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2013 Minerals Yearbook

IRON ORE [ADVANCE RELEASE]

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Iron Ore

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In 2013, U.S. domestic iron ore producers focused on cutting costs and improving efficiencies as iron ore consumption fell, owing to declines in production of pig iron and raw steel. The majority of iron and steel companies in the United States use a vertically integrated structure and (or) long-term price contracting, either of which buffer the domestic industry from variable global prices. Domestic iron ore production in 2013 decreased slightly to 53.0 million metric tons (Mt), from 54.0 Mt in 2012. The United States was the eighth-ranked producer of iron ore by gross weight and by iron content, globally (table 1). U.S. iron ore consumption was 51.7 Mt in 2013, a 6% increase from 48.8 Mt in 2012. U.S. raw steel and pig iron production decreased to 86.9 Mt and 30.3 Mt in 2013, from 88.7 Mt and 32.1 Mt in 2012, respectively (American Iron and Steel Institute, 2014, p. 72, 77).

In the global market, large-scale producers in Australia focused on increasing production capacity and reducing mining costs with the intention of increasing iron ore supply for seaborne trade to China. Steel producers in China began the year with strong iron ore demand, owing to restocking of iron ore and increased raw steel production, but consumption waned in the second half of 2013. Worldwide production of iron ore, by gross weight, increased to 3.16 billion metric tons (Gt) in 2013, a 7% increase from 2.96 Gt in 2012, with an average iron content of 1.48 Gt, a 6% increase from 1.39 Gt in 2012. China was the leading global producer of iron ore, accounting for 47% of iron ore production by gross weight (29% by metal content), followed by Australia, Brazil, and India (table 12). These countries accounted for about 82% of global iron ore production by gross weight.

Iron ore is the basic raw material for producing steel, a metal critical to the economies of all industrialized nations. Two iron oxides—hematite (Fe_2O_3) and magnetite (Fe_3O_4)—are the primary ore minerals of iron found in the United States. Taconite, the principal form of iron ore mined in the United States, contains hematite and magnetite in varying proportions averaging 25% to 30% iron content (Fe) and occurs in hard, fine-grained banded iron formations.

In the United States, low-grade iron ore is concentrated to reach, on average, the 62% iron content or greater benchmark required for steel production. The concentrates can then be agglomerated using binders to create iron ore pellets for more efficient melting in blast furnaces and transportation. Almost all domestic iron ore production is transformed into molten iron, also known as pig iron, in blast furnaces by removing residual oxygen. The pig iron can then be transferred to basic oxygen furnaces for the removal of residual carbon and conversion to steel.

Minimills use the electric arc furnace (EAF) to produce steel from alternative forms of high-purity iron, iron ore, pig iron, recycled steel scrap, and reduced slag. Direct-reduced iron (DRI), also known as sponge iron, may be used in conjunction with scrap as an alternative EAF feed. DRI is created by reducing iron ore in a rotary hearth furnace to 90% to 94% Fe. Iron nuggets, a form of pig iron containing greater than 95% Fe, may also be used as feedstock for EAF steel production.

This report includes information from U.S. Geological Survey (USGS) surveys, government agency reports, company reports, and public information on the 12 iron ore mines and 2 DRI operations active in the United States in 2013. Trade data in this report are sourced from the U.S. Census Bureau. Labor statistics were based on data available from the Mine Safety and Health Administration. Percentages in the report were computed using unrounded data and are then rounded to three significant digits.

Legislation and Government Programs

In Minnesota, the tax rate for taconite production increased in 2013 to $2.560 per taxable long ton of concentrates from $2.465 in 2012 (Minnesota Department of Revenue, 2014).

The Wisconsin Senate passed legislation aimed at reducing the time involved in permitting iron ore mines. Gogebic Taconite LLC publicly supported the legislation and indicated they would file permits for an iron ore mine and processing plant along the Penokee Range in Ashland and Iron Counties, WI. The permitting process was expected to take more than 3 years (Miller and Peters, 2013).

The U.S. Export-Import Bank approved $694 million in financing for the sale of equipment from Caterpillar Inc., General Electric Co., and Atlas Capco North America LLC to the Roy Hill iron ore project in Western Australia. When complete, Roy Hill was expected to produce 55 Mt of iron ore annually (Merrion, 2013).

Nucor Corp. (Charlotte, NC) filed a request and the United Steelworkers Union filed a petition, along with other manufacturers and the Municipal Castings Association, to repeal a Federal Highway Administration waiver. The waiver was made for certain iron and steel products under the Buy America Act. The Act required Government-funded transportation projects to use steel and other materials produced by U.S. manufacturers. The Federal Highway Administration issued a memorandum in December 2012, which exempted iron and steel components used to encase, assemble, and construct primary construction products. The petition was awaiting scheduling in the U.S. District Court for the District of Columbia (Frizell, 2013).

In 2013, the U.S. Environmental Protection Agency issued a Federal Implementation Plan for six taconite facilities in Minnesota and one in Michigan. The plan included a requirement to install and operate continuous air monitoring systems and set nitrogen oxide (NO_x) emission limits based on

cost-effective measures. The final rule went into effect in 2014 (U.S. Environmental Protection Agency, 2013b).

The U.S. Environmental Protection Agency approved revisions to Minnesota's Mercury Total Maximum Daily Load Implementation Plan as part of an effort to reduce mercury in airborne emissions from Minnesota's taconite facilities by 75% by 2025 (U.S. Environmental Protection Agency, 2013a, p. 1–5). According to the initial report, taconite processing accounted for 21% of Minnesota's mercury emissions in 2000. No cost-effective technologies have been identified and Minnesota's Department of Natural Resources (DNR) was working with the industry to fund research for the development and identification of control technologies (Minnesota Pollution Control Agency, 2007, p. 22).

The Minnesota Pollution Control Agency (MPCA) proposed amendments relating to mercury air emissions reporting and reduction. The amendments would formalize voluntary agreements with taconite facilities and require broader adherence to mandatory policy (Minnesota Pollution Control Agency, 2013a). The MPCA's modified air permit rules to incorporate Federal permit requirements for greenhouse gas emissions became effective on January 24, 2013. The emissions thresholds for greenhouse gas emissions were modified to the potential to emit 100,000 tons per year (t/yr) of carbon dioxide equivalent (Minnesota Pollution Control Agency, 2013b).

Production

Alabama.—Metamining Nevada Inc. was expected to begin the 4-year process of exporting 5 Mt of iron ore fines at 62% Fe content and 10% moisture from a stockpile in Mobile to China beginning in the second quarter of 2013 (PR Newswire, 2013). However, shipments were delayed until the second quarter of 2014 (H. Lei, Secretary, Metamining Nevada Inc., oral commun., June 2013).

California.—In March, SA Recycling LLC began shipping iron ore from CML Metals Corp.'s mine in Utah through the Port of Long Beach to markets in Asia. SA Recycling also uses the Long Beach shipping facility to transport steel scrap and had increased export capacity to more than 1 Mt of iron ore in 2013 (Bennett, 2013).

Indiana.— Iron Dynamics operated a DRI operation in Butler as a subsidiary of Steel Dynamics Inc. In 2013, Iron Dynamics produced 255,000 metric tons (t) of hot-briquetted iron (HBI), 13% more than the 226,000 t produced in 2012. HBI, a form of DRI, is used as a substitute for a portion of the metallic raw material mix for EAF steel production. The majority of HBI produced at Iron Dynamics was converted into liquid pig iron in a submerged arc furnace and used in Steel Dynamics' Flat Roll Division's melt shop. The plant is a pilot facility designed to maximize liquid pig iron production to reduce the cost of energy and materials as well as to achieve a quicker melting cycle (Steel Dynamics Inc., 2014, p. 40, 53–55).

In May 2013, Magnetation LLC secured the final $375 million needed to finance construction of a pellet plant in Reynolds (AK Steel Holding Corp., 2013). The facility was expected to be operational by the second half of 2014.

Louisiana.—Nucor Steel Louisiana, LLC's DRI operation began production in St. James Parish in December. The 2.5-million-metric-ton-per-year (Mt/yr) plant was the largest DRI facility of its kind in the world and the first constructed in the United States since 2009 (Boone, 2014). In July 2013, Nucor signed an agreement with Luossavaara-Kiirunavaara AB (Sweden) to supply 750,000 t/yr of DRI pellets (Lovell and Richardson, 2013).

Michigan.—Empire Iron Mining Partnership (Empire Mine) and Tilden Mining Co. (Tilden Mine) (both subsidiaries of Cliffs Natural Resources Inc.), operated open pit mines in Marquette County. In 2013, Empire Mine produced 3.0 Mt of pellets, and Tilden Mine produced 7.5 Mt of pellets. As of January 2014, annual pellet production capacities for the Empire and Tilden Mines were 5.5 Mt and 8.0 Mt, respectively. In 2013, the Empire Mine's production was temporarily idled and the mine was scheduled for closure at yearend 2014, owing to the expiration of its partnership agreement (Cliffs Natural Resources Inc., 2014, p. 30, 37).

Minnesota.—Six open pit operations were active in Itasca County, Lake County, and St. Louis County: Hibbing Taconite Co. (Hibbing Taconite), Keewatin Taconite Co. (Keetac Mine), Minntac Iron Ore Operations (Minntac Mine), Minorca Mine Inc. (Minorca Mine), Northshore Mining Co. (Northshore Mining), and United Taconite LLC. (United Taconite). Three tailings reclamation operations were active in Itasca and St. Louis Counties: Mesabi Chief Plant #1–Keewatin (Plant #1), Mesabi Chief Plant #2–Taconite (Plant #2), and Mining Resources LLC (Mining Resources). One iron nugget facility, Mesabi Nugget Delaware Inc. (Mesabi Nugget), operated in St. Louis County. Two open pit mines, Mesabi Mining LLC (Mesabi Mining) and Essar Steel Minnesota LLC (Essar Steel), and one tailings reclamation operation, Mesabi Chief Plant #4–Coleraine, were under construction in Minnesota.

Other deposits in Minnesota's Mesabi Range, including the former LTV Corp. mine and the Sherman, Buhl, Kinney, and McKinley deposits, were estimated to contain approximately 1.5 Gt of high-grade iron ore. An additional 1 Gt of iron ore in tailings ponds and stockpiles may be economically recoverable (Minnesota Department of Natural Resources, 2013).

ArcelorMittal S.A.'s annual production capacity, as of yearend 2013, for the Minorca Mine was 2.9 Mt. In 2013, the mine produced 2.9 Mt of fluxed pellets, the same as in 2012, and ArcelorMittal's share of Hibbing Taconite's production was an estimated 4.8 Mt of taconite pellets. At yearend 2013, ArcelorMittal's U.S. operations had 143 Mt of proven and probable iron ore reserves at 23.4% Fe with an estimated mine life of 16 years (ArcelorMittal S.A., 2014, p. 207–216).

Cliffs' annual production capacities, as of yearend 2013, for Hibbing Taconite, Northshore Mining, and United Taconite were 8.0 Mt, 6.2 Mt, and 5.2 Mt, respectively. In 2013, Hibbing Taconite produced 7.7 Mt of pellets, Northshore Mining produced 3.9 Mt of pellets and 69,000 t of concentrate, and United Taconite produced 5.2 Mt of pellets. Cliffs' share of production from all U.S. iron ore operations, including the Empire and Tilden Mines in Michigan, was 20.3 Mt, a decrease

from 22.0 Mt in 2012, with an additional 6.9 Mt produced on behalf of the steel company partners of the mines, a decrease from 7.5 Mt in 2012. At yearend 2013, Cliffs' U.S. mineral reserves included 2,520 Mt of proven and probable iron ore reserves, which was enough to produce 837 Mt of standard pellets at 60% to 66% Fe.

Analyses conducted in 2013 increased saleable product reserves by 43.4 Mt at United Taconite owing to updated life-of-mine plans and production schedules. In January, two of the four pellet furnaces at Northshore Mining's facility were idled, which resulted in 1.4 Mt of decreased production compared with 2012. Cliffs planned to restart the idled furnaces in the first quarter of 2014, which would increase production by 1.3 Mt in 2014 (Cliffs Natural Resources Inc., 2014, p. 30–31, 38).

In February, Cliffs announced the successful test production of low-silica iron ore pellets, which could be used to make DRI at United Taconite and Northshore Mining (Kraker, 2013b). In August, Cliffs extended its pellet supply contract with AK Steel Holding Corp. through 2023. Long-term pricing was to be determined by a formula, which could include shipping charges and price indices (Cliffs Natural Resources Inc., 2013). In October, Cliffs requested a review by the Minnesota DNR of plans for a 100-acre expansion at the Northshore Mine. The expansion plans raised environmental concerns regarding possible acid runoff from sulfide-bearing rocks. High sulfide content in waste rock may pose water pollution risks, such as acid mine drainage (Associated Press, The, 2013a).

Essar Steel Minnesota LLC (Essar Steel) had a $1.7 billion project under construction in Nashwauk during 2013. The planned open pit operation hosted 1,700 Mt of proven and probable reserves of magnetite, which would supply the 7-Mt/yr processing and pelletizing facility. The facility would be capable of producing standard pellets and DRI-grade pellets. In February, Essar Steel entered into an agreement with ArcelorMittal USA, expected to begin March 2014. The agreement was to supply 3.5 Mt of standard and fluxed pellets to ArcelorMittal's North America operations for 10 years (Essar Steel Minnesota LLC, 2013). In August, Essar Steel announced that the mine opening would be delayed from the fall of 2013 until the second half of 2014. The 2012 decision to increase planned production from 4 Mt/yr to 7 Mt/yr, requiring an additional $600 million in financing, was cited as cause for the delay (Depass, 2013).

Magnetation's annual production capacities, as of yearend 2013, for Plant #1 and Plant #2 were 363,000 t and 998,000 t of concentrates, respectively (AK Steel Holding Corp., 2014, p. 28–29). As of May 2012, Magnetation's equivalent of reserves at Plant #1 and Plant #2 were estimated at 3.6 Mt and 17.5 Mt of concentrate tailings, respectively (Magnetation LLC, 2014). As of April 2014, Magnetation's U.S. mineral reserves included 1,400 Mt of unspecified virgin iron ore resources and 2,640 Mt of unspecified total iron ore resources (Magnetation LLC, 2012). Since 2011, Magnetation used advanced magnetic recovery processes to reclaim iron ore from previously mined stockpiles and tailings basins, containing primarily hematite, which was previously unrecoverable.

Magnetation secured $375 million in financing, which completed funding for the construction of a fourth reclamation facility in Itasca County, as well as operating permits from the MPCA. The $120 million facility was expected to begin producing 2 Mt/yr of concentrate by early 2015 (AK Steel Holding Corp, 2013; Minnesota Public Radio News, 2013).

Mesabi Nugget [joint venture between Steel Dynamics, Inc. (81%) and Kobe Steel, Ltd. (19%)], a pilot iron nugget production facility in Hoyt Lakes, had an annual production capacity of 500,000 t of iron nuggets as of yearend 2013. Mining Resources [joint venture between Steel Dynamics, Inc. (80%) and Magnetation, Inc. (20%)] had an annual production capacity of 1 Mt of concentrates as of yearend 2013. In 2013, Steel Dynamics reported that Mesabi Nugget produced 214,000 t of iron nuggets, an increase from 178,000 t in 2012, and Mining Resources produced 407,000 t of concentrates, an increase from 56,000 t in 2012. During 2013, Steel Dynamics consumed 6.3 Mt of metallic materials, 95% of which were supplied by Iron Dynamics and Mesabi Nugget. Steel Dynamic's raw steel mix, on average, was 8% iron metallic material, including DRI, HBI, pig iron, and iron nuggets (Steel Dynamics Inc., 2014).

Mesabi Nugget met production expectations and was expected to focus on increasing product yield and reducing costs. The facility underwent testing during the fourth quarter of 2013 through early 2014, with the goal of implementing process improvements. At yearend 2013, Mesabi Mining was seeking operating permits to mine taconite ore for use in the production of nuggets (Steel Dynamics Inc., 2014, p. 40, 53–55).

U.S. Steel Corp.'s combined annual production capacity, as of yearend 2013, for the Keetac and Minntac Mines was 22.4 Mt. In 2013, the Minntac Mine produced 16.1 Mt, an increase from 15.6 Mt in 2012, and Keetac Mine produced 5.6 Mt, a slight decrease from 5.8 Mt in 2012. At yearend 2013, U.S. Steel's mineral reserves for the Minntac and Keetac Mines included 541 Mt and 392 Mt of proven and probable iron ore reserves, respectively. In U.S. Steel's share of reserves at Hibbing Taconite and the Tilden Mine, an additional 52 Mt were proven and probable. U.S. Steel maintained a 14.7% ownership interest in Hibbing Taconite Co. and a 15.0% ownership interest in Tilden Mining Co. throughout 2013. At yearend 2013, one long-term purchase contract for iron ore pellets had expired, and one remaining contract was set to expire in December 2014.

