports were mainly from the Middle East, which accounted for 85.2%; Asia, which included China, 11.4%; and other regions, 3.4%. The major suppliers of crude petroleum were the United Arab Emirates (25.2%), Saudi Arabia (18.8%), Iran (16.7%), Qatar (9.3%), Oman (6.4%), Kuwait (6%), Indonesia (5.8%), the Kuwaiti/Saudi Arabian neutral zone (5.4%); China (2.33%), and Iraq (2.3%).

Production of refined petroleum products totaled 1,539.3 Mbbbl in 1999. Refined petroleum products were produced by 24 oil companies that operated 36 refineries with a total capacity of 5.27 million barrels per day mostly on the east coast of Honshu. Capacity utilization rate in 1999 was about 77.2% (Ministry of International Trade and Industry, 1999e, p. 67). Because of the excess oil refining capacity and increased imports of refined petroleum products, Japan's petroleum refining industry began its industry consolidation and strategic alliance in distributing products and purchasing crude petroleum to cut costs and to be more competitive.

Nippon Oil Co. Ltd. and Mitsubishi Oil Co. Ltd. merged to form Nippon Mitsubishi Oil Refining Co. Ltd. in early 1999.

Nippon Mitsubishi Oil then acquired Koa Oil Co. Ltd. in September 1999 and announced its strategic alliance with Cosmo Oil Co. Ltd. to coordinate distribution of their refined petroleum products and to cut costs through elimination of duplicated functions in October. In early 1999, Showa Shell Sekiyu K.K. and Japan Energy Corp. jointly announced their strategic alliance in refined petroleum products distribution and crude petroleum procurement. General Sekiyu K.K. and Tonen Corp. reportedly were planning to merge in February 2000 (U.S. Energy Information Administration, May 2000, Country analysis briefs—Japan, accessed October 25, 2000, at URL <http://www.eia.doe.gov/emeu/cabs/japan.html>).

According to the Ministry of International Trade and Industry (1999e, p. 24-25, 68-69, 114), the 1999 domestic demand for refined petroleum, by product, was as follows: asphalt, 31.7 Mbbl; diesel (distillate fuel oil), 274.3 Mbbl; gasoline, 357.5 Mbbl; heavy fuel oil, 396.7 Mbbl; jet fuel, 28.3 Mbbl; kerosene, 185.1 Mbbl; lubricants, 14.2 Mbbl; naphtha, 298 Mbbl; and paraffin, 0.4 Mbbl. To meet its domestic demand, Japan imported 7.7 Mbbl of diesel, 8.7 Mbbl of gasoline, 16.7 Mbbl of heavy fuel oil, 0.7 Mbbl of jet fuel, 24 Mbbl of kerosene, 0.4 Mbbl of lubricants, 188.5 Mbbl of naphtha, and small quantities of asphalt and paraffin. Imports of refined petroleum products (excluding asphalt, lubricant, and paraffin) increased by 28.6% in 1999, when domestic demand for gasoline, naphtha, and kerosene increased by 2.6%, 8.5%, 4%, respectively. Consumption of domestically produced natural gas totaled 2.8 Gm³, of which the gas industry consumed 49.4%; the electric power industry, 21.2%; the oil and gas industry, 14.4%; the chemical industry, 11.3%; and other manufacturing and service industries, 3.7%. Additionally, Japan consumed 51.5 Mt or 77.2 Gm³ of imported natural gas, in the form of LNG, and the electric power industry consumed 70.4% for power generation, 28.2% for the city gas industry and household use, and 1.4% for industrial use.

Japan's stockpiling of crude petroleum, partially refined, and refined petroleum products at the end of 1999 totaled 161 days supply, of which the national stockpile was 85 days and the private stockpile was 76 days (Ministry of International Trade and Industry, 1999e, p. 166).

Reserves

Japan's ore reserves for limestone and other industrial minerals, such as iodine, pyrophyllite, and silica stone, are large and of world significance. Coal reserves were substantial but not large and very costly to produce. With the exception of gold and zinc, its ore reserves for other minerals, especially oil and gas, and metallic minerals are very small (table 3).

Infrastructure

Japan has one of the world's most modern and complete infrastructures for its mining and mineral processing industries. Despite its small land area, Japan has a highway system of 1.1 million kilometers (Mkm), 75% of which is paved, and a railroad network of 23,640 kilometers (km), of which 2,893 km are 1.435-meter (m) gauge, 90 km are 1.372-m gauge, and 20,657 km are 1.067-m narrow gauge. Highway and railroad networks link all major seaports and coastal cities on the four major islands and connect Honshu to the islands of Shikoku and

Kyushu in the south and Hokkaido in the north by means of bridges and tunnels.

Japan's domestic and international telecommunication services were among the best in the world with satellite earth stations [5 Intelsat (4 Pacific Ocean and 1 Indian Ocean), 1 Intersputnik (Indian Ocean region), and 1 Inmarsat (Pacific and Indian Ocean regions)]; submarine cables to China, the Philippines, Russia, and the United States (via Guam); and 357 Internet service providers (1999 estimate). For electric power transmission, Japan has a route length of 88,500 km and a circuit length of 155,000 km (1995 estimate). For power distribution, Japan's total length of line distances, including high- and low-voltage, was 1.18 Mkm (1995 estimate), concentrating in the major industrial areas of Fukuoka, Hiroshima, Nagoya, Osaka, Takamatsu, Tokyo, and Toyama. Japan also has extensive pipeline systems: natural gas, 1,800 km; crude petroleum, 84 km; and refined petroleum products, 322 km.

Japan has 25 major ports and more than 2,000 minor ports to receive raw materials from overseas and to export manufactured products. The major port facilities, which included the terminals and warehouses, were among the most indispensable parts of the infrastructure for the mineral industry because of their role in receiving imported raw materials, such as coal, crude petroleum, iron ore, LNG, nonferrous ore, and phosphate rock for minerals-processing plants and powerplants and in exporting value-added mineral and metal products. The important seaports of the major mineral-processing centers were Akita, Amagasaki, Chiba, Hachinohe, Higashi-Hamrma, Himeji, Hiroshima, Kawasaki, Kinuura, Kobe, Kushiro, Mizushima, Moji, Nagoya, Osaka, Sakai, Sakaide, Shimizu, Tokyo, and Yokohama on Honshu; Fukuoka, Kita Kyushu, and Oita on Kyushu; and Muroran and Tomakomai on Hokkaido.

Japan has 171 airports [1999 estimate]; of those, 140 have paved runways, and 31 have unpaved runways. Japan also had 14 heliports [1999 estimate]. The major international airports are Fukuoka, Haneda (Tokyo), Kansai, Nagoya, Narita (New Tokyo), and Osaka. Japan's first round-the-clock airport, Kansai International, opened in September 1994 on reclaimed offshore land in Osaka Bay.

Outlook

The domestic mining activities were expected to remain at about the same level as that of 1999 because of the slow economic recovery. Metal production of copper and zinc is expected to increase because exports to Asian markets, especially to China, the Republic of Korea, Malaysia, Taiwan, and Thailand, are anticipated to increase. Production of crude steel is expected to increase slightly because the Japanese economy and the economies of the Southeast Asian nations were expected to recover gradually in 2000.

Imports of coal, nonferrous metals, and other minerals are expected to remain at a high level. In line with the country's mineral policy to secure and diversify its long-term supply of raw materials in order to ensure a steady economic growth, Japan is expected to continue its active search for direct investment in joint exploration and development of minerals in developed and developing countries, especially in Australia, Canada, Chile, China, Mexico, Peru, and the United States. The targeted minerals were antimony, chromium, coal, columbium

(niobium), copper, gold, iron ore, lead, lithium, manganese, molybdenum, natural gas, nickel, crude petroleum, rare earths, silver, strontium, tantalum, titanium, tungsten, vanadium, and zinc.

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- Geological Survey of Japan
1-1-3 Higashi, Yatabe, Ibaraki 305, Japan
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TABLE 1
JAPAN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1995	1996	1997	1998	1999 p/
METALS					
Aluminum:					
Alumina, gross weight					
thousand tons	363	337	368 r/	359 r/	335
Metal:					
Primary:					
Regular grades	18	17	17	16	11
do.	28	29	36	35	35
High-purity					
do.					
Secondary 2/	1,181	1,191	1,277	1,155	1,158
Antimony:					
Oxide	10,393	10,311	10,916	10,197	10,348
Metal	93	98	122	170	178
Arsenic, high-purity e/	60	56	66	110	110
Bismuth	591	562	550	479	481
Cadmium, refined	2,652	2,344	2,473	2,337	2,567
Chromium:					
Metal e/	1,010	1,000	800	1,000	900
Cobalt metal	227	258	264	329	247
Columbium (niobium) and tantalum, tantalum metal e/	80	80	80	80	85
Copper:					
Mine output, Cu content	2,376	1,145	932	1,070	1,038
Metal:					
Blister and anode:					
Primary	1,043,275	1,122,571	1,214,172	1,171,657	1,256,276
Secondary	125,206	110,856	136,274	131,979	133,188
Total	1,168,481	1,233,427	1,350,446	1,303,636	1,389,464
Refined:					
Primary	1,081,235	1,140,502	1,157,299	1,149,266	1,215,248
Secondary	106,724	110,871	121,400	128,086	126,301
Total	1,187,959	1,251,373	1,278,699	1,277,352	1,341,549
Gallium metal: e/					
Primary	6	6	6	6	12
Secondary	51 r/	56 r/	60 r/	69 r/	61
Germanium:					
Oxide e/	10	11	11	10	10
Metal	2,222	1,787	1,039	454	765
Gold:					
Mine output, Au content	9,185	8,627	8,384	8,601	9,405
Metal:					
Primary	113,148	127,506	136,079	129,859	147,719
Secondary 3/	14,736	17,150	18,502 r/	19,288 r/	20,000 e/
Total	127,884	144,656	154,581 r/	149,147 r/	167,719 e/
Indium metal	61,222	33,184	24,407	29,413	40,465
Iron and steel:					
Iron ore and iron sand concentrate:					
Gross weight					
thousand tons	3	4	4	2 r/	1
Fe content	2	2	2	1 r/	1
Metal:					
Pig iron and blast furnace ferroalloys	74,905	74,597	78,519	74,981	74,520
Electric-furnace ferroalloys:					
Ferromanganese	210,445	193,695	186,432	142,931	119,777
Ferromanganese	346,977	343,104	376,633	334,081	315,152
Ferromanganese	351,337	328,699	352,840	345,772	332,293
Ferrosilicon	3,650	--	--	951	1,452
Silicomanganese	64,870	72,727	74,897	70,886	65,744
Other:					
Ferrocolumbium	37	--	--	--	--
Ferromolybdenum	4,109	4,420	4,328	3,443	3,391
Ferrotungsten	120	64	62	61	43
Ferrovandium	3,618	3,902	4,232	4,073	3,349
Unspecified	4,669	4,820	5,021	1,101	6,077
Total	989,832	951,431	1,004,445	903,299	847,278
Steel, crude	101,640	98,801	104,545	93,548	94,192
Semimanufactures, hot-rolled:					
Of ordinary steels	79,449	78,266	82,201	73,379	73,221
Of special steels	16,171	15,332	16,517	14,774	14,224

See footnotes at end of table.

TABLE 1--Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1995	1996	1997	1998	1999 p/
METALS--Continued					
Lead:					
Mine output, Pb content	9,659	7,753	5,227	6,198	6,074
Metal, refined:					
Primary	148,117	140,531	142,326	144,542	125,514
Secondary	139,461	146,842	154,438	157,555 r/	167,915
Total	287,578	287,373	296,764	302,097 r/	293,429
Magnesium metal, secondary	11,767	8,175	10,934	7,807	7,732
Manganese:					
Oxide	60,366	58,523	57,920	52,341	57,993
Metal	865	--	--	--	--
Molybdenum metal	689	596	699	632	586
Nickel metal:					
Refined	26,824	26,564	26,889	29,397	30,481
Ni content of nickel oxide sinter	35,966	34,772	26,899	25,435	35,190
Ni content of ferronickel	69,876	66,796	72,079	69,202	66,458
Ni content of chemical	2,297	2,323	2,536	2,511	2,570
Total	134,963	130,455	128,403	126,545	134,699
Platinum-group metals:					
Palladium metal kilograms	2,174	2,182	1,899	4,151	5,354
Platinum metal do.	730	816	693	533	737
Rare-earth oxide 4/	4,667	4,892	5,161	4,728	5,092
Selenium, elemental	548	588	546	550	546
Silicon, high-purity	3,328	4,112	5,486	5,340	3,844
Silver:					
Mine output, Ag content kilograms	100,078	85,115	87,180	94,472	94,004
Metal: do.					
Primary do.	2,056,657	2,032,120	2,094,097	2,203,697 r/	2,257,888
Secondary 3/ do.	171,969	180,741	218,999	415,757 r/	503,938
Total do.	2,228,626	2,212,861	2,313,096	2,619,454 r/	2,761,826
Tellurium, elemental	43	37	25	39	35
Tin, metal, smelter	630	524	507	500	568
Titanium:					
Oxide	249,290	237,942	241,417	251,275	269,193
Metal	16,702	21,062	24,462	24,182	18,898
Tungsten metal	4,468	4,288	4,759	4,082	4,357
Vanadium metal e/ 5/	250	250	250	250	250
Zinc:					
Mine output, Zn content	95,274	79,709	71,569	67,670	64,263
Oxide	75,973	76,008	79,688	77,183	78,928
Metal:					
Primary	573,912	500,674	500,603	513,916	524,979
Secondary	137,139	141,593	149,605	138,771 r/	158,637
Total	711,051	642,267	650,208	652,687 r/	683,616
Zirconium oxide	6,510 r/	6,680 r/	6,820 r/	7,270 r/	7,500
INDUSTRIAL MINERALS					
Asbestos e/	20,000	18,000	18,000	18,000	18,000
Bromine, elemental e/	15,000	15,000	15,000	15,000	15,000
Cement, hydraulic thousand tons	90,474	94,492	91,938	81,328	80,120
Clays:					
Bentonite	478,056	468,728	495,646	443,566	428,247
Fire clay, crude	566,569	526,143	560,759	577,666 r/	558,110
Kaolin	182,122	141,230	110,915	83,257	53,092
Diatomite	174,510	194,115	194,000 e/	190,000 e/	190,000 e/
Feldspar and related materials:					
Feldspar	65,086	55,122	55,000 e/	50,000 e/	50,000 e/
Aplite	388,000	365,580	310,000 e/	310,000 e/	330,000 e/
Gypsum thousand tons	5,334	5,432	5,371	5,305	5,400 e/
Iodine, elemental	5,492	6,178	6,036	6,142	6,152
Lime, quicklime thousand tons	7,871	7,744	8,104	7,646	7,594
Nitrogen, N content of ammonia do.	1,584	1,567	1,589	1,464	1,457
Perlite	275,600 r/	304,300 r/	290,000 r/	251,400 r/	260,000 e/
Salt, all types e/ thousand tons	1,351 6/	1,390	1,400	1,390	1,390
Silica sand	3,734,425	3,556,998	3,305,595	3,049,263	2,763,658
Silica stone thousand tons	18,349	19,026	18,074	16,235	15,548

See footnotes at end of table.

TABLE 1--Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1995	1996	1997	1998	1999 p/
INDUSTRIAL MINERALS--Continued					
Sodium compounds, n.e.s.:					
Soda ash	1,049,017	925,671	801,169	721,747	721,752
Sulfate	206,893	193,439	203,530	177,407	174,139
Stone, crushed and broken:					
Dolomite thousand tons	3,773	3,905	4,013	3,873	3,648
Limestone do.	201,097	202,894	201,399	183,955	180,193
Sulfur:					
S content of pyrite do.	88 r/	45 r/	39 r/	23 r/	41
Byproduct:					
Of metallurgy do.	1,342	1,314	1,331	1,322 r/	1,363
Of petroleum do.	1,682	1,791	2,013	2,083	2,060
Talc and related materials:					
Talc	57,269	56,153	53,000 e/	50,000	50,000 e/
Pyrophyllite	947,713	913,973	913,822	764,099 r/	694,317
Vermiculite e/	15,000	15,000	15,000	15,000	15,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black thousand tons	757	757	776	723	761
Coal:					
Anthracite do.	--	4	2	-- r/	--
Bituminous 7/ do.	6,263	6,476	4,272	3,663 r/	3,906
Total do.	6,263	6,480	4,274	3,663 r/	3,906
Coke including breeze:					
Metallurgical do.	42,010	40,728	41,089	39,554	36,473
Gashouse including breeze do.	593	528	135	14	--
Gas, natural:					
Gross 8/ million cubic meters	2,209	2,230	2,279	2,301	2,280
Marketed do.	2,315	2,325	2,367	2,373 r/	2,362
Petroleum:					
Crude thousand 42-gallon barrels	5,415	5,265	5,296	4,982	4,592
Refinery products:					
Gasoline:					
Aviation do.	64	63	59	50	104
Other do.	319,263	328,164	336,158	347,422	353,730
Asphalt and bitumen do.	36,137 r/	36,922 r/	35,733 r/	34,216 r/	34,259
Distillate fuel oil do.	287,498	296,381	302,870	289,777	280,122
Jet fuel do.	49,520	47,155	58,015	66,205	65,732
Kerosene do.	171,675	177,577	173,725	174,133 r/	167,744
Liquefied petroleum gas do.	56,665	56,272	59,090 r/	55,413 r/	56,187
Lubricants do.	17,203	17,423	17,819 r/	16,541	16,939
Naphtha do.	112,110	104,379	120,981	113,234	113,080
Paraffin do.	909	823	790	807	842
Petroleum coke e/ do.	950	900	950	950	900
Refinery fuel and losses e/ 9/ do.	160,000	155,000	160,000	160,000	150,000
Refinery products--Continued:					
Residual fuel oil thousand 42-gallon barrels	489,605	463,087	467,311	451,494	435,916
Unfinished oils e/ do.	60,000	55,000	60,000	60,000	50,000
Total e/ do.	1,761,921	1,739,454	1,793,478	1,769,358	1,725,555

e/ Estimated. p/ Preliminary. r/ Revised. -- Zero.

1/ Table includes data available through November 3, 2000.

2/ Includes unalloyed ingot and alloyed ingot.

3/ Includes recovered from scrap and waste.

4/ Includes oxide of cerium, europium, gadolinium, lanthanum, neodymium, praseodymium, samarium, terbium, and yttrium.

5/ Represents metal content of vanadium pentoxide recovered from petroleum residues, ashes, and spent catalysts.

6/ Reported figure.

7/ All steam coal.

8/ Includes output from gas wells and coal mines.

9/ May include some additional unfinished oils.

Sources: Ministry of International Trade and Industry (Tokyo). Yearbook of Minerals and Nonferrous Metals Statistics, 1999; Yearbook of Iron and Steel Statistics, 1999; Yearbook of Chemical Industries Statistics, 1999; Yearbook of Ceramics and Building Materials Statistics, 1999; and Yearbook of Production, Supply and Demand of Petroleum, Coal and Coke, 1999. Arumu Publishing Company. Industrial Rare Metals, No. 115, Annual Review, 1999.

