



2012 Minerals Yearbook

CLAY AND SHALE

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The quantity of clay sold or used by domestic producers in 2012 increased slightly to 25.8 million metric tons (Mt) valued at \$1.54 billion compared with 25.7 Mt valued at \$1.54 billion in 2011 (table 1). Common clay and shale accounted for 45% of the tonnage, and kaolin accounted for 57% of the value (tables 1, 5, and 8). In 2012, exports decreased slightly to 4.17 Mt valued at \$963 million compared with 4.24 Mt valued at \$988 million in 2011. Imports of clays were 524,000 metric tons (t) valued at \$108 million in 2012 compared with 593,000 t valued at \$97.4 million in 2011 (table 1). World production of bentonite was 14.8 Mt, production of fuller's earth was 3.11 Mt, and production of kaolin was 38.2 Mt (tables 16–18).

Approximately 180 companies mined clay and shale in the United States in 2012. The 20 leading companies, many with multiple operations, accounted for 61% of the tonnage and 85% of the value for all types of clay sold or used. Clay production was reported in all States except Alaska, Delaware, Hawaii, Idaho, Minnesota, New Hampshire, New Jersey, Rhode Island, Vermont, and Wisconsin (table 2). Companies that mined clay for construction fill and landfill caps and did not operate mills or plants were not included in the U.S. Geological Survey (USGS) canvass of the clay and shale industry. These companies operated in most, if not all, States.

The 10 leading producer States were, in decreasing order of tonnage, Georgia, Wyoming, Texas, Alabama, Missouri, Virginia, Tennessee, California, Ohio, and Oklahoma. These 10 States accounted for 77% of U.S. clay production (table 2). The 15 leading producer companies were, in alphabetical order, American Colloid Co. (bentonite); BASF SE (bentonite, fuller's earth, and kaolin); Bentonite Performance Minerals LLC (bentonite); Black Hills Bentonite, LLC (bentonite); CARBO Ceramics Inc. (kaolin); Cemex USA (common clay and shale); General Shale, Inc. (common clay and shale); Imerys SA (ball clay and kaolin); KaMin LLC (kaolin); M-I L.L.C. (bentonite); Nestlé S.A. (fuller's earth); Oil-Dri Corp. of America (fuller's earth); Texas Industries, Inc. (common clay and shale); Thiele Kaolin Co. (kaolin); and Unimin Corp. (ball clay and kaolin).

Most clay mining in the United States was by open pit methods; less than 1% of U.S. clay output was from underground mines. Most subsurface production was in Ohio, where the clays were mainly underclays associated with underground coal mining.

Domestic production data for clays were developed by the USGS from a voluntary survey of U.S. operations. Responses to the survey and company production data available from other sources accounted for approximately 54% of the total clay and shale tonnage sold or used quantity listed in table 1. Production data for the nonrespondents were estimated from preliminary survey data or reported prior-year production levels adjusted by trends in the industry, employment hours, and other guidelines.

Ball Clay

Production.—In 2012, four companies mined ball clay in four States. Production of domestic ball clay increased by 10% to 973,000 t valued at \$45.1 million compared with 886,000 t valued at \$40.9 million in 2011 (table 3). The leading producer State was Tennessee, followed by, in descending order of tonnage, Texas, Mississippi, and Kentucky. One producer reported production in Indiana, but this probably was fire clay rather than ball clay.

Consumption.—Consumption of ball clay increased in 2012. The two principal domestic markets were, in decreasing order by tonnage, ceramic floor and wall tile (44%) and sanitaryware (18%). Ball clay also was sold to manufacture bricks, electrical porcelain, fine china, pottery, refractory products, roofing granules, and other types of ceramics (table 3). Ball clay producers also reported sales for fiberglass and filler, extender, and binder applications; those were likely to have been kaolin mined or purchased by the ball clay producers. Domestic sales for ceramic tile manufacture increased by 25% with two companies accounting for most of the increase. It was possible that some sales destined for foreign tile manufacturing markets were reported as domestic sales because U.S. shipments of ceramic tile increased by only 4% from 2011 to 2012 and the annualized rate of ceramic tile shipments, through the second quarter of 2013, increased by only 9% from the same period in 2012 (Tile Council of North America, Inc., 2013). Other markets were relatively unchanged in 2012. Producers reported that exports accounted for 21% of total ball clay sales.