U.S. Steel continued examining plans to expand pelletizing capacity at its Keetac Mine to 9.6 Mt from 6 Mt at an anticipated cost of $820 million. Final permitting was completed in December 2011 with an extension granted to the construction air permit in November 2013, extending the permit's expiration until September 2014. U.S. Steel was considering investing in alternative energy technologies for ironmaking and steelmaking to include natural-gas-based technology, DRI, and EAF steelmaking. U.S. Steel verified in 2013 that iron reserves were suitable for DRI-grade pellets at the Minntac Mine and examined costs associated with producing DRI pellets for internal consumption or third-party sale (United States Steel Corp., 2014, p. 13–14).

In November, the Minnesota Center for Environmental Advocacy asked the Minnesota Court of Appeals for a full environmental review of U.S. Steel's Minntac Mine expansion

plan. The Minnesota Center for Environmental Advocacy claimed the expansion plan, expected to operate on 202 hectares (500 acres) and extend the mine's life until 2031, would violate water quality standards downstream from the mine. The Minnesota DNR indicated, however, that the Minntac Mine's operators complied with its Clean Water Act permits. U.S. Steel Corp. entered into an agreement with the MPCA to address water quality downstream from the site, including installing a seepage collection system (Kraker, 2013a). The Iron Range Resources and Rehabilitation Board approved more than $5 million in funding from the Taconite Economic Development Fund for miscellaneous projects at U.S. Steel Corp.'s Minntac and Keetac Mines. Projects included the installation of a new pumping station at the Minntac Mine and a new pump transfer station at the Keetac Mine (Hanna, 2013).

Nevada.—Zephyr Minerals, Inc. received approval from Nevada's Bureau of Mining Regulation and Reclamation for a water pollution control permit for its Parker Brothers Mine. In Pershing County, the company planned to use a portable crushing and physical separation beneficiation facility with a permitted production rate of 33,100 t/yr (Nevada Division of Environmental Protection, 2013). Using waste dumps and stockpiles from the sites of the abandoned Segerstrom-Heiser and Thomas Mines, the project was expected to reach production levels of 1 to 2 Mt/yr of iron fines. Potential also existed for developing a DRI plant (J. Welsh, President, Zephyr Minerals Inc., oral commun., June 2013).

Nevada Iron Ltd. entered into an agreement to acquire lands adjacent to its Buena Vista iron ore project in Nevada. The acquisition was expected to increase the project's land holdings by 163% to 6,464 hectares (15,973 acres) (Swanepoel, 2013). Nevada Iron's Buena Vista National Instrument 43–101 technical report indicated a life-of-mine average ore grade of 19% Fe with 1.8 Mt of average annual concentrate produced (Nevada Iron Ltd., 2013).

North Dakota.—E-Nugget North Dakota, LLC announced plans to construct a $60 million iron nugget plant near Jamestown, which would use concentrates supplied by Magnetation LLC. Construction of the plant was expected to begin in 2014 with production beginning in 2015. The company planned to use readily available sugar beet residue in place of coking coal. E-Nugget initially expected to produce 100,000 t/yr of iron nuggets and planned to expand production to 300,000 t/yr. The 96%-iron-content nuggets were expected to be used in domestic EAFs and minimills (Myers, 2013b).

Texas.—Austrian company voestalpine AG planned to construct a 2-Mt/yr DRI plant near Corpus Christi. Midrex Technologies Inc. and Siemens Industry Inc. were contracted to build the $270 million facility, which would supply HBI to voestalpine's facilities in Austria and to other customers beginning in late 2015. The consortium also planned infrastructure improvements, including construction of port facilities (Siemens Industry Inc., 2013).

Utah.—In 2013, CML Metals produced approximately 1.31 Mt of iron concentrates at 63.6% Fe from the Mountain Lion Mine located west of Cedar City. Palladon Ventures Ltd. (Pleasant View), parent company of CML Metals, announced that access had been secured at the Port of Long Beach, CA, allowing for larger shipping vessels, resulting in lower unit costs and increased export capacity. The company expected to ship 90,000 tons per month in 2014 at an average of $126 per ton. The plant was reportedly operating at 75% production capacity in 2013 and was expected to reach design capacity of 2 Mt/yr when new hyperbaric disk filters were operational in January 2014 (Palladon Ventures Ltd., 2013).

Wisconsin.—Gogebic Taconite LLC (GTAC) considered developing an iron ore mine in the Penokee Range in Wisconsin's northern Ashland County and Iron County. In June, the company filed an intent-to-mine notice along with a bulk-sampling plan for testing the quality of iron ore. The Wisconsin DNR was set to decide on the bulk-sampling plan and approved a mineral exploration license to begin drilling. Agency officials requested more information detailing the potential effects of drilling on wetlands and storm water runoff (Bergquist, 2013; Simonson, 2013b).

Grunerite, an asbestos mineral found near the deposit, was determined to be elongate to fibrous, causing concern about the health risk posed by the release of particles during mining and bulk handling. The Wisconsin DNR was reviewing GTAC's bulk handling and mining plans to determine if they are adequate to address that issue (Simonson, 2013a). In November, protests that interfered with workers and sampling at the proposed mine site prompted State legislators to pass a bill establishing a 600-foot restricted zone around GTAC's mining equipment and roads (Associated Press, The, 2013b).

Consumption

Iron ore is primarily consumed in the steelmaking process. In 2013, domestic iron ore supply (production minus exports) met 93% of U.S. demand. In 2013, construction was the leading consumer of steel (40%), followed by automotive (26%), machinery and equipment (10%), energy (10%), container (4%), appliances (4%), and national defense and homeland security (3%) (American Iron and Steel Institute, 2014, p. 1–4). It is estimated that producing 1 ton of steel requires 0.4 t of coking coal, 0.3 t of steel scrap, and 1.3 t of iron ore pellets, as well as 6 million British thermal units of natural gas, using blast furnaces at normal operating conditions (United States Steel Corp., 2014, p. 23).

Iron ore may also be used for nonsteel applications including ballast, cement clinker production, coal washing, crushed road base material, fertilizer, heavy media separation, iron oxide pigments, ferrite magnets, oil and gas well drilling, radiation shielding, water treatment, and other specialty applications. These applications represent a relatively small portion of iron ore consumption, estimated to be collectively less than 1 Mt, and some applications require costly beneficiation to create high-grade products. Data for these applications are not included in USGS production, shipping, or consumption tables for iron ore.

In 2013, U.S. consumption of iron ore, including agglomerates, reported to the American Iron and Steel Institute by producers of iron and steel totaled 48.8 Mt, including 42.1 Mt of pellets; 6.0 Mt of sinter, briquettes, and other products; and 0.5 Mt of direct-shipping ore. Steelmaking

furnaces consumed 675,000 t of direct-shipping ore and sintered products in 2013 (table 6).

Raw steel production in the United States decreased to 95.8 Mt in 2013 from 97.8 Mt in 2012. Raw steel produced using basic oxygen furnace technology, which had decreased in 2009 to the lowest level in more than a decade, remained stable, decreasing in 2013 to 37.7 Mt from 40.0 Mt in 2012. Raw steel produced using EAFs increased to 58.0 Mt in 2013 from 57.8 Mt in 2012. The United States imported 9.4 Mt of iron (including pig iron, sponge iron, and cast iron) and ferroalloys products in 2013, an 8% decrease from 10.2 Mt in 2012, and exported 424,000 t of iron and steel products in 2013, a decrease from 446,000 t in 2012. Integrated steel mills in the United States produced steel from iron ore and imported pig iron and semifinished steel; minimills produced steel from DRI and scrap. In 2013, the minimill sector of the steel industry accounted for 60.6% of U.S. raw steel production (American Iron and Steel Institute, 2014, p. 37–38, 50, 72).

Materials consumed for steel production included 7.1 Mt of fluxes (fluorspar, limestone, lime, and other fluxes) and 9.5 Mt of coke. Imported iron ore supplemented domestically produced iron ore in the production of pig iron, which was used along with imported pig iron and scrap to produce raw steel. Pig iron produced in the United States in 2013 decreased by 5.4% to 33.4 Mt in 2013 from 35.3 Mt in 2012 (American Iron and Steel Institute, 2014, p. 77–81).

With the exception of iron oxides and cement clinker, USGS surveys do not include production or consumption of iron ore for miscellaneous, nonsteel end uses. Iron ore used in the production of clinker for cement was estimated to be 628,000 t in 2013 (Hendrik van Oss, Mineral Commodity Specialist, National Minerals Information Center, unpub. data, August 2014). In 2013, U.S. imports for consumption of iron oxides, natural and synthetic, were 165,000 t, and finished pigments sold totaled 47,200 t (Tanner, 2015).

