

THE MINERAL INDUSTRY OF

JAPAN

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Japan has considerable resources of carbonate rocks (construction aggregates, dolomite, and limestone), clays (bentonite and fire clay), iodine, pyrophyllite, and silica. Because of its limited resources of hydrocarbons, ferrous and nonferrous metals, and other industrial minerals, Japan relied heavily on imports of mineral fuels, which included coal, crude petroleum, natural gas, and uranium, and crude ore and concentrates of most nonfuel minerals to meet the requirements for its world-class manufacturing sector. Japan's mineral-processing industry within its manufacturing sector was among the world's largest. The industry processed imported raw materials and produced a wide variety of mineral products, which included inorganic chemicals and compounds, ferrous metals, industrial minerals, nonferrous metals, petrochemicals, and refined petroleum products, for domestic consumption and exports.

In 2000, Japan was one of the world's major importers and consumers 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, magnesium, nickel ore and metal, crude petroleum, potash, phosphate rock, precious metals, rare earths, silicon metal, zinc ore and metal, and zirconium. Japan was one of the world's major exporters of cement, refined copper, mineral-related chemicals and fertilizers, iodine, electrolytic manganese dioxide, high-purity rare metals, iron and steel, and titanium sponge metal and mill products.

The mining sector was the smallest sector of Japan's industrial-based economy. According to the Government statistics on national accounts, the percentage contribution of the mining sector to Japan's gross domestic product (GDP) was only 0.16% in 1999 (the latest year for which data are available). The percentage contribution by the mineral-processing industry of the manufacturing sector, which included chemicals, industrial minerals, iron and steel, nonferrous metals, petroleum, however, was 5.15%; and if the fabricated metal products were included, then the percentage was 6.26% in 1999 (Economic and Social Research Institute, 2000, Gross domestic product classified by economic activities at constant prices, accessed August 7, 2001, via URL <http://www5.cao.go.jp/2000/g/1215g-sna-e/e90fcm3r>). The mineral industry was important to the Japanese economy because of its contribution to GDP and its vital role in supplying primary materials not only to its own construction and manufacturing sectors, but also to those sectors of neighboring countries in northeastern and southeastern Asia.

The Japanese economic growth, as measured by the change in GDP, continued the 1999 positive growth path and managed to registered a 0.9% growth in 2000 compared with a 0.2% growth in 1999 owing largely to a 0.5% increase in private consumption and a 3.6% increase in public spending. Japan's

real GDP was estimated to be \$4,550 billion in 2000 (Economic and Social Research Institute, June 21, 2001, Development of real GDP (changes from the previous year), accessed August 7, 2001, at URL <http://www.esri.cao.go.jp/jp/sna/qe011-68/nen68.gif>; GDP—Referential series of gross domestic product, accessed August 7, 2001, at URL <http://www.esri.cao.go.jp/jp/sna/qe011-68/jissuu68y.gif>).

In 2000, Japan's unemployed workers increased to 3.2 million from 3.17 million in 1999, and the total labor force decreased to 67.66 million from 67.79 million in 1999. As a result, the unemployment rate remained unchanged at a historical high level of 4.7% in 2000. Japan's merchandise trade surplus, however, rose to \$108.4 billion from \$107.8 billion in 1999, and the Japanese yen appreciated by 5.7% to 107.8 yen against US\$1 in 2000. As measured by the Consumer Price Index, Japan continued to experience deflation—0.7% in 2000 compared with 0.3% in 1999 (Japan Institute of Labour, August 2, 2001, Main labor economic indicators, Statistical Informations [sic], accessed August 8, 2001, via URL <http://www.jil.go.jp/estatis/econtents.htm>).

Government Policies and Programs

To save money, to promote greater efficiency in Government services, and to put more power in the hands of elected officials, the Government revealed the new administration structure following a massive reorganization in December 2000. According to the reorganized structure, the existing 23 ministries and agencies, which included the Prime Minister's Office, would be reduced to 13 through merger or rearrangement and would be effective January 6, 2001. The Ministry of International Trade and Industry (MITI), which had the jurisdiction over the mining and minerals-processing industries, would become the Ministry of Economy, Trade and Industry (METI). In conjunction with the MITI, the Environment Agency, which regulated mining- and mineral-processing-related pollution and materials recycling, would be named the Ministry of Environment (Nikkei Weekly, 2000b).

The existing Geological Survey of Japan would become part of a newly created National Institute of Advanced Industrial Science and Technology under the METI. The existing Mining Division would become the Mineral and Natural Resources Division, Natural Resources and Fuel Department of the Agency for Natural Resources and Energy under the METI. The existing Divisions of Iron and Steel, Nonferrous Metals, and Chemicals, which were under the Basic Industries Bureau, which was under the MITI, would be under the Manufacturing Industries Bureau, which would be under the METI. The existing Metal Mining Agency of Japan (MMAJ) would be under the supervision of the METI (Ministry of Economy, Trade and Industry, January 6, 2001, the METI organization chart, accessed August 8, 2001, at URL <http://www.meti.go.jp/english/other/metiintroduction/c10130gj.html>).

The MMAJ, in cooperation with the Japan International Cooperation Agency (JICA), continued to promote overseas mineral exploration as part of the Official Development Assistance Program of the Japanese Government in 2000. In response to requests from the Governments of developing countries, the MMAJ provided technical assistance, which included the transfer of advanced exploration technology to these Governments, and carried out a broad range of basic exploration for further exploration and development of their mineral resources. The MMAJ also provided loans and exploration assistance to support private Japanese companies and their foreign partners that were involved in joint exploration works overseas.

The MMAJ's active overseas projects in 2000 included two 2-year reconnaissance survey projects, five 3-year mineral exploration projects, and a regional development planning project. The two reconnaissance surveys were for copper, gold, lead, and zinc in the southern Andes area in Argentina and copper and gold in the north-central area in Mongolia. The five mineral-exploration projects were for copper and gold in the Oruro-Uyuni area of Bolivia; gold in the Alta Floresta area of Brazil; copper, gold, and molybdenum in Region I of Chile; copper and gold in the Bico North area of the Philippines; and copper, gold, and zinc in the Umm Ad Damar area of Saudi Arabia. The regional development planning project was for lead and zinc in the Krib-Mehz area of the Republic of Tunisia (Metal Mining Agency of Japan, 2000, p. 3-4).

Additionally, the MMAJ announced in July 2000 that it had signed a new 2-year agreement with the Sultanate of Oman for copper and gold exploration, which was to begin in August in the Ghuzain and the Yanqul regions (Mining Journal, 2000b); that during a 3-year exploration program (1997-99) in cooperation with the JICA, it had made discoveries of two gold deposits in the Baoule-Banifing and the Kekoro areas, about 150 kilometers (km) southeast of Bamako, Mali; and that the Overseas Mineral Resources Development Co. (a consortium of private Japanese mining and metals companies) was expected to undertake further exploration in Mali (Mining Journal, 2000a).

The MMAJ continued to provide financial and technical support to nine private Japanese companies' overseas exploration projects in 2000. These 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 of Australia; gold by Mitsubishi Materials in the Bahia area of Brazil; copper, gold, and molybdenum by Mitsubishi Materials in the Amarillo-Sealeste and El Miragro areas of Chile; copper, gold, lead, and zinc by Sumitomo Metal Mining in the Eastern area of Kazakhstan; copper and gold by Nippon Mining and Metals Co. Ltd. in the Kainantu area of Papua New Guinea; lead and zinc by Mitsui Mining and Smelting Co. Ltd. in the central area 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 supporting overseas copper and gold exploration by private Japanese companies in Papua New Guinea, the MMAJ's exploration team discovered gold mineralization about 140 km west of the Kainantu area. The team drilled 10 holes in the Irumafimpa and the Maniape mining areas and intercepted gold veins in Irumafimpa that grade from 11 to 51.6 grams per metric ton (g/t) gold. According to the MMAJ, the gold veins were likely to be part of larger veins in the areas, and the MMAJ was

to carry out detailed investigations of the geological structure and mineralization in 2000. The mining rights to the area were owned by the Port Moresby-based Highland Pacific Ltd., which had a joint exploration agreement with Nippon Mining and Metals of Japan (American Metal Market, 2000, Japan agency probe hits gold vein, accessed February 2, 2000, at URL <http://www.amm.com/subscrib/2000/feb/inside/0201pm.htm>).

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 Metal Association) continued to maintain their strategic stockpile of chromium, cobalt, manganese, molybdenum, nickel, tungsten, and vanadium in 2000. The total amount of national stockpile remained at 32.8 days of consumption, or about 80% of the stockpile target. The 60-day stockpile target constituted 42 days of national stockpile and 18 days of private stockpile (Metal Mining Agency of Japan, 2000a, p. 11-12).

According to the report released by the Mining Industry Council of the MITI in November 2000, the Council recommended that the stockpile quantities of chromium, manganese, molybdenum, and nickel should be reduced and that the 60-day stockpile target for cobalt, tungsten, and vanadium as initially stipulated in 1983 should be maintained. In 2000, the actual amount of the stockpile was equivalent to 78.2% of the stockpile target for chromium; 100%, for manganese; 74.9%, for molybdenum; and 65.5%, for nickel (Tex Report, 2000c). The MMAJ was reevaluating its stockpiling program to modify or expand its existing stockpile program in view of the future requirements not only for the iron and steel, electrical, and electronic industries, but also for such emerging industries as information technology and storage batteries for electric cars.

Environmental Issues

To achieve sustainable development in the 21st century and to create a recycling-oriented economy, the Japanese Government enacted the Law for Promotion of Effective Utilization of Resources in June 2000. The law was to promote 3R—reduce, reuse, and recycle. The major provisions of the law included promotional measures for reduction of waste generation by designing and manufacturing products that save resources and have longer service lives, promotional measures for reuse of parts, promotion of collection and recycling as the part of businesses, labeling the products for selective collection, and promotion of measures for reduction of generating byproducts and for recycling byproducts (Ministry of Economy, Trade and Industry, 2000, Law for promotion of effective utilization of resources, July, accessed August 8, 2001, at URL <http://www.meti.go.jp/english/information/data/creeffecte.html>).

In solving mine-related pollution problems, the Government through the MMAJ assisted a local government in completing construction of the country's second neutralization plant at the abandoned Fukuchiyama Mine in Kyoto Prefecture. The new neutralization plant started operation in February 2000. The acid drainage of the Fukuchiyama Mine, which contains heavy metals, had polluted downstream rivers. At the request of another local government, the MMAJ designed, planned, and supervised construction of the water-treatment (neutralization) plant between 1995 and 1999. Construction work started in 1997 and was completed in early 2000 (Metal Mining Agency of Japan, 2000a, p. 9-10). The country's first neutralization plant at the Matsuo Mine in Iwate Prefecture, which also was

designed and operated by the MMAJ, was completed in November 1981 and has been operating since April 1982.

To develop Japan's ability to purify the soil, NKK Corp., which was Japan's second largest steelmaker, signed an agreement with BioGenesis Enterprises Inc. of the United States for the use of its technology to remove harmful substances from the soil. The technology, which was developed by BioGenesis Enterprises, uses high water pressure to granulate lump soil and a biodegradable surface-active chemical agent to remove such harmful substances as heavy metals, volatile organic compounds, polychlorinated biphenyls, oil contaminants, and dioxin from soil. To meet the growing demand for soil cleaning on the sites of demolished plants in the oil, chemical, mining, and other industries in Japan, NKK established a Concept Engineering Center to conduct soil environmental business and planned to implement soil purification solutions, which included soil analysis, soil remedy formulations, and formulation execution, with Mitsubishi Corp. (NKK Corp., November 16, 2000, NKK moving into soil purification environmental solution business, accessed August 14, 2001, at URL <http://www.nkk.co.jp/en/release/40-9/art04.html>).

To clean up mining and mineral-processing sites where soils were contaminated by heavy metals, volatile organic compounds, and petroleum hydrocarbons, Dowa Mining Co. Ltd. established a soil remedy business unit to investigate such treatment technologies as incineration, bioremediation, soil washing, and chemical treatment following the establishment of a subsidiary Eco-Recycling Co. Ltd. at Ohdate in Akita Prefecture in July 1999 (Dowa Mining Co. Ltd., 2000, Our company, accessed August 20, 2001, at URL <http://www.dowa.co.jp/index.htm>; Dowa Engineering Co. Ltd., 2000, Brief introduction, accessed August 20, 2001, at URL <http://www.dec.co.jp>).

Production

Mine production of most nonferrous metals (except copper, lead, and silver) and most industrial minerals (except limestone and silica stone) continued to decrease in 2000 because of low domestic metal prices. Coal mine output also declined from that of 1998. The output of crude petroleum and natural gas rebounded slightly in 2000 but remained small.

In the mineral-processing industry, production of most metals (except cadmium, gold, platinum, and silver) increased when demand for most ferrous and nonferrous metals increased in the domestic and Asian market in 2000. Production of iron and steel increased owing mainly to increased exports to the Asian market. Production of refined copper increased because of expanded production capacity and increased demand in the Asian market. Production of cement and other construction-related materials remained unchanged in 2000. Domestic demand for most construction-related materials was weak because of the continued slowdown in the construction sector in 2000. Production of most refined petroleum products remained unchanged owing to a weak economic recovery in 2000 (table 1).

Trade

Japan was a net importer of minerals mainly because of its large import bill for mineral fuels. Japan's mineral trade deficit rose to \$80.7 billion in 2000 from \$51.1 billion in 1999. The

higher mineral trade deficit was caused mainly by a 55% increase in import bills of mineral fuels that resulted from higher oil prices in 2000 (table 4).

Total imports of minerals were valued at \$115.5 billion and accounted for 30.4% of the total imports, which were valued at \$379.8 billion in 2000. Of the total minerals imports, \$77.5 billion was for such mineral fuels as coal, LNG, crude and partially refined petroleum, refined petroleum products, and other mineral fuels; \$7.0 billion, for ores and concentrates of ferrous and nonferrous minerals, slag, scrap, and ash of iron and steel, other metals, and metal compounds; and \$1.5 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 \$29.6 billion, of which \$4.0 billion was for mineral-related chemicals and fertilizers; \$15.0 billion, for products of iron and steel and nonferrous, rare, and other base metals; \$7.4 billion, for precious and semiprecious stones and precious metals; and \$3.1 billion, for products of asbestos, cement, ceramics, glass, mica, and stone (Ministry of Finance, 2000b, p. 9-13, 15-16, 33-41).

Total exports of minerals, mineral-related chemicals, and processed minerals products were valued at \$34.8 billion and accounted for 7.3% of Japan's total exports, which were valued at \$479.2 billion in 2000. Exports of iron and steel products and nonferrous, rare, and other base metals totaled \$23.8 billion. Exports of processed mineral products of asbestos, cement, ceramics, glass, mica, and stone amounted to \$5.0 billion. Exports of salt, sulfur, earths and stone, plastering materials, lime, cement, mineral fuels, and nonferrous minerals were \$1.9 billion. Exports of mineral-related chemicals and fertilizer were \$2.2 billion. Exports of precious and semiprecious stones and precious metals were \$1.9 billion (Ministry of Finance, 2000a, p. 11-13, 15, 33-41). Physical measures of the exports and imports of mineral commodities in 1998 and 1999 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 (table 2). 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 coal mining workforce in 2000 decreased by 205 to 2,737, of which 1,847 were regular employees. In 2000, the number of operating nonferrous metal mines decreased to 13 from 14 in 1999, but the number of employees increased to 1,144 from 1,139 in 1999. The number of operating industrial minerals mines declined to 515 from 522 in 1999, and the number of employees decreased to 10,959 from 11,655 in 1999 (Research Institute of Economy, Trade and Industry, 2001, p. 6-7).

In the mineral-processing sector, the steel industry continued to cut its employment to 191,347 from 202,059 in 1999. The industry's production capacity of pig iron increased to 94.63 Mt/yr from 93.99 Mt/yr in 1999, but the production capacity of crude steel decreased to 145.78 Mt/yr from 146.94 Mt/yr in 1999. To meet the growing demand for refined copper in the

Asian market, Japan increased its refined-copper production capacity at Hibi Kyodo Smelting Co. Ltd.'s Tamano refinery by 14.5% to 218,400 metric tons per year (t/yr); at Mitsubishi Materials' Naoshima refinery by 2.2% to 220,800 t/yr; at Nippon Mining and Metals' Hitachi and Saganoseki refineries by 8.6% to 182,000 t/yr and 7.1% to 270,000 t/yr, respectively; and at Sumitomo Metal Mining's Besshi refinery by 7.7% to 252,000 t/yr in 2000. Mitsui Mining and Smelting's Takehara copper-refining operation ceased at the end of September 2000 and transferred its copper-refining business to Hibi Kyodo Smelting's Tamano refinery, in which Mitsui Mining and Smelting owned a 64% equity interest. The lead- and zinc-refining capacity remained unchanged at 274,200 t/yr and 698,400 t/yr, respectively, in 2000. The copper smelting and refining industry's workforce decreased to 3,295 from 3,713 in 1999. The workforce of the lead smelting and refining industry increased to 838 from 830 in 1999, and that of the zinc smelting and refining industry also increased to 1,313 from 1,292 in 1999 (Research Institute of Economy, Trade and Industry, 2001, p. 30-31).

Commodity Review

Metals

Aluminum.—Nippon Light Metal Co. Ltd., which was Japan's sole producer of primary aluminum, operated a 20,000-t/yr smelter at Kambara in Shizuoka Prefecture and produced less than 0.3% of Japan's requirements for primary aluminum. In 2000, virtually all Japan's requirements for primary aluminum was met by imports. Imports of primary aluminum totaled 2.91 million metric tons (Mt), of which 1.96 Mt was regular grade with a purity of 99.99% or more, but not less than 99.0% aluminum and 941,607 metric tons (t) was primary aluminum alloys. The import bill for primary aluminum amounted to \$4.5 billion (Ministry of Finance, 2000b, p. 641).

Because of its heavy reliance on imports, Japan widely diversified its supply sources of primary aluminum. In 2000, about 46% of imported primary aluminum was supplied from Japan's 10 overseas aluminum smelter projects in which the Japanese aluminum and major trading companies held substantial equity shares; those smelters were in Australia, Brazil, Canada, Indonesia, Mozambique, New Zealand, the United States, and Venezuela (table 5). Among the primary aluminum overseas' suppliers, the top 10 supplying countries were Russia (22.7%), Australia (21.5%), Brazil (8.8%), New Zealand (7.3%), Canada (4.8%), South Africa (4.7%), Indonesia (4.5%), Venezuela (4.2%), China (3.8%), and the United Arab Emirates (3.5%). The United States supplied 60,015 t and accounted for 2.1% of Japan's imported primary aluminum in 2000 (Ministry of Finance, 2000b, p. 641).

To secure an additional captive supply of primary aluminum from overseas smelters, Mitsubishi Corp., which was a major trading company, acquired a 25% interest in Mozambique Aluminum Co. (MOZAL) in 1999. MOZAL completed construction of the 250,000-t/yr primary aluminum smelter in the Maputo metropolitan area in the Republic of Mozambique and started production in June 2000, 6 months earlier than was scheduled in the original plan. Full production was expected to be reached in the first quarter of 2001 (Mitsubishi Corp., June 19, 2000, Aluminum refining company in Mozambique starts production, Press Release, accessed August 2, 2001, at URL

<http://www.mitsubishi.co.jp/en/news/press/release51.html>).

