IRON ORE

By William S. Kirk

Domestic survey data and tables were prepared by Heather A. Geissler, statistical assistant, and the world production table was prepared by Linder Roberts, international data coordinator.

Domestic production of iron ore in 2000 increased by 9%, reflecting an increase in steel production with the attendant increase in pig iron production. Similarly, world iron ore output rose reflecting higher levels of steel and pig iron production. There were major acquisitions in the iron ore industry. Iron ore prices increased.

Iron ore is essential to the economy and national security of the United States. As the basic raw material from which iron and steel are made, its supply is critical to any industrial country. Scrap is used as a supplement in steelmaking but is limited as a major feed material because the supply of high-quality scrap is limited. However, alternatives, such as direct reduced iron (DRI), were available, and their use is growing. In 2000, the steel industry accounted for more than 98.5% of iron ore consumption.

Iron ore is a mineral substance which, when heated in the presence of a reductant, will yield metallic iron. It almost always consists of iron oxides, the primary forms of which are magnetite (Fe_3O_4) and hematite (Fe_2O_3). Taconite, the principal iron ore mined in the United States, has a low (20% to 30%) Fe content and is found in hard, fine-grained, banded iron formations.

Production

Following a year marked by reduced demand for iron ore, U.S. iron ore production in 2000 reached its highest level since 1981, 63.0 million metric tons (Mt).

The nine taconite mining operations in Michigan and Minnesota accounted for virtually all domestic iron ore production. Seven of these operations were on the Mesabi Iron Range in northeastern Minnesota: EVTAC Mining LLC, Hibbing Taconite Co., Inland Steel Mining Co., LTV Steel Mining Co., National Steel Pellet Co., Northshore Mining Co., and the US Steel Group of USX Corp. (Minntac). The two taconite operations on the Marquette Iron Range in the Upper Peninsula of Michigan were the Empire and the Tilden Mines.

U.S. production data for iron ore are developed by the U.S. Geological Survey (USGS) by means of the annual "Iron Ore" survey, which provided 100% of total production shown in tables 1 through 4. This information is supplemented by employment data, mine inspection reports, and information from consumers. The American Iron Ore Association (AIOA) provided data on ore shipments from loading docks on the upper Great Lakes, as well as receipts at transfer docks and furnace yards nationwide. The dock and steel plant data were compiled jointly by AIOA and the American Iron and Steel Institute (AISI).

Iron ore was produced by 13 companies. One other company did not produce ore, but shipped it from stockpiles. The nine taconite producers in Michigan and Minnesota accounted for 99% of domestic production. The producing companies operated 13 mining operations, 10 iron ore concentration plants, and 10 pelletizing plants. Of the two iron ore producers that did not produce pellets, one produced iron ore as a byproduct of gold mining, and the others produced direct-shipping ore, which requires minimal processing. Of the 13 mining operations, 12 were open pit and 1 was underground. Virtually all ore was concentrated before shipment, and 99% was pelletized. In 2000, combined United States and Canadian production represented 9% of the world output of usable ore in terms of metal content. Trends in world mine production since 1996 are shown on a country basis in table 17.

Domestic iron ore supply (production minus exports) satisfied 75% of domestic demand in 2000, compared with an average of 70% from 1990 through 2000. Domestic iron ore production, at 63 Mt, increased by 9% from that of 1999. Productivity in the Lake Superior District, in terms of thousands of tons of usable

Iron Ore in the 20th Century

From well before 1900 and into 2000 virtually all iron ore has been used to make steel, so the iron ore industry's fortunes were and continued to be inextricably linked to those of the steel industry. In 1904, the United States was the world's largest iron ore producer, accounting for about 60% of total world output of 46 million metric tons (Mt). Despite this, the United States was already a net importer of iron ore, if only by a small margin. After domestic production peaked at 127 Mt during World War II, it became apparent that U.S. reserves of high-grade ore would be seriously depleted by the 1950s. It was in this decade that production of high-grade pelletized concentrate began. Despite the need for much more processing, compared with the direct shipping ores of the past, the use of pellets made blast furnaces much more productive.

By the end of the 20th century, world iron ore production had grown to more than 1 billion tons per year. In the United States, however, production averaged about 60 million tons per year (Mt/yr) and consumption averaged 77 Mt/yr. The United States ranked as the sixth largest producing nation and accounted for only 6% of world production. Globally, the proportion of ore production that was exported continued to grow, reaching almost 45%. Australia and Brazil increasingly dominated that export market, capturing almost 70%. The end of the 20th century saw a wave of consolidation in the iron ore industry as producers strove to reduce production costs and become more competitive.

ore produced per worker in 2000, was 9.3, an 8% increase from that of 1999. Low-grade ores of the taconite type mined in Michigan and Minnesota accounted for 99% of total usable ore production. U.S. production of pellets totaled 62.4 Mt. The average Fe content of usable ore produced was 62.9%. Fluxed pellets' share of total pellet production was 60% in 2000.

Michigan.—Michigan accounted for 23.8% of the output of usable ore in 2000. Pellets accounted for 99% of total production.

Minnesota.—Minnesota produced 76.1% of the national output of usable ore in 2000. All the State's production came from open pit mines on the Mesabi Range.

LTV Steel Co., Inc., a subsidiary of The LTV Corp., on May 24, announced its intention to close permanently the operations of LTV Steel Mining Co. (LTVSMC). LTVSMC was located at Hoyt Lakes, MN, employed approximately 1,400 people, and produced about 7 Mt of pellets in 1999. LTV Steel stated that its blast furnaces were experiencing lower levels of productivity and higher costs as a result of operating problems related to poor taconite pellet quality. The poor quality pellet was the result of deteriorating ore quality and the obsolete shaft furnaces used in the pelletizing plant. LTVSMC operated the only remaining shaft furnaces in the North American taconite pellet industry. These maintenance-intensive furnaces were not competitive with modern straight grate or grate kiln furnaces, which produce better quality pellets at lower cost. Replacement of the shaft furnaces and other related changes would require investments of about $500 million within 3 years, and a total investment of about $700 million in the next 10 years. The company said that such an investment could not be justified and would not resolve the problems of poor quality ore reserves (Kirk, 2000a).

Another major problem at the mine was the high stripping ratio. Stripping is the removal of layers of soil and waste rock that cover the ore. The more overburden that must be stripped to expose the crude ore, the higher the stripping ratio and, consequently, the higher the production costs. The iron formation on the Mesabi Range dips at an angle of about 8 degrees. Mining must follow the iron formation down dip, and as it proceeds, the overburden becomes thicker. Because LTVSMC was the oldest continuously operating taconite mining operation on the Minnesota Iron Range, and had some of the deepest pits, it had considerably more stripping to do than the other producers (Kirk, 2000a).

Minntac closed one of its agglomerating lines on November 5th for the remainder of the year. National Steel Pellet Co. announced that it would lay off 22 employees at the end of the year. The closings were attributed to low iron ore demand that was the result of high levels of steel imports (Lee Bloomquist, Duluth News Tribune, November 7, 2000, Minntac layoffs delayed—Agreement prevents cuts until year's end, accessed November 7, 2000, at URL http://www.duluthnews.com/today/dnt/tac.htm; Lee Bloomquist, Duluth News Tribune, December 8, 2000, Keewatin taconite plant to lay off 22, accessed December 8, 2000, at URL http://www.duluthnews.com/today/dnt/nat.htm).

Missouri.—Pea Ridge Iron Ore Co. produced iron oxide powder at its mining complex near Sullivan. The company has the only active underground iron ore mine in the country. In January 1991, the company ceased pellet production and began concentrating on specialty iron oxide products, which had formerly been coproducts.

Consumption

Data on consumption and stocks of iron ore and iron ore agglomerates (pellets and sinter) at iron and steel plants were provided by the AIOA. Data on consumption of iron ore for nonsteel end uses were compiled from information gathered from USGS surveys. Domestic iron ore consumption, responding to increased steel production, rose 2%, to 76 Mt. Stocks and net imports increased.

The number of blast furnaces in operation during the year ranged from 33 to 36. Consumption of iron ore, including agglomerates reported to the AISI by integrated producers of iron and steel, totaled 73 Mt. This included 61.8 Mt of pellets; 10.8 Mt of sinter, briquettes, etc.; and 0.4 Mt of natural coarse ore. Of the ore consumed, 82% was of domestic origin, 9% came from Canada, and 9% came from other countries. Other materials consumed in sintering plants included mill scale, flue dust, limestone and dolomite, slag and slag scrap, and coke breeze. Other iron-bearing materials charged to blast furnaces included mill scale, slag scrap, and steel-furnace slag.