Prices

In 2013, the average value of iron ore produced in the United States was $104.90 per metric ton, an increase from $98.16 per metric ton in 2012 (table 1). The average value of exported iron ore was $134.33 per metric ton, ranging from an average per country of $65.44 to $375.75 per metric ton (table 7). The average value of imported iron ore was $131.18 per metric ton, ranging from an average per country of $52.00 to $187.92 per metric ton (table 8). The producer price index for iron ore rose from 128.2 in January 2013 to 139.6 in May before falling to 133.4 in December. The 2013 average index of 133.4 was 30% lower than the average of 190.0 in 2012 (U.S. Bureau of Labor Statistics, 2014).

The average spot price of imported iron ore fines at 62% Fe at Tianjin, China, port rose from $150.49 per metric ton in January to $154.64 per metric ton in February before steadily declining to $114.82 per metric ton in June. The price fluctuated on an overall upward trend to $135.79 per metric ton at yearend owing to increased consumption in China. In 2013, the lowest spot market price, $114.82 in June, was 15% higher than that in 2012, $99.47 in September. In 2013, the highest spot market price, $154.64 in February, was 4.7% higher than that in 2012, $147.65 in April (Index Mundi, undated).

Transportation

In May, lack of dredging at Great Lakes ports and shipping lanes, combined with low water levels in the Great Lakes, caused iron ore freighters to transport loads as much as 15% below capacity (Myers, 2013a). In October, the House of Representatives passed bill H.R. 3080, which proposed funds for dredging the Great Lakes in an effort to maintain optimal depth of the waterways, allowing vessels to carry at full capacity (Lake Carriers' Association, 2013).

Cyclical fluctuations in shipments, production, sales, and stocks of iron ore in Minnesota and Michigan from December through April were attributed to the closing and reopening of the Soo Locks at Sault Ste. Marie, MI, as well as to frozen lake surfaces. The U.S. Coast Guard began breaking ice on December 6, the earliest date on record; December shipments were 21% lower than the year before owing to early winter weather (Lake Carriers' Association, 2014).

Foreign Trade

In 2013, U.S. net exports of iron ore totaled 7.8 Mt, a 28% increase from 6.1 Mt in 2012. Exports decreased slightly, and imports decreased by 37% compared with 2012. U.S. iron ore pellet exports accounted for 71% (7.8 Mt) of total exports. U.S. exports totaled 11 Mt, of which 55% was shipped to steel companies in Canada, 25% to China, and 10% to Mexico (table 7). U.S. imports totaled 3.2 Mt, of which Canada accounted for 64% and Brazil accounted for 19% (table 9). Imports from the following countries increased year on year: Argentina, 69%; Chile 46%; and South Africa, 4%. Imports from the following countries decreased year on year: Brazil, 15%; Canada, 45%; Mexico, 98%; Peru, 73%; and Sweden, 32%.

World Industry Structure

Production.—World iron ore production was 3.16 Gt by gross weight, a 6.8% increase from 2.96 Gt in 2012, and 1.48 Gt by iron content, a 6.3% increase from 1.39 Gt in 2012. By iron content, China remained the leading iron ore producer (435 Mt), followed by Australia (377 Mt), Brazil (246 Mt), and India (96 Mt) (table 12). Global DRI production increased slightly to 75.2 Mt in 2013 from 73.1 Mt in 2012. The Middle East/North Africa region was the leading producer of DRI with 32.4 Mt, followed by the Asia/Oceania Region (20.5), Latin America (13.8), CIS/Eastern Europe (5.33), Sub-Saharan Africa (1.41), North America (1.25 Mt), and Western Europe (0.50 Mt) (Midrex Technologies, Inc., 2014).

Consumption.—DRI and pig iron production are indirect indicators of iron ore consumption. World consumption of iron ore was estimated to have increased marginally in 2013, owing to an increase in pig iron production (3.8%), raw steel production (3.1%), and DRI production (2.8%), compared with 2012. World production of DRI increased to 75.2 Mt in 2013, from 73.14 Mt in 2012 (Midrex Technologies Inc., 2014). World production of pig iron increased to 1.29 Gt in 2013

from 1.24 Gt in 2012. Global raw steel production increased to 1.77 Gt in 2013 from 1.72 Gt in 2012. In 2013, 10 countries each produced more than 30 Mt of crude steel and, combined, accounted for 83% of world production. Of those countries, raw steel production increased the most in China (53 Mt), followed by India (4.4 Mt), and Japan (3.7 Mt) (American Iron and Steel Institute, 2014).

Trade.—Reported world iron ore imports rose to 1.20 Gt in 2013, a 4.4% increase from 1.15 Gt in 2012. This continued the trend of year-over-year increases in imports during the past 12 years, with slowing growth over the past 4 years. Since 2002, China, Germany, Japan, and the Republic of Korea have accounted for more than two-thirds of world iron ore imports, with their combined share increasing to 88% in 2013 from 62% in 2002. China's share more than tripled during this 10-year period to 68% from 21%. Reported world iron ore exports rose to 1.28 Gt in 2013, a 9.4% increase from 1.17 Gt in 2012. Australia was the leading source of iron ore exports (46%), followed by Brazil (26%), South Africa (5.1%), Ukraine (3.0%), and Canada (3.0%) (United Nations Commodity Trade Statistics Database, undated).

Exploration.—Companies continued to expand current mines and facilities, to develop mines, and to investigate new deposits. A survey conducted by Metals Economics Group found that total budgets for iron ore exploration fell to $1.7 billion in 2013, a 41% decrease from $2.9 billion in 2012. Australia led in regional funding for iron ore exploration (44%), followed by Asia (14%), Africa (12%), the Commonwealth of Independent States (11%), Europe (7%), and Canada (5%) (Wilburn and Stanley, 2014).

Cliffs, which primarily produces iron ore and thermal coal, invested $10.8 million in global exploration activities in 2013, an 85% decrease from $73.3 million in 2012 (Cliffs Natural Resources Inc., 2014, p. 10). The United Nations Conference on Trade and Development reported new production capacity could be operational between 2013 and 2015, with 360 Mt classified as "certain," 231 Mt as "probable," and 306 Mt as "possible," of which 32% would be located in Australia with the remainder in Latin America (29%), Africa (13%), Europe (11%), Asia (11%), and North America (4%) (Mojarov, 2013).

World Review

Afghanistan.—In August, the Afghan Iron and Steel Consortium agreed to complete in phases the $10.8 billion iron ore mining project on the Hajigak deposit in Afghanistan. The rights to develop the project were awarded in November 2011 with plans to establish a 6.1-Mt/yr steel plant, an 800-megawatt powerplant, an iron ore mine, and necessary infrastructure. The plan was later rescaled to include a 1.25-Mt/yr steel plant and a 120-megawatt powerplant for $2.9 billion. The projected changes would require approval from the Government of Afghanistan (Economic Times, The, 2013).

In October, the Steel Authority of India sought to renegotiate the terms of an iron ore deal for the Hajigak deposit following increased attacks by insurgents in the area. Two Chinese firms, which were under contract to develop the nearby Aynak Mine, canceled plans to build a 559-mile (900-km)-long railway to the site as initially planned in 2007. The railway was engineered to run from northern Pakistan, through Kabul, and into Uzbekistan to transport mineral production in the region (Donati, 2013).

Australia.—Australia's reported Economic Demonstrated Resources at yearend 2013 were 52.6 Gt with 23.0 Gt of contained iron. Australia's Economic Demonstrated Resources had an estimated resource life of 86 years. In Western Australia, nine projects were in various stages of development for 1.0 Gt of JORC Code-compliant resources, ranging from 28% to 61% Fe, with an estimated 529 Mt of contained iron. Brockman Resources Ltd.'s Opthalmia Project was the largest of Western Australia's resource development projects with 290 Mt of JORC Code resources at 59.1% Fe, followed by Iron Ore Holdings Ltd. (259 Mt at 58.3% Fe), and Aquila Resources Ltd. (102 Mt at 57.3% Fe) (Summerfield, undated).

Rio Tinto Group's mine production capacity at yearend 2013 was 261 Mt/yr. In 2013, Rio Tinto's share of saleable iron ore production was Hammersley Iron (six mines), 133 Mt; Rober River, 33.1 Mt; Hope Downs, 16.9 Mt; Eastern Range, 10.1 Mt; and Channar, 6.6 Mt. Rio Tinto's share of production from Australia totaled 200 Mt, a 4.7% increase from 191 Mt in 2012. The first phase of Rio Tinto's expansion plans was accomplished in the second half of 2013, achieving a 290-Mt/yr production capacity, a 32% increase from its previous capacity. The second phase of expansion plans, which includes several brownfield expansions and further port expansions, would increase production capacity to 330 Mt/yr in 2015 and to 350 Mt/yr in 2017. Rio Tinto continued investment in autonomous mine technology, including 30 automated hauling trucks at three mine sites and an automated train. Rio Tinto improved efficiencies in production in 2013 by reducing truck and train cycle times, extending tire life, and reducing fuel and maintenance costs. Hope Downs 4 successfully reached the 1-Mt/yr operating rate in the third quarter; full rampup of operations was expected to be concluded in 2014 (Rio Tinto Group, 2014, p. 34–35, 213, 217).

BHP Billiton Ltd.'s mine production capacity at yearend 2013 was 271 Mt/yr. In 2013, BHP Billiton's share of production, on a wet ton basis, was 53.0 Mt of concentrates from the Mt. Newman and Jimblebar joint venture (JV), 60.1 Mt of coarse ores from the Yandi JV, and 45.8 Mt of coarse ores from the Mt. Goldsworthy JV. In 2013, two expansion projects were underway to increase capacity to 220 Mt/yr. The Jimblebar Mine began production in the fourth quarter of 2013 following a $4.3 billion investment, with an initial capacity of 35 Mt/yr and an option to expand to 55 Mt/yr. The Port Hedland expansion, a $2.3 billion investment, would expand port capacity from 188 Mt/yr to 220 Mt/yr. The Orebody 24 Mine began production in December 2012 (BHP Billiton Ltd., 2014, p. 31–34, 74).

Fortescue Metals Group Ltd.'s production capacity, as of March 2014, was 150 Mt/yr. In 2013, Fortescue Metals shipped 94.7 Mt of iron ore on a wet ton basis (9% moisture). Expansion plans would increase capacity to 155 Mt/yr by the second half of 2014 (Fortescue Metals Group, 2013a, p. 6–10; 2013b; 2014a, p. 8–18; 2014b).

Brazil.—Vale S.A.'s share of production at all operations in Brazil, including the Samarco Mine, was 311 Mt, a decrease of 2.8% from 320 Mt in 2012. Production at the 29.2-Mt/yr Turbaráo Plants and 7.5-Mt/yr São Luis pellet plants was suspended in 2012. Among Vale's projects in Brazil, the Carajás

Serra Sul S11D project had the largest nominal production capacity increase (90 Mt/yr), followed by Cauê Itabiritios (24 Mt/yr), Conceição Itabiritios II (19 Mt/yr), Vargem Grande Itabiritos (10 Mt/yr), Turbarão VIII (7.5 Mt/yr), and Serra Leste (6 Mt/yr) (Vale S.A., 2014, p. 25–31, 36, 60, 69–71). Samarco's Fourth Pellet Plant Project, a $3.5 billion expansion project aimed at increasing iron ore pellet production capacity from 22.3 Mt/yr to 30.5 Mt/yr, was 90% complete in June 2013 and on schedule to be operational in the first half of 2014 (BHP Billiton Ltd., 2014, p. 34).

Anglo American plc continued developing the Minas-Rio Project, an open pit mine and facility with an annual production capacity of 26.5 Mt/yr (wet ton basis). Ore would be transported from the mine through a 326-mile (525-km) slurry pipeline to the port of Acu, where it would be formed into high-grade pellet feed. At yearend 2013, the project was 84% complete and scheduled to begin shipping by yearend 2014 (Anglo American plc, 2014, p. 55–58). Anglo American halted shipments of iron ore pellets and sinter feed following the collapse of a river bank near its operations in Amapa, Brazil. The shipping pier for the Pedra Branca do Amapari Mine was destroyed in the collapse, indefinitely curtailing shipments from the Amapa Mine (Boadle and Semora, 2013). In November, Anglo American completed the sale of its stake in the Amapa iron ore operation to Zamin Ferrous Ltd. (Tex Report, The, 2013).

Canada.—ArcelorMittal Mines Canada's production capacities, as of yearend 2013, for the Mt. Wright Mine and Fermont concentrator facility were 24 Mt/yr of concentrate and 9.3 Mt/yr of acid and flux pellets. In 2013, ArcelorMittal Mines Canada's share of production was 9.1 Mt of pellets and 8.9 Mt of concentrates.

ArcelorMittal Mines Canada reported that the Fire Lake operation would be transitioned from seasonal operation, with an annual production of 2.5 Mt of crude ore, to year-round operation beginning in 2014. The Mt. Reed deposit was not actively mined in 2013. Expansion projects to increase iron ore production capacity by 0.8 Mt/yr and concentrator capacity by 8 Mt/yr were completed in the first half of 2013 (ArcelorMittal S.A., 2014, p. 207, 217).

Iron Ore Co. of Canada (IOC) [jointly owned by Labrador Iron Ore Royalty Income Fund (15.1%), Mitsubishi Corp. (26.18%), and Rio Tinto (58.72%)] produced 8.6 Mt of pellets and 6.8 Mt of saleable concentrates in 2013. In the second half of 2013, IOC began its concentrate expansion plan and remained on track to commission additional mining equipment and upgrades to power distribution infrastructure during the second quarter of 2014 (Rio Tinto Group, 2014, p. 35, 213, 216).

ArcelorMittal S.A. sold a 15% stake in ArcelorMittal Mines Canada Inc., valued at $1.1 billion, to Taiwan's China Steel Corp. and South Korea's POSCO. ArcelorMittal planned to double output at the Mt. Wright (Quebec) complex from 15 Mt/yr, made progress on the Mary River project (Baffin Island) in a joint venture with Nunavut Iron Ore Acquisition Inc., and continued development at Mt. Reed and Fire Lake in the Labrador Trough. Iron ore deposits in Quebec and Labrador were also being reviewed for development by Champion Iron Ore Mines Ltd., Alderon Iron Ore Corp., and a joint venture between Tata Steels Ltd. and New Millennium Capital Corp. (Donville and others, 2013).

Cliffs' annual production capacities for the Bloom Lake and Wabush Mines were 7.2 Mt/yr and 5.6 Mt/yr, respectively. In 2013, the Bloom Lake Mine produced 5.9 Mt of concentrate and the Wabush Mine produced 2.8 Mt of pellets and concentrates. The Wabush Pointe Noire pellet plant in Sept-Iles, Quebec, was idled in June 2013 owing to high production costs and decreasing pellet prices. The Wabush Scully Mine in Newfoundland and Labrador was expected to be idled by the end of the first quarter of 2014 (Cliffs Natural Resources Inc., 2014, p. 32–33).

China.—In 2013, China consumed an estimated 644 Mt of iron ore, 56% of global demand (Anglo American plc, 2014, p. 55). In China, iron ore imports from Australia increased by 11% and imports from Brazil decreased 19% compared with those of December 2012 (Wong, 2014). These months exemplified trends in 2013 as China increased reliance on ore from Australia instead of Brazil.

The Rizhao International Iron Ore Exchange opened in July to facilitate spot trading at the largest iron ore port in China. The public trading group included 21 primary dealers. More than 100 Mt/yr of iron ore was shipped through the Port of Rizhao (Rong, 2013). Steel mills in Hebei Province shut down owing to power shortages. Other facilities are expected to close to reduce the steel surplus in the region as well as for routine maintenance (Arnsdorf, 2013).

Guinea.—BHP Billiton, which held a 41.3% interest in Nimba Mining Concession and four permitted areas, underwent prefeasibility studies for development of the concession and infrastructure (BHP Billiton Ltd., 2014, p. 34).

India.—Restrictions on mining in the States of Goa and Karnataka were expected to reduce India's iron ore exports in 2013 from an average of 100 Mt/yr to an estimated 27 to 30 Mt/yr. In April, India's Supreme Court allowed iron ore mining to resume in Karnataka on a conditional basis; however, 49 mine leases were canceled owing to illegal mining practices. A ruling in mid-November 2013 by the Supreme Court of India allowed electronic auctions of iron ore stockpiled in Goa State, although mining restrictions continued (Serapio, 2013).

The Odisha (State) Steel and Mines Department issued a notification in December, which was upheld by the Orissa High Court, ordering iron ore producers in Odisha to reserve one-half of their monthly production for domestic sale. The High Court also stated that if the Odisha Government could not develop a mechanism for fair distribution and market pricing to domestic consumers, the policy could be delayed (Mohapatra, 2014).