Domestic demand for primary aluminum increased by 6.8% in 2000 to 2.16 Mt, of which 1.78 Mt was for rolling and extrusion; 109,572 t, for casting; 73,566 t, for secondary aluminum ingot; 53,320 t, for electric wire; 31,742 t, for steelmaking (deoxidization); 22,800 t, for diecasting; and 87,924 t, for other uses. The yearend stocks of primary aluminum decreased to 289,624 t from 307,173 t in 1999, of which 170,086 t was dealers' inventory; 106,612 t, consumers' inventory; and 12,926 t, the single primary aluminum producer inventory (Ministry of Economy, Trade and Industry, 2000d, p. 160-161).

Exports of primary aluminum, which included aluminum alloys, totaled 10,002 t and were valued at \$25.5 million in 2000. The major buyers in 2000 were Indonesia (25%), China including Hong Kong (19%), the Republic of Korea (18%), the Philippines (14%), Malaysia (5%), Thailand (3%), and the United States (3%) (Ministry of Finance, 2000a, p. 570-571).

Cadmium.—Japan was the world's largest producer and consumer of cadmium in 2000 (Roskill's Letter from Japan, 2001a). Cadmium was recovered as a byproduct of zinc refining, which used more than 75% of imported zinc sulfide concentrates mainly from Australia, Peru, and the United States and about 25% of domestic zinc sulfide concentrates from the Kamioka and the Toyoha Mines. Producers of cadmium were, in order of relative importance, Toho Zinc Co. Ltd., Dowa Mining, Mitsui Mining and Smelting, Sumitomo Metal Mining, Nippon Mining and Metals, and Mitsubishi Materials.

Because of increased demand for nickel-cadmium batteries and insufficient domestic supply, Japan imported about 57% of its cadmium requirements in 2000. Japan imported 3,916 t of cadmium mainly from the Republic of Korea (39%), Belgium (16%), Canada (15%), and the United Kingdom (8%). Imports of cadmium were valued at \$1.7 million (Ministry of Finance, 2000a, p. 649). Japan's consumption of cadmium was estimated to be 6,900 t in 2000, of which about 90% was for production of nickel-cadmium batteries (Roskill's Letter from Japan, 2001a).

Chromium.—Japan relied on imports to meet all chromium requirements for its iron and steel industry. Japan's imports of chromium ore and concentrate (chromite) increased by 32% to 501,727 t and were valued at \$38.7 million in 2000. The major suppliers were South Africa (59.2%), India (22.5%), Iran (6.8%), Madagascar (5.2%), and Turkey (3.9%) (Ministry of Finance, 2000b, p. 164).

Consumption of chromite by the iron and steel industry increased by 14% to 366,205 t, of which 249,728 t was consumed by the ferroalloy industry and 116,477 t by others. The iron and steel industry's yearend inventory of chromite increased by 4% to 222,585 t, which was equivalent to about a 7-month consumption (Ministry of Economy, Trade and Industry, 2000c, p. 87).

Production of ferrochromium increased by 9% to 130,074 t in 2000 owing to increased demand for the production of stainless steel, which rose by 14% to more than 3 Mt in 2000 (Ministry of Economy, Trade and Industry, 2000c, p. 26, 27, 56-57). Imports of ferrochromium, increased by 29% to 776,327 t, of which 714,531 t was high-carbon ferrochromium and 61,796 t was low-carbon ferrochromium. The top supplying countries of high-carbon ferrochromium were South Africa (56%),

Kazakhstan (15%), Zimbabwe (9%), and China and India (8% each). The top suppliers of low-carbon ferrochromium were South Africa (38%), Russia (23%), China (15%), Zimbabwe (13%), and Kazakhstan (9%). Import bills of high- and low-carbon ferrochromium were valued at \$407 million in 2000 (Ministry of Finance, 2000b, p. 603).

In April 2000, Mitsubishi Corp. acquired from Nittetsu Shoji Co. Ltd. or Nippon Steel Trading Co. Ltd., which was an affiliate of Nippon Steel Corp., 11% of its equity interest in Hernic Ferrochrome (Pty.) Ltd., which operated a 260,000-t/yr ferrochromium plant at Brits, South Africa. Annual shipment of Hernic ferrochromium to Japan was about 70,000 t (Metal Bulletin, 2000c).

Consumption of ferrochromium, which included high-carbon ferrochromium (832,020 t) and low-carbon ferrochromium (45,038 t), increased by 16% to 877,058 t in 2000, of which 872,749 t was consumed by steel producers and 4,309 t, by ferroalloys producers (Ministry of Economy, Trade and Industry, 2000c, p. 117). Exports of ferrochromium totaled 2,541 t in 2000, of which 2,389 t was low-carbon ferrochromium and 152 t, high-carbon ferrochromium. The major buyers of low-carbon ferrochromium were the United States (94%) and Thailand (4%). Exports of ferrochromium were valued at \$5.7 million (Ministry of Finance, 2000a, p. 491).

Production of chromium metal was by Nippon Denko Co. Ltd., which operated an 800-t/yr plant that used aluminothermic method at Oshima in Toyama Prefecture. In 2000, NKK Material Co. Ltd. (a subsidiary of NKK) had developed a new process to produce high-grade chromium metal that has a minimum purity of 99.5% chromium with very low impurities of aluminum and silicon. In June, NKK Material began production of high-grade chromium metal at its Toyama plant using its own patented process that refined chromium metal in two steps by electric furnaces and then removed the gases contained in the metal by a large vacuum furnace. The production capacity of high-grade chromium metal at the Toyama plant was about 1,000 t/yr and could be expanded to 3,000 t/yr if the demand for the metal by the manufacturers of super alloys should continue to grow (Tex Report, 2000a).

Cobalt.—Japan relied on imported cobalt matte and other intermediate products of cobalt for cobalt metal production. Sumitomo Metal Mining, which was Japan's sole producer of cobalt metal and chemicals, operated a refinery in Niihama, Ehime Prefecture, with a rated capacity of 480 t/yr (Shedd, 2001, p. 20.16). Japan also imported substantial amounts of cobalt metal and chemicals to meet its growing cobalt requirements.

In 2000, imports of cobalt matte, other intermediate products of cobalt, and other articles of cobalt increased by 25% to 9,337 t. The major suppliers were Canada (20.6%), Zambia (15.3%), Norway (12.3%), Finland (10.7%), Australia (10.5%), Belgium and the Republic of Congo (6.9% each), the Democratic Republic of the Congo (6.4%), and Morocco (2.6%). Japan also imported 3,119 t of cobalt oxide and 236 t of cobalt hydroxide. Belgium, which was the principal supplier of cobalt oxides, accounted for 93%. The top two suppliers of cobalt hydroxide were Belgium and Finland, which accounted for 80.5% and 16%, respectively. Import bills for cobalt metal and chemicals were valued at \$280 million and \$94 million, respectively, in 2000 (Ministry of Finance, 2000b, p. 177, 648-649).

According to Government statistics, domestic demand for cobalt metal in 2000 increased by 17.7% to 2,823 t, of which 884 t was for manufacturing of specialty steel; 521 t, for magnetic materials; 432 t, for pipe, plate, rod, and wire; 420 t, for ultrahard tool steel (cemented carbides); 160 t, for catalysts; and 405 t, for other end uses. Increased demand for specialty steel in 2000 was most drastic—83.8%. Demand for cobalt metal for manufacturing of ultrahard tool steel also increased by 16.7% (Ministry of Economy, Trade and Industry, 2000d, p. 170-171).

According to Mitsui and Co. Ltd., however, Japan's overall demand for cobalt metal and chemicals had grown to 8,700 t in 2000 from 7,500 t in 1999 owing to the continued growth in production of lithium ion and nickel-metal hydride (portable rechargeable) batteries, which contain cobalt, and increased demand in production of specialty steels and ultra hard tool steels (Roskill's Letter from Japan, 2001). According to an estimate by Mitsui and Co. Ltd. in 1999, Japan's overall consumption of primary cobalt metal was 7,500 t, of which 46% was for batteries; 13%, for such specialty steel as heat-resistant, wear-resistant alloys and glass sealing alloys; 9%, for hard metals, diamond tools, and sintered parts; 8%, for VCR tape; 7%, for permanent magnets; 3% each, for catalyst and organic; 2%, for ceramics; and 9%, for other uses (Terada, 2000, p. 9).

Copper, Lead, and Zinc.—Mine production of copper, lead, and zinc was by Kamioka Mining and Smelting Co. Ltd. at its Kamioka Mine in Gifu Prefecture and Toyoha Mining Co. Ltd. at its Toyoha Mine in Hokkaido Prefecture. Mine output of copper and lead increased considerably, but zinc decreased only slightly in 2000. Domestic mine output of copper, lead, and zinc was equivalent to 0.08%, 3.69%, and 9.72%, respectively, of Japan's raw material requirements for its copper, lead, and zinc smelting and refining industry in 2000 (Ministry of Economy, Trade and Industry, 2000d, p. 24-25).

In 2000, 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 increased captive copper concentrate imports from nonferrous metal mines in Chile, Japan's imports of copper concentrate increased by 4.2% to 4.47 Mt, which was estimated to contain about 1.35 Mt of copper. The top six suppliers of copper concentrate in 2000 were Chile (42.5%), Indonesia (22.9%), Canada (11.8%), Papua New Guinea (6.9%), Australia (6.8%), and Argentina (2.9%). Japan's imports of copper concentrate were valued at \$2.46 billion in 2000. Japan's imports of lead and zinc concentrates were 185,584 t and 1.06 Mt, which contained 128,290 t of lead and 531,030 t of zinc, respectively. The major suppliers of lead concentrate in 2000 were the United States (38.3%), Australia (26.6%), Peru (11.4%), Bolivia (8.5%), and Russia (5.9%). The major suppliers of zinc concentrate were Australia (42.4%), Peru (14.0%), the United States (12.8%), Canada (7.9%), Chile (6.2%), Mexico (4.7%), Russia (4.6%), and Bolivia (3.5%). Japan's imports of lead and zinc concentrates were valued at \$53.39 million and \$292.33 million, respectively, in 2000 (Ministry of Finance, 2000b, p. 164).

To secure more captive copper concentrate from overseas nonferrous metals mines in which Japanese nonferrous metal mining and major trading companies held a major or substantial portion of equity, Japanese companies increased their equity interest in two copper projects in Canada and one copper project in Chile in 2000. Sumitomo Corp. increased its equity interest

in the Mount Polley copper project in Canada to 47.5% from 45% in 1999. Mitsubishi Materials (31.25%), Dowa Mining (6.25%), Furukawa Co. Ltd. (6.25%), and Marubeni Corp. (6.25%) increased their combined equity interest in the Huckleberry copper project in Canada to 50% from 40% in 1999. Nittetsu Mining Co. Ltd. increased its equity interest in El Bronce copper project in Chile to 60% from 32% in 1998. In 2000, Furukawa acquired 1.5% equity interest in the Batu Hijau copper-gold project on Sumbawa Island in Indonesia from Sumitomo Corp., which reduced its equity interest to 26% from 27.5% (Research Institute of Economy, Trade and Industry, 2001, p. 210-220).

Three new overseas development projects of nonferrous metals mines in which Japanese companies held substantial equity shares started production in 2000, and a new development project, which started construction in 1998, was expected to start production in June 2002 (table 6). In March, 2000, the Los Pelambres copper-molybdenum project in Chile started production and was to ship 138,000 t/yr of copper in concentrate to Japan. In October 2000, the Rey de Plata copper-lead-zinc-silver project in Mexico, which Dowa Mining (39%) and Sumitomo Corp. (10%) held equity interest, started production and was to ship about 47,000 t/yr of zinc in concentrate to Japan. In December 2000, El Bronce copper project in Chile started production and was to ship 10,000 t/yr of copper in concentrate to Japan. The Antamina copper and zinc project in Peru, in which Mitsubishi Corp. held 10% equity interest, was expected to start production in June 2002 (Research Institute of Economy, Trade and Industry, 2001, p. 210-220).

Metal production of copper, lead, and zinc increased in 2000 owing mainly to increased demand for copper, lead, and zinc in the domestic market as the Japanese economy continued its slow-paced recovery. To cut unit cost, Japan's nonferrous metals smelting and refining industry operated at near capacity for refined copper at 97.5%, refined lead at 87.3%, and refined zinc at 93.7% in 2000 (Ministry of Economy, Trade and Industry, 2000d, p. 36-41, 45). Exports of copper, lead, and zinc, however, decreased in 2000 owing to a slower economic growth in Malaysia, the Philippines, Taiwan, and Thailand.

In anticipation of further growth in demand for refined copper in the Asian markets, Japan's major nonferrous metals companies expanded their capacity of copper smelting and refining in 2000. Nippon Mining and Metals expanded the copper smelting capacity to 470,000 t/yr from 451,200 t/yr and the refining capacity to 270,000 t/yr from 252,000 t/yr at its Saganoseki plant in Oita Prefecture. The company also expanded the refining capacity to 182,400 t/yr from 168,000 t/yr at its Hitachi plant in Ibaraki Prefecture. Mitsubishi Materials expanded the refining capacity to 220,800 t/yr from 216,000 t/yr at its Naoshima plant in Kagawa Prefecture. Sumitomo Metal Mining expanded the refining capacity to 252,000 t/yr from 234,000 t/yr at its Besshi plant in Ehime Prefecture. Mitsui Mining and Smelting expanded the refining capacity to 218,400 t/yr from 190,800 t/yr at its 64% owned Hibi Kyodo Smelting's Tamano plant in Okayama Prefecture. As a result of these expansions in 2000, Japan's copper smelting capacity was raised to 1.75 Mt/yr from 1.73 Mt/yr, and copper refining capacity, to 1.74 Mt/yr from 1.42 Mt/yr (Research Institute of Economy, Trade and Industry, 2001, p. 30).

In April 2000, Sumitomo Metal Mining announced that under its revival program, it planned to expand the copper refining

capacity to 400,000 t/yr and to boost its production of gold and silver to 60 t/yr and 480 t/yr from 36 t/yr and 300 t/yr, respectively, by constructing a new converter furnace, an oxygen plant, and a new refinery at its Toyo complex in Ehime Prefecture by 2003 (Japan Metal Review, 2000b, d). In September 2000, Mitsui Mining and Smelting shut down its 30,000-t/yr refinery at Takehara in Hiroshima Prefecture and shifted its copper refining business to Hibi Kyodo Smelting's Tamano refinery (Metal Bulletin, 2000d).

In overseas copper smelting-refining projects, Furukawa and its partners finally started their operations at the Port Kembla copper smelter-refinery complex in New South Wales, Australia, in July 2000, almost 1 year later than the original plan because of problems related to bad weather, the shortage of construction workers, and problems at the smelter. In October 2000, Furukawa announced that refined copper produced from the Port Kembla refinery would be about 9,000 t in 2000 and could produce about 90,000 t in 2001 (Mining Journal, 2000c). In June 2000, Nippon Mining and Metals announced that it planned to spend about \$48 million to expand the refining capacity of its joint-venture LG Nikko Copper Inc., which owned and operated two smelters and two refineries, to 510,000 t/yr from 460,000 t/yr by October 2002. After the expansion is completed, LG Nikko Copper's Changhan-Onsan copper smelting and refining complex would be the largest copper producer in the Asia and Pacific region (Metal Bulletin, 2000b).

Imports of refined copper decreased to 202,914 t from 230,119 t in 1999 and were valued at \$369.6 million. The major suppliers of refined copper were Chile (56.1%), Zambia (12.9%), the Philippines (9.0%), Indonesia (5.6%), Australia (5.4%), Burma (Myanmar) (4.3%), and Peru (4.0%). Imports of refined lead increased to 20,847 t from 13,818 t in 1999 and were valued at \$10.6 million. Imports of slab zinc increased to 80,769 t from 55,334 t in 1999 and were valued at \$94.1 million. The major suppliers of refined lead were China (84.7%), Australia (7.6%), and Peru (7.5%). The major suppliers of slab zinc were China (76.0%), Peru (16.9%), and Canada (5.7%) (Ministry of Finance, 2000b, p. 634-635, 645-646).

Domestic consumption of refined copper increased by 6.5% to 1.35 Mt in 2000. Domestic demand for refined copper was 62.6% for wire and cable, 35.2% for brass mill, and 2.2% for others. The overall stocks of refined copper at the end of December remained steady at 89,349 t (Ministry of Economy, Trade and Industry 2000d, p. 152, 153). Exports of refined copper decreased to 299,373 t from 318,849 t in 1999 and were valued at \$536.9 million. The major buyers of refined copper were Taiwan (51.8%), China (and Hong Kong) (26.4%), Thailand (6.7%), the Republic of Korea (6.6%), Malaysia (2.6%), Indonesia (2.3%), and the United States (1.8%) (Ministry of Finance, 2000a, p. 571).

Domestic demand for refined lead increased by 4.1% to 251,164 t in 2000, 73.9% of which was for storage batteries; 13.2%, for inorganic chemicals; and 12.9%, for solders and other uses. The overall stocks of primary lead decreased by 21.8% to 18,312 t at the end of December (Ministry of Economy, Trade and Industry, 2000d, p. 154-155). Exports of refined lead dropped sharply to 1,564 t from 4,352 t in 1999. The major buyers of refined lead in 2000 were Malaysia (57.8%), China (24.9%), and the Philippines (11.3%) (Ministry of Finance, 2000a, p. 576).

Domestic demand for zinc slab increased by 7.5% to 614,120

t in 2000, 50.7% of which was for sheet galvanizing; 16.9%, for other plating; 12.2%, for brass mill products; 8.8%, for zinc die-cast products; 5.9%, for inorganic chemicals; and 5.5%, for other uses. The overall stocks of zinc slab increased by 8.2% to 111,779 t at the end of December (Ministry of Economy, Trade and Industry, 2000d, p. 158). Exports of slab zinc decreased by 27.9% to 51,096 t and were valued at \$58.5 million in 2000. The major buyers of slab zinc in 2000 were Taiwan (37.0%), the Philippines (23.2%), Bangladesh (11.3%), Indonesia (14.2%), Pakistan (2.7%), and Vietnam (2.5%) (Ministry of Finance, 2000a, p. 577).

To cut cost and increase efficiency, Dowa Mining, Mitsui Mining and Smelting, and Nippon Mining and Metals initiated a joint feasibility study in November 1999 for establishing a joint venture to cooperate in such copper businesses as raw material (copper concentrate) procurement, smelting and refining, production technology, logistics, and export sales (Japan Metal Review, 1999). In October 2000, Mitsui Mining and Smelting and Nippon Mining and Metals announced that they had formed the joint venture Pacific Copper Co. to handle domestic and export sales of copper and sulfuric acid. Pacific Copper, which was 65% owned by Nippon Mining and Metals and 35% owned by Mitsui Mining and Smelting, would begin operation in January 1, 2001. Pacific Copper was expected to save about \$9.3 million per year for the two partners (Metal Bulletin, 2000a). Dowa Mining withdrew from the joint-venture study in May 2000, before Pacific Copper was formed in October because of the difference in its raw material source from that of the two other joint-venture partners.

