

THE MINERAL INDUSTRY OF

JAPAN

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Japan is a high-income developed country in eastern Asia. In 2002, its per capita gross domestic product (GDP) was \$31,471, and its economy was the world's second largest with a GDP of \$4.0 trillion (World Bank, The, 2003§¹). It also was one of the most industrialized and technologically advanced countries in the world despite its limited resources of raw materials. Japan relied heavily on imports of mineral fuels and a wide variety of nonfuel minerals to meet the raw material requirements for its large manufacturing and utility (electricity and gas) sectors. Japan, however, has substantial resources of such industrial minerals as dolomite, iodine, limestone, pyrophyllite, and silica (table 3).

Japan's production capacities of the chemical, construction material, electricity, and ferrous and nonferrous metals industries in the manufacturing and utility sectors were among the world's largest. These industries processed imported raw materials and produced a broad category of mineral products, which included inorganic chemicals and compounds, construction materials, ferrous metals, industrial minerals, nonferrous metals, petrochemicals, and refined petroleum products, for domestic consumption by the downstream industries in the manufacturing and construction sectors and for export to the world markets. The electricity and gas industries used imported coal, natural gas, petroleum, and uranium and other nuclear fuel materials to produce electricity and processed natural gas to meet the energy requirements for the construction, mining, manufacturing, and other sectors of the economy.

In 2002, Japan was one of the world's top importers and consumers of primary aluminum, cadmium metal, chromite, coal, cobalt metal, copper ore and metal, diamond, ferrochromium, ferronickel, fluorspar, gallium metal, gold 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, platinum-group-metals (PGM), potash, phosphate rock, rare earths, silicon metal, silver metal, tin metal, zinc ore and metal, and zircon. Japan was one of the world's major exporters of cement, refined copper, inorganic chemicals, compound fertilizers, iodine, electrolytic manganese dioxide, high-purity rare (minor) metals, iron and steel, and titanium sponge metal and mill products.

The mining sector was the smallest sector of Japan's industry-based economy. According to the Government statistics on national accounts, the percentage contribution of the mining sector to Japan's GDP was only 0.18% in 2001 (the latest year for which data are available). The percentage contribution to Japan's GDP by the mineral industry, which included the mining sector (0.18%) and the mineral-processing sectors of the ferrous and nonferrous metals (3.31%), chemicals (3.00%), fabricated metal products (1.44%), petroleum and coal products (0.95%), and industrial mineral products (0.85%) in the manufacturing industry, however, was 9.73% in 2001 (Economic and Social Research Institute, 2003b§).

The mineral industry was important to the Japanese economy because of its sizable contribution to the GDP and the vital role it played in supplying primary materials not only to its own construction and manufacturing sectors, but also to those sectors of China, the Republic of Korea, and Taiwan in northeastern Asia and to such members of the Association of Southeast Asia Nations (ASEAN) as Brunei, Indonesia, Malaysia, the Philippines, Singapore, and Thailand in southeastern Asia.

The Japanese economy, as measured by real GDP (in 1995 constant prices), recovered to a positive growth of 1.6% in fiscal year 2002 following an economic recession with a 1.2% negative growth in fiscal year 2001. Japan's real GDP (in 1995 constant prices), however, registered only a 0.1% positive growth in calendar year 2002 compared with a 0.4% positive growth in calendar year 2001; this was largely the result of an 0.8% decline in private demand despite a 0.3% increase in public demand in calendar year 2002. Japan's GDP, in 1995 constant prices, was estimated to be \$4.4 trillion in 2002 (Economic and Social Research Institute, 2003a§, Japan Institute for Social and Economic Affairs, 2003§).

In 2002, Japan's industrial production, as measured by the indices of mining and manufacturing, decreased by 1.3%. The number of Japan's unemployed workers increased to 3.49 million from 3.40 million in 2001, and its total labor force decreased to 66.89 million from 67.52 million in 2001. As a result, Japan's unemployment rate rose to 5.4%, which was a record high, from 5.0% in 2001. Japan's merchandise trade surplus rose to \$78.8 billion from \$54.0 billion in 2001, and the Japanese yen depreciated by 3.08% to 125.39 yen against US\$1.00 in 2002. As measured by the Consumer Price Index, Japan's rate of deflation was 0.9% compared with 0.7% in 2000 and 2001 (Japan Institute of Labor, 2003§).

Government Policies and Programs

The Metal Mining Agency of Japan (MMAJ) in cooperation with the Japan International Cooperation Agency (JICA) continued to undertake overseas mineral exploration projects as part of the Official Development Assistance Program (ODA) of the Japanese Government in 2002. 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

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

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 ongoing ODA projects in 2002 included two 2-year reconnaissance survey projects, nine 3-year mineral exploration projects, a deep-sea mineral exploration project, and a 2-year environmental survey project. The purpose of the ongoing two 2-year reconnaissance surveys was to explore for copper, gold, lead, and zinc in massive sulfide, porphyry copper, and vein-type deposits in a 100,000-square-kilometer (km²) area in northwestern Argentina and copper, nickel, and PGM in magmatic deposits in a 1,400,000-km² area in the Parana Basin of Brazil. The purpose of the ongoing nine 3-year mineral exploration projects was to explore for copper, gold, lead, nickel, and zinc in massive sulfide and porphyry copper in a 53,000-km² area in the Altai area of China; copper, gold, lead, silver, and zinc in porphyry copper, skarn, and vein-type deposits in a 26,000-km² area in the southwestern and central areas of Honduras; copper and gold in porphyry copper and vein-type deposits in a 12,000-km² area in the East Java area of Indonesia; titanium in placer deposits in a 2,700-km² area in the Kokpetinskaya area of Kazakhstan; gold in greenstone-type deposits in a 5,800-km² area in the Baoule-Banifing area of Mali; gold, lead, silver, and zinc in massive sulfide deposits in a 1,100-km² area in the Zacualpan area of Mexico; copper, gold, and molybdenum in porphyry copper and vein-type deposits in a 5,500-km² area in the Western Erdenet area of Mongolia; copper and zinc in massive sulfide deposits in a 2,100-km² area in the Marrakech-Tekna area of Morocco; and gold in greenstone-type deposits in a 12,000-km² area in the Arroyo Grande and San Jose areas of Uruguay. The purpose of the ongoing deep-sea mineral exploration project was to explore for cobalt, manganese, nickel, and platinum in cobalt-rich manganese crusts offshore Marshall Island. The purpose of the one ongoing 2-year environmental survey project was to conduct a geochemical baseline study involving analyses of river water quality, stream sediments, and other analyses in a 4,000-km² area in the Viti Levu South region of Fiji. In 2002, the MMAJ signed two new mineral exploration agreements with Bolivia and Turkey to explore for copper, lead and zinc in the Yani-Pelecuchio area of the La Paz region in Bolivia and in the Hopa area in northeastern Turkey and a new regional development survey project with Vietnam in 2002 (Metal Mining Agency of Japan, 2002a).

The MMAJ continued to provide financial and technical support, which included geologic and geophysical surveys and drilling, to five private Japanese companies in 2002. These overseas exploration projects were for copper and gold by Mitsubishi Materials Corp. in the Los Dos Buhos Cateo area of Argentina; lead and zinc by Mitsui Metal Mining Co. Ltd. in the Ciquian East area of Peru; nickel by Sumitomo Metal Mining Co. Ltd. in the Zambales area of the Philippines; copper, gold, and PGM by Sumitomo Metal Mining in the Tropico area of Mexico; and copper by Nittetsu Mining Co. Ltd. in the Namosi area of Fiji (Metal Mining Agency of Japan, 2002b).

By January 31, 2002, Japan's last major coal mine operated by Taiheiyo Coal Mining Co. Ltd in Kushiro, Hokkaido Prefecture, was closed after Japan's 8th National Coal Policy (1992-2001) ended. Because of Japan's increased reliance on imported coal, the Ministry of Economy, Trade and Industry began implementing the Overseas Transfer Project on Coal Mining Technology in 2002 under the 5-year (2002-2006) Technical Transfer Plan for Coal Mining Technology. As part of Japan's long-term energy policy to secure a stable supply of overseas coal, transfer of coal mining technology under the 5-year plan focused mainly on training for large coal-producing countries in Asia by using Japan's coal mine (Agency for Natural Resources and Energy, 2003§). Taiheiyo coal mine became a center for implementing transfer of coal mining technology and changed its name to Kushiro Coal Mining Co. Ltd. (M. Ikenaga, Manager, Planning Department, Japan Coal Energy Center, written commun., October 28, 2002).

Environmental Issues

To recover and recycle materials from disposed cars, chlorofluorocarbons (CFCs) used in air conditioners, and safety air bags, the Diet (the Japanese Parliament) enacted the Law for Effective Re-utilization of Used Auto Parts (Automobile Recycling Law), which became effective July 5, 2002; it would be fully enforced by the end of 2004. Under the law, automakers and importers would be required to recover and recycle materials, which will include CFCs from automobiles. The car owners must pay the automakers a designated recycling fee of about 20,000 yen, or about \$160, per vehicle to an appointed body at the time of a new car purchase. The car owner also would be required to purchase a 3,000-yen (about \$25) coupon to recover and destroy CFCs and CFC substitutes used in automobile air conditioners (Japan for Sustainability, 2002a§).

To regulate soil contamination caused by hazardous substances and to prevent human health from being damaged by the contamination, the Diet also enacted the Contaminated Soil Countermeasure Law on May 29, 2002; it would be fully enforced by February 15, 2003. It was Japan's first law to regulate soil contamination in urban areas. Companies that handle chemicals would be required to comply with the new law. Under the law, if a site is so polluted that it can damage the public health, then the Prefecture governor can order its landowner to investigate the land for soil contamination. If the soil is found to be contaminated, then the governor can designate it to be a polluted site and order the polluter or its landowner, if the polluter is not identified or nonexistent, to clean up the site (Japan for Sustainability, 2002b§).

Following the Government enactments of the latest environmental laws on recycling, Dowa Mining Co. Ltd., which had been expanding its recycling business for the past 2 to 3 years, would continue to focus on its environmental businesses on soil purification business and would expand into metal recycling for smelting. The company was building up its business to recover and recycle the rare metals from catalytic converters in junked cars. In April, Dowa Mining started pilot operations of a car shredder dust treatment plant at Kosaka in Akita Prefecture at a cost of \$21.5 million, about 33% of which was funded by the Government. Dowa Mining, which has extensive experience in recycling catalytic converters, also would invest from \$3 million to \$4 million in Nippon PGM Co. (its subsidiary) to increase its monthly processing capacity to 800 metric tons (t) from 450 t. The expanded capacity would allow Dowa Mining to increase recovery of platinum and palladium from the exhaust systems (Nikkei Weekly, 2002b; Japan Metal Bulletin,

2002a§). In April, Dowa Mining also started construction of a new recycling treatment plant in Okayama in Western Japan (Japan Metal Review, 2002a).

Production

Mine production of most nonferrous metals (except gold, lead, and silver) and most industrial minerals (except dolomite) declined in 2002 because of depleting ore reserves, lower domestic prices, and weaker domestic demand for mineral products. Mine production of zinc declined in 2002 because the ore production from the Toyoha Mine in Hokkaido Prefecture had lower content of zinc and a higher content of lead and silver. Japan's coal output declined to less than 1.5 million metric tons (Mt) in 2002 because of the permanent closures of the Ikeshima Mine in Nagasaki Prefecture in December 2001 and the Kusbiro Mine in Hokkaido Prefecture in January 2002. According to Japan Coal Energy Center, about 11 small-scale open pit coal mines and 1 underground coal mine still operated in the Prefectures of Hokkaido and Yamaguchi in 2002 (Masakazu Ikenaga, Manager Planning Department, Japan Coal Energy Center, written commun., October 28, 2002). The output of crude petroleum and natural gas remained very small.

In the mineral processing industry, production of nonferrous metals was mixed. Metal production of refined copper, gold, lead, silver, and zinc decreased because of weak domestic demand. Production of chromium metal increased in 2002 because of increased production from the new plant in Toyama Prefecture that was operated by NKK Materials Co. Ltd. Production of iron and steel increased to the highest level in 13 years owing to a significant increase in exports to Asian countries. Production of electrolytic manganese oxide and titanium sponge metal decreased because of weak domestic demand or reduced exports of titanium sponge, and production of cement and other construction-related materials was lower because of the continued weakness in the construction sector in 2002. Production of refined petroleum products was mostly lower in 2002 because of weak domestic demand for petroleum products (table 1).

Trade

Japan was a net importer of minerals because of its large import bill for mineral fuels. Japan's mineral trade deficit, however, decreased to \$63.8 billion in 2002 from \$71.7 billion in 2001 as a result of lower import bills for mineral fuels and other nonfuel minerals and higher export earnings from iron and steel in 2002 (table 4).

Total imports of minerals decreased by 5.7% to \$97 billion and accounted for 28.7% of the total imports, which were valued at \$337.6 billion in 2002 (Ministry of Finance, 2002b, p. 9-13, 15-16, 33-41). Of the total minerals imports, \$65.7 billion was for such mineral fuels as coal, LNG, crude and partially refined petroleum, refined petroleum products, and other mineral fuels; \$6.5 billion, for ores and concentrates of ferrous and nonferrous minerals, slag, scrap, and ash of iron and steel, other metals, and metal compounds; and \$1.2 billion, for such industrial minerals as salt, sulfur, earths and stone, lime, plastering materials, and cement. Imports of processed minerals, mineral-related chemicals, and metals totaled \$24.7 billion, of which \$3.5 billion was for mineral-related chemicals and fertilizers; \$11.6 billion, for products of iron and steel and nonferrous, rare, and other base metals; \$5.7 billion, for precious and semiprecious stones and precious metals; and \$2.9 billion, for articles and products of asbestos, cement, ceramics, glass, mica, and stone.

Total exports of minerals, mineral-related chemicals, and processed minerals products increased by 6.6% to \$33.2 billion and accounted for 8.0% of Japan's total exports, which were valued at \$416.5 billion in 2002 (Ministry of Finance, 2001a, p. 9-13, 15-16, 34-41). Exports of iron and steel products and nonferrous, rare, and other base metals totaled \$23.7 billion. Exports of processed mineral articles and products of asbestos, cement, ceramics, glass, mica, and stone amounted to \$4.1 billion. Exports of salt, sulfur, earths and stone, lime, plastering materials, cement, mineral fuels, and nonferrous minerals were \$1.7 billion. Exports of mineral-related chemicals and fertilizer were \$2.0 billion. Exports of precious and semiprecious stones and precious metals were \$1.6 billion (table 4). Physical measures of the exports and imports of mineral commodities in 2000 and 2001 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 mineral-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, the number of major nonferrous metal mines remained at two in 2002. The major industrial mineral mines totaled 42 in 2002, the same number as that of 2001. The coal mining sector consisted of 11 small-scale open pit mines mostly in Hokkaido Prefecture and one underground mine at Kushiro in Hokkaido Prefecture, which was owned and operated by Taiheiyo Coal Mining Co. Ltd. prior to February 2002 and by newly established Kushiro Coal Mining Co. Ltd. beginning in February 2002. Japan's mining capacity of nonferrous metals (mainly lead, gold, silver and zinc) and coal shrunk substantially between 2001 and 2002. The number of persons employed by the mining sector totaled about 50,000 in 2002 (Statistical Handbook of Japan, 2003§).

In the mineral-processing sector, the iron and steel industry continued to cut the number of employees to 165,932 from 178,716 in 2001. The industry's production capacity of pig iron decreased to 93.2 million metric tons per year (Mt/yr) from 94.13 Mt/yr in 2001, and the production capacity of crude steel decreased to 144.8 Mt/yr from 145.3 Mt/yr in 2000. In the nonferrous metal industry, which included smelting and refining of copper, gold, lead, silver, zinc, and other minor metals, the number of its regular employees was reduced by 393 to 5,664 in 2002. Japan's production capacity of refined copper remained at 1.496 Mt/yr; that of refined gold and

lead remained steady at 166 metric tons per year (t/yr) and 274,800 t/yr, respectively; that of refined silver remained at 2,916 t/yr; and that of zinc remained at 750,000 t/yr. Japan's electrolytic manganese dioxide production capacity was reduced by 18,000 t/yr to 59,000 t/yr owing to the closure of the 18,000-t/yr Takaoka plant in Toyama Prefecture by Japan Metal & Chemical Co. Ltd. Japan's cement industry cut the number of its regular employees by 177 to 3,836, and reduced its cement clinker capacity by 3.75 Mt/yr to 82.93 Mt/yr (Ministry of Economy, Trade and Industry, 2002a, p. 127, 130; 2002c, p. 94-95, 155, 157; Arumu Publishing Co. Ltd., 2003, p. 34).

Commodity Review

Metals

Alumina and Aluminum Hydroxide.—Japan relied 100% on imports of bauxite for the manufacture of alumina and aluminum hydroxide. In 2002, Japan imported 1.87 Mt of bauxite, which was valued at \$45 million. The two principal suppliers of bauxite were Australia (54.9%) and Indonesia (39.1%). Production of alumina and aluminum hydroxide was by Nippon Light Metal Co. Ltd. (NLM) at its Shimizu plant in Shizuoka Prefecture, Showa Denko K.K. at its Yokohama plant in Kanagawa Prefecture, and Sumitomo Chemical Co. Ltd. at its Ehime plant in Ehime Prefecture.

In 2002, alumina production totaled 332,541 t, and domestic shipments totaled 204,028 t, of which 110,318 t was for the manufacture of refractories; 41,309 t, for ceramics; 4,771 t, for abrasives; 1,307 t, for welding rods; and 46,323 t, for other uses. In 2002, Japan exported 90,744 t of alumina principally to China, the Republic of Korea, and Taiwan. In 2002, aluminum hydroxide production totaled 723,860 t, and domestic shipment totaled 261,155 t, of which 165,996 t was for the manufacture of flocculate materials; 37,273 t, for rubber and plastics; 14,223 t, for synthetic zeolite; 1,650 t, for fluoride; and 42,013 t, for other uses. In 2002, Japan exported 85,120 t of aluminum hydroxide principally to Indonesia, the Republic of Korea, Taiwan, and Thailand (Japan Aluminum Association, 2003, p. 11, 20).

Aluminum.—Japan's production of primary aluminum (unwrought aluminum) by NLM at the Kambara refinery in Shizuoka Prefecture amounted to about 0.32% of Japan's requirements for primary aluminum in 2002. Virtually all Japan's requirements for primary aluminum was met by imports. In 2002, imports of primary aluminum totaled 2.58 Mt, of which 1.73 Mt was primary aluminum ingots and 848,330 t was primary aluminum alloys. The import bill for primary aluminum, which included ingots and alloys, was \$3.59 billion (Ministry of Finance, 2002b, p. 662-663).

According to the estimate by Marubeni Corp., which was the largest aluminum trader among the Japanese trading companies, about 45.6 % of imported primary aluminum was to be supplied from Japan's 11 overseas aluminum smelter projects in fiscal year 2002. Japanese aluminum and major trading companies held substantial equity shares in those smelters in Australia, Brazil, Canada, Indonesia, Mozambique, New Zealand, the United States, and Venezuela (table 5). About 52.7% of the imported aluminum was to be supplied under long-term contracts from the world's major producers of primary aluminum; and about 2% was to be supplied from the spot market (Marubeni Corp., 2001).

The major primary aluminum and aluminum alloy suppliers in 2002 included Russia (26.4%), Australia (22.4%), New Zealand (7.7%), Brazil (7.4%), South Africa (6.7%), China (5.8%), Indonesia (4.8%), Canada (3.8%), the United Arab Emirates (3.1%), and Ukraine (2.8%). The United States supplied only 5,418 t and accounted for 0.2% of imported primary aluminum and aluminum alloys in 2002 (Ministry of Finance, 2002b, p. 662-663).

Prior to 2002, Venezuela supplied between 110,000 and 123,000 t/yr of primary aluminum, which included 90,000 t/yr of primary aluminum under equity-share investment in Venezuela's aluminum smelter and 30,000 t/yr of primary aluminum under long-term contract. The contract renewal negotiations between the six Japanese shareholders, which were led by Showa Denko K.K. (20%), and Venezuela state-owned Corp. Venezolana de Guayana (80%) concluded a new 4-year contract in mid-November 2002 after 10 months of talks. Under the new contract, Industria Venezolana de Alumino C.A. of Venezuela (VENALUM) was to supply 360,000 t of primary aluminum to Japan at a rate of 90,000 t/yr of primary aluminum in the next 4 years ending March 2006. The new contract, however, would replace the preferential price terms that the Japanese shareholders enjoyed in the past with an undisclosed new price terms (Metal Bulletin, 2002b, i).

Kobe Steel Ltd., which owned 13.33% of Aluminerie Alouette Inc. (ALOUETTE) of Canada, sold its 13.33% interest in ALOUETTE to the Provincial Government of Quebec through Société Générale de Financement for \$100 million and sold its 9.5% interest in reduction lines 1 and 2 at the Boyne Island Smelter in Australia to Comalco Ltd. of Australia for \$78.5 million in mid-2002. Kobe Steel was trying to sell, but could not find buyers for its 1.8% interest in Nippon Amazon Aluminum, which owned 49% interest in Alumino Brasileiro S.A. of Brazil, and its 4% interest in VENALUM (Metal Bulletin, 2002c; Mining Journal, 2002d).

In September 2002, Marubeni, which owned a 6.67% interest in ALOUETTE, announced that it would participate in the capacity expansion of ALOUETTE by increasing its investment by 7.5 billion yen, or \$59.8 million, in the project that would start in 2003 to boost ALOUETTE's smelting capacity to 550,000 t/yr from 243,000 t/yr by fall 2005. Marubeni had about 160,000 t/yr of equity primary aluminum through its investments in aluminum smelters in Australia, Brazil, Canada, Indonesia, and Venezuela. After capacity expansion of ALOUETTE is completed, Marubeni would increase its right of off-take of equity primary aluminum to more than 180,000 t/yr (Marubeni Corp., 2002§).

Because of a weak economic recovery, domestic demand for primary aluminum decreased slightly by 0.2% to about 2 Mt, about 85% of which was for rolling and die-casting in 2002. Exports of primary aluminum, which included aluminum alloys (10,280 t) and aluminum ingots (2,167 t), totaled 12,447 t and were valued at \$26.1 million in 2002. The major buyers of aluminum ingots in 2002

were China (37.4%), Thailand (27.7%), the Republic of Korea (13.0%), Malaysia (7.7%), and the Philippines (5.6%). The major buyers of aluminum alloys in 2002 were Indonesia (30.1%), the Republic of Korea (28.3%), the Philippines (14.2%), Thailand (7.9%), China (6.9%), and the United States (5.2%) (Ministry of Finance, 2002a, p. 576).

Cadmium.—In 2002, Japan was one of the top two producers and consumers of cadmium in the world. Cadmium was produced mainly as a byproduct of zinc refining operations that used mostly imported ore. According to the Japan Mining Industry Association, cadmium was produced by Toho Zinc Co. Ltd. and accounted for 31.4% of the total production; Dowa Mining Co. Ltd., 27.1%; Sumitomo Metal Mining Co. Ltd. and Nippon Mining and Metals Co. Ltd. (NMM), 13.5% each; Mitsui Mining and Smelting Co. Ltd., 12.5%; and Mitsubishi Materials Corp., 2.0% (Arumu Publishing Co. Ltd., 2003, p. 113).

Because of lower domestic production of cadmium and increased consumption of electrodes for nickel-cadmium (Ni-Cd) batteries, imports of cadmium ingot and powder rose by 28% to 2,819 t and were valued at \$2.2 million in 2002. The major suppliers were the Republic of Korea (42.0%), Canada (17.8%), Peru (7.8%), Germany (7.1%), Russia (6.1%), and the United Kingdom (5.9%) (Ministry of Finance, 2002b, p. 670).

In 2002, Japan's demand for domestically produced cadmium was 2,586 t, of which 2,437 t was consumed by the producers of Ni-Cd battery electrodes. In 2002, the consumption of cadmium for the production of Ni-Cd batteries accounted for 94.2% of shipment of domestically produced cadmium. Other domestic demand for domestically produced cadmium for alloys was 31 t; plating, 1 t; pigments, 3 t; and other end users, 114 t in 2002. Japan also imported 2,813 t of cadmium, of which 2,783 t was mainly for the production of Ni-Cd batteries (Arumu Publishing Co. Ltd., 2003, p. 112).

Chromium.—Japan relied on imports to meet all chromium requirements for its iron and steel industry. Because of increased imports of ferrochromium, Japan's imports of chromium ore and concentrate decreased by 13.7% to 354,928 t and were valued at \$20.8 million in 2002. The major suppliers were South Africa (53%), India (41%), and Iran (3%) (Ministry of Finance, 2002b, p. 169-170).

Consumption of chromium ore and concentrate by the iron and steel industry decreased by 9.7% to 296,851 t, of which 169,003 t was consumed by the ferroalloy industry and 127,848 t, by others. The iron and steel industry's yearend inventory of chromium ore decreased by 5.9% to 145,064 t, which was equivalent to about 6 months of consumption in 2002 (Ministry of Economy, Trade and Industry, 2002c, p. 90).

Production of ferrochromium decreased by 17.3% to 91,937 t in 2002 owing to high production costs and low import prices. Imports of ferrochromium, which included high- and low-carbon ferrochromium, increased by 5.9% to 783,371 t. The major overseas suppliers were South Africa (56.4%), Kazakhstan (17.8%), Zimbabwe (16.0%), China (3.8%), Russia (2.4%), and India (2.3%). Imports of ferrochromium were valued at \$301.4 million (Ministry of Finance, 2002b, p. 624).

To secure more overseas supply of ferrochromium, Mitsubishi Corp. reached an agreement in August to acquire a 36.6% interest in Herculite Ferrochrome of South Africa from Herculite (Pty) Ltd. and a 7.5% interest from Herculite's management. In March 2000, Mitsubishi Corp. had acquired from Nippon Steel Trading Co. Ltd. an 11% interest in Herculite Ferrochrome, which decreased to 9.375% later. After completion of the Herculite acquisition, Mitsubishi would own 53.475% interest in Herculite Ferrochrome, which operated a 260,000-t/yr plant at Brits, South Africa. In addition to 70,000 t/yr of shipments to Japan based on a prior contract agreement, Mitsubishi would take an additional 40% of the plant's output to supply its Japanese customers, which included Nippon Steel Corp., Sumitomo Metal Industries Ltd., Daido Steel Co. Ltd., Nippon Yakin Kogyo Co. Ltd., and Nippon Metal Industry Co. Ltd. (Metal Bulletin, 2002d).

Consumption of ferrochromium, which included high-carbon ferrochromium (802,872 t) and low-carbon ferrochromium (38,781 t), increased by 0.4% to 841,653 t, of which 836,992 t was consumed by steel producers and 4,661 t, by ferroalloy producers (Ministry of Economy, Trade and Industry, 2002c, p. 210). Exports of ferrochromium totaled 1,362 t, of which 1,255 t was low-carbon ferrochromium and 107 t, high-carbon ferrochromium. The major buyers of ferrochromium were the United States (77.2%) and Thailand (15.6%). Exports of ferrochromium totaled \$2.7 million (Ministry of Finance, 2002a, p. 497).

Production of chromium metal was by NKK Materials Co. Ltd., which operated a 1,000-t/yr plant that used the silicothermic method at Shinminato in Toyama Prefecture, and by Nippon Denko Co. Ltd., which operated an 800-t/yr plant that used the aluminothermic reduction method at Oshima, which is located a few kilometers south of Shinminato in Toyama Prefecture. Chromium metal produced by Nippon Denko decreased to 700 t in 2002 from 750 t in 2001, and NKK Materials increased to 900 t in 2002 from 600 t in 2001. In the domestic market, chromium metal was consumed mainly for the manufacture of super alloys, heat resisting steel, and electronic materials (Arumu Publishing Co. Ltd., 2003, p. 100).

Cobalt.—Japan relied 100% on imported cobalt matte and other intermediate products of cobalt for metal production. Sumitomo Metal Mining, which was Japan's sole producer of cobalt metal and cobalt salts (cobalt sulfate and cobalt oxide), operated a cobalt refinery in Niihama, Ehime Prefecture, with a rated capacity of 600 t/yr (Arumu Publishing Co. Ltd., 2003, p. 74). Japan also imported cobalt metal, cobalt oxide, and cobalt hydroxide to meet its cobalt requirements.

In 2002, imports of cobalt matte, other intermediate products of cobalt, cobalt ingots, and other articles of cobalt totaled 9,827 t and were valued at \$154.5 million. The major suppliers were Canada, 20.7%; Finland, 20.1%; Australia, 18.1%; Zambia, 14.8%; Norway, 9.0%; Belgium, 4.2%; Congo (Brazzaville) and Congo (Kinshasa), 5.5% combined; and Morocco, 3.3%. Japan also imported 2,173 t of cobalt oxide and 332 t of cobalt hydroxide. Belgium and Finland were the two principal suppliers of cobalt oxides and accounted for 76% and 21%, respectively. Belgium, Finland, and the United States were the three major suppliers of cobalt hydroxide and

accounted for 35%, 32%, and 28%, respectively. Imports of cobalt oxide and hydroxide amounted to \$41.2 million (Ministry of Finance, 2002b, p. 182, 670).

Domestic demand for cobalt metal decreased by 16.8% to 2,058 t, of which 764 t was for specialty steel; 460 t, for pipe, plate, rod, and wire; 276 t, for ultra-hard tool steel (cemented carbides); 193 t, for manufacturing of magnetic materials; 134 t, for catalysts; and 231 t, for other end uses (Ministry of Economy, Trade and Industry, 2002c, p. 280). In addition to the Government statistics on reported domestic demand for cobalt, demand for cobalt by the manufacturers of batteries was estimated to be 7,000 t. According to an estimate by Mitsui & Co., the overall demand for cobalt in Japan was about 9,000 t compared with 8,200 t in 2001 (Arumu Publishing Co. Ltd., 2003, p. 74).

Copper, Lead, and Zinc.—In 2002, Toyoha Mining Co. Ltd., which operated the Toyoha Mine in Hokkaido Prefecture, was Japan's only lead and zinc mining company in 2002. Mine production of lead increased by 14.5%, and that of zinc decreased by 3.7%. The mine also produced a considerable amount of byproduct silver and a very small amount of byproduct copper. For raw material requirements that included domestic ore, imported ore, scrap, and other raw materials for its nonferrous metal smelting and refining industries, Japan relied on imported copper ores and concentrates (86%), on imported zinc ore and concentrate (79%) and on imported lead ore and concentrate (48%) for the production of refined copper, refined zinc, and refined lead, respectively.

In 2002, Japan was the world's largest importer of copper concentrate and one of the world's major importers of lead and zinc concentrates. Imports of copper concentrate decreased by 3.6% to 4.2 Mt and were valued at \$2.07 billion. The major suppliers of copper concentrate were Chile (35.9%), Indonesia (23.9%), Papua New Guinea (8.8%), Australia (8.6%), Canada (7.1%), Peru (6.5%), and Argentina (4.7%). Imports of zinc and lead concentrates decreased by 13.1% to 1 Mt and 16.6% to 155,109 t, respectively. The import bills for zinc and lead were \$198 million and \$57 million, respectively. The major suppliers of lead concentrate were the United States (42.5%), Australia (34.4%), and Peru (8.7%). The major suppliers of zinc concentrate were Australia (35.6%), Peru (19.1%), the United States (14.2%), Canada (8.5%), Chile (6.1%), Mexico (5.9%), and Bolivia (4.6%) (Ministry of Finance, 2002b, p. 169).

To secure more captive copper concentrate from overseas nonferrous metals mines in which Japanese nonferrous metal mining companies held substantial equity and provided long-term loans. Sumitomo Metal Mining decided to increase its investment in an exploration and development project of copper, gold, and PGM in Mexico (table 9).

Sumitomo Metal Mining in joint venture with Santoy Resources Ltd. of Canada completed the first phase of their 60%-owned Tropico Project in Sinaloa State, Mexico. The remaining 40% interest of the project was owned by Almanden Minerals Ltd. of Canada. Under the terms of a newly amended joint-venture agreement in 2002, Sumitomo Metal Mining was required to fund \$3.5 million to earn a 51% interest in the Tropico Project by March 31, 2006, and Sumitomo Metal Mining agreed to expend a minimum of \$400,000 per year from April 1, 2002, through March 31, 2006, and to complete a prefeasibility study (Santoy Resources Ltd., 2002; Almaden Mineral Ltd., 2002§).

In 2002, metal production of copper, lead, and zinc declined mainly because of decreases in exports of refined copper and sluggish domestic demand for lead and zinc. Exports of lead and zinc, however, increased because of the effects of Japanese overseas' plants (transplants) in China and Southeast Asian countries. Japan's capacity utilization rate of the nonferrous metals smelting and refining industry was 95.9% for copper, 85.3% for zinc, and 77.6% for lead (Ministry of Economy, Trade and Industry, 2002c, p. 97-99, 155).

In February, Sumitomo Metal Mining announced that it was to spend about \$88 million in the next 3 years for the expansion of its Toyo copper smelter and refining complex in Besshi, Ehime Prefecture, to meet the growing exports of refined copper to China and other Asian countries. The expansion project involved adjustments and modifications to the flash furnace, flotation plant, converter, tank house (refinery), and other facilities to raise refining capacity to 300,000 t/yr from 270,000 t/yr by March 2004 (Metal Bulletin, 2002h; Japan Metal Bulletin, 2002c§).

In June, Mitsubishi Materials, which was the parent company of Hosokura Smelting and Refining Co. Ltd., suspended operations of its 21,600-t/yr secondary lead smelter at Hosokura in Miyagi Prefecture because of the environmental problems caused by high lead contamination in its drainage (Japan Metal Review, 2002b).

Following the establishment of the joint venture United Copper Resources Co. Ltd. (UCR) for purchasing copper ore and concentrate and the joint venture Pan Pacific Copper Co. Ltd. (PPC) for selling refined copper in 2001, NMM and Mitsui Mining and Smelting Co. Ltd. (MMS) announced in May 2002 that they would fully integrate their copper businesses by moving toward strengthening their collaboration in copper smelting operations to promote timely responses to the changing business environment and to strengthen international competitiveness. In their announcement in May, NMM and MMS were to reorganize PPC to take over UCR's raw materials procurement gradually. In addition, PPC's responsibilities would include copper production, sales, and handling investments and financing for mines, and planning and development of new technologies to enhance sales activities. UCR was to be dissolved after the transfer of its raw materials procurement business to PPC is completed. Beginning in April 2003, the newly organized PPC would be owned by NMM (66%) and by MMS (34%), and the full integration of copper businesses would start (Metal Bulletin, 2002e; Japan Metal Bulletin, 2002b§).

In July, NMM entered into a joint venture agreement with Chile's state-owned copper producer, Corporación de Nacional del Cobre de Chile (CODELCO), to construct a pilot plant in Hitachi, Ibaraki Prefecture, and to establish the joint-venture firm Biosigma with \$3 million in paid-up capital to develop and patent biotechnologies to recover copper from lower grade sulfate copper ore by using bioleaching (bacterial leaching). NMM was to provide \$1 million to own 34% of Biosigma, and CODELCO was to provide \$2 million to own 67%. This was the first time that a Japanese copper producer entered into a joint venture with CODELCO on bioleaching (Japan Metal Review, 2002c; Mining Journal, 2002a).

Imports of refined copper decreased by 26.7% to 114,371 t and were valued at \$182.2 million. The major suppliers of refined copper were Chile (46.5%), Zambia (20.0%), Australia (8.0%), Peru (6.7%), Indonesia (5.2%), the Philippines (3.3%), China (3.2%), India (2.5%), and Burma (2.2%). Imports of refined lead decreased sharply by 71.2% to 10,687 t and were valued at about \$9.2 million. The principal suppliers of refined lead were China (91.8%) and Peru (7.5%). Imports of zinc slab (refined zinc, not alloyed) also decreased sharply by 66.3% to 21,432 t and were valued at about \$18.0 million. The major suppliers of zinc slab were Peru (50.1%), China (38.9%), and Canada (10.3%) (Ministry of Finance, 2002b, p. 656, 677).

Domestic demand for refined copper increased by 5.7% to more than 1.16 Mt (revised from more than 1.03 Mt). Domestic demand for refined copper, by sector, was 742,141 t (revised from 613,083 t) for wire and cable, 388,277 t for brass mill products, and 32,528 t for others (Ministry of Economy, Trade and Industry, 2002c, p. 266). Exports of refined copper decreased by 9.2% to 377,855 t and were valued at \$603.6 million in 2002. The major buyers of refined copper were Taiwan (42.9%), China (33.1%), the Republic of Korea (7.3%), Indonesia (7.0%), Thailand and the United States (2.4% each), Malaysia (2.2%), and Vietnam (1.7%). Most of the 50,449 t of unrefined copper and copper anodes was exported mainly to the Republic of Korea (94.0%) and Taiwan (4.1%). Exports of unrefined copper and copper anodes were valued at \$108.5 million (Ministry of Finance, 2002a, p. 568).

In 2002, domestic demand for refined lead decreased by 15% to 207,154 t, of which 168,715 t was for storage batteries; 20,134 t, for inorganic chemicals; 6,833 t, for solder; and 11,472 t, for other uses (Ministry of Economy, Trade and Industry, 2002c, p. 268). Exports of refined lead increased sharply by to 10,325 t from 747 t in 2001 and were valued at \$4.8 million in 2002. The major buyers of refined lead in 2002 were Indonesia (31.1%), Singapore (29.1%), and Malaysia (15.6%) (Ministry of Finance, 2002a, p. 581).

Domestic demand for zinc slab decreased by 11.0% to 485,005 t, of which 231,191 t was for sheet galvanizing (47.7%); 97,364 t, for other plating (20.1%); 63,057 t, for brass mill products (13.0%); 39,426 t, for zinc die-cast products (8.1%); 30,900 t, for inorganic chemicals (6.4%); and 23,067 t, for other uses (4.7%) (Ministry of Economy, Trade and Industry, 2002c, p. 272). Exports of zinc slab increased by 30.5% to 94,973 t and were valued at \$75.3 million. The major buyers were Taiwan (38.59%), Vietnam (15.4%), the Philippines (12.1%), Indonesia (11.0%), the United States (9.0%), Bangladesh (6.6%), and Malaysia and Thailand (1.5% each) (Ministry of Finance, 2002a, p. 582).

Gallium.—Japan was one of the world's top importers and consumers of gallium metal. Japan's primary production of high-purity gallium metal was by Dowa Mining, which produced about 8 t in 2002. Secondary producers of high-purity gallium metal, which included Dowa Mining, Nichia Chemical Industries, Rosa Industries Co. Ltd., Sumitomo Chemical Co. Ltd., and Sumitomo Metal Mining, recycled gallium metal from scrap materials and upgraded imported intermediate-grade gallium metal (4 nines, or 99.99%) to high-purity gallium metal (6 nines, or 99.9999%, to 7 nines, or 99.99999%).

Gallium metal production from recycling scrap materials, which included new scraps of gallium metal, wafer scraps of gallium arsenic (GaAs) and gallium phosphate (GaP), and residue from the liquid-phase epitaxial process, totaled 63,259 kilograms (kg). Imports of gallium metal, which included gallium metal with purity between 4 nines and 7 nines, totaled 55,080 kg (Arumu Publishing Co. Ltd., 2003, p. 26).

Overall supply of gallium metal totaled about 126 t, but Japan's total demand for gallium metal was estimated to be 130 t, of which 45.6% was for the manufacture of GaAs and GaP crystals; 53.2%, for GaAs-based light-emitting diodes (LEDs), GaP-based LEDs, and GaAs-based laser diodes (LDs); and 1.2% for other endusers (Arumu Publishing Co. Ltd., 2003, p. 25-26).