Prices.—The average unit value for ball clay reported by domestic producers was unchanged at \$46 per metric ton from that of 2011. The average free alongside ship (f.a.s.) value for exported ball clay was \$62 per ton. The average Customs value for imported ball clay was \$314 per ton.

Foreign trade.—Ball clay exports were 74,000 t valued at \$4.58 million in 2012 compared with 49,000 t valued at \$2.89 million in 2011, according to the U.S. Census Bureau (table 14). Producers reported exports to be 202,000 t (table 3). Most of the difference in exports reported by producers and the U.S. Census Bureau involved shipments to Mexico, whose trade statistics suggested that Mexico's imports of ball clay from the United States were reported under Mexico's Harmonized Tariff Standard (HTS) code for kaolin and other kaolinic clays. Ball clay imports were 436 t valued at \$137,000 (table 15).

Bentonite

Production.—In 2012, 21 companies produced nonswelling and (or) swelling bentonite in 11 States. About 4.98 Mt valued at \$311 million was sold or used in 2012, a slight decrease in

quantity from 4.99 Mt valued at \$304 million of bentonite sold or used in 2011 (table 4).

Production of swelling bentonite was 4.84 Mt valued at \$300 million in 2012, essentially unchanged from that of 2011. Wyoming was dominant in the production of swelling bentonite with 90% of the total production, followed by, in descending order of tonnage, Utah, Montana, Texas, California, Oregon, Nevada, and Colorado.

Production of nonswelling bentonite was 140,000 t valued at \$10.7 million in 2012, a 5% decrease from that of 2011. Alabama led in the production of nonswelling bentonite, followed by, in descending order of tonnage, Mississippi, California, and Arizona.

Western Lithium USA Corp. submitted mine plans for its hectorite deposit in Kings Valley, NV. The company planned to market hectorite for deep drilling situations with specialty products meeting American Petroleum Institute specifications. The review process was not expected to be completed until early 2014 (Western Lithium USA Corp., 2012).

Consumption.—In 2012, domestic sales and use of bentonite decreased slightly from that of 2011. Major domestic sales of bentonite were, in decreasing order by quantity, drilling mud (all swelling bentonite), pet waste absorbent (more than 99% swelling bentonite), pelletizing iron ore (all swelling bentonite), and foundry sand bond (more than 85% swelling bentonite). Bentonite also was sold for civil engineering, fillers and extenders, waterproofing and sealing, and a variety of other applications (table 4).

Sales to several leading domestic bentonite markets declined slightly in 2012 compared with those of 2011. The 32% decline in sales for waterproofing and sealing was likely accounted for by the increase in sales for miscellaneous civil engineering applications. Export sales to the drilling mud and foundry sand markets declined in 2012, although some tonnage to those markets may be reported under Exports–Other, which increased by 35% compared with that of 2011 (table 4).

The leading markets shown in table 4 are representative of those of swelling bentonite, which accounted for 97% of total bentonite sales. The leading uses of nonswelling bentonite were in foundry sand bond and water treatment and filtering.

For smaller markets, swelling bentonite accounted for more than 90% of the bentonite sold for adhesives; animal feed; clarifying, decolorizing, and filtering animal, mineral, and vegetable oils and greases; cosmetics, medical, and pharmaceutical applications; fertilizers; miscellaneous ceramics; miscellaneous fillers and extenders; oil and grease absorbents; paint; pesticides; and plastics. Swelling bentonite accounted for less than 50% of sales for water treatment and filtering.

In 2012, American Colloid (a subsidiary of AMCOL International) reported increases in sales revenue for metal casting applications, its leading revenue market. Its foundry sales also increased with the continuing growth in the automotive and heavy equipment markets, and its basic minerals markets increased mainly on the strength of sales for gas and oil drilling (AMCOL International Corp., 2013, p. 34).