The four consumption numbers in this annual review are listed in tables 1, 6, 7, and 8. The following explains why more than one consumption number is used and how each of them is derived. The first consumption number (76.5 Mt in 2000) is in table 1 and is the sum of the quantity of ore consumed by form as reported by the AISI (American Iron and Steel Institute, 2000, p. 84) and the quantities of ore consumed in DRI production and ore consumed in nonsteel uses, as reported to the USGS; the AISI number is reported in short tons and is converted to metric tons. The second consumption number (70.7 Mt in 2000) is in table 6 and is the quantity of ore consumed at U.S. iron and steel plants by originating area, as reported by the AIOA; the number has been converted from long tons, as it appears in the AIOA annual report, to metric tons (American Iron Ore Association, 2000, p. 42). The third consumption number (73.0 Mt in 2000) is in table 7 and is the quantity of ore consumed in U.S. iron and steel plants by type of ore as reported by the AISI; the number has been converted from short tons, as it is listed in the AISI annual report, to metric tons (American Iron and Steel Institute, 2000, table 32). The fourth consumption number (74.1 Mt in 2000) is in table 8 and is the sum of the AIOA number for consumption at United States Iron and Steel plants (American Iron Ore Association, 2000, p. 46, 47) and two other numbers; these are the quantities of ore consumed in DRI production (2.3 Mt in 2000) and nonsteel uses (1.2 Mt in 2000) as reported to the USGS. In summary, iron ore consumption for steelmaking is calculated by the AIOA and the AISI using different methods. To obtain total domestic iron ore consumption, iron ore consumption for other end uses must be added to AIOA and AISI reported consumption, thereby generating four consumption numbers.

Ispat International NV planned to install electric arc furnaces at its Inland Works in East Chicago to replace the No. 2 oxygen steelmaking shop there. Blast furnaces nos. 5 and 6 were nearing the end of their working lives, but were not to be replaced. Instead, Ispat planned to put in two electric furnaces with a combined capacity of about 3 million metric tons per year (Mt/yr), about the same as the existing facilities (Metal Bulletin, 2000q).

Prices

Most iron ore prices are negotiated between buyer and seller. In 2000, 79% of domestic ore was produced by captive mines (mines producing for company-owned blast furnaces) and, therefore, did not reach the open market and cannot be said to have a price. Slightly less than 20% of domestic production came from mines wholly or partly owned by Cleveland-Cliffs Inc. (Cliffs). Prices for that ore were unavailable. Prices may be available for the less than 1% of ore from mines owned by steel companies and Cliffs, but those prices would be representative of only a tiny portion of domestic production.

The average free-on-board mine value of usable ore shipped in 2000 was $25.57 per metric ton, slightly lower than that of 1999. This average value should approximate the average commercial selling price less the cost of mine-to-market transportation.

International iron ore prices rose in 2000. The price for Hamersley Iron Ore Pty. Ltd. and Mount Newman Mining Co. Pty. Ltd. fine ores for fiscal year 2000 (April 1, 2000, to March 31, 2001) in the Japanese market was 27.35 cents per 1% Fe per long ton unit, up 4.4% compared with that of 1999 (Duisenberg, 2001, p. 46). The price for lump ore was settled at 36.26 cents per 1% Fe per long ton unit, an increase of 5.8 % compared with that of 1999. The lump ore to fine ore premium for Australian ore sold to Japan, increased from 8.2 in 1999 to 9.1 cents per 1% Fe per long ton unit. There were similar price percentage decreases in Europe. Iron ore prices have declined over the long term as well. The price of Carajás fines, a grade of ore produced by Companhia Vale do Rio Doce (CVRD) and sold to Europe, when denominated in U.S. dollars and adjusted for inflation using the U.S. Consumer Price Index for All Urban Consumers, fell by 33% between 1990 and 2000.

Transportation

Almost no iron ore is consumed near its source; most ores must be transported, often great distances. Nearly all iron ore leaves the mine by rail, after which much of it is transferred to ships. In the United States, a much larger proportion of ore is moved by water than in other countries because of the proximity of the mines to the Great Lakes, which offer low-cost transportation. No taconite mine is more than about 160 kilometers (km) from Lake Superior or Lake Michigan, and most are much closer. In 2000, 47.5 Mt of ore was moved on the Great Lakes, the equivalent of about 75% of domestic production. Iron ore constituted 47% of U.S.-flag cargoes, more than twice that of stone and gypsum, the next largest dry bulk material category shipped. Excluding transshipments, U.S.-flag carriers moved 53 Mt of iron ore in 2000.

Iron ore plays a more important role in Great Lakes shipping than is readily apparent. Significant quanities of coal and stone move via the Great Lakes, but they are generally backhaul cargoes. When a laker (ore carrier) moves an iron ore cargo to a steel mill, it often carries a stone or coal cargo on the way back to the iron ore ports of Lake Superior. Without iron ore to fill one leg of the voyage, freight rates would increase so much that railroads would capture much of these markets (Lake Carriers Association, oral commun., July 12, 2001).

The U.S. Congress passed and the President signed a bill providing funding for a new icebreaker for the Great Lakes. The $110 million contract for building the ship was expected to be let in July 2001, with the vessel scheduled to be working by 2005. The current icebreaker, the 56-year old Mackinaw, is well beyond its designed service life and is scheduled to be decommissioned in 2006 (Steve Kuchera, Duluth News Tribune, July 1, 2000, Senate funds new icebreaker—$110 million to go to Mackinaw replacement—U.S. Coast Guard's Great Lakes icebreaking capability replacement project, accessed July 5, 2000, at URL http://www.duluthnews.com/news/day4/dnt/local/ship.htm; Lake Carriers Association, oral commun., March 12, 2001).

The near drought conditions that have been causing low water levels in the Great Lakes since 1998 persisted through 2000. Lake Superior began the year at about 20 centimeters (cm) below the long-term average (LTA) and ended at about 38 cm below the LTA. The largest cargo shipped from Two Harbors in 2000 was 58,716 metric tons (t) compared with 62,559 t in 1998, an 8% drop. The average cargo shipped from Two Harbors for the same period fell by 7% (Lake Carriers Association, 2000).

The greatest financial loss caused by the low water levels was suffered by the shipping companies that transport iron ore on the Great Lakes. These companies enter into contracts with steelmakers to move a given quantity of ore at a certain price. Because of the low water levels, the ore boats must carry lighter loads to avoid running aground, so it takes more trips to carry a given quantity of ore. The shipping companies have not raised their rates to pass higher costs on to the steel companies because most of the steel companies are having financial troubles of their own.

Foreign Trade

Net imports, as usual responding strongly to the increase in consumption, rose 17%. U.S. exports of iron ore were less than 1% higher than those of 1999 (tables 9-15). U.S. net import reliance as a percent of apparent consumption of iron ore was 10% in 2000. Almost all exports consisted of pellets shipped via the Great Lakes to Canadian steel companies, which are partners in U.S. taconite projects in Michigan and Minnesota. U.S. imports of iron ore at 15.7 Mt, were 10% higher than those of 1999. Net imports, which averaged 11 Mt from 1989 through 2000, were 9.5 Mt in 2000. This was equivalent to 14% of U.S. ore consumption. Canada's share of U.S. imports was 51%; Brazil's was 39%.

World Review

The year 2000 was characterized as one in which major consolidation in the iron ore industry began. (See section below on Mergers and Acquisitions.)

Production.—World iron ore production was 1.1 Mt, a 4% increase compared with that of 1999 (table 17). Although iron ore production was widely distributed, taking place in about 48 countries, the bulk of world production came from just a few countries. The five largest producers, in decreasing order of production of gross weight of ore, were China, Brazil, Australia, Russia, and India. The United States and Canada were 6th and 8th. The top five accounted for 70% of world production.

China was the largest producer in gross weight of ore produced, but because its ore was of such low grade, the country's output ranked well below Australia's and Brazil's output in Fe content. Of the largest producing countries, India

experienced the highest growth, increasing 7% over production in 1999.

Consumption.—World iron ore consumption, as indicated by the production of pig iron, DRI, and crude steel, reached record high levels. These are the chief indicators of iron ore consumption, with pig iron and DRI production being the more direct indicators. World pig iron production increased by 6% to 572 Mt. Asia's share of world pig iron production has consistently increased, rising from 35% in 1990 to 47% in 2000. In the same period, Europe's share fell from 24% to 21% and the former Soviet Union's share fell from 21% to 13%. DRI production increased by 12%, reaching 43 Mt in 2000.

World crude steel production grew by 7.4%, the largest such gain since 1973. The largest gains in production were in the countries of the former Soviet Union (14.4%), followed in decreasing order by Asia (7.5%), Western Europe (5.8%), and North America (3.9%). Six countries accounted for 57% of world crude steel production. From 1990 through 2000, Asia's share of world crude steel production rose from 31% to 39%. North America's rose from 14% to 16%. Europe's share fell from 28% to 25%. For the rest of the world as a whole, production share fell from 27% to 20%.

Trade.—In 2000, 46% of world iron ore production was exported, down from 47% in 1999. At 1,061 Mt, world exports increased by 11%. Australia was the leading exporter of iron ore, shipping 165 Mt to world markets, followed by Brazil, which exported 160 Mt, and India, which exported 35 Mt. Australia and Brazil continued to increase their domination of the global export market, with 67% of the total in 2000. In decreasing order of market share, Australia held 34%, Brazil 33%, India 7%, and Canada 5%. No other exporting country had as much as 5%. Western Europe and Asia accounted for 83% of world iron ore imports in 2000. Japan, as usual, was the leading importing country, accounting for 27% of imports. The next largest country was China, which imported 14%, followed by Germany at 10% and the Republic of Korea at 8%. Japan, China, and the Republic of Korea accounted for 50% of world iron ore imports in 2000.