Gallium.—Japan was the world's largest consumer and one of the world's major importers of gallium in 2000. High-purity gallium metal production was estimated to be about 158 t in 2000, of which 14 t was produced from domestic raw materials, 66 t from imported materials, and 78 t from such domestic scrap materials as new scrap of gallium metal, wafer scraps of gallium arsenic (GaAs) and gallium phosphate (GaP), and residue from the liquid phase epitaxial (LPE) process (Roskill's Letter from Japan, 2001c).

Dowa Mining, which was Japan's largest producer of gallium metal, started operation of its newly completed processing plant in 2000. The new plant, which is adjacent to its copper refinery at Kosaka in Akita Prefecture, was expected to produce 8 t of high purity (6-7 nines) gallium metal in 2000 and 14 to 15 t in 2001. Japan imported 42,216 kilograms (kg) of gallium in 1999 and was estimated to import about 65,750 kg in 2000. The major sources of imported gallium were Kazakhstan and the United States (22.8% each), France (21.3%), Russia (7.6%), and China and Germany (6.1% each) (Roskill's Letter from Japan, 2001c).

Dowa Mining also produced high-purity gallium metal using imported intermediate-grade (3-4 nines) gallium. Other major high-purity gallium metal producers, which mostly processed imported and domestic scrap materials, were Rasa Industries Co. Ltd. and Sumitomo Chemical Co. Ltd. A small quantity of gallium metal was also produced by Nichia Chemical Industries, Ltd. and Sumitomo Metal Mining. All five companies recycled residue from the LPE process; Dowa Mining and Rasa Industries also recycled wafer scrap (Metal Bulletin, 1999).

According to an estimate by Dowa Mining, Japan's demand for gallium was 139.5 t in 2000, of which 52 t was for manufacturing GaAs-based light emitting diodes (LEDs); 49 t,

for GaAs crystals; 18.5 t, for GaP crystals; 17.5 t, for GaP-based LEDs; and 2.5 t, for GaAs-based laser diodes (LDs) and other uses. Japan's demand for gallium accounted for more than 66% of the world's total demand, which was estimated to be 210 t in 2000 (Roskill's Letter from Japan, 2001c).

Gold and Silver.—Mine production of gold decreased by 10.6%, but that of silver increased by 10.4% in 2000. Gold mine production was mainly by Sumitomo Metal Mining from its Hishikari Mine in Kagoshima Prefecture. The company, which was working on its Honko (main mine) and Yamada deposits in the Hishikari mining area, maintained gold production at between 7 and 8 t/yr. Other small-scale operating gold and silver mines were the Kouryu Mine in the southwestern part of Hokkaido Prefecture and the Akesi, the Iwato Kinzan, and the Kasuga Mines in Kagoshima Prefecture (Research Institute of Economy, Trade and Industry, 2001, p. 3). The Kamioka and the Toyoha Mines produced most of Japan's mined silver as a byproduct of their lead and zinc mining operations.

Sumitomo Metal Mining announced in May 2000 that it had discovered three new gold veins at the Koganezawa deposit, which is south of the Yamada deposit in the Hishikari mining area. The veins are 1 to 1.66 meters (m) wide, and ore grade averages 25 to 55 g/t gold and 8.9 to 24 g/t silver. The company planned to conduct further exploration by drilling to assess ore reserves at the Koganezawa deposit (Japan Metal Review, 2000c).

In overseas exploration, Sumitomo Metal Mining completed its \$33 million feasibility study in the Pogo area of its Stone Boy property in Alaska. The company announced in August 2000 that its exploration work indicated that the gold vein at the Liese deposit in the Pogo area contains ore reserves of 9.7 Mt with an average ore grade of 18 g/t gold, which could contain about 170 t of gold. Sumitomo Metal Mining applied for a mining permit in August 2000. A feasibility study to develop the mine was planned after the mining permit was approved by U.S. Government, which probably would take about 18 months. According to the company's plan, gold mining in the Pogo area was slated to start in summer 2004 with ore output of between 2,500 and 3,500 metric tons per day and was expected to produce between 11 and 15.6 t/yr of gold. The Pogo gold project would be owned 51% by Sumitomo Metal Mining, 40% by Teck Corp., and 9% by Sumitomo Corp. (Tekko Shimbun, 2000).

Production of refined gold held steady in 2000. Refined gold produced from imported ore decreased by 7.1% to 99,123 kg; from domestic ore, increased by 0.3% to 8,345 kg; from scrap, increased by 22.6% to 9,491 kg; and from other raw materials, increased by 16.1% to 26,961 kg. Production of refined silver increased by 5.6%. Refined silver produced from imported ore increased by 1.3% to 1,494 t; from domestic ore, by 11.7% to 66 t; from scrap, by 19.8% to 350 t; and from other materials, by 9.8% to 474 t (Ministry of Economy, Trade and Industry, 2000d, p. 40-41).

To increase the efficiency and productivity of gold refining, Sumitomo Metal Mining planned to introduce a new precious-metals-refining process in the next 2 years. The new process would enable the company to raise its gold and silver production to 60 t/yr and 480 t/yr from 36 t/yr and 300 t/yr, respectively, in 2003. The new process would also enable the company to recover platinum-group metals (Sumitomo Metal

Mining Co. Ltd., 2000, p. 8). Dowa Mining, which operated a gold recycling plant at its Kosaka nonferrous metals smelting and refining complex in Aikta Prefecture, had raised its gold recycling capacity to 110 t/yr. The recycling plant also recovered palladium (Japan Metal Review, 2000a).

Imports of gold ingots and powder dropped by 33.1% to 70,118 kg, thus reflecting higher domestic production and lower domestic demand for jewelry in 2000. Imports of silver ingots and powder rose by 29.5% to 1,565 t owing mainly to increased domestic demand for all end-use sectors. The major end user of silver—the manufacturers of silver nitrate for photographic use—rose by 5.5% in 2000. The top suppliers of gold ingots and powder in 2000 were Australia (38.2%), Uzbekistan (9.8%), Papua New Guinea (8.8%), the United Kingdom (8.4%), the United States (8.0%), Russia (7.8%), Switzerland (7.1%), Brazil (3.7%), and Canada (3.2%). The major suppliers of silver ingots and powder in 2000 were Mexico (37.4%), Peru (18.8%), the United States (16.6%), Australia (8.8%), the Republic of Korea (5.9%), Kazakhstan (2.7%), and China (2.6%). Import bills for gold ingots and powder were \$623 million, and silver ingot and powder were \$235 million (Ministry of Finance, 2000b, p. 597-598).

In 1999 (the latest year for which data are available), overall demand for gold, which included industrial uses, industrial arts and crafts, private investments, and other uses totaled 337.1 t, of which 110.7 t was for personal holdings; 82.5 t, for electronic devices; 45.0 t, for art and ornaments; 24.2 t, for galvanizing; 19.9 t, for dental; and 54.8 t for other uses (Metal Mining Agency of Japan, 2000c, p. 8). Domestic demand for silver increased by 27.0% to 3,939 t in 2000, 43.8% of which was for silver nitrate for photographic use; 8.5%, for silver nitrate for other uses; 8.0%, for electric contacts; 5.3%, for rolled products; 3.5%, for silver branning alloy; and 30.9%, for other uses (Ministry of Economy, Trade and Industry, 2000d, p. 176).

Exports of refined gold ingots and powder rose sharply by 52.5% to 4,714 kg and were valued at \$41 million in 2000. The major buyers of refined gold ingots and powder were Singapore (53.4%), Taiwan (17.7%), Switzerland (12.8%), and China and Hong Kong (7.4%). Exports of silver ingots and powder also rose sharply by 60.2% to 296 t and were valued at \$28 million. The major buyers of refined silver ingots and powder were Singapore (38.3%), the Republic of Korea (24.0%), Malaysia (12.2%), China and Hong Kong (11.6%), Taiwan (3.0%), and Sweden (2.2%) (Ministry of Finance, 2000a, p. 486-487).

Indium.—In 2000, Japan was one of the leading producers and the largest consumer of indium metal in the world. The country produced about 55 t of indium metal and recycled about 173 t of indium metal from scrap. Because of a record-high demand, imports of indium metal reached their highest level in 2000. Despite the record-high demand, the world price of indium dropped to between \$110 and \$130 per kilogram at the end of 2000 because of excessive indium supply in the Japanese market (Roskill's Letter from Japan, 2001d). The averaged prices of indium were between \$271 and \$291 per kilogram in 1998 and between \$191 and \$223 per kilogram in 1999.

Indium metal was produced mainly by Nippon Mining and Metals. The company used zinc slag generated at its affiliated zinc smelters to extract indium and recycled scrap to recover indium at its Saganoseki nonferrous metals smelting and refining complex in Oita Prefecture. Other indium metal producers, which used zinc slag and scrap as raw materials,

were Dowa Mining at Kosaka, Mitsui Mining and Smelting at Tamano, and Sumitomo Metal Mining at Besshi (Roskill's Letter from Japan, 2001e). Imports of indium metal rose sharply by 42.9% to 130,453 kg and were valued at \$19 million in 2000. The major suppliers of indium metal were China (38.2%), France (37.8%), and Canada (16.0%) (Ministry of Finance, 2000b, p. 650).

In 2000, demand for indium rose by 23.2% to 335 t, of which 282 t was for production of indium-tin oxide for transparent electrodes used in liquid crystal displays of personal computers and cellular phones. Other end uses were for solder (18 t), compound semiconductors (9 t), phosphors (8 t), low-melting-point alloys (6 t), contact materials (4 t), dental alloys (3 t), and others (5 t) (Roskill's Letter from Japan, 2000d).

Iron and Steel.—Japan's iron and steel industry relied on imports to meet all its iron ore requirements. Because of increased demand by the iron and steel industry, imports of iron ore increased by 9.7% to 131.7 Mt and were valued at \$3.2 billion in 2000. The average cost, insurance, and freight (c.i.f.) import price per metric ton of iron ore rose to \$24.49 from \$23.68. The major suppliers of iron ore were Australia (53.9%), Brazil (20.5%), India (12.6%), South Africa (3.8%), the Philippines (3.3%), and Chile (2.7%). Imports of pig iron rose sharply to 850,763 t from 143,000 t in 1999 and were valued at \$115.4 million. The average c.i.f. import price per metric ton of pig iron increased slightly to \$135.65 from \$132.13 in 1999. The major suppliers of pig iron in 2000 were China (60.4%), Brazil (15.3%), South Africa (13.4%), and North Korea (11.2%) (Ministry of Finance, 2000b, p.164, 603).

Consumption of iron ore by the iron and steel industry totaled 112 Mt in 2000, of which 86.6 Mt was for sintering; 24.4 Mt, for ironmaking; 0.9 Mt, for steelmaking; and 0.1 Mt, for other uses. Consumption of other iron ore raw materials by the iron and steel industry included 5.2 Mt of imported pellets, 566,554 t of imported iron sand, 230,334 t of imported ferruginous manganese ore, and 11.6 Mt of other iron ore materials. Other important raw materials consumed by the iron and steel industry in 2000 were 62.7 Mt of coking coal, 43.8 Mt of iron and steel scrap, 36.2 Mt of coke, 13.1 Mt of limestone, 4.8 Mt of quicklime, 1.5 Mt of serpentinite, 1.2 Mt of dolomite, 329,557 t of baked dolomite, 216,376 t of fluorite (Ministry of Economy, Trade and Industry, 2000c, p. 80-91). In 2000, pig iron production increased by 9% to 81.1 Mt, of which 80.6 Mt was for steelmaking and 500,000 t was for foundry (Ministry of Economy, Trade and Industry, 2000c, p. 24). In the ironmaking sector, the total ironmaking capacity remained unchanged at 94.0 Mt/yr in 2000 with 39 blast furnaces, and 4 other furnaces (Ministry of Economy, Trade and Industry, 2000c, p. 112).

Japan, which was the world's second largest producer of crude steel, accounted for 12.6% of the world total in 2000 (International Iron and Steel Institute, 2001, The major steel-producing countries, 1999 and 2000, Worldsteel, accessed September 4, 2001, at URL http://www.worldsteel.org/trends_indicators/figures_3.html). The top Japanese steelmakers in 2000 were as follows: Nippon Steel Corp., which produced 29.07 Mt of crude steel, ranked 1st; NKK, which produced 20.56 Mt, ranked 6th; Kawasaki Steel Corp., which produced 13.01 Mt, ranked 11th; Sumitomo Metal Industries, Ltd., which produced 11.65 Mt, ranked 12th; and Kobe Steel Ltd., which produced 6.43 Mt, ranked 27th (Metal Bulletin, 2001).

Crude steel output increased by 13% to 106.4 Mt in 2000; this was the highest level since 1991. The strong domestic demand for steel by the construction and manufacturing industries and increased exports to the Asian market because of the regional economic recovery were the two driving forces to push the crude steel production above the 100-Mt level. Of the total crude steel produced in 2000, 71.2% and 28.8% was processed by basic oxygen (LD converter) and electric furnaces, respectively; and 82.3% and 17.7% was processed into ordinary steel and specialty steel, respectively (Ministry of Economy, Trade and Industry, 2000c, p. 34-35). In the steelmaking sector, the number of basic oxygen furnaces remained unchanged with 64 units in 2000, and the number of electric arc furnaces decreased to 409 from 425 in 1999. The overall crude steel production capacity decreased to 145.8 Mt/yr from 146.9 Mt/yr in 1999, of which 94.4 Mt/yr was basic oxygen furnaces and 51.4 Mt/yr, electric furnaces (Ministry of Economy, Trade and Industry, 2000c, p. 113). The iron and steel industry continued its restructuring and had reduced its labor force by 10,712 to 191,347 workers by the end of 2000; between 1996 and 2000, the iron and steel industry had cut its workforce by 46,102 workers (Ministry of Economy, Trade and Industry, 2000c, p. 115).

Domestic demand and exports of steel moved higher in 2000. Japan's apparent steel consumption, in crude steel equivalent, increased by 14% to about 80.6 Mt, and apparent steel consumption per capita rose to 635 kg from 557 kg in 1999 (Japan Iron and Steel Federation, 2001a). The overall domestic demand for steel products increased by 9.4% to 65.9 Mt, of which 56.1 Mt was ordinary steel products and 9.8 Mt, specialty steel products (Japan Iron and Steel Federation 2001b, p. 5). Exports of iron and steel products increased by 3.4% to 29.2 Mt. Japan's domestic demand for ordinary steel products increased in most end-use markets except tanks, containers, and other end users. Domestic demand for specialty steel products also increased in most end-use markets except in conversion and further steel processing (table 7a).

Exports of iron and steel reached 29.2 Mt in 2000; this was a 15-year high. Exports of iron and steel products in 2000 included 1.5 Mt of steel ingots and semifinished products, 22.4 Mt of ordinary steel products, 4.3 Mt of specialty steel products, and 900,000 t of other iron and steel products (Japan Iron and Steel Federation, 2000a, p. 12-13). Export earnings from iron and steel and articles of iron and steel totaled \$18.4 billion in 2000 (Ministry of Finance, 2000a, p. 36-37). Exports of iron and steel products to the Asian markets increased by 8.1% to 22.4 Mt in 2000 owing mainly to the continued strong economic growth in China and the continued economic recovery in the Republic of Korea and Thailand. Exports of iron and steel product to all other regional markets except Africa, however, decreased in 2000; exports to the United States continued to decrease in 2000 to about 2.1 Mt from 2.8 Mt in 1999 and 7.0 Mt in 1998 (table 8).

Imports of iron and steel products increased by 19.7% to 7.75 Mt in 2000. Of the total imports, 4.66 Mt was ordinary steel products; 1.66 Mt, ferroalloys; and 1.43 Mt, pig iron, steel ingots and semimanufactured steel, specialty steel, and other steel products. Among the major suppliers of the ordinary steel products, the Republic of Korea accounted for 56.5%; Taiwan, 24.6%; and China, 10.5% (Japan Iron and Steel Federation, 2001b, p. 6-7). The import bill of iron and steel and articles of iron and steel products totaled \$5.7 billion (Ministry of Finance,

2000b, p. 36-38).

Manganese.—All Japan's manganese ore requirements were met by imports. Japan imported 1,888 t of high-grade manganese dioxide ore, 927,018 t high-grade (more than 39% Mn) manganese ore, 90,909 t low-grade (not more than 39% Mn) manganese ore, and 128,225 t, ferruginous manganiferous (more than 20% Mn) ore in 2000. The major suppliers of high-grade manganese dioxide ore were Gabon (60.4%) and Mexico (24.4%). The major suppliers of high-grade manganese ore were South Africa (58.9%) and Australia (35.0%). The major suppliers of low-grade manganese ore were South Africa (51.5%) and India (48.4%). The major suppliers of ferruginous manganiferous ore were Ghana (45.4%), India (25.5%), and South Africa (19.1%). The total import bill for manganese ore amounted to \$109.6 million (Ministry of Finance, 2000b, p. 164).

To secure a stable source of raw material requirements for its Tokushima ferromanganese plant in Tokushima Prefecture on Shikoku Island, Nippon Denko K.K. reached an agreement with Samancor Ltd. of South Africa in August 2000 for a long-term supply of manganese ore. Under the agreement, Nippon Denko was to provide Samancor with the technology for the production of ferromanganese, and Nippon Denko, in exchange, would be allowed to import more manganese ore from Samancor and raise its high-carbon ferromanganese production to meet the demand for high-carbon ferromanganese in Japan (Tex Report, 2000b).

Consumption of manganese ore decreased slightly to 815,135 t from 831,766 t in 1999; that by producers of ferroalloys increased by 2.5% to 621,671 t, by steelmakers decreased by 14.1% to 193,379 t, and by other users decreased by 24.1% to 85 t in 2000 (Ministry of Economy, Trade and Industry, 2000c, p. 86). Production of ferromanganese rebounded from the downward trend that began in 1997 and increased by 7.2% from that of 1999 owing mainly to increased consumption by steel producers. Imports of ferromanganese totaled 69,683 t in 2000, of which 53,503 t was high-carbon ferromanganese and 16,180 t, low-carbon ferromanganese. The total import bill of ferromanganese amounted to \$32.2 million in 2000. The major suppliers of high-carbon ferromanganese were China (43.3%), South Africa (35.2%), and Australia (19.6%). The major suppliers of low-carbon ferromanganese were South Africa (71.4%), the Republic of Korea (19.9%), and China (8.7%). In 2000, Japan also imported 223,747 t of silicomanganese principally from China (80.6%) and Australia (7.1%) to meet steelmaking requirements (Ministry of Finance, 2000b, p. 603).

Consumption of ferromanganese totaled 386,309 t in 2000, of which 359,043 t was by steel producers and 27,266 t, by ferroalloys producers. Of the total consumption by steel producers, 299,898 t was high-carbon ferromanganese and 59,145 t, low-carbon ferromanganese. Overall consumption of high-, medium-, and low-carbon ferromanganese increased by 10.9% to 387,067 t (Ministry of Economy, Trade and Industry, 2000c, p. 117). Exports of ferromanganese increased sharply by 128.1% to 44,248 t in 2000, of which 10,609 t was high-carbon ferromanganese and 33,639 t, low-carbon ferromanganese. The principal buyer of high-carbon ferromanganese was Taiwan (92.5%). The major buyers of low-carbon ferromanganese were the United States (27.8%), Taiwan (23.4%), the Republic of Korea (19.1%), and Indonesia (6.7%). Exports of ferromanganese were valued at \$27.1

million in 2000 (Ministry of Finance, 2000a, p. 490).