Rockwood Holdings, Inc. (the parent company of Southern Clay Products, Inc.) reported slightly decreased sales in most of its clay-additive markets because of lower demand for coatings

and inks and oilfield applications (Rockwood Holdings, Inc., 2013, p. 38).

Prices.—The average unit value reported by domestic producers for nonswelling bentonite was \$76 per ton in 2012 compared with \$73 per ton in 2011. The average value for swelling bentonite was \$62 per ton compared with \$61 per ton in 2011. The average value for all bentonite was \$62 per ton in 2012 compared with \$61 per ton in 2011. The average f.a.s. value of exported bentonite was \$159 per ton. The average Customs value of imported bentonite was \$1,270 per ton.

The price of bentonite that was sold in bulk, crude form for iron ore pelletizing from the mill in Wyoming was \$60 to \$65 per ton; foundry-grade that was bagged and shipped in railcars was \$88 to \$112 per ton; pet waste absorbent grade, \$45 to \$54 per ton; and American Petroleum Institute (API)-grade bentonite that was bagged and shipped in railcars was \$82 to \$118 per ton. Crushed, dried, loose in bulk bentonite from India was \$34 to \$38 per ton for pet waste absorbent grade. Foundry grades, crude and dried, in bulk, free on board, Milos, Greece, was \$79 to \$106 per ton (Industrial Minerals, 2012a).

Foreign trade.—Bentonite exports increased slightly to 1.04 Mt valued at \$165 million in 2012 from 1.02 Mt valued at \$167 million in 2011 (table 14). Canada and Japan accounted for the largest share of the bentonite exports with 26% and 12%, respectively. Domestic bentonite producers reported exports of 1.19 Mt (table 4). Some discrepancy typically occurs between data reported by producers and the U.S. Census Bureau data because producers often include a portion of the exports destined for Canadian and Mexican markets under domestic sales. In addition, some bentonite is packaged domestically and then exported as a finished product, such as pet waste absorbent. Sales through U.S. mineral brokers, where producers do not know if the bentonite is used domestically or exported, also could contribute to the discrepancy.

Bentonite imports consisted mainly of untreated bentonite clay and chemically or artificially activated materials. Imports of untreated bentonite were 12,000 t valued at \$15.3 million. Imports of artificially activated material were 31,000 t valued at \$34.0 million (table 15).

Common Clay and Shale

Production.—In 2012, 121 companies produced common clay and shale for manufacturing products in 39 States and Puerto Rico. Companies that mined clay for construction fill and landfill caps and did not operate mills or plants were not included in the USGS canvass of the clay and shale industry. These companies operated in most, if not all, States.

The quantity of common clay and shale sold and used was 11.7 Mt in 2012, essentially unchanged from that of 2011 (table 5). The 10 leading producing States were, in descending order of tonnage, Texas, Alabama, Ohio, Georgia, Oklahoma, Virginia, California, North Carolina, New York, and Missouri. These 10 States accounted for 65% of U.S. common clay and shale production.

Texas Industries announced that it would exchange its expanded shale and clay aggregates division, with plants in California, Nevada, and Texas, for 42 ready-mix concrete plants in Arkansas and Texas, owned by Trinity Industries Inc. Trinity

indicated that the exchange would allow it to focus more on its core business of aggregates. (Texas Industries, Inc., 2012).

Consumption.—Brick manufacture remained the leading market for common clay and shale, followed by, in descending order of tonnage, portland cement and lightweight aggregate. These three markets accounted for 93% of sales in 2012. Lightweight aggregate sales (2.75 Mt) were subdivided into concrete block (45%), structural concrete (19%), and highway surfacing and miscellaneous lightweight aggregates (18% each). Other markets for common clay and shale included civil engineering, ceramic floor and wall tile, miscellaneous ceramics, heavy-clay (nonbrick) products, and refractory products (table 5).