Mergers and Acquisitions.—There was major merger activity in 2000 and it all, directly or indirectly, involved the two primary iron ore exporting countries, Australia and Brazil. Behind the trend was a need for iron ore producers to become larger to achieve economies of scale and to put themselves in a better bargaining position with individual customers who were themselves becoming larger through consolidation.

In August, Rio Tinto Ltd. completed a hostile takeover bid for North Ltd. of Australia and Canada (Kirk, 2000b). CVRD of Brazil was then and still is the world's largest iron ore producer. The next largest, situated in Western Australia, were the Broken Hill Pty. Co. Ltd. (BHP), Hamersley Iron Ore Pty. Ltd., a wholly owned subsidiary of Rio Tinto, and in Western Australia and Canada, North Ltd. As a result of the takeover, Rio Tinto, sole owner of Hamersley, became the second largest iron ore producer in the world followed by BHP. The North takeover bid came about a year after the collapse of Rio Tinto's negotiations with BHP over the pooling of the two companies' iron ore operations.

Anglo American plc, of London and Johannesburg, South Africa, made a counter bid. Anglo's offer was backed by the Japanese steel mills who were concerned that the consolidation of Western Australia's iron ore mining industry would weaken their bargaining position during price negotiations. The Japanese steel companies have long-term supply contracts with the three Australian mining companies, but renegotiate prices annually. In early August, Rio Tinto countered Anglo's bid and shortly thereafter North's directors recommended that shareholders accept Rio Tinto's increased bid.

Rio Tinto acquired a majority position in three large iron ore assets. Two of them are mining operations, Robe River Iron Associates in Western Australia and the Iron Ore Co. of Canada (IOC) in Canada. The third asset, the West Angelas deposit in Western Australia, was the primary target of Rio Tinto's interest in North Ltd. The West Angelas deposit is 300 km southeast of Robe River's port at Cape Lambert. In March 2000, the West Angelas Development was formally endorsed by the Western Australia Minister for Resources Development, enabling work to begin on the project The project has received all other Western Australian and Federal Government approvals. North had planned for production to begin in 2002 at a rate of 7 Mt/yr, rising to 20 Mt/yr in several years. Resources were reported to be at least1 billion tons, with 440 Mt of proven and probable reserves in two adjacent deposits. North expected that lump ore would comprise 33% of production. The development of West Angelas was underpinned by letters of intent from the Japanese steel industry to buy its production, one of the primary factors in Rio Tinto's decision to buy North. The tonnage to be purchased was to be 5 million dry long tons in 2002-03, increasing to 8 million dry long tons in the fourth year and thereafter. Construction contracts began to be let late in 1999, so that Robe River could meet customer demand for delivery in mid-2002.

Mergers in the mining industry generally do not have as much potential for synergy as they do in other industries because mining companies usually cannot share infrastructure. Mines cannot be moved, and most savings would come from consolidation of staffs. The Rio Tinto-North merger is a notable exception because the two companies can easily share infrastructure. The West Angelas deposit is about 50 km from Hamersley's rail line to Yandi. Thus, Rio Tinto could gain access to West Angelas by constructing a short spur rather than a 340-km rail line.

This acquisition resulted in a number of benefits to Rio Tinto. One of the more important benefits was that, as a result of acquiring very large iron ore deposit located close to its rail line, Rio Tinto should be able to make a major increase in its production rate with low production costs. It also boosted Rio Tinto's reserves. Another benefit was the addition of a port in Western Australia. The rail line from North's existing mine in Western Australia crosses the Hamersley rail line, and Rio Tinto could divert iron ore from Mesa J to Rio Tinto's own port at Dampier, providing greater flexibility. Hamersley also would probably be able to cancel, or postpone, the development of its Nammuldi Marra Mamba deposit because the West Angelas also has Marra Mamba type ore. Another benefit is that Rio Tinto's headquarters and North's main office are both in Melbourne, which would simplify the merger of corporate activities. One of the most important benefits is the increase in size. With the addition of IOC and Pannawonica, Robe River's iron ore mine in Western Australia, Rio Tinto has put itself in a better bargaining position. The beginning of production at West Angelas will enhance that position.

A possible disadvantage is the desire of the Japanese steel mills for a rail line between West Angelas and the Hamersley-Robe River rail crossing about 70 kilometers from Cape Lambert. The Japanese steel mills say that there is a strong

likelihood that production at the West Angelas Mine could increase to 40 Mt/yr to 50 Mt/yr, and a new rail line would be required to handle it. Under the terms of the Robe River joint-venture agreement, which governs the West Angelas project, Rio Tinto will be unable to reverse the unanimous decision to develop the West Angelas project, inclusive of the new railway construction, as per the resolution dated March 6, 2000. Seen as a whole, the benefits to Rio Tinto far outweigh the disadvantages. If Rio Tinto follows North's expansion plans of producing 20 Mt/yr from West Angelas and 45 Mt/yr from Pannawonica by 2010, Rio Tinto could be producing 104 Mt/yr by the end of the decade (Metal Bulletin, 2000u). The near-term effect was that Rio Tinto's iron ore production rose 40%, increasing from 51.8 Mt in 1999 to 72.5 Mt in 2000 (Metal Bulletin, 200l).

Late in the year, Rio Tinto announced that it intended to raise its stake in IOC from 56.1% to 75% by making a $266 million ($8.90 per unit) offer to Labrador Iron Ore Royalty Income Fund. The fund owns an 18.9% stake in IOC through its wholly owned subsidiary Labrador Mining and Exploration Co. Ltd. The remaining 25% in IOC is held by Mitsubishi. The offer, which is being made through Rio Tinto's wholly owned subsidiary, Rio Tinto Canada Inc., was to be conditional on the acceptance of 75% of the unit-holders and regulatory approval (Rio Tinto, December 15, 2000, Offer for Labrador iron ore Royalty Fund, Media Release, accessed on February 15, 2001, at URL www.riotinto.com/utilities/search/ShowPressRelease .asp?PDFNumber=316&Keywords='iron%20orre'&PDFDocTy pe=P).

Billiton plc, the large London-based mining and metals company, bought a 2.1% indirect interest in CVRD. The $327 million deal, Billiton's first venture in the iron ore industry, bought the company a 66.97% share in Sweet River Investment Ltd., provided Billiton with 7.74% share in Valepar SA. Valepar was established in 1997 to participate in the privatization of CVRD by the Brazilian Government and holds a 27% interest in CVRD and a 42% voting interest, which effectively made them the controlling shareholder. The transaction gave Billiton a seat on Valepar's executive board (Kepp, 2000d; Kohl, 2000; Mining Journal, 2000a).

On May 11, CVRD purchased Mineração Socoimex S.A. (Socoimex) whose main iron ore mine, the Gongo Soco Mine is located along the CVRD-owned Vitoria Minas railroad. The mine reportedly has proven reserves of 75 Mt of high-grade hematite and 30 Mt of itabirite. Socoimex has been producing 7 Mt/yr of sinter seed, pellet feed, and lump ore for the domestic market and Europe (Metal Bulletin, 2000g; TEX Report, 2000d; Companhia Vale do Rio Doce, May 15, 2000, CVRD acquired SOCOIMEX, accessed August 24, 2000, via URL http://www.cvrd.com.br/ing/infofin/e_infofin.htm).

On May 30, CVRD purchased 63% of S.A. Mineração Trinidade - Samitri (Samitri) from the Luxembourg-based Arbed Group. The sale was part of Arbed's plan to focus on its core steelmaking business, through the divestment of noncore assets. In September, CVRD made an offer to the minority shareholders, which resulted in the acquisition of 36% of the remaining shares, raising CVRD's ownership of Samitri to 99%. Samitri owned four mines in Minas Gerais, as well as 51% of Samarco Mineração S.A., with BHP holding the remaining 49%. BHP and CVRD agreed to enter a joint venture to rationalize the Alegria Iron Ore Complex in Brazil. The companies agreed that BHP would acquire a further 1% holding in Samarco to equalize its ownership with Samitri at 50-50. Samitri and Samarco have iron ore mining and processing facilities in the Alegria Complex. The agreement between BHP and CVRD was to facilitate the restructuring of Samitri and Samarco operations aimed at increased efficiencies, reducing costs, and improving Samarco's product quality.

Samitri's mines, Alegria, Andrade, Corrego do Meio, and Morro Agidu, are in the Brazilian State of Minas Gerais. Prior to the sale of Samitri to CVRD, the Andrade Mine was sold to Arbed's Brazilian steel subsidiary Companhia Siderúrgica Belgo Mineira. Samitri's production capacity is 17.5 Mt/yr. Their products include sinter feed, concentrate, and lump, most of which are moved by rail under contract with CVRD to the port of Tubarão. Samarco's assets include a mine and concentrating plant near Alegria and a pellet plant and port at Ponta Ubu. They are linked by a 396-km slurry pipeline. Samarco recently doubled its pellet production capacity to 12 Mt/yr and plans to invest $126 million through 2002 for a further expansion to 14 Mt/yr. Most of the increased production will be sent to Asia. Part of the investment will be spent on a hydroelectric plant to help make Samarco self-sufficient in energy (Kepp, 2000c; Mining Journal, 2000b; TEX Report, 2000b; Jones, 200l; BHP Ltd., May 31, 2000, BHP and CVRD enter agreement to rationalise the Alegria iron ore complex in Brazil, accessed February 18, 2000, at URL http://www.bhp.com/default.asp?page=62&file=newscentre/ pressarchive/20000531a.asp; Companhia Vale do Rio Doce, written commun., November 22, 2000; Companhia Vale do Rio Doce, written commun., March 19, 2001).

On October 9th CVRD through Itabira Rio Doce Co. Ltd., a wholly owned subsidiary, purchased one-half of the 4-Mt/yr pellet plant in Bahrain. CVRD, with joint-venture partner and investment bank Gulf Investment Corp., paid $183 million. The plant has its own port capable of taking ships of 100,000 deadweight tons (dtw), and a thermoelectric powerplant. CVRD already supplies most of the plant's pellet feed. About 75% of the plant's output is for the direct reduction market (Metal Bulletin, 2000f; i; Cia.Vale do Rio Doce, October 6, 2000, CVRD acquires pelletizing plant in Bahrain, accessed February 27, 2001, at URL http://www.cvrd.com.br/ing/ e_mapadosite.htm).

CVRD and a group of institutional investors acquired Ferrovia Centro-Atlântica (FCA), the largest railroad in Brazil. FCA has 7,080 km of track and its own fleet of 270 locomotives and 8,400 railcars. It connects the iron ore mines in Minas Gerais to the port of Tubarão [Cia. Vale do Rio Doce, January 24, 2000, Ferrovia Centro-Atlântica (FCA), accessed February 27, 2000, at URL http://www.cvrd.com.br/ing/ e_mapadosite.htm].

In the space of 5 months, CVRD acquired the whole of two iron ore producers and one-half of a third. In doing so it has increased its production capacity by more than 30 Mt/yr. It has also increased its jointly held pellet production capacity by 14 Mt/yr, a gain of 56%. Its reserves have increased considerably. The company has solidified its position as the world's largest iron ore producer.

Among the effects of these acquisitions are the following: Two of the three iron ore producers (CVRD and Rio Tinto) became larger; with the third largest (Rio Tinto) becoming the second largest. The consolidations will provide CVRD and Rio Tinto with more leverage in price negotiations. Both companies should be in better positions to reduce costs. A major

greenfield project will be developed. Deposits of other companies stand a better chance to be developed. With the big three in Western Australia becoming the big two, deposits such as Hope Downs are more likely to be funded because they could provide competition to Rio Tinto and BHP.

Australia.—(See also earlier section on Mergers and Acquisitions.) BHP announced that it had decided to raise production at its Yandi Mine in the Pilbara region of Western Australia because of continued strong demand for its fines. The company intends to increase production from 25 Mt/yr to 30 Mt/yr. The increase is to be achieved with only minor modifications to existing operations. BHP also intends to introduce a new higher value product: Yandi lump, a pisolitic iron ore. Trial with the Yandi lump began during the year in cooperation with the Japanese steel mills. Four mining campaigns have produced 375,000 t of Yandi lump for shipment to Japan, and BHP has decided to extend the trial mining for another year (Metal Bulletin, 2000a).

In 1999, BHP offered its 1,000 employees at its Pilbara iron ore operations in Western Australia individual staff contracts to replace the existing employee contracts between the company and labor unions. The object of these contracts was to broaden the range and type of work being done by employees to increase productivity (Kirk, 2001, p. 41.4).

Staff contracts have been the norm at competing iron ore producers—at Robe River since the 1980s, and at Hamersley since the mid-1990s (Metal Bulletin, 2000b). The old contracts negotiated with the unions could have put BHP at a competitive disadvantage with the other two major Western Australia iron ore producers. Workers held a one-day strike in December 1999 to protest BHP's tactics, and the labor unrest continued into the new year (Mining Journal, 1999). The Australian Council of Trade Unions began legal action against the company, alleging that BHP's strategy of offering staff contracts was unlawful (Mining Journal, 2000c). The Australian Federal Court issued an injunction on January 31 against BHP, preventing the company from offering and entering into individual contracts with members of its Pilbara workforce. At yearend, the situation remained unresolved.

Strong demand for Marra Mamba type iron ore has heightened the prospects for BHP to develop its Mining Area C (MAC) deposit near the Yandi Mine. Full capacity of 15 Mt/yr at the $80-million project could be reached by 2010, although there is potential to increase production to 20 Mt/yr. A $70-million rail line will link MAC to the Yandi Mine. Another $11 million will be needed to upgrade the rail network that links BHP's mines to its port at Port Hedland. If production is boosted to 20 Mt/yr, BHP would have to use larger locomotives capable of hauling more than 300 railcars compared with 100 currently (Hagopian, 2000).

Hamersley received approval from the Western Australia Government to increase production capacity at the Yandi Mine from 15 Mt/yr to 20 Mt/yr. No major changes to the existing facilities are planned. The capacity increase will be achieved by plant modifications that will allow annual planned operating hours and throughput rates to be increased (Engineering and Mining Journal, 2000). The Hamersley port expansion and upgrade of the existing Parker Point and East Intercourse Island facilities have been substantially completed. The combined capacity has been increased from 55 Mt/yr to 70 Mt/yr (Western Australia Department of Resources Development, [undated], Commissioned projects (for financial year 1999-2000), accessed March 16, 2000, via URL http://www.drd.wa.gov.au/search/index.htm).

Portman Mining Ltd., which changed its name to Portman Ltd., was mining on Cockatoo Island, off the coast of Western Australia (TEX Report, 2000h). Cockatoo Island had been previously mined by BHP. Portman was treating waste stockpiles and producing a concentrate. That operation was closed, and Portman began mining a 1.6-Mt high-grade hematite deposit at the eastern end of the pit that had been covered by infrastructure facilities. The first shipment of ore from the new operation was made on September 10. The guaranteed specifications of the ore are a minimum 68% Fe and maxima of 1.5% silica, 0.75% alumina, and 0.01% phosphorus. The company expects the mine to have a life of 2 years (Metal Bulletin, 2000e, f; Portman Mining Ltd., February 9, 2000, Portman extends Cockatoo Island output, accessed February 10, 2001, via URL http://www.portman.com.au/html/frames.htm).

At the Koolyanobbing Mine, Portman plans to increase production from the current level of 2 Mt/yr to 3.5 Mt/yr in 2001 and to 6 to 8 Mt/yr over the next 5 years. The expansion includes the opening of an additional storage facility at the port at Esperance, which was completed in July 2000, and the delivery of 50 new railcars. An additional 80 ore cars of a new lighter weight design have been ordered to handle the expansion to 3.5 Mt (Metal Bulletin, 2000m, v, x; Portman Mining Ltd., November 3, 2000, Portman moves ahead with next phase of Koolyanobbing expansion, accessed November 20, 2000, via URL http://www.portman.com.au/html/frames.htm; Portman Mining Ltd., March 11, 2000, Government approval received for dredging of Esperance Harbor, accessed November 20, 2000, at URL http://www.portman.com.au/asp/frames.asp?newsItem=43&news Title=ASX+ANNOUNCEMENTS).

A three-stage dredging program at Esperance will allow the full loading of capesize vessels (those too large to transit the Panama Canal) of as much as 180,000 dwt by the third quarter of 2001. The Western Australia Government has committed itself to the construction of a new shiploader and upgrading of the railway system, which will allow Portman to increase annual production to about 5 Mt/yr. The ability to fully load capesize vessels is expected to lower Portman's seaborne freight rates. Portman's plans also include an A$6 million exploration and development program to evaluate its recently acquired Mt. Jackson, Bungalbin, and Windarling deposits north of the Koolyanobbing operation (Metal Bulletin, 2000d).

The Robe River Mining Co. Pty. Ltd. participants approved the construction of a second mine tailings processing plant. The plant is to have a feed capacity of 7.9 Mt/yr, which is higher than that of the existing plant. The processing plant converts material previously regarded as waste to a salable product by removing clay. The plant is expected to increase the mine's reserves, reduce the stripping ratio, and extend the life of the Mesa J operation by 1½ years. The first process plant, which was commissioned last year, has performed at better than planned recovery rates and will receive minor upgrades to increase its feed capacity to 5.2 Mt/yr (TEX Report, 2000c, g; North Ltd., January 16, 2000, Robe ships 500 million tonne, accessed February 15, 2000, at URL http://www.north.com.au/news-releases/rel-2000011700.html).

ABM Mining Ltd., formerly Australian Bulk Minerals, was to have merged with Ivanhoe Mines Ltd. late in the year. ABM bought the Savage River iron ore operation from the Tasmanian Government in 1997. In 1999, ABM produced 2 Mt of pellets

and 48,000 t of concentrate. In September, ABM started the fifth production line in the pellet plant, which is expected to raise pellet production to 2.5 Mt/yr. An expansion project is underway that is expected to raise production to 2.95 Mt/y (Mining Journal, 2000e; TEX Report, 2000a).

Brazil.—(See also earlier section on Mergers and Acquisitions.) CVRD announced a budget of $589 million for its iron ore operations for 2000, 63% of its overall budget (Kepp, 2000b; Metal Bulletin, 2000h). Most of the funds ($410 million) were allocated for the construction of the 6-Mt/yr pellet plant located at São Luìs in northern Maranhão State (Metal Bulletin, 2000j). About $285 million was to be spent on the plant itself and $125 million on the mine, railway, and port infrastructure. Construction began in the first half of the year. Although this will be CVRD's eighth pellet plant, it will be the first to use ore from Carajás, which is in the northern system. It will be similar to the southern system in that the ore will be moved by rail from several hundred kilometers inland to a pellet plant at or near a port from which iron ore is shipped. The plant initially will produce DRI pellets. The plant is to be wholly owned by CVRD, and when it reaches full capacity it will increase the capacity of CVRD's two other wholly owned plants and five joint venture plants to 31 Mt/yr. The plant, scheduled to begin production in mid-2002, will use Lurgi Metallurgie technology.

Other funds were to be used to begin increasing capacity at CVRD's Brucutu Mine in Minas Gerais, which currently produces 2 Mt/yr. The mine was expected to begin producing at a rate of 6 Mt/yr by 2005, eventually reaching a capacity of 24 Mt/yr. Another $30 million was to be spent on expanding the Carajás beneficiation plant and adding to the excavator fleet. The beneficiation plant at Carajás is used to wash, crush, and screen the ore. The ore does not need to be concentrated because of its high Fe content of 67%. Funds were to be directed toward the construction of two hydroelectric dams that are expected to lower operating costs. The southern system rail line was to receive funds to purchase new locomotives.

CVRD announced plans to automate the seven pellet plants at Tubarão in the southern system. Although this $23-million project will result in a marginal increase in capacity, its primary goal is to improve pellet quality, reduce production costs by 20 U.S. cents per ton, and cut the pellet rejection rate. The system will be introduced in three stages: first in field instrumentation, including sensors and measures; second in new software to control and supervise the pelletization process; and third in optimizing control of all processes, principally in energy-intensive areas such as ore crushing and pellet induration. The 4-year project will begin with CVRD I and II plants, which are wholly owned by CVRD and are more than 30 years old (Kinch, 2000; Metal Bulletin, 2000d; Companhia Vale do Rio Doce, written commun., March 19, 2001).

Mineraçãoes Brasileiras Reunidas S.A. (MBR) plans to spend $240 million over the next 2 years to increase the company's production capacity from its current 26.5 Mt/yr to 32 Mt/yr. Some of the funds will go into building a new beneficiation plant to handle the increased production from MBR's new mines, Tamandua and Capito do Mato. The production is to offset the production lost when the Aguas Claras and Mutuca Mines are depleted. In addition, the terminal at the port of Septiba will receive a new stacker-reclaimer (Kepp, 2000a).

Canada.—(See also earlier section on Mergers and Acquisitions.) The Board of Directors of IOC announced on June 30 that it had approved the refurbishment and reactivation of its pellet plant in Sept-Iles at a cost of $254 million, some of which had already been spent on engineering and evaluation studies. Closed since 1982, the refurbished plant is expected to be commissioned in June 2002. Initial production rate in the second half of 2002 is expected to be 1.3 Mt, with full production of 4.5 Mt of high-quality blast furnace pellets being achieved in 2003. The pellets will be mainly for North American and European steel mills. This increased production rate is expected to lift pellet production at IOC to 17 Mt/yr and take nearly all of IOC's production through to pellet form.

IOC selected Svedala Industri to supply engineering, equipment, and services for the reactivation of the plant. Svedala Pyro Systems USA, which will provide services throughout the construction and startup phases of the project, has already begun work. IOC also announced that it was to buy 12 new haul trucks for the mine (Metal Bulletin, 2000ab; Mining Journal, 2000f; g; Iron Ore Co. of Canada, June 30, 2000, Iron Ore Co. of Canada announces reactivation of its Sept-Iles pellet plant, accessed March 7, 2001, at URL http://www.ironore.ca/overview_1.htm).

China.—Officials at the State Administration for the Metallurgical Industry (Sami) expected to import about 65 Mt of iron ore in 2000, about 4 Mt more than in 1999. Their target for pig iron production for the year was 111.4 Mt, and their expected domestic production of 240 Mt of iron ore would only yield 73.6 Mt of pig iron because of the low Fe content of Chinese ore. It takes 3.26 t of Chinese ore to produce 1 t of pig iron; thus, China would need to import some 65 Mt of higher yield ore to produce the remaining 37.8 Mt of pig iron (Metal Bulletin, 2000c). A study by Sami concluded that China should invest further in overseas iron ore mines to raise the proportion of imports from Chinese joint-venture mines from the current 12% to 50%.

China is the world's largest steel producer, with output exceeding 100 Mt/yr in each of the past 5 years, but still must import about 10 Mt/yr of steel to meet domestic needs. There are two overseas investments in iron ore: China Metallurgical Import & Export Corp.'s 40% ownership of the Channar Mine in Australia and Shougang Corp.'s 100% ownership of the Marcona Mine in Peru (Metal Bulletin, 2000w).

India.—Arrangements were being made to ship ore from the port of Haldia near Calcutta, and the Government was planning to build a new port at Dhamra, 70 km south of Paradeep in Orissa. Iron ore production costs in India are relatively low, but transportation costs are high. In Goa, the distance from mine to port is 50 km, but other major mines have to transport their ore long distances to the ports for export. The new port at Dhamra will reduce this distance. Once the ore arrives at a port, there are further problems due mainly to poor port handling facilities, according to Indian Ministry of Mines officials. Nearly all leading ports around the world have loading rates approaching 100,000 metric tons per day (t/d). Indian ports achieve a maximum of 40,000 t/d. It was estimated that shipping ore in 300,000-dwt vessels loaded at 100,000 t/d could achieve a total freight savings of $5 per ton (Metal Bulletin, 2000y; Raghuvanshi, 2000b; TEX Report, 2000e).

The State Government of Karnataka decided to extend by a year the work permit given to Kudremukh Iron Ore Co. (KICOL). KIOCL's 30-year mining lease was due to expire on July 24. The company was granted a 1-year work permit so that mining operations could continue. The issue preventing the

spectacular DRI growth is during the next decade, it will not be able to replace more than a fraction of the world's blast furnace production because of technological restrictions. The blast furnace is expected to remain the mainstay of the iron and steel industries in most developed countries during the next 25 years.

Based on recent growth rates in Asia, additional iron ore production capacity will be needed there and in other countries. As in the United States, much of the increase in consumption of iron in Asia will be from newly constructed minimills, but unlike the United States, where the consumption of iron ore in blast furnaces is declining, much of the additional ore needed will go to feed blast furnaces.

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long-term lease being granted was the State government's designation of a 500-square kilometer park, which includes the mining leases and all of KIOCL's operations. The company was asked to confine its operations to an area of about 1,400 hectares and not the 4,600 hectares that KIOCL had sought. KIOCL's request for a long-term lease of 20 years will await studies of the environmental impact of the mine (Metal Bulletin, 2000s).

Mineral Sales Pvt. Ltd. (MSPL) plans to sell 2.5 Mt of ore in 2000-01. The company plans to increase production at all its mines, to reach 4.5 Mt/yr to 5 Mt/yr of ore by 2003-04. MSPL has been acquiring new mines to aid in this increase (Metal Bulletin, 2000n).

Jindal Vijayangar Steel plans to open its new iron ore mine. The mine is expected to produce about 1.8 Mt/yr of ore, rising to 3 Mt/yr when full production is reached. The ore will feed the company's new 3-Mt/yr pelletizing plant (Metal Bulletin, 2000r).

Construction was started on the second phase of development for Hy-Grade Pellets Ltd., which will add an 8-Mt/yr beneficiation plant and a 267-km slurry pipeline to the existing 3.3-Mt/yr pelletizing plant. Hy-Grade pellets is a joint venture between the United Kingdom-based steel trading group, Stemcor Holdings, and Essar Steel Ltd. of India, on a 51-49 basis, respectively. Essar Steel entered into a 20-year purchase agreement with the new company. Completion of the plant, which is expected to take 14 to 18 months, will enable Hy-Grade to produce pellets with an Fe content of 68.5%, up from the current level of 67%. The company is also considering increasing pellet capacity to 7 Mt/yr. The pellet plant is near the Visakhapatnam Port Trust and has access to mechanized shiploading facilities capable of handling capesize vessels. More than 30 Mt of iron ore fines lying at the mine head in Bailadila will be beneficiated and transported by slurry pipeline to the pellet plant (Metal Bulletin, 2000l; Raghuvanshi, 2000a).

Some of the smaller iron ore mines in the Indian State of Goa may be forced to close because of rising costs and an increasing tax burden, according to industry officials. Miners are challenging a proposal by the Marmugoa Port Trust to raise cargo-related charges by 25% and are criticizing the State's plan to impose a levy on mining to raise funds for environmental restoration of mine sites. Iron ore companies were also facing a demand to pay tax on their exports for the first time. Mining companies in Goa, particularly iron ore producers, which have enjoyed total tax exemptions on their exports since 1991, will have tax on their earnings introduced in a phased manner. In the first year, 20% of their income will be taxed; the rest will be taxed in 20% increments per year for 4 years until all export income is taxed (Metal Bulletin, 2000aa, o, z).