NSL Consolidated Ltd. received $12.2 million from the Vijay Group under a joint-venture agreement to develop iron ore projects in Andhra Pradesh State. These operations were expected to produce 1.5 Mt within the first 2 years while development and expansion of existing mines were pursued. A Vijay Group subsidiary will maintain 40% interest in the project (Australian, The, 2013).

Liberia.—ArcelorMittal Liberia Ltd. continued mining direct-shipping ore from the Mt. Tokadeh deposit in Nimba, which began operations in 2011, as the first of three projects to be

completed in the area. The phase 2 expansion of the Liberian iron ore mines, aimed at increasing production capacity to 15 Mt/yr of sinter feed, was expected to be complete by yearend 2015 (ArcelorMittal S.A., 2014, p. 213, 217).

BHP Billiton maintained a Mineral Development Agreement with the Government of Liberia, enabling it to explore and develop its iron ore mineral leases. Drilling continued on selected targets (BHP Billiton Ltd., 2014, p. 34). Sesa Goa Ltd. expected to produce 4 Mt/yr of iron ore beginning in early 2014 from its project in Liberia (Mayenkar, 2013).

Mauritania.—Charter Pacific Corp. reported the potential for production of low-cost concentrates from the Kaoua iron ore project in Mauritania with a potential resource of 4,400 Mt of magnetite iron ore. Preliminary analysis indicated that 69%-iron-content concentrates could be produced using a dry sinter process, resulting in production costs of $32 per metric ton. Jindal Steel and Power Ltd. acquired permits for sites adjacent to the Kaoua project (Proactive Investors, 2013).

Sierra Leone.—In 2013, African Minerals Ltd.'s Tonkolili Mine produced 13.1 Mt, more than double that of 5.1 Mt in 2012, of which 12.1 Mt was exported. At yearend 2013, a run rate of 19.2 Mt/yr was achieved. Construction of a concentrate facility in the second half of 2014 was expected to increase annual production capacity to 25 Mt/yr (African Minerals Ltd., 2014, p. 2–3).

South Africa.—Kumba Iron Ore Ltd.'s production capacities, as of yearend 2013, for the Kolomela Mine, the Shishen Mine, and the Thabazimbi Mine were 10 Mt/yr, 31 Mt/yr, and 46 Mt/yr, respectively. In 2013, the Shishen Mine produced 30.9 Mt, the Kolomela Mine produced 10.8 Mt, and the Thabazimbi Mine produced 0.6 Mt of iron ore products. The Sishen Iron Ore Company Ltd. (SIOC) became the exclusive holder of mining rights at the Sishen Mine following dismissal of the case brought before the Supreme Court of Appeal in March 2013. In November 2013, SIOC entered into a supply agreement with ArcelorMittal, to be effective beginning in 2014, for ore produced from the Sishen Mine for the life of mine. The Sishen Mine recovery and optimization plan was expected to increase production capacity to 35 Mt/yr in 2014 and 37 Mt/yr in 2015 (Anglo American plc, 2014, p. 55–58, 220–221).

Outlook

Global demand for iron ore, led by consumption in China, is gradually slowing and being met by increasing production and exports in Australia. The risk of near-term oversupply increased greatly moving into 2014, following the successful completion and initiation of production capacity increases. Despite growth forecasts, only a fraction of projects was delayed or canceled. With production and exports from India partially resuming at yearend 2013, following the decision from India's Supreme Court, the global seaborne trade supply of iron ore is expected to increase in 2014 and 2015.

During the next 5 years, construction in parts of Asia and Africa may shift from nonresidential structures to infrastructure in residential development areas, owing to a growing middle class and increased growth in population centers. This shift could diminish steel consumption slightly, on a year-on-year basis through the next 5 to 10 years, as nonresidential construction growth slows. Residential construction would be expected to increase high-tonnage structural steel product consumption in the short term as transportation and utilities projects are underway, but decrease over the long term. As structural steel demand fades, high-end finished steels and ferroalloys demand could rise for appliance, automotive, and finished steel products. In terms of tonnage, global steel consumption would decrease as heavier structural steel is replaced by lighter specialty-steel products driven by consumption in China, India, and Africa.

If steel consumption decreases, consumption of iron ore for steel production would also decrease. Decreases in consumption, paired with expected increases in global supply, could cause decreased prices of iron ore as the market struggles to rebalance. Junior miners with high-cost mines would be subject to closures, especially in China and Australia, as low-quality ore is forced out of the market in favor of high-quality, less expensive iron ore. In an effort to increase price margins, focuses likely would shift to increasing efficiencies, reducing costs, and optimizing production practices. Improvements in technology are decreasing operational costs as infrastructure for powerplants, transportation, and production plants are improved. DRI and high-purity iron nuggets continue to receive increased interest in development projects, in the United States and abroad, as processes to produce less expensive iron ore alternatives are improved.

Trends in the steel industry are provided in the "Outlook" section in the Iron and Steel chapter of the 2013 USGS Minerals Yearbook, volume I, Metals and Minerals.

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TABLE 1
SALIENT IRON ORE STATISTICS[1]

(Thousand metric tons and thousand dollars unless otherwise specified)

		2009	2010	2011	2012	2013
United States, iron ore, usable, less than 5% manganese:[2]						
Production		26,700	49,900	54,700	54,000 e	53,000 e
Shipments:						
Quantity		27,600	50,600	55,600	52,900 e	53,300 e
Value		2,560,000	5,000,000	5,530,000	5,190,000	5,110,000 e, 3
Average value at mines	dollars per metric ton	92.76	98.79	99.45	98.16	104.90 e, 3
Exports:						
Quantity		3,920	9,950	11,100	11,200	11,000
Value		356,000	1,090,000	1,330,000	1,440,000	1,480,000
Imports for consumption:						
Quantity		3,870	6,420	5,270	5,160 r	3,250
Value		376,000	703,000	841,000	759,000 r	426,000
Consumption, iron ore and agglomerates		31,000	42,300	46,300	46,900	54,800
Stocks, December 31, at mines, plants and loading docks[3, 4]		5,060	3,470	3,260	3,110	2,290
Additional stocks, December 31:						
Crude ore at mines and plants[4]		580	734	978	1,140	1,400
Unagglomerated concentrates for pelletizing plants		896	949	1,120	1,260	1,090
World, production[5]		2,220,000 r	2,590,000	2,930,000	2,960,000 r	3,160,000

eEstimated. rRevised.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Agglomerates, byproduct ore, concentrates, direct-reduced iron, and direct-shipping ore.

[3]Excludes data for direct-reduced iron products.

[4]Crude ore stocks and unagglomerated concentrates for pelletizing plants removed. Marketable stocks only. Excludes by-product ore.

[5]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 2013, BY DISTRICT AND STATE[1, 2]

				Production				Average quantity per worker hour (metric tons)		
						Iron contained in usable products				
District and State	Number of mines	Average number of employees	Worker hours (thousands)	Crude ore (thousand metric tons)	Usable iron-ore products (thousand metric tons)	(thousand metric tons)	(percent)	Crude ore	Usable ore	Iron contained
Lake Superior:										
Michigan[3]	2	1,300	2,720	30,000 e	10,500	6,410 e	61.0 e	10.84 e	3.90 e	2.37 e
Minnesota	10	4,170	8,780	137,000	41,000	25,800	63.0	15.51	3.85	4.02
Total or average	12	5,470	11,500	167,000 e	51,500	32,200 e	62.0 e	14.41 e	3.86 e	3.63 e
Other States:										
Indiana	1	60	115	NA	255	NA	92.0 e	0.38	3.45	2.27
Utah	1	116	54	2,430	1,310	833	63.6	0.43	3.85	2.37
Total or average	2	176	169	2,430	1,570	833	63.6 e	0.81	8.20	4.39
Grand total or average	14	5,640	11,700	170,000 e	53,000	33,000 e	62.8 e	14.19 e	3.93 e	3.64 e

eEstimated. NA Not available.
[1]Data are rounded to no more than three significant digits, except "Average quantity per worker hour, crude ore"; may not add to totals shown.
[2]Data for direct-reduced iron products not included in crude ore or contained iron totals.
[3]Does not include professional or clerical workers at mines, or research lab workers.

Source: Cliffs Natural Resources Inc. and Steel Dynamics Inc.

TABLE 3
USABLE IRON-ORE PRODUCTS PRODUCED IN THE UNITED STATES IN 2013, BY DISTRICT, STATE, AND TYPE OF PRODUCT[1, 2]

(Thousand metric tons)

District and State	Concentrates	Pellets and other agglomerates[3]	Direct-reduced iron	Total
Lake Superior:				
Michigan	--	10,500	--	10,500
Minnesota	1,480	39,300	214	41,000
Total	1,480	49,800	214	51,500
Other States:				
Indiana	--	--	255	255
Utah	1,310	--	--	1,310
Total	1,310	--	255	1,570
Grand total	2,790	49,800	469	53,000

-- Zero.
[1]Excludes ore containing 5% or more manganese.
[2]Data are rounded to no more than three significant digits; may not add to totals shown.
[3]Data may include pellet chips, screenings, and sinter.

Source: Cliffs Natural Resources Inc. and Steel Dynamics Inc.

TABLE 4
SHIPMENTS OF USABLE IRON-ORE PRODUCTS FROM MINES IN THE UNITED STATES IN 2013[1, 2]

District and State	Gross weight of ore shipped (thousand metric tons)				Average iron content, natural[4] (percent)	Value[4] (thousands)
	Concentrates	Pellets and other agglomerates[3]	Direct-reduced iron	Total		
Lake Superior:						
Michigan	--	10,500	--	10,500	61.0 e	W
Minnesota	1,480	39,400	216	41,100	63.0	W
Total reportable or average	1,480	49,900	216	51,600	62.0 e	$4,920,000
Other States:						
Indiana	--	--	354	354	92.0 e	NA
Utah	1,310	--	--	1,310	63.6	190,000 e
Total reportable or average	1,310	--	354	1,660	63.6 e	190,000 e
Grand total or average	2,790	49,900	570	53,300	62.8 e	5,110,000 e

eEstimated. NA Not available. W Withheld to avoid disclosing company proprietary data; included in "Total reportable or average." -- Zero.
[1]Includes byproduct ore. Excludes ore containing 5% or more manganese.
[2]Data are rounded to no more than three significant digits; may not add to totals shown.
[3]Data may include pellet chips, screenings, and sinter.
[4]Data for direct-reduced iron products not included in average iron content totals or value.

Source: Cliffs Natural Resources Inc. and Steel Dynamics Inc.

TABLE 5
IRON ORE-PRODUCING MINES IN THE UNITED STATES IN 2013

State and mine	County	Operator	Source of iron ore
Indiana, Iron Dynamics	DeKalb	Steel Dynamics Inc.	Hematite tailings.
Michigan:			
Empire	Marquette	Cliffs Natural Resources Inc.	Hematite-magnetite taconite ore.
Tilden	do.	do.	Do.
Minnesota:			
Hibbing Taconite	St. Louis	do.	Magnetite taconite ore.
Keewatin Taconite	do.	United States Steel Corp.	Do.
Mesabi Chief Plant #1	do.	Magnetation, Inc.	Hematite tailings.
Mesabi Chief Plant #2	do.	do.	Do.
Mining Resources LLC	do.	Steel Dynamics Inc.	Do.
Mesabi Nugget Delaware LLC	do.	do.	Magnetite taconite ore.
Minntac	do.	United States Steel Corp.	Do.
Minorca	do.	ArcelorMittal S.A.	Do.
Northshore	do.	Cliffs Natural Resources Inc.	Do.
United Taconite	do.	do.	Do.
Utah, Comstock Mountain Lion Mine	Iron	CML Metals Corporation	Do.

Do., do. Ditto.

TABLE 6
CONSUMPTION OF IRON ORE AT U.S. IRON AND STEEL PLANTS, BY TYPE OF PRODUCT[1]

(Thousand metric tons)

Type of product	2012	2013
Blast furnaces:		
Pellets	40,600	NA
Sinter[2]	5,640	NA
Total	46,300	NA
Steelmaking furnaces:		
Direct-shipping ore	454	NA
Sinter[2]	159	NA
Total	613	NA
Grand total	46,900	NA

NA Not available.
[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 7
U.S. EXPORTS OF IRON ORE, BY COUNTRY AND TYPE OF PRODUCT[1, 2]

	2012			2013		
Country and type of product	Quantity (thousand metric tons)	Value (thousands)	Unit value[3, 4] (dollars per metric ton)	Quantity (thousand metric tons)	Value (thousands)	Unit value[3, 4] (dollars per metric ton)
Country:						
Belgium	6	$992	$165.33	--	--	--
Canada	6,370	889,000	139.41	6,080	$899,000	$147.88
China	4,110	474,000	115.25	2,750	365,000	132.42
France	--	--	--	137	17,400	126.85
Germany	3	830	276.67	12	4,510	375.75
Hong Kong	3	256	85.33	164	11,700	71.46
Japan	70 r	9,650 r	137.81	89	10,800	121.62
Mexico	641	65,400	102	1,130	110,000	97.99
Slovak Republic	--	--	--	115	7,530	65.44
Spain	(5)	3	300.00	135	17,100	127.01
United Kingdom	--	--	--	423	39,100	92.47
Other	4 r	556 r	102.33	3	500	166.67
Total	11,200	1,440,000	128.43	11,000	1,480,000	134.33
Type of product:						
Briquettes	--	--	--	--	--	--
Coarse ores	1,330	90,800	68.55	213	$23,300	109.23
Concentrates	1,330	$112,000	83.99	2,390	280,000	117.05
Fine ores	279 r	30,000 r	107.35 r	382	46,800	122.59
Other agglomerates	23	2,900	126.22	266	23,500	88.16
Pellets	8,260	1,200,000	145.95	7,790	1,110,000	142.47
Roasted pyrites	3	299	99.67	1	176	176.00
Total	11,200	1,440,000	128.43	11,000	1,480,000	134.33

[r]Revised. -- 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.
[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 8
U.S. IMPORTS OF IRON ORE, BY COUNTRY AND TYPE OF PRODUCT[1, 2]

Country and type of product	2012 Quantity (thousand metric tons)	2012 Value (thousands)	2012 Unit value[3, 4] (dollars per metric ton)	2013 Quantity (thousand metric tons)	2013 Value (thousands)	2013 Unit value[3, 4] (dollars per metric ton)
Country:						
Argentina	81	$11,400	$140.43	137	$23,100	$168.88
Brazil	739	94,700	128.09	630	74,700	118.63
Canada	3,820 r	588,000 r	153.81 r	2,090	280,000	133.97
Chile	104	15,500	148.86	152	12,400	161.08
China	(5)	115	23.00	1	52	52.00
Mexico	47	5,630	119.74	1	90	90.00
Norway	(5)	72	14.40	78	11,900	152.77
Peru	44	4,620	104.89	12	2,260	187.92
South Africa	91	11,300	124.62	95	13,800	145.55
Sweden	72	9,000	124.97	49	7,310	149.27
United Kingdom	76	10,100	132.87	(5)	5	1.00
Venezuela	75	8,340	111.16	--	--	--
Other	4 r	320 r	80.00 r	(5)	79	15.60
Total	5,160 r	759,000 r	147.33 r	3,250	426,000	131.18
Type of product:						
Briquettes	--	--	--	--	--	--
Coarse ores	51	2,730	53.45	45	6,390	141.91
Concentrates	862	99,600	115.52	566	56,900	115.88
Fine ores	363	49,300	135.73	573	79,600	138.84
Other agglomerates	(5)	115	48.00	1	50	50.00
Pellets	3,880 r	607,000 r	156.70 r	2,060	283,000	137.26
Roasted pyrites	4	303	75.75	(5)	19	3.80
Total	5,160 r	759,000 r	147.33 r	3,250	426,000	131.18

rRevised. -- 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.
[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 9
U.S. IMPORTS OF IRON ORE IN 2013, BY COUNTRY AND TYPE
PRODUCT[1, 2]

(Thousand metric tons)

Country of origin	Concentrates	Fine ores	Pellets	Other	Total
Argentina	--	137	--	--	137
Brazil	319	112	199	--	630
Canada	--	302	1,790	4	2,090
Chile	152	--	--	--	152
Mexico	--	(3)	--	1	1
Norway	--	(3)	78	--	78
Peru	--	12	--	(3)	12
South Africa	95	--	--	--	95
Sweden	--	9	(3)	40	49
United Kingdom	--	--	--	(3)	(3)
Venezuela	--	--	--	--	--
Other	(3)	(3)	(3)	1	1
Total	566	573	2,060	46	3,250

-- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes agglomerates.
[3]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 10
U.S. IMPORTS OF IRON ORE, BY CUSTOMS DISTRICT[1, 2]

(Thousand metric tons and thousand dollars)