Prices.—The average unit value reported by domestic producers for all common clay and shale produced in the United States was \$10 per ton, a decrease from \$12 per ton in 2011. The value of clay and shale used to produce lightweight aggregate was estimated to be \$21 per ton in 2012 compared with \$27 per ton in 2011. Average prices for lightweight aggregate produced from clay and shale ranged from \$30 to \$80 per ton for most applications. Unit values for common clay and shale should be used with caution. Most common clay and shale producers do not sell their clay, but use it directly to manufacture products and have not established a selling price for their clays.

Fire Clay

Production.—Fire clay producers were mostly refractory product manufacturers that used the clays in firebrick and various heavy-clay products. In 2012, four firms mined fire clay in three States. Fire clay production declined by 15% to 183,000 t valued at \$4.87 million compared with 215,000 t valued at \$6.36 million in 2011 (table 6). Missouri was the leading producing State, followed by, in descending order of tonnage, Texas and Colorado. Lower production was reported by the two leading fire clay producers, and several common clay producers that occasionally mine fire clay indicated that they did not do so in 2012.

Consumption.—Consumption of fire clay decreased in 2012. Leading markets for fire clay were, in descending order of tonnage, refractory grogs and calcines, fire brick, portland cement, and pottery. Most data were withheld to avoid disclosing company proprietary data (table 6). Fire clay also was sold for high-alumina brick and specialties; ramming and gunning mixes; refractory block and mortars; refractory saggars; and common brick.

Prices.—In 2012, the average unit value for fire clay reported by domestic producers was \$27 per ton compared with \$30 per ton in 2011. The average f.a.s. value of exported fire clay was \$163 per ton. The average Customs value of imported fire clay was \$172 per ton.

Foreign trade.—Exports of fire clay and refractory-grade kaolin appear to have been shipped under the same HTS code in recent years. At least 70%, and possibly more, of the exports reported by the U.S. Census Bureau under the HTS code for fire clay was thought to be refractory-grade kaolin rather than fire clay, based on the locations of ports from which the material was exported. In 2012, exports of fire clay and refractory-grade

kaolin decreased to 289,000 t valued at \$47.2 million compared with 371,000 t valued at \$61.6 million in 2011 (table 14). Mexico accounted for 64% of the decline in exports but exports decreased significantly to many European countries. In 2012, Luxembourg and Mexico accounted for 44% and 20% of U.S. fire clay exports, respectively. In 2012, imports were 8,000 t valued at \$1.38 million. China accounted for 82% of the import tonnage (table 15).

Fuller's Earth

Production.—In 2012, 11 companies produced fuller's earth in 10 States. Fuller's earth deposits consist mainly of palygorskite (attapulgite) in Florida and southwestern Georgia and montmorillonite in central Georgia and other States. Gellant grades of attapulgite, used as thickeners in such items as drilling muds and paints, were mined in western Florida and near Attapulgus, GA. Sorbent grades of attapulgite were mined a little further north near Ochlocknee, GA. To be consistent with past reporting, sorbent grades of attapulgite were grouped with the montmorillonite-type fuller's earth, whose major market also was sorbent applications.

Gellant-grade attapulgite was mined or sold in the Florida Panhandle and southwestern Georgia by two companies. Attapulgite production data were withheld to avoid revealing company proprietary data, but production increased in 2012 compared with that of 2011. Florida led in the production of attapulgite, followed by Georgia.

Production of the montmorillonite variety of fuller's earth increased slightly to 1.98 Mt valued at \$182 million in 2012 compared with 1.95 Mt valued at \$194 million in 2011 (table 7). Montmorillonite-type fuller's earth was produced, in decreasing order of tonnage, in Missouri, Georgia, Mississippi, Virginia, California, Tennessee, Florida, Illinois, Kansas, and Texas. Georgia, Mississippi, Missouri, and Virginia, accounted for 79% of U.S. production.

Oil-Dri Corp. stopped production of industrial floor absorbent and pet waste absorbents at its Mounds, IL, facility, moving that production line to its facilities in Mississippi. The decision was based on cost savings and State regulatory requirements in Illinois. The Illinois facility continued to produce products for animal health and nutrition (Oil-Dri Corp. of America, 2013, p. 28, 47).