Ten companies, seven of them international firms, responded to an expression of interest for joint-venture participation for mine development with Indian Iron and Steel Co. (Iisco), a wholly owned subsidiary of state-owned Steel Authority of India Ltd. (Sail). The Indian Government announced that it had written off $391 million in loans and advances to Iisco from Sail. Part of the attraction to Iisco is its rich iron ore resources, reportedly measured in billions of tons. The company's Chiria iron ore deposits are the largest in India (Raghuvanshi, 2000c).

Iran.—National Iranian Steel Co. (Nisco), the primary steel producer, set as a goal the production of 7 Mt of steel for 2000, with plans for a further increase to 10 Mt by 2005. Nisco's principal iron ore mine is at Tchogart. It provides at least 5 Mt/yr of lump ore (56% to 60% Fe) to the steelworks at Isfahan. The construction of a new $115-million ore processing plant was proceeding. At Nisco's Gol-e-Gohar Mine, Voest-Alpine Industrieanlagenbau, the Austrian construction firm, is expanding the beneficiation plant to increase capacity from the existing capacity of 3.5 Mt/yr to 5.2 Mt/yr. The project was expected to be completed in 18 months. Elsewhere in the iron ore sector, development is proceeding at the Sangan deposit in eastern Iran, which was expected to produce at an annual rate of 3.4 Mt of concentrates within a few years (Metal Bulletin, 2000p; Mining Journal, 2000g).

South Africa.—The iron ore division of Iscor Ltd. was studying the development of a new mine at a location 60 km south of its existing Sishen Mine. A recent drilling program has shown that the Welgevonden deposit is more promising than had been previously thought and is a potential replacement for the Thabazimbi Mine. Iron ore reserves at Thabazimbi are forecast to be depleted in 2006 to 2007 (Metal Bulletin, 2000t; TEX Report, 2000f).

Venezuela.—CVG Ferrominera Orinoco was expecting iron ore sales to rise to 27 Mt/yr by 2004, with most of the increase coming from the domestic market. This will require Ferrominera to invest in its mines, processing, and transport facilities. The company intends to install 12 Mt of new concentration capacity. This is expected to take place in two stages. Ferrominera was close to selecting a contractor to build the first two of three modules, which are expected to be in place by the second half of 2003. The company also intends to raise its pellet plant capacity to 4 Mt/yr (Metal Bulletin, 2000k).

Outlook

Mergers and acquisitions are expected to cause major changes in the structure of the iron ore industry in the near term. Iron ore prices have been declining for some time and there is no reason to believe that this trend will not continue. (See earlier section on Prices.) Thus, iron ore producers must find ways of making profits other than raising prices. As the producers operate in an increasingly global economy, there will be pressure to reduce production costs; one way of doing this is by mergers and acquisitions. Mergers in the mining industry, however, generally do not have as much potential for synergy as they do in other industries. Mining companies usually cannot share infrastructure because mines cannot be moved. Synergy can be achieved by the industry by the consolidation of corporate and other activities.

The domestic iron ore industry is totally dependent on the steel industry for sales. This dependence is not expected to change in the near future. Information about steel industry trends is provided in the outlook section in the Iron and Steel chapter of the 2000 USGS Minerals Yearbook. For the near term, growth of the U.S. iron ore industry is tied to the growth of the integrated steelworks along the Great Lakes. Significant expansion in the domestic iron ore industry may be possible if one or more direct-reduction processes prove to be economic for existing and potential Great Lakes producers. If this occurs, the industry can supply the rapidly expanding minimill sector of the U.S. steel industry. Steel products require lower residual alloy content than can be readily achieved with scrap. This indicates a role for imported DRI in the coastal regions of the United States and domestically produced DRI further inland where cheaper power is available. However, no matter how

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TABLE 1
SALIENT IRON ORE STATISTICS 1/

(Thousand metric tons and thousand dollars unless otherwise specified)

	1996	1997	1998	1999	2000
United States:					
Iron ore (usable, less than 5% manganese): 2/					
Production	62,083	62,971	62,931	57,749	63,089
Shipments	62,200	62,800	63,200	58,500 r/	61,000
Value	$1,750,000	$1,860,000	$1,970,000	$1,550,000	$1,560,000
Average value at mines, dollars per ton	$28.07	$29.60	$31.14	$26.47	$25.57
Exports	6,260	6,340	6,000	6,120	6,150
Value	$232,000	$235,000	$245,000	$243,000	$246,000
Imports for consumption	18,400	18,500	16,900	14,300	15,700
Value	$556,000	$547,000	$517,000	$399,000	$420,000
Consumption (iron ore and agglomerates)	79,600	79,500	78,200	75,100	76,500
Stocks, December 31:					
At mines, plants and loading docks 3/	4,650	4,860	6,020	5,710	9,150
At receiving docks 4/	2,250	2,880	4,080	2,770	2,860
At consuming plants	18,800	20,200	20,500	17,900	16,800
Total 5/	25,700	27,900	30,600	26,400	28,800
World, production 6/	1,018,436 r/	1,068,727 r/	1,050,688 r/	1,019,051 r/	1,061,148 e/

e/ Estimated. r/ Revised.
1/ Data are rounded to no more than three significant digits, except "Production," and "World, production;" may not add to totals shown.
2/ Direct-shipping ore, concentrates, agglomerates, and byproduct ore.
3/ Excludes byproduct ore.
4/ Transfer and/or receiving docks of Lower Lake ports.
5/ Sum of stocks at mines, consuming plants, and U.S. docks.
6/ Gross weight.

TABLE 2
EMPLOYMENT AT IRON ORE MINES AND BENEFICIATING PLANTS, QUANTITY AND TENOR OF ORE PRODUCED, AND AVERAGE OUTPUT PER WORKER-HOUR IN THE UNITED STATES IN 2000, BY DISTRICT AND STATE 1/

			Production (thousand metric tons)				Average per worker-hour (metric tons)		
District and State	Average number of employees	Worker-hours (thousands)	Crude ore	Usable ore	Iron contained (in usable ore)	Iron content natural (percent)	Crude ore	Usable ore	Iron contained
Lake Superior:									
Michigan 2/	1,700	3,450	45,200	15,000	9,280	61.7	13.12	4.36	2.69
Minnesota	5,100	10,500	162,000	48,000	30,400	63.4	15.43	4.56	2.89
Total or average	6,800	14,000	208,000	63,000	39,700	63	14.86	4.51	2.84
Other States 3/	10	22	55	60	20	34	2.51	2.72	0.92
Grand total or average	6,810	14,000	208,000	63,100	39,700	62.9	14.84	4.51	2.84

1/ Data are rounded to no more than three significant digits, except "Average per worker-hour," and "Crude ore;" may not add to totals shown.
2/ Does not include professional or clerical workers at mine of plant or maintenance shop nor research lab workers.
3/ Includes California and South Dakota.

TABLE 3
CRUDE IRON ORE MINED IN THE UNITED STATES IN 2000, BY DISTRICT, STATE, AND MINING METHOD 1/ 2/

(Thousand metric tons unless otherwise specified and exclusive of ore containing 5% or more manganese)

District and State	Number of mines	Open pit	Underground	Total quantity
Lake Superior:				
Michigan	2	45,200	NA	45,200
Minnesota	8	162,000	NA	162,000
Total	10	208,000	NA	208,000
Other States:	2	55	NA	55
Grand total	12	208,000	NA	208,000

NA Not available.
1/ Excludes byproduct ore.
2/ Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 4
USABLE IRON ORE PRODUCED IN THE UNITED STATES IN 2000, BY DISTRICT, STATE, AND TYPE OF PRODUCT 1/

(Thousand metric tons and exclusive of ore containing 5% or more manganese)

District and State	Direct shipping ore	Concentrates	Agglomerates 2/	Total
Lake Superior:				
Michigan	39	--	15,000	15,000
Minnesota	406	187	47,400	48,000
Total	445	187	62,400	63,000
Other States 3/	55	5	--	60
Grand total	500	191	62,400	63,100

--Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Data may include pellet chips and screenings.
3/ Includes California and South Dakota.

TABLE 5
SHIPMENTS OF USABLE IRON ORE FROM MINES IN THE UNITED STATES IN 2000 1/ 2/

(Exclusive of ore containing 5% or more manganese)

District and State	Gross weight of ore shipped (thousand metric tons)				Average iron content, natural (percentage)	Value (thousands)
	Direct shipping ore	Concentrates	Agglomerates	Total		
Lake Superior:						
Michigan	43	--	14,200	14,200	61.6	W
Minnesota	299	171	46,300	46,700	63.3	$1,180,000
Total reportable or average	342	171	60,400	60,900	62.9	1,180,000
Other States 3/	109	--	--	109	62.1	2,210
Total withheld	--	--	--	--	--	375,000
Grand total or average	451	171	60,400	61,000	62.9	1,560,000

W Withheld to avoid disclosing company proprietary data. -- Zero.
1/ Includes byproduct ore.
2/ Data are rounded to no more than three significant digits; may not add to totals shown.
3/ Includes California and South Dakota.

TABLE 6
CONSUMPTION OF IRON ORE AT U.S. IRON AND STEEL PLANTS 1/ 2/

(Thousand metric tons)

Year	Iron ore originating areas					
	U.S. ores		Canadian ores			
	Great Lakes	Other U.S.	Great Lakes	Other Canada	Foreign ores	Total
1999	56,900 r/	--	448 r/	5,220 r/	5,420 r/	68,000 r/
2000	57,900	--	343	5,920	6,520	70,700

r/ Revised. -- Zero.
1/ Excludes dust, mill scale, and other revert iron-bearing materials added to sinter.
2/ Data are rounded to no more than three significant digits; may not add to totals shown.