TABLE 2
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 1999

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Aso Cement Co. Ltd.	Tagawa, Fukuoka Prefecture	1,443
Do.		Daichi Cement Co. Ltd.	Kawasaki, Kanagawa Prefecture	1,169
Do.		Denki Kagaku K.K.	Omi, Niigata Prefecture	2,762
Do.		Hachinohe Cement Co. Ltd.	Hachinohe, Aomori Prefecture	1,533
Do.		Hitachi Cement Co. Ltd.	Hitachi, Ibaraki Prefecture	941
Do.		Kanda Cement Co. Ltd.	Kanda, Fukuoka Prefecture	1,118
Do.		Mitsubishi Materials Corp.	Higashidori, Shimokita-gun, Aomori Prefecture; Higashiyama, Higashiiwai-gun, Iwate Prefecture; Yokoze, Saitama Prefecture; Kurosaki, Kyushu, and Higashitani, Fukuoka Prefecture	13,467
Do.		Mitsui Mining Co. Ltd.	Togawa, Fukuoka Prefecture	2,075
Do.		Myojo Cement Co. Ltd.	Itoigawa, Niigata Prefecture	2,482
Do.		Nippon Steel Chemical Co. Ltd.	Tobata, Kitakyushu, Fukuoka Prefecture	855
Do.		Nittetsu Cement Co. Ltd.	Muroran, Hokkaido Prefecture	1,589
Do.		Ryukyu Cement Co. Ltd.	Yabu, Nago, Okinawa Prefecture	722
Do.		Sumitomo Osaka Cement Co. Ltd.	Tamura, Fukushima Prefecture; Aso, Tochigi Prefecture; Motosu Gifu Prefecture; Sakata, Shiga Prefecture; Ako, Hyogo Prefecture; and Susaki, Kochi Prefecture	14,402
Do.		Taiheiyo Cement Co. Ltd. 1/	Ofunato, Iwate Prefecture; Chichibu, Kumagaya, and Saitama, Saitama Prefecture; Fujiwara, Mie Prefecture; Saiki and Tsukumi, Oita Prefecture; Kamiiso, Hokkaido Prefecture; Tosa, Kochi Prefecture; and Kawara, Fukuoka Prefecture	29,904
Do.		Tokuyama Cement Co. Ltd.	Nanyo, Yamaguchi Prefecture	5,936
Do.		Tosoh Corp.	Shin Nanyo, Yamaguchi Prefecture	2,869
Do.		Tsuruga Cement Co. Ltd.	Tsuruga, Fukui Prefecture	1,710
Do.		Ube Industries Ltd.	Ube, Isa, Yamaguchi Prefecture; and Kanda, Fukuoka Prefecture	10,736
Coal		Matsushima Coal Mining Co. Ltd.	Ikeshima in Sotome, Nagasaki Prefecture	1,400
Do.		Taiheiyo (Pacific) Coal Mining Co. Ltd.	Kushiro, Hokkaido Prefecture	2,200
Copper:				
Refined	metric tons	Hibi Kyodo Smelting Co. Ltd. (Mitsui Mining and Smelting Co. Ltd. owned 64% with minority ownership by Nittetsu Mining Co. Ltd. and Furukawa Co. Ltd.)	Tamano, Okayama Prefecture	190,800
Do.	do.	Mitsubishi Materials Corp.	Naoshima, Kagawa Prefecture	216,000
Do.	do.	Nippon Mining and Metals Co. Ltd. (wholly owned subsidiary of Nikko Kyodo Co. Ltd.)	Hitachi, Ibaraki Prefecture Saganoseki, Oita Prefecture	168,000 252,000
Do.	do.	Onahama Smelting and Refining Co. Ltd. (Dowa Mining Co. Ltd. owned 30%; Furukawa Group Co., 12%; and Mitsubishi Materials Corp., 49%; Mitsui Mining and Smelting Co. Ltd., 4%; and others, 5%)	Onahama, Fukushima Prefecture	258,000
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Besshi, Ehime Prefecture	234,000
Do.	do.	Kosaka Smelting and Refining Co. Ltd. (wholly owned subsidiary of Dowa Mining Co. Ltd.)	Kosaka, Akita Prefecture	72,000
Do.	do.	Mitsui Mining and Smelting Co. Ltd.	Takehara, Hiroshima Prefecture	30,000
Gold:	kilograms			
In concentrate		Sumitomo Metal Mining Co. Ltd.	Hishikari, Kagoshima Prefecture	9,000
Refined	kilograms	Kosaka Smelting and Refining Co. Ltd. (wholly owned subsidiary of Dowa Mining Co. Ltd.)	Kosaka, Akita Prefecture	18,000
Do.	do.	Mitsui Mining and Smelting Co. Ltd.	Takehara, Hiroshima Prefecture	22,000
Do.	do.	Mitsubishi Materials Corp.	Naoshima, Kagawa Prefecture	60,000
Do.	do.	Nippon Mining and Metals Co. Ltd.	Hitachi, Ibaraki Prefecture	30,000
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Niihama, Ehime Prefecture	30,000
Limestone		Mitsubishi Materials Corp.	Higashitani, Fukuoka Prefecture	10,000
Do.		Nittetsu Mining Co. Ltd.	Torigatayama, Kochi Prefecture; Hanezuru, Tochigi Prefecture; and Shiriya, Aomori Prefecture	23,000
Do.		Sumikin Mining Co., Ltd.	Hachinohe Sekkai, Aomori Prefecture	5,500
Do.		Sumitomo-Osaka Cement Co. Ltd.	Shuho, Yamaguchi Prefecture, and Karazawa, Tochigi Prefecture	10,000
Do.		Shuho Mining Co., Ltd.	Sumitomo Cement Shuho, Yamaguchi Prefecture	8,200
Do.		Taiheiyo Cement Co. Ltd. 1/	Ofunato, Iwate Prefecture; Ganji and Tsukumi, Oita Prefecture; Garō, Hokkaido Prefecture; Kawara, Fukuoka Prefecture, Tosayama, Kochi Prefecture; Taiheiyo Buko, Saitama Prefecture; and Shigeyasu, Yamaguchi Prefecture	44,000
Do.		Todaka Mining Co. Ltd.	Todaka-Tsukumi, Oita Prefecture	13,500
Do.		Ube Kosan Co. Ltd.	Ube Isa, Yamaguchi Prefecture	9,000
Iodine, crude	metric tons	Ise Chemical Industries Co. Ltd. (Asahi Glass Co. Ltd. owned 52.4% and Mitsubishi Corp., 11.2%)	Oami-Shirasato, and Ichinomya, Chiba Prefecture; and Sadowara, Miyazaki Prefecture	3,600
Do.	do.	Godo Shigen Sangyo Co. Ltd. (Kanto Natural Gas Develop- ment Co. Ltd. owned 11% and Mitsui & Co. Ltd., 10%)	Chosei, Chiba Prefecture	2,400
Do.	do.	Kanto Natural Gas Development Co. Ltd. (Mitsui Chemicals, Inc., owned 21.9% and Godo Shigen Sangyo Co. Ltd., 14.3%)	Mobara, Chiba Prefecture	1,200
Do.	do.	Nihon Tennen Gas Co. Ltd. (Kanto Natural Gas Develop- ment Co. Ltd. owned 50% and Tomen Corp., 41%)	Shirako and Yokoshiba, Chiba Prefecture	1,200
Do.	do.	Toho Earthtech, Inc. (Itochi Corp. owned 34.1%; Mitsubishi Gas Chemical Co. Ltd., 32.2%; and Nippon Light Metal Co. Ltd., 31.1%)	Kurosaki, Niigata Prefecture	720

See footnotes at end of table.

TABLE 2--Continued
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 1999

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iodine, crude	metric tons	Nippon Chemicals Co. Ltd. (Nippon Shokubai Co. Ltd., 17%; Takeda Chemical Industries Ltd., 16.4%; and Chugai Boyeki Co. Ltd., 13.6%)	Isumi, Chiba Prefecture	720
Lead:				
In concentrate		Kamioka Mining and Smelting Co. Ltd. (wholly owned subsidiary of Mitsui Mining and Smelting Co. Ltd.)	Kamioka, Gifu Prefecture	3
Do.		Toyoha Mining Co. Ltd. (wholly owned subsidiary of Nippon Mining and Metals Co. Ltd.)	Toyoha, Hokkaido Prefecture	7
Refined	metric tons	Kamioka Mining and Smelting Co. Ltd. 2/	Kamioka, Gifu Prefecture	33,600
Do.	do.	Mitsui Mining and Smelting Co. Ltd.	Takehara, Hiroshima Prefecture	43,800
Do.	do.	Toho Zinc Co. Ltd.	Chigirishima, Hiroshima Prefecture	120,000
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Harima, Hyogo Prefecture	30,000
Do.	do.	Kosaka Smelting and Refining Co. Ltd.	Kosaka, Akita Prefecture	25,200
Do.	do.	Hosokura Mining Co. Ltd. (wholly owned subsidiary of Mitsubishi Materials Corp.) 3/	Hosokura, Miyagi Prefecture	21,600
Manganese:				
In electrolytic dioxide		Japan Metals & Chemicals Co. Ltd.	Takaoka, Toyama Prefecture	18
Do.		Mitsui Mining and Smelting Co. Ltd.	Takehara, Hiroshima Prefecture	25
Do.		Tosoh Corp.	Hyuga, Miyazaki Prefecture	34
Nickel:				
In ferronickel	metric tons	Hyuga Smelting Co. Ltd. (wholly owned subsidiary of Sumitomo Metal Mining Co. Ltd.)	Do.	18,000
Do.	do.	Nippon Yakin Kogyo Co. Ltd.	Oheyama, Kyoto Prefecture	12,720
Do.	do.	Pacific Metals Co. Ltd.	Hachinohe, Aomori Prefecture	40,800
In oxide	do.	Tokyo Nickel Co. Ltd.	Matsuzaka, Mie Prefecture	60,000
Refined	do.	Sumitomo Metal Mining Co. Ltd.	Niihama, Ehime Prefecture	36,000
Pyrophyllite				
Do.		Goto Kozan Co. Ltd.	Goto, Nagasaki Prefecture	204
Do.		Ohira Kozan Co. Ltd.	Ohira, Okayama Prefecture	132
Do.		Sankin Kogyo Co. Ltd.	Otsue, Hiroshima Prefecture	72
Do.		Shinagawa Shirenga Co. Ltd.	Mitsuishi, Okayama Prefecture	180
Do.		Shokozan Kogyosho Co. Ltd.	Yano-Shokozan, Hiroshima Prefecture	180
Do.		Showa Kogyo Co. Ltd.	Showa-Shokozan, Hiroshima Prefecture	60
Steel, crude				
Do.		Kawasaki Steel Corp.	Mizushima, Okayama Prefecture, and Chiba, Chiba Prefecture	17,405
Do.		Kobe Steel Ltd.	Kakogawa and Kobe, Hyogo Prefecture	8,943
Do.		NKK Corp.	Fukuyama, Hiroshima Prefecture, and Keihin, Kanagaw Prefecture	16,430
Do.		Nippon Steel Corp.	Oita, Oita Prefecture; Kawata, Fukuoka Prefecture; Kimitsu, Chiba Prefecture; and Nagoya, Aichi Prefecture	33,199
Do.		Sumitomo Metal Industries, Ltd.	Kashima, Ibaraki Prefecture; Kokura, Fukuoka Prefecture; and Wakayama, Wakayama Prefecture	12,820
Titanium:				
In sponge metal		Sumitomo Sitix Corp. (Sumitomo Metal Industries, Ltd. owned 92.4% and Kobe Steel Ltd., 7.6%)	Amagasaki, Hyogo Prefecture	15
Do.		Toho Titanium Co. Ltd. (Nippon Mining and Metals Co. Ltd. owned 47%; Mitsui & Co. Ltd., 20%; and others, 33%)	Chigasaki, Kanagawa Prefecture	11
In oxide	metric tons	Fuji Titanium Industry Co. Ltd. (Ishihara Sangyo Kaishia Ltd. owned 24.8%)	Kobe, Hyogo Prefecture	17,400
Do.	do.	Furukawa Co. Ltd.	Osaka, Osaka Prefecture	23,400
Do.	do.	Ishihara Sangyo Kaisha Ltd. (Mitsui & Co. Ltd. owned 11%)	Yokkaichi, Mie Prefecture	154,800
Do.	do.	Sakai Chemical Industries Co. Ltd.	Onahama, Fukushima Prefecture	43,200
Do.	do.	Tayca Corp.	Saidaiji, Okayama Prefecture	60,000
Do.	do.	Titan Kogyo Kabushiki Kaisha	Ube, Yamaguchi Prefecture	16,800
Do.	do.	Tohkem Products Corp.	Akita, Akita Prefecture	30,000
Zinc:				
In concentrate		Kamioka Mining and Smelting Co. Ltd.	Kamioka, Gifu Prefecture	35
Do.		Toyoha Mining Co. Ltd.	Toyoha, Hokkaido Prefecture	45
Refined	metric tons	Akita Smelting Co. Ltd. (Dowa Mining Co. Ltd. owned 57% Nippon Mining and Metals Co. Ltd., 24%; Sumitomo Metal Mining Co. Ltd., 14%; and Mitsubishi Materials Corp., 5%)	Iijima, Akita Prefecture	195,600
Do.	do.	Hachinohe Smelting Co. Ltd. (Dowa Mining Co. Ltd. owned 20%, Mitsui Mining and Smelting Co. Ltd., 50%; Nippon Mining and Metals Co. Ltd. and Mitsubishi Materials Corp., 10% each; and Toho Zinc Co. Ltd. and Nisso Smelting Co. Ltd., 5% each)	Hachinohe, Aomori Prefecture	117,600
Do.	do.	Hikoshima Smelting Co. Ltd.	Hikoshima, Yamaguchi Prefecture	84,000
Do.	do.	Kamioka Mining and Smelting Co. Ltd.	Kamioka, Gifu Prefecture	72,000
Do.	do.	Nikko Mikkaichi Recycle Co. Ltd. 4/	Mikkaichi, Toyama Prefecture	18,000
Do.	do.	Toho Zinc Co. Ltd.	Annaka, Gunma Prefecture	139,200
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Harima, Hyogo Prefecture	90,000

1/ Chichibu Onoda Cement Co. Ltd. and Nihon Cement Co. Ltd. merged in October 1998 and renamed Taiheiyō Cement Co. Ltd.