	2012		2013	
Customs district	Quantity	Value	Quantity	Value
Baltimore, MD	1,450	216,000	11	1,820
Buffalo, NY	--	--	(3)	9
Charleston, SC	(3)	21	--	--
Chicago, IL	708 r	74,300 r	527	57,400
Cleveland, OH	2,210	343,000	1,560	206,000
Detroit, MI	(3)	23	1	125
Houston-Galveston, TX	54	10,400	44	6,380
Los Angeles, CA	(3)	2	(3)	7
Mobile, AL	48	5,990	18	1,900
New Orleans, LA	618	107,000	1,080	150,000
New York, NY	(3)	44	(3)	41
Ogdensburg, NY	(3)	31	(3)	65
Pembina, ND	--	--	(3)	10
Philadelphia, PA	4	292	--	--
Port Arthur, TX	27	618	--	--
San Diego, CA	--	--	1	90
Seattle, WA	37	588	--	--
St. Albans, VT	1	127	3	85
Tampa, FL	3	1,240	9	1,610
Total	5,160 r	759,000 r	3,250	426,000

[r]Revised. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes agglomerates.
[3]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 11
AVERAGE UNIT VALUE FOR SELECTED IMPORTS OF IRON ORE IN 2013[1]

Type of product	Country of origin	Average unit value[2] (dollars per metric ton, gross weight)
Concentrates	Brazil	$96.08
Do.	Chile	81.64
Fine ores	Argentina	168.43
Do.	Brazil	114.94
Do.	Canada	132.80
Pellets	Brazil	156.90
Do.	Canada	134.41

Do. Ditto.
[1]Includes agglomerates.
[2]Weighted averages of individual customs values.

Source: U.S. Census Bureau.

TABLE 12
IRON ORE: WORLD PRODUCTION, BY COUNTRY[1]

(Thousand metric tons)

Country	Gross weight[2]					Metal content[3]				
	2009	2010	2011	2012	2013[e]	2009	2010	2011	2012	2013[e]
Algeria	1,307	1,469 r	1,320 r	1,784 r	1,067 4	700	771 r	693 r	820 r	835
Australia[e]	394,000	433,000	488,000	521,000	609,000	228,000	271,000	277,000	315,000	377,000
Austria	2,002	2,069	2,207	2,142	2,100	641	662	706	686	680
Azerbaijan	--	58	214	215 r	220	--	33	114	114 r	117
Bosnia and Herzegovina	1,615	1,401	1,891	2,076 r	2,100	678	588	794	872	870
Brazil	298,528	372,120	398,131 r	400,822 r	386,270 4	198,711	247,772	265,091 r	258,129	245,668 4
Canada	31,704	37,001	33,573 r	39,427	42,800	20,000 e	23,300 e	21,000 r, e	24,900 r, e	26,000
Chile	8,242	9,129 r	12,625	17,330	17,109 4	5,006	5,852	7,747	9,429	9,088 4
China[e, 5]	880,000	1,070,000	1,330,000	1,330,000 r	1,450,000	280,000	332,000	412,000	399,000 r	435,000
Colombia	281	77	174	392 r	710 4	154 e	42 e	96 e	216 r, e	391
Egypt	2,314 r	3,329 r	3,930 r	4,000 r	3,000	1,557 r	1,664 r	1,963 r	2,000 r	1,500
Germany	364	390	489	450	450	38	41	51	47	47
Greece[e, 6]	1,500	1,500	1,200	1,200	1,200	560	560	550	550	550
Guatemala	NA r	NA r	NA r	NA r	NA	NA r	NA r	NA r	NA r	NA
India[7]	217,155	210,006	177,256	142,710	150,000	138,979	134,404	113,444	91,974	96,000
Indonesia[e]	45 4	46 4	46	48	50	25	26	27	29	30
Iran[e, 7]	34,034 r, 4	35,000	44,335 r, 4	50,000 r	50,000	16,000	16,500	20,900 r	24,000 r	24,000
Kazakhstan	22,281	24,229	24,813	25,210 r	25,500	12,700	13,800	14,100	14,326 r	14,500
Kenya[e]	7	11	11	71 r, 4	-- 4	4	6 r	6 r	39 r	--
Korea, North[e]	5,300	5,300	5,300	5,300	5,300	1,500	1,500	1,500	1,500	1,500
Korea, Republic of	455	513	542	593 r	600	274 r	308 r	320 r	332 r	325
Liberia	--	--	1	3	5	--	--	1	2	3
Malaysia	1,470	3,466	8,078 r	10,278 r	10,000	838 e	1,970 e	4,600 r, e	5,860 r, e	5,700
Mauritania	10,524	11,534	11,160	11,200 r	13,000	6,840 e	7,500 e	7,250 e	7,280 r, e	7,800
Mexico	11,677	13,998	12,806 r	14,915 r	14,500	7,007	8,400	7,722	7,750	7,530
Mongolia	1,379	3,203	5,678	7,561	6,011 4	883 e	2,050 e	3,600 e	4,760 e	3,790
Morocco	31	45	79	261 r	270	16	24	43	104 r	143
New Zealand[6]	2,092	2,439	2,357	2,395	2,400	1,200 e	1,400 e	1,300 e	1,320 e	1,320
Nigeria[e]	99 4	63 4	70 4	70	50	37	20	26	26	19
Norway	1,678	3,292	3,427	3,911	3,900	896 r	1,926	2,047	2,405	2,410
Pakistan[e, 7]	333 4	418 4	430 r, 4	380	400	167	210	200	190	200
Peru	4,490 r	6,140 r	7,123 r	6,792 r	6,788 4	3,008 r	4,114 r	4,772 r	4,551 r	4,548 4
Portugal[e, 6]	14	14	14	14	14	10	10	10	10	10
Russia	92,000	95,900	104,000	104,000 r	105,000	53,200 e	56,600 r, e	61,400 r, e	61,400 r, e	60,700
Sierra Leone	--	--	1	7	13	--	--	1	4	8
South Africa	55,313	58,709	58,057	67,100 r	71,534 4	34,800 e	36,900 e	36,500 e	42,900 r, e	45,700
Sweden	20,389	27,917	22,968	26,039 r	26,000	12,233	16,750	15,159	17,186 r	17,000
Thailand	529 r	970	286 r	103 r	100	259 r, e	475 r, e	140 r, e	50 r, e	50
Togo	--	--	41	40	40	--	--	12	12	12
Tunisia	151	181	171	175	170	79	94	79	87	85

See footnotes at end of table.

TABLE 12
IRON ORE: WORLD PRODUCTION, BY COUNTRY[1]

(Thousand metric tons)

Country	Gross weight[2]					Metal content[3]				
	2009	2010	2011	2012	2013[e]	2009	2010	2011	2012	2013[e]
Turkey	3,855 [r]	5,814 [r]	6,450 [r]	4,452 [r]	4,500	2,583 [r]	3,895 [r]	4,322 [r]	2,975 [r]	3,000
Ukraine	66,476	78,171	80,581	81,966	82,000	36,600 [e]	43,000 [e]	44,300 [e]	45,100 [e]	45,100
United States	26,700	49,900	54,700	54,000 [e]	53,000	16,600	31,300	34,300	33,400 [r, e]	32,800
Venezuela	13,801 [r]	14,004 [r]	17,037 [r]	15,124 [r]	10,583 [4]	8,580 [r, e]	8,700 [r, e]	10,600 [r, e]	9,400 [r, e]	6,580
Vietnam	3,593	3,721	4,474 [r]	2,870 [r]	2,830	1,905	1,972	2,209	1,523 [r]	1,500
Total	2,220,000	2,590,000	2,930,000 [r]	2,960,000 [r]	3,160,000	1,090,000 [r]	1,280,000	1,380,000 [r]	1,390,000	1,480,000

[e]Estimated. [r]Revised. NA Not available. -- Zero.

[1]All data, with the exception of reported figures, are rounded to no more than three significant digits; may not add to totals shown. Includes data available through September 21, 2015.

[2]Gross weight represents total for all iron ore products used in steelmaking, unless otherwise noted, produced in the country, excluding agglomerates produced from imported iron ore.

[3]Iron content indicates either reported weight of contained iron ore metal content as calculated based on surveyed and reported figures or estimates by respective country specialists.

[4]Reported figure.

[5]China's gross weight figures are significantly higher because China reports crude ore production, with an average iron content of 33%, as opposed to usable ore.

[6]Production includes alternative iron ore sources as follows: Greece, nickeliferous iron ore; New Zealand, titaniferous magnetite beach sands; and Portugal, manganiferous iron ore.

[7]Production is based on fiscal year, with starting dates as follows: India, April 1; Iran, March 21; and Pakistan, July 1.