Source: American Iron Ore Association.

TABLE 7
CONSUMPTION OF IRON ORE AT U.S. IRON AND STEEL PLANTS, BY TYPE OF PRODUCT 1/

(Thousand metric tons)

Type of product	1999	2000
Blast furnaces:		
Direct-shipping ore	645	345
Pellets	59,400	61,800
Sinter 2/	10,900	10,600
Total	70,900	72,800
Steelmaking furnaces:		
Direct-shipping ore	48	40
Pellets	24	21
Sinter 2/	172	184
Total	244	245
Grand total	71,200	73,000

1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes briquettes, nodules, and other.

Source: American Iron and Steel Institute.

TABLE 8
U.S. CONSUMPTION OF IRON ORE, BY END USE 1/ 2/

(Thousand metric tons and exclusive of ore containing 5% ore more manganese)

Year	Blast furnaces	Steel furnaces	Sintering plants 3/	Miscellaneous 4/	Subtotal integrated iron and steel plants 5/	Direct-reduced iron for steelmaking 6/	Nonsteel end uses 7/	Total
1999	62,100	57	5,840	2	68,000	2,420	1,290	71,700
2000	64,400	49	6,190	--	70,700	2,340	1,150	74,100

-- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes agglomerates.
3/ Excludes dust, mill scale, and other revert iron-bearing materials.
4/ Sold to nonreporting companies or used for purposes not listed.
5/ Data from American Iron Ore Association.
6/ U.S. Geological Survey estimates based on production reports compiled by Midrex Corp.
7/ Includes iron ore consumed in production of cement and iron ore shipped for use in manufacturing paint, ferrites, heavy media, cattle feed, refractory and weighing materials, and for use in lead smelting. Data from U.S. Geological Survey surveys.

TABLE 9
U.S. EXPORTS OF IRON ORE, BY COUNTRY OF DESTINATION 1/ 2/

(Thousand metric tons and thousand dollars)

	1999		2000	
Country	Quantity	Value	Quantity	Value
Canada	6,100	242,000	6,120	244,000
Other	26	1,460	25	1,890
Total	6,120	243,000	6,150	246,000

1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes agglomerates.

Source: U.S. Census Bureau.

TABLE 10
U.S. EXPORTS OF IRON ORE, BY TYPE OF PRODUCT 1/ 2/

Type of product	1999 Quantity (thousand metric tons)	1999 Value (thousand dollars)	1999 Unit value 3/ (dollars per metric ton)	2000 Quantity (thousand metric tons)	2000 Value (thousand dollars)	2000 Unit value 3/ (dollars per metric ton)
Concentrates	30	912	30.22	51	1,730	34.05
Coarse ores	--	--	--	(4/)	3	102.20
Fine ores	17	565	33.45	25	811	32.93
Pellets	6,050	241,000	39.77	5,870	235,000	39.90
Briquettes	(4/)	11	246.55	(4/)	13	21.62
Other agglomerates	21	795	37.04	201	8,050	40.04
Roasted pyrites	4	269	61.53	3	184	72.55
Total	6,120	243,000	39.72 5/	6,150	246,000	39.95

-- Zero.
1/ Data are rounded to no more than three significant figures, except unit value; may not add to totals shown.
2/ Includes agglomerates.
3/ Unit values shown are calculated from unrounded data.
4/ Less than 1/2 unit.
5/ Weighted average calculated from unrounded data by dividing total value by total tonnage.

Source: U.S. Census Bureau.

TABLE 11
U.S. IMPORTS OF IRON ORE, BY COUNTRY AND TYPE OF PRODUCT 1/ 2/

Country and type of product	1999 Quantity (thousand metric tons)	1999 Value (thousand dollars)	1999 Unit value 3/ (dollars per metric ton)	2000 Quantity (thousand metric tons)	2000 Value (thousand dollars)	2000 Unit value 3/ (dollars per metric ton)
Australia	694	8,430	12.14	755	6,180	8.19
Brazil	5,540	138,000	24.82	6,090	150,000	24.68
Canada	6,860	207,000	30.18	7,990	238,000	29.79
Chile	69	1,300	18.83	135	2,620	19.44
Peru	63	918	14.47	40	590	14.75
Sweden	421	13,300	31.64	250	7,930	31.71
Venezuela	327	21,100	64.53	349	11,200	32.15
Other	275	9,320	33.89	78	3,600	46.17
Total	14,300	399,000	28.00	15,700	420,000	26.80
Concentrates	1,440	23,800	16.58	311	6,630	21.32
Coarse ores	318	9,850	31.03	3	104	34.97
Fine ores	3,390	70,800	20.87	5,090	97,100	19.10
Pellets	8,230	264,000	32.03	9,670	302,000	31.23
Briquettes	195	16,900	87.00	--	--	--
Other agglomerates	676	13,700	20.19	611	14,300	23.43
Roasted pyrites	11	561	52.65	6	309	48.60
Total	14,300	399,000	28.00 4/	15,700	420,000	26.80

-- Zero.
1/ Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.
2/ Includes agglomerates.
3/ Unit values shown are calculated from unrounded data.
4/ Weighted average calculated from unrounded data by dividing total value by total tonnage.

Source: U.S. Census Bureau.

TABLE 12
U.S. IMPORTS OF IRON ORE IN 2000, BY COUNTRY AND TYPE OF PRODUCT 1/ 2/

(Thousand metric tons)

Country of origin	Concentrates	Coarse ores	Fine ores	Pellets	Other agglomerates 3/	Roasted pyrites	Total
Australia	--	--	755	--	--	--	755
Brazil	--	--	3,940	2,060	95	--	6,090
Canada	128	--	358	7,000	503	--	7,990
Chile	111	--	25	--	--	--	135
Peru	--	--	1	38	--	1	40
Sweden	53	--	--	197	(4/)	--	250
Venezuela	--	--	--	349	--	--	349
Other	20	3	12	25	14	5	79
Total	311	3	5,090	9,670	611	6	15,700

-- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes agglomerates.
3/ Includes briquettes.
4/ Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 13
AVERAGE UNIT VALUE FOR SELECTED IMPORTS
OF IRON ORE IN 2000 1/

Type of product	Country of origin	Average unit value 2/ (dollars per metric ton gross weight)
Concentrates	Canada	17.81
Fine ores	Australia	44.46
Do.	Brazil	21.10
Pellets	do.	30.87
Do.	Canada	31.16

1/ Includes agglomerates.
2/ Weighted averages of individual Customs values.

Source: U.S. Census Bureau.

TABLE 14
U.S. IMPORTS OF IRON ORE, BY CUSTOMS DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

	1999		2000	
Customs district	Quantity	Value	Quantity	Value
Baltimore	3,210	75,300	4,220	90,400
Charleston	412	13,000	202	6,550
Chicago	2,340	50,200	2,170	47,100
Cleveland	783	21,100	909	26,700
Detroit	1,290	45,100	1,480	47,700
Mobile	2,850	87,100	3,390	108,000
New Orleans	3,170	102,000	3,110	88,600
Philadelphia	84	2,550	114	3,130
Other	124	2,860	84	1,920
Total	14,300	399,000	15,700	420,000

1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes agglomerates.

Source: U.S. Census Bureau.

TABLE 15
U.S. IMPORTS OF PELLETS, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

Country	1999 Quantity	1999 Value	2000 Quantity	2000 Value
Brazil	1,940	60,200	2,060	63,500
Canada	5,780	185,000	7,000	218,000
Peru	--	--	38	526
Sweden	367	11,600	197	6,180
Venezuela	111	3,780	349	11,200
Other	26	2,390	25	2,280
Total	8,230	264,000	9,670	302,000

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

Source: U.S. Census Bureau.

TABLE 16
SELECTED PRICES FOR IRON ORE IN THE JAPANESE MARKET

(F.o.b. shipping port basis. U.S. cents per dry long ton of iron)

Country and producer	Ore types	April 1-March 31 Fiscal year 1999	April 1-March 31 Fiscal year 2000
Australia:			
Hamersley Iron Pty. Ltd. and Mount Newman Mining Co. Pty. Ltd.	Lump ore	34.83	36.84
Do.	Fines	26.63	27.79
Robe River Iron Associates	do.	21.23	22.15
Savage River Mines Ltd.	Pellets	41.99	44.50
Brazil:			
Companhia Nipo-Brasileira de Pelotizacao (Nibrasco)	do.	44.38	47.03
Companhia Vale do Rio Doce (Carajas)	Fines	24.37	25.41
Companhia Vale do Rio Doce (Itabira)	do.	23.87	24.91
Do.	Lump ore	25.95	27.45
Mineraçoes Brasileiras Reunidas S.A.	do.	25.78	27.27
Do.	Fines	24.33	25.39
Samarco Mineracâo S.A.	Pellet feed	20.05	20.92
Canada, Iron Ore Co. of Canada (Carol Lake)	Concentrates	23.15	24.16
Chile:			
Minera del Pacifico S.A. (El Algarrobo)	Pellets	41.35	43.82
Minera del Pacifico S.A. (El Romeral)	Fines	18.49	19.29
India:			
Minerals and Metals Trading Corp. (Bailadila)	Lump ore	33.59	35.53
Do.	Fines	25.56	26.67
Peru, Empresa Minera del Hierro del Peru S.A.	Pellet feed	18.15	18.94
South Africa: 1/			
South African Iron and Steel Industrial Corp. Ltd.	Lump ore	28.50	29.83
Do.	Fines	20.25	21.13

1/ Price per dry metric ton unit.