Nickel.—Japan was the world's largest consumer of nickel and accounted for 17.8% of the world's demand and was the second largest producer of nickel metal and accounted for 14.9% of the world's production in 2000 (International Nickel Study Group, 2001, Current statistics, accessed September 5, 2001, at URL <http://www.insg.org/curstats.htm>). All raw materials for nickel metal production, however, were imported. 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 for the manufacturers of battery, magnetic materials, nonferrous alloys, and specialty steel, as well as other end-users.

Imports of nickel ore increased by 17.9% to 4.6 Mt and were valued at \$206.1 million in 2000. The three suppliers of nickel ore were New Caledonia (50.3%), Indonesia (26.5%), and the Philippines (23.2%). Imports of nickel matte, in gross weight, increased by 29.3% to 111,690 t and were valued at \$607 million. The two suppliers of nickel matte were Indonesia (65.8%) and Australia (34.2%). Imports of ferronickel, in gross weight, increased by 9.8% to 37,630 t and were valued at \$82 million. The three suppliers of ferronickel were New Caledonia (75.7%), Indonesia (14.5%), and the Dominican Republic (9.8%). Imports of refined nickel increased by 19.9% to 57,894 t and were valued at \$507 million. The top nine suppliers of refined nickel were Australia (19.8%), China (17.4%), Russia (16.8%), Zimbabwe (11.2%), Norway (8.7%), South Africa (6.6%), Brazil (6.5%), the United Kingdom (5.8%), and Canada (5.6%). Imports of nickel oxide sinter increased by 8.5% to 1,572 t and were valued at \$10.9 million. Australia, which was the dominant supplier of nickel oxide sinter, accounted for 96.7%. Imports of nickel powders and flakes increased only slightly to 11,206 t from 11,167 t in 1999 and were valued at \$112.9 million. The two major suppliers of nickel powder and flakes were Canada (47.6%) and the United Kingdom (45.1%). Imports of nickel waste and scrap increased by 40.3% to 15,665 t and were valued at \$118.7 million. The major suppliers of nickel waste and scrap were Zimbabwe (26.3%), Russia (25.1%), the United States (14.3%), Taiwan (5.8%), China (5.8%), South Africa (5.1%), and Canada (4.3%) (Ministry of Finance, 2000b, p. 164, 603, 639-640).

Consumption of nickel ore by the ferroalloys industry increased by 14.9% to 3.5 Mt in 2000. Production of ferronickel increased by 10.5% to 367,181 t in 2000. Consumption of ferronickel for steelmaking increased by 7.4% to 264,635 t because of increased production of stainless steel (Ministry of Economy, Trade and Industry, 2000c, p. 86, 117). Exports of ferronickel increased by 3.2% to 114,828 t, 62.0% of which went to Taiwan and 37.8%, to the Republic of Korea. Export earnings from ferronickel were valued at \$188.7 million (Ministry of Finance, 2000a, p. 491).

Production of refined nickel was solely by Sumitomo Metal Mining at its nickel refinery that used 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 and planned to expand further to 60,000 t/yr in the next 2 years (Sumitomo Metal Mining Co. Ltd., 2000, p. 9). Production of nickel oxide sinter was solely by Tokyo Nickel Co. Ltd. at its 60,000-t/yr Matsusaka nickel

oxide sinter plant in Mie Prefecture. Nickel matte produced by P.T. Inco at the Soroako plant in Indonesia and Western Mining Corp. at the Kalgoorlie plant in Australia were the two major sources of raw material for the two Japanese nickel refineries.

In April 2000, Sumitomo Metal Mining announced that it had reached an agreement with Rio Tuba Nickel Mining Corp. of the Philippines to conduct a technical feasibility study for building a \$100 million to \$150 million laterite nickel refinery on Palawan Island in the Philippines. Under the company's plan, the nickel refinery would be based on high-pressure, acid-leaching technology and would produce mixed nickel and cobalt intermediates that contain 10,000 t/yr of nickel and 550 t/yr of cobalt. The plant would convert 1 Mt/yr from 20 Mt of stockpiled low-grade nickel oxide ore (sapolite and laterite ore that averages 1.25% nickel) at the Rio Tuba Mine on Palawan Island. The company indicated that construction work on the plant could begin in 2001 and that operations could start in 2003 (Metal Bulletin, 2000e; Mining Engineering, 2000).

Domestic demand for refined nickel increased by 5.2% to 72,221 t; of that total, specialty steel production accounted for 50,209 t; galvanized sheet, 5,449 t; batteries, 4,047 t; magnetic materials, 2,735 t; copper and copper-base alloys, 3,776 t; catalysts, 380 t; and other uses, 5,625 t (Ministry of Economy, Trade and Industry, 2000d, p. 168). Exports of refined nickel increased by 203.8% to 963 t; of this total, 46.3% went to the Republic of Korea; 38.1%, to Singapore; 5.7% to Thailand; 3.6%, to Indonesia; 2.8%, to the Philippines; and 1.8%, to Vietnam. Exports of nickel oxide sinter and other intermediate products of nickel metallurgy increased by 191.8% to 23,072 t, 73.3% of which went to the Republic of Korea and 26.7%, to Taiwan. Exports of nickel powders and flakes increased by 84.7% to 1,184 t, 41.6% of which went to China and Hong Kong; 22.8%, to France; 21.9%, to Taiwan; and 6.2%, to the United States. Exports of nickel waste and scrap increased by 39.6% to 681 t, 50.2% of which went to the United Kingdom and 19.7%, to the United States (Ministry of Finance, 2000a, p. 569).

Titanium.—Japan was the world's largest producer of titanium sponge metal and one of the world's top producers of titanium dioxide pigment in 2000 (Roskell's Letter from Japan, 2001g). All the raw material requirements for production of titanium metal and dioxide pigment, however, 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.

In 2000, Japan imported 80,392 t of rutile mainly from Australia (67.5%), South Africa (16.5%), and India (14.4%). Japan also imported 336,326 t of ilmenite mainly from Australia (37.4%), Vietnam (32.3%), Canada (14.0%), and Malaysia (6.7%). Imports of rutile and ilmenite were valued at \$35 million and \$42 million, respectively, in 2000 (Ministry of Finance, 2000b, p. 165).

Production of titanium sponge increased slightly in 2000 owing mainly to increased exports to the United States. In 2000, Sumitomo Sitix Corp.'s 15,000-t/yr plant at Amagasaki near Osaka produced about 10,500 t, and Toho Titanium Co. Ltd.'s 10,800-t/yr plant at Chigasaki in Kanagawa Prefecture produced about 9,000 t (Roskill's Letter from Japan, 2001g). To cut production costs by 30%, Toho Titanium planned to

reduced its workforce to below 500 by the end of March 2003 from 608 in April 2000; this could save \$5.6 million in annual labor costs. At the same time, the company also planned to spend about \$18.6 million at its Chigasaki plant to increase batch size and to shorten the reaction time for sponge production (Metal Bulletin, 2000f).

According to the Japan Titanium Society, domestic shipments of titanium sponge decreased to 11,475 t from 12,398 t in 1999. Overseas shipments, however, increased to 7,712 t from 7,095 t in 1999. Production of titanium ingots declined to 13,111 t from 13,897 t in 1999. Total shipments of titanium mill products increased to 11,946 t from 11,662 t in 1999; domestic shipments of titanium mill products increased to 6,049 t from 5,479 t in 1999, and overseas shipments decreased to 5,897 t from 6,183 t in 1999. The upturn in domestic shipments largely was a result of increased sales of pure terephthalic acid plants in the chemical industry (Roskill's Letter from Japan, 2001g, h). Shipments of titanium mill products to the manufacturers of chemical plants increased to 1,641 t from 1,368 t in 1999, of power-generation and water-desalination plants decreased sharply to 488 t from 1,171 t in 1999, of consumer, medical, and sports leisure goods increased to 1,305 t from 1,042 t in 1999, of aircraft decreased slightly to 254 t from 256 t in 1999, of automobiles increased sharply to 473 t from 248 t in 1999, of architecture and civil engineering materials increased sharply to 113 t from 44 t in 1999, and of shipping, marine, and other materials increased to 496 t from 362 t in 1999 (Roskill's Letter from Japan, 2001g).

In 2000, exports of titanium sponge increased by 6.0% to 7,734 t. The two principal buyers were the United States (61.7%) and the United Kingdom (37.0%). Export earnings from titanium sponge were valued at \$59 million. Exports of titanium waste and scrap and titanium powder decreased slightly to 2,421 t from 2,427 t in 1999. The major buyers were the United States (77.4%), Taiwan (6.5%), and the United Kingdom (5.5%). Export earnings from titanium waste and scrap and titanium powder were valued at \$12 million (Ministry of Finance, 2000a, p. 580). To meet domestic requirements, Japan imported 6,264 t of low-grade titanium sponge, waste, scrap, and powder that was valued at \$40 million in 2000. The principal suppliers in 2000 were Russia (41.1%), Kazakhstan (22.0%), and the United States (16.9%) (Ministry of Finance, 2000b, p. 631).

Imports of titanium mill products increased by 31.8% to 1,065 t and were valued at \$50 million in 2000. The major suppliers were the United States (87.8%), Italy (4.6%), and Russia (3.2%) (Ministry of Finance, 2000b, p. 649). Exports of titanium mill products decreased to 6,701 t from 7,077 t in 1999 and were valued at \$186 million in 2000. The major buyers were Sweden (14.7%), the Netherlands (13.3%), the Republic of Korea (10.3%), the United States (10.1%), Taiwan (8.3%), China and Hong Kong (8.3%), France (7.1%), Italy (6.4%), Denmark (5.8%), Germany (4.2%), and the United Kingdom (2.8%) (Ministry of Finance, 2000a, p. 580-581).

Production of titanium dioxide held steady at the 270,000-t level in 2000. According to the Japan Titanium Dioxide Industry Association, Furukawa cut capacity of its Osaka plant to 13,200 t/yr from 23,400 t/yr in 1999. Sakai Chemical Industries Co. Ltd. raised the capacity of its Onahama plant in Fukushima Prefecture to 60,000 t/yr from 43,200 t/yr in 1999. Tohkem Products Corp.'s Akita plant did not operate in 2000. According to Government statistics, the titanium dioxide

industry's capacity had reduced to 325,800 t/yr by the end of 2000 from 341,400 t/yr in 1999, and the capacity utilization rate averaged 82% in 2000 (Ministry of Economy, Trade and Industry, 2000b, p. 286-287).

According to the Japan Titanium Dioxide Industry Association, shipments of titanium dioxide to domestic end users increased by 3.4% to 183,000 t, 44.5% of which was for the manufacture of paints and coating materials; 19.9%, printing inks and pigments; 10.9%, synthetic resin (plastics); 10.4%, papers; 1.9%, chemical fibers; 1.5%, capacitors, 1.3%, rubber; and 9.6%, other end users (Roskill's Letter from Japan, 2000f).

Exports of titanium dioxides decreased by 9.5% to 28,263 t and were valued at \$80.9 million in 2000. The major buyers were China and Hong Kong (29.2%), Taiwan (26.9%), the Republic of Korea (19.0%), Indonesia (5.0%), the United States (2.7%), India (2.5%), Thailand (2.0%), the Netherlands (1.7%), and Kuwait (1.4%) (Ministry of Finance, 2000a, p. 110).

Industrial Minerals

Cement.—Japan was the world's fourth largest cement producer after China, India, and the United States in 2000 (van Oss, 2001). Cement production increased slightly owing mainly to increased exports of clinker in 2000. Japan's cement clinker capacity was reduced to 90.1 Mt from 94.1 Mt in 1999. The industry's capacity utilization rate averaged 83.1% in 2000 (Ministry of Economy, Trade and Industry, 2000a, p. 124).

Taiheiyo Cement Corp., which was created by a merger between Chichibu Onoda Cement Co. Ltd. and Nihon Cement Co. Ltd. in October 1998 to amalgamate plants and cut costs, has not shown significant improvements in the past 2 years because of a sluggish domestic cement market and cutbacks in public sector investment. As a countermeasure to offset the shrinking domestic market and the entry by the major European and Mexican cementmakers in Asian markets, Taiheiyo Cement, which had a 37.3% of the domestic market share in 2000 compared with 39.9% in 1998, began its expansion program to gain an overseas market share in 2000 (Nikkei Weekly, 2000c). In October 2000, Taiheiyo Cement announced that it would acquire a 20% stake in Ssanyong Cement Industrial Co., which was the largest cement manufacturer of the Republic of Korea, and a 90% equity interest in Grand Cement Manufacturing Corp. of the Philippines. As a result of the acquisitions, Taiheiyo Cement would become the world's fifth largest cement producer in 2001 (Nikkei Weekly, 2000a).

Domestic demand for cement held steady and was estimated to be 71 Mt in 2000, which was at about the same level as that of 1999. Exports of cement, which included clinker, remained at 7.6 Mt in 2000. Exports of cement clinker increased to 2.61 Mt from 1.77 Mt in 1999, and exports of portland cement decreased to 4.99 Mt from 5.89 Mt in 1999. The major buyers of cement clinker were China and Hong Kong (42.9%), Spain (12.6%), Ivory Coast (9.3%), Australia (8.9%), Taiwan (8.8%), Singapore (4.5%), and Kenya (3.9%). The major importers of portland cement were Taiwan (42.5%), Singapore (23.5%), Hong Kong (15.1%), Nigeria (9.4%), and the Philippines (6.2%). Export earnings from cement clinker and portland cement were \$45.6 million and \$104.9 million, respectively, in 2000. The average export free-on-board (f.o.b.) price of portland cement increased to \$21.06 per metric ton from \$20.94 per ton in 1999 (Ministry of Finance, 2000a, p. 98). Imports of cement, which included portland, white, and aluminous cement,

increased to 1.38 Mt from 1.09 Mt in 1999. The major suppliers were the Republic of Korea (88.5%) and China (10.1%). The average import c.i.f. price of portland cement increased to \$44.64 per ton from \$42.03 per ton in 1999 (Ministry of Finance, 2000b, p. 162-163).

Limestone.—Japan was one of the world's top limestone producers. The country's major limestone quarries were mostly owned and operated by cement, construction, and steel companies. Japan was 100% self-sufficient in limestone and was a net exporter of limestone in 2000. It imported 282,820 t of limestone flux, limestone, and other calcareous stone principally from the Philippines (47.3%), Malaysia (30.9%), Vietnam (12.3%), and China (9.0%) (Ministry of Finance, 2000b, p. 162). It exported 3.1 Mt of limestone flux, limestone, and other calcareous stone mainly to Taiwan (48.5%), Hong Kong (26.7%), Australia (18.8%), and the Republic of Korea (6.0%) in 2000 (Ministry of Finance, 2000a, p. 97).

Limestone production increased by 3% in 2000 because of increased consumption by the cement, construction, and iron and steel industries. The number of large-scale limestone quarries increased to 51 from 49 in 1999 (Research Institute of Economy, Trade and Industry, 2001, p. 6-7). Among the major limestone quarries, nine were owned and operated by Taiheiyo Cement; three, by Nittetsu Mining; two, by Sumitomo Osaka Cement Co. Ltd.; and the remaining major limestone quarries, by other cement, construction, lime, and iron and steel companies. The combined output of the top 31 large-scale limestone quarries accounted for about 80% of the limestone produced in 1999 (the latest year for which data are available) (table 8).

Sales of limestone increased by 3.5% to 190.6 Mt in 2000. Sales by end user in 2000 were 87.5 Mt for the manufacture of cement, 37.1 Mt for the manufacture of concrete, 22.9 Mt for the manufacture of iron and steel, 13.2 Mt for road construction, 10.4 Mt for the manufacture of lime, 5.9 Mt for the manufacture of potassium carbonate, and 13.6 Mt for such other end users as the manufacturers of construction materials, paper, soda and glass, and other. By the end of 2000, the industry had a limestone inventory of 10.9 Mt (Ministry of Economy, Trade and Industry, 2000d, p. 134).

Mineral Fuels

Coal.—Japan was one of the world's major coal-consuming countries and the world's largest coal importer. Because of increased coal imports, Japan's coal production decreased by 19.4% in 2000. The two major operating companies in 2000 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.

According to the Japan Coal Energy Center, coal accounted for 17.4% of Japan's primary energy supply in fiscal year 1999, which ended in March 2000 (Japan Coal Energy Center, 2001, Coal plays—Supply outlook for primary energy in Japan, accessed September 12, 2001, at URL http://www.jcoal.or.jp/jcoal/e_coalplays.nsf/). Japan's coal supply was mostly imported; supply from domestic coal mines accounted for only 2.2% of overall coal supply in 2000. Japan relied on imports to meet 100% of its requirements for coking coal and anthracite and about 95.8% of its requirements for steam coal (Ministry of Economy, Trade and Industry, 2001, p. 19).

Overall coal imports increased by 9.1% to 145.3 Mt. Japan's coal imports were valued at \$5.4 billion in 2000 (Ministry of Finance, 2000b, p. 166). Imports of coking coal increased by 2.2% to 64.8 Mt. Imports of steam coal increased by 14.7% to 77.2 Mt. Imports of anthracite increased by 33.2% to 3.7 Mt. The major coal suppliers in 2000 were Australia (60.1%), China (11.4%), Indonesia (9.9%), Canada (9.2%), the United States (2.8%), South Africa (1.3%), and other countries (5.3%) (Ministry of Economy, Trade and Industry, 2001, p. 18).

Overall demand for coal in 2000 increased by 8.0% to 148.2 Mt, of which 145.0 Mt was imported coal and 3.2 Mt, domestic coal. Of the imported coal consumed, 64.8 Mt was coking coal; 77.2 Mt, steam coal; and 3.0 Mt, anthracite. Demand for coal by the manufacturing sector increased by 4.2% to 91.0 Mt in 2000, of which 64.0 Mt was consumed by the iron and steel industry; 17.6 Mt, by chemical, paper and pulp, and other manufacturing industries; and 9.4 Mt, by the cement industry. Demand for coal by electric power sector increased by 13.8% to 56.8 Mt, of which 53.6 Mt was imported coal and 3.2 Mt, domestic coal (Ministry of Economy, Trade and Industry, 2001, p. 19-20).

Natural Gas and Petroleum.—Japan was the world's largest importer of natural gas and crude petroleum because of a large demand by the utility industry and a small domestic production. Natural gas and crude petroleum accounted for 64% of Japan's primary energy supply in fiscal year 1999. Virtually all Japan's hydrocarbons supply was from overseas. Japan relied on imports to meet 97.0% of its domestic natural gas requirements and 99.7% of its crude petroleum requirements in 2000 (Ministry of Economy, Trade and Industry, 2001, p. 10-11).

Domestic production of natural gas and crude petroleum totaled about 2.45 billion cubic meters and 4.7 million barrels (Mbbbl), respectively, compared with 82.66 billion cubic meters and 1,519 Mbbbl of Japan's natural gas and crude petroleum requirements, respectively, in 2000 (Ministry of Economy, Trade and Industry, 2001, p. 10-11). Japan's natural gas and crude petroleum reserves were estimated to be 42.3 billion cubic meters and 58.6 Mbbbl, respectively (Oil & Gas Journal, 2000).

Japan imported 80.47 billion cubic meters of natural gas in the form of LNG and 1,576 Mbbbl of crude petroleum. LNG imports were from Indonesia (33.5%), Malaysia (20.4%), Australia (13.5%), Qatar (10.9%), Brunei (10.6%), the United Arab Emirates (8.7%), the United States (2.3%) and Oman (0.1%). The import bills of LNG were valued at \$13.0 billion in 2000 [Ministry of Finance, 2000, p. 172 (import portion)]. Crude petroleum imports were mainly from the Middle East, which accounted for 85.7%; Asia, which included China, 10.1%; and other regions, 4.2%. The major supplying countries of crude petroleum were the United Arab Emirates (25.2%), Saudi Arabia (21.2%), Iran (11.5%), Qatar (9.4%), Kuwait (6.9%), Neutral Zone (the area shared equally by Kuwait and Saudi Arabia) (5.4%), Indonesia (5.1%), Oman (4.5%), China (2.4%), and Iraq (1.7%) (Ministry of Economy, Trade and Industry, 2001, p. 18). The import bills of crude petroleum were valued at \$44.6 billion in 2000 (Ministry of Finance, 2000b, p. 167).

Production of refined petroleum products decreased slightly to 1,531 Mbbbl in 2000. Refined petroleum products were produced by 25 oil companies that operated 37 refineries with a total capacity of 5.27 million barrels per day located mostly on the east coast of Honshu. Capacity utilization rate in 2000 was

78.3% (Ministry of Economy, Trade and Industry, 2001, p. 56).

Overall demand for refined petroleum products decreased slightly owing mainly to a decrease in consumption of heavy fuel oil and diesel, despite a moderate increase in gasoline, naphtha, and jet fuel in 2000. Domestic demand for refined petroleum in 2000, by product, was as follows: gasoline increased by 2.4% to 366.1 Mbbbl, naphtha increased by 1.8% to 303.4 Mbbbl, jet fuel increased by 1.7% to 28.8 Mbbbl, kerosene increased by 1.5% to 187.9 Mbbbl; diesel (distillate fuel oil) decreased by 3.1% to 274.3 Mbbbl, asphalt decreased by 2.8% to 30.8 Mbbbl, heavy fuel oil decreased by 2.8% to 385.5 Mbbbl, and lubricants decreased by 1.9% to 14.0 Mbbbl. In 2000, Japan imported 195.1 Mbbbl of naphtha, 17.9 Mbbbl of kerosene, 14.7 Mbbbl of heavy fuel oil, 13.3 Mbbbl of diesel, 10.1 Mbbbl of gasoline, 400,000 barrels (bbl) of jet fuel; 200,000 bbl of lubricants, and small quantities of asphalt, and paraffin (Ministry of Economy, Trade and Industry, 2001, p. 12-16).

In 2000, consumption of domestically produced natural gas totaled 2.5 billion cubic meters, of which the gas industry consumed 57.6%; the electric power industry, 22.9%; the chemical industry, 14.3%; and other manufacturing and industries, 5.2%. Additionally, Japan consumed 53.6 Mt, or 80.2 billion cubic meters of imported natural gas, in the form of LNG, of which the electric power industry consumed 69.8% for power generation; the city gas industry and households, 28.9%; and general industry, 1.3% (Ministry of Economy, Trade and Industry, 2001, p. 11, 17).

Japan's stockpiling of crude petroleum, partially refined, and refined petroleum products at the end of 2000 totaled 161 days supply, of which the national stockpile was 84 days and the private stockpile, 77 days (Ministry of Economy, Trade and Industry, 2001, p. 56).

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 1.16 million kilometers, of which 74.7% is paved, and a railroad network of 23,670 kilometers (km), of which 2,893 km is 1.435-m gauge (all electrified), 90 km is 1.372-m gauge (all electrified), and 20,657 km is 1.067-m narrow gauge (about 50% electrified). Highway and railroad networks link all major seaports and coastal cities on the four major islands and connect Honshu to 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—five Intelsat (four Pacific Ocean and one Indian Ocean), one Intersputnik (Indian Ocean region), and one Inmarsat (Pacific and Indian Ocean regions) satellite earth stations; 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 92,000 km and a circuit length of 160,000 km (1998). Japan also has an extensive pipeline system—natural gas, 1,800 km; refined petroleum products, 322 km; and crude petroleum, 84 km.

Japan had 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, iron ore, nonferrous ore, phosphate rock, crude petroleum, and LNG for mineral-processing plants and powerplants, as well as exporting value-added mineral and metal products. The important seaports of the major mineral-processing centers were Akita, Amagasaki, Chiba, Hachinohe, Higashi-Hamrima, 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 had 171 airports (1999 estimate); of those, 140 had paved runways and 31, unpaved runways. Japan also had 14 heliports (1999 estimate). The major international airports were Fukuoka; Haneda (Tokyo); Kansai, which was open 24 hours; Nagoya; Narita (New Tokyo); and Osaka.

Outlook

The domestic mining activities were expected to decline because of a gradual slowdown in the economy. Metal production of copper is expected to remain steady despite the continued expansion of its capacity, and that of other nonferrous metals and ferrous metal was expected to move downward along with the Japanese economic downward trend and decreased domestic and overseas demand in 2001. Imports of coal, nonferrous metals, and other minerals, are also expected to decrease in 2001.

In line with its mineral policy to secure and diversify its long-term supply of raw materials, thus ensuring 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 Argentina, Australia, Bolivia, Brazil, 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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TABLE 1
JAPAN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1996	1997	1998	1999	2000 p/
METALS						
Aluminum:						
Alumina, gross weight	thousand tons	337	368	359	335	337
Metal:						
Primary:						
Regular grades	do.	17	17	16	11	7
High-purity	do.	29	36	35	35	41
Secondary 2/	do.	1,191	1,277	1,155	1,158	1,214
Antimony:						
Oxide		10,311	10,916	10,197	10,348	11,051
Metal		98	122	170	178	146
Arsenic, high-purity e/		56	66	110	110	100
Bismuth		562	550	479	481	520
Cadmium, refined		2,344	2,473	2,337	2,567	2,472
Chromium, metal e/		1,000	800	900 r/	700 r/	700
Cobalt metal		258	264	329	247	311
Columbium (niobium) and tantalum, tantalum metal e/		80	80	80	85	85
Copper:						
Mine output, Cu content		1,145	932	1,070	1,038	1,211
Metal:						
Blister and anode:						
Primary		1,122,571	1,214,172	1,171,657	1,256,276	1,331,352
Secondary		110,856	136,274	131,979	133,188	149,282
Total		1,233,427	1,350,446	1,303,636	1,389,464	1,480,634
Refined:						
Primary		1,140,502	1,157,299	1,149,266	1,215,248	1,289,682
Secondary		110,871	121,400	128,086	126,301	147,669
Total		1,251,373	1,278,699	1,277,352	1,341,549	1,437,351
Gallium metal: e/						
Primary		6	6	6	12	14
Secondary		56	60	69	61	78
Germanium:						
Oxide e/		11	11	10	10	10
Metal	kilograms	1,787	1,039	454	765	1,809
Gold:						
Mine output, Au content	do.	8,627	8,384	8,601	9,405	8,400
Metal:						
Primary	do.	127,506	136,079	129,859	147,719	147,061
Secondary 3/	do.	17,150	18,502	19,288	20,000	21,000 e/
Total	do.	144,656	154,581	149,147	167,719	168,000 e/
Indium metal	do.	33,184	24,407	29,413	40,465	55,078
Iron and steel:						
Iron ore and iron sand concentrate:						
Gross weight	thousand tons	4	4	2	2 r/	2
Fe content	do.	2	2	1	1	1
Metal:						
Pig iron and blast furnace ferroalloys	do.	74,597	78,519	74,981	74,520	81,071
Electric-furnace ferroalloys:						
Ferrochrome		193,695	186,432	142,931	119,777	130,074
Ferromanganese		343,104	376,633	334,081	315,152	337,694
Ferronickel		328,699	352,840	345,772	332,293	367,181
Ferrosilicon		--	--	951	1,452	--
Silicomanganese		72,727	74,897	70,886	65,744	67,926
Other:						
Ferromolybdenum		4,420	4,328	3,443	3,391	3,699
Ferrotungsten		64	62	61	43	42
Ferrovandium		3,902	4,232	4,073	3,349	4,108
Unspecified		4,820	5,021	1,101	6,077	7,171
Total		951,431	1,004,445	903,299	847,278	917,895
Steel, crude	thousand tons	98,801	104,545	93,548	94,192	106,444
Semimanufactures, hot-rolled:						
Of ordinary steels	do.	78,266	82,201	73,379	73,221	83,048
Of special steels	do.	15,332	16,517	14,774	14,224	15,747

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1996	1997	1998	1999	2000 p/
METALS--Continued					
Lead:					
Mine output, Pb content	7,753	5,227	6,198	6,074	8,835
Metal, refined:					
Primary	140,531	142,326	144,542	125,514	129,969
Secondary	146,842	154,438	157,555	167,915	182,142
Total	287,373	296,764	302,097	293,429	312,111
Magnesium metal, secondary	8,175	10,934	7,807	7,732	7,900 e/
Manganese, oxide	58,523	57,920	52,341	57,993	63,379
Molybdenum metal	596	699	632	586	626
Nickel metal:					
Refined	26,564	26,889	29,397	30,481	36,230
Ni content of nickel oxide sinter	34,772	26,899	25,435	34,482 r/	48,325
Ni content of ferronickel	66,796	72,079	69,202	67,166 r/	73,448
Ni content of chemical	2,323	2,536	2,511	2,570	2,700
Total	130,455	128,403	126,545	134,699	160,703
Platinum-group metals:					
Palladium metal kilograms	2,182	1,899	4,151	5,354	4,712
Platinum metal do.	816	693	533	737	782
Rare-earth oxide 4/	4,892	5,161	4,728	5,092	5,619
Selenium, elemental	588	546	550	546	612
Silicon, high-purity	4,112	5,486	5,340	3,844	4,688
Silver:					
Mine output, Ag content kilograms	85,115	87,180	94,472	94,004	103,781
Metal: do.					
Primary do.	2,032,120	2,094,097	2,203,697	2,257,888	2,384,739
Secondary 3/ do.	180,741	218,999	415,757	503,938	345,358
Total do.	2,212,861	2,313,096	2,619,454	2,761,826	2,730,097
Tellurium, elemental	37	25	39	35	36
Tin, metal, smelter	524	507	500	568	593
Titanium:					
Dioxide	237,942	241,417	251,275	269,193	270,272
Metal	21,062	24,462	24,182	18,898	19,458
Tungsten metal	4,288	4,759	4,082	4,357	4,993
Vanadium metal e/ 5/	250	250	250	250	250
Zinc:					
Mine output, Zn content	79,709	71,569	67,670	64,263	63,601
Oxide	76,008	79,688	77,183	78,928	82,816
Metal:					
Primary	500,674	500,603	513,916	524,979	541,704
Secondary	141,593	149,605	138,771	158,637	158,806
Total	642,267	650,208	652,687	683,616	700,510
Zirconium oxide	6,680	6,820	7,270	7,500	7,500 e/
INDUSTRIAL MINERALS					
Asbestos e/	18,000	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	94,492	91,938	81,328	80,120	81,070
Clays:					
Bentonite	468,728	495,646	443,566	428,247	415,115
Fire clay, crude	526,143	560,759	577,666	558,110	506,314
Kaolin	141,230	110,915	83,257	53,092	25,739
Diatomite e/	194,115 6/	194,000	190,000	190,000	190,000
Feldspar and related materials: e/					
Feldspar	55,122 6/	55,000	50,000	52,000 r/	52,000
Aplite	365,580 6/	310,000	310,000	330,000	330,000
Gypsum thousand tons	5,432	5,371	5,305	5,549 r/	5,917
Iodine, elemental	6,178	6,036	6,142	6,152	6,157
Lime, quicklime thousand tons	7,744	8,104	7,646	7,594	8,106
Nitrogen, N content of ammonia do.	1,489 r/	1,509 r/	1,389 r/	1,385 r/	1,410
Perlite	304,300	290,000	251,400	260,000 e/	250,000 e/
Salt, all types thousand tons	1,344 r/	1,329 r/	1,293 r/	1,327 r/	1,300 e/
Silica sand	3,556,998	3,305,595	3,049,263	2,763,658	2,745,903
Silica stone (quartzite) thousand tons	19,026	18,074	16,235	15,548	15,578

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1996	1997	1998	1999	2000 p/
INDUSTRIAL MINERALS--Continued					
Sodium compounds, n.e.s.:					
Soda ash	925,671	801,169	721,747	721,752	669,203
Sulfate	193,439	203,530	177,407	174,139	163,057
Stone, crushed and broken:					
Dolomite	thousand tons	3,905	4,013	3,873	3,648
Limestone	do.	202,894	201,399	183,955	180,193
Sulfur:					
S content of pyrite	do.	45	39	23	41
Byproduct:					
Of metallurgy	do.	1,314	1,331	1,322	1,363
Of petroleum	do.	1,791	2,013	2,083	2,060
Talc and related materials:					
Talc e/	56,153 6/	53,000	50,000	50,000	50,000
Pyrophyllite	913,973	913,822	764,099	694,317	692,998
Vermiculite e/	15,000	15,000	15,000	15,000	15,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	thousand tons	757	776	723	761
Coal:					
Anthracite	do.	4	2	--	--
Bituminous 7/	do.	6,476	4,272	3,663	3,906
Total	do.	6,480	4,274	3,663	3,906
Coke including breeze:					
Metallurgical	do.	40,728	41,089	39,554	36,473
Gashouse including breeze	do.	528	135	14	--
Gas, natural:					
Gross 8/	million cubic meters	2,230	2,279	2,301	2,280
Marketed	do.	2,325	2,367	2,373	2,362
Petroleum:					
Crude	thousand 42-gallon barrels	5,265	5,296	4,982	4,592
Refinery products:					
Gasoline:					
Aviation	do.	63	59	50	104
Other	do.	328,164	336,158	347,422	353,730
Asphalt and bitumen	do.	36,922	35,733	34,216	34,259
Distillate fuel oil	do.	296,381	302,870	289,777	280,122
Jet fuel	do.	47,155	58,015	66,205	65,732
Kerosene	do.	177,577	173,725	174,133	167,744
Liquefied petroleum gas	do.	56,272	59,090	55,413	56,187
Lubricants	do.	17,423	17,819	16,541	16,939
Naphtha	do.	104,379	120,981	113,234	113,080
Paraffin	do.	823	790	807	842
Petroleum coke e/	do.	900	950	950	900
Refinery fuel and losses e/ 9/	do.	155,000	160,000	160,000	150,000
Residual fuel oil	do.	463,087	467,311	451,494	435,916
Unfinished oils e/	do.	55,000	60,000	60,000	50,000
Total e/	do.	1,740,000	1,790,000	1,770,000	1,730,000

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

1/ Table includes data available through September 21, 2001.

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 Economy, Trade and Industry (Tokyo). Yearbook of Minerals and Nonferrous Metals Statistics, 2000; Yearbook of Iron and Steel Statistics, 2000; Yearbook of Chemical Industries Statistics, 2000; Yearbook of Ceramics and Building Materials Statistics, 2000; and Monthly of Energy Production, Supply and Demand of Petroleum, Coal and Coke, March 2001. Japan Aluminum Association (Tokyo). Light Metal Statistics in Japan, 2000.

TABLE 2
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2000

(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	1,700	
Do.	Daiichi 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. (affiliate of Aso Cement)	Kanda, Fukuoka Prefecture	1,300	
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 Corp. 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., 64%; Nittetsu Mining Co. Ltd. and Furukawa Co. Ltd., minority ownership)	Tamano, Okayama Prefecture	218,400
Do.	do.	Mitsubishi Materials Corp.	Naoshima, Kagawa Prefecture	220,800
Do.	do.	Nippon Mining and Metals Co. Ltd. (Nikko Kyodo Co. Ltd., 100%)	Hitachi, Ibaraki Prefecture	182,400
Do.	do.	do.	Saganoseki, Oita Prefecture	270,000
Do.	do.	Onahama Smelting and Refining Co. Ltd. (Dowa Mining Co. Ltd., 30%; Furukawa Group Co., 12%; Mitsubishi Materials Corp., 49%; Mitsui Mining Smelting Co. Ltd., 4%; others, 5%)	Onahama, Fukushima Prefecture	258,000
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Besshi, Ehime Prefecture	252,000
Do.	do.	Kosaka Smelting and Refining Co. Ltd. (Dowa Mining Co. Ltd., 100%)	Kosaka, Akita Prefecture	72,000
Do.	do.	Mitsui Mining and Smelting Co. Ltd. 2/	Takehara, Hiroshima Prefecture	30,000
Gold:				
In concentrate	kilograms	Sumitomo Metal Mining Co. Ltd.	Hishikari, Kagoshima Prefecture	9,000
Refined	do.	Kosaka Smelting and Refining Co. Ltd. (Dowa Mining Co. Ltd., 100%)	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	36,000
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.	Ibuku, Shiga Prefecture, and Karazawa, Tochigi Prefecture	4,000
Do.		Shuho Mining Co., Ltd.	Sumitomo Cement Shuho, Yamaguchi Prefecture	8,200

See footnotes at end of table.

TABLE 2--Continued
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2000

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Limestone--Continued:		Taiheiyo Cement Corp. 1/	Ofunato, Iwate Prefecture; Ganji and Tsukumi, Oita Prefecture; Garo, Hokkaido Prefecture; Kawara, Fukuoka Prefecture, Tosayama, Kochi Prefecture; Taiheiyo Buko, Saitama Prefecture; and Shigeyasu, Yamaguchi Prefecture	46,000
Do.		Todaka Mining Co. Ltd.	Todaka-Tsukumi, Oita Prefecture	12,000
Do.		Ube Kosan Co. Ltd.	Ube Isa, Yamaguchi Prefecture	9,000
Iodine, crude	metric tons	Ise Chemical Industries Co. Ltd. (Asahi Glass Co. Ltd., 52.4%; Mitsubishi Corp., 11.2%)	Oami-Shirasato, and Ichinomya, Chiba Prefecture; and Sadowara, Miyazaki Prefecture	3,600
Do.	do.	Godō Shigen Sangyo Co. Ltd. (Kanto Natural Gas Development Co. Ltd., 11%; Mitsui & Co. Ltd., 10%)	Chosei, Chiba Prefecture	2,400
Do.	do.	Kanto Natural Gas Development Co. Ltd. (Mitsui Chemicals, Inc., 21.9%; Godō Shigen Sangyo Co. Ltd., 14.3%)	Mobara, Chiba Prefecture	1,200
Do.	do.	Nihon Tennen Gas Co. Ltd. (Kanto Natural Gas Development Co. Ltd., 50%; Tomen Corp., 41%)	Shirako and Yokoshiba, Chiba Prefecture	1,200
Do.	do.	Toho Earthtech, Inc. (Itochi Corp., 34.1%; Mitsubishi Gas Chemical Co. Ltd., 32.2%; Nippon Light Metal Co. Ltd., 31.1%)	Kurosaki, Niigata Prefecture	720
Iodine, crude	metric tons	Nippon Chemicals Co. Ltd. (Nippon Shokubai Co. Ltd., 17%; Takeda Chemical Industries Ltd., 16.4%; Chugai Boyeki Co. Ltd., 13.6%)	Isumi, Chiba Prefecture	720
Lead:				
In concentrate		Kamioka Mining and Smelting Co. Ltd. (Mitsui Mining Mitsui Mining and Smelting Co. Ltd., 100%)	Kamioka, Gifu Prefecture	3
Do.		Toyoha Mining Co. Ltd. (Nippon Mining and Metals Co. Ltd., 100%)	Toyoha, Hokkaido Prefecture	7
Refined	metric tons	Kamioka Mining and Smelting Co. Ltd. 3/	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. (Mitsubishi Materials Corp., 100%) 4/	Hosokura, Miyagi Prefecture	21,600
Manganese:				
In electrolytic dioxide		Japan Metals & Chemicals Co. Ltd.		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. (Sumitomo Metal Mining Co. Ltd., 100%)	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		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		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

See footnotes at end of table.