Consumption.—Consumption of fuller's earth (excluding gel-grade attapulgite-type fuller's earth) increased slightly in 2012. Pet waste absorbent was the leading market for the montmorillonite-type and sorbent-grade attapulgite-type of fuller's earth, followed by miscellaneous (unknown or unspecified uses); oil and grease absorbents; filtering, clarifying, and decolorizing of animal, mineral, and vegetable oils and greases; fillers and extenders; animal feed; and exports. Other uses included civil engineering, drilling mud, fertilizer carriers, paint, pesticide carriers, and portland cement (table 7). The leading market for gel-grade attapulgite-type fuller's earth was unknown or unspecified uses; followed by, in decreasing order of tonnage, drilling mud; paint; miscellaneous fillers, extenders, and binders; fertilizer carriers; pesticide carriers; adhesives; animal feed; plastics; oil and grease absorbents; filtering, clarifying, and decolorizing of animal, mineral, and

vegetable oils and greases; and medical, pharmaceuticals, and cosmetics applications.

Domestic sales of fuller's earth for pet waste absorbents increased by 5% compared with that of 2011. Sales of fuller's earth for filtering, clarifying, and decolorizing animal, mineral, and vegetable oils and greases increased by 11%. A major producer reported increased U.S. demand for fluid filtration products in 2012 (Oil-Dri Corp. of America, 2013, p. 26). Several fuller's earth producers reported increased sales for filler, extender, and binder applications.

Montmorillonite grades dominated sales to most fuller's earth markets, but attapulgite accounted for most of the sales of fuller's earth, in decreasing order of tonnage, for adhesives; paint; medical, pharmaceuticals, and cosmetics applications; drilling mud; fertilizer carrier; paint; and plastics.

Prices.—The average unit value of attapulgite-type fuller's earth reported by domestic producers was withheld to avoid disclosing company proprietary data but the value was unchanged from that of 2011. The average value of montmorillonite-type fuller's earth was \$92 per ton in 2012 compared with \$100 per ton in 2011. Two operations with large tonnage production reported lower unit values for 2012, causing the decline in the overall unit value. The average f.a.s. value of exported fuller's earth was \$345 per ton. The average Customs value of imported fuller's earth was \$113 per ton.

The price of fuller's earth, soda ash-treated, civil engineering grade, ex-works, South Africa, was \$81 to \$113 per ton; pet waste absorbent grade, ex-works, South Africa, was \$27 to \$65 per ton; and foundry grade, ex-works, South Africa, was \$97 to \$137 per ton (Industrial Minerals, 2012a).

Foreign trade.—In 2012, exports increased slightly to 105,000 t valued at \$36.2 million (table 14). Imports of decolorizing earth and fuller's earth were 1,410 t valued at \$160,000 in 2012 (table 15).

Kaolin

Production.—In 2012, 17 firms mined kaolin in 9 States. Domestic production increased slightly to 5.98 Mt valued at \$873 million compared with 5.95 Mt valued at \$851 million in 2011 (table 8). Georgia accounted for 92% of the U.S. kaolin production, followed by, in descending order of tonnage, South Carolina, Alabama, Arkansas, Texas, Florida, North Carolina, Nevada, and California. Kaolin production in Georgia increased slightly to 5.49 Mt valued at \$836 million in 2012 compared with 5.48 Mt valued at \$814 million in 2011 (table 9). Companies in Georgia accounted for nearly all the pigment-grade calcined kaolin produced in the United States in 2012. A small amount also was produced in Texas. Production in South Carolina, which accounted for 4% of U.S. kaolin production, increased slightly to 246,000 t valued at \$19.8 million in 2012 compared with 245,000 t valued at \$19.7 million in 2011 (table 10).

Advanced Primary Minerals Corp. sold its kaolin subsidiary, Advanced Primary Minerals USA Corp. (APM USA), to a private ownership group. APM USA owned a mine and mill as well as rights to kaolin reserves near Dearing, GA (Advanced Primary Minerals Corp., 2012).