Source: Trust Fund Project on Iron Ore Information, Iron Ore 2001.

TABLE 17
IRON ORE, IRON ORE CONCENTRATES, AND IRON ORE AGGLOMERATES: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country 4/	Gross weight 2/					Metal content 3/				
	1996	1997	1998	1999	2000 e/	1996	1997	1998	1999	2000 e/
Algeria	2,245	1,637 e/	1,783 e/	1,336 r/	1,400	1,100	800 e/	900	680 r/	710
Australia	147,100	157,766	155,731 r/	154,268 r/	167,935 5/	93,000	97,901	99,419 r/	95,223 r/	104,226 5/
Austria	1,853	1,800 e/	1,797	1,752	1,800	504	490 e/	500	500	500
Azerbaijan e/	150	NA	NA	NA	NA	83	NA	NA	NA	NA
Bosnia and Herzegovina e/	150	150	150	150	150	50	50	50	50	50
Brazil	174,157	184,970 r/	197,500 r/	194,000 r/	195,000	112,000	122,184	124,210	124,000 r/	125,000
Bulgaria	475	479	462	466	500	320	320 e/	277 e/	280	300
Canada 6/	34,400	37,277	37,808	33,900 r/	35,207 p/	21,911	24,914	24,082	21,967	22,640 p/
Chile	8,324	8,010	8,334 r/	7,632 r/	7,900	5,577 r/	5,367 r/	5,667 r/	5,113 r/	5,293
China e/	249,550	268,000	246,900	237,000 r/	224,000	75,000	80,400	74,500	71,000 r/	67,200
Colombia	600	640	530	580	580	330	350	295	320	320
Egypt	2,429	2,744	3,001	2,700 r/ e/	2,500	1,200 r/	1,400	1,500	1,350 r/	1,250
France e/	1,464 5/	523	250	250	--	430	150	75	35	--
Germany	100	201	200	100 r/	--	15	28	28	14 r/	--
Greece e/ 7/	1,990	NA	NA	1,600	1,500	810	NA	NA	600	575
Guatemala e/	5 5/	3 r/ 5/	4	3	3	3	2 r/	2 r/	2	2
India	66,657	69,453	72,532	70,220 r/	75,000	42,660	44,400	48,000	44,940 r/	48,000
Indonesia e/	425	516	560	563	560	230 e/	280 e/	310 e/	310	310
Iran 8/	9,850	12,750	10,536 r/	10,776 r/	11,000	4,800	6,300	5,200 r/	5,300 r/	5,400
Japan	4	4	2	1	1 5/	2	2	1	1	1 5/
Kazakhstan	13,000	12,600	8,693	9,091	16,160	7,300	7,100	4,900	5,200	9,200
Korea, North e/	11,000	10,000	10,000	7,000 r/	7,000	5,100	4,700	4,700	3,000 r/	3,000
Korea, Republic of	440 r/	500 r/	486 r/	410 r/	336 5/	247 r/	280 r/	272 r/	2,296 r/	188
Macedonia e/	15	15	15	15	15	9	9	9	9	9
Malaysia	325	269 r/	376	337	250	208	172	243	216	158
Mauritania	11,360	11,700	11,400	11,500	11,500	7,384	7,605	7,410	7,475	7,500
Mexico 9/	10,182	10,466	10,557	11,422 r/	11,500	6,109	6,280	6,334	6,853 r/	6,900
Morocco	12	12	9 r/	7 r/	6	8	8 r/	6 r/	4 r/	4
New Zealand 10/	2,334	2,478	2,120 r/	2,303 r/	2,400	700 e/	740 e/	635 r/	720	720
Nigeria e/	100	50	--	--	--	33	17	--	--	--
Norway	1,705	770 r/	637 r/	520 r/	543 r/	1,023	462 r/	382 r/	355 r/	369
Peru	4,364	4,439	4,439	4,230	4,231 p/	2,800	2,850 r/	2,850 r/	2,715 r/	2,688 p/
Portugal 11/	19	18 e/	16	16	15	7	7 e/	7	7	6
Romania e/	670	670	250	200	200	175 5/	170	85	71	70
Russia	72,100	70,900	72,343	81,311	86,630 5/	41,600	40,900	41,700	46,900	50,000
Serbia and Montenegro e/	110	110	100	50	50	34	34	31	15	15
Slovakia	436	453	479	465 r/	450	190	200	215	200	200
South Africa 12/	30,830	33,225	32,948	29,508	33,707 5/	19,115 e/	20,600 e/	20,400	18,442	20,900
Spain 13/	1,269	--	--	--	--	588	--	53	--	--
Sweden	21,020 r/	21,893	20,930	18,558	20,560 5/	13,453 r/	13,912 e/	12,977 r/	11,506	12,747 5/
Thailand	86	44	91	123 r/	100 5/	43 e/	22 e/	46 e/	61 r/	50
Tunisia	239 e/	252 r/	220	219 r/	182 5/	130	137 e/	119 r/	120	98 5/
Turkey	6,404 e/	5,986	5,885	4,300	3,500	3,500 e/	3,239	3,200 e/	2,300 r/	1,900
Ukraine	47,600	53,000 e/	50,758	47,769 r/	55,883 5/	26,200	29,200 e/	28,000	26,200	30,600

See footnotes at end of table.

TABLE 17--Continued

IRON ORE, IRON ORE CONCENTRATES, AND IRON ORE AGGLOMERATES: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country 4/	Gross weight 2/					Metal content 3/				
	1996	1997	1998	1999	2000 e/	1996	1997	1998	1999	2000 e/
United Kingdom	1	1	1 r/	1 r/	1	1 r/	1 r/ e/	1 r/	1 r/	1
United States	62,083	62,971	62,931	57,749	63,089 5/	39,243	40,022	39,724	36,530	39,703
Venezuela	18,480	18,503	16,553	14,051 r/	17,353 5/	11,520	12,245	11,014	9,292 r/	11,100
Zimbabwe e/	324	479 5/	372 5/	599 r/	451	160	240	190	300 r/	226
Total	1,018,436 r/	1,068,727 r/	1,050,688 r/	1,019,051 r/	1,061,148	546,902 r/	576,489 r/	570,519 r/	552,472 r/	5,801,127

e/ Estimated. p/ Preliminary. r/ Revised. NA Not available. -- Zero.

1/ Table includes data available through July 14, 2001.

2/ Insofar as availability of sources permit, gross weight in this table represent the nonduplicative sum of marketable direct-shipping iron ores, iron ore concentrates, and iron agglomerates produced from imported iron ores have been excluded under the assumption that the ore from which such materials are produced has been credited as marketable ore in the country where it was mined.

3/ Data represent actual reported weight of contained metal or are calculated from reported metal content. Estimated figures are based on latest available iron content reported, except for the following countries for which grades are U.S. Geological Survey estimates: Azerbaijan, Kazakhstan, North Korea, and Ukraine.

4/ In addition to the countries listed, Cuba and Vietnam may also produce iron ore, but definitive information on output levels, if any, is not available.

5/ Reported figure.

6/ Series represented gross weight and metal content of usable iron ore (including byproduct ore) actually produced, natural weight.

7/ Nickeliferous iron ore.

8/ Data are for year beginning March 21 of that stated.

9/ Gross weight calculated from reported iron content based on grade of 60% Fe.

10/ Concentrates from titaniferous magnetite beach sands.

11/ Includes manganiferous iron ore.

12/ Includes magnetite ore as follows, in thousand metric tons: 1996--2,070; 1997--2,564; 1998--2,211; 1999--2,200; 2000--2,854.

13/ Includes byproduct ore.

TABLE 18
IRON ORE: WORLD PELLETIZING CAPACITY, BY CONTINENT AND COUNTRY IN 2000

	Rated capacity (million metric tons, gross weight)
North America:	
Canada	27.6
Mexico	13.7
United States	66.8
Total 1/	108.0
South America:	
Argentina	2.0
Brazil	41.5
Chile	4.4
Peru	6.4
Venezuela	9.9
Total 1/	64.3
Europe:	
Belgium	0.7
Netherlands	4.4
Norway	1.4
Russia	34.0
Sweden	16.4
Turkey	1.0
Ukraine	32.0
Total 1/	89.9
Africa:	
Liberia	3.0
South Africa	0.6
Total 1/	3.6
Asia:	
Bahrain	4.0
China	20.0
India	8.5
Iran	9.0
Japan	3.0
Kazakhstan	8.4
Total 1/	52.9
Oceania, Australia	4.0
Grand total 1/	323.0

1/ Data may not add to totals shown because of independent rounding.

Sources: International Iron and Steel Instuitute, Brussels, Belgium; United Commission on Trade and Development; Trust Fund on Iron Ore Information; U.S. Geological Survey.