To secure captive high-purity gallium metal from gallium-metal-processing plants overseas to meet the growing demand by the compound semiconductor market, especially for such mobile communications uses as cellular phones, Sumitomo Chemical established a manufacturing facility in Shanghai, China, in a joint venture with Technical Sources International Group (TSI) of the United States and Inabata & Co. Ltd. of Japan in mid-2001. The joint-venture Shanghai Sumika High Purity Metal, Ltd. was owned by Sumitomo Chemical (70%) and TSI and Inabata (15% each). The 40-t/yr-capacity plant in Shanghai used Sumitomo Chemical's proprietary technology. Gallium metal produced by the plant in 2002 was shipped to Sumitomo Chemical, which also operated a 40-t/yr processing plant in Ehime Prefecture. The Ehime plant's capacity was expanded to 60 t/yr in 2002 (Sumitomo Chemical Co. Ltd., 2001§, 2002§).

Gold and Silver.—Mine production of gold and silver increased because of higher precious metals prices in 2002. Gold mine production was mainly by Sumitomo Metal Mining from the Hishikari Mine in Kagoshima Prefecture on Kyushu Island. The company, which was working on its Honko (main mine) and Yamada deposits in the Hishikari mining area, produced about 8.6 t of gold in 2002. Other small-scale productive gold and silver mines were the Arkesi and Kasuga in Kagoshima Prefecture. The Toyoha Mines produced most of Japan's mined silver as a byproduct of their lead and zinc mining operations in Hokkaido Prefecture.

In overseas mineral exploration, Sumitomo Metal Mining (51%) and its partners Teck Cominco Ltd. (40%) of Canada and Sumitomo Corp. (9%) completed the final feasibility study for the Pogo (Stone Boy) gold project at yearend 2001. The Pogo gold project, which was located about 61 kilometers (km) northeast of Delta Junction near Goodpaster River in eastern interior Alaska, was still waiting for a wastewater discharge (National Pollution Discharge Elimination System) permit from the U.S. Environmental Protection Agency (EPA). According to Teck Cominco, the joint venture's (Teck-Pogo, Inc.) revised documents, which eliminated shaft hoisting and updated the water management plan to address changes in support of project permitting, were submitted in 2002 so that an environmental impact statement (EIS) could be drafted. Road access for construction, construction of mill and site facilities, and mine development were expected to begin in 2003 following the completion of an EIS; and the EPA was the lead agency for the development of the EIS (Teck Cominco Ltd., 2002§; U.S. Environmental Protection Agency, 2002§).

According to the proposed development plan, the project would develop an underground mine in land owned by the State of Alaska with a surface mill designed to process 2,500 metric tons per day (t/d) of ore to produce about 375,000 ounces per year, or about

11,664 kilograms per year (kg/yr), of gold with the possibility of increasing production capacity to 3,500 t/d and to produce 500,000 ounces per year, or 15,552 kg/yr of gold. The project would require 25 to 33 months to construct and would have a mine life of about 11 to 12 years. The capital cost of the project was estimated to be between \$200 million and \$250 million (Resources Development Council for Alaska, Inc., 2003§).

In 2002, production of refined gold and refined silver decreased by 7.1% and 1.5%, respectively, owing mainly to reduced input from imported ore. Imports of gold ingots and powder increased by 101.7% to 80,386 kg because of decreased domestic production of refined gold and a substantial increase in the domestic gold demand for private investment and industrial use. Imports of silver ingots and powder increased by 1.4% to 884 t, but domestic demand for silver decreased in all end users except in silver nitrate for other uses, which increased by 46%. The major suppliers of gold ingots and powder in 2002 were Australia (47.2%), Switzerland (14.6%), Republic of Uzbekistan (8.3%), Hong Kong (6.8%), Canada (5.8%), the United States (4.4%), Russia (4.2%), and South Africa (2.5%). The major suppliers of silver ingots and powder in 2002 were Mexico (35.6%), the Republic of Korea (15.5%), Peru (14.6%), Australia (14.3%), the United States (9.2%), and China (5.9%). Import bills for gold ingots and powder were \$791.7 million and that for silver ingot and powder were \$133.8 million (Ministry of Finance, 2002b, p. 618-619).

Overall demand for gold, which included such uses as dental, medical, industrial, industrial arts and crafts, and private investment, increased to 303,098 kg in 2002 from 262,495 kg in 2001. Of this overall domestic demand for gold, dental and medical uses increased to 24,112 kg in 2002 from 20,813 kg (revised) in 2001; industrial uses increased to 125,591 kg in 2002 from 119,629 kg in 2001; industrial arts and crafts decreased to 4,597 kg in 2002 from 4,893 kg in 2001; and private investment and other uses increased to 148,698 kg in 2002 from 117,160 kg (revised) in 2001. Despite the continued decline in demand for jewelry to 18,154 kg in 2002 from 21,739 kg in 2001, gold demand for electronics and telecommunications rebounded in 2002 and increased to 80,415 kg in 2002 from 70,916 kg in 2001 (Arumu Publishing Co. Ltd., 2003, p. 117).

The continuing decline in the domestic demand for silver decreased by 10.1% to 2,658 t from 2,958 t in 2001 owing to the continued decline in the demand for photographic materials, which decreased to 1,532 t in 2002 from 1,663 t in 2001, electric contacts (silver solder), which decreased to 98 t in 2002 from 111 t in 2001, and other uses, which decreased to 440 t in 2002 from 637 t in 2001. Despite the general decline, silver nitrate for other than photographic uses increased to 220 t in 2002 from 150 t in 2001, and rolled products, to 216 t in 2002 from 194 t in 2001 (Ministry of Economy, Trade and Industry 2002c, p. 286).

Exports of refined gold ingots and powder decreased by 62.6 % to 5,350 kg and were valued at \$47.1 million in 2002. The major buyers of refined gold ingots and powder were Switzerland (61.2%), the Republic of Korea (10.7%), Hong Kong (3.5%), Taiwan (2.6%), and Vietnam (2.5%). Exports of silver ingots and powder increased by 44.2% to 359.7 t and were valued at \$22.5 million. The major buyers of refined silver and powder were the Republic of Korea (19.9%), Singapore (17.4%), Taiwan (16.2%), China (12.5%), Hong Kong (11.8%), the United Kingdom (9.0%), Malaysia (8.1%), and the United States (2.2%) (Ministry of Finance, 2002a, p. 492-493).

Iron and Steel.—Japan relied on imports to meet virtually all the iron ore requirements for its iron and steel industry. In 2002, imports of iron ore totaled 129.1 Mt and were valued at \$3.0 billion. The average c.i.f. (cost, insurance, and freight) import price per metric ton of iron ore was \$23.54 compared with \$24.31 in 2001. In 2002, the major suppliers of iron ore were Australia (57.5%), Brazil (19.4%), India (12.0%), South Africa (3.7%), the Philippines (2.8%), and Chile (2.0%). Imports of pig iron increased slightly by 1.9% to 184,698 t and were valued at \$22 million. The average c.i.f. import price per ton of pig iron was \$136.72 compared with \$121.69 in 2001. The major suppliers of pig iron in 2002 were China (40.5%), Brazil (29.9%), North Korea (19.8%), and South Africa (9.8%) (Ministry of Finance, 2002b, p. 169, 624).

Consumption of iron ore by the iron and steel industry increased by 3.3% to 113.9 Mt, of which 86.4 Mt was for sintering; 26.5 Mt, for ironmaking; 807,000 t, for steelmaking; and 135,000 t, for other uses. Consumption of other iron ore raw materials by the iron and steel industry included 3.6 Mt of imported pellets, 716,000 t of imported iron sand, 228,000 t of imported ferruginous manganese ore, and 11.6 Mt of other iron ore materials. The industry also consumed 43.4 Mt of iron and steel scrap. Consumption of other major raw materials was 65.3 Mt of coking coal, 36.5 Mt of coal coke, 12.9 Mt of limestone, 4.5 Mt of quicklime, 1.7 Mt of dolomite, 1.5 Mt of serpeninite, 448,976 t of silica stone, and 156,481 t of fluorite (Ministry of Economy, Trade and Industry, 2002c, p. 84-86, 90-93).

In 2002, pig iron production increased by 2.7% to 81 Mt, of which 80.5 Mt was for steelmaking and 465,900 t, was for foundry. The total ironmaking capacity decreased to 93.2 Mt/yr from 94.1 Mt/yr in 2001, and the number of blast furnaces (35) and other furnaces (4) for ironmaking decreased to 39 from 42 in 2001 (Ministry of Economy, Trade and Industry, 2002c, p. 28, 94).

Crude steel production increased by 4.7% to 107.7 Mt owing mainly to increased exports of iron and steel especially to the Asian markets. Of the total crude steel produced in 2002, 72.9% was processed by basic oxygen furnaces (L.D. converter), and 27.1%, by electric furnaces. In the steelmaking sector, the number of basic oxygen furnaces decreased to 63 from 64 in 2002, and the number of electric arc furnaces decreased to 366 from 407 in 2001. The overall crude steel production capacity decreased to 144.8 Mt/yr from 145.3 Mt/yr in 2001 (Ministry of Economy, Trade and Industry, 2002c, p. 39, 94).

In 2002, Japan was the world's second largest producer of crude steel and accounted for 11.9% of the world total (International Iron and Steel Institute, 2003b§). Among Japan's top five steelmakers in 2002, Nippon Steel Corp., which produced 29.8 Mt of crude steel, was the third largest steel-producing company in the world after Arcelor S.A. of the European Union and the LNM Group of the United Kingdom; NKK Corp., which produced 15.2 Mt, ranked 8th; Kawasaki Steel Corp., which produced 13.7 Mt, ranked 11th; Sumitomo Metal Industries, Ltd., which produced 11.8 Mt, ranked 13th; and Kobe Steel Ltd., which produced 6.6 Mt, ranked 27th (International Iron and Steel Institute, 2003a§). In 2002, all five integrated steelmakers either achieved or exceeded their targeted sales and reported better-than-expected financial results all owing to increased exports and better export prices (Metal Bulletin, 2003).

In September 2002, Kawasaki Steel and NKK formally merged and created a new company called JFE Holdings Inc. to reduce costs and to improve efficiencies to meet the worldwide customer's requirements. Under JFE Holdings, five wholly owned subsidiaries would be established by April 2003 to continue the business. Among the five subsidiaries, the two most important were JFE Steel Corp. and JFE Engineering Corp. The impact of the merger would not be known until after April 2003. According to Japan's Fair Trade Commission, however, JFE Steel would have an average market share of 30% in the domestic market in electric sheet, tinplate, high-tensile sheet and plate, and line-pipe for domestic gas and water projects. According to Kawasaki Steel, about 6,000 jobs and 2 Mt/yr of steel production capacity would be cut at JFE Steel (Metal Bulletin, 2002a; Metal Bulletin Monthly 2002).

Following the merger of Kawasaki Steel and NKK in September 2002, Nippon Steel, Kobe Steel, and Sumitomo Metal reached an agreement in November 2002 to form a three-way partnership to cut costs and to take on JFE Holdings in the domestic and world markets. The three companies announced that as part of their planned comprehensive alliance, they would invest several billion yen in each other; integrate production, distribution, and material procurement; and consolidate facilities. As a result, Japan's steel industry would be consolidated into two major groups. In terms of crude steel output, number of mills, and number of employees, the three-way partnership would have 42.4 Mt, 14 Mt, and 107,363 t compared with JFE Holdings' 25.2 Mt, 4 Mt, and 57,004 t, respectively, in 2002 (Nikkei Weekly, 2002c).

In October, Sumitomo Metal also engaged in talks with China Steel Corp. of Taiwan to set up a joint venture for the early stages of the steelmaking process at its Wakayama works in a cross-border alliance to make use of excess capacity. The joint venture, which would be established in 2003, would operate blast furnaces and converters at the steel works in Wakayama Prefecture and produce steel billets for Sumitomo Metal and steel slab for China Steel (Nikkei Weekly, 2002d).

In 2002, domestic demand for steel increased only by 1.2% to about 63.4 Mt, of which 53.4 Mt was ordinary steel products and 10.0 Mt, specialty steel products. The increase in overall domestic demand for steel was mainly to the result of stronger demand by the manufacturers of automobile, electric machinery and equipment, and industrial machinery and equipment. Domestic demand, as measured by orders for ordinary and specialty steels, remained weak in most of the end user's categories in 2002 (table 6).

Exports of iron and steel, however, continued to move higher, especially to the East Asian market where exports rose by 31.7% in 2002. Overall exports of iron and steel products increased by 19.2% to 36.3 Mt; this was the second highest level after the record 37.0 Mt of 1976. Of total exports, 70.9% was ordinary steel products; 14.1%, specialty steel products; 10.9%, steel ingots and semifinished products; 1.9%, pig iron; and 1.4%, secondary products (Japan Iron and Steel Federation, 2003§).

Exports of iron and steel products to the Asia markets increased by 31.7%. Exports to the European and Middle Eastern markets decreased by 40.1% and 22.5% respectively; the Oceania markets increased by 20.4%; the North America and South America markets decreased by 18.7%; and the African markets increased by 18.4% in 2002. Exports of iron and steel products to the United States dropped sharply by 32.7% to 1.5 Mt (table 7; Japan Iron and Steel Federation, 2003§).

Imports of iron and steel products decreased by 13.6% to 5.3 Mt in 2002 for the second consecutive year of decline; this was the lowest level in 16 years. Of the total imports, 2.8 Mt was ordinary steel products; 1.9 Mt, pig iron, ferroalloys, steel ingots, and semimanufactured steel; 362,000 t, other steel products; and 106,000 t, specialty steel products (Japan Iron and Steel Federation, 2003, p. 18-19). Among the major suppliers of all steel products, the Republic of Korea and Taiwan accounted for more than 90% of total steel products imported by Japan (Japan Iron and Steel Federation, 2003§).

Manganese.—Japan relied 100% on imports to meet its manganese raw material requirements for the iron and steel and electrolytic manganese dioxide industries. In 2002, Japan imported 897,990 t of high-grade manganese ore, 125,896 t of ferruginous manganiferous ore, 1,463 t of high-grade manganese dioxide ore, and 89,389 t of low-grade manganese ore. The major suppliers of high-grade manganese dioxide ore were Colombia (31.6%), Mexico (27.3%), Gabon (21.9%), and China (12.3%). The major suppliers of ferruginous manganiferous ore were India (80.3%) and South Africa (18.2%). The major suppliers of high-grade manganese ore were South Africa (71.7%) and Australia (26.3%). The major suppliers of low-grade manganese ore were South Africa (44.8%), Ghana (28.1), and India (25.9%). The import bills for manganese totaled \$106.9 million in 2002 (Ministry of Finance, 2002b, p. 169).

Consumption of manganese ore for the production of ferroalloys increased by 2.4% to 646,096 t, that for steelmaking increased by 6.8% to 167,203 t, and that for other uses increased by 30.0% to 78 t in 2002. Production of ferromanganese decreased by 3.1%, owing to increased consumption for steelmaking (Ministry of Economy, Trade and Industry, 2002c, p. 29, 91). Imports of ferromanganese increased by 6.4% to 58,052 t because of decreased domestic production. The major suppliers were China (55.9%), South Africa (29.3%), the Republic of Korea (7.5%), and Australia (6.9%) (Ministry of Finance, 2002b, p. 624).

Consumption of domestically produced high- and low-carbon ferromanganese for steelmaking increased by 1.5% to 408,696 t, of which 332,961 t was high-carbon ferromanganese and 75,735 t, low-carbon ferromanganese (Ministry of Economy, Trade and Industry, 2002c, p. 210). Exports of ferromanganese decreased by 47.0% to 14,855 t. The major buyers were Taiwan (31.4%), the United States (29.6%), Thailand (8.4%), Saudi Arabia (8.1%), Australia (7.8%), the Republic of Korea (4.9%), and India (3.6%). Export earnings from ferromanganese totaled valued at \$10.2 million in 2002 (Ministry of Finance, 2002a, p. 496).

In 2002, Japan was the world's largest producer of electrolytic manganese dioxide (EMD). Japan's EMD producers were Mitsui Mining and Smelting at its Takehara plant (24,600 t/yr) in Hiroshima Prefecture and its County Cork plant (19,000 t/yr) in Ireland and Tosoh Corp. at its Hyuga plant (34,000 t/yr), Miyazaki Prefecture, and its Salonika plant (18,000 t/yr) in Greece. Japan Metal & Chemicals Co. Ltd. suspended operations of its Takaoka plant (18,000 t/yr) in Toyama Prefecture and its Hunan plant (10,000 t/yr) in China. Japan's EMD production capacity, which included three overseas plants, totaled 95,600 t/yr and accounted for 32.4% of the world's production capacity of 295,200 t/yr. Of the 45,867 t produced, 27,057 t was consumed domestically for the production of batteries and 23,855 t was exported. The major buyers were Indonesia (26.5%), China (18.5%), Singapore (18.3%), the Republic of

Korea (13.1%), the United States (8.3%), and Greece (4.2%). Export earnings from manganese dioxides were valued at \$31.7 million in 2002 (Ministry of Finance, 2002a, p. 112; Arumu Publishing Co. Ltd., 2003, p. 34).

Nickel.—Japan relied 100% on imported raw materials to meet its nickel requirements in 2002. Japan was the world's largest importer and consumer of nickel and the second largest producer of nickel metal after Russia (International Nickel Study Group, 2003, p. 8, 10). All nickel ores and nickel mattes were imported for the production of ferronickel, nickel chemicals (salts), nickel oxide sinter, and refined nickel. Additionally, ferronickel, nickel powder and flake, nickel oxide sinter, nickel waste and scrap, and refined nickel also were imported to meet the nickel requirements of the battery, magnetic materials, nonferrous alloys, and specialty steel industries, as well as other end users.

Imports of nickel ore increased by 2.3% to 4.5 Mt and were valued at \$141.1 million. The suppliers of nickel ore were Indonesia (53.8%), the Philippines (26.4%), and New Caledonia (19.7%). Imports of nickel matte, in gross weight, decreased by 13.5% to 101,450 t and were valued at \$414.7 million. The suppliers of nickel matte were Indonesia (74.2%) and Australia (25.8%). Imports of ferronickel, in gross weight, increased by 10.1% to 50,058 t and were valued at \$98.2 million. The suppliers of ferronickel were New Caledonia (63.8%), Indonesia (13.3%), the Dominican Republic (11.5%), and Colombia (11.4%). Imports of refined nickel increased by 44.0% to 40,415 t and were valued at \$266 million. The top suppliers of refined nickel were Australia (27.1%), Russia (20.2%), Zimbabwe (10.9%), Norway (9.6%), South Africa (8.2%), Canada (7.3%), Brazil (6.1%), the United Kingdom (4.9%), and China (4.2%). Imports of nickel oxide sinter increased by 26.5% to 1,147 t and were valued at \$6.2 million; Australia, which was the dominant supplier of nickel oxide sinter, accounted for 99.4%. Imports of nickel powders and flakes increased by 18.64% to 9,780 t and were valued at \$84.7 million. The major suppliers were the United Kingdom (44.4%) and Canada (48.8%). Imports of nickel waste and scrap decreased by 12.5% to 14,033 t and were valued at \$77.1 million. The major suppliers were Russia (23.3%), the United States (18.2%), Zimbabwe (17.6%), the Republic of Korea (7.1%), Taiwan (6.6%), and South Africa (6.0%) (Ministry of Finance, 2002b, p. 169, 624, 661).

Consumption of nickel ore by the ferroalloy industry increased by 6.2% to 3.4 Mt in 2002. Production of ferronickel was by Hyuga Smelting Co. Ltd. (a wholly owned subsidiary of Sumitomo Metal Mining) in Hyuga, Miyazaki Prefecture; Nippon Yakin Kogyo at Oheyama, Miyazu, Kyoto Prefecture; and Pacific Metals Co. Ltd. in Hachinohe, Aomori Prefecture. Production of ferronickel, in gross weight, increased by 0.9% to 370,973 t, which contained about 74,400 t of nickel. Consumption of ferronickel for steelmaking, in gross weight, increased by 4.6% to 308,560 t owing to stronger demand by the manufacturers of nickel-based stainless steel (Ministry of Economy, Trade and Industry, 2002c, p. 91, 210). Exports of ferronickel decreased by 1.8% to 119,507 t, of which 54.9% went to Taiwan and 45.1%, to the Republic of Korea. Export earnings from ferronickel were valued at \$139 million (Ministry of Finance, 2002a, p. 497).

Refined nickel was produced solely by Sumitomo Metal Mining at its nickel refinery that used its Matte Chlorine Leaching Electrowinning process in Niihama, Ehime Prefecture. The 36,000-t/yr nickel refinery used imported nickel matte from Australia and Indonesia to produce refined nickel and nickel salts for domestic consumption and exports. Tokyo Nickel Co. Ltd. operated a 60,000-t/yr smelter in Matsuzaka, Mie Prefecture, which also used imported nickel matte to produce briquettes, granules, and nickel oxide sinters for domestic consumption and export. Sumitomo Metal Mining announced in mid-2002 that it planned to expand refined nickel production capacity to 46,000 t/yr from 36,000 t/yr and refined cobalt capacity to 1,100 t/yr from 300 t/yr at its Niihama Facilities in Ehime Prefecture by mid-2004. The expansion project would be in line with the start up of nickel-cobalt sulfide production that will use high-pressure acid-leach technology at the Rio Tuba Mine on Palawan Island in the Philippines; Sumitomo Metal Mining owned 54%. Sumitomo Metal Mining reportedly also expressed an interest in acquiring up to 25% interest in the Goro laterite nickel project in New Caledonia (Mining Journal, 2002c, e, f; Nikkei Weekly, 2002a).

Domestic demand for refined nickel increased by 4.4% to 65,010 t owing to a substantial increase in demand by the manufacturers of specialty steel in 2002. Among the end users, production of specialty steel increased by 18.0% to 53,233 t; batteries, by 11.5% to 3,983 t; magnetic materials, by 38.3% to 1,991 t; and catalysts, by 15.5% to 440 t. The end users for the manufacturing of galvanized sheet decreased by 42.0% to 2,500 t; and other users, by 61.6% to 2864 t in 2002 (Ministry of Economy, Trade and Industry, 2002c, p. 278). Exports of refined nickel decreased by 65.1% to 167 t and were valued at \$1.5 million in 2002. The major buyers were Indonesia (33.8%), the Republic of Korea (17.7%), Thailand (15.6%), Singapore (7.7%), the Philippines (7.6%), and Hong Kong (5.4%). Exports of nickel oxide sinter and other intermediate products of nickel metallurgy decreased by 9.3% to 23,112 t and were valued at \$129.3 million. The principal buyers were the Republic of Korea (53.8%) and Taiwan (44.8%). Exports of nickel powders and flakes increased by 77.5% to 1,449 t in 2002 and were valued at \$26.2 million. The major buyers were China (51.5%), Hong Kong (29.6%), France (6.5%), and the United States (3.8%). Exports of nickel waste and scrap decreased by 56.7% to 308 t and were valued at \$0.9 million. The major buyers were the United Kingdom (39.2%), the United States (29.1%), Hong Kong (19.1%), the Republic of Korea (4.6%), Australia (3.9%), and Taiwan (3.8%) (Ministry of Finance, 2002a, p. 575).

Titanium.—In 2002, Japan was the world's largest producer of titanium sponge metal and accounted for 40.2% of the world total (Arumu Publishing Co. Ltd., 2003, p. 52). Japan also was one of the world's major producers of titanium dioxide pigment. All the raw material requirements for production of titanium sponge metal and dioxide pigment, however, were supplied by imports. Titanium ore (rutile) was consumed by the producers of titanium sponge metal. Ilmenite and titanium slag were 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.

Imports of titanium ore (rutile) decreased by 16.2% to 94,468 t because of lower titanium sponge production in 2002. The major suppliers were Australia (54.7%), India (24.9%), Canada (10.5%), and South Africa (9.6%). Imports of ilmenite decreased by 22.1%

to 290,755 t. The major suppliers were Vietnam (40.1%), Australia (34.6%), Malaysia (9.4%), Egypt (9.1%), and India (3.7%). Import bills for rutile and ilmenite totaled \$43.0 million and \$30.2 million, respectively, in 2002. No imports of titanium slag were reported (Ministry of Finance, 2002b, p. 170).

In 2002, production of titanium sponge decreased by 9.3% because of a sharp decline in exports to the European Union and the United States. Sumitomo Titanium Corp. (formerly Sumitomo Sitix Corp.; the name was changed in 2002) launched a \$29 million expansion project to add three reduction furnaces and auxiliary equipment at its Amagasaki plant near Osaka in Hyogo Prefecture. By the end of 2001, the expansion project was completed, and the capacity was boosted to 18,000 t/yr from 15,000 t/yr (Metal Bulletin, 2002f, g).

Total titanium sponge shipments decreased by 9.8% to 22,652 t in 2002. According to the Japan Titanium Society, domestic shipments of titanium sponge increased to 16,801 t in 2002 from 14,328 t in 2001. Exports of titanium sponge decreased to 5,851 t in 2002 from 10,779 t in 2001. Imports of titanium sponge increased slightly to 9,210 t in 2002 from 9,100 t in 2001. Total shipments of titanium mill products increased to 14,481 t in 2002 from 14,434 t in 2001; domestic shipments of titanium mill products decreased to 7,256 t from 7,307 t in 2001. Exports of titanium mill products increased to 7,225 t in 2002 from 7,127 t in 2001. Imports of titanium mill products increased to 1,389 t in 2002 from 1,223 t in 2001 (Arumu Publishing Co. Ltd., 2003, p. 52-53).

In the domestic market, according to the Japan Titanium Society, shipments of titanium mill products to chemical-plant and heat-exchange equipment manufacturers increased to 2,199 t in 2002 from 2,043 t in 2001. Shipments to power-generation and water-desalination plant manufacturers increased to 886 t in 2002 from 805 t in 2001. Shipments to the distributors decreased to 1,135 t in 2002 from 1,325 t in 2001. Shipments to consumer and sports leisure goods manufacturers decreased to 1,335 t in 2002 from 1,352 t in 2001. Shipments to aircraft manufacturers decreased to 447 t in 2002 from 554 t in 2001. Shipments to automobiles manufacturers increased to 571 t in 2002 from 499 t in 2001. Shipments to architectural and civil engineering materials manufacturers decreased to 43 t from 72 t in 2001. Shipments to the manufacturers of ship, marine, and energy materials increased to 194 t from 153 t in 2001 (Arumu Publishing Co. Ltd., 2003, p. 56).

According to Government trade statistics, exports of titanium sponge decreased by 46.1% to 5,996 t and totaled \$43.1 million in 2002. The major buyers were the United States (66.3%), the United Kingdom (22.0%), and the Republic of Korea (5.6%) (Ministry of Finance, 2002a, p. 586). Exports of titanium waste and scrap and titanium powder increased by 72.5% to 4,177 t and totaled \$17.8 million in 2002. The major buyers were the United States (73.9%), Taiwan (15.5%), the United Kingdom (3.4%), and Germany (2.7%). To meet the domestic requirements, Japan imported 9,680 t of lower grade titanium sponge, powder, waste and scrap, which were valued at \$74.6 million in 2002. The principal suppliers were Kazakhstan (35.3%), Russia (35.1%), and the United States (22.7%) (Ministry of Finance, 2002b, p. 670).

Imports of titanium mill products increased to 1,389 t in 2002 from 1,223 t in 2001 and were valued at \$51.2 million. The principal suppliers were the United States (46.7%), Russia (36.7%), China (8.5%), and Italy (3.1%) (Ministry of Finance, 2002b, p. 671). Exports of titanium mill products increased to 8,704 t in 2002 from 8,836 t in 2001 and were valued at \$202.6 million in 2002. The major buyers were Sweden (16.1%), Taiwan (12.4%), the Republic of Korea (11.2%), France (10.8%), Italy (8.1%), the United States (6.9%), Germany (6.2%), Hong Kong (5.0%), the Netherlands (4.3%), and Denmark (2.7%) (Ministry of Finance, 2002a, p. 586).

Production of titanium dioxide decreased by 6.4% because of the weaker demand in the domestic market despite a 10.6% increase in exports in 2002. According to Government statistics, the industry's capacity decreased by 2.6% to 317,400 t/yr in 2002 from 325,800 t/yr in 2001. The capacity utilization was 75.8% (Ministry of Economy, Trade and Industry, 2002b, p. 70, 238-239). According to the Japan Titanium Dioxide Industry Association, only six companies were operating in 2002, and the industry's total capacity was estimated to be 322,200 t/yr in 2002 (Arumu Publishing Co. Ltd., 2003, p. 57).

According to the Japan Titanium Dioxide Industry Association, total shipments of titanium dioxide to the domestic market decreased by 2.6% to 169,451 t. Of that total 73,705 t was for the manufacture of paints and coating materials; 34,279 t, printing inks and pigments; 18,476 t, papers; 18,307 t, synthetic resin (plastics); 2,833 t, chemical fibers; 2,668 t, rubber; 1,818 t, condenser; and 17,599 t, other end uses (Arumu Publishing Co. Ltd., 2003, p. 57).

Imports of titanium oxide decreased by 36.3% to 9,105 t in 2002 from 14,298 t in 2001 and were valued at \$11.9 million. The major suppliers were China (61.3%), the Republic of Korea (22.5%), France (6.6%), and Canada (2.6%) (Ministry of Finance, 2002b, p. 182). Exports of titanium oxides increased by 8.4% to 25,500 t in 2002 and were valued at \$67.3 million. The major buyers were China (35.2%), Taiwan (24.0%), the Republic of Korea (10.6%), the United States (6.1%), Indonesia (4.3%), the Netherlands (2.3%), and Germany (2.1%) (Ministry of Finance, 2002a, p.112-113).

Industrial Minerals

Cement.—In 2002, Japan was the world's fourth largest cement producer after China, India, and the United States (van Oss, 2003). Japan's cement production decreased by 6.2% to 71.8 Mt because of reduced public works budgets that generated about 60% of domestic cement demand. Japan's apparent consumption of cement decreased by 5.8% to 64.6 Mt from 68.6 Mt in 2000; and per capita apparent consumption decreased to 507 kg in 2002 from 539 kg in 2001. In 2002, Japan's cement industry comprised 20 producers (companies), which operated 35 plants with 62 kilns and had a total capacity of 78 Mt/yr. Japan's cement plants were concentrated mainly in the Chugoku (Kansai and Kanto) and the Kyushu areas where most of Japan's limestone reserves are located (Japan Cement Association, 2003a§, b§).

As a result of the continued consolidation in the cement industry, Japan's cement clinker capacity decreased to 82.9 Mt/yr in 2002 from 86.7 Mt/yr in 2001, and the number of regular employees in the cement industry decreased to 3,836 in 2002 from 4,013 in 2001.

Production of portland cement clinker decreased to 68.9 Mt in 2002 from 71.7 Mt in 2001, and that of cement decreased to 71.8 Mt in 2002 from 76.5 Mt in 2001. As a result, the cement capacity utilization rate dropped to 91.2 % in 2002 from 95.9% in 2001. In 2002, 50.1 Mt of ordinary portland cement was produced; 3.9 Mt, high early strength and moderate heat portland cement; 17.1 Mt, blast-furnace slag cement; 329,000 t, other cement; 211,000 t, flyash cement; and 76,000 t, white cement. The major raw materials consumed by the cement industry included 78.6 Mt of limestone, 10.6 Mt of clay, 6.3 Mt of silica stone, 5.9 Mt of blast furnace ore slag, and 2.6 Mt of gypsum (Ministry of Economy, Trade and Industry, 2002a, p. 63-67, 122-123, 127, 130).

Taiheiyo Cement Corp. reported net profit in its 2002 financial result for the first time after two consecutive years of net loss. The company, however, failed to gain the price-control power as widely anticipated following the merger of Chichibu Onoda Cement Corp. and Nihon Cement Co. Ltd. in October 1998. To improve its financial results through an increase in the rate of return on assets and to reduce fixed costs of interest-bearing debt, Taiheiyo Cement began implementing a management plan called Taiheiyo 04 Mid-Term Management Plan. Under this plan, Taiheiyo would further downsize its cement business activities because of reduced domestic cement demand, reduce costs by increasing use of recycled natural resources, and strengthen the existing overseas investment and export business activities (Taiheiyo Cement Corp., 2002§).

According to the Japan Cement Association (2003b§), domestic demand for cement decreased by 5.5% to 63.8 Mt, and exports of cement, which included clinker, increased by 9.2 % to 8.3 Mt in 2002. According to Government trade statistics, exports of cement clinker increased by 16.9% to 4.16 Mt. Exports of portland cement, however, decreased by 1.0% to 3.97 Mt. In the past 3 years, exports of cement clinker had been increasing, and those of portland cement, decreasing. The major buyers of cement clinker were China (37.4%), Hong Kong (27.7%), Australia (11.2%), Côte d'Ivoire (7.0%), Kenya (4.2%), Singapore (5.3%), Chile (3.5%), and Malaysia (3.2%). The major buyers of portland cement were Singapore (40.1%), Hong Kong (17.2%), Taiwan (9.9%), China (9.4%), the Republic of Korea (8.9%), and Nigeria (5.2%). Export earnings from portland cement and cement clinker were \$77.9 million and \$67.2 million, respectively. The average export f.o.b. (free-on-board) price of portland cement decreased to \$19.63 per metric ton in 2002 from \$22.69 per ton in 2001 (Ministry of Finance, 2002a, p. 100). Imports of cement, which included aluminous, portland, and white cement, decreased by 30.2% to 823,469 t. The principal suppliers were the Republic of Korea (97.0%), France (1.4%), and China (1.3%). The average import c.i.f. price of portland cement increased to \$42.82 per metric ton in 2002 from \$32.94 per ton in 2001 (Ministry of Finance, 2002b, p. 168).

Limestone.—Japan was self-sufficient in limestone in 2002. The country remained one of the world's top limestone producers, although production decreased by 5.7% owing to decreased consumption as raw materials for the cement production and as construction aggregates for public works projects by the construction industry. In Japan, most of the major limestone quarries were owned and operated by cement, construction, or steel companies (table 8).

Total sales (demand) of domestically produced limestone decreased to 179.1 Mt in 2002 from 187.2 Mt in 2001 mainly because of decreased consumption of limestone by the cement and construction industries in 2002 (Ministry of Economy, Trade and Industry, 2002d, p. 108).

In 2002, the country imported 308,395 t of limestone flux, limestone, and other calcareous stone mainly from Malaysia (35.6%), the Philippines (31.7%), Vietnam (28.6%), and China (3.7%). Japan exported 2.0 Mt of limestone flux, limestone, and other calcareous stone mainly to Taiwan (58.6%), Australia (28.1%), and the Republic of Korea (12.3%). Export earnings and import bills of limestone flux, limestone, and other calcareous stone were valued at \$13.9 million and \$9.3 million, respectively (Ministry of Finance, 2002a, p. 99; 2002b, p. 167).

Mineral Fuels

Coal.—Japan was the largest coal importer and one of the largest coal consumers in the world because of its large and growing demand for coal by the cement, paper, and power generation industries (U.S. Energy Information Administration, 2003§). Japan's coal production dropped to less than 1.5 Mt in 2002. Japan's coal import reliance was estimated to be 100% for coking coal and anthracite, and about 98.5% for steam (thermal) coal.

Coal was produced mainly by an underground mine operated by Kushiro Coal Mine Co. Ltd., which was established in February 2002 following the closure of Taiheiyo (Pacific) Coal Mining Co. Ltd. at the end of January 2002, in Kushiro, Hokkaido Prefecture, and 11 small-scale open pit mines (10 in Hokkaido Prefecture and 1 in Yamaguchi Prefecture).

According to the Japan Coal Energy Center, Taiheiyo Coal Mining Co. Ltd., which changed its name to Kushiro Coal Mine Co. Ltd. in February 2002, became a center for the implementation of transferring Japanese coal technology to large-scale coal-producing countries in Asia. In 2002, Japan produced about 1.37 Mt of coal, of which 762,751 t was produced from the Kushiro Mine and 604,709 t, from 11 small-scale open pit mines (Shinji, Tomita, Director, Planning Department, Japan Coal Energy Center, written commun., October 16, 2003).

To encourage the use of cleaner fuels like natural gas and to limit greenhouse emissions, the Ministry of Economy, Trade and Industry reportedly was considering a new tax on coal imports in September 2002. The Government intended to impose a tax on coal imports beginning April 1, 2003; details of the tax, however, were still undecided. The proposed new coal tax would affect the Australian coal producers most because Australia was Japan's largest coal supplier and accounted for more than 40% of Japan's total imports of coking coal and more than 65% of steam (thermal) coal in 2002 (Mining Journal, 2002b; Ministry of Finance, 2002b, p. 171; Environmental Finance News, 2002§).

In 2002, Japan's overall coal imports, which were based on trade statistics of the Ministry of Finance, increased by 1.8% to 158.6 Mt, of which 104.2 Mt was bituminous (steam; other than coking coal); 49.5 Mt, coking coal, and 4.9 Mt, anthracite. The total value

of imported coal was estimated to be \$6.26 billion. The major suppliers of coking coal were Australia (44.2%), Indonesia (23.5%), Canada (15.1%), China (9.7%), and Russia (5.1%). The major suppliers of bituminous were Australia (67.7%), China (20.3%), Indonesia (16.7%), Russia (3.7%), and Canada (1.7%). The major suppliers of anthracite were China (57.2%), Vietnam (29.0%), North Korea (7.2%), and Australia (5.1%). China gradually was gaining market share of Japan coal market by offering lower prices in 2002. The average c.i.f. import price of coking coal was \$45.00 per ton from China against \$47.98 per ton from Australia. The average c.i.f. import price of bituminous was \$36.03 per ton from China against \$37.32 per ton from Australia (Ministry of Finance, 2002b, p. 171).

Natural Gas and Petroleum.—In 2002, Japan was one of the world's top importers of natural gas and crude petroleum. Domestic production of natural gas and crude petroleum was insignificant because of its limited indigenous resources. Japan's natural gas and crude petroleum reserves were estimated to be 39.6 billion cubic meters and 58.5 million barrels (Mbbbl), respectively (Oil & Gas Journal, 2002a). In 2002, domestic production of natural gas and crude petroleum totaled about 2.6 billion cubic meters and 4.5 Mbbbl, respectively, compared with 79 billion cubic meters and 1,457 Mbbbl of domestic consumption of natural gas and crude petroleum (Ministry of Economy, Trade and Industry, 2002d, p. 24-25, 64-65, 94).

In 2002, Japan relied on imports to meet 96.7% of its domestic natural gas requirements and 99.7% of its crude petroleum requirements. Japan imported 76.1 billion cubic meters of natural gas in the form of LNG and 1,482 Mbbbl of crude petroleum (Ministry of Economy, Trade and Industry, 2002d, p. 32-34, 94).

According to the Government trade statistics, imports of LNG totaled 53,877,618 t, or 80.7 billion cubic meters, and were valued at \$11.9 billion in 2002. The suppliers of LNG were Indonesia (32.3%), Malaysia (19.8%), Australia (13.4%), Qatar (11.6%), Brunei (10.9%), the United Arab Emirates (8.2%), the United States (2.3%), and Oman (1.5%) (Ministry of Finance, 2002b, p.177). Crude petroleum imports were mainly from the Middle East (86.0%) and Asia (7.8), which included China and Southeast Asia. The major suppliers of crude petroleum were the United Arab Emirates (23.8%), Saudi Arabia (22.6%), Iran (12.7%), Qatar (9.6%), Kuwait (7.4%), Oman (5.3%), Neutral Zone (the area shared equally by Kuwait and Saudi Arabia) (4.3%), Indonesia (3.9%), and China (1.7%) (Ministry of Economy, Trade and Industry, 2002d, p. 32-34). Imports of crude petroleum were valued at \$36.3 billion (Ministry of Finance, 2002b, p. 172-173). The average monthly import c.i.f. price per barrel of crude petroleum was \$24.63 in 2002 compared with \$25.34 in 2001, and the average monthly import c.i.f. price per ton of LNG was \$220.58 (27,659 yen) in 2002 compared with \$237.85 (28,899 yen) in 2001 (Ministry of Economy, Trade, and Industry, 2002d, p. 122-123).

In 2002, refined petroleum products were produced by 18 oil companies that operated 32 refineries with a total capacity of 4.77 million barrels per day mostly along the eastern coast of Honshu (Oil & Gas Journal, 2002b).

In 2002, domestic demand for refined petroleum, by product, was as follows: heavy fuel oil, 413 Mbbbl; gasoline, 375 Mbbbl; naphtha, 300 Mbbbl; diesel (distillate fuel oil), 250 Mbbbl; kerosene, 184 Mbbbl; asphalt, 32 Mbbbl; jet fuel, 30 Mbbbl; lubricants, 17 Mbbbl; and paraffin, 905,600 barrels (bbl). To meet its domestic demand, Japan imported a total of 233 Mbbbl of refined petroleum products in 2002. The imported refined petroleum products included 188 Mbbbl of naphtha, 16 Mbbbl of kerosene, 11 Mbbbl of gasoline, 10 Mbbbl of heavy fuel oil, 7 Mbbbl of diesel, 642,000 bbl of jet fuel, 195,000 bbl of lubricants, 82,000 bbl of asphalt, and 38,900 bbl of paraffin (Ministry of Economy, Trade and Industry, 2002d, p. 68-69).

In 2002, consumption of domestically produced natural gas was by the gas industry (50.3%), the electric power industry (17.8%), the oil and gas industry (13.7%), the chemical industry (12.4%), and other manufacturing and service industries (5.8%). Additionally, Japan consumed 50.9 Mt, or 76.2 billion cubic meters, of imported natural gas in the form of LNG, of which about 69% was consumed by the electric power industry for power generation; 30%, for city gas industry; and 1%, for industrial use mainly by the iron and steel industry (Ministry of Economy, Trade and Industry, 2002d, p. 28-29, 95).

At the end of 2002, Japan's stockpile of crude petroleum, partially refined, and refined petroleum products totaled 171 days supply, of which the national stockpile was 92 days and the private stockpile, 78 days (Ministry of Economy, Trade and Industry, 2001d, p. 122-123).

Reserves

Japan's reserves of limestone and other industrial minerals, such as dolomite, iodine, pyrophyllite, and silica stone, are large. Coal reserves were substantial and very costly to produce in Japan. With the exception of gold and zinc, its ore reserves for metallic minerals and other minerals, especially oil and gas, are negligible (table 3).

Infrastructure

Japan had one of the most modern and complete infrastructures for its mining and mineral- processing industries in the world. Despite its small land area, Japan had a highway system of 1.15 million kilometers, of which 863,003 km was paved. The railroad network had 23,654 km, of which 20,491 km was 1.067-meter (m) narrow gauge (12,732 km electrified), 3,059 km was 1.435-m standard gauge (all electrified), 77 km is 1.372-m narrow gauge (all electrified), and 27 km is 0.762-m narrow gauge (all electrified). Highway and railroad networks link all major seaports and coastal cities on the four major islands. The networks also connect Honshu to the islands of Kyushu and Shikoku in the south and Hokkaido in the north by means of bridges and tunnels.

Japan's domestic and international telecommunication services were among the best in the world with satellite earth stations—five Intelsat (four Pacific Ocean and one Indian Ocean), one Intersputnik (Indian Ocean region), and one Inmarsat (Indian and Pacific

Ocean regions); submarine cables to China, the Philippines, Russia, and the United States (via Guam); and 73 Internet service providers (2000). For electric power transmission, Japan had a route length of 94,000 km and a circuit length of 166,000 km (2001). For power distribution, Japan's total length of line distances, which included high- and low-voltage, was 1.23 Mkm (2001); this was concentrated in the major industrial areas of Fukuoka, Hiroshima, Nagoya, Osaka, Takamatsu, Tokyo, and Toyama. Japan also had 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, crude petroleum, iron ore, LNG, nonferrous ore, and phosphate rock 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-Harima, 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 Hakodate, Muroran, and Tomakomai on Hokkaido.

Japan had 173 airports (2001); of those, 142 had paved runways and 31, unpaved runways. Japan also had 16 heliports (2001). The major international airports were Fukuoka, Haneda (Tokyo), Kansai, Nagoya, Narita (New Tokyo), and Osaka. Japan's round-the-clock airport, Kansai International, which opened in September 1994 sits on reclaimed offshore land in Osaka Bay.

Outlook

The Japanese economic recovery is expected to continue at a slow pace in 2003. The domestic mining activities are expected to hold steady in 2003 at about the same level as that in 2002. Metal production of copper and zinc is expected to increase slightly when the Japanese economy recovers. Demand for nonferrous metals in the domestic markets in 2003 is expected to be stronger than that of 2002. Production of crude steel is also expected to increase to more than the 110-Mt level because of the continued recovery in the Japanese economy and the economies of the Southeast Asian nations in 2003. Production of titanium sponge metal is expected to continue the 2002 downward trend or to remain at the same level as that of 2002 because of slow recovery of commercial airlines business, particularly in the United States. Production of cement and limestone is expected to continue the 2002 downward trend because of the continuing weak domestic demand owing to decreasing Government spending for public works projects.

To sustain its economic health and to prevent another economic recession, Japan is expected to continue exporting more ferrous and nonferrous metals and cement clinker and cement to China, the Republic of Korea, Taiwan, and ASEAN countries where the economies are expected to continue to improve in the coming years. Imports of coal, nonferrous metals, and other minerals are expected to increase slightly in 2003 when the activities of the manufacturing move to higher gear in 2003.

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 Australia, Canada, Chile, China, Indonesia, Mexico, Peru, the Philippines, 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 COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1998	1999	2000	2001	2002 ^p	
METALS						
Aluminum:						
Alumina, gross weight	thousand tons	359	335	369 ^r	331 ^r	333
Aluminum hydroxide, gross weight	do.	738	737	782	739 ^r	724
Metal:						
Primary:						
Regular grades	do.	16	11	7	7	6
High-purity	do.	35	35	41	27	40
Secondary ²	do.	1,155	1,158	1,214	1,171	1,239
Antimony:						
Oxide		10,197	10,348	11,051	8,789	9,052
Metal		170	178	146	101	183
Arsenic, high-purity ^c		110	110	100	100	100
Bismuth		479	481	520	551	474
Cadmium, refined		2,337	2,567	2,472	2,460	2,444
Chromium, metal ^c		900	700	750	1,350 ^r	1,600
Cobalt metal		329	247	311	350	354
Columbium (niobium) and tantalum, tantalum metal ^c		80	85	85	90	90
Copper:						
Mine output, Cu content		1,070	1,038	1,211	744	--
Metal:						
Blister and anode:						
Primary		1,171,657	1,256,276	1,331,352	1,328,489	1,317,291
Secondary		131,979	133,188	149,282	139,764	182,069
Total		1,303,636	1,389,464	1,480,634	1,468,253	1,499,360
Refined:						
Primary		1,149,266	1,215,248	1,290,091	1,287,165	1,211,111
Secondary		128,086	126,301	147,260	138,526	189,968
Total		1,277,352	1,341,549	1,437,351	1,425,691	1,401,079
Gallium metal:						
Primary ^c		6	12	14	8 ^r	8
Secondary		54	47	56	50 ^r	63
Germanium:						
Oxide ^c		10	10	10	10	10
Metal	kilograms	454	765	1,809	1,615	803
Gold:						
Mine output, Au content	do.	8,601	9,405	8,400	7,815	8,615
Metal:						
Primary	do.	129,859	147,719	146,061	155,826	144,748
Secondary ³	do.	19,288	20,107	19,280	19,831	22,000 ^e
Total	do.	149,147	167,826	165,341	175,657	166,748
Indium metal	do.	29,413	40,465	55,078	55,000 ^e	55,000 ^e

See footnotes at end of table.

TABLE 1--Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1998	1999	2000	2001	2002 ^p
METALS--Continued					
Iron and steel:					
Iron ore and iron sand concentrate:					
Gross weight	1,720	1,450	1,454	750	700 ^e
Fe content	699	589	523	258	240 ^e
Metal:					
Pig iron and blast furnace ferroalloys	74,981	74,520	81,071	78,836	80,979
Electric-furnace ferroalloys:					
Ferrochrome	142,931	119,777	130,074	111,167	91,937
Ferromanganese	334,081	315,152	337,694	368,293	356,717
Ferronickel	345,772	332,293	367,181	367,739	370,973
Ferrosilicon	951	1,452	--	--	--
Silicomanganese	70,886	65,744	67,926	62,238	70,965
Other:					
Ferromolybdenum	3,443	3,391	3,699	3,485	2,375
Ferrotungsten	61	43	42	109	9
Ferrovandium	4,073	3,349	4,108	3,613	3,592
Unspecified	1,101	6,077	7,171	5,733	6,376
Total	903,299	847,278	917,895	922,377	902,944
Steel, crude	93,548	94,192	106,444	102,866	107,745
Semimanufactures, hot-rolled:					
Ordinary steels	73,379	73,221	83,048	78,927	80,864
Special steels	14,774	14,224	15,747	15,835	17,443
Lead:					
Mine output, Pb content	6,198	6,074	8,835	4,997	5,723
Metal, refined:					
Primary	144,542	125,514	129,469	127,358	107,744
Secondary	157,555	167,915	182,209	175,088	178,016
Total	302,097	293,429	311,678	302,446	285,760
Magnesium metal, secondary	7,807	7,732	10,000 ^e	10,000 ^e	9,000 ^e
Manganese, oxide	52,341	57,993	63,379	51,095	45,867
Molybdenum metal	632	586	626	610	465
Nickel metal:					
Refined	29,397	30,481	36,230	32,526	32,303
Ni content of nickel oxide sinter	25,435	34,482	47,020	49,600	48,950
Ni content of ferronickel	69,202	67,166	74,753	68,113 ^r	74,418
Ni content of chemical	2,511	2,570	2,721 ^r	2,394 ^r	1,820
Total	126,545	134,699	160,724 ^r	152,633 ^r	157,491
Platinum-group metals:					
Palladium metal	4,151	5,354	4,712	4,805	5,618
Platinum metal	533	737	782	791	762
Rare-earth oxide ⁴	4,728	5,092	5,619	5,109	5,423
Selenium, elemental	550	546	612	735	752
Silicon, high-purity	5,340	3,844	4,688	4,334	4,457
Silver:					
Mine output, Ag content	94,472	94,004	103,781	80,397	81,416
Metal:					
Primary	2,203,697	2,257,888	2,384,739	2,293,028	2,259,551
Secondary ³	415,757	503,938	345,358	303,804	320,000 ^e
Total	2,619,454	2,761,826	2,730,097	2,596,832	2,579,551
Tellurium, elemental	39	35	36	39	29
Tin, metal, smelter	500	568	593	668	659

See footnotes at end of table.

TABLE 1--Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1998	1999	2000	2001	2002 ^p	
METALS--Continued						
Titanium:						
Dioxide	251,275	269,193	270,272	256,961	240,469	
Metal	24,182	18,898	19,458	24,815	22,500	
Tungsten metal	4,082	4,357	4,993	3,607	3,302	
Vanadium metal ^{e,5}	250	250	250	250	250	
Zinc:						
Mine output, Zn content	67,670	64,263	63,601	44,519	42,851	
Oxide	77,183	78,928	82,816	75,414	74,515	
Metal:						
Primary	513,916	524,979	541,704	541,277	547,183	
Secondary	138,771	158,637	157,047	142,777	126,723	
Total	652,687	683,616	698,751	684,054	673,906	
Zirconium oxide	7,270	7,660	8,540	7,930	8,500 ^e	
INDUSTRIAL MINERALS						
Asbestos ^e	18,000	18,000	18,000	18,000	18,000	
Bromine, elemental ^c	15,000	15,000	15,000	15,000	20,000	
Cement, hydraulic	thousand tons	81,328	80,120	81,097	76,550	71,828
Clays:						
Bentonite	443,566	428,247	415,115	405,738	400,000 ^e	
Fire clay, crude	577,666	558,110	506,314	475,665	480,000 ^e	
Kaolin	83,257	53,092	25,739	19,976	19,000 ^e	
Diatomite ^e	190,000	190,000	190,000	180,000	180,000	
Feldspar and related materials: ^e						
Feldspar	50,000	52,000	52,000	50,000	50,000	
Aplite	310,000	330,000	330,000	310,000	300,000	
Gypsum	thousand tons	5,305	5,549	5,917	5,874	5,644
Iodine, elemental	6,142	6,152	6,157	6,643	6,548	
Lime, quicklime	thousand tons	7,646	7,594	8,106	7,586 ^r	7,420
Nitrogen, N content of ammonia	do.	1,389	1,385	1,410	1,318	1,192
Perlite ^c	251,000	260,000	250,000	255,000	250,000	
Salt, all types	thousand tons	1,293	1,327	1,374	1,358 ^r	1,350 ^e
Silica sand	do.	6,650 ^r	6,088 ^r	6,121 ^r	5,768 ^r	4,884
Silica stone, quartzite	do.	16,235	15,548	15,578	14,213	13,571
Sodium compounds, n.e.s.:						
Soda ash	721,747	721,752	669,203	461,204	460,000 ^e	
Sulfate	177,407	174,139	163,057	146,780	137,713	
Stone, crushed and broken:						
Dolomite	thousand tons	3,873	3,648	3,539	3,389	3,450
Limestone	do.	183,955	180,193	185,569	182,255	171,948
Sulfur:						
S content of pyrite	do.	23	41	30	30	20
Byproduct of metallurgy	do.	1,322	1,363	1,384	1,319	1,326
Byproduct of petroleum	do.	2,081	2,054	2,071	2,024 ^r	1,865
Talc and related materials:						
Talc ^e	50,000	50,000	50,000	45,000	40,000	
Pyrophyllite	764,099	694,317	692,998	623,097	600,000 ^e	
Vermiculite ^e	15,000	15,000	15,000	15,000	15,000	

See footnotes at end of table.

TABLE 1--Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1998	1999	2000	2001	2002 ^p
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	723	761	788	742	755
thousand tons					
Coal, bituminous ⁶	3,663	3,906	3,126	3,198	1,367
do.					
Coke including breeze:					
Metallurgical	39,554	36,473	38,394	38,402	38,417
do.					
Gashouse including breeze	14	--	--	--	--
do.					
Gas, natural:					
Gross ⁷	2,301	2,280	2,453	2,521	2,571
million cubic meters					
Marketed	2,373	2,362	2,507	2,602	2,662
do.					
Petroleum:					
Crude	4,982	4,592	4,656	4,782	4,548
thousand 42-gallon barrels					
Refinery products:					
Gasoline:					
Aviation ^c	50	104	45	40	40
do.					
Other	347,422	353,730	356,530	364,714	364,129
do.					
Asphalt and bitumen	34,216	34,259	33,909	33,148	31,506
do.					
Distillate fuel oil	289,777	280,122	268,022	261,851	250,932
do.					
Jet fuel	66,205	65,732	66,828	67,320	65,263
do.					
Kerosene	174,133	167,744	175,399	176,655 ^r	169,472
do.					
Liquefied petroleum gas	55,413	56,187	56,926	59,902 ^r	53,592
do.					
Lubricants	16,541	16,939	16,677	16,304 ^r	16,630
do.					
Naphtha	113,234	113,080	112,935	116,122 ^r	119,298
do.					
Paraffin	807	842	837	806 ^r	800 ^e
do.					
Petroleum coke	4,117 ^r	3,710 ^r	4,247 ^r	4,700 ^r	4,500 ^e
do.					
Refinery fuel and losses ^{e, 8}	160,000	150,000	150,000	150,000	150,000
do.					
Residual fuel oil	451,494	435,916	429,153	409,780 ^r	398,673
do.					
Unfinished oils ^c	60,000	50,000	50,000	50,000	50,000
do.					
Total ^c	1,770,000	1,730,000	1,720,000	1,710,000	1,670,000

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

¹Table includes data available through November 7, 2003.

²Includes unalloyed ingot and alloyed ingot.

³Includes recovered from scrap and waste.

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

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

⁶Included small amount of anthracite in 1998 - 2001. All major coal mines had closed by January 2002, but 12 smaller mines still operated in 2002.

⁷Includes output from gas wells and coal mines.

⁸May include some additional unfinished oils.

Sources: Ministry of Economy, Trade and Industry (Tokyo). Yearbook of Iron and Steel, Non-ferrous Metal, and Fabricated Metals Statistics, 2002; Yearbook of Chemical Industries Statistics, 2002; Yearbook of Ceramics and Building Materials Statistics, 2002; and Yearbook of Mineral Resources and Petroleum Products Statistics, 2002; Japan Aluminum Association (Tokyo). Aluminum Statistics, 2003. Arumu Publishing Co. Ltd. Industrial Rare Metals, Annual Review, No. 119, 2003.

TABLE 2
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2002

(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 and Kanda, Fukuoka Prefecture	3,000
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.		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.	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		Kushiro Coal Mine Co. Ltd. ¹	Kushiro, Hokkaido Prefecture	800
Cobalt, refined	metric tons	Sumitomo Metal Mining Co. Ltd.	Niihama, Ehime Prefecture	600
Copper, refined	do.	Hibi Kyodo Smelting Co. Ltd. (Mitsui Mining and Smelting Co. Ltd., 64% ; Nittetsu Mining Co. Ltd., 20%; and Furukawa Co. Ltd., 16%)	Tamano, Okayama Prefecture	218,400
Do.	do.	Mitsubishi Materials Corp.	Naoshima, Kagawa Prefecture	225,600
Do.	do.	Nippon Mining and Metals Co. Ltd. (wholly owned subsidiary of Nikko Kyodo Co. Ltd.)	Hitachi, Ibaraki Prefecture; Saganoseki, Oita Prefecture	452,400
Do.	do.	Onahama Smelting and Refining Co. Ltd. (Dowa Mining Co. Ltd., 31.15%; Furukawa Co. Ltd., 8.31%; Furukawa Electric Co. Ltd., 4.17%; Mitsubishi Materials Corp., 49.29%; Mitsubishi Cable Industries, Ltd., 4.17%; and others, 2.91%	Onahama, Fukushima Prefecture	258,000
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Besshi, Ehime Prefecture	270,000
Do.	do.	Kosaka Smelting and Refining Co. Ltd. (wholly owned subsidiary of Dowa Mining Co. Ltd.)	Kosaka, Akita Prefecture	72,000
Gold:				
In concentrate	kilograms	Sumitomo Metal Mining Co. Ltd.	Hishikari, Kagoshima Prefecture	9,000
Refined	do.	Kosaka Smelting and Refining Co. Ltd. (wholly owned subsidiary of Dowa Mining Co. Ltd.)	Kosaka, Akita Prefecture	18,000
Do.	do.	Mitsui Mining and Smelting Co. Ltd.	Takehara, Hiroshima Prefecture	22,000
Do.	do.	Mitsubishi Materials Corp.	Naoshima, Kagawa Prefecture	60,000
Do.	do.	Nippon Mining and Metals Co. Ltd.	Hitachi, Ibaraki Prefecture	30,000
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Niihama, Ehime Prefecture	36,000

See footnotes at end of table.

TABLE 2--Continued
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2002

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
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
Do.		Taiheiyo Cement Co. Ltd.	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%, and Mitsubishi Corp., 11.2%)	Oami-Shirasato, and Ichinomya, Chiba Prefecture; and Sadowara, Miyazaki Prefecture	3,600
Do.	do.	Godo Shigen Sangyo Co. Ltd. (Kanto Natural Gas Development Co. Ltd., 11%, and Mitsui & Co. Ltd., 10%)	Chosei, Chiba Prefecture	2,400
Do.	do.	Kanto Natural Gas Development Co. Ltd. (Mitsui Chemicals, Inc., 21.9%, and Godo Shigen Sangyo Co. Ltd., 14.3%)	Mobara, Chiba Prefecture	1,200
Do.	do.	Nihon Tennen Gas Co. Ltd. (Kanto Natural Gas Development Co. Ltd. 50%, and Tomen Corp., 41%)	Shirako and Yokoshiba, Chiba Prefecture	1,200
Do.	do.	Toho Earthtech, Inc. (Itoshi Corp., 34.1%; Mitsubishi Gas Chemical Co. Ltd., 32.2%; and Nippon Light Metal Co. Ltd., 31.1%)	Kurosaki, Niigata Prefecture	720
Do.	do.	Nippon Chemicals Co. Ltd. (Nippon Shokubai Co. Ltd., 17%; Takeda Chemical Industries Ltd., 16.4%; and Chugai Boyeki Co. Ltd., 13.6%)	Isumi, Chiba Prefecture	720
Lead:				
In concentrate		Toyoha Mining Co. Ltd. (wholly owned subsidiary of Nippon Mining and Metals Co. Ltd.)	Toyoha, Hokkaido Prefecture	7
Refined	metric tons	Kamioka Mining and Smelting Co. Ltd.	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 Smelting and Refining Mining Co. Ltd. (wholly owned subsidiary of Mitsubishi Materials Corp.) ²	Hosokura, Miyagi Prefecture	21,600
Manganese:				
In electrolytic dioxide ³		Mitsui Mining and Smelting Co. Ltd.	Takehara, Hiroshima Prefecture	25
Do.		Tosoh Corp.	Hyuga, Miyazaki Prefecture	34

See footnotes at end of table.

TABLE 2--Continued
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2002

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Nickel:				
In ferronickel	metric tons	Hyuga Smelting Co. Ltd. (wholly owned subsidiary of Sumitomo Metal Mining Co. Ltd.)	Hyuga, Miyazaki Prefecture	19,000
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
Titanium:				
In sponge metal		Sumitomo Sitix Corp. (Sumitomo Metal Industries, Ltd., 92.4%, and Kobe Steel Ltd., 7.6%)	Amagasaki, Hyogo Prefecture	18
Do.		Toho Titanium Co. Ltd. (Nippon Mining and Metals Co. Ltd., 47%; Mitsui & Co. Ltd., 20%; and others, 33%)	Chigasaki, Kanagawa Prefecture	12
In dioxide	metric tons	Fuji Titanium Industry Co. Ltd. (Ishihara Sangyo Kaishia Ltd., 24.8%, and others, 75.2%)	Kobe, Hyogo Prefecture	17,400
Do.	do.	Furukawa Co. Ltd.	Osaka, Osaka Prefecture	13,200
Do.	do.	Ishihara Sangyo Kaisha 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		Toyoha Mining Co. Ltd.	Toyoha, Hokkaido Prefecture	45
Refined	metric tons	Akita Smelting Co. Ltd. (Dowa Mining Co. Ltd., 57%; Nippon Mining and Metals Co. Ltd., 24%; Sumitomo Metal Mining Co. Ltd., 14%; and Mitsubishi Materials Corp., 5%)	Iijima, Akita Prefecture	200,400
Do.	do.	Hachinohe Smelting Co. Ltd. (Mitsui Mining and Smelting Co. Ltd., 57.7%; Nippon Mining and Metals Co. Ltd., 27.8%; and Toho Zinc Co. Ltd. and Nisso Smelting Co. Ltd., 14.5%)	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.	Toho Zinc Co. Ltd.	Annaka, Gunma Prefecture	139,200
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Harima, Hyogo Prefecture	90,000

¹Coal mining operation continued, following establishment of Kushi Coal Mining Co. Ltd. in 2002.

²Mitsubishi Materials Corp. suspended operations of its secondary lead smelter at Hosokura in June 2002.

³Japan Metal & Chemical Co. Ltd. ceased operations of its Takaoka plant at the end of 2001.

TABLE 3
JAPAN: RESERVES OF MAJOR MINERAL COMMODITIES IN 2002

(Thousand metric tons unless otherwise specified)

Commodity	Reserves
Coal ¹	785,000
Copper ore, Cu content	40
Dolomite ²	1,400,000
Gold ore, Au content kilograms	179,000
Iodine	5,000 ^e
Lead ore, Pb content	600
Kaolin	35,000
Limestone ³	60,000,000
Pyrophyllite	160,000
Silica sand ⁴	201,000
Silica stone, white ⁵	881,000
Silver ore, Ag content	2,400
Zinc ore, Zn content	3,200

^eEstimated.

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

²Average ore grade is 17.9% MgO.

³Average ore grade is 53.8% CaO.

⁴Average ore grade is 78.0% SiO₂.

⁵Average ore grade is 92.8% SiO₂.

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

TABLE 4
JAPAN: MINERALS TRADE¹

(Millions of U.S. dollars)

Code	Commodity Description	Imports			Exports		
		2000	2001	2002	2000	2001	2002
25	Salt, sulfur, earths and stone, lime, plastering materials, cement	1,464	1,345	1,176	312	286	301
26	Ferrous and nonferrous metal ores, slag, ash	7,004	6,486	6,511	35	29	30
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes	77,478	70,368	65,664	1,520	1,508	1,403
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements, or of isotopes	3,536	2,941	2,942	2,114	1,814	1,934
31	Fertilizers	529	482	526	93	81	84
68	Articles of stone, plaster, cement, asbestos, mica or similar materials	1,027	1,062	1,085	949	831	855
69	Ceramic products	634	643	647	1,364	1,100	860
70	Glass and glassware	1,422	1,218	1,202	2,711	2,326	2,413
71	Natural or cultured pearls, precious or semi-precious, precious metals, metals clad with precious metals, and articles thereof; imitation jewellery; coin	7,432	5,937	5,698	1,940	1,698	1,636
72	Iron and steel	3,445	2,481	2,185	12,957	11,159	13,160
73	Articles of iron and steel	2,232	2,363	2,455	5,426	5,708	5,821
74	Copper and articles thereof	1,127	812	692	2,579	2,247	2,270
75	Nickel and articles thereof	1,463	905	927	415	311	324
76	Aluminum and articles thereof	5,564	4,879	4,533	1,625	1,323	1,434
78	Lead and articles thereof	27	36	19	13	9	20
79	Zinc and articles thereof	124	89	41	95	88	107
80	Tin and articles thereof	175	115	113	50	46	53
81	Other base metals; cermet; articles thereof	838	766	622	591	619	540
	Total, minerals trade	115,521	102,928	97,038	34,789	31,183	33,245
	Total, Japan merchandise trade	379,763	349,099	337,550	479,167	403,121	416,538

¹Values have been converted from Japanese yen (¥) to U. S. dollars at the rate of ¥107.8=US\$1.00 for 2000, ¥121.5=US\$1.00 for 2001, and ¥125.4 for 2002.

Source: Ministry of Finance, Japan Exports & Imports, Commodity by Country, December 2000-2002.

TABLE 5
JAPAN: OVERSEAS ALUMINUM SMELTING PROJECTS, 2002

Company name (project name) and country	Annual capacity (metric tons)		Type of power	Production started	Shipment to Japan started	Shipment to Japan 2002 ^e (metric tons)	Major equity holder and/or other holders	Participated Japanese companies and their equity share
	Total	Japanese share						
New Zealand Aluminium Smelters Ltd. (NZAS), New Zealand	313,000	67,600	Hydro	April 1971	July 1971	66,000	Comalco New Zealand Ltd., 79.36%	Sumitomo Chemical Co. Ltd., 20.64%.
Alcan Smelters and Chemical Ltd. (ALPAC), Canada	90,000	45,000	do.	Unknown	January 1977	35,000	Alcan Aluminum Ltd. of Canada, 50%	Nippon Light Metal Co. Ltd., 50%.
Intalco Aluminum Corp.	272,000	106,000	do.	1966	Unknown	84,000	Alcoa Inc., 61%	Mitsui & Co., Ltd., 32% and YKK Corp., 7%.
Eastalco Aluminum Co. (ALUMAX) ¹ , United States	174,000	68,000	Thermal	1970				
Industria Venezolana de Aluminio C.A. (VENALUM), Venezuela	450,000	90,000	Hydro	February 1978	December 1978	130,000	Corp. Venezolana de Guayana (CVG), of Venezuela, 80%	Showa Denko K.K., 7%; Sumitomo Chemical Co. Ltd., 4%; Kobe Steel Ltd., 4%; Mitsubishi Materials Corp., 3%; Mitsubishi Aluminum Co. Ltd., 1%; and Marubeni Corp., 1%.
P.T. Indonesia Asahan Aluminum (ASAHAN), Indonesia	225,000	133,000	do.	February 1982	October 1982	115,000	Indonesian Government, 41%	Nippon Asahan Aluminium Co. Ltd. (a 13-member Japanese consortium), 59%.
Boyne Island Smelter Ltd.: (BOYNE reduction lines 1, 2), Australia	260,000	130,000	Thermal	do.	July 1982	238,000 ²	Comalco Ltd. of Australia, 59.5%	Sumitomo Light Metal Co. Ltd., 17%; Ryowa Development Pty. Ltd., 9.5%; YKK Aluminum Pty. Ltd., 9.5%; and Sumitomo Chemical Co. Ltd., 4.5%.
(BOYNE reduction line 3), Australia	230,000	94,000	do.	July 1997	October 1997		Comalco Ltd. of Australia, 59.25%	Sumitomo Light Metal No. 2 Co. Pty. Ltd., 17%; Ryowa Development II Pty. Ltd., 14.25%; and YKK Aluminium Pty. Ltd., 9.5%.
Alcoa of Australia Ltd. (PORTLAND), Australia	350,000	80,500	do.	November 1986	Unknown	78,000	Alcoa of Australia, 45%; Eastern Aluminum Co., 10%; China International Trust & Investment Corp., 22%	Marubeni Corp., 23%.
Aluminio Brasileiro S.A. (ALBRAS), Brazil	345,000	169,000	Hydro	July 1985	November 1986	175,000	Companhia Vale do Rio Doce, 51%	Nippon Amazon Aluminum Co. (a 32-member Japanese consortium), 49%.
Mozambique Aluminum Co. (MOZAL 1), ³ Mozambique	250,000	63,000	do.	June 2000	Unknown	63,000	Billiton plc, 47.11%; Industrial Development Corp. of South Africa, 24.04%; the Government of Mozambique, 3.85%	Mitsubishi Corp., 25%.
Aluminerie Alouette Inc. (ALOUETTE), ⁴ Canada	230,000	46,000	do.	June 1992	September 1992	48,000	Alcan, 40%; Austria Metal AG, 20%; Norsk Hydro, 20%; Societe Generale de Financement du Duebec, 13.33%	Marubeni Corp., 6.67%.

^eEstimate based on Japanese fiscal year ending March of the following year.

¹The two smelters under the company ALUMAX were acquired by Alcoa Inc. in July 1998.

²Shipment to Japan included from Boyne reduction lines 1, 2, and 3.

³Phase 2 (MOZAL 2) will add an additional 253,000 metric tons per year of aluminum capacity by 2003.

⁴Capacity would be expanded to 500,000 metric tons per year in fall 2005.

Source: Japan Aluminum Association, Japan Overseas Aluminum Smelting Projects; U.S. Geological Survey, Primary Aluminum Plant Worldwide—1998, Part I—Detail, p. 4, 22, and 155; Marubeni Corp.

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

(Thousand metric tons)

End use	1998	1999	2000	2001	2002
Automobiles:	10,593	10,574	11,970	12,020	13,300
Ordinary steel	8,314	8,211	9,310	9,430	10,310
Specialty steel	2,279	2,363	2,660	2,590	2,990
Construction:	13,633	14,074	14,840	14,270	14,220
Ordinary steel	12,945	13,360	14,060	13,550	13,580
Specialty steel	688	714	780	720	640
Conversion and processing:	5,828	6,171	6,490	6,170	6,350
Ordinary steel	2,848	3,079	3,090	2,910	2,790
Specialty steel	2,980	3,092	3,400	3,260	3,560
Electric machinery and equipment:	2,106	2,062	2,330	2,070	1,970
Ordinary steel	2,003	1,954	2,190	1,940	1,840
Specialty steel	103	108	140	130	130
Home and office appliances:	709	697	810	760	740
Ordinary steel	523	522	610	550	540
Specialty steel	186	175	200	210	200
Industrial machinery and equipment:	2,267	2,167	2,400	2,230	2,340
Ordinary steel	1,284	1,171	1,330	1,290	1,360
Specialty steel	983	996	1,070	940	980
Shipbuilding and marine equipment:	3,242	2,950	3,250	3,620	3,600
Ordinary steel	3,166	2,881	3,130	3,480	3,420
Specialty steel	76	69	120	140	180
Steel dealers:	19,114	19,176	21,310	19,160	18,690
Ordinary steel	17,994	18,099	20,030	17,930	17,480
Specialty steel	1,120	1,077	1,280	1,230	1,210
Tanks and containers:	1,789	1,763	1,760	1,640	1,580
Ordinary steel	1,769	1,750	1,740	1,620	1,560
Specialty steel	20	13	20	20	20
Other:	637	596	720	680	610
Ordinary steel	531	488	610	570	500
Specialty steel	106	108	110	110	110
Total domestic demand	59,918	60,225	65,880	62,620	63,400
Ordinary steel	51,377	51,510	56,100	53,270	53,380
Specialty steel	8,541	8,715	9,780	9,350	10,020

Source: The Japan Iron and Steel Federation. The Steel Industry of Japan 2003; Monthly Report of the Iron and Steel Statistics, v. 46, no. 7, July 2003, p. 10-11.

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

(Thousand metric tons)

Destinations	1998	1999	2000	2001	2002
Asia:	15,556	20,729	22,405	23,037	30,339
China	2,477	2,960	4,062	4,566	6,532
Hong Kong	1,568	1,641	1,735	1,363	1,542
Korea, Republic of	2,756	5,366	6,029	6,537	9,198
Malaysia	1,138	1,616	1,464	1,515	1,704
Taiwan	2,959	3,080	2,557	2,528	3,263
Thailand	1,749	2,553	2,793	2,572	3,350
Singapore	918	900	776	700	760
Other countries	1,991	2,613	2,989	3,256	3,990
Middle East	1,146	1,283	1,090	1,523	1,074
Europe	1,192	1,004	854	1,193	715
Americas:	8,914	4,313	4,000	3,808	3,097
Argentina	96	90	8	55	62
Brazil	65	34	41	31	44
Canada	592	443	499	244	315
Colombia	178	110	176	246	190
United States	7,020	2,803	2,137	2,206	1,485
Venezuela	94	30	52	57	38
Other countries	869	803	1,087	969	963
Africa	409	339	371	365	432
Oceania:	434	544	441	553	666
Australia	381	483	382	498	593
New Zealand	47	57	50	43	63
Other countries	6	4	9	12	10
Total	27,651	28,212	29,161	30,478	36,323

Source: The Japan Iron and Steel Federation, Monthly Report of the Iron and Steel Statistics, v. 46, no. 7, July 2003, p. 14-17.

TABLE 8
JAPAN: MAJOR LIMESTONE PRODUCERS

(Thousand metric tons)

Company	Location		Production	
	Prefecture	Mine	2000	2001
Taiheiyo Cement Co. Ltd. (formerly Chichibu Onoda Cement Co. Ltd.)	Oita	Ganji	9,983	8,814
Do.	do.	Tsukumi	9,224	4,502
Do.	Hokkaido	Garō	8,325	8,929
Do.	Iwate	Oofunato	4,423	3,922
Do.	Saitama	Minowa, Taiheiyo Buko	3,876	2,839
Do.	Guma	Kanoyama	2,962	2,851
Do.	Kochi	Tosayama	2,891	3,029
Do.	Yamaguchi	Shigeyasu	2,200	2,030
Do.	Fukuoka	Kawara	2,098	--
Total			43,884	36,916
Nittetsu Mining Co. Ltd.	Kochi	Torigatayama	12,627	13,707
Do.	Aomori	Shiriya	4,690	5,425
Do.	Tochigi	Hanezuru	3,190	3,335
Total			20,507	22,467
Todaka Mining Co. Ltd.	Oita	Todaka Tsukumi	11,520	12,041
Ube Kosan Co. Ltd.	Yamaguchi	Ube Isa	8,841	9,258
Mitsubishi Materials Corp.	Fukuoka	Higashitani	8,363	8,995
Shuho Mining Co. Ltd.	do.	Sumitomo Cement Shuho	8,007	8,460
Sumikin Mining Co. Ltd.	Aomori	Hachinohe Sekkai	5,315	6,036
Ishizaki Co. Ltd.	Mie	Fujiwara	3,797	4,944
Mitsui Mining Co. Ltd.	Fukuoka	Sekinoyama	3,553	3,674
Sumitomo Osaka Cement Co. Ltd.	Shiga	Ibuki	1,743	--
Do.	Tochigi	Karasawa	1,641	1,731
Total			3,384	1,731
Boku Mining Co. Ltd.	Saitama	Buko	--	2,839
Ryoko Lime Industries Co. Ltd.	do.	Une	4,056	3,812
Denki Kagaku Industries Co. Ltd.	Niigata	Omi	3,389	3,488
Ryukiu Cement Co. Ltd.	Okinawa	Awa	2,968	2,632
Oita Mining Co. Ltd. (formerly Furukawa Co. Ltd.)	Oita	Oita	2,626	2,432
Yabashi Ryutaro	Gifu	Kinsyozan Sekkaiseki	2,289	2,439
Funao Mine Co. Ltd.	Fukuoka	Funao	2,268	2,299
Gikenkomusho Co. Ltd.	Fukuoka	Ube Kanda	2,149	2,352
Myojo Cement Co. Ltd.	Niigata	Tomi	2,048	2,473
Yoshizawa Lime Industries Co., Ltd.	Tochigi	Okano	1,321	1,417
Okutama Industries Co. Ltd.	Tokyo	Hikawa	1,108	1,141
Total of 21 companies			141,393	141,846
Grand total for Japan			185,569	182,255

-- Zero.

Source: Research Institute of International Trade and Industry (Chosakai), Mining Handbook (Kogyo Benran), 2000-2001.

TABLE 9

JAPAN: MAJOR OVERSEAS DEVELOPMENT PROJECTS OF NONFERROUS METALS MINES IN THE 1990s, AN UPDATE IN 2002

Item	Location and name of the project			
	Northern Territory, Australia McArthur River	New South Wales, Australia Northparkes	British Columbia, Canada Mount Polley ¹	British Columbia, Canada Huckleberry
Nature of project involvement	Investment in exploration and development	Investment in exploration and development	Equity participation	Equity participation and provided loan
Participating 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 Oceania Pty., 13.3%; and SC Mineral Resources Ltd. of Australia, 6.7%	Sumitomo Corp., 0% ²	Mitsubishi Materials Corp., 31.25%; Dowa Mining Co. Ltd., 6.25%; Furukawa Co. Ltd., 6.25%; and Marubeni Corp., 6.25%
Majority equity holder and/or other equity holder	Mount Isa Mines Ltd. of Australia, 70%	North Broken Hill Peko Ltd. of Australia, 80%	Imperial Metals Corp. of Canada, 100% ²	Princeton Mining Corp. of Canada, 50%
Mineral commodity involved	Lead, silver, and zinc	Copper and gold	Copper and gold	Copper
Estimated reserves and ore grade	40 million metric tons, 5.5% lead, 12.6% zinc, 55 grams per metric ton silver	63.7 million metric tons, 1.108% copper, 0.487 gram per metric ton gold	81.5 million metric tons, 0.3% copper, 0.42 gram per metric ton gold	56.5 million metric tons, 0.494% copper, 0.014% molybdenum
Type of mine	Underground	Open pit and underground	Open pit	Open pit
Total cost of the project	\$246 million (Australian)	\$303 million (Australian)	\$123 million (Canadian)	\$136 million (Canadian)
Japanese share	\$22 million (Australian)	\$75.6 million (Australian)	\$109 million (Canadian)	\$78 million (Canadian)
Annual production capacity	1,270,000 metric tons of crude ore containing 6.1% lead, 15.4% zinc	3,934,000 metric tons of crude ore containing 1.73% copper plus 0.88 gram per ton gold	6,500,000 metric tons of crude ore	7,145,600 metric tons of crude ore containing 0.502% copper, 0.013% molybdenum
Annual shipment to Japan	3,284 metric tons of lead and 17,999 metric tons of zinc in mixed concentrate	27,985 metric tons of copper in concentrate	15,000 metric tons of copper in concentrate plus gold value	28,277 metric tons of copper in concentrate
Construction started	August 1993	May 1993	September 1996	1996
Production started or planned	September 1995	October 1995	June 1997	October 1997

See footnotes at the end of table.

TABLE 9--Continued
 JAPAN: MAJOR OVERSEAS DEVELOPMENT PROJECT OF NONFERROUS METALS MINES IN THE 1990s, AN UPDATE IN 2002

Item	Location and name of the project			
	Region III, Chile	Region I, Chile	Region IV, Chile	Region III, Chile
	La Candelaria	Collahuasi	Los Pelambres	El Bronce
Nature of project involvement	Investment in exploration and development	Equity participation and provided loan	Equity participation	Investment in exploration and development
Participating Japanese companies and their equity share	Sumitomo Metal Mining Arizona Inc., 15%; and Sumitomo Corp., 5%	Mitsui and Co. Ltd., 6.9%; Mitsui Mining and Smelting Co. Ltd., 1.5%; and Nippon Mining and Metals Co., Ltd., 3.6%	Nippon Mining and 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%
Major equity holder and/or other equity holder	Phelps Dodge Corp. of the United States, 80%	Falconbridge Ltd. of Canada, 44%, and Anglo American plc of the United Kingdom, 44%	Antofagasta plc of the United Kingdom, 55.55%, and Ananconda Chile S.A. of Chile, 9.45%	El Bronce SA of Chile, 40%
Mineral commodity involved	Copper and gold	Copper	Copper	Copper
Estimated reserves and ore grade	366 million metric tons, 0.84% copper, 0.205 gram per metric ton gold	1,867.7 million metric tons, 0.93% copper	1,139.7 million metric tons, 0.74% copper	50 million metric tons, 1.6% copper
Type of mine	Open pit	Open pit	Open pit	Underground
Total cost of the project	\$592 million	\$1,760 million	\$1,355 million	\$132 million
Japanese share	\$296 million	\$174 million	\$835 million	\$116 million
Annual production capacity	10,000,000 metric tons of crude ore	25,600,000 metric tons of crude ore	34,000,000 metric tons of crude ore	1,820,000 metric tons of crude ore
Annual shipment to Japan	90,801 metric tons of copper in concentrate	94,591 metric tons of copper in concentrate	167,282 metric tons of copper in concentrate	10,000 metric tons of copper in concentrate
Construction started	April 1993	1996	November 1997	May 1999
Production started or planned	March 1995	January 1999	April 2000	2002

See footnotes at the end of table.

TABLE 9--Continued
 JAPAN: MAJOR OVERSEAS DEVELOPMENT PROJECT OF NONFERROUS METALS MINES IN THE 1990S, AN UPDATE IN 2002

Item	Location and name of the project			
	Sumbawa Island, Indonesia	Mexico, Mexico	Guerrero, Mexico	Ancash, Peru
	Batu Hijau	Tizapa	Rey de Plata	Antamina
Nature of project involvement	Equity participation	Investment in exploration and development	Investment in exploration and development	Investment in exploration and development
Participating Japanese companies and their equity share	Sumitomo Corp., 26%; Sumitomo Metal Mining Co. Ltd., 5.0%; Mitsubishi Materials Corp., 2.5%; and 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%
Majority equity holder and/or other equity holder	Newmont Gold Co. of the United States, 45%, and P.T. Pukuafu Indah of Indonesia, 20%	Industrias Penoles SA de C.V. of Mexico, 51%	Industrias Penoles SA de C.V. of Mexico, 51%	Noranda Inc. of Canada and Billiton plc of the U.K. 33.75% each; and Teck, & Cominoco Ltd. of Canada, 22.5%
Mineral commodity involved	Copper and gold	Copper, lead, and zinc	Copper, lead, and zinc	Copper and zinc
Estimated reserves and ore grade	907.3 million metric tons, 0.44% copper, 0.377 gram per metric ton gold	2.5 million metric tons, 0.61% copper, 1.36% lead, 6.56% zinc plus gold and silver	2.9 million metric tons, 0.68% copper, 2.56% lead, 8.78% zinc plus gold and silver	559 million metric tons, 1.23% copper, 1.03% zinc, and 0.03% molybdenum
Type of mine	Open pit	Underground	Underground	Open pit
Total cost of the project	\$1,925 million	\$38.2 million	\$45.4 million	\$2,296 million
Japanese share	\$513 million	\$35.1 million	\$41.3 million	\$404 million
Annual production capacity	43,870,000 metric tons of crude ore containing 0.75% copper and 0.44 grams per metric ton gold	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	101,492 metric tons of copper in concentrate	22,151 metric tons of zinc in concentrate	21,985 metric tons of zinc in concentrate	10,579 metric tons of copper in concentrate
Construction started	September 1996	May 1992	January 1998	1998
Production started or planned	October 1999	November 1994	October 2000	June 2001

¹Mining operations at Mount Polley were suspended in September 2001 owing to continued low copper and gold prices.

²SC Minerals Canada Ltd. (a wholly owned subsidiary of Sumitomo Corp.) sold its 47.5% interest in Mount Polley Copper Project to Imperial Metals Corp. of Canada for \$4.5 million by the end of 2000.

Sources: Research Institute of Economy, Trade and Industry (Chosakai), Mining Handbook (Kogyo Benran), 2002, p. 210-217.

TABLE 10
JAPAN: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2000	2001	Destinations, 2001	
			United States	Other, principal
METALS				
Alkali and alkaline-earth metals	1,873	404	17	China 174; India 124; Republic of Korea 66.
Aluminum:				
Ore and concentrate	300	660	--	Taiwan 600; Republic of Korea 60.
Oxides and hydroxides	337,317	101,333	2,979	Republic of Korea 55,634; Taiwan 13,274; China 11,539.
Ash and residue containing aluminum	10,150	9,159	--	China 5,500; North Korea 2,161; Taiwan 893.
Metal including alloys:				
Scrap	34,673	52,674	42	China 45,961; Hong Kong 3,390; Republic of Korea 849.
Unwrought	10,002	12,567	418	Republic of Korea 3,133; Indonesia 2,598; Philippines 1,295.
Semimanufactures	311,679	273,008	14,571	China 68,553; Taiwan 43,435; Thailand 27,633.
Antimony:				
Oxides	2,321	1,924	36	Republic of Korea 328; Taiwan 269; Thailand 237.
Metal including alloys, all forms ²	180	162	1	Thailand 97; Spain 54.
Arsenic, metal including alloys, all forms	42	29	24	United Kingdom 2; Germany 1.
Beryllium, metal including alloys, all forms	8	6	1	China 1; Hong Kong 1; Taiwan 1.
Bismuth, metal including alloys, all forms ²	3	31	3	Belgium 25; Republic of Korea 1.
Cadmium, metal including alloys, all forms	(3)	57	(3)	Netherlands 40; Hong Kong 15.
Chromium:				
Ore and concentrate	8,322	65	--	Republic of Korea 25; Philippines 20; Taiwan 20.
Oxides and hydroxides	4,932	1,606	880	Taiwan 248; Republic of Korea 224; France 85.
Metal including alloys, all forms	218	226	46	Republic of Korea 107; Taiwan 56; Netherlands 5.
Cobalt:				
Oxides and hydroxides	234	380	1	Republic of Korea 182; China 110; Taiwan 29.
Metal including alloys, all forms	1,106	1,342	140	Canada 550; Hong Kong 212; China 123.
Columbium and tantalum, tantalum metal including alloys, all forms				
	385	348	93	China 75; Germany 63; United Kingdom 58.
Copper:				
Oxides and hydroxides	1,961	1,736	4	Singapore 775; China 447; Republic of Korea 372.
Sulfate	3,330	2,922	40	Taiwan 2,040; Hong Kong 306; Republic of Korea 173.
Metal including alloys:				
Scrap	110,853	156,490	77	China 146,936; Hong Kong 4,324; Taiwan 2,462.
Unwrought	82,714	45,137	(3)	Republic of Korea 42,326; Taiwan 2,124; Hong Kong 469.
Semimanufactures	329,287	268,343	27,009	China 45,509; Malaysia 37,230; Republic of Korea 29,173.
Germanium, metal including alloys, all forms	1	(3)	(3)	
Gold:				
Waste and scrap	kilograms	528	48	--
Metal including alloys, unwrought and partly wrought	do.	69	70	7
Iron and steel:				
Iron ore and concentrate		78,831	60,442	10
Metal:				
Scrap	thousand tons	2,895	6,151	33
Pig iron, cast iron, related materials	do.	224	532	(3)
Ferroalloys:				
Ferrosilicon		2,541	2,686	2,308
Ferromanganese		44,248	28,018	--
Ferromolybdenum		22	21	--
Ferronickel		114,828	121,708	--
Ferrosilicomanganese		4,928	431	--
Ferrosilicon		4,883	4,287	(3)
Silicon metal		489	464	5
Unspecified		3,592	3,449	2,000

See footnotes at end of table.

TABLE 10--Continued
JAPAN: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2000	2001	Destinations, 2001		
			United States	Other, principal	
METALS--Continued					
Lead:					
Oxides	112	246	4	Germany 108; Taiwan 64; Republic of Korea 26.	
Ash and residue containing lead	61	--	--		
Metal including alloys:					
Scrap	5,164	3,857	--	Republic of Korea 3,739; India 82; Thailand 20.	
Unwrought	6,475	6,729	--	China 3,127; Malaysia 2,134; Taiwan 873.	
Semimanufactures	644	488	16	China 195; Malaysia 98; Taiwan 78.	
Lithium:					
Oxide and hydroxide	24	22	2	Taiwan 6; Hong Kong 5; China 4.	
Magnesium, metal including alloys:					
Scrap	43	210	4	China 104; United Kingdom 72; Russia 29.	
Unwrought	143	121	13	Taiwan 81; Norway 22; China 3.	
Semimanufactures	1,241	829	(3)	Taiwan 790; Singapore 20; Malaysia 4.	
Manganese:					
Ore and concentrate:					
Battery-grade	--	2,922	--	All to China.	
Oxides	2,370	2,358	72	China 1,554; Republic of Korea 448; Taiwan 190.	
Metal including alloys, all forms	44	48	(3)	China 25; India 9; Taiwan 7.	
Mercury					
	39	17	--	Netherlands 11; Iran 4.	
Molybdenum:					
Ore and concentrate:					
Roasted	3	--	--		
Oxides and hydroxides	108	35	10	Australia 10; Italy 8; Republic of Korea 3.	
Metal including alloys, all forms	156	172	35	Republic of Korea 63; Taiwan 26; Germany 19.	
Nickel:					
Matte and speiss	thousand tons	23,072	25,480	3	Republic of Korea 17,515; Taiwan 7,800; Belgium 152.
Oxides and hydroxides		3,873	3,077	458	Hong Kong 820; Taiwan 625; China 423.
Metal including alloys:					
Scrap		681	712	205	United Kingdom 167; Belgium 72; Taiwan 66.
Unwrought		1,222	954	213	Republic of Korea 213; United Kingdom 189; China 175.
Semimanufactures		10,619	8,085	1,363	Hong Kong 1,284; Iran 1,129; Republic of Korea 902.
Platinum-group metals:					
Waste and sweepings		77	3	1	Germany 1; United Kingdom 1.
Metal including alloys, unwrought and partly wrought:					
Palladium	thousands	\$172	\$171	\$91	Hong Kong \$33; Austria \$31; Switzerland \$10.
Platinum	do.	\$115	\$139	\$15	Hong Kong \$63; Switzerland \$20; Singapore \$5.
Rhodium	do.	\$8	\$3	\$1	Thailand \$1; Taiwan \$1.
Iridium, osmium, ruthenium	do.	\$8	\$3	(3)	Mainly to the Republic of Korea \$1.
Unspecified	do.	\$9	\$1	(3)	Germany \$4; Hong Kong \$3; Republic of Korea \$1.
Rare-earth metals including alloys, all forms		199	197	(3)	China 186; Hong Kong 8; Thailand 1.
Selenium		528	605	1	Hong Kong 249; China 180; India 93.
Silicon		3,269	3,022	616	Republic of Korea 492; United Kingdom 462; Malaysia 414.
Silver metal including alloys, unwrought and partly wrought	thousands	\$85	\$88	\$5	Taiwan \$21; Malaysia \$7; Singapore \$3.
Tin:					
Metal including alloys:					
Scrap		975	567	53	United Arab Emirates 249; Belgium 147; Taiwan 69.
Unwrought		341	954	213	Republic of Korea 213; United Kingdom 189; China 175.
Semimanufactures		2,434	1,705	72	Hong Kong 547; China 268; Singapore 175.

See footnotes at end of table.

TABLE 10--Continued
JAPAN: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2000	2001	Destinations, 2001	
			United States	Other, principal
METALS--Continued				
Titanium:				
Ore and concentrate	15	60	--	Singapore 50; Republic of Korea 10.
Oxides	28,263	23,531	472	Indonesia 10,410; China 7,473; Taiwan 6,570.
Metal including alloys, all forms	16,856	24,057	10,037	United Kingdom 4,105; Republic of Korea 1,889; Taiwan 1,848.
Tungsten:				
Ore and concentrate	--	20	20	
Metal including alloys, all forms	1,538	2,021	463	Germany 814; Taiwan 256; United Kingdom 131.
Uranium and thorium:				
Metal including alloys, all forms	66	31	1	Mainly to United Kingdom.
Vanadium:				
Oxides and hydroxides	52	31	--	Republic of Korea 8; Indonesia 6; Taiwan 6.
Metal including alloys, all forms	(3)	19	17	Mainly to Thailand.
Zinc:				
Oxides	2,480	2,277	569	China 444; Taiwan 288; Thailand 211.
Blue powder	58	50	--	Indonesia 39; Republic of Korea 10.
Ash and residue containing zinc	1,690	1,566	32	Republic of Korea 1,168; Taiwan 366.
Metal including alloys:				
Scrap	6,598	5,291	--	China 2,925; Taiwan 1,525; Hong Kong 835.
Unwrought	55,658	77,623	7,018	Taiwan 21,969; Philippines 14,151; Indonesia 8,558.
Semimanufactures	5,218	3,605	79	China 906; Singapore 271; United Kingdom 123.
Zirconium:				
Ore and concentrate	92	56	19	Mainly to the Philippines.
Metal including alloys, all forms	159	51	4	Republic of Korea 13; Germany 10; Taiwan 10.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.				
	20,788	17,462	28	Republic of Korea 10,953; China 2,868; Taiwan 1,355.
Artificial:				
Corundum	27,312	22,054	3,819	Republic of Korea 5,837; China 3,129; Taiwan 2,649.
Silicon carbide	11,731	9,586	1,083	Republic of Korea 4,652; Malaysia 1,383; Taiwan 1,296.
Dust and powder of precious and semiprecious stones including diamonds				
	thousands			
	\$14	\$25	\$96	Philippines \$575; China \$172; Taiwan \$100.
Grinding and polishing wheels and stones	9,357	9,769	1,648	Indonesia 1,282; Republic of Korea 976; Saudi Arabia 664.
Asbestos, crude	--	54	--	Indonesia 25; Thailand 25; Republic of Korea 3.
Barite and witherite	--	2	--	All to Indonesia.
Boron materials:				
Crude natural borates	300	--	--	
Oxides and acids	551	206	(3)	Taiwan 111; Republic of Korea 34; Malaysia 20.
Cement	thousand tons	7,637	7,576	(3) China 1,899; Singapore 1,626; Hong Kong 1,286.
Chalk	1,201	1,251	--	Republic of Korea 985; Taiwan 248; Thailand 18.
Clays, crude:				
Bentonite	1,780	1,621	49	Indonesia 599; Thailand 479; Israel 182.
Chamotte or dinas earth	84	96	--	Republic of Korea 63; Indonesia 30; Bangladesh 3.
Fire clay	3,665	3,033	--	Taiwan 1,592; Republic of Korea 443; Thailand 364.
Kaolin	7,554	5,490	55	Taiwan 1,990; China 1,937; Thailand 630.
Unspecified	19,569	20,644	98	Indonesia 5,229; Republic of Korea 3,102; Taiwan 2,627.
Diamond, natural:				
Gem, not set or strung	carats	7,507	10,342	1,438 Hong Kong 3,478; China 2,042; India 1,280.
Industrial stones	thousand carats	2,925	2,221	490 Taiwan 298; Germany 288; Thailand 188.
Dust and powder	do.	19,299	18,077	6,136 Switzerland 4,212; Republic of Korea 3,301; Philippines 1,288.
Diatomite and other infusorial earth	1,139	2,496	--	Taiwan 1,381; Vietnam 588; Republic of Korea 116.

See footnotes at end of table.

TABLE 10--Continued
JAPAN: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2000	2001	Destinations, 2001	
			United States	Other, principal
INDUSTRIAL MINERALS--Continued				
Feldspar	7,166	3,242	--	Taiwan 2,246; Thailand 671; Hong Kong 270.
Fluorspar	227	129	--	Taiwan 77; Singapore 42; Thailand 10.
Fertilizer materials:				
Crude, n.e.s.	1,451	1,834	--	Taiwan 744; Republic of Korea 707; China 335.
Manufactured:				
Ammonia	4,439	3,118	392	Taiwan 1,278; Singapore 533; Malaysia 449.
Phosphatic	183	113	1	Taiwan 71; Republic of Korea 30; Thailand 5.
Unspecified and mixed	1,078,282	892,332	16,498	Malaysia 241,214; Vietnam 219,085; Philippines 198,545.
Graphite, natural	1,707	1,762	598	Germany 336; Republic of Korea 223; China 183.
Gypsum and plaster	4,124	4,548	24	Bangladesh 1,061; Republic of Korea 963; Hong Kong 734.
Iodine	4,736	5,440	1,764	France 685; United Kingdom 601; Italy 483.
Kyanite and related materials:				
Mullite and unspecified	3,607	2,876	2	Republic of Korea 2,210; Taiwan 315; Thailand 91.
Lime	3,625	4,210	164	Republic of Korea 2,422; Taiwan 1,026; Singapore 256.
Magnesium compounds:				
Magnesite, crude	83	38	--	Taiwan 17; Indonesia 21.
Oxides and hydroxides	14,602	13,806	4,515	Germany 1,648; Republic of Korea 1,470; Taiwan 933.
Mica:				
Crude including splittings and waste	951	1,133	150	Republic of Korea 215; China 373; Indonesia 160.
Worked including agglomerated splittings	958	1,246	30	Austria 685; China 137; Thailand 92.
Nitrates, crude	298	290	--	Thailand 126; Indonesia 100; Philippines 55.
Phosphorus, elemental	30	22	(3)	Republic of Korea 18; Malaysia 1.
Pigments, mineral:				
Natural, crude	23	--	--	
Iron oxides and hydroxides, processed	40,357	37,595	4,383	Republic of Korea 11,624; China 6,979; Thailand 5,664.
Precious and semiprecious stones, other than diamond:				
Natural kilograms	12,782	18,370	405	India 13,000; China 2,572; Hong Kong 1,813.
Synthetic do.	168,758	86,973	6,014	China 23,314; Indonesia 18,789; Germany 8,414.
Pyrite, unroasted	47	25	--	Taiwan 20; New Zealand 5.
Quartz crystal, piezoelectric kilograms	89,887	50,421	3,553	Republic of Korea 9,770; Malaysia 9,489; Philippines 8,007.
Salt and brine	1,337	1,250	71	Thailand 645; Russia 214; Indonesia 100.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	20,087	18,261	--	China 17,914; Republic of Korea 280.
Worked thousands	\$371	\$270	\$32	China \$58; Taiwan \$49; Cambodia \$44.
Dolomite, chiefly refractory-grade	511	273	18	Taiwan 140; Malaysia 85; Republic of Korea 30.
Gravel and crushed rock	21,757	10,738	--	Indonesia 5,106; Republic of Korea 3,391; Thailand 2,008.
Limestone other than dimension thousand tons	3,118	2,673	--	Taiwan 1,374; Hong Kong 619; Australia 479.
Quartz and quartzite	1,663	1,249	--	Republic of Korea 721; United Kingdom 260; Singapore 141.
Sand other than metal-bearing and sand and gravel	12,062	9,512	263	Taiwan 4,658; Thailand 1,211; Indonesia 1,173.

See footnotes at end of table.

TABLE 10--Continued
 JAPAN: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2000	2001	Destinations, 2001		
			United States	Other, principal	
INDUSTRIAL MINERALS--Continued					
Sulfur:					
Elemental:					
Crude including native and byproduct	thousand tons	1,064	1,218	--	China 679; Republic of Korea 201; India 125.
Colloidal, precipitated, sublimed		468	308	(3)	Taiwan 103; Republic of Korea 91; Indonesia 33.
Dioxide		18	12	--	Republic of Korea 9; Vietnam 3.
Sulfuric acid	thousand tons	1,224	1,248	144	China 352; Taiwan 192; Chile 187.
Talc, steatite, soapstone, pyrophyllite		8,920	11,640	240	Republic of Korea 6,442; Taiwan 1,112; Singapore 1,012.
Vermiculite, perlite, chlorite		16,890	18,006	25	Republic of Korea 15,736; Taiwan 1,955; China 196.
Other, slag and dross, not metal-bearing	thousand tons	3,460	2,851	175	Taiwan 1,579; Republic of Korea 373; Australia 168.

¹Data presented in this table are from Japan Exports and Imports Commodity by Country, 2000 and 2001. Table prepared by Regina Coleman, international data coordinator.

²Includes waste and scrap.

³Less than 1/2 unit.

TABLE 11
JAPAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity		2000	2001	Sources, 2001	
				United States	Other, principal
METALS					
Alkali and alkaline-earth metals					
		384	288	133	France 73; China 51; Russia 27.
Aluminum:					
Ore and concentrate	thousand tons	2	2	--	Mainly from Australia.
Oxides and hydroxides		91,894	88,519	5,490	Australia 73,856; Germany 3,283; China 2,938.
Ash and residue		1,820	1,331	--	Russia 1,121; China 105; Malaysia 77.
Metal including alloys:					
Scrap		130,423	120,829	31,707	China 9,086; Singapore 8,634; Thailand 8,347.
Unwrought	thousand tons	2,605	2,611	22	Australia 653; Russia 639; Brazil 186.
Antimony:					
Ore and concentrate		40	20	--	All from China.
Oxides		8,497	7,382	40	China 6,371; Mexico 282; Taiwan 516.
Metal including alloys, all forms		10,965	7,372	(2)	China 7,366; Thailand 5.
Arsenic, metal including alloys, all forms		45	(2)	--	
Beryllium, metal including alloys, all forms		3	13	13	
Bismuth, metal including alloys, all forms		361	241	(2)	Belgium 78; Peru 72; China 36.
Cadmium, metal including alloys, all forms		4,056	2,723	--	Germany 485; Belgium 360; Canada 319.
Chromium:					
Ore and concentrate		501,727	411,120	--	South Africa 271; India 109; Iran 11.
Oxides and hydroxides		3,472	4,970	567	Kazakhstan 1,584; China 1,196; United Kingdom 997.
Metal including alloys, all forms		3,202	3,480	674	China 1,372; France 737; United Kingdom 395.
Cobalt:					
Oxides and hydroxides		3,354	1,482	12	Belgium 1,106; Finland 211; Philippines 34.
Metal including alloys, all forms		10,337	7,973	46	Canada 1,777; Australia 995.
Columbium and tantalum, tantalum metal including alloys, all forms					
		409	251	83	Thailand 46; China 37; United Kingdom 19.
Copper:					
Ore and concentrate	thousand tons	4,469	4,112	--	Chile 1,781; Indonesia 808; Canada 506.
Matte including cement copper		--	1,956	--	Taiwan 861; France 684; Malaysia 239.
Oxides and hydroxides		3,297	3,732	2,148	Malaysia 516; Norway 406; Vietnam 233.
Sulfate		429	741	6	Taiwan 380; Thailand 187; Republic of Korea 122.
Ash and residue containing copper		1,946	4,020	1,701	Malaysia 1,619; Philippines 332; Indonesia 108.
Metal including alloys:					
Scrap		190,221	142,702	39,772	Malaysia 19,029; Philippines 17, 973; Thailand 7,507.
Unwrought		227,564	167,242	796	Chile 72,374; Philippines 12,284; Republic of Korea 1,677.
Semimanufactures		1,053	58,738	2,117	Republic of Korea 11,649; Malaysia 10,526; Germany 5,527.
Germanium, metal including alloys, all forms					
		7	7	(2)	China 4; Belgium 1; Russia 1.

See footnotes at end of table.

TABLE 11--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2000	2001	Sources, 2001	
			United States	Other, principal
METALS--Continued				
Gold:				
Waste and sweepings	198	238	(2)	Singapore 124; Republic of Korea 35; Taiwan 17.
Metal including alloys, unwrought and partly wrought	kilograms 72,796	43,231	694	Australia 17,132; Brazil 4,999; Uzbekistan 4,778.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	million tons 122	126	--	Australia 70; Brazil 25; Philippines 4.
Metal:				
Scrap	thousand tons 321	144	42	Republic of Korea 34; Taiwan 29; Thailand 12.
Pig iron, cast iron, related materials	do. 919	340	3	Australia 79; Brazil 46; Sweden 32.
Ferroalloys:				
Ferrochromium	776,327	739,687	--	South Africa 392,161; Kazakhstan 146,356; Zimbabwe 84,106.
Ferromanganese	69,683	54,549	--	China 23,754; South Africa 20,514; Republic of Korea 4,204.
Ferromolybdenum	3,346	3,873	--	China 3,633; Chile 240.
Ferronickel	37,630	45,470	--	New Caledonia 32,970; Indonesia 6,109; Dominica 4,712.
Ferrosilichromium	5,818	3,493	34	China 3,040; Zimbabwe 419.
Ferrosilicomanganese	223,747	218,405	--	China 155,940; Australia 17,979; Ukraine 11,199.
Ferrotungsten	1,101	826	--	All from China.
Silicon metal	194,362	184,771	11	China 135,180; Australia 19,036; Norway 16,998.
Unspecified	39,428	33,787	20	China 11,389; Brazil 10,390; United Kingdom 2,406.
Lead:				
Ore and concentrate	185,584	186,136	65,816	Australia 67,619; Peru 19,030; Bolivia 11,488.
Oxides	49,514	37,301	25	China 20,965; Taiwan 8,710.
Metal including alloys:				
Scrap	(2)	--		
Unwrought	31,383	45,208	2	China 40,116; Taiwan 674.
Semimanufactures	2,201	2,397	4	China 981; France 765; United Kingdom 413.
Lithium, oxides and hydroxides	1,558	1,312	930	China 228; Russia 110; Taiwan 43.
Magnesium, metal including alloys:				
Scrap	948	790	--	All from Taiwan.
Unwrought	38,221	33,665	166	China 26,095; Norway 5,910; Canada 1,022.
Semimanufactures	4,092	3,350	296	China 2,900; Russia 209; Republic of Korea 47.
Manganese:				
Oxides and dioxides	2,946	2,155	(2)	China 1,093; Belgium 630; Mexico 160.
Metal including alloys, all forms	43,270	52,748	885	China 45,143; South Africa 6,558; Netherlands 77.
Mercury	7	11	(2)	Mainly from Algeria.
Molybdenum:				
Ore and concentrate:				
Roasted	32,389	31,687	2,618	Chile 11,872; China 6,508; Canada 3,285.
Unroasted	13	60	--	China 40; Australia 20.
Oxides and hydroxides	1,167	1,492	176	Chile 554; China 370; Iran 310.
Metal including alloys:				
Semimanufactures	291	378	130	Austria 127; China 100; Germany 11.
All forms	541	504	145	Germany 165; China 140; Uzbekistan 34.

See footnotes at end of table.

TABLE 11--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity		2000	2001	Sources, 2001	
				United States	Other, principal
METALS--Continued					
Nickel:					
Ore and concentrate	thousand tons	4,579	4,420	--	Indonesia 1,920; Philippines 1,312; New Caledonia 1,187.
Matte		111,690	117,349	--	Indonesia 80,742; Australia 36,607.
Oxides and hydroxides		125	60	8	Canada 25; Finland 23.
Metal including alloys:					
Scrap		15,665	16,040	2,077	Russia 2,259; Zimbabwe 3,903; South Africa 619.
Unwrought		58,325	28,762	27	Australia 8,353; Russia 3,029; Norway 2,770.
Semimanufactures		14,226	11,289	1,760	United Kingdom 3,898; Canada 3,652; Republic of Korea 362.
Platinum-group metals:					
Waste and scrap		480	339	8	Republic of Korea 138; Malaysia 63; Taiwan 35.
Metal including alloys, unwrought and partly wrought:					
Palladium		84	49	4	Russia 25; South Africa 12.
Platinum	kilograms	51,844	49,299	3,025	South Africa 37,979; Russia 2,816; Norway 669.
Rhodium	do.	1,106	503	--	Italy 300; Russia 105; South Africa 52.
Iridium, osmium, ruthenium	do.	8,147	6,963	509	South Africa 5,145; Germany 683; Russia 494.
Unspecified	do.	12,145	13,130	1,950	South Africa 3,708; Germany 2,428; Switzerland 1,392.
Rare-earth metals including alloys, all forms		7,077	3,346	30	China 3,213; Estonia 97.
Selenium		46	18	(2)	Philippines 11; Belgium 5.
Silicon, high-purity		200,375	6,271	4,382	Germany 965; United Kingdom 379; China 242.
Silver:					
Ore and concentrate		14,157	14,813	--	Peru 13,965; Chile 848.
Metal including alloys, unwrought and partly wrought:	kilograms	2,051,348	1,387,568	127,997	Peru 336,813; Mexico 335,580; Republic of Korea 228,045.
Tin, metal including alloys:					
Ore and concentrate		14	14	--	All from the Netherlands.
Metal including alloys:					
Scrap		196	36	(2)	Republic of Korea 31; Malaysia 5.
Unwrought		32,483	24,144	77	China 9,325; Indonesia 9,227; Thailand 3,288.
Semimanufactures		409	369	12	Singapore 252; Republic of Korea 23; Thailand 52.

See footnotes at end of table.

TABLE 11--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2000	2001	Sources, 2001		
			United States	Other, principal	
METALS--Continued					
Titanium:					
Ore and concentrate	80,392	112,802	--	Australia 55,726; Canada 23,020; India 22,960.	
Oxides	15,303	14,298	601	China 5,369; France 5,043; Republic of Korea 1,942.	
Metal including alloys, all forms	7,527	10,333	3,188	Russia 3,959; Kazakhstan 2,429; Republic of Korea 78.	
Tungsten:					
Ore and concentrate	1,514	951	--	Russia 777; Portugal 151; China 20.	
Metal including alloys, all forms	700	1,418	58	China 854; Republic of Korea 237; Germany 125.	
Uranium and thorium, metal including alloys, all forms	2,595	767	73	France 99; Canada 44; United Kingdom 19.	
Vanadium, metal including alloys, all forms:					
Oxides and hydroxides	4,539	3,638	(2)	Australia 1,420; China 1,292; South Africa 886.	
Ash and residue containing zinc	242	127	--	Mainly from United Kingdom.	
Metal including alloys, all forms	238	230	132	Germany 97; South Africa 1.	
Zinc:					
Ore and concentrate	thousand tons	1,063	1,164	136	Australia 478; Peru 162; Canada 125.
Oxides		19,378	13,874	205	China 6,747; Republic of Korea 4,406; Taiwan 1,484.
Blue powder		1,995	1,532	--	Singapore 850; Republic of Korea 435; Malaysia 151.
Ash and residue containing zinc		26,884	31,165	3,069	Taiwan 12,826; Republic of Korea 8,172; Spain 4,511.
Metal including alloys:					
Scrap		69	31	--	All from Republic of Korea.
Unwrought		85,627	63,580	--	China 50,011; Peru 6,479; Canada 2,285.
Semimanufactures		6,686	4,130	67	China 1,920; Belgium 1,421; France 408.
Zirconium:					
Ore and concentrate		86,952	84,124	4,702	Australia 45,014; South Africa 29,583; Russia 4,412.
Metal including alloys, all forms		704	557	300	France 218; United Kingdom 18.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.					
		16,234	17,056	3,472	China 6,213; India 5,896; Republic of Korea 654.
Artificial:					
Corundum		172,991	162,405	303	China 125,151; Australia 10,864; Hungary 7,353.
Silicon carbide		76,934	68,519	81	China 61,761; Taiwan 8,351; Brazil 3,240.
Dust and powder of precious and semiprecious stones					
including diamonds	thousands	\$34	\$1,953	\$1,548	China \$220; India \$128; Brazil \$51.
Grinding and polishing wheels and stones		5,245	5,200	319	China 3,325; Thailand 797; Austria 133.
Asbestos, crude		98,595	79,463	5,127	Canada 44,203; Zimbabwe 14,684; South Africa 6,960.
Barite and witherite		108,156	94,272	411	China 87,223; North Korea 6,478; Thailand 160.
Boron:					
Crude natural borates		46,150	44,679	10	Turkey 40,300; Russia 4,341; China 28.
Oxides and acids		900	555	401	Russia 154.
Cement	thousand tons	1,378	1,184	(2)	Republic of Korea 1,117; China 48.

See footnotes at end of table.

TABLE 11--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity		2000	2001	Sources, 2001	
				United States	Other, principal
INDUSTRIAL MINERALS--Continued					
Clays, crude:					
Bentonite		224,126	200,022	168,688	China 29,543; New Zealand 820; India 680.
Chamotte or dinas earth		12,564	15,388	--	China 6,757; South Africa 5,208; Republic of Korea 3,052.
Fire clay		5,809	9,989	3,073	China 6,899; Germany 17.
Fuller's earth		8,224	9,140	5,346	China 3,230; Australia 564.
Kaolin	thousand tons	1,401	1,397	971	Brazil 236; Indonesia 66; China 61.
Unspecified		176,333	152,695	3,333	China 148,506; Vietnam 300; Germany 261.
Cryolite and chiolite		20	53	--	China 50; Denmark 3.
Diamond, natural:					
Gem, not set or strung	thousand carats	2,735	2,574	71	India 1,834; Israel 223; Hong Kong 191.
Industrial stones	do.	524	1,534	174	Ireland 1,311; United Kingdom 14; Belgium 13.
Dust and powder	do.	113,250	92,436	19,641	Ireland 33,343; China 23,420; Republic of Korea 3,328.
Diatomite and other infusorial earth		9,048	7,427	6,952	China 201; Thailand 180; Canada 38.
Feldspar		1,781	1,366	--	India 535; China 407; Malaysia 236.
Fluorspar		562,147	519,221	--	China 400,771; Mexico 110,462; Thailand 4,000.
Fertilizer materials:					
Crude, n.e.s.		64,850	57,635	113	Republic of Korea 21,007; China 18,967; Indonesia 11,948.
Manufactured:					
Ammonia		25,740	20,505	(2)	Canada 12,505; Indonesia 7,999.
Phosphatic		314,522	139,713	53,386	China 78,345; Republic of Korea 4,672; Israel 3,300.
Potassic	thousand tons	954	930	217	Canada 437; Russia 85; Israel 40.
Unspecified and mixed	do.	2,130	496	136	Jordan 92; China 52; Republic of Korea 45.
Graphite, natural		143,906	143,540	357	China 135,520; North Korea 3,440; Sri Lanka 3,227.
Gypsum and plaster	thousand tons	2,495	1,982	(2)	Australia 920; Thailand 731; Mexico 324.
Iodine		363	273	--	Chile 257; Peru 16.
Lime		15,728	17,675	--	Thailand 17,303; Republic of Korea 100; France 57.
Magnesium compounds:					
Magnesite, crude		2,244	1,870	--	China 1,690; Australia 180.
Oxides and hydroxides		27,598	26,689	1,261	China 16,521; Israel 4,776; Republic of Korea 1,580.
Other		238	476	--	All from China.
Mica:					
Crude including splittings and waste		45,369	47,902	426	China 30,248; India 6,824; Canada 3,014.
Worked including agglomerated splittings		421	236	1	China 116; Belgium 43; Switzerland 30.
Nitrates, crude		22,048	22,024	40	Chile 4,595; Germany 85; China 60.
Phosphates, crude	thousand tons	899	771	--	China 371; South Africa 201; Jordan 106.
Phosphorus	do.	26,163	26,541	153	China 25,592; Germany 700; Netherlands 678.
Pigments, mineral:					
Natural crude		249	252	--	Australia 188; Austria 51; United Kingdom 13.
Iron oxides and hydroxides, processed		31,123	54,460	3,241	China 11,779; Germany 7,193; Republic of Korea 1,871.
Potassium salts		216	72	36	Mainly from Canada.
Precious and semiprecious stones, other than diamond:					
Natural		609	672	11	Brazil 390; China 99; South Africa 76.
Synthetic	kilograms	119,246	50,706	15,958	Republic of Korea 11,977; China 8,086; Austria 4,948.
Pyrite, unroasted		6,243	9,773	--	All from China.
Quartz crystal, piezoelectric	kilograms	115,272	150,588	11,910	Russia 65,747; China 48,280; Malaysia 8,070.
Salt and brine	thousand tons	7,974	7,866	1	Mexico 3,868; Australia 3,508; China 293.

See footnotes at end of table.

TABLE 11--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity		2000	2001	Sources, 2001	
				United States	Other, principal
INDUSTRIAL MINERALS--Continued					
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked	thousand tons	306	268	3	Republic of Korea 49; China 40; South Africa 35.
Worked	do.	1,438	1,542	1	China 1,378; Italy 48; Spain 22.
Dolomite, chiefly refractory-grade	do.	1,975	1,992	(2)	Thailand 1,154; China 755; Philippines 486.
Gravel and crushed rock		332,624	294,587	1,507	Taiwan 146,606; China 95,038; Philippines 29,591.
Limestone other than dimension		282,820	285,923	45	Philippines 94,671; Malaysia 85,146; Vietnam 70,793.
Quartz and quartzite		265,610	108,538	2,591	India 39,413; Republic of Korea 38,421; China 14,034.
Sand other than metal-bearing and sand and gravel	thousand tons	13,474	7,273	3	China 4,309; Australia 1,643; Republic of Korea 794.
Sulfur:					
Elemental:					
Crude including native and byproduct		535	488	--	China 424; Republic of Korea 44; Mexico 20.
Colloidal, precipitated, sublimed		1,298	1,198	2	Republic of Korea 1,081; France 107; Germany 8.
Sulfuric acid		6	2	2	
Talc, steatite, soapstone, pyrophyllite		403,257	362,623	8,157	China 288,630; Australia 63,711.
Vermiculite, perlite, chlorite		191,478	193,303	791	China 167,426; South Africa 18,305.
Other; slag and dross, not metal-bearing		815,684	778,149	35,225	Republic of Korea 209,262; Taiwan 199,889; Indonesia 61,709.

-- Zero.

¹Data presented in this table are from Japan Exports and Imports Commodity by Country, 2000 and 2001. Table prepared by Regina Coleman, international data coordinator.

²Less than 1/2 unit.