2/ The plant was renovated to a secondary lead smelter recycling batteries in 1995.

3/ The plant became a secondary lead smelter recycling batteries in 1995.

4/ The plant, closed in October 1995, was renovated to a secondary zinc refinery in 1997 and reopened in 1998.

TABLE 3
JAPAN: RESERVES OF MAJOR MINERAL
COMMODITIES IN 1999

(Thousand metric tons unless otherwise specified)

Commodity	Reserves
Coal 1/	821,000
Copper ore, Cu content	36
Dolomite 2/	1,187,816
Gold ore, Au content	182,002
kilograms	
Iodine	4,900 r/ e/
Lead ore, Pb content	623
Kaolin	36,025
Limestone 3/	57,914,734
Pyrophyllite	160,370
Silica sand 4/	200,954
Silica stone, white 5/	880,701
Zinc ore, Zn content	3,245

e/ Estimated. r/ Revised.

1/ Recoverable reserves, including 17 million metric tons of lignite.

2/ Average ore grade is 17.9% MgO.

3/ Average ore grade is 53.8% CaO.

4/ Average ore grade is 78.0% SiO₂

5/ Average ore grade is 92.8% SiO₂

Sources: Ministry of International Trade and Industry (Tokyo).

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TABLE 4
JAPAN: MINERALS TRADE

(Million of U.S. dollars)

Commodity		Imports 1/		Exports 1/	
Code	Description	1998	1999	1998	1999
25	Salt, sulfur, earths and stone, lime, plastering materials, cement	1,409	1,353	334	308
26	Ferrous and nonferrous metal ores, slag, ash	6,114	6,222	21	20
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; minerals waxes	43,172	49,861	1,232	1,225
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes	2,980	2,850	1,570	1,806
31	Fertilizers	491	489	85	92
68	Articles of stone, plaster, cement, asbestos, mica or similar materials	906	941	813	843
69	Ceramic products	512	543	1,236	1,169
70	Glass and glassware	996	1,034	1,813	2,087
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coin	5,335	6,383	1,638	1,669
72	Iron and steel	2,930	2,756	11,870	11,367
73	Articles of iron and steel	1,821	1,821	6,093	5,390
74	Copper and articles thereof	1,038	1,021	2,087	2,226
75	Nickel and articles thereof	717	831	182	205
76	Aluminum and articles thereof	4,753	4,633	1,491	1,592
78	Lead and articles thereof	30	21	14	12
79	Zinc and articles thereof	159	88	85	111
80	Tin and articles thereof	146	157	18	28
81	Other base metals; cermets; articles thereof	831	680	454	480
	Total, minerals trade	74,340	81,684	31,046	30,630
	Total, Japan merchandise trade	279,756	309,640	386,603	417,450

1/ Values have been converted from Japanese yen (Y) to U.S. dollars at the rate of Y131.02=US\$1.00 for 1998 and Y113.9 =US\$1.00 for 1999.

Source: Ministry of Finance, Japan Exports & Imports, Commodity by Country, December 1998-99.

TABLE 5
JAPAN: OVERSEAS ALUMINUM SMELTING PROJECTS IN 1999

Company name (project name) and country	Annual capacity		Type of power	Production started	Shipment to Japan started	Shipment to Japan FY 1999 (metric tons)	Major equity holder and/or other holders	Participated Japanese companies and their equity share
	Total (metric tons)	Japanese share						
New Zealand Aluminium Smelters Ltd. (NZAS), New Zealand	313,000	65,000	Hydro	April 1971	July 1971	64,000	Comalco Ltd. of Australia, 78.4%	Sumitomo Chemical Co. Ltd., 21.6%.
Alcan Smelters and Chemical Ltd. (ALPAC), Canada	90,000	45,000	do.	Unknown	January 1977	41,000	Alcan Aluminum Ltd. of Canada, 50%	Nippon Light Metal Co. Ltd., 50%.
Intalco Aluminum Corp.	272,000	106,000	do.	1966	Unknown	176,000	Alcoa Inc. 61%	Mitsui & Co., Ltd. 32% and YKK Corp., 7%.
Eastalco Aluminum Co. (ALUMAX) 1/ The United States	174,000	68,000	Thermal	1970				
Industria Venezolana de Aluminio C.A. (VENALUM), Venezuela	450,000	90,000	Hydro	February 1978	December 1978	130,000	Corp. Venezolana de Guayana (CVG), of Venezuela, 80%	Showa Denko K.K., 7%; Sumitomo Chemical Co. Ltd., 4%; Kobe Steel Ltd., 4%; Mitsubishi Materials Corp., 3%; Mitsubishi Aluminum Co. Ltd., 1%; and Marubeni Corp., 1%.
P.T. Indonesia Asahan Aluminum (ASAHAN) Indonesia	225,000	133,000	do.	February 1982	October 1982	140,000	Indonesian Government, 41%	Nippon Asahan Aluminium Co. Ltd. (a 13-member Japanese consortium), 59%.
Boyne Island Smelter Ltd. (BOYNE reduction lines 1, 2), Australia	260,000	130,000	Thermal	do.	July 1982	224,000	Comalco Ltd. of Australia, 50%	Sumitomo Light Metal Co. Ltd., 17%; Ryowa Development Pty. Ltd., 9.5%; YKK Aluminium Pty Ltd., 9.5%; Kobe Steel Ltd., 9.5%; and Sumitomo Chemical Co. Ltd., 4.5%.
Boyne Island Smelter Ltd. (BOYNE reduction line 3), Australia	230,000	94,000	do.	July 1997	October 1997		Comalco Ltd. of Australia, 59.25%	Sumitomo Light Metal No. 2 Co. Pty Ltd., 17%; Ryowa Development II Pty. Ltd., 14.25%; and YKK Aluminium Pty. Ltd., 9.5%.
Alcoa of Australia Ltd. (PORTLAND) Australia	350,000	80,500	do.	November 1986	Unknown	78,000	Alcoa of Australia, 45%; Eastern Aluminum Co., 10%; China International Trust & Investment Corp., 22%	Marubeni Corp., 23%.
Aluminio Brasileiro S.A. (ALBRAS), Brazil	345,000	169,000	Hydro	July 1985	November 1986	170,000	Companhia Vale Do Rio Doce, 51%	Nippon Amazon Aluminum Co. (a 32-member Japanese consortium), 49%.
Aluminerie Alouette Inc. (ALOUETTE), Canada	230,000	46,000	do.	June 1992	September 1992	43,000	Austria Metal AG, 20% SGF, 20%; VAW, 20%; Hogovens Group, 20%	Kobe Steel Ltd., 13.33% and Marubeni Corp., 6.67%.

1/ The two smelters under the company ALUMAX was aquired by Alcoa Inc. in July 1998.

TABLE 6
JAPAN: DOMESTIC ORDERS FOR ORDINARY AND SPECIALTY STEEL PRODUCTS, BY END USE

(Thousand metric tons)

End use	Ordinary steel products			Specialty steel products		
	1997	1998	1999	1997	1998	1999
Automobiles	9,722	8,314	8,208	2,709	2,279	2,363
Construction	14,283	12,945	13,286	773	689	714
Conversion and processing	3,423	2,848	3,069	3,630	2,980	3,092
Electric machinery and equipment	2,417	2,003	1,946	125	104	107
Home and office appliances	623	523	519	228	186	175
Industrial machinery and equipment	1,741	1,284	1,171	1,364	983	996
Rolling stock	32	27	29	14	16	24
Shipbuilding and marine equipment	3,261	3,166	2,881	79	76	69
Steel dealers	21,656	17,994	18,014	1,412	1,120	1,078
Tanks and containers	1,985	1,769	1,759	21	20	13
Other	592	504	459	158	89	84
Total domestic demand	59,735	51,377	51,341	10,513	8,542	8,715
Exports	15,619	15,778	18,113	4,065	4,197	3,876
Grand Total	75,354	67,155	69,454	14,578	12,739	12,591

Source: The Japan Iron and Steel Federation.

TABLE 7
JAPAN: EXPORTS OF IRON AND STEEL PRODUCTS, BY COUNTRY OF DESTINATION

(Thousand metric tons)

Destinations	1995	1996	1997	1998	1999
Asia:	17,894	16,067	17,647	15,556	20,729
China	3,843	2,538	2,659	2,477	2,960
Hong Kong	1,254	1,382	1,644	1,568	1,641
Korea, Republic of	3,128	3,344	3,566	2,756	5,366
Malaysia	1,358	1,509	1,661	1,138	1,616
Taiwan	2,585	2,231	2,428	2,959	3,080
Thailand	2,629	2,236	2,194	1,749	2,553
Singapore	1,111	961	1,183	918	900
Other countries	1,986	1,866	2,312	1,991	2,613
Middle East	583	628	848	1,146	1,283
Europe	615	710	734	1,192	1,004
America:	3,089	2,632	3,553	8,914	4,313
Argentina	15	5	45	96	90
Brazil	31	21	66	65	34
Canada	167	112	178	592	443
Colombia	284	132	104	178	110
United States	2,334	2,049	2,704	7,020	2,803
Venezuela	13	17	34	94	30
Other countries	245	296	422	869	803
Africa	372	269	408	409	339
Oceania:	434	309	345	434	544
Australia	366	247	275	381	483
New Zealand	61	58	57	47	57
Other countries	7	4	13	6	4
Total	22,987	20,615	23,535	27,651	28,212

Source: The Japan Iron and Steel Federation, Monthly Report of the Iron and Steel Statistics, v. 43, no. 2, February 2000, p. 14-17.

TABLE 8
JAPAN: MAJOR LIMESTONE PRODUCERS

(Thousand metric tons)

Company	Location		Production		
	Prefecture	Mine	1996	1997	1998
Taiheiyo Cement Co. Ltd.:					
(formerly Chichibu Onoda Cement Co. Ltd.)	Oita	Ganji	9,990	9,925	9,891
(formerly Nihon Cement Co. Ltd.)	do.	Tsukumi	10,007	9,808	9,294
Do.	Hokkaido	Garo	7,173	7,082	8,064
(formerly Chichibu Onoda Cement Co. Ltd.)	Iwate	Oofunato	5,754	5,615	4,715
(formerly Nihon Cement Co. Ltd.)	Fukuoka	Kawara	3,173	3,204	2,173
(formerly Chichibu Onoda Cement Co. Ltd.)	Guma, Kochi	Kanoyama, Tosayama	3,123	3,067	2,603
Do.	Saitama	Minowa, Taiheiyo Buko	2,614	2,262	4,238
Do.	Yamagichi	Shigeyasu	2,179	2,244	2,248
Total			44,013	43,207	43,226
Nittetsu Mining Co. Ltd.	Kochi	Torigatayama	14,222	14,049	13,007
Do.	Aomori	Shiriya	5,639	5,690	4,395
Do.	Tochigi	Hanezuru	2,811	3,011	3,292
Total			22,672	22,750	20,694
Todaka Mining Co. Ltd.	Oita	Todaka Tsukumi	13,415	13,144	11,700
Mitsubishi Materials Corp.	Fukuoka	Higashitani	9,869	10,095	8,402
Ube Kosan Co. Ltd.	Yamaguchi	Ube Isa	8,828	8,642	8,236
Shuho Mining Co. Ltd.	do.	Sumitomo Cement Shuho	7,791	8,131	8,010
Sumikin Mining Co. Ltd.	Aomori	Hachinohe Sekkai	5,372	5,467	5,186
Ishizaki Co. Ltd.	Mie	Fujiwara	4,786	4,617	4,486
Mitsui Mining Co. Ltd.	Fukuoka	Sekinoyama	4,845	4,730	4,007
Sumitomo Osaka Cement Co. Ltd.	Shiga	Ibuki	3,135	2,626	2,261
Do.	Tochigi	Karasawa	2,046	1,900	1,691
Total			5,181	4,526	3,952
Boku Mining Co. Ltd.	Saitama	Buko	4,760	4,062	--
Ryoko Lime Industries Co. Ltd.	do.	Une	2,900	3,388	4,147
Denki Kagaku Industries Co. Ltd.	Niigata	Omi	3,676	3,752	3,050
Gikenkomusho Co. Ltd.	Fukuoka	Ube Kanda	3,350	3,063	2,273
Yabashi Ryutaro	Gifu	Kinsyozan Sekkaiseki	2,845	2,743	2,416
Myojo Cement Co. Ltd.	Niigata	Tomi	2,699	2,639	2,050
Oita Mining Co. Ltd. (formerly Furukawa Co. Ltd.)	Oita	Oita	2,564	2,862	2,743
Ryukiu Cement Co. Ltd.	Okinawa	Awa	2,450	2,481	2,471
Funao Mine Co. Ltd.	Fukuoka	Funao	2,175	2,192	2,336
Okutama Industries Co. Ltd.	Tokyo	Hikawa	2,033	2,182	1,664
Shikoku Mine Development Co. Ltd.	Kochi	Shirokidani	2,057	2,022	--
Yoshizawa Lime Industries Co., Ltd.	Tochigi	Okano	1,399	1,371	1,384
Total			159,680	158,066	142,433
Grand total			201,399	183,955	180,193

-- Zero.

Source: Ministry of International Trade and Industry, Mining Division, Mining Handbook (Kogyo Benran), 1998-2000.

TABLE 9
JAPAN: COAL DEMAND, BY END USE

(Thousand metric tons)

End use	Anthracite			Bituminous						Total		
	1997	1998	1999	Coking			Steam			1997	1998	1999
				1997	1998	1999	1997	1998	1999			
Briquets:												
Domestic	--	--	--	--	--	--	2	2	--	2	2	--
Imported	81	53	44	--	--	--	3	3	--	84	57	44
Cement and ceramics:												
Domestic	--	--	--	--	--	--	(1/)	(1/)	--	(1/)	(1/)	--
Imported	1,476	1,188	637	--	--	--	8,601	7,420	7,812	10,077	8,607	8,449

See footnotes at end of table.

TABLE 9--Continued
JAPAN: COAL DEMAND, BY END USE

(Thousand metric tons)

End use	Anthracite			Bituminous						Total		
	1997	1998	1999	Coking			Steam			1997	1998	1999
				1997	1998	1999	1997	1998	1999			
Chemicals:												
Domestic	--	--	--	--	--	--	--	--	--	--	--	--
Imported	282	188	175	--	--	--	4,305	3,990	4,349	4,587	4,178	4,524
City gas, imported	11	--	--	23	12	--	--	--	--	34	12	--
Coke, imported	--	--	--	5,786	5,338	3,693	--	--	--	5,786	5,338	3,693
Electric power:												
Domestic	--	--	--	--	--	--	5,223	3,782	3,843	5,223	3,782	3,843
Imported	--	--	--	--	--	--	39,378	42,242	46,033	39,378	42,242	46,033
Iron and steel, imported	2,135	2,333	1,918	59,580	57,467	59,439	1,994	2,476	3,107	63,708	62,276	64,464
Paper and pulp:												
Domestic	--	--	--	--	--	--	2	--	--	2	--	--
Imported	--	--	--	--	--	--	4,044	4,365	3,887	4,044	4,365	3,887
Other:												
Domestic	--	--	--	--	--	--	19	21	15	19	21	15
Imported	26	37	7	--	2	14	1,732	1,762	2,288	1,758	1,808	2,309
Total	4,011	3,800	2,781	65,389	62,819	63,146	65,302	66,062	71,334	134,702	132,681	137,261
Of which												
Domestic	--	--	--	--	--	--	5,246	3,805	3,858	5,246	3,805	3,858
Imported	4,011	3,800	2,781	65,389	62,819	63,146	60,056	62,257	67,476	129,456	128,876	133,403

-- Zero.

1/ Less than 1/2 unit.

Source: Ministry of International Trade and Industry, Yearbook of Production, Supply, and Demand of Petroleum, Coal, and Coke, 1997-99.

TABLE 10
JAPAN: EXPORTS OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1997	1998	Destinations, 1998	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals	443	286	10	Canada 137; India 86; Republic of Korea 20.
Aluminum:				
Ore and concentrate	189	12	--	All to Taiwan.
Oxides and hydroxides	223,031	245,176	4,151	Republic of Korea 151,494; Taiwan 45,717; Thailand 19,190.
Metal including alloys:				
Scrap	21,431	26,695	150	China 15,811; Hong Kong 7,902.
Unwrought	10,262	7,153	382	Republic of Korea 1,690; Hong Kong 1,510; China 1,276.
Semimanufactures	277,582	310,555	32,657	China 68,960; Taiwan 48,003; Hong Kong 26,761.
Antimony:				
Ore and concentrate	--	3	--	Philippines 2; Thailand 1.
Oxides	2,157	1,925	35	Republic of Korea 229; Taiwan 192; China 190.
Metal including alloys, all forms 2/	79	343	(3/)	Thailand 141; Hong Kong 96; Spain 51.
Arsenic, metal including alloys, all forms	13	17	16	United Kingdom 1.
Beryllium, metal including alloys, all forms	1	6	--	China 2; Hong Kong 2; Taiwan 1.
Bismuth, metal including alloys, all forms 2/	11	5	--	Taiwan 1; Belgium 1; Thailand 1.
Cadmium, metal including alloys, all forms	98	17	(3/)	Pakistan 10; Republic of Korea 7.
Chromium:				
Ore and concentrate	8,649	116	--	Republic of Korea 76; Taiwan 40.
Oxides and hydroxides	4,386	4,122	1,405	Republic of Korea 1,170; Taiwan 749; Kuwait 119.
Metal including alloys, all forms	327	173	35	Republic of Korea 69; Taiwan 37; Netherlands 9.
Cobalt:				
Ore and concentrate	--	3	--	All to India.
Oxides and hydroxides	88	134	11	Taiwan 30; Finland 26; China 14.

See footnotes at end of table.

TABLE 10 -- Continued
JAPAN: EXPORTS OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1997	1998	Destinations, 1998	
			United States	Other (principal)
METALS--Continued				
Cobalt--Continued:				
Metal including alloys, all forms	900	1,119	332	Taiwan 236; United Kingdom 124; Belgium 83.
Columbium and tantalum, tantalum metal including alloys, all forms	219	242	56	Germany 53; United Kingdom 51; China 50.
Copper:				
Oxides and hydroxides	1,061	849	7	Singapore 306; Republic of Korea 214; China 145.
Sulfates	2,875	3,903	14	Taiwan 2,541; Indonesia 612; Hong Kong 303.
Metal including alloys:				
Scrap	79,937	75,486	157	China 54,230; Hong Kong 11,979; Taiwan 3,525.
Unwrought	193,054	342,561	9,225	Taiwan 152,241; Republic of Korea 54,571; Canada 51,725.
Semimanufactures	318,710	299,384	29,967	Hong Kong 61,459; Taiwan 44,056; Malaysia 36,148.
Germanium, metal including alloys, all forms	1	(3/)	--	Mainly to Taiwan.
Gold:				
Waste and scrap thousand grams	11	4	--	Hong Kong 3; United Kingdom 1.
Metal including alloys, unwrought and partly wrought do.	51	72	1	Singapore 17; Malaysia 12; Hong Kong 10.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	70	103	--	Republic of Korea 48; Hong Kong 37; Taiwan 18.
Metal:				
Scrap thousand tons	2,311	3,821	--	Republic of Korea 1,726; China 916; Taiwan 624.
Pig iron, cast iron, related metal do.	250	2,311	474	Republic of Korea 1,096; Taiwan 380; Indonesia 60.
Ferroalloys:				
Ferromanganese	45,555	26,815	5,726	Australia 8,684; Indonesia 3,614; Netherlands 2,760.
Ferromolybdenum	98	42	--	Thailand 17; Taiwan 15; Republic of Korea 7.
Ferronickel	69,662	74,020	--	Taiwan 48,189; Republic of Korea 25,812.
Ferrosilicomanganese	122	217	--	Taiwan 189; Thailand 20; Republic of Korea 8.
Ferrosilicon	5,292	4,055	403	Republic of Korea 1,326; Taiwan 839; Thailand 620.
Silicon metal	493	539	(3/)	Republic of Korea 400; Malaysia 45; China 28.
Unspecified	3,308	2,719	2,082	Taiwan 276; Republic of Korea 64; India 42.
Semimanufactures, unspecified thousand tons	22,345	23,858	6,421	China 2,407; Thailand 1,671; Republic of Korea 1,466.
Lead:				
Ore and concentrate	1	--	--	
Oxides	196	101	--	Taiwan 55; Thailand 18.
Ash and residue containing lead	--	3	--	All to Belgium.
Metal including alloys:				
Scrap	15,615	8,575	--	Republic of Korea 7,703; India 677; Indonesia 100.
Unwrought	6,165	6,413	--	Malaysia 4,733; Indonesia 802; Burma 174.
Semimanufactures	348	1,154	18	China 894; Malaysia 71; Taiwan 43.
Lithium, oxides and hydroxides	23	12	9	China 1; Indonesia 1; Taiwan 1.
Magnesium, metal including alloys:				
Scrap	20	6	--	All to United Kingdom.
Unwrought	194	22	4	Taiwan 11; China 5; Russia 2.
Semimanufactures	20	15	--	Malaysia 5; Sweden 2; Thailand 2.
Manganese:				
Oxides	1,225	1,154	137	China 484; Republic of Korea 304; Hong Kong 72.
Metal including alloys, all forms	485	391	(3/)	Republic of Korea 371; Taiwan 12; Thailand 4.
Mercury	6	5	--	North Korea 3; Indonesia 1.
Molybdenum:				
Ore and concentrate:				
Roasted	8	74	31	China 25; Republic of Korea 18.
Unroasted	--	99	--	Hong Kong 57; China 42.
Oxides and hydroxides	92	106	(3/)	Russia 72; Austria 15; Germany 15.
Metal including alloys, all forms	110	126	21	Republic of Korea 43; Germany 36; Thailand 5.
Nickel:				
Oxides and hydroxides	3,026	3,312	846	Hong Kong 710; China 374; Singapore 357.

See footnotes at end of table.

TABLE 10 -- Continued
 JAPAN: EXPORTS OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1997	1998	Destinations, 1998	
			United States	Other (principal)
METALS--Continued				
Nickel--Continued:				
Metal including alloys:				
Scrap	8,563	954	315	United Kingdom 289; Hong Kong 248; Canada 50.
Unwrought	1,387	394	25	Taiwan 153; United Kingdom 108; Indonesia 27.
Semimanufactures	6,678	6,372	840	Republic of Korea 1,393; Hong Kong 602; Taiwan 537.
Platinum-group metals:				
Waste and sweepings	14	42	--	Mainly to Germany.
Metal including alloys, unwrought and partly wrought:				
Palladium value, thousands	\$82	\$93	\$59	United Kingdom \$18; Republic of Korea \$9.
Platinum do.	\$91	\$84	\$14	Hong Kong \$46; Thailand \$7; Taiwan \$4.
Rhodium do.	\$1	(3/)	(3/)	
Iridium, osmium, ruthenium do.	\$2	\$4	(3/)	United Kingdom \$3; Germany \$1.
Unspecified do.	\$6	\$5	\$3	Germany \$1; Hong Kong \$1.
Rare-earth metals including alloys, all forms	402	383	8	China 324; North Korea 32; Germany 14.
Selenium	563	553	11	Hong Kong 219; China 117; United Kingdom 67.
Silicon	1,792	1,887	572	Republic of Korea 419; Malaysia 344; Taiwan 116.
Silver metal including alloys, unwrought and partly wrought value, thousands	\$32	\$38	\$12	United Kingdom \$8; Malaysia \$6; Thailand \$3.
Tin:				
Ore and concentrate	167	28	--	All to Malaysia.
Metal including alloys:				
Scrap	1,161	760	209	Belgium 276; Taiwan 161; United Arab Emirates 77.
Unwrought	211	289	23	Malaysia 135; Taiwan 48; Belgium 38.
Semimanufactures	1,269	1,642	59	Hong Kong 465; China 403; Singapore 196.
Titanium:				
Ore and concentrate	10	48	--	All to Singapore.
Oxides	27,513	29,240	1,093	Taiwan 6,532; China 6,183; Republic of Korea 5,760.
Metal including alloys, all forms	23,711	19,395	6,792	United Kingdom 5,421; Republic of Korea 974; Taiwan 640.
Tungsten:				
Ore and concentrate	5	--	--	
Metal including alloys, all forms	1,300	1,586	343	United Kingdom 152; China 36; Taiwan 27.
Uranium and thorium, metal including alloys, all forms	1	--	--	
Vanadium, metal including alloys, all forms	85	66	1	Germany 16; Taiwan 12; Malaysia 9.
Zinc:				
Oxides	2,271	1,986	697	China 453; Thailand 182; Taiwan 145.
Blue powder	166	13	--	China 5; Thailand 3; Malaysia 2.
Ash and residue containing zinc	2,204	1,799	85	Mainly to Republic of Korea 1,714.
Metal including alloys:				
Scrap	7,091	5,877	--	China 2,689; Taiwan 2,057; Hong Kong 1,131.
Unwrought	25,294	59,517	8,003	Taiwan 21,870; Philippines 15,261; Indonesia 2,705.
Semimanufactures	3,697	3,193	54	Indonesia 886; China 332; United Kingdom 321.
Zirconium:				
Ore and concentrate	73	192	--	China 142; Sri Lanka 23.
Metal including alloys, all forms	79	58	26	Taiwan 13; Germany 5.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural, corundum, emery, pumice, etc.	21,193	18,952	5	Republic of Korea 9,675; Taiwan 4,144; China 1,441.
Artificial:				
Corundum	26,029	26,895	3,674	Republic of Korea 6,180; Taiwan 4,130; Australia 1,865.
Silicon carbide	12,282	9,386	939	Republic of Korea 4,732; Taiwan 1,715; Malaysia 907.
Dust and powder of precious and semiprecious stones including diamonds value, thousands	\$10	\$11	\$2	Switzerland \$5; Republic of Korea \$1.
Grinding and polishing wheels and stones	10,691	8,543	1,991	Taiwan 735; Republic of Korea 609; Thailand 603.
Asbestos, crude	160	32	--	Indonesia 19; Malaysia 8; Republic of Korea 5.
Barite and witherite	1	3	3	

See footnotes at end of table.

TABLE 10 -- Continued
JAPAN: EXPORTS OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1997	1998	Destinations, 1998	
			United States	Other (principal)
INDUSTRIAL MINERALS--Continued				
Boron:				
Crude natural borates	10	8,533	--	Taiwan 7,138; Thailand 958; Hong Kong 270.
Oxides and acids	209	234	1	Taiwan 138; Republic of Korea 31; Singapore 23.
Cement thousand tons	12,127	7,613	5	Singapore 2,332; Taiwan 1,595; Hong Kong 1,356.
Chalk	3,106	1,680	--	Republic of Korea 1,188; Taiwan 419; Hong Kong 20.
Clays, crude:				
Bentonite	2,245	1,518	--	Thailand 585; Indonesia 435; Vietnam 153.
Chamotte or dinas earth	109	103	--	Republic of Korea 69; Indonesia 25; Mexico 9.
Fire clay	3,649	3,337	15	Taiwan 1,198; Bangladesh 739; Republic of Korea 574.
Kaolin	9,139	12,475	13	Taiwan 4,108; China 2,751; Malaysia 2,689.
Unspecified	38,282	34,470	26	Indonesia 5,147; Taiwan 4,591; Malaysia 3,672.
Diamond, natural:				
Gem, not set or strung carats	964	4,377	1	Belgium 2,280; Hong Kong 668; United Kingdom 594.
Industrial stones thousand carats	1,403	2,519	996	Republic of Korea 503; Taiwan 244.
Dust and powder do.	15,066	16,529	6,143	Switzerland 4,011; Republic of Korea 2,284; Philippines 1,511.
Diatomite and other infusorial earth	1,715	2,669	21	Taiwan 1,010; Republic of Korea 821; Malaysia 609.
Feldspar	13,062	8,533	--	Taiwan 7,138; Thailand 958; Hong Kong 270.
Fluorspar	1,013	867	--	Singapore 420; Taiwan 196; Thailand 186.
Fertilizer materials:				
Crude, n.e.s.	1,439	1,233	2	Taiwan 936; China 102; Republic of Korea 88.
Manufactured:				
Ammonia	5,512	4,315	873	Taiwan 1,611; Singapore 725; Republic of Korea 515.
Phosphatic	3,344	9,105	97	Indonesia 8,000; Argentina 750; Thailand 175.
Unspecified and mixed 5/	945,064	928,380	20,134	Malaysia 306,084; Vietnam 192,578; Philippines 190,207.
Graphite, natural	3,027	1,958	793	Germany 390; Taiwan 214; Republic of Korea 150.
Gypsum and plaster	5,521	4,644	21	Hong Kong 873; Taiwan 831; Republic of Korea 665.
Iodine	5,603	4,994	1,756	United Kingdom 840; France 627; Italy 537.
Lime	5,303	2,583	67	Republic of Korea 1,329; Taiwan 627; Malaysia 216.
Magnesium compounds:				
Magnesite, crude	418	285	--	Taiwan 220; Indonesia 21; Australia 18.
Oxides and hydroxides	13,771	13,265	3,574	Germany 1,609; Taiwan 1,572; China 1,249.
Other	47	--	--	
Mica:				
Crude including splittings and waste	915	626	191	Taiwan 127; Indonesia 99; Thailand 50.
Worked including agglomerated splittings	835	911	15	Austria 370; Thailand 146; China 75.
Nitrates, crude	2	11	--	Malaysia 6; Thailand 4; Taiwan 1.
Phosphorus, elemental	28	22	1	Republic of Korea 19; Malaysia 1.
Pigments, mineral, natural, crude				
Iron oxides and hydroxides, processed	52,635	45,791	7,689	Republic of Korea 12,952; Taiwan 4,651; Hong Kong 4,364.
Precious and semiprecious stones, other than diamond:				
Natural kilograms	7,561	15,403	--	Hong Kong 10,181; Germany 2,934; the Netherlands 932.
Synthetic thousand grams	203,463	255,535	4,106	Hong Kong 497,502; China 494,098; Thailand 467,677.
Pyrite, unroasted	102	94	--	Republic of Korea 48; Taiwan 40; New Zealand 6.
Quartz crystal, piezoelectric thousand grams	92,554	65,723	1,842	China 34,093; Malaysia 11,300; Germany 2,128.
Salt and brine	2,046	1,925	40	Singapore 547; Russia 526; Republic of Korea 355.
Stone, sand, and gravel:				
Dimension stone:				
Crude and partly worked	2,803	2,774	--	China 2,399; Republic of Korea 268.
Worked	5,815	5,051	297	Taiwan 4,080; China 301; Hong Kong 117.
Dolomite, chiefly refractory-grade	270	395	--	Indonesia 205; Taiwan 120; Republic of Korea 40.
Gravel and crushed rock	80,981	101,313	42	Taiwan 70,175; Australia 27,800; Republic of Korea 1,900.
Limestone other than dimension thousand tons	4,096	3,514	--	Taiwan 1,376; Australia 1,079; Hong Kong 1,009.
Quartz and quartzite	2,866	2,635	60	Malaysia 827; United Kingdom 720; Republic of Korea 496.

See footnotes at end of table.

TABLE 10 -- Continued
JAPAN: EXPORTS OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1997	1998	Destinations, 1998	
			United States	Other (principal)
INDUSTRIAL MINERALS--Continued				
Sulfur:				
Elemental:				
Crude including native and byproduct thousand tons	983	1,081	--	China 486; Republic of Korea 236; Indonesia 129.
Colloidal, precipitated, sublimed	1,054	915	3	Taiwan 457; Malaysia 185; Republic of Korea 113.
Dioxide	3	8	--	Mainly to Republic of Korea.
Sulfuric acid thousand tons	1,258	1,419	420	Taiwan 213; Chile 161; Indonesia 150.
Talc, steatite, soapstone, pyrophyllite	7,755	--	--	
Vermiculite, perlite, chlorite	19,243	16,640	4	Republic of Korea 15,839; Taiwan 425; Singapore 290.
Other:				
Slag and dross, not metal-bearing thousand tons	2,391	2,748	11	Taiwan 1,738; Singapore 506; Australia 120.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	54	6	--	All to Poland.
Carbon black	17,538	16,409	2,074	Taiwan 2,431; Netherlands 2,204; Republic of Korea 1,871.
Coal:				
Anthracite	58	177	--	Taiwan 86; Mexico 28; China 20.
Bituminous	1,466	10	--	All to Singapore.
Other	409	770	--	Thailand 600; Indonesia 104; China 26.
Coke and semicoke thousand tons	2,870	3,072	1,997	India 376; Brazil 210; Germany 126.
Peat including briquets and litter	155	--	--	
Petroleum:				
Crude thousand 42-gallon barrels	1,379,477	965,665	--	All to Republic of Korea.
Refinery products:				
Liquefied petroleum gas do.	67	67	--	Republic of Korea 27; Taiwan 18; China 15.
Mineral jelly and wax do.	400	400	152	Taiwan 32; Republic of Korea 30; South Africa 22.
Asphalt, bitumen and other re do.	2,104	1,290	34	China 1,032; Republic of Korea 209.
Bituminous mixtures do.	3	1	(3/)	Mainly to Taiwan.
Petroleum coke do.	927	943	63	Netherlands 201; Italy 133; Taiwan 113.
Unspecified do.	63,782	47,673	2,350	China 16,904; Republic of Korea 12,692; Hong Kong 8,009.

-- Zero.

1/ Data presented in this table are from Japan Exports and Imports Commodity by Country, 1997 and 1998. Table prepared by Regina R. Coleman, International Date Unit.

2/ Includes waste and scrap.

3/ Less than 1/2 unit.

TABLE 11
JAPAN: IMPORTS OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1997	1998	Sources, 1998	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals	609	573	135	China 208; France 125; Russia 95.
Aluminum:				
Ore and concentrate thousand tons	2	2	(2/)	Australia 1; Indonesia 1.
Oxides and hydroxides 3/	106,395	101,216	8,707	Australia 82,995; Russia 3,674; Germany 3,224.
Metal including alloys:				
Scrap	158,602	143,134	28,087	Australia 15,317; Thailand 9,919; China 8,772.
Unwrought thousand tons	2,986	2,552	81	Russia 385; New Zealand 215; Canada 157.
Semimanufactures	97,940	73,405	19,427	Republic of Korea 12,499; Germany 10,995; France 9,814.
Antimony:				
Ore and concentrate	1,077	698	--	Bolivia 640; China 58.
Oxides	11,162	8,887	582	China 6,308; Taiwan 483.
Metal including alloys, all forms	8,796	8,513	(2/)	China 8,489.
Arsenic, metal including alloys, all forms	78	--	--	
Beryllium, metal including alloys, all forms	6	9	9	Mainly from the United States.

See footnotes at end of table.

TABLE 11--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1997	1998	Sources, 1998	
			United States	Other (principal)
METALS--Continued				
Bismuth, metal including alloys, all forms 4/	380	373	--	Peru 137; Belgium 133; China 30.
Cadmium, metal including alloys, all forms	4,772	3,562	96	Belgium 935; Republic of Korea 738; Canada 694.
Chromium:				
Ore and concentrate	577,858	416,665	--	South Africa 240,340; India 83,500; Iran 34,539.
Oxides and hydroxides 5/	5,099	2,863	747	United Kingdom 646; Germany 556; Kazakhstan 359.
Metal including alloys, all forms	1,973	2,365	642	France 639; China 540; United Kingdom 233.
Cobalt:				
Oxides and hydroxides	1,753	1,752	10	Belgium 1,508; Finland 183.
Metal including alloys, all forms	6,730	6,787	46	Australia 1,250; Canada 1,131; Norway 951.
Columbium and tantalum, tantalum metal including alloys, all forms	128	154	34	Germany 46; United Kingdom 23; China 18.
Copper:				
Ore and concentrate thousand tons	3,837	3,974	1	Chile 1,373; Indonesia 839; Canada 581.
Mattes including cement copper	10,347	7	--	All from China.
Oxides and hydroxides	3,985	3,767	1,893	Malaysia 1,196; Australia 240; Singapore 200.
Ash and residue containing copper	3,343	1,751	26	Malaysia 799; Philippines 555; Singapore 171.
Metal including alloys:				
Scrap	175,666	162,733	33,841	Malaysia 23,813; Singapore 21,036; Philippines 13,816.
Unwrought	7,449	4,440	153	Chile 134,709; Zambia 37,637; Philippines 38,467.
Semimanufactures	63,427	51,315	2,789	Republic of Korea 13,019; Malaysia 11,618; Taiwan 8,185.
Germanium, metal including alloys, all forms	4	4	(2/)	Russia 2; China 1.
Gold:				
Waste and scrap	64	151	--	Singapore 89; Thailand 39; Malaysia 14.
Metal including alloys, unwrought kilograms	119,358	86,017	4,268	Australia 28,506; Switzerland 12,347; United Kingdom 8,060.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite thousand tons	127	121	--	Australia 64; Brazil 23; India 16.
Roasted pyrites	40	20	--	All from China.
Metal:				
Scrap thousand tons	426	177	16	Taiwan 43; Republic of Korea 26; Russia 18.
Pig iron, cast iron, related mate do.	1,284	304	3	China 79; Venezuela 60; North Korea 51.
Ferroalloys:				
Ferromanganese	811,353	628,260	--	South Africa 408,770; India 60,318; Zimbabwe 51,997.
Ferromanganese	95,240	109,887	--	South Africa 65,619; China 25,531; Australia 10,546.
Ferromolybdenum	3,167	2,213	36	China 1,904; Chile 216; United Kingdom 57.
Ferronickel	49,749	41,066	--	New Caledonia 28,520; Dominican Republic 7,682; Indonesia 3,951.
Ferrosilicochromium	4,728	3,415	--	China 2,783; Zimbabwe 632.
Ferrosilicomanganese	257,496	201,240	--	China 110,660; Ukraine 33,540; Australia 25,740.
Ferrosilicon	556,731	401,938	237	China 210,710; Brazil 71,995; Russia 62,007.
Silicon metal	161,845	157,790	231	China 98,573; Brazil 28,830; Australia 12,860.
Unspecified	195,551	190,995	4,084	China 110,178; Brazil 40,251; Norway 12,072.
Semimanufactures, unspecified thousand tons	6,116	4,810	12	Republic of Korea 2,906; Taiwan 967; China 438.
Lead:				
Ore and concentrate	154,242	182,810	34,443	Australia 72,380; Peru 23,888; China 14,977.
Oxides	42,693	38,277	49	China 16,338; Taiwan 9,030; Indonesia 1,260.
Ash and residue containing lead	6,345	--	--	
Metal including alloys:				
Unwrought	46,093	35,693	363	Peru 25,715; Australia 2,822; Mexico 2,532.
Semimanufactures	786	805	8	United Kingdom 328; France 268; Germany 118.
Lithium, oxides and hydroxides	1,360	1,343	1,167	Taiwan 90; China 85; France 1.
Magnesium, metal including alloys:				
Scrap	5	41	--	Russia 22; Republic of Korea 10; Taiwan 8.
Unwrought	31,089	32,050	3,367	China 22,064; Norway 3,500; Canada 2,848.
Semimanufactures	1,484	2,389	896	China 925; Russia 317; Norway 89.
Manganese:				
Oxides	3,983	3,186	23	Belgium 1,395; China 701.
Metal including alloys, all forms	40,565	39,197	1,137	South Africa 12,793; United Kingdom 194.

See footnotes at end of table.

TABLE 11--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1997	1998	Sources, 1998	
			United States	Other (principal)
METALS--Continued				
Mercury	14	7	--	Algeria 3; Spain 3.
Molybdenum:				
Ore and concentrate:				
Roasted	31,190	30,451	6,656	Chile 14,540; Canada 5,043; China 2,500.
Unroasted	72	72	64	Austria 7; Canada 1.
Oxides and hydroxides	1,698	1,816	427	China 751; Chile 351; Iran 248.
Metal including alloys:				
Semimanufactures	313	379	128	Austria 129; China 52; Netherlands 37.
All forms	401	137	35	China 45; Austria 22; Netherlands 17.
Nickel:				
Ore and concentrate	thousand tons	4,362	4,117	--
New Caledonia				2,097; Indonesia 1,092; Philippines 928.
Matte		74,439	78,472	--
Indonesia				43,002; Australia 35,431.
Oxides and hydroxides		221	129	7
Finland				122.
Metal including alloys:				
Scrap	12,840	10,270	1,557	Russia 4,391; Zimbabwe 1,557; Republic of Korea 597.
Unwrought	57,844	40,046	28	Zimbabwe 6,497; China 5,847; Norway 5,372.
Semimanufactures	12,971	13,538	2,174	United Kingdom 5,348; Canada 4,539; Germany 441.
Platinum-group metals:				
Waste and scrap	257	539	73	Republic of Korea 222; Taiwan 133; Thailand 41.
Metal including alloys, unwrought and partly wrought:				
Palladium	value, thousands	\$589	\$702	\$45
Russia				\$358; South Africa \$134; United Kingdom \$74.
Platinum	do.	\$821	\$747	\$32
South Africa				\$434; Russia \$129; Germany \$63.
Rhodium	do.	\$19	\$45	\$2
South Africa				\$33; Russia \$5; Germany \$2.
Iridium, osmium, ruthenium	do.	\$18	\$41	\$4
South Africa				\$24; United Kingdom \$8; Germany \$4.
Rare-earth metals including alloys, all forms	2,696	3,727	(2/)	China 3,714; Republic of Korea 11.
Selenium	7	13	(2/)	Philippines 9; Canada 4.
Silicon, high-purity	166,252	163,202	1,039	China 98,898; Germany 1,127; Republic of Korea 200.
Silver:				
Ore and concentrate	21,143	12,401	--	Chile 6,477; Peru 5,924.
Metal including alloys, unwrought and partly wrought	value, thousands	\$219	\$159	\$35
Mexico				\$55; Republic of Korea \$10; Canada \$9.
Tin, metal including alloys:				
Scrap	49	145	--	Thailand 78; Hong Kong 34; Taiwan 31.
Unwrought	30,623	26,104	8	Indonesia 11,868; China 7,198; Thailand 3,980.
Semimanufactures	745	563	9	Singapore 430; France 42; Malaysia 38.
Titanium:				
Ore and concentrate	66,954	97,076	--	Australia 62,688; South Africa 16,817; Malaysia 10,534.
Oxides	10,329	9,004	51	China 4,413; Republic of Korea 2,107; Finland 1,104.
Metal including alloys, all forms	13,041	11,694	2,684	Kazakhstan 5,258; Russia 3,115; China 196.
Tungsten:				
Ore and concentrate	1,482	1,881	--	Russia 1,641; China 160; Portugal 80.
Metal including alloys, all forms	871	750	35	China 315; Republic of Korea 107; Austria 91.
Uranium and thorium:				
Ore and concentrate	20	--	--	
Metal including alloys, all forms	1,683	2,034	14	France 1,194; Canada 822; United Kingdom 3.
Vanadium, metal including alloys, all forms:				
Oxides and hydroxides	5,302	5,043	--	South Africa 3,224; China 2,912.
Ash and residue containing zinc	24	66	57	Taiwan 7; Republic of Korea 2.
Metal including alloys, all forms	206	190	113	Germany 76; United Kingdom 1.
Zinc:				
Ore and concentrate	thousand tons	1,016	942	121
Australia				473; Peru 130; Canada 73.
Oxides	17,589	14,858	280	Republic of Korea 5,934; China 4,638; Canada 280.
Blue powder	1,190	889	2	Singapore 465; Republic of Korea 376; China 41.
Ash and residue containing zinc	24,644	27,344	2,929	Spain 13,851; Republic of Korea 4,544; Thailand 1,931.
Metal including alloys:				
Scrap	339	47	--	Hong Kong 22; Philippines 14; China 11.
Unwrought	191,521	121,378	212	China 34,484; Republic of Korea 21,353; Kazakhstan 16,924.

See footnotes at end of table.

TABLE 11--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1997	1998	Sources, 1998	
			United States	Other (principal)
METALS--Continued				
Zinc--Continued:				
Metal including alloy--Continued:				
Semimanufactures	3,082	3,586	33	China 2,491; France 664; Belgium 210.
Zirconium:				
Ore and concentrate	90,496	78,626	2,381	Australia 62,079; South Africa 9,349; Russia 4,316.
Metal including alloys, all forms	714	671	382	France 238; Sweden 21; United Kingdom 11.
Other, ashes and residues	15,611	13,620	2,515	Republic of Korea 6,290; China 2,240.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural, corundum, emery, pumice, etc.	21,059	32,533	4,646	Republic of Korea 17,390; China 4,045; India 3,234.
Artificial:				
Corundum	135,592	125,615	511	China 94,847; Australia 12,421; Hungary 8,921.
Silicon carbide	71,262	65,194	361	China 56,052; Brazil 3,440; Norway 2,016.
Dust and powder of precious and semiprecious stones including diamonds value, thousands	\$78	\$62	\$18	Ireland \$35.
Grinding and polishing wheels and stones	5,569	4,935	632	China 2,843; Thailand 484.
Asbestos, crude	176,021	120,813	5,687	Canada 57,954; Zimbabwe 24,919; South Africa 16,822.
Barite and witherite	114,384	90,840	120	China 82,259; India 5,511; North Korea 2,824.
Boron:				
Crude natural borates	49,776	26,591	--	Turkey 22,720; Russia 3,851.
Oxides and acids	32,402	32,680	12,104	Russia 11,977; Chile 4,519; Italy 3,598.
Cement	545,387	728,724	286	Republic of Korea 580,812; China 125,356; France 12,474.
Chalk	1	--	--	
Clays, crude:				
Bentonite	227,815	157,386	119,243	China 25,946; Canada 11,973.
Chamotte or dinas earth	27,117	25,413	--	China 10,680; Republic of Korea 9,423; South Africa 4,834.
Fire clay	8,748	3,072	2,140	Malaysia 523; China 339; Germany 70.
Fuller's earth	8,350	8,125	5,754	China 1,563.
Kaolin thousand tons	1,317	1,381	1,001	Brazil 185; Indonesia 88; China 32.
Unspecified	241,280	224,598	8,480	China 176,266; South Africa 19,266; Malaysia 16,600.
Diamond, natural:				
Gem, not set or strung thousand carats	2,692	2,502	64	India 1,774; Israel 265; Belgium 231.
Industrial stones do.	1,976	2,150	309	Ireland 1,473; Republic of Korea 162; Taiwan 54.
Dust and powder do.	111,790	78,122	22,511	Ireland 28,851; China 8,051; Belgium 7,290.
Diatomite and other infusorial earth	8,668	7,735	7,668	Mainly from the United States.
Feldspar	13,004	6,613	--	Australia 4,617; India 883; China 763.
Fluorspar	573,784	547,166	--	China 467,362; Mexico 66,043; Kenya 7,260.
Fertilizer materials				
Crude, n.e.s.	63,669	59,749	54	Republic of Korea 29,774; China 16,720; Indonesia 7,205.
Manufactured:				
Ammonia	45,042	37,592	18	Canada 29,428; Indonesia 8,116; Singapore 27.
Phosphatic	125,503	117,863	39,807	China 68,672; Republic of Korea 9,384.
Potassic thousand tons	1,200	981	216	Canada 328; Russia 143; Germany 103.
Unspecified and mixed do.	1,783	1,917	942	Indonesia 435; Qatar 370; Malaysia 318.
Graphite, natural	85,213	76,205	184	China 69,780; North Korea 3,657; Sri Lanka 1,219.
Gypsum and plaster thousand tons	4,823	2,935	515	Thailand 1,476; Mexico 761; Australia 685.
Iodine	205	349	(2/)	Mainly from Chile.
Lime	24	22	--	All from Canada.
Magnesium compounds:				
Magnesite, crude	2,738	1,828	200	China 1,442; Australia 200; North Korea 166.
Oxides and hydroxides	21,832	15,644	1,112	China 10,886; Israel 2,460; Mexico 800.
Other	1,690	1,946	--	Belgium 1,060; China 546; Germany 340.
Mica:				
Crude including splittings and waste	49,806	43,589	434	China 24,948; India 7,379; Finland 3,075.
Worked including agglomerated splittings	304	301	2	Belgium 106; Republic of Korea 90; Switzerland 34.
Nitrates, crude	20,604	23,822	--	Chile 23,731; Germany 71; China 20.
Phosphates, crude thousand tons	1,031	976	19	China 293; South Africa 234; Morocco 231.
Phosphorus	24,100	26,522	3,009	China 23,075; the Netherlands 362; Germany 63.

See footnotes at end of table.

TABLE 11--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1997	1998	Sources, 1998	
			United States	Other (principal)
INDUSTRIAL MINERALS--Continued				
Pigments, mineral:				
Natural crude	184	11	--	All from United Kingdom.
Iron oxides and hydroxides, processed	30,283	26,435	3,919	China 9,000; Germany 6,257; Republic of Korea 2,655.
Precious and semiprecious stones, other than diamond:				
Natural	974	595	14	Brazil 458; South Africa 66; Indonesia 16.
Synthetic	50,383	64,701	30,125	France 17,023; Malaysia 5,709; Republic of Korea 4,013.
Pyrite, unroasted	41,980	44,477	--	Finland 39,832; China 4,645.
Quartz crystal, piezoelectric	thousand grams 56,141	59,120	478	Republic of Korea 22,269; Russia 14,469; China 7,744.
Salt and brine	thousand tons 7,918	7,914	(2/)	Mexico 3,891; Australia 3,877; China 72.
Stone, sand, and gravel:				
Dimension stone:				
Crude and partly worked	do. 639	437	8	China 122; South Africa 62; Indonesia 60.
Worked	do. 1,555	1,249	1	China 1,086; Italy 43; Republic of Korea 29.
Dolomite, chiefly refractory-grade	do. 1,858	1,705	1	Thailand 496; Philippines 386; China 367.
Gravel and crushed rock	440,612	219,043	576	Taiwan 138,646; China 37,382; Philippines 31,671.
Limestone other than dimension	86,933	125,817	6	Philippines 73,539; Malaysia 47,067; China 3,072.
Quartz and quartzite	172,746	127,423	5,783	India 73,376; Republic of Korea 20,886; China 16,562.
Sand other than metal-bearing and gravel	thousand tons 4,460	3,803	3	Australia 1,634; China 1,434; Taiwan 470.
Sulfur:				
Elemental:				
Crude including native and byproduct	572	389	--	China 153; India 143; Australia 51.
Colloidal, precipitated, sublimed	1,433	1,225	4	Republic of Korea 1,038; China 128; France 50.
Sulfuric acid	115	52	52	
Talc, steatite, soapstone, pyrophyllite	579,930	453,587	3,456	China 353,650; Australia 96,110; North Korea 292.
Vermiculite, perlite, chlorite	116,672	151,491	523	China 133,064; South Africa 16,214; Australia 800.
Other, slaag and dross, not metal-bearing	687,255	718,012	4,485	Taiwan 216,877; Republic of Korea 185,010; South Africa 82,969.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	719,429	608,499	2,073	Venezuela 605,510; Trinidad 916.
Carbon black	99,959	72,052	4,256	Thailand 41,953; Republic of Korea 20,171; Canada 1,726.
Coal:				
Anthracite	thousand tons 3,475	3,261	(2/)	China 1,484; Vietnam 1,313; North Korea 350.
Bituminous	do. 126,920	125,142	7,314	Australia 69,755; Canada 16,421; Indonesia 11,914.
Briquettes of anthracite and bituminous coal and lignite	17,266	15,033	430	Russia 11,495; China 3,082.
All grades including briquettes	thousand tons 3,188	3,360	(2/)	Australia 1,662; Canada 838; Indonesia 370.
Coke and semicoke	do. 1,290	951	--	China 925; Australia 26.
Gas, natural, liquefied	do. 47,656	49,133	1,305	Indonesia 17,992; Malaysia 9,838; Australia 7,228.
Peat including briquettes and litter	130,008	132,215	986	Canada 86,951; Germany 12,311; China 9,697.
Petroleum:				
Crude	thousand 42-gallon barrels 1,669,153	1,581,318	2,750	Saudi Arabia 385,382; United Arab Emirates 432,088; Iran 176,371.
Refinery products:				
Liquefied petroleum gas	do. 176,081	166,227	106,983	Saudi Arabia 64,252; Indonesia 17,102; Kuwait 15,947.
Mineral jelly and wax	do. 207	148	38	Malaysia 81; China 57; South Africa 30.
Asphalt, bitumen and other residues	do. 1,790	2,611	1,240	China 931; Republic of Korea 438.
Bituminous mixtures	do. 10	9	2	United Kingdom 5; Republic of Korea 1.
Petroleum coke	do. 27,032	22,925	17,113	China 2,212; Indonesia 577; Republic of Korea 458.

-- Zero.

1/ Data presented in this table are from Japan Exports and Imports Commodity by Country, 1997 and 1998. Table prepared by Regina R. Coleman, International Data Unit.

2/ Less than 1/2 unit.

3/ Includes waste and scrap.

4/ Includes trioxide.