TABLE 2--Continued
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2000

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Titanium:				
In sponge metal		Sumitomo Sitix Corp. (Sumitomo Metal Industries, Ltd., 92.4%; Kobe Steel Ltd., 7.6%)	Amagasaki, Hyogo Prefecture	15
Do.		Toho Titanium Co. Ltd. (Nippon Mining and Metals Co. Ltd., 47%; Mitsui & Co. Ltd., 20%; others, 33%)	Chigasaki, Kanagawa Prefecture	11
In dioxide	metric tons	Fuji Titanium Industry Co. Ltd. (Ishihara Sangyo Kaishia Ltd., 24.8%)	Kobe, Hyogo Prefecture	17,400
Do.	do.	Furukawa Co. Ltd.	Osaka, Osaka Prefecture	13,200
Do.	do.	Ishihara Sangyo Kaishia Ltd. (Mitsui & Co. Ltd., 11%)	Yokkaichi, Mie Prefecture	154,800
Do.	do.	Sakai Chemical Industries Co. Ltd.	Onahama, Fukushima Prefecture	60,000
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., 57% Nippon Mining & Metals Co. Ltd., 24%; Sumitomo Metal Mining Co. Ltd., 14%; Mitsubishi Materials Corp., 5%)	Iijima, Akita Prefecture	195,600
Do.	do.	Hachinohe Smelting Co. Ltd. (Dowa Mining Co. Ltd., 20%, Mitsui Mining and Smelting Co. Ltd., 50%; Nippon Mining and Metals Co. Ltd., 10%; Mitsubishi Materials Corp., 10%; Toho Zinc Co. Ltd., 5%; Nisso Smelting Co. Ltd., 5%)	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. 5/	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 Taiheiyo Cement Co. Ltd.

2/ Copper refinery ceased operation in September 2000.

3/ The plant was renovated to a secondary lead smelter to recycle batteries in 1995.

4/ The plant became a secondary lead smelter to recycle batteries in 1995.

5/ 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 2000

(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 kilograms	178,762
Iodine	4,900 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.

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: Research Institute of Economy, Trade and Industry (Tokyo).

TABLE 4
JAPAN: MINERALS TRADE 1/

(Million U.S. dollars)

Commodity		Imports			Exports		
Code	Description	1998	1999	2000	1998	1999	2000
25	Salt, sulfur, earths and stone, lime, plastering materials, cement	1,409	1,353	1464	334	308	312
26	Ferrous and nonferrous metal ores, slag, ash	6,114	6,222	7,004	21	20	35
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes	43,172	49,861	77,478	1,232	1,225	1,520
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals of radioactive elements or of isotopes	2,980	2,850	3,536	1,570	1,806	2,114
31	Fertilizers	491	489	529	85	92	93
68	Articles of stone, plaster, cement, asbestos, mica or similar materials	906	941	1,027	813	843	949
69	Ceramic products	512	543	634	1,236	1,169	1,364
70	Glass and glassware	996	1,034	1,422	1,813	2,087	2,711
71	Natural or cultured pearls, precious or semiprecious, precious metals, metals clad with precious metals, articles thereof; imitation jewelry; coin	5,335	6,383	7,432	1,638	1,669	1,940
72	Iron and steel	2,930	2,756	3,445	11,870	11,367	12,957
73	Articles of iron and steel	1,821	1,821	2,232	6,093	5,390	5,426
74	Copper and articles thereof	1,038	1,021	1,127	2,087	2,226	2,579
75	Nickel and articles thereof	717	831	1,463	182	205	415
76	Aluminum and articles thereof	4,753	4,633	5,564	1,491	1,592	1,625
78	Lead and articles thereof	30	21	27	14	12	13
79	Zinc and articles thereof	159	88	124	85	111	95
80	Tin and articles thereof	146	157	175	18	28	50
81	Other base metals; cermets; articles thereof	831	680	838	454	480	591
Total, minerals trade		74,340	81,684	115,521	31,046	30,630	34,789
Total, Japan merchandise trade		279,756	309,640	379,763	386,603	417,450	479,167

1/ Values have been converted from Japanese yen (Y) to U.S. dollars at the rate of Y131.0=US\$1.00 for 1998, Y113.9 =US\$1.00 for 1999, and Y107.8=US\$1.00 for 2000.

Source: Ministry of Finance, Japan Exports & Imports, Commodity by Country, December 1998-2000.

TABLE 6
JAPAN: MAJOR OVERSEAS DEVELOPMENT PROJECTS OF NONFERROUS METALS MINES IN THE 1990s, AN UPDATE

Item	Location and name of the project					
	Northern Territory, Australia McArthur River	New South Wales, Australia Northparkes	British Columbia, Canada Mount Polley	British Columbia, Canada Huckleberry	Region III, Chile La Candelaria	Region I, Chile Collahuasi
Nature of project involvement	Investment in exploration and development	Investment in exploration and development	Equity participation	Equity participation and provided loan	Investment in exploration and development	Equity participation and provided loan.
Participated Japanese companies and their equity share	Nippon Mining and Metals Co. Ltd., 15%; Mitsui and Co. Ltd., 5%; Mitsubishi Materials Corp., 5%; and Marubeni Corp., 5%	Sumitomo Metal Mining Co. Ltd., 13.3%; and Sumitomo Corp., 6.7%	Sumitomo Corp., 47.5%	Mitsubishi Materials Corp., 31.5%; Dowa Mining Co. Ltd., 6.25%; Furukawa Co. Ltd., 6.25%; Marubeni Corp., 6.25%	Sumitomo Metal Mining Co. Ltd., 15%; and Sumitomo Corp., 5%	Mitsui and Co. Ltd., 6.9%; Mitsui Mining and Smelting Co. Ltd., 1.5%; Nippon Mining and Metals Co., Ltd., 3.6%.
Majority equity holder and other equity holder(s)	Mount Isa Mines Ltd. of Australia, 70%	North Broken Hill Peko Ltd. of Australia, 80%	Imperial Metals Corp. of Canada, 52.5%	Princeton Mining Corp. of Canada, 50%	Phelps Dodge Corp. of the United States, 80%	Falconbridge Ltd. of Canada, 44%; and Mantos Minarco S.A. of Luxembourg, 44%.
Mineral commodity involved	Lead, silver, and zinc	Copper and gold	Copper and gold	Copper	Copper and gold	Copper.
Estimated reserves and ore grade	227 million metric tons, 4.1% lead, 9.2% zinc, and 41 grams per metric ton silver	80 million metric tons, 1.12% copper and 0.56 gram per metric ton gold	81.5 million metric tons, 0.3% copper plus 0.42 gram per metric ton gold	162 million metric tons, 0.47% copper	399 million metric tons, 1.06% copper and 0.25 gram per metric ton gold	3,100 million metric tons, 0.82% copper.
Type of mine	Underground	Open pit and underground	Open pit	Open pit	Open pit	Open pit.
Total cost of the project	\$A246 million	\$A303 million	Can\$123 million	Can\$136 million	US\$592 million	US\$1,760 million.
Japanese share	\$A22 million	\$A75.6 million	Can\$109 million	US\$78 million	US\$296 million	US\$174 million.
Annual production capacity	1,350,000 metric tons of crude ore containing 6.2% lead, 13.9% zinc, and 63 grams per metric ton silver	5,230,000 metric tons of crude ore containing 1.3% copper plus 0.6 gram per metric ton gold	6,500,000 metric tons of crude ore	6,000,000 metric tons of crude ore	11,000,000 metric tons of crude ore containing 1.1% copper	22,000,000 metric tons of crude ore containing 1.3% copper.
Annual shipment to Japan	25,000 metric tons of lead and 56,000 metric tons of zinc in mixed concentrate	11,000 metric tons of copper in concentrate plus gold value	15,000 metric tons of copper in concentrate plus gold value	28,500 metric tons of copper in concentrate	60,000 metric tons of copper in concentrate plus gold value	83,000 metric tons of copper in concentrate.
Construction started	August 1993	May 1993	September 1996	1996	April 1993	1996.
Production started or planned	September 1995	October 1995	June 1997	October 1997	March 1995	January 1999.

TABLE 6--Continued
 JAPAN: MAJOR OVERSEAS DEVELOPMENT PROJECT OF NONFERROUS METALS MINES IN THE 1990s, AN UPDATE

Item	Location and name of the project					
	Region IV, Chile Los Pelambres	Region III, Chile El Bronce	Sumbawa Island, Indonesia Batu Hijau	Mexico, Mexico Tizapa	Guerrero, Mexico Rey de Plata	Ancash, Peru Antamina
Nature of project involvement	Equity participation	Investment in exploration and development	Equity participation	Investment in exploration and development	Investment in exploration and development	Investment in exploration and development
Participated Japanese companies and their equity share	Nippon Mining & Metals Co. Ltd., 15%; Mitsubishi Materials Corp., 10%; Marubeni Corp., 8.75%; Mitsubishi Corp., 5%; and Mitsui and Co. Ltd., 1.25%	Nittetsu Mining Co. Ltd., 60%	Sumitomo Corp., 26%; Sumitomo Metal Mining Co. Ltd., 5%; Mitsubishi Materials Corp., 2.5%; Furukawa Co. Ltd., 1.5%	Dowa Mining Co. Ltd., 39%; and Sumitomo Corp., 10%	Dowa Mining Co. Ltd., 39%; and Sumitomo Corp., 10%	Mitsubishi Corp., 10%.
Major equity holder and other equity holder(s)	Antofagasta Holding (Luksic Group of the United Kingdom, 60%)	El Bronce SA of Chile, 40%	Newmont Gold Co. of the United States, 45%; P.T. Pukuafu Indah of Indonesia, 20%	Industrias Penoles S.A. de C.V. of Mexico, 51%	Industrias Penoles S.A. de C.V. of Mexico, 51%	Noranda Inc., 33.75%; Rio Algom Ltd. of Canada, 33.75%; Teck Corp. of Canada, 22.5%.
Mineral commodity involved	Copper and molybdenum	Copper	Copper and gold	Copper, lead, and zinc	Copper, lead, and zinc	Copper and zinc.
Estimated reserves and ore grade	2,400 million metric tons, 0.63% copper	20 million metric tons, 1.5% copper	1,022 million metric tons, 0.52% copper and 0.41 gram per metric ton gold	5.3 million metric tons, 0.7% copper, 1.64% lead, 7.9% zinc plus gold and silver	3 million metric tons, 0.5% copper, 2.1% lead, 8.3% zinc, and gold and silver	494 million metric tons, 1.3% copper and 1.0% zinc.
Type of mine	Open pit	Underground	Open pit	Underground	Underground	Open pit.
Total cost of the project	US\$1,355 million	US\$132 million	US\$1,925 million	US\$38.2 million	US\$45.4 million	US\$2,296 million.
Japanese share	US\$835 million	US\$116 million	US\$513 million	US\$35.1 million	US\$41.3 million	US\$404 million.
Annual production capacity	31,000,000 metric tons of crude ore containing 0.75% copper and 0.02% molybdenum	1,820,000 metric tons of crude ore containing 1.5% copper	43,800,000 metric tons of crude ore	480,000 metric tons of crude ore	330,000 metric tons of crude ore	25,600,000 metric tons of crude ore.
Annual shipment to Japan	220,000 metric tons of copper in concentrate	10,000 metric tons of copper in concentrate	101,400 metric tons of copper in concentrate	50,000 metric tons of zinc in concentrate	46,740 metric tons of zinc in concentrate	200,000 metric tons of copper and 80,000 metric tons of zinc concentrates.
Construction started	November 1997	May 1999	September 1996	May 1992	January 1998	1998.
Production started or planned	April 2000	2001 or later	October 1999	November 1994	October 2000	June 2002.

Sources: Research Institute of Economy, Trade and Industry (Chosakai), Mining Handbook (Kogyo Benran), 2001, p. 210-217.

TABLE 7
JAPAN: DOMESTIC ORDERS FOR ORDINARY AND SPECIALTY STEEL PRODUCTS, BY END USE

(Thousand metric tons)

End use	1996	1997	1998	1999	2000
Automobiles:	11,895	12,431	10,593	10,574	11,969
Ordinary	9,304	9,722	8,314	8,211	9,313
Specialty	2,591	2,709	2,279	2,363	2,656
Construction:	15,234	15,057	13,633	14,074	14,841
Ordinary	14,491	14,283	12,945	13,360	14,062
Specialty	743	774	688	714	779
Conversion and processing:	6,842	7,052	5,828	6,171	6,488
Ordinary	3,420	3,423	2,848	3,079	3,464
Specialty	3,422	3,630	2,980	3,092	3,024
Electric machinery and equipment:	2,416	2,543	2,106	2,062	2,331
Ordinary	2,308	2,417	2,003	1,954	2,189
Specialty	108	126	103	108	142
Home and office appliances:	882	851	709	697	810
Ordinary	656	623	523	522	609
Specialty	226	228	186	175	201
Industrial machinery and equipment:	3,011	3,105	2,267	2,167	2,400
Ordinary	1,679	1,741	1,284	1,171	1,332
Specialty	1,332	1,364	983	996	1,068
Shipbuilding and marine equipment:	3,200	3,339	3,242	2,950	3,251
Ordinary	3,087	3,260	3,166	2,881	3,133
Specialty	113	79	76	69	118
Steel dealers:	23,476	23,068	19,114	19,176	21,312
Ordinary	22,099	21,656	17,994	18,099	20,029
Specialty	1,377	1,412	1,120	1,077	1,283
Tanks and containers:	2,079	2,006	1,789	1,763	1,761
Ordinary	2,050	1,985	1,769	1,750	1,742
Specialty	29	21	20	13	19
Other:	709	797	637	596	718
Ordinary	552	624	531	488	235
Specialty	157	173	106	108	483
Domestic demand total:	69,744	70,248	59,918	60,225	65,881
Ordinary	59,646	59,733	51,377	51,510	56,108
Specialty	10,098	10,515	8,541	8,715	9,773

Source: The Japan Iron and Steel Federation. The Steel Industry of Japan 2001, p. 5; Monthly Report of the Iron and Steel Statistics, v. 44, no. 7, July 2001, p. 10-11.

TABLE 8
JAPAN: EXPORTS OF IRON AND STEEL PRODUCTS, BY COUNTRY OF DESTINATION

(Thousand metric tons)

Destinations	1996	1997	1998	1999	2000
Asia:	16,067	17,647	15,556	20,729	22,405
China	2,538	2,659	2,477	2,960	4,062
Hong Kong	1,382	1,644	1,568	1,641	1,735
Korea, the Republic of	3,344	3,566	2,756	5,366	6,029
Malaysia	1,509	1,661	1,138	1,616	1,464
Taiwan	2,231	2,428	2,959	3,080	2,557
Thailand	2,236	2,194	1,749	2,553	2,793
Singapore	961	1,183	918	900	776
Other countries	1,866	2,312	1,991	2,613	2,989
Middle East	628	848	1,146	1,283	1,090
Europe	710	734	1,192	1,004	854
America:	2,632	3,553	8,914	4,313	4,000
Argentina	5	45	96	90	8
Brazil	21	66	65	34	41
Canada	112	178	592	443	499
Colombia	132	104	178	110	176
United States	2,049	2,704	7,020	2,803	2,137

See footnotes at end of table.

TABLE 8--Continued
JAPAN: EXPORTS OF IRON AND STEEL PRODUCTS, BY COUNTRY OF DESTINATION

(Thousand metric tons)

Destinations	1996	1997	1998	1999	2000
America--Continued:					
Venezuela	17	34	94	30	52
Other countries	296	422	869	803	1,087
Africa	269	408	409	339	371
Oceania:	309	345	434	544	441
Australia	247	275	381	483	382
New Zealand	58	57	47	57	50
Other countries	4	13	6	4	9
Total	20,615	23,535	27,651	28,212	29,161

Source: The Japan Iron and Steel Federation, Monthly Report of the Iron and Steel Statistics, v. 44, no. 7, July 2001, p. 14-17.

TABLE 9
JAPAN: PRODUCTION OF LIMESTONE, BY MAJOR PRODUCERS, BY LOCATION

(Thousand metric tons)

Company	Location		Production		
	Prefecture	Mine	1997	1998	1999
Taiheiyo Cement Corp.:					
(formerly Chichibu Onoda Cement Co. Ltd.)	Oita	Ganji	9,925	9,891	9,983
(formerly Nihon Cement Co. Ltd.)	do.	Tsukumi	9,808	9,294	9,224
Do.	Hokkaido	Garō	7,082	8,064	8,325
(formerly Chichibu Onoda Cement Co. Ltd.)	Iwate	Oofunato	5,615	4,715	4,423
(formerly Nihon Cement Co. Ltd.)	Fukuoka	Kawara	3,204	2,173	2,098
(formerly Chichibu Onoda Cement Co. Ltd.)	Guma, Kochi	Kanoyama, Tosayama	3,067	2,603	2,962
Do.	Saitama	Minowa, Taiheiyo Buko	2,262	4,238	3,876
Do.	Yamaguchi	Shigeyasu	2,244	2,248	2,200
(formerly Shikoku Mine Development Co. Ltd.)	Kochi	Shirokidani, Tosayama	2,022	2,603	2,891
Subtotal			45,229	45,829	45,982
Nittetsu Mining Co. Ltd.	Kochi	Torigatayama	14,049	13,007	12,627
Do.	Aomori	Shiriya	5,690	4,395	4,690
Do.	Tochigi	Hanzuru	3,011	3,292	3,190
Subtotal			22,750	20,694	20,507
Todaka Mining Co. Ltd.	Oita	Todaka Tsukumi	13,144	11,700	11,520
Mitsubishi Materials Corp.	Fukuoka	Higashitani	10,095	8,402	8,363
Ube Kosan Co. Ltd.	Yamaguchi	Ube Isa	8,642	8,236	8,841
Shuho Mining Co. Ltd.	do.	Sumitomo Cement Shuho	8,131	8,010	8,007
Sumikin Mining Co. Ltd.	Aomori	Hachinohe Sekkai	5,467	5,186	5,315
Ishizaki Co. Ltd.	Mie	Fujiwara	4,617	4,486	3,797
Mitsui Mining Co. Ltd.	Fukuoka	Sekinoyama	4,730	4,007	3,553
Sumitomo Osaka Cement Co. Ltd.	Shiga	Ibuki	2,626	2,261	1,743
Do.	Tochigi	Karasawa	1,900	1,691	1,641
Subtotal			4,526	3,952	3,384
Boku Mining Co. Ltd.	Saitama	Buko	4,062	--	--
Ryoko Lime Industries Co. Ltd.	do.	Une	3,388	4,147	4,056
Denki Kagaku Industries Co. Ltd.	Niigata	Aomi	3,752	3,050	3,389
Gikenkomusho Co. Ltd.	Fukuoka	Ube Kanda	3,063	2,273	2,149
Yabashi Ryutaro	Gifu	Kinsyozan Sekkaiseki	2,743	2,416	2,289
Myojo Cement Co. Ltd.	Niigata	Tomi	2,639	2,050	2,048
Oita Mining Co. Ltd. (formerly Furukawa Co. Ltd.)	Oita	Oita	2,862	2,743	2,626
Ryukiu Cement Co. Ltd.	Okinawa	Awa	2,481	2,471	2,968
Funao Mine Co. Ltd.	Fukuoka	Funao	2,192	2,336	2,268
Okutama Industries Co. Ltd.	Tokyo	Hikawa	2,182	1,664	1,108
Yoshizawa Lime Industries Co., Ltd.	Tochigi	Okano	1,371	1,384	1,321
Total			158,066	142,433	143,491
Grand total			201,399	183,954	180,193

-- Zero.

Source: Research Institute of Economy, Trade and Industry. Mining Handbook (Kogyo Benran), 1998-2001.

TABLE 10
JAPAN: EXPORTS OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1998	1999	Destinations, 1999	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals	286	455	2	India 317; Canada 90; Republic of Korea 27.
Aluminum:				
Ore and concentrate	12	21	--	Mainly to Indonesia 20.
Oxides and hydroxides	245,176	307,318	3,680	Republic of Korea 191,104; Taiwan 44,960; Thailand 21,731.
Ash and residue	116,072	8,174	--	China 4,538; North Korea 1,944; Taiwan 1,319.
Metal including alloys:				
Scrap	26,695	27,635	131	China 20,482; Hong Kong 4,301; Philippines 759.
Unwrought	7,153	10,515	290	Hong Kong 1,513; China 1,506; Indonesia 1,298.
Semimanufactures	310,555	354,418	29,726	China 98,348; Taiwan 47,721; Thailand 26,696.
Antimony:				
Ore and concentrate	3	--	--	
Oxides	1,925	2,339	33	Singapore 433; Thailand 395; Republic of Korea 354.
Metal including alloys, all forms	343	187	1	Thailand 170; United Kingdom 6; Indonesia 4.
Arsenic, metal including alloys, all forms	17	28	25	United Kingdom 1; Singapore 1.
Beryllium, metal including alloys, all forms	6	3	(2/)	Mainly to China.
Bismuth, metal including alloys, all forms	5	9	2	Netherlands 3; Taiwan 2; India 1.
Cadmium, metal including alloys, all forms	17	4	(2/)	Mainly to Republic of Korea 4.
Chromium:				
Ore and concentrate	116	95	--	Republic of Korea 78; Philippines 12.
Oxides and hydroxides	4,122	5,032	1,230	Republic of Korea 1,869; Taiwan 1,114; Kuwait 102.
Metal including alloys, all forms	173	346	33	Republic of Korea 254; Netherlands 23; Taiwan 17.
Cobalt:				
Ore and concentrate	3	71	--	China 39; India 30.
Oxides and hydroxides	134	193	7	Canada 44; Republic of Korea 31; Taiwan 24.
Metal including alloys, all forms	1,119	751	153	Taiwan 123; Hong Kong 85; Belgium 78.
Columbium and tantalum, tantalum metal including alloys, all forms	242	302	45	Germany 83; China 74; United Kingdom 70.
Copper:				
Oxides and hydroxides	849	1,439	7	Singapore 792; Republic of Korea 314; China 116.
Sulfates	3,903	4,029	16	Taiwan 3,032; Hong Kong 385; Republic of Korea 241.
Metal including alloys:				
Scrap	75,486	83,901	64	China 73,817; Taiwan 2,750; Hong Kong 2,432.
Unwrought	342,561	373,857	7,575	Taiwan 165,716; China 69,698; Republic of Korea 63,996.
Semimanufactures	299,384	317,476	30,747	Hong Kong 49,624; China 45,928; Taiwan 44,780.
Germanium, metal including alloys, all forms	(2/)	(2/)	--	
Gold:				
Waste and scrap kilograms	4	25	--	Germany 22; Hong Kong 3.
Metal including alloys, unwrought and partly wrought do.	72	62	(2/)	Singapore 18; Malaysia 17; Taiwan 13.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	103	29,042	--	Mainly to China.
Metal:				
Scrap thousand tons	3,821	4,315	(2/)	Republic of Korea 2,251; China 1,008; Taiwan 735.
Pig iron, cast iron, related materials do.	2,311	1,734	112	Republic of Korea 1,074; Taiwan 290; Indonesia 108.
Ferroalloys:				
Ferrochromium	700	1,461	1,156	Thailand 111; South Africa 94; Malaysia 45.
Ferromanganese	26,815	19,397	8,455	Taiwan 2,807; Australia 2,434; India 1,820.
Ferromolybdenum	42	23	--	Thailand 17; Republic of Korea 5; Philippines 1.
Ferronickel	74,020	111,310	--	Taiwan 76,362; Republic of Korea 34,897; India 49.
Ferrosilicomanganese	217	3,103	--	Republic of Korea 2,914; Taiwan 189.
Ferrosilicon	4,055	5,059	507	Republic of Korea 1,679; Taiwan 1,004; Thailand 630.
Silicon metal	539	586	2	Norway 200; China 113; Republic of Korea 110.
Unspecified	2,719	3,602	2,732	Thailand 116; United Kingdom 106; India 96.
Semimanufactures, unspecified thousand tons	23,858	23,976	2,187	Republic of Korea 3,841; China 2,689; Taiwan 2,197.
Lead:				
Oxides	101	132	1	Germany 60; Taiwan 44; China 15.
Ash and residue containing lead	3	23	--	All to Belgium.
Metal including alloys:				
Scrap	8,575	9,368	--	Republic of Korea 9,247; India 80.
Unwrought	6,413	6,861	1	Malaysia 4,097; Thailand 669; Philippines 620.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1998	1999	Destinations, 1999	
			United States	Other (principal)
METALS--Continued				
Lead--Continued:				
Metal including alloys--Continued:				
Semimanufactures	1,154	376	9	China 127; Malaysia 60; Taiwan 34.
Lithium, oxides and hydroxides	12	21	5	Republic of Korea 5; China 4; Taiwan 2.
Magnesium, metal including alloys:				
Scrap	6	74	--	United Kingdom 54; Taiwan 7.
Unwrought	22	34	(2/)	Taiwan 19; China 12; Singapore 2.
Semimanufactures	15	454	(2/)	Taiwan 435; Republic of Korea 4; Singapore 3.
Manganese:				
Oxides	1,154	2,036	121	Republic of Korea 917; China 589; Taiwan 270.
Metal including alloys, all forms	391	35	34	Taiwan 22; Malaysia 4; Thailand 3.
Mercury				
	5	7	--	North Korea 3; Iran 2.
Molybdenum:				
Ore and concentrate:				
Roasted	74	18	--	Mainly to the Philippines.
Unroasted	99	90	--	Mainly to China.
Oxides and hydroxides	106	24	--	Germany 19; Italy 4.
Metal including alloys, all forms	126	90	5	Republic of Korea 56; Taiwan 9; Germany 7.
Nickel:				
Oxides and hydroxides	3,312	4,580	849	Republic of Korea 1,259; Hong Kong 757; Taiwan 620.
Metal including alloys:				
Scrap	954	488	221	United Kingdom 188; China 4; Republic of Korea 4.
Unwrought	394	503	3	Republic of Korea 196; United Kingdom 140; Indonesia 39.
Semimanufactures	6,372	6,430	694	Republic of Korea 1,560; United Arab Emirates 1,306; Hong Kong 871.
Platinum-group metals:				
Waste and sweepings				
	42	5	--	Mainly to Republic of Korea.
Metal including alloys, unwrought and partly wrought:				
Palladium value, thousands	\$93	\$88	\$58	Republic of Korea \$8; United Kingdom \$5.
Platinum do.	\$84	\$9	2	Mainly to Hong Kong.
Rhodium do.	(2/)	(2/)	--	
Iridium, osmium, ruthenium do.	\$4	(2/)	(2/)	
Unspecified do.	\$5	\$1	--	Mainly to Germany.
Rare-earth metals including alloys, all forms	383	289	(2/)	China 243; Hong Kong 33; Germany 6.
Selenium	553	525	6	China 285; United Kingdom 62; India 61.
Silicon	1,887	2,768	577	Republic of Korea 559; Malaysia 487; China 203.
Silver metal including alloys, unwrought and partly wrought value, thousands	\$38	\$4	(2/)	Mainly to Taiwan.
Tin:				
Ore and concentrate				
	28	1	--	All to Taiwan.
Metal including alloys:				
Scrap	760	697	85	United Arab Emirates 284; Belgium 195; Taiwan 121.
Unwrought	289	310	(2/)	Malaysia 70; Vietnam 63; Singapore 44.
Semimanufactures	1,642	2,517	28	Hong Kong 689; China 620; Singapore 195.
Titanium:				
Ore and concentrate				
	48	6	--	All to Singapore.
Oxides	29,240	31,235	1,282	Taiwan 7,664; Republic of Korea 7,046; China 6,495.
Metal including alloys, all forms	19,395	16,802	5,126	United Kingdom 4,612; Republic of Korea 1,330; Sweden 965.
Tungsten:				
Metal including alloys, all forms				
	1,586	1,362	303	Germany 718; Republic of Korea 48; Taiwan 27.
Uranium and thorium; metal including alloys, all forms				
	--	93	1	Mainly to United Kingdom.
Vanadium, metal including alloys, all forms				
	66	29	1	Indonesia 9; Republic of Korea 7; Taiwan 6.
Zinc:				
Oxides				
	1,986	1,752	255	China 567; Thailand 223; Republic of Korea 185.
Blue powder	13	65	(2/)	Taiwan 36; India 16; France 9.
Ash and residue containing zinc	1,799	2,284	113	Republic of Korea 1,740; Taiwan 431.
Metal including alloys:				
Scrap	5,877	6,489	--	China 3,554; Taiwan 2,246; Hong Kong 688.
Unwrought	59,517	79,379	2	Taiwan 29,734; Philippines 19,017; Bangladesh 10,514.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1998	1999	Destinations, 1999	
			United States	Other (principal)
METALS--Continued				
Zinc--Continued:				
Metal including alloys--Continued:				
Semimanufactures	3,193	3,862	4	Indonesia 1,165; China 715; Thailand 394.
Zirconium:				
Ore and concentrate	192	159	--	China 100; Hong Kong 20; Philippines 20.
Metal including alloys, all forms	58	41	13	Republic of Korea 8; China 5; Taiwan 5.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural, corundum, emery, pumice, etc.				
	18,952	21,227	57	Republic of Korea 12,265; Taiwan 2,826; Malaysia 1,606.
Artificial:				
Corundum	26,895	26,027	4,663	Republic of Korea 7,635; Taiwan 3,582; China 2,373.
Silicon carbide	9,386	11,037	1,094	Indonesia 1,750; Malaysia 1,404.
Dust and powder of precious and semiprecious stones including diamonds	value, thousands \$11	\$12	\$2	Switzerland \$6; Philippines \$1; Republic of Korea \$1.
Grinding and polishing wheels and stones	8,543	8,879	1,582	Indonesia 1,041; Thailand 887; Republic of Korea 831.
Asbestos, crude	32	20	--	Indonesia 11; Republic of Korea 9.
Barite and witherite	3	2	2	
Boron:				
Crude natural borates	8,533	180	--	All to Malaysia.
Oxides and acids	234	325	(2/)	Taiwan 173; Hong Kong 38; Thailand 26.
Cement	thousand tons 7,613	7,681	(2/)	Taiwan 2,746; Singapore 1,514; Hong Kong 1,182.
Chalk	1,680	1,639	--	Republic of Korea 925; Taiwan 398; Malaysia 144.
Clays, crude:				
Bentonite	1,518	2,372	56	Indonesia 869; Thailand 764; Taiwan 247.
Chamotte or dinas earth	103	66	--	Republic of Korea 47; Indonesia 19.
Fire clay	3,337	4,665	2	Taiwan 1,450; China 1,319; Republic of Korea 732.
Kaolin	12,475	13,628	25	Malaysia 4,472; Taiwan 3,328; China 2,235.
Unspecified	34,470	24,790	10	Indonesia 4,160; Taiwan 4,010; Republic of Korea 3,830.
Diamond, natural:				
Gem, not set or strung	carats 4,377	3,234	270	Hong Kong 1,072; Republic of Korea 603; Belgium 533.
Industrial stones	thousand carats 2,519	3,095	2,469	Republic of Korea 899; Germany 279; Philippines 118.
Dust and powder	do. 16,529	17,204	4,275	Switzerland 5,456; Republic of Korea 2,882; Philippines 1,930
Diatomite and other infusorial earth	2,669	2,206	1	Republic of Korea 935; Taiwan 562; Malaysia 448.
Feldspar	8,533	6,422	--	Taiwan 4,989; Thailand 1,005.
Fluorspar	867	407	--	Singapore 220; Taiwan 103; Thailand 60.
Fertilizer materials:				
Crude, n.e.s.				
	1,233	959	--	Taiwan 588; Republic of Korea 133; Malaysia 79.
Manufactured:				
Ammonia	4,315	4,595	534	Taiwan 1,733; Singapore 921; Republic of Korea 568.
Phosphatic	9,105	15,176	--	Indonesia 15,000; Taiwan 161; Republic of Korea 13.
Unspecified and mixed	928,380	979,194	1,080	Thailand 78,507; Taiwan 978; Republic of Korea 330.
Graphite, natural	1,958	1,894	599	Germany 417; Republic of Korea 220; Taiwan 170.
Gypsum and plaster	4,644	4,064	14	Sri Lanka 717; Republic of Korea 701; Taiwan 605.
Iodine	4,994	4,653	1,409	France 689; United Kingdom 654; Italy 466.
Lime	2,583	3,947	99	Republic of Korea 2,456; Taiwan 789; Malaysia 324.
Magnesium compounds:				
Magnesite, crude	285	174	--	Taiwan 102; Indonesia 42; Philippines 30.
Oxides and hydroxides	13,265	13,850	4,373	Republic of Korea 1,925; Taiwan 1,587; Germany 1,207.
Other	--	--		
Mica:				
Crude including splittings and waste				
	626	862	364	Indonesia 164; Republic of Korea 138.
Worked including agglomerated splittings				
	911	1,020	14	Austria 472; Thailand 135; China 112.
Nitrates, crude	11	121	--	Thailand 96; Republic of Korea 17; Indonesia 6.
Phosphorus, elemental	22	90	5	Republic of Korea 84; Thailand 1.
Pigments, mineral:				
Natural, crude				
	23	7	--	Philippines 5; India 2.
Iron oxides and hydroxides, processed	45,791	35,766	5,932	Republic of Korea 11,400; China 3,518; Singapore 2,918.
Precious and semiprecious stones, other than diamond:				
Natural				
	kilograms 15,403	5,419	85	Thailand 5,202; Switzerland 87.
Synthetic	do. 255,535	176,963	4,940	Thailand 68,763; Indonesia 51,895; China 15,496.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1998	1999	Destinations, 1999	
			United States	Other (principal)
INDUSTRIAL MINERALS--Continued				
Pyrite, unroasted	94	44	--	Republic of Korea 20; Taiwan 20; New Zealand 4.
Quartz crystal, piezoelectric kilograms	65,723	121,884	1,194	Indonesia 33,376; China 29,878; Malaysia 11,618.
Salt and brine	1,925	2,044	44	Taiwan 533; Thailand 312; Singapore 397.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	2,774	5,064	--	China 4,446; Republic of Korea 495; Philippines 71.
Worked value, thousands	\$5,051	\$1,574	\$70	China \$462; Hong Kong \$426; Philippines \$19.
Dolomite, chiefly refractory-grade	395	357	--	Taiwan 180; Republic of Korea 94; Malaysia 68.
Gravel and crushed rock	101,313	45,406	36	Taiwan 20,621; Australia 16,000.
Limestone other than dimension thousand tons	3,514	3,131	--	Taiwan 1,309; Hong Kong 912; Australia 859.
Quartz and quartzite	2,635	1,971	52	Republic of Korea 1,047; United Kingdom 360; Taiwan 141.
Sand other than metal-bearing and sand and gravel	9,046	11,772	--	Taiwan 5,868; Thailand 2,129; Russia 947.
Sulfur:				
Elemental:				
Crude including native and byproduct thousand tons	1,081	1,058	--	China 503; Republic of Korea 214; Indonesia 110.
Colloidal, precipitated, sublimed	915	812	3	Taiwan 328; Malaysia 184; Indonesia 82.
Dioxide	8	14	--	Republic of Korea 8; Vietnam 6.
Sulfuric acid thousand tons	1,419	1,458	721	Taiwan 211; Chile 116; Philippines 103.
Talc, steatite, soapstone, pyrophyllite	5,222	6,830	691	Taiwan 1,428; Singapore 1,088; China 1,017.
Vermiculite, perlite, chlorite	16,640	19,832	11	Republic of Korea 18,197; Taiwan 1,431; Thailand 75.
Other, slag and dross, not metal-bearing thousand tons	2,748	2,926	45	Taiwan 1,634; Singapore 516; Australia 211.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	6	28	--	Taiwan 13; Netherlands 9.
Carbon black	16,409	22,474	2,994	Thailand 3,196; Taiwan 2,878; Republic of Korea 2,870.
Coal:				
Anthracite	177	138	--	India 84; Philippines 33.
Bituminous	10	--	--	
Other	770	1,480	--	Thailand 1,060; Indonesia 388; Malaysia 20.
Coke and semicoke thousand tons	3,072	2,790	1,821	India 387; Brazil 253; Philippines 87.
Peat including briquets and litter	--	211	--	Republic of Korea 118; Taiwan 92; Malaysia 1.
Petroleum:				
Crude thousand 42-gallon barrels	972,544	(2/)	(2/)	
Refinery products:				
Liquefied petroleum gas do.	67	287	(2/)	Republic of Korea 216; China 67.
Mineral jelly and wax do.	400	433	171	Republic of Korea 58; Taiwan 32; Vietnam 13.
Asphalt, bitumen and other residues do.	1,290	1,322	--	China 1,073; Republic of Korea 217.
Bituminous mixtures do.	1	1	--	Mainly to Taiwan.
Petroleum coke do.	943	456	39	Netherlands 133; Italy 110; Russia 49.
Unspecified do.	47,673	39,891	5,844	China 10,268; Republic of Korea 6,857; Taiwan 5,260.

1/ Data presented in this table are from Japan Exports and Imports Commodity by Country, 1998 and 1999. Table prepared by Regina Coleman, International Data Unit
2/ Less than 1/2 unit.

TABLE 11
JAPAN: IMPORTS OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1998	1999	Sources, 1999	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals	573	347	137	Mainly from China.
Aluminum:				
Ore and concentrate thousand tons	2	2	(2/)	Australia 1; Indonesia 1.
Oxides and hydroxides	101,216	86,100	6,732	Australia 72,137; Germany 1,977; China 1,551.
Ash and residue	6,124	3,010	2	Russia 1,643; Singapore 734; China 459.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1998	1999	Sources, 1999	
			United States	Other (principal)
METALS--Continued				
Aluminum--Continued:				
Metal including alloys:				
Scrap	143,134	160,641	35,862	China 10,096; United Kingdom 8,989; Singapore 8,614.
Unwrought thousand tons	2,552	2,659	71	Russia 600; Brazil 253; Venezuela 170.
Semimanufactures	73,405	61,899	15,502	Republic of Korea 14,044; France 5,966; Germany 9,976.
Antimony:				
Ore and concentrate	698	96	--	Bolivia 77; China 19.
Oxides	8,887	8,270	158	China 6,225; Taiwan 644; France 120.
Metal including alloys, all forms	8,513	8,576	118	Mainly from China.
Arsenic, metal including alloys, all forms	--	103	--	China 100; Germany 3.
Beryllium, metal including alloys, all forms	9	6	5	Mainly from Taiwan.
Bismuth, metal including alloys, all forms	373	242	(2/)	Belgium 60; China 33; Canada 20.
Cadmium, metal including alloys, all forms	3,562	3,351	(2/)	Republic of Korea 1,420; Belgium 680; Canada 438.
Chromium:				
Ore and concentrate	416,665	380,115	309	South Africa 257,030; India 74,020; Iran 33,473.
Oxides and hydroxides	2,863	3,104	540	Germany 629; United Kingdom 619; China 542.
Metal including alloys, all forms	2,365	2,343	636	China 890; France 406; United Kingdom 304.
Cobalt:				
Oxides and hydroxides	1,752	2,800	36	Belgium 2,539; Finland 147.
Metal including alloys, all forms	6,787	7,476	113	Canada 1,541; Zambia 1,383; Australia 1,122.
Columbium and tantalum, tantalum metal including alloys, all forms:	154	228	62	United Kingdom 60; Germany 33; Thailand 29.
Copper:				
Ore and concentrate thousand tons	3,974	4,286	1	Chile 1,787; Indonesia 832; Canada 529.
Mattes including cement copper	7	28	10	Mainly from China 18.
Oxides and hydroxides	3,767	3,612	1,862	Malaysia 1,128; Vietnam 188; Republic of Korea 174.
Sulfates	445	419	19	Thailand 238; China 102; Taiwan 60.
Ash and residue containing copper	1,751	12,531	7	Australia 10,469; Malaysia 1,563; Philippines 259.
Metal including alloys:				
Scrap	162,733	174,450	30,941	Singapore 23,026; Malaysia 21,342; Philippines 16,301.
Unwrought	4,440	5,919	306	Chile 4,388; Republic of Korea 188.
Semimanufactures	51,315	56,611	2,489	Malaysia 15,584; Republic of Korea 12,446; Taiwan 6,392
Germanium, metal including alloys, all forms	4	3	(2/)	Belgium 1; China 1; Russia 1.
Gold:				
Waste and scrap	151	146	(2/)	Malaysia 55; Taiwan 43; France 26.
Metal including alloys, unwrought and partly wrought kilograms	86,017	108,393	17,292	Australia 25,977; Switzerland 25,622; United Kingdom 13,183.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite thousand tons	121	120	(2/)	Australia 66; Brazil 23; India 16.
Roasted pyrites	20	--	--	
Metal:				
Scrap thousand tons	177	282	63	Taiwan 46; China 29; Australia 26.
Pig iron, cast iron, related materials do.	304	240	4	China 79; Sweden 40; North Korea 34.
Ferroalloys:				
Ferrochromium do.	628,260	599,836	--	South Africa 363,059; Zimbabwe 73,995; Kazakhstan 62,836.
Ferromanganese do.	109,887	89,569	17	South Africa 44,606; China 29,572; Australia 11,775.
Ferromolybdenum do.	2,213	2,192	--	China 1,948; Chile 210; Netherlands 34.
Ferronickel do.	41,066	34,283	--	New Caledonia 27,092; Indonesia 5,081.
Ferrosilicochromium do.	3,415	3,171	--	China 2,691; Zimbabwe 480.
Ferrosilicomanganese do.	201,240	227,219	--	China 156,010; Ukraine 28,128; Australia 18,349.
Ferrosilicon do.	401,938	440,149	709	China 224,124; Russia 71,241; Brazil 63,442.
Silicon metal do.	157,790	179,884	20	China 125,247; Australia 17,140; Brazil 17,074.
Unspecified do.	190,995	36,559	3,526	Brazil 11,909; China 1,002; United Kingdom 2,797.
Semimanufactures, unspecified thousand tons	4,810	4,716	10	Republic of Korea 2,667; Taiwan 1,101; China 393.
Lead:				
Ore and concentrate	182,810	167,880	57,818	Australia 63,946; Peru 23,864; Russia 11,055.
Oxides	38,277	43,025	69	China 18,711; Taiwan 12,116; Indonesia 2,240.
Ash and residue containing lead	--	20	--	All from the Philippines.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1998	1999	Sources, 1999		
			United States	Other (principal)	
METALS--Continued					
Lead--Continued:					
Metal including alloys:					
Scrap	--	133	--	All from Australia.	
Unwrought	35,693	21,084	1	China 14,802; Australia 1,034; North Korea 903.	
Semimanufactures	805	1,615	7	France 630; United Kingdom 360; Republic of Korea 127.	
Lithium, oxides and hydroxides	1,343	1,572	1,427	China 115; Taiwan 26; Germany 3.	
Magnesium, metal including alloys:					
Scrap	41	269	--	Taiwan 259; Republic of Korea 10.	
Unwrought	32,050	34,678	464	China 26,821; Norway 5,309; Canada 1,690.	
Semimanufactures	2,389	2,506	487	China 1,331; Russia 518; Republic of Korea 107.	
Manganese:					
Oxides	3,186	1,440	19	China 653; Belgium 500; Brazil 105.	
Metal including alloys, all forms	39,197	39,936	1,444	China 28,792; South Africa 9,344; Netherlands 106.	
Mercury	7	10	(2/)	Algeria 7; Spain 3.	
Molybdenum:					
Ore and concentrate:					
Roasted	30,451	26,474	3,958	Chile 12,733; China 3,091; Canada 2,613.	
Unroasted	72	3	--	All from Austria.	
Oxides and hydroxides	1,816	1,147	250	Chile 417; Iran 178; China 140.	
Metal including alloys:					
Semimanufactures	379	189	70	Austria 98; Taiwan 5; Russia 5.	
All forms	137	244	67	China 143; Germany 20.	
Nickel:					
Ore and concentrate	thousand tons	4,117	3,906	--	New Caledonia 1,773; Indonesia 1,115; Philippines 1,018.
Matte		78,472	86,370	--	Indonesia 55,197; Australia 30,622; China 552.
Oxides and hydroxides		129	103	7	Finland 94; Philippines 3.
Metal including alloys:					
Scrap		10,270	11,738	1,700	Russia 2,865; Zimbabwe 2,440; Taiwan 995.
Unwrought		40,046	48,906	40	China 9,075; Russia 6,308; Zimbabwe 7,808.
Semimanufactures		13,538	14,765	2,509	Canada 5,510; United Kingdom 5,195; Russia 346.
Platinum-group metals:					
Waste and scrap		539	391	119	Republic of Korea 129; Thailand 89; Singapore 16.
Metal including alloys, unwrought and partly wrought:					
Palladium	value, thousands	\$702	\$953	\$43	Russia \$436; United Kingdom \$87; Switzerland \$61.
Platinum	do.	\$747	\$828	\$47	South Africa \$507; Russia \$147; Germany \$59.
Rhodium	do.	\$45	\$102	--	South Africa \$86; United Kingdom \$9.
Iridium, osmium, ruthenium	do.	\$41	\$42	\$3	South Africa \$23; United Kingdom \$11; Germany \$6.
Rare-earth metals including alloys, all forms		3,727	4,659	(2/)	China 4,652; Kyrgyzstan 4; Austria 1.
Selenium		13	42	(2/)	Philippines 40; Belgium 2.
Silicon, high-purity		163,202	184,596	3,347	China 125,400; Australia 17,154; Brazil 17,074.
Silver:					
Ore and concentrate		12,401	14,076	--	Peru 7,145; Chile 6,931.
Metal including alloys, unwrought and partly wrought	value, thousands	\$159	\$202	\$30	Mexico \$58; Peru \$30; Australia \$27.
Tin, metal including alloys:					
Scrap		145	89	--	Thailand 41; Republic of Korea 39; China 7.
Unwrought		26,104	28,894	14	Indonesia 11,887; China 8,775; Thailand 4,421.
Semimanufactures		563	706	2	Singapore 582; France 48; Republic of Korea 47.
Titanium:					
Ore and concentrate		97,076	96,150	--	Australia 60,567; South Africa 26,579; India 9.
Oxides		9,004	11,073	34	China 6,369; Republic of Korea 1,901; Finland 861.
Metal including alloys, all forms		11,694	4,096	1,247	Kazakhstan 1,298; Russia 926; Finland 146.
Tungsten:					
Ore and concentrate		1,881	1,794	18	Russia 1,614; China 162.
Metal including alloys, all forms		750	169	24	China 82; Austria 34; Germany 14.
Uranium and thorium, metal including alloys, all forms		2,034	1,512	8	Canada 862; France 642.
Vanadium, metal including alloys, all forms:					
Oxides and hydroxides		5,043	3,700	--	South Africa 2,296; China 1,404.
Ash and residue containing zinc		66	49	--	United Kingdom 35; Republic of Korea 8; Taiwan 4.
Metal including alloys, all forms		190	103	78	Germany 24.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1998	1999	Sources, 1999		
			United States	Other (principal)	
METALS--Continued					
Zinc:					
Ore and concentrate	thousand tons	942	1,123	136	Australia 485; Peru 175; Chile 93.
Oxides		14,858	16,064	295	Republic of Korea 7,144; China 5,445; India 1,102.
Blue powder		889	988	6	Singapore 532; Republic of Korea 432; Taiwan 18.
Ash and residue containing zinc		27,344	18,190	3,336	Republic of Korea 5,136; Spain 5,007; Thailand 2,246.
Metal including alloys:					
Scrap		47	349	--	Australia 185; Republic of Korea 99; Philippines 65.
Unwrought		121,378	62,891	103	China 34,537; Peru 12,118; Canada 6,114.
Semimanufactures		3,586	3,464	4	China 2,530; France 574; Belgium 168.
Zirconium:					
Ore and concentrate		78,626	74,647	2,173	Australia 50,683; South Africa 17,368; Russia 4,050.
Metal including alloys, all forms		671	654	409	France 183; United Kingdom 25; Sweden 15.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural, corundum, emery, pumice, etc.		32,533	14,359	4,328	China 4,382; India 4,222; Republic of Korea 827.
Artificial:					
Corundum		125,615	131,748	245	China 102,740; Hungary 8,567; Republic of Korea 7,398.
Silicon carbide		65,194	66,119	169	China 5,849; Brazil 3,760; Norway 1,855.
Dust and powder of precious and semiprecious stones including diamonds	value, thousands	\$62	\$68	\$14	Ireland \$43; Republic of Korea \$4; China \$3.
Grinding and polishing wheels and stones		4,935	4,421	388	China 2,622; Thailand 688; Italy 161.
Asbestos, crude		120,813	117,143	6,835	Canada 59,146; Zimbabwe 24,392; South Africa 13,302.
Barite and witherite		90,840	113,018	224	China 109,176; North Korea 3,260; Vietnam 200.
Boron:					
Crude natural borates		26,591	52,872	3	Turkey 48,464; Russia 4,165; China 240.
Oxides and acids		32,680	35,919	13,846	Russia 12,681; Chile 4,322; Italy 3,974.
Cement	thousand tons	729	1,091	(2/)	Republic of Korea 923; China 150; France 12.
Clays, crude:					
Bentonite		157,386	173,122	141,605	China 31,066; Germany 150; Indonesia 102.
Chamotte or dinas earth		25,413	17,935	--	China 9,072; Republic of Korea 5,225; South Africa 3,076
Fire clay		3,072	2,241	1,715	China 477; Germany 29; Republic of Korea 20.
Fuller's earth		8,125	8,239	5,855	China 1,569; Australia 815.
Kaolin	thousand tons	1,381	1,339	932	Brazil 212; Indonesia 90; China 36.
Unspecified		224,598	176,503	7,060	China 157,261; South Africa 7,685; Hungary 887.
Diamond, natural:					
Gem, not set or strung	thousand carats	2,502	3,097	73	India 2,272; Belgium 279; Israel 248.
Industrial stones	do.	2,150	1,556	123	Ireland 1,204; Republic of Korea 92; Italy 63;
Dust and powder	do.	78,122	101,873	20,106	Ireland 36,587; China 33,356; Ukraine 5,661.
Diatomite and other infusorial earth		7,735	7,927	7,143	China 721; Thailand 40; Netherlands 17.
Feldspar		6,613	1,805	--	North Korea 580; China 551; India 532.
Fluorspar		547,166	535,413	--	China 406,309; Mexico 113,062; Kenya 6,600.
Fertilizer materials					
Crude, n.e.s.		59,749	116,472	48	Republic of Korea 83,886; China 19,253; Indonesia 7,628.
Manufactured:					
Ammonia		37,592	28,831	(2/)	Canada 20,058; Indonesia 8,769.
Phosphatic		117,863	143,594	51,471	China 86,183; Israel 2,700.
Potassic	thousand tons	981	878	221	Canada 390; Russia 133; Germany 89.
Unspecified and mixed	do.	1,917	1,016	475	Jordan 221; Indonesia 59; China 51.
Graphite, natural		76,205	111,615	281	China 104,765; North Korea 3,520; Sri Lanka 2,106.
Gypsum and plaster	thousand tons	2,935	2,546	457	Australia 1,066; Thailand 948; Mexico 525.
Iodine		349	290	126	Chile 164.
Lime		22	72	--	France 45; China 20; Germany 5.
Magnesium compounds:					
Magnesite, crude		1,828	1,607	--	China 1,507; Australia 100.
Oxides and hydroxides		15,644	22,759	1,739	China 13,725; Israel 3,712; Mexico 1,804.
Other		1,946	2,394	--	China 2,254; Germany 140.
Mica:					
Crude including splittings and waste		43,589	44,968	511	China 26,060; India 7,825; Finland 3,409.
Worked including agglomerated splittings		301	258	1	Belgium 103; China 40; Switzerland 32.
Nitrates, crude		23,822	22,083	--	Chile 21,996; Germany 87.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity		1998	1999	Sources, 1999	
				United States	Other (principal)
INDUSTRIAL MINERALS--Continued					
Phosphates, crude	thousand tons	976	933	(2/)	China 343; South Africa 223; Morocco 210.
Phosphorus		26,522	25,208	1,701	China 23,016; Netherlands 395; Germany 81.
Pigments, mineral:					
Natural crude		11	208	--	All from Australia.
Iron oxides and hydroxides, processed		26,435	26,246	2,431	China 10,777; Germany 6,945; Sweden 862.
Precious and semiprecious stones, other than diamond:					
Natural		595	459	14	Brazil 302; Republic of Korea 32; South Africa 23.
Synthetic	kilograms	64,701	98,903	19,654	France 37,000; Republic of Korea 17,111; Austria 6,161.
Pyrite, unroasted		44,477	4,166	--	All from China.
Quartz crystal, piezoelectric	kilograms	59,120	66,396	2,161	Russia 30,647; Republic of Korea 8,369; China 8,508.
Salt and brine	thousand tons	7,914	8,236	1	Australia 4,096; Mexico 4,019; China 112.
Stone, sand, and gravel:					
Dimension stone:					
Crude and partly worked	do.	437	373	4	China 96; India 58; Republic of Korea 52.
Worked	do.	1,249	1,353	2	China 1,203; Italy 34; Republic of Korea 28.
Dolomite, chiefly refractory-grade	do.	1,705	1,875	--	China 591; Philippines 465; Thailand 461.
Gravel and crushed rock		219,043	269,985	(2/)	Taiwan 180,646; China 49,302; Philippines 27,566.
Limestone other than dimension		125,817	234,240	1	Philippines 124,126; Malaysia 60,554; Vietnam 24,155.
Quartz and quartzite		127,423	120,832	4,613	India 57,019; Republic of Korea 31,102; China 15,962.
Sand other than metal-bearing and sand and gravel	thousand tons	3,803	4,873	2	China 1,977; Australia 1,487; Republic of Korea 708.
Sulfur:					
Elemental:					
Crude including native and byproduct		389	177	34	China 128; Republic of Korea 15.
Colloidal, precipitated, sublimed		1,225	1,133	(2/)	Republic of Korea 1,040; France 52; China 32.
Sulfuric acid		52	26	2	Taiwan 18; Philippines 5.
Talc, steatite, soapstone, pyrophyllite		453,587	404,581	8,098	China 331,427; Australia 62,815.
Vermiculite, perlite, chlorite		151,491	181,452	3,409	China 159,929; South Africa 15,465; Australia 1,140.
Other, slag and dross, not metal-bearing		718,012	725,471	25,855	Taiwan 257,661; Republic of Korea 199,122; South Africa 82,985.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		608,499	614,536	2,564	Venezuela 611,534; Trinidad 438.
Carbon black		72,052	60,876	3,400	Thailand 28,743; Republic of Korea 20,691; Taiwan 2,145.
Coal:					
Anthracite	thousand tons	3,261	2,782	--	Vietnam 1,172; China 1,130; North Korea 252.
Bituminous	do.	125,142	130,845	4,760	Australia 77,998; Canada 15,073; Indonesia 12,950.
Briquettes of anthracite and bituminous coal and lignite		15,033	14,320	352	Russia 10,153; China 3,797.
All grades including briquettes	thousand tons	3,360	3,572	--	Australia 1,802; Indonesia 823; Canada 450.
Coke and semicoke	do.	951	1,297	--	China 1,282; Australia 13; Germany 2.
Gas, natural, liquefied	do.	49,133	51,724	1,224	Indonesia 18,385; Malaysia 9,959; Australia 7,224.
Peat including briquettes and litter		132,215	147,772	1,413	Canada 94,039; Germany 15,710; Russia 11,150.
Petroleum:					
Crude	thousand 42-gallon barrels	2,493,311	4,949,540	34,380	United Arab Emirates 1,234,378; Saudi Arabia 1,095,286; Qatar 442,138.
Refinery products:					
Liquefied petroleum gas	do.	166,227	167,692	2,023	Saudi Arabia 73,488; United Arab Emirates 44,826; Kuwait 14,079.
Mineral jelly and wax	do.	158,097	186,137	40,856	China 74,792; South Africa 39,111; Taiwan 9,695.
Asphalt, bitumen and other residues	do.	2,611	2,811	1,173	China 1,400; Republic of Korea 238.
Bituminous mixtures	do.	9	6	(2/)	Mainly from the United Kingdom.
Petroleum coke	do.	22,925	23,955	17,982	China 1,848; Canada 1,775; Malaysia 756.

1/ Data presented in this table are from Japan Exports and Imports Commodity by Country, 1998 and 1999. Table prepared by Regina Coleman, International Data Uni
2/ Less than 1/2 unit.