Because of growing demand for proppants used in hydraulic fracturing for gas and oil production, CARBO Ceramics began construction of its third ceramic proppants plant; this one in Millen, GA. The plant should begin operating in 2013 and will use locally sourced kaolin as plant feed (CARBO Ceramics, Inc., 2013).

PyraMax Ceramics, LLC announced that its Wrens ceramic proppants plant in Georgia was expected to be operational in March 2013. That plant would use locally sourced kaolin to manufacture proppants used by the gas and oil industries during hydraulic fracturing operations (Howard, 2012).

Consumption.—Consumption of kaolin increased slightly in 2012 from that of 2011 (table 11). The major domestic markets for kaolin were, in descending order of tonnage, paper coating and filling (34% of domestic sales), refractory products (18%), miscellaneous ceramics (15%), fiberglass and mineral wool (7%), and catalysts (6%). Other smaller but significant markets were catalyst manufacture, chemical manufacture, floor and wall tile, heavy-clay products (brick and portland cement), paint, plastics, and rubber. The leading export market for kaolin was in paper coating and filler (table 11). A similar market distribution was seen for producers in Georgia (table 9).

The sales distribution for South Carolina kaolin producers was, in descending order of tonnage, fiberglass, catalyst manufacture (included in ceramics in table 10), rubber, brick, adhesives, unknown uses, paper coating, portland cement, miscellaneous ceramics, animal feed, firebrick, plastics, and electrical porcelain. Much of the data for individual markets was withheld to avoid disclosing company proprietary data (table 10).

Paper coating and filling markets accounted for 48% of total (domestic and export) kaolin sales in 2012 compared with 51% in 2011. Domestic sales of kaolin for paper coating markets decreased by 27% in 2012. One U.S. producer accounted for the bulk of the decline in overall domestic sales for paper coating applications but that same company reported a significant increase in export sales for paper coating and filler applications. Total sales (domestic and export combined) for paper applications declined by only 4% in 2012. Refractory products accounted for 12% of total kaolin sales in 2012, with sales increasing slightly because of a small improvement in U.S. industrial production. Other increases were distributed across many end-use markets. A few companies accounted for the bulk of the increase in kaolin sales for catalysts (56%) and paint (35%). Almost equivalent declines in sales for miscellaneous ceramics and miscellaneous applications (domestic) in 2012 suggested that some catalyst and paint sales may have been included under the miscellaneous categories in 2011.

Prices.—The average unit value of kaolin reported by domestic producers was \$146 per metric ton for all kaolin grades. The average value for airfloat was \$75 per ton; delaminated, \$150 per ton; unprocessed, \$53 per ton; and water washed, \$156 per ton. All types of calcined kaolin combined were valued at \$208 per ton. The average f.a.s. value of exported kaolin was \$224 per ton. The average Customs value of imported kaolin was \$120 per ton.

The price of number 1 paper coating grades of kaolin from a plant in Georgia ranged from \$161 to \$209 per ton, and the

price of number 2 paper coating grades varied from \$108 to \$166 per ton (Industrial Minerals, 2012a).

Foreign trade.—Exports decreased slightly in 2012 to 2.45 Mt of kaolin valued at \$549 million compared with 2.49 Mt valued at \$555 million in 2011 (table 14). Producers reported exports of 1.98 Mt (table 11). Some of the kaolin exported to Canada and Mexico probably was reported under domestic consumption by U.S. producers. Sales through U.S. mineral brokers, where producers do not know if the kaolin is used domestically or exported, also could explain part of the discrepancy.

Kaolin imports were 472,000 t of kaolin valued at \$56.8 million in 2012 compared with 549,000 t valued at \$56.2 million in 2011 (table 15). Decreased imports from Brazil accounted for about 88% of the decline in imports. About 85% of kaolin imports were from Brazil and were used primarily in paper coating applications.

World Review

World production of bentonite was approximately 14.8 Mt (table 16), and fuller's earth production was 3.11 Mt (table 17). