MANGANESE

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Manganese (Mn) is essential to iron and steel production by virtue of its sulfur-fixing, deoxidizing, and alloying properties. Steelmaking, including its ironmaking component, has accounted for most domestic manganese demand, presently in the range of 85% to 90% of the total demand. Among a variety of other uses, manganese is a key component of certain widely used aluminum alloys and is used in oxide form in dry cell batteries. The overall level and nature of manganese use in the United States is expected to remain about the same in the near term. No practical technologies exist for replacing manganese with other materials nor for utilizing domestic deposits or other accumulations in order to reduce the complete dependence of the United States on foreign countries for manganese ore.

Domestic consumption of manganese ore, exclusive of the relatively small quantities used at iron and steel plants, increased marginally, and was just slightly less than the average consumption for the prior 4 years. Unit consumption of manganese in steel, as ferroalloys and metal, was 6 kilograms per metric ton (kg/t) of raw steel produced, as estimated from apparent consumption calculations. This level also was about the same as the average for the prior 4 years.

For U.S. foreign trade in manganese materials, volumes generally decreased for exports and increased for imports. On a content basis, the number of manganese units imported increased by about 9%, while the number of units exported declined by about 14%. The volume of receipts reached new record levels for manganese dioxide (third successive year) and silicomanganese.

Prices reversed the trend of 1999 and increased for ore and ferroalloys. The amount of increase was about 7% internationally for metallurgical-grade ore; and, for imported ferroalloys on a year-average basis, 6% for high-carbon ferromanganese, 23% for medium-carbon ferromanganese, and 8% for silicomanganese. In 2000, ferroalloy prices were at their highest in the first half of the year. Sales of manganese materials from the Government's National Defense Stockpile reduced the Government's inventory of manganese by about another 5%, leaving an inventory about 1.5 times annual domestic consumption. The larger disposals were of high-carbon ferromanganese and metallurgical-grade ore.

World production of manganese ore was estimated to have increased about 11% (contained weight) in comparison with that for 1999. (See table 1.) China was assumed to be the largest producer on a gross weight basis; South Africa easily was the largest producer on a contained weight basis. A number of the larger ferroalloy producers revamped their operations, such as those in Brazil, France, and South Africa. In Ukraine, production of ore and ferroalloys increased significantly.

Most data in this report are rounded by the U.S. Geological Survey (USGS) to not more than three significant digits. Table footnotes indicate which statistics have been rounded.

Legislation and Government Programs

Stockpile.—The proposed Annual Materials Plan (AMP) for fiscal year 2001 that the Defense National Stockpile Center (DNSC) of the Defense Logistics Agency issued on October 3 was the same with respect to manganese as in the AMPs that were in effect for fiscal years 1999 and 2000. The AMP for

Manganese in the 20th Century

In the early 1900s, annual domestic apparent consumption of manganese was in the range of 100,000 to 200,000 metric tons. Annual ore consumption was about 100,000 tons, of which approximately 90% was derived from imported ore. World production of ore was in the range of 1 to 2 million metric tons. Domestic ore production, which virtually had ceased by 1970, mostly had been as manganiferous ore such as that coproduced with iron ore. At the close of the century, annual domestic apparent consumption of manganese was about 750,000 tons valued at approximately $400 million. World output of ore was approximately 20 million tons per year.

Manganese demand had been driven mainly by steel production, which typically accounted for 85% to 95% of total manganese demand. The importance of manganese to steel production and the lack of domestic production led to the establishment of a number of Government programs to ensure manganese supply, including buildup of sizable inventories, particularly beginning in the 1950s. The trend in manganese demand in steelmaking was displaced downwards beginning about 1980 because of changes in steelmaking technology.

Domestically, ore was smelted to ferromanganese mainly in blast furnaces until the late 1970s. The last remaining domestic ferromanganese producer used electric furnace production for manganese ferroalloys, a process whose early usage was spurred by World War I. Manganese metal and dioxide were developed as electrolytic products in the 1930s and 1940s. Research by the former U.S. Bureau of Mines contributed importantly to commercialization of electrolytic methods for producing manganese metal and dioxide. Electrolytic manganese dioxide became a key ingredient in household batteries, and the demand for it had the highest growth rate of any manganese commodity product.

fiscal year 2001 became effective as of October 1, 2000, the start of the 2001 fiscal year. Under this AMP, the maximum disposal authority for manganese materials was 27,216 metric tons (t) for natural battery-grade ore; 2,732 t for synthetic manganese dioxide; 36,287 t for chemical-grade ore; 226,796 t for metallurgical-grade ore; 45,359 t for the manganese ferro group; and 1,814 t for electrolytic manganese metal.

In its sales program for metal, the DNSC amended as of October 1 its Solicitation of Offers DLA-ELECTROLYTIC MANGANESE METAL-001 so as to make available the same quantity of metal; 1,814 t, as in the AMP. When originally issued on May 1, 1997, the quantity of metal being made available was 1,053 t.

For 2000, disposals of manganese materials announced by the DNSC totaled 5,988 t for natural battery-grade ore; 6,565 t for chemical-grade ore; 37,987 t for stockpile-grade metallurgical-grade ore; 90,719 t for high-carbon ferromanganese; and 146 t for electrolytic metal. All disposals were cash transactions.

Data on physical inventory of manganese materials reported by the DNSC indicated that all net changes in 2000 were decreases and consisted of 5,928 t for natural battery-grade ore, 3,600 t for chemical-grade ore, 52,060 t for stockpile-grade metallurgical-grade ore, 923 t for nonstockpile-grade metallurgical-grade ore, and 32,524 t for high-carbon ferromanganese. The estimated manganese content of manganese inventories being held by the Government at yearend was lowered in 2000 by about another 5%, to somewhat greater than 1.1 million metric tons (Mt). (See table 2.) The total remaining inventory was about 1.5 times current national apparent consumption.

Other.—In August, the Drug Enforcement Administration of the U.S. Department of Justice sustained its 1998 suspensions of three shipments of Chinese potassium permanganate that were to have been transshipped to Colombia through ports in California. These shipments were suspended because of the possibility that they might be diverted for use in the manufacture of cocaine (Drug Enforcement Administration, 2000).

In November, the Agency for Toxic Substances and Disease Registry of the U.S. Department of Health and Human Services announced that six updated final toxicological profiles for priority hazardous substances had become available (Agency for Toxic Substances and Disease Registry, 2000). One of these, Toxicological Profile for Manganese, emphasized the health effects of manganese and related toxicological information (Sciences International, Inc., 2000).

As of December 26, the Employment and Training Administration (ETA) of the U.S. Department of Labor certified that specified current and former workers at the North Plant of Eramet Marietta Inc., Marietta, OH, were eligible to apply for benefits under the Trade Adjustment Assistance (TAA) program administered by ETA. This determination was made after Eramet Marietta had notified the ETA that it had accepted delivery of imported manganese metal in place of its own production (Employment and Training Administration, 2001). Shortly before that, the ETA had determined that these workers were not eligible to apply for such assistance (Employment and Training Administration, 2000). Under the TAA program, workers whose jobs are adversely affected by increased imports can receive various benefits and services designed to help them obtain suitable employment.

Production

Ore and Concentrate.—The only possible mine production of manganese consisted of small amounts of manganiferous material having a natural manganese content of less than 5%. This type of material has been produced in South Carolina for use in coloring brick.

Ferroalloys, Metal, and Synthetic Dioxide.—Production statistics for these materials were not published to avoid disclosing proprietary data. The only plant at which manganese ferroalloys were produced domestically was that of Eramet Marietta at Marietta, OH (table 3). In July, Eramet Marietta announced that by the end of the year it would close its facilities for producing manganese metal. Production of metal was a minor part of that plant's overall production program that included an annual output of about 170,000 t of manganese ferroalloys. Production of manganese-aluminum briquets for use as aluminum hardeners was to continue using manganese not produced at Marietta (Platt's Metals Week, 2000).

Consumption, Uses, and Stocks

Data relating to manganese end use and certain other information have indicated that metallurgical applications account for most domestic manganese consumption, 85% to 90% of which has been for steelmaking. This usage pattern is typical for most industrialized countries (Mining Magazine, 1990). Reported data for U.S. ore consumption in 2000 indicated that unit consumption of manganese in ironmaking, which could not be published to avoid disclosing proprietary data, declined from that for 1999 to become an even smaller comparatively minor component of overall manganese use in steelmaking. Reported data for U.S. consumption of manganese ferroalloys and metal in 2000 are presented in table 4. Data in this table are not directly comparable to those for years prior to 1998, especially for ferromanganese. Also, because of the incompleteness of reporting to the USGS's voluntary consumption survey, the figures in this table are more representative of relative rather than absolute quantities. Combination of the indicated consumption pattern with estimates of apparent consumption suggests that manganese unit consumption in steelmaking in 2000 was about 6 kg/t or about twice that if calculated on the basis of reported consumption. Overall domestic manganese apparent consumption in 2000 was estimated as 774,000 t.

In decreasing order, the most important steel end uses in the United States were given as construction, automotive, machinery, and domestic and commercial equipment (Iron & Steelmaker, 2000).

Ownership of plants for manufacture of manganese sulfide used, for example, in parts made by iron powder metallurgy, were included in the sale of the Pyron Corp. and Pyron Metals Powders, Inc., subsidiaries of Zemex Corp., Toronto, Canada, to Sweden's Höganäs AB. Plants involved in the sale were located in New York, Pennsylvania, and Tennessee (Skillings Mining Review, 2000).

Relatively small quantities of manganese were used for alloying with nonferrous metals, chiefly in the aluminum industry as manganese-aluminum briquets that typically contained either 75% or 85% manganese. The small addition to manganese demand from the U.S. Mint's introduction in 1999 of the so-called Golden Dollar was diminished because of the new coin's lack of popularity (Day, 2001).

In 2000, domestic consumption of manganese ore increased by a marginal amount to 486,000 t, while corresponding yearend stocks increased by about 31% to 226,000 t. Because of the need to avoid disclosing proprietary data, these figures do not include the relatively small quantities associated with ironmaking and cannot be disaggregated into end-use segments.

Comparatively small amounts of manganese were used domestically in animal feed, brick coloring, dry cell batteries, manganese chemicals, and fertilizers. These were among the many nonmetallurgical applications of manganese (Weiss, 1977; Harben, Raleigh, and Harris, 1998). The source of manganese units for these applications was mainly manganese ore. As discussed under Spain in the World Review section of this report, Carus Chemical Co., Peru, IL, the only domestic producer of potassium permanganate, completed its acquisition of the only Spanish maker of that chemical. Remediation of sites such as those of Government facilities that have been contaminated with chlorinated solvents was a growing application for potassium permanganate (Wickramanayake, Gavaskar, and Chen, 2000a, b). In December, TETRA Technologies, Inc., headquartered in The Woodlands, TX, in exiting the micronutrients business, sold all of its U.S. and foreign manganese sulfate assets (TETRA Technologies, 2001, p. 15). TETRA had been producing manganese sulfate at plants at Fairbury, NE, and in Mexico. Sale of the Mexican plant is discussed under Mexico in the World Review section of this report.

Data on domestic consumption of manganese ore, exclusive of that consumed within the steel industry, are collected by means of the Manganese Ore and Products survey. Approximately 15 firms were canvassed that process ore by such methods as grinding and roasting or that consume it in the manufacture of dry cell batteries and manganese ferroalloys, metal, and chemicals. The collective consumption of these firms is believed to constitute all manganese ore consumption in the United States, exclusive of that by the steel industry. Full-year responses, or a basis upon which to estimate the data, were obtained from all these firms for 2000.

In batteries containing manganese, those of the alkaline type in which electrolytic manganese dioxide (EMD) is used continued to expand their share of the market at the expense of those of the carbon-zinc type in which natural battery-grade ore is a component. Market penetration of alkaline batteries in 2000 was 91% for North America, 62% for Europe, 32% for Latin America, and 26% for Asia. New products were aimed at applications requiring a high discharge rate, such as in digital cameras. Battery sales in 2000 were depressed by the abnormally high sales in the last quarter of 1999 that were brought on by anticipation of Y2K problems (MacArthur and Blomgren, 2001, p. 35-37). In military applications, lithium-sulfur dioxide batteries were being replaced mostly by those of the lithium-manganese dioxide type (Advanced Battery Technology, 2000).

In April, the battery products business of Ralston Purina Co. was spun off into Energizer Holdings, Inc., an independent company, that included the Eveready Battery Co., one of the principal domestic battery makers (Haflich, 2000). Ralston Purina and Energizer were headquartered in St. Louis, MO.

Recycling of batteries such as dry cells, a topic of considerable interest in Western Europe, has led to development of a variety of processes for recovering metals or removing them from the environment. A hydrometallurgical process developed in France recovers manganese as the carbonate or sulfate (Ferlay and Weill, 2000).

Prices

For 2000, if the price of manganese in metallurgical-grade ore is set at 1.0, the corresponding price per manganese unit was approximately 2.6 for high-carbon ferromanganese, 4.2 for medium-carbon ferromanganese, 2.5 for silicomanganese, and 7.5 for manganese metal. Compared with the corresponding price factors for 1999, the factor for high-carbon ferromanganese was unchanged, while those for medium-carbon ferromanganese and silicomanganese are somewhat greater. The factors are based on year-average prices for ferroalloys as derived from prices listed in Platt's Metals Week, and for metal as given in Ryan's Notes (North American transaction price). Year-average prices increased for metallurgical-grade ore and all main categories of manganese ferroalloys.

Manganese Ore.—The average price, on the basis of cost, insurance, and freight (c.i.f.) U.S. ports, of metallurgical-grade ore containing 48% manganese was assessed at $2.39 per metric ton unit. It is recognized that prices were somewhat above or below this value, depending on ore quality, time of year, and nature of the transaction. The price of a metric ton of ore is obtained by multiplying the metric ton unit price by the percentage manganese content of the ore; that is, by 48 when the manganese content is 48%. The ore market consisted of a number of submarkets because of differences between ores according to such various end uses as ferroalloy production, blast furnace ironmaking, and manufacture of manganese chemicals.

Because the metric ton unit is 1% of a metric ton (i.e., 10 kilograms of contained manganese), the price of manganese in ore in 2000 and 1999 can be expressed as 23.9 and 22.6 cents per kilogram, respectively. These values indicate an increase of about 6% in U.S. c.i.f. price or somewhat less than the increase in free-on-board (f.o.b.) price in international markets.

The international benchmark price for metallurgical-grade ore ended a 3-year decline, increasing by about 7% in 2000, or by about the same percentage as for the decrease in 1999. Price negotiations between Japanese consumers, with Nippon Steel Corp. playing a leading role, and their major suppliers were not concluded until late May, or about 2 months after the April 1 beginning of the Japanese fiscal year. On an f.o.b. basis per metric ton unit for delivery during the annual contract year, the prices agreed to were $2.03 for ore from the Groote Eylandt Mine in Australia and $1.94 for ore from the Wessels Mine in South Africa. These prices were negotiated by South Africa's Samancor Ltd., a subsidiary of the United Kingdom's Billiton plc. Samancor had assumed control of both mines late in 1998.

Manganese Ferroalloys.—For high-carbon and medium-carbon ferromanganese, the pattern of price changes was similar, in a general way to that for the change in domestic raw steel production rate—an increase in the first part of the year to a plateau, followed by a decline thereafter. The silicomanganese price was nearly constant through June, after which it declined to a bottom in October that was followed by a modest recovery in November through December. These trends and the price information that follows pertain to quotations for U.S. imports because public information on current prices for domestic product was not available. English units were the basis for price quotes in the United States.

For ferromanganese, the price range for the high-carbon grade containing 78% manganese, per long ton of alloy f.o.b. Pittsburgh or Chicago warehouse, began the year unchanged at $450 to $470 and ended the year at $475 to $490, for a net overall increase of 5%. For the year, the average for the middle of the price range was $482.50, which was about 6% greater than that of 1999. The range for the plateau-like high that was reached as of mid-June was about $500 to $525. The price range for medium-carbon ferromanganese with a manganese content of 80% to 85% and a nominal carbon content of 1.5%, per pound of manganese f.o.b. warehouse, was an unchanged 35 to 38 cents at the beginning of the year and 42 to 45 cents at the end of the year, for a net overall increase of about 19%. The middle of the price range averaged 46 cents for the year, for an increase of 23% over that of 1999. The price range of medium-carbon ferromanganese rose sharply in April to a 3-month long plateau of 50 to 54 cents. During the first part of the year, trade journals spoke of a shortness in ferromanganese supply.

For imported silicomanganese with 2% carbon, the price range, per pound of alloy, f.o.b. Pittsburgh or Chicago warehouse, started the year at 24.5 to 26 cents, or slightly higher than that at the end of 1999, and ended the year at 21 to 22 cents, for a net decrease of 15%. Even so, an average for the year for the middle of the price range of about 23.8 cents was about 8% greater than that of 1999. At the bottom in October, the price range was 19.5 to 20.5 cents.

Manganese Metal.—Trade journals listed the same producer prices that they have been listing since about the beginning of 1996; for bulk shipments of domestic material, per pound f.o.b. shipping point, American Metal Market listed a range of $1.15 to $1.17, and Platt's Metals Week and Ryan's Notes listed $1.15. Platt's discontinued its listing as of its October 2 issue. For its listing of North American transaction price, Ryan's Notes indicated an overall decrease during the year that approached 9%. For this listing, the price range was more or less steady at 78 to 84 cents, January through November, but in December dropped to 72 to 77 cents. The year-average price of about 81 cents for this listing was about 30% below producer list price and about 5% less than that for 1999.

Foreign Trade

In comparison with those of 1999, trade volumes for most categories of manganese materials, in terms of manganese units contained, decreased for exports and increased for imports. (See tables 5 and 6.) Overall, the year-to-year comparisons were -14% for exports and +9% for imports. Also on the basis of content, the ratio of imports of ferroalloy plus metal divided by imports of ore plus dioxide tentatively increased, from 1.86:1 in 1999 to 2.0:1. In the absence of domestic mine production, U.S. net import reliance as a percent of apparent consumption was 100% for manganese, the same as it has been for years.

Within exports, the number of manganese units and the quantity of metal were the least since at least prior to 1983. Exports of ore reportedly were more than twice as great as in 1999. The data remained in question for 4,000 t or more of ore, particularly the large quantity reported as having been exported to the United Kingdom. Exports of manganese ferroalloys and metal all declined; those of total ferromanganese and silicomanganese were the least since 1990. Percentage declines from 1999 ranged from 31% for total ferromanganese to as much as 50% for silicomanganese. Most of the decline in ferromanganese exports was in the subcategory of carbon content greater than 2%. For this category, exports decreased by 49% and share of total ferromanganese exports declined to 43%. Exports of ferromanganese containing more than 2% carbon were 3,450 t and those containing less than 2% carbon were 4,500 t.

Reexports of ore, ferromanganese, silicomanganese, and metal were, in tons, 9,010; 10,600; 2,270; and 246; respectively. Except for metal, all or nearly all of the reexports went to Canada. Other main destinations of reexports of metal were the Republic of Korea, the Netherlands, and Mexico.

Among imports, overall average manganese contents were 78.8% for ferromanganese and tentatively 52.8% for ore. The average manganese content for ferromanganese was the greatest since the same level was attained in 1994. Average contents for ore were abnormally high (55% for ore with greater than 47% manganese). Averages were in question where ore was involved, however, as well as the ore data in general. Questions about obvious discrepancies in a significant portion of the data for Gabon were unresolved at the time this report was prepared. The ore data presented in table 5 indicate that overall imports decreased by 6% and that Gabon's share of receipts rose to 84%.

The import volume for total ferromanganese was virtually the same as in 1999. The most significant year-to-year change was for low-carbon ferromanganese, for which imports increased by 27%. The validity of the data for Brazil in this subcategory was in question, as it seemed likely that the more than 6,000 t reported as low-carbon ferromanganese was actually medium-carbon ferromanganese. If so, the quantity of medium-carbon ferromanganese imported would be a record high. Comparing leading supplying countries of medium-carbon ferromanganese with those in 1999, import volumes increased for China, Japan, and Norway, and decreased for France; for high-carbon ferromanganese, quantities increased for Australia and decreased for France. Declines in these subcategories were especially notable for France, from which imports of high-carbon ferromanganese fell by nearly one-half.

For silicomanganese, an import volume 26% greater than for 1999 was easily a new record. Record amounts were received from India and Kazakhstan, for which the amounts received were 5.6 and 2.4 times as great, respectively, as for 1999. For manganese metal overall, import volume was 5% greater than for 1999. For the unwrought subcategory, increases in shipments from China, Germany (especially), and the United Kingdom contributed to a 17% increase. Imports in the "Other" subcategory fell by two-thirds. Reported imports of spiegeleisen (pig iron containing about 20% manganese) declined to 270 t, all of which was from South Africa at high unit value.

Among imports of manganese chemicals, those of manganese dioxide increased for the second successive year by about one-fourth to set a new record for volume. Amounts received from Australia, Ireland, and South Africa set new records also, increasing by 14% to 19%. After Australia, South Africa continued to lead Ireland as the source of the largest amount. Unit values indicated that virtually all dioxide imports were synthetic material. Data for imports under the classification of "sulfates, other," suggested that imports of manganese sulfate may have decreased by 6%, as the volume of imports of material in that class decreased by 15% for China and increased only marginally for Mexico. Receipts from China were 13,100 t at a value of $4.8 million and those from Mexico 19,000 t at a value of $9.5 million.

Antidumping duties on EMD, manganese metal, and silicomanganese were the subject of investigations by Government trade agencies. For EMD, in May, the U.S. International Trade Commission determined in its full 5-year review that revocation of antidumping duty orders on EMD from Greece and Japan would be unlikely to cause material injury to a domestic industry in the reasonably foreseeable future (U.S. International Trade Commission, 2000a, b). Accordingly, the International Trade Administration (ITA) of the U.S. Department of Commerce revoked these antidumping duty orders effective January 1, 2000. In so doing, the ITA said it would complete pending administrative reviews of these orders and would conduct reviews of EMD imported prior to January 1, if appropriately requested (International Trade Administration, 2000e).

In reviews for EMD subsequently completed, for that from Greece for the period of review (POR) of April 1, 1998, through March 31, 1999, the ITA in November found a margin of 0.00% for Tosoh Hellas A.I.C.; no "all-others" rate was specified (International Trade Administration, 2000a). For that from Japan for the same POR, the ITA in September found a margin of 0.00% for Tosoh Corp. and also did not specify an "all-others" rate (International Trade Administration, 2000b).

For manganese metal from China, for the POR of February 1, 1998, through January 31, 1999, the ITA found a margin of 36.49% for China Metallurgical Import & Export Hunan Corp./Hunan Nonferrous Metals Import & Export Associated Corp. and an "all-others" margin of 143.32%, which also was assigned to China Hunan International Economic Development (Group) Corp. (International Trade Administration, 2000d).

For silicomanganese, the ITA found in its expedited 5-year ("sunset") review of the antidumping duty orders that applied to Brazil and China that revocation of the antidumping orders likely would lead to dumping. For Brazil, the corresponding weighted-average margins were 64.93% for Companhia Paulista de Ferro-Ligas and Sibra Electro-Siderurgia Brasileria S.A. and 17.6% for all others. For China, the margin was 150% for all manufacturers, producers, and exporters (International Trade Administration, 2000f). Also for silicomanganese from China, for the POR of December 1, 1997, through November 30, 1998, the ITA found margins of 126.22% for Guangxi Bayi Ferroalloy Works, 182.97% for Sichuan Emei Ferroalloy Import and Export Co., Ltd., and 150% for all others not specified (International Trade Administration, 2000g).

For silicomanganese from Ukraine, the ITA found in its full sunset review that termination of the suspended antidumping investigation likely would lead to dumping at a country-wide margin of 163% (International Trade Administration, 2000c).

The Generalized System of Preferences (GSP) Program was modified as of December 21 so as to grant duty-free status to certain products from sub-Saharan African countries. High-carbon ferromanganese was among the products to which this form of GSP treatment was extended (Clinton, 2000). Electrolytic manganese metal also had been a candidate for GSP treatment, but it was not included (Ryan's Notes, 2000).

World Review[1]

Leading producer countries among a relatively concentrated production of manganese ore were Australia, Brazil, China, Gabon, India, South Africa, and Ukraine. (See table 7.) Leading producer countries among a more widely distributed production of manganese ferroalloys were China, France, India, Japan, Norway, South Africa, and Ukraine. (See table 8.)

Australia.—Ore production was 15% less for Australia as a whole. Production in Western Australia by Consolidated Minerals Ltd. in the Woodie Woodie area of the Pilbara Manganese Province was nearly twice that for 1999. This did not compensate, however, for a drop in production of about one-fourth at Billiton plc's much larger operations at Groote Eylandt in the Northern Territory; the production level there was the lowest since 1992. Mining by Consolidated Minerals was adversely affected by heavy rains in the first part of the year, but the company still showed a profit for the fiscal year that ended June 30.

Expansion of EMD capabilities was underway on both sides of the continent. Delta EMD Australia Pty. Ltd. raised the annual capacity of its plant at Newcastle, New South Wales, from 23,000 to 25,000 t. In Western Australia, HiTec Energy NL further changed the direction of its program by raising its target capacity for EMD to 40,000 metric tons per year (t/yr) and reducing manganese sulfate to byproduct status, with no target capacity. Encouraging results for EMD produced for HiTec on a pilot plant basis under the technical direction of South Africa's Mintek research organization were to be followed up by operation of a demonstration plant to be set up in the first part of 2001 at Murdoch University in Perth.

Brazil.—Ore production by Cia. Vale do Rio Doce (CVRD) rebounded to increase overall by about 32%. For the Azul Mine in the Carajás region and the Urucum Mine in Mato Grosso do Sul State, output in tons and percentage change in parentheses from 2000 were 1,219,000 (+34%) and 308,000 (+22%), respectively.

Late in the year, CVRD made the decision to combine all its manganese interests into a single company, as opposed to other alternatives such as selling or partnering some or all of its mines and ferroalloy plants. Besides Brazilian operations, the

[1]In a number of instances, discussions of the more-significant developments during 2000 for specific countries were based on news items in trade journals, such as American Metal Market, Metal Bulletin, Platt's Metals Week, Ryan's Notes, and TEX Report. These items have not been acknowledged individually because the information they conveyed often was aggregated, possibly with that from other sources.

new company would include the wholly owned ferroalloy plant at Dunkirk, France, whose name was changed as mentioned under France. Among its manganese ferroalloy plants in Brazil, the decision was made not to reopen that at Jeceaba in Minas Gerais State. The Corumbá plant in Mato Grosso do Sul State was reopened and was being upgraded. Output was being raised toward full capacity at Eletrosiderúrgica Brasileira S.A. in Bahia State and, in Minas Gerais State, at Barbacena, Ouro Preto, and Santa Ria. These efforts were projected to give a total production for the year of 240,000 t of manganese ferroalloys.

Shortly after midyear, the United Kingdom's Billiton acquired a 2.1% indirect shareholding in CVRD.

China.—Imports of manganese ore increased by 13% to 1.21 Mt. This ended a downward trend for imports during the preceding 3 years. A significant factor in the increase for 2000 was further growth in receipts from Ghana. Factors contributing to increased shipments from Ghana to China included suitability of Ghanian carbonate ore for production of silicomanganese, substitution for China's own low-grade ore, and use as an alternate to high-grade ore from other producers in the Western World.

In an effort to proceed with its program for rationalizing the domestic ferroalloy industry, the central government instructed local governments to end their financial support of a number of small- and medium-sized ferroalloy plants. How well this request was implemented was uncertain.

An agreement was worked out in the first part of the year with the Republic of Korea that liberalized restrictive measures imposed by the Republic of Korea in late 1998 against China's exporting of silicomanganese to the Republic of Korea (see Korea, Republic of).

France.—One of the high-carbon ferromanganese blast furnaces at the coastal Boulogne-sur-Mer plant of Société du Ferromanganèse de Paris-Outreau (SFPO), an Eramet subsidiary, was shut down during most of the second half of the year. This was done so that this furnace could be refurbished so as to be able to accept sintered ore produced in Gabon from manganese ore from Eramet's Moanda Mine. Also, a dry filtration system for improving environmental control was installed. The shutdown removed about 50,000 t of ferromanganese from the market and kept SFPO's output at about the 300,000 t level.

The name of CVRD's (Brazil) manganese ferroalloy plant, which also is on the coast nearby at Dunkirk, was changed at midyear to Rio Doce Manganese Europe (RDME) from Société Européenne d'Alliages pour la Sidérurgie (SEAS). This plant was producing high-carbon ferromanganese at a rate of about 140,000 t/yr, and also manganese sinter.

Gabon.—At yearend, Compagnie Minière de l'Ogooué S.A. (Comilog) inaugurated a sinter plant with a capacity of 600,000 t/yr along with associated facilities for beneficiating ore from the Moanda Mine. By this means, low-grade ore with a manganese content of 40% was to be upgraded to a sinter with a manganese content of 56% or more. Also, the sinter would effectively replace a portion of the mine's output of lump ore and reduce the quantity of crude ore needing to be extracted. Once the sinter plant's full capacity is reached, three-fourths of its output was to be shipped to SFPO in France for smelting and the balance sold externally.

Ghana.—Overall sales of ore produced at the Nsuta Mine of Ghana Manganese Co. rose by 40%. A significant portion of shipments were to China, particularly of carbonate ore; shipments to China were reported to have been in the range of 200,000 to 300,000 t.

Japan.—Overall imports of metallurgical-grade manganese ore that were only slightly less than those for 1999 gave the same rounded total of 1.02 Mt. The majority of imports were ore containing more than 39% manganese, imports of which decreased about 3% to 927,000 t, of which 94% was from the usual two sources, South Africa (546,000 t) and Australia (325,000 t). Imports of ore containing no more than 39% manganese increased 36%, to 90,900 t, of which virtually all was from South Africa (46,800 t) and India (44,000 t). Imports of ferruginous manganese ore again decreased, by about 38% to 128,000 t; Ghana (45%) displaced India (26%) as the largest supplier, followed by South Africa (19%) and Gabon (8%).

Overall production of manganese ferroalloys increased about 7%. Production of high-carbon ferromanganese and silicomanganese were up by about 13% and 3%, respectively, while that of low-carbon ferromanganese fell by about 11% to become the least since 1992.

Overall imports of manganese ferroalloys decreased about 7%, to 293,000 t. Those of high-carbon ferromanganese dropped again (53,500 t, -33%), those of medium- plus low-carbon ferromanganese rose again (16,200 t, +58%), and those of silicomanganese decreased about 2%, to 224,000 t. South Africa still led China as a source of ferromanganese overall for Japan; of these two countries, China supplied Japan with more high-carbon ferromanganese, while South Africa supplied about 10 times as much medium- plus low-carbon ferromanganese. Shipments of silicomanganese from China to Japan advanced about 16% to 180,000 t.

Exports of manganese ferroalloys more than doubled overall to 44,200 t. Exports of high-carbon ferromanganese increased almost 20 times, to 10,600 t, over 90% of which went to Taiwan. Exports of refined ferromanganese rose 78% to 33,600 t, of which 9,340 t went to the United States, 7,860 t to Taiwan, and 6,440 t to the Republic of Korea.

The year-to-year changes in trade patterns for manganese ferroalloys especially reflected production arrangements made within the past few years between Japanese and South African producers. In a further alignment, Japan's Nippon Denko Co. Ltd. and South Africa's Samancor Ltd. entered into an arrangement commencing April 2000 under which Nippon Denko was to produce high-carbon ferromanganese in place of that which Samancor had been shipping to Japanese customers, and Samancor was to increase its supply of manganese ore to Nippon Denko. The agreement, which included a technology exchange, would increase Nippon Denko's production of high-carbon ferromanganese at its Tokushima plant by about 50,000 t/yr above the 2000 level of about 130,000 t/yr. The agreement also would increase the quantity of Samancor manganese ore being taken by Nippon Denko from about 125,000 t/yr to 200,000 t/yr.

Production of manganese dioxide again rose, by 9%, to 63,400 t, the greatest since that for the record year of 1988. Exports of manganese dioxide declined, however, by 14% to 27,700 t.

Imports of unwrought manganese metal, including scrap, increased about 8%, to 43,300 t; China (77%), South Africa

(20%), and the United States (3%) continued as the sources for practically all metal imports.

Kazakhstan.—The manganese deposits of central Kazakhstan and their commercial prospects were reviewed by Takenov and others (2000). Ores from the Ushkatyn III deposit were said to be especially suitable for production of high-carbon ferromanganese, and smelting trials of these ores were discussed.

Disagreement that extended back to 1997 over ownership of and marketing of products from a number of mines and smelters in Kazakhstan was finally resolved in February. Trans-World Group (TWG) of the United Kingdom and the Shodiyev Group reached a settlement under which TWG would be paid for its shares in the assets in dispute, and the Shodiyev Group would assume the managing and product marketing of these assets. The Shodiyev Group was headed by Kazakhstani nationals. The Aksu ferroalloy plant located near Pavlodar was among assets included in the settlement. Manganese ferroalloys are produced at the Aksu plant, which is a part of Kazkhrom, the national chrome corporation. The Tur manganese deposit, to the southwest and also in central Kazakhstan, was being developed as a manganese ore source for the Aksu plant.

Late in the year, a rebuilt furnace was started up for production of manganese ferroalloys at the Temirtau Chemicals and Metallurgical Plant near and to the northwest of Karaganda. The output of this plant, which could be as much as 50,000 t/yr of ferromanganese and silicomanganese combined, was to be shipped a short distance to the Ispat Karmet steel works (Interfax Mining & Metals Report, 2000c). Mining licenses for local ore sources for the Temirtau plant, however, became the subject of a dispute (Interfax Mining & Metals Report, 2000b).

Korea, Republic of.—In mid-March, the Government relaxed measures it took in September 1998 to restrict the importing of Chinese silicomanganese. Under the new measures, effective as of the April-June quarter, silicomanganese could be imported from China without an antidumping duty provided that the quantity per quarter did not exceed 20,000 t, and the price must not be below a floor price set by the Government of the Republic of Korea.

Mexico.—Overall output of ore products by Cía. Minera Autlán decreased by 9%; 2000 quantities in metric tons and, in parentheses, percentage changes from 1999 were manganese carbonates sold, 42,000 (-35%); oxide nodules, 355,000 (-6%); and manganese dioxide, manganous oxide, and other oxides, 21,000 (+31%). Production of nodules was affected when the natural gas-fired kiln being used to nodulize carbonate ore from the mine in Hidalgo State was shut down for December because of the high price of natural gas. Overall production of manganese ferroalloys increased; however, by 6,000 t to a new record total of 199,000 t. A 44% rise in production of high-carbon ferromanganese more than offset decreases of 7% and 5% for refined ferromanganese and silicomanganese, respectively.

In December, TETRA Technologies, Inc., The Woodlands, TX, sold the operations of Industrias Sulfamex, S.A. de C.V., a producer of manganese sulfate and manganous oxide, to Comilog U.S., a holding company subsidiary of Eramet. Capacities of Sulfamex' Tampico plant were 27,000 t/yr for the sulfate and 24,000 t/yr for the oxide (Chemetals Inc., 2000).

Norway.—During the last quarter of the year, Tinfos Jernverk A/S commissioned a new furnace at its Kvinesdal plant near the southern tip of Norway. Addition of this third furnace raised capacity of the plant for silicomanganese to approximately 180,000 t/yr, or by about 60,000 t/yr.

Russia.—The West Siberian Metallurgical Combine (ZSMK) at Novokuznetsk in southwestern Siberia commissioned mining and processing facilities from which as much as 100,000 t of low-grade concentrate (18% to 25% manganese content) would be produced from the Durnovskoye deposit. By this means, the need to import ores from Kazakhstan and Ukraine for ZSMK's steel production would be reduced (Interfax Mining & Metals Report, 2000e). The Durnovskoye deposit is near Leninsk-Kuznetsky, slightly north of Novokuznetsk.

Blast furnace production of ferromanganese decreased at the Kosogorsky metallurgical plant at Tula south of Moscow because only one furnace was being used to produce ferromanganese in at least the first part of the year (Interfax Mining & Metals Report, 2000d). Late in the year, legal troubles involving payments to Trans Commodities Inc. caused the Kosogorsky plant to be placed under court supervision (Interfax Mining & Metals Report, 2000a).

South Africa.—According to preliminary data, production of metallurgical-grade ore and total ore increased by about one-sixth to the highest levels since 1990. All but 0.6% of total production was metallurgical-grade ore, the rest being chemical-grade ore, production of which has been declining since 1996. Within the production of metallurgical-grade ore, the proportions accounted for by ore containing 30% to 40% manganese and by ore containing more than 48% manganese decreased slightly to about 29% and 57% of the total, respectively. Production of ore containing 45% to 48% manganese rose 26-fold to the highest level since 1990, and accounted for about 8% of production of metallurgical-grade ore.

Toward yearend, Samancor reconfigured manganese ferroalloy operations at its Metalloys plant at Meyerton near Johannesburg. Seven smaller furnaces that had been producing silicomanganese were shut down, possibly permanently. All but about 40,000 t/yr of the productive capacity of these furnaces potentially was to be made up once maintenance was completed on one of the three large furnaces at the plant. This furnace had been used to produce high-carbon ferromanganese but could be used to produce silicomanganese. Even with such a change, productive capacity for high-carbon ferromanganese was expected to be maintained using only the two remaining large furnaces owing to achievement of higher operational efficiencies.

In another development affecting Samancor's ferroalloys output, Samancor and Japan's Nippon Denko worked out a long-term agreement that would favor Samancor's shipping of ore rather than high-carbon ferromanganese to Japan (see Japan).

In June, Delta (E.M.D.) (Pty.) Ltd. announced that by the second half of 2001 it would expand the annual capacity of its EMD plant at Nelspruit, Mpumulanga Province, by 11,000 t, or by 50%. The expansion project included provision for infrastructure sufficient for an ultimate capacity of 50,000 t, and also installation of a kiln in Northern Cape Province for Delta EMD's own production of reduced ore feed. Feed from the kiln would supplement that currently being obtained from the adjacent plant of Manganese Metal Co. (Pty) Ltd. in Nelspruit (Industrial Minerals, 2000).

Spain.—In July, the permanganate business of Industrial Quimica del Nalón (IQN) was acquired by Carus Chemical Co., headquartered at Peru, IL, in the United States and one of the world's few producers of potassium permanganate. The acquisition was made a subsidiary of Carus named Carus Nalon S.L., which included the former IQN plant at Trubia on the north coast near Oviedo. In recent years, this plant had been the only site in the European Economic Community at which potassium permanganate was being produced (Carus Chemical Co., 2000).

Ukraine.—Output of manganese concentrates rose 38%, as production was up 30% to 1.82 Mt at the Ordzhonikidze complex in the western part of the Nikopol' Basin and 58% to 917,000 t at the Marganets complex in the eastern part of the basin (Interfax Mining & Metals Report, 2001b). Of a total production that was the greatest since 1997, about two-thirds was by the Ordzhonikidze complex and one-third by the Marganets complex.

A review of manganese mining and beneficiation in the Nikopol' basin gave the makeup of the Ordzhonikidze complex as eight quarries, three beneficiation plants, and one agglomeration plant. Practical annual capacities of these facilities were stated to be, in Mt per year, 7.1 for extraction of crude ore, 2.28 for production of manganese concentrates, and 0.4 for production of agglomerate. Makeup of the Marganets complex was given as five underground mines, two quarries, two beneficiation plants, and a facility for production of manganese sulfate in solid or solution form. Efforts were underway to deal with beneficiation wastes that consisted of more than 100 Mt with a manganese content of 12.2% at the Ordzhonikidze complex and 120 Mt with a manganese content of from 10% to 18% at the Marganets complex (Postolovskiy, Kravchenko, and Prokopenko, 2000).

Higher outputs at electric furnace plants contributed to an increased production of manganese ferroalloys. Production was up more than 50% at the Nikopol' plant and modestly at the Zaporozh'ye plant (Interfax Mining & Metals Report, 2001a, c). Limited quantities of ferroalloys having a reduced phosphorus content were produced at the Nikopol' plant. At the Kramatorsk Works north of Donetsk in eastern Ukraine, addition of fluxed sinter to the charge was found to improve blast furnace production of ferromanganese (Mishchenko and others, 2000). Also at this works, trials of blast furnace production of silicomanganese showed this unconventional way of making this ferroalloy to be inefficient.

Current Research and Technology

Among many items in the current literature that reported on various aspects of manganese and the topics addressed were the following:

Geology.—Model of sedimentation of banded iron formation and associated iron and manganese ores, with particular reference to South Africa (Klemm, 2000), and a review of manganese in seawater and marine deposits (Glasby, 2000).

Ore Leaching and Reduction.—Leaching of Indian manganese ore (about 32% Mn) with aqueous sulfur dioxide (Naik, Sukla, and Das, 2000), simultaneous leaching of zinc sulfide and manganese dioxide using iron-oxidizing bacteria (Kai and others, 2000), and reduction of manganese ore (Australian and South African samples) with carbon monoxide, in reference to manganese ferroalloy production (Berg and Olsen, 2000).

Electrochemistry of Manganese Oxides.—Summary of presentations made at a special meeting of the International Battery Materials Association on manganese oxides in batteries (Blomgren, 2000; MacArthur and Blomgren, 2001, p. 76-79), review of manganese dioxide electrochemistry (Donne, 2000), and comparison of EMD versus chemical and natural manganese dioxides as cathode material in alkaline batteries (Bowden, Sirotina, and Hackney, 2000).

Lithium-Manganese Oxides.—Intensive research continued to be directed on their use in rechargeable lithium-ion batteries; review of forms of oxides by Whittingham and Zavalij (2000), characterization of commercial powders (Huang and others, 2000), chromium substitution into layered oxides (Hwang, Park, and Choy, 2000), and development of a hydrothermal method for preparing a manganese oxide from a lithium manganese oxide (Tang and others, 2000).

Uses of Manganese Oxides.—Molecular sieves and their potential applications (Suib, 2000), manganese-molybdenum oxides as anodes for electrolysis of seawater (Fujimura and others, 2000), and thin film studies of manganese dioxide as a potential ultracapacitor material (Pang, Anderson, and Chapman, 2000).

Biology.—Review of availability of manganese to biological systems and its effect on them (Sigel and Sigel, 2000).

Environment and Toxicology.—Study of industrial hygiene at a domestic alkaline battery plant (Hanley and Lenhart, 2000) and at manganese ferroalloy plants in Italy (Apostoli, Lucchini, and Alessio, 2000) and Norway (Gunst and others, 2000).

Water Systems.—Control of manganese content in well water supply by using potassium permanganate (Fulton and Ferrand, 2000), and effect of biomineralized manganese on corrosion of steel (Olesen, Nielsen, and Lewandowski, 2000).

Outlook

The trend of domestic and global demand for manganese will continue to follow closely that of steel production. Although growth rates for some nonmetallurgical components of manganese demand, especially batteries, may be higher than for steel production, this situation will have only a minor effect on overall manganese demand.

From 1988 to 2000, U.S. apparent consumption of manganese has been within about plus or minus 14% of 680,000 t of contained manganese. This largely has been a consequence of a reasonably comparable degree of variation in domestic steel production. During this period, manganese apparent consumption (see table 1) has tended to increase at about the same rate as raw steel production. Manganese apparent consumption may not have tracked steel production precisely because of the influence of unmeasured changes in stocks of manganese materials, such as those of importers. The effect of this may have outweighed changes in demand by steelmakers and may explain why for some years calculated apparent consumption showed positive or negative deviations from that which could be estimated on the basis of steel production.

Data of the American Iron and Steel Institute indicated that overall domestic raw steel production increased in 2000 by about 4%, which makes it likely that domestic manganese consumption increased by about the same extent. The trend line for manganese apparent consumption suggests that consumption will reach 800,000 t within 5 years. This is contingent upon U.S. raw steel production maintaining the past trend of an annual growth rate close to 1.4%, and no significant change in manganese unit consumption by U.S. steelmakers. The outlook for steel production to increase at a rate similar to that for the past two decades was not favorable, at least in the immediate future, in view of a downturn in the domestic economy that was continuing into 2001. Also, the October 2000 midterm forecast for 2000 through 2005 of the International Iron and Steel Institute (IISI) suggested a slow recovery, as the compound annual growth rate projected for steel consumption in the North American Free Trade Agreement countries was only 0.9% (Ian Christmas, Secretary General, International Iron and Steel Institute, October 3, 2000, IISI survey reveals renewed world steel consumption growth, accessed June 1, 2001, at URL http://www.worldsteel.org/trends_indicators/demand.html). For the automotive industry, demand for steel was seen as remaining important but in decline overall, whereas cast iron seemed increasingly likely to be replaced by aluminum (Wrigley, 2000). The majority of U.S. demand for manganese units will be met by imports.

Globally, growth trends for manganese demand similarly are linked strongly with steel production, which rose to a record level in 2000. In its October 2000 midterm steel consumption forecast for 2000 through 2005, the IISI projected an annual growth rate of 2% for the world overall. Higher growth rates were projected for Asian countries other than Japan; for China, the rate projected was 3.8%. One of the major companies in the world's manganese industry was not optimistic about growth in the midterm, foreseeing a growth of only 1.9% in the amount of steel produced worldwide during 2000 through 2005 (Bacardats, 2000). This company also foresaw that growth in global manganese demand would be held down by decreases in manganese unit consumption, particularly in countries such as China. Consumption was expected to trend downward for high-carbon ferromanganese and upward for silicomanganese and refined manganese ferroalloys. Buying patterns of U.S. steel mills were reported to be in line with this outlook (Ryan's Notes, 2001). Like the steel industry, the manganese industry continued to be challenged by overcapacity for mining and smelting.

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TABLE 1
SALIENT MANGANESE STATISTICS 1/

(Thousand metric tons, gross weight)

	1996	1997	1998	1999	2000
United States:					
Manganese ore (35% or more Mn):					
Exports	32	84	8	4	10
Imports for consumption	478	355	332	460	430
Consumption 2/	478	510	499	479	486
Stocks, December 31, consumers 2/	319	241	163	172	226
Ferromanganese:					
Exports	10	12	14	12	8
Imports for consumption	374	304	339	312	312
Consumption 3/	326	337	290	281	300
Stocks, December 31, consumers and producers	27	21	26	40	31
Consumption, apparent, manganese 4/	776	643	776	719	774
Ore price, dollars per metric ton unit, c.i.f. U.S. ports	3	2	2	2	2
World, production of manganese ore	24,300	21,900	20,100 r/	17,900 r/	20,200 e/

e/ Estimated. r/ Revised.
1/ Data are rounded to no more than three significant digits.
2/ Exclusive of iron and steel plants.
3/ Data for 1998 and later not directly comparable to that for prior years.
4/ Thousand metric tons, manganese content. Based on estimates of average content for all significant components except imports, for which content is reported.

TABLE 2
U.S. GOVERNMENT DISPOSAL AUTHORITIES AND INVENTORIES FOR MANGANESE MATERIALS AS OF YEAREND 2000 1/

(Metric tons, gross weight)

		Physical inventory				
		Uncommitted			Sold,	
	Disposal	Stockpile	Nonstockpile		pending	Grand
Material	authority	grade	grade	Total	shipment	total
Natural battery ore	106,000	89,500	16,800	106,000	874	107,000
Synthetic manganese dioxide	2,730	2,730	--	2,730	--	2,730
Chemical ore	137,000	137,000	--	137,000	4,010	141,000
Metallurgical ore	878,000	547,000	331,000	878,000	103,000	982,000
High-carbon ferromanganese	582,000	772,000	--	772,000	78,900	851,000
Electrolytic metal	5,640	5,640	--	5,640	146	5,790

-- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.

Source: Defense National Stockpile Center.

TABLE 3
DOMESTIC PRODUCERS OF MANGANESE PRODUCTS IN 2000

		Products 1/				
Company	Plant location	FeMn	SiMn	Mn	MnO_2	Type of process
Chemetals Inc. 2/	Baltimore, MD				X	Chemical.
Do.	New Johnsonville, TN				X	Electrolytic.
Eramet Marietta Inc.	Marietta, OH	X	X	X		Electric furnace and electrolytic.
Kerr-McGee Chemical LLC	Hamilton, MS			X		Electrolytic.
Do.	Henderson, NV				X	Do.
Ralston Purina Co., Eveready Battery Co. 3/	Marietta, OH				X	Do.

1/ FeMn, ferromanganese; SiMn, silicomanganese; Mn, manganese metal; MnO_2, synthetic manganese dioxide.
2/ Name changed to Erachem Comilog Inc. as of January 1, 2001.
3/ Spun off into Energizer Holdings, Inc., as of April 1, 2000.

TABLE 4
U.S. CONSUMPTION, BY END USE, AND INDUSTRY STOCKS OF MANGANESE FERROALLOYS AND METAL IN 2000

(Metric tons, gross weight)

End use	Ferromanganese: High carbon	Ferromanganese: Medium and low carbon	Ferromanganese: Total	Silico-manganese	Manganese metal
Steel:					
Carbon	125,000	101,000	225,000	74,600	1,340
High-strength, low-alloy	22,700	4,120	26,800	4,930	(2/)
Stainless and heat-resisting	13,700	(2/)	13,700	6,350	1,530
Full alloy	15,500	6,610	22,100	19,600	(2/)
Unspecified 3/	299	332	631	275	195
Total	177,000	112,000	289,000	106,000	3,060
Cast irons	8,660	503	9,160	1,340	5
Superalloys	W	W	W	--	W
Alloys (excluding alloy steels and superalloys)	1,570	629	2,200	(4/)	18,300 5/
Miscellaneous and unspecified	--	W	W	(4/)	W
Total consumption	187,000	113,000	300,000	107,000 6/	21,400
Total manganese content 7/	146,000	90,200	236,000	70,700	21,400
Stocks, December 31, consumers and producers	11,300	20,200	31,500	10,700	4,750

W Withheld to avoid disclosing company proprietary data; included with "Alloys (excluding alloy steels and superalloys)." -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Withheld to avoid disclosing company proprietary data; included with "Steel: Unspecified."
3/ Includes electrical and tool steel, and items indicated by (2/).
4/ Withheld to avoid disclosing company proprietary data.
5/ Approximately 85% of this combined total was for consumption in aluminum alloys.
6/ Internal evaluation indicates that silicomanganese consumption is considerably understated.
7/ Estimated based on typical percent manganese content.

TABLE 5
U.S. EXPORTS OF MANGANESE ORE, FERROALLOYS, AND METAL, BY COUNTRY 1/

Country	1999: Gross weight (metric tons)	1999: F.a.s. value (thousands)	2000: Gross weight (metric tons)	2000: F.a.s. value (thousands)
Ore and concentrates with 20% or more manganese:				
Canada	1,250	$332	4,160	$1,020
Germany	--	--	589	278
Italy	--	--	350	172
Norway	--	--	333	136
Singapore	2,440	180	24	12
United Kingdom	136	11	3,800	304
Other	351 2/	128 2/	776	277
Total	4,170	651	10,000	2,200
Ferromanganese, all grades:				
Canada	10,700	5,920	7,610	4,910
Mexico	94	107	231	266
Venezuela	749	431	--	--
Other	54	54	111	106
Total	11,600	6,510	7,950	5,290
Silicomanganese:				
Canada	3,360	1,850	1,460	942
Mexico	250	220	373	221
Other	95	109	34	35
Total	3,700	2,180	1,870	1,200
Metal, including alloys and waste and scrap:				
Brazil	125	268	--	--
Canada	1,490	3,580	762	1,680
Japan	659	1,470	773	1,620
Mexico	111	299	248	491
Netherlands	190	411	73	136
United Kingdom	711	1,060	17	43
Other	254 2/	850 2/	349	1,050
Total	3,540	7,940	2,220	5,020

See footnotes at end of table.

TABLE 5--Continued
U.S. EXPORTS OF MANGANESE ORE, FERROALLOYS, AND METAL, BY COUNTRY 1/

-- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Revised; unspecified group of countries differs from that in the 1999 Annual Report.

Source: U.S. Census Bureau.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF MANGANESE ORE, FERROALLOYS, METAL, AND SELECTED CHEMICALS, BY COUNTRY 1/

Country	1999			2000		
	Gross weight (metric tons)	Manganese content (metric tons)	Customs value (thousands)	Gross weight (metric tons)	Manganese content (metric tons)	Customs value (thousands)
Ore and concentrates with 20% or more manganese:						
All grades:						
Australia	44,900	23,500	$4,380	34,800	18,100	$3,280
Brazil	2	1	2	7,030	3,250	373
Gabon	280,000	142,000	25,600	363,000	196,000	27,200
Ghana	26,100	10,200	505	17,400	6,510	209
Mexico	23,600	9,130	1,980	8,080	3,250	1,050
South Africa	85,300	39,100	4,690	--	--	--
Other	100	55 2/	54	132	97	29
Total	460,000	224,000	37,200	430,000	227,000	32,100
More than 20%, but less than 47% manganese:						
Brazil	--	--	--	7,030	3,250	373
Gabon	--	--	--	38,000	16,100	2,170
Ghana	26,100	10,200	505	17,400	6,510	209
Mexico	22,500	8,600	1,910	8,080	3,250	1,050
South Africa	27,300	9,970	1,410	--	--	--
Other	18	6	7	--	--	--
Total	75,900	28,800	3,840	70,500	29,100	3,800
47% or more manganese:						
Australia	44,900	23,500	4,380	34,800	18,100	3,280
Brazil	2	1	2	--	--	--
Gabon	280,000	142,000	25,600	325,000	180,000	25,000
South Africa	58,000	29,200	3,280	--	--	--
Other	1,170	572 2/	117	132	97	29
Total	384,000	195,000	33,400	360,000	198,000	28,300
Ferromanganese:						
All grades:						
Australia	11,700	8,920	4,600	30,400	22,800	11,500
Brazil	6,580	5,000	2,430	14,800	11,600	6,370
China	7,280	5,530	3,540	7,630	6,240	5,330
France	96,300	74,500	45,300	45,300	35,800	19,500
Italy	3,800	3,260	4,620	5,520	4,700	5,390
Japan	6,920	5,900	6,120	10,900	9,060	8,080
Korea, Republic of	10,800	8,760	6,210	8,550	6,840	5,060
Mexico	27,600	22,200	16,600	23,600	19,000	15,800
Norway	20	9	19	10,500	8,560	6,170
South Africa	140,000	110,000	59,400	151,000	119,000	66,600
Other	1,340	1,060	533	3,400	2,690	1,510
Total	312,000	245,000	149,000	312,000	246,000	151,000
1% or less carbon:						
Brazil	--	--	--	6,410	5,140	2,920
China	1,280	1,110	1,270	1,410	1,250	1,490
Italy	3,800	3,260	4,620	5,520	4,700	5,390
Japan	6,500	5,540	5,610	4,660	3,920	3,980
Mexico	2,220	1,770	2,010	1,570	1,260	1,350
South Africa	3,740	3,290	3,970	2,490	2,330	3,880
Other	69	64	70	230	211	229
Total	17,600	15,000	17,600	22,300	18,800	19,200

See footnotes at end of table.

TABLE 6--Continued
U.S. IMPORTS FOR CONSUMPTION OF MANGANESE ORE, FERROALLOYS, METAL, AND SELECTED CHEMICALS, BY COUNTRY 1/

Country	1999 Gross weight (metric tons)	1999 Manganese content (metric tons)	1999 Customs value (thousands)	2000 Gross weight (metric tons)	2000 Manganese content (metric tons)	2000 Customs value (thousands)
Ferromanganese--Continued:						
More than 1% to 2% or less carbon:						
China	--	--	--	6,230	4,990	$3,840
France	9,540	7,700	$7,970	60	48	37
Japan	424	361	511	6,250	5,140	4,100
Korea, Republic of	10,800	8,760	6,210	8,550	6,840	5,060
Mexico	25,400	20,400	14,600	20,700	16,700	13,800
Norway	20	9	19	10,500	8,520	6,140
South Africa	25,100	20,400	14,100	25,300	20,500	15,800
Other	--	--	--	188	150	130
Total	71,300	57,600	43,400	77,800	62,900	48,900
More than 2%, but not more than 4% carbon:						
Brazil	--	--	--	1	(3/)	2
South Africa	--	--	--	57	46	46
Total	--	--	--	58	46	48
More than 4% carbon:						
Australia	11,700	8,920	4,600	30,400	22,800	11,500
Brazil	6,580	5,000	2,430	8,310	6,410	3,370
China	6,000	4,420	2,260	--	--	--
France	86,700	66,800	37,300	45,200	35,700	19,500
South Africa	111,000	86,500	41,200	124,000	96,000	46,900
Other	1,270	994	463	4,540	3,550	1,880
Total	224,000	173,000	88,300	212,000	164,000	83,200
Silicomanganese:						
Australia	67,500	45,000	26,600	52,400	35,500	24,300
France	6,740	4,500	2,930	1,350	918	636
Georgia	13,400	9,900	5,470	6,250	4,390	2,940
India	10,900	7,020	4,340	60,500	39,300	26,200
Kazakhstan	27,700	18,800	10,900	66,400	45,200	28,400
Mexico	58,800	38,600	24,900	45,400	29,700	21,000
Norway	--	--	--	4,400	2,680	2,780
Romania	--	--	--	9,630	6,360	4,170
South Africa	89,300	60,000	35,800	97,400	65,400	43,600
Ukraine	8,190	6,030	2,850	--	--	--
Venezuela	16,900	11,100	6,530	24,100	16,100	10,500
Other	1,190	753	694	10,300	6,710	4,890
Total	301,000	202,000	121,000	378,000	252,000	169,000
Metal:						
Unwrought:						
China	2,770	XX	3,860	3,320	XX	4,410
Germany	255	XX	433	1,760	XX	2,360
South Africa	8,910	XX	14,100	9,160	XX	13,900
Ukraine	429	XX	622	20	XX	23
United Kingdom	497	XX	976	627	XX	1,120
Other	40	XX	69	193	XX	288
Total	12,900	XX	20,100	15,100	XX	22,100
Other:						
China	1,700	XX	847	92	XX	162
France	29	XX	308	92	XX	841
Netherlands	33	XX	67	80	XX	148
Ukraine	119	XX	129	189	XX	204
Other	162 4/	XX	1,200 4/	211	XX	911
Total	2,040	XX	2,550	663	XX	2,270
Waste and scrap:						
Canada	130	XX	183	433	XX	357
China	22	XX	61	--	XX	--
Norway	--	XX	--	20	XX	16

See footnotes at end of table.

TABLE 6--Continued
U.S. IMPORTS FOR CONSUMPTION OF MANGANESE ORE, FERROALLOYS, METAL, AND SELECTED CHEMICALS, BY COUNTRY 1/

Country	1999 Gross weight (metric tons)	1999 Manganese content (metric tons)	1999 Customs value (thousands)	2000 Gross weight (metric tons)	2000 Manganese content (metric tons)	2000 Customs value (thousands)
Manganese dioxide:						
Australia	21,400	XX	$30,200	25,400	XX	$36,500
Belgium	591	XX	913	769	XX	1,260
China	24	XX	31	1,060	XX	1,320
Greece	16	XX	22	1,580	XX	2,060
Ireland	8,380	XX	11,700	9,510	XX	13,100
South Africa	10,400	XX	14,700	12,200	XX	17,200
Other	154 4/	XX	628 4/	633	XX	1,300
Total	40,900	XX	58,200	51,200	XX	72,700
Potassium permanganate:						
Czech Republic	750	XX	1,410	824	XX	1,590
India	420	XX	749	481	XX	873
Spain	491	XX	704	156	XX	352
Other	59 4/	XX	111 4/	60	XX	136
Total	1,720	XX	2,980	1,520	XX	2,950

XX Not applicable. -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes U.S. Geological Survey's conversion of part of reported data (from apparent MnO_2 content to Mn content).
3/ Less than 1/2 unit.
4/ Revised; unspecified group of countries differs from that in the 1999 Annual Report.

Source: U.S. Census Bureau, adjusted by the U.S. Geological Survey.

TABLE 7
MANGANESE ORE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons)

Country 3/	Range percent Mn e/ 4/	Gross weight 1996	Gross weight 1997	Gross weight 1998	Gross weight 1999	Gross weight 2000 e/	Metal content 1996	Metal content 1997	Metal content 1998	Metal content 1999	Metal content 2000 e/
Australia 5/	37-53	2,109	2,136	1,500	1,892	1,614 6/	1,023	1,024	729	926	787 6/
Brazil 7/	30-50	2,506	2,124	2,149	1,674 r/	2,000	977	977 r/	988 r/	770 r/	920
China e/ 8/	20-30	7,600	6,000	5,300	3,190 r/	4,000	1,520	1,200	1,060	630 r/	800
Gabon 9/	45-53	1,983	1,904	2,092	1,908 r/	1,743 6/	915	879	966	881 r/	804 6/
Ghana	30-50	448	437	537	639 r/ 10/	896 10/	152	149	172 e/	204 r/	287
India 11/	10-54	1,797	1,596	1,557	1,500 e/	1,550	680 e/	606 e/	592 e/	570 e/	590
Kazakhstan (crude ore) e/	20-30	430	400	634 6/	980 6/	1,136 6/	106	98	155	240	280
Mexico 12/	27-50	485	534	510	459	418	173	193	187	169	156
South Africa 9/	30-48+	3,240	3,121	3,044	3,122	3,635 6/	1,381 r/	1,324 r/	1,298 r/	1,343 r/	1,578 6/
Ukraine	30-35	3,070	3,040	2,226	1,985 r/	2,741 6/	1,040 e/	1,030 e/	755 e/	675 e/	930
Other e/ 13/	XX	632 r/	608	551 r/	551 r/	467	201 r/	181 r/	159 r/	162 r/	147
Total	XX	24,300	21,900	20,100 r/	17,900 r/	20,200	8,170 r/	7,660 r/	7,060 r/	6,570 r/	7,280

e/ Estimated. r/ Revised. XX Not applicable.
1/ World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.
2/ Table includes data available through July 26, 2001. Data pertain to concentrates or comparable shipping product, except that in a few instances the best data available appear to be for crude ore, possibly after some upgrading.
3/ In addition to the countries listed, Burkina Faso, Cuba, Panama, and Sudan may have produced manganese ore and/or manganiferous ore, but available information is inadequate to make reliable estimates of output levels.
4/ May be average content of each year's production rather than for content of typical products.
5/ Metallurgical ore.
6/ Reported figure.
7/ Production of beneficiated ore as reported in Sumário Mineral (Brasilia).
8/ Includes manganiferous ore.
9/ Calculated metal content includes allowance for assumed moisture content.
10/ Sales.
11/ Much of India's production grades below 35% Mn; content averaged 38.3% Mn for fiscal years 1998-99 through 1999-2000.
12/ Mostly oxide nodules; may include smaller quantities of direct-shipping carbonate and oxide ores for metallurgical and battery operations.
13/ Category represents the combined totals of Bosnia and Herzegovina, Bulgaria, Burma, Chile, Colombia, Egypt, Georgia, Greece, Hungary, Indonesia, Iran, Italy (from wastes), Japan (low-grade ore), Malaysia, Morocco, Namibia, Romania, Russia (crude ore), Thailand, and Turkey.

TABLE 8
FERROMANGANESE AND SILICOMANGANESE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons, gross weight)

Country 3/	1996 Ferromanganese Blast furnace	1996 Ferromanganese Electric furnace	1996 Ferromanganese Total	1996 Silico-manga-nese	1996 Grand total	1997 Ferromanganese Blast furnace	1997 Ferromanganese Electric furnace	1997 Ferromanganese Total	1997 Silico-manga-nese	1997 Grand total
Argentina	--	7	7	25	32	--	8	8	26	35
Australia e/	--	110	110	95	205	--	95	95	95	190
Belgium e/ 4/	--	25	25	--	25	--	25	25	--	25
Brazil	--	215	215	232	447	--	153	153	175	328
Chile	--	8	8	2	10	--	6	6	3	9
China e/	450	700	1,150	840	1,990	500	680	1,180	770	1,950
Egypt e/	--	35	35	--	35	--	26 r/	26 r/	--	26 r/
France 5/	337	100	437	61 e/	498 e/	326	100	426	66 e/	492 e/
Georgia e/	--	8	8	7	15	--	4	4	17	21
Germany e/ 4/	--	10 r/	10 r/	--	10 r/	--	-- r/	-- r/	--	-- r/
India e/	--	190	190	170	360	--	166	166	198	364
Indonesia e/	--	14	14	7	21	--	15	15	7	22
Italy	--	25	25	100	125	--	40 r/	40 r/	100 e/	140 r/ e/
Japan	--	343	343	76	419	--	377	377	78	455
Kazakhstan e/	--	--	--	50	50	--	--	--	55	55
Korea, North e/ 4/	--	6	6	--	6	--	6	6	--	6
Korea, Republic of	--	126	126	83	210	--	159	159	77 r/	236 r/
Mexico 6/	--	69	69	93	162	--	68	68	105	173
Norway e/	--	215 7/	215 7/	210	425	--	235	235	230	465
Poland	60	--	60	25	85	48 e/	--	48 e/	20	68 e/
Romania	--	20	20	79	99	--	12	12	63	74
Russia 8/	67	--	67	--	67	47	--	47	--	47
Slovakia e/	--	25	25	12	37	--	20	20	45 r/ 7/	65 r/
South Africa	--	548 r/	548 r/	254 r/ e/	802 r/ e/	--	499 r/	499 r/	286 e/	785 r/ e/
Spain e/	--	16 r/	16 r/	102 r/	118 r/	--	23 r/	23 r/	122 r/	145 r/
Taiwan	--	14	14	--	14	--	12	12	--	12
Ukraine e/	100	170	270	600	870	125	160	285	560	845
Venezuela	--	--	--	53 r/	53 r/	--	--	--	64 r/	64 r/
Total	1,010	3,000 r/	4,010 r/	3,180 r/	7,190 r/	1,050	2,890 r/	3,930 r/	3,160 r/	7,100 r/

Country 3/	1998 Ferromanganese Blast furnace	1998 Ferromanganese Electric furnace	1998 Ferromanganese Total	1998 Silico-manga-nese	1998 Grand total	1999 Ferromanganese Blast furnace	1999 Ferromanganese Electric furnace	1999 Ferromanganese Total	1999 Silico-manga-nese	1999 Grand total
Argentina	--	5	5	25	30	--	2 r/ e/	2 r/ e/	10 r/ e/	12 r/ e/
Australia e/	--	110	110	105	215	--	98 r/	98 r/	116 r/	214 r/
Belgium e/ 4/	--	20	20	--	20	--	--	--	--	--
Brazil	--	122	122	124	246	--	85 r/	85 r/	148 r/	234 r/
Chile	--	4	4	4	8	--	4 e/	4 e/	4 e/	8 e/
China e/	550	500	1,050	639	1,690	550 r/	550	1,100 r/	822 r/	1,920 r/
Egypt e/	--	18 r/	18 r/	--	18 r/	--	30 r/	30 r/	--	30 r/
France 5/	321 e/	100 e/	421 e/	65 e/	486 e/	302	138 r/ e/	440 r/ e/	55 r/ e/	495 r/ e/
Georgia e/	--	10	10	35	45	--	7 r/	7 r/	25 r/	32 r/
Germany e/ 4/	--	-- r/	-- r/	--	-- r/	--	-- r/	-- r/	--	-- r/
India e/	--	165	165	193	358	--	160	160	190	350
Indonesia e/	--	13	13	7	20	--	12 r/	12 r/	7	19 r/
Italy	--	49 r/	49 r/	70 r/	119 r/	--	19 r/	19 r/	67 r/	86 r/
Japan	--	334	334	71	405	--	315	315	66	381
Kazakhstan e/	--	--	--	57	57	--	--	--	75	75
Korea, North e/ 4/	--	6	6	--	6	--	6	6	--	6
Korea, Republic of	--	158	158	107	265	--	140 r/	140 r/	116 r/	256 r/
Mexico 6/	--	87	87	105	192	--	79	79	114	193
Norway e/	--	235	235	230	465	--	235	235	230	465
Poland	50	--	50	15 r/	65 r/	60 e/	--	60 e/	25	85 e/
Romania	--	4	4	84	88	--	(9/)	(9/)	1	1
Russia 8/	65	--	65	--	65	90 e/	--	90 e/	--	90 e/
Slovakia e/	--	20	20	47 r/ 7/	67 r/	--	20	20	37 r/	57 r/
South Africa	--	542 r/	542 r/	265 e/	807 r/ e/	--	527 r/	527 r/	267 r/	794 r/
Spain e/	--	18 r/	18 r/	108 r/	126 r/	--	10 r/	10 r/	95 r/	105 r/
Taiwan	--	13	13	--	13	--	--	--	--	--
Ukraine e/	112 7/	150	262	486 7/	748	58	200 r/ 7/	257 r/ 7/	499 7/	756 r/
Venezuela	--	8	8	49 r/	57 r/	--	11 e/	11 e/	48 r/	59 r/ e/
Total	1,100	2,690	3,790	2,890 r/	6,680 r/	1,060 r/	2,650	3,710 r/	3,020 r/	6,720 r/

See footnotes at end of table.

TABLE 8--Continued
FERROMANGANESE AND SILICOMANGANESE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons, gross weight)

	2000 e/				
	Ferromanganese			Silico-	
Country 3/	Blast furnace	Electric furnace	Total	manga-nese	Grand total
Argentina	--	--	--	--	--
Australia e/	--	115	115	135	250
Belgium e/ 4/	--	--	--	--	--
Brazil	--	110	110	150	260
Chile	--	4	4	4	8
China e/	500	520	1,020	900	1,920
Egypt e/	--	30	30	--	30
France 5/	300	140	440	60	500
Georgia e/	--	7	7	25	32
Germany e/ 4/	--	--	--	--	--
India e/	--	160	160	185	345
Indonesia e/	--	12	12	7	19
Italy	--	40	40	90	130
Japan	--	338 7/	338 7/	68 7/	406 7/
Kazakhstan e/	--	5	5	100	105
Korea, North e/ 4/	--	6	6	--	6
Korea, Republic of	--	140	140	110	250
Mexico 6/	--	91	91	108	199
Norway e/	--	235	235	230	465
Poland	60	--	60	25	85
Romania	--	1 7/	1 7/	21 7/	22 7/
Russia 8/	71	--	71	--	71
Slovakia e/	--	20	20	35	55
South Africa	--	530	530	270	800
Spain e/	--	10	10	100	110
Taiwan	--	--	--	--	--
Ukraine e/	85	253 7/	338	684 7/	1,022
Venezuela	--	--	--	50	50
Total	1,020	2,770	3,780	3,360	7,140

e/ Estimated. r/ Revised. -- Zero.
1/ Table includes data available through July 25, 2001.
2/ World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.
3/ In addition to the countries listed, Iran is believed to have produced ferromanganese and silicomanganese, but production figures are not reported; general information is inadequate for the formulation of reliable estimates of output levels. Production of manganese ferroalloys, ferrosilicon, and silicon metal began in 1996 for Saudi Arabia, but data for actual production were not available. Data for U.S. production of manganese ferroalloys are not included to avoid disclosing company proprietary data.
4/ Ferromanganese includes, if any, silicomanganese.
5/ Silicomanganese includes, if any, silicospiegeleisen.
6/ Salable products from Autlán.
7/ Reported figure.
8/ Russia is believed to have produced some silicomanganese during 1996-99, but data for actual production were not available.

TABLE 8--Continued
FERROMANGANESE AND SILICOMANGANESE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons, gross weight)

	1998					1999				
	Ferromanganese			Silico-		Ferromanganese			Silico-	
	Blast	Electric		manga-	Grand	Blast	Electric		manga-	Grand
Country 3/	furnace	furnace	Total	nese	total	furnace	furnace	Total	nese	total
Venezuela	--	8	8	49 r/	57 r/	--	11 e/	11 e/	48 r/	59 r/ e/
Total	1,100	2,690	3,790	2,890 r/	6,680 r/	1,060 r/	2,650	3,710 r/	3,020 r/	6,720 r/

	2000 e/				
	Ferromanganese			Silico-	
	Blast	Electric		manga-	Grand
Country 3/	furnace	furnace	Total	nese	total
Argentina	--	--	--	--	--
Australia e/	--	115	115	135	250
Belgium e/ 4/	--	--	--	--	--
Brazil	--	110	110	150	260
Chile	--	4	4	4	8
China e/	500	520	1,020	900	1,920
Egypt e/	--	30	30	--	30
France 5/	300	140	440	60	500
Georgia e/	--	7	7	25	32
Germany e/ 4/	--	--	--	--	--
India e/	--	160	160	185	345
Indonesia e/	--	12	12	7	19
Italy	--	40	40	90	130
Japan	--	338 7/	338 7/	68 7/	406 7/
Kazakhstan e/	--	5	5	100	105
Korea, North e/ 4/	--	6	6	--	6
Korea, Republic of	--	140	140	110	250
Mexico 6/	--	91	91	108	199
Norway e/	--	235	235	230	465
Poland	60	--	60	25	85
Romania	--	1 7/	1 7/	21 7/	22 7/
Russia 8/	71	--	71	--	71
Slovakia e/	--	20	20	35	55
South Africa	--	530	530	270	800
Spain e/	--	10	10	100	110
Taiwan	--	--	--	--	--
Ukraine e/	85	253 7/	338	684 7/	1,022
Venezuela	--	--	--	50	50
Total	1,020	2,770	3,780	3,360	7,140

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

1/ Table includes data available through July 25, 2001.

2/ World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

3/ In addition to the countries listed, Iran is believed to have produced ferromanganese and silicomanganese, but production figures are not reported; general information is inadequate for the formulation of reliable estimates of output levels. Production of manganese ferroalloys, ferrosilicon, and silicon metal began in 1996 for Saudi Arabia, but data for actual production were not available. Data for U.S. production of manganese ferroalloys are not included to avoid disclosing company proprietary data.

4/ Ferromanganese includes, if any, silicomanganese.

5/ Silicomanganese includes, if any, silicospiegeleisen.

6/ Salable products from Autlán.

7/ Reported figure.

8/ Russia is believed to have produced some silicomanganese during 1996-99, but data for actual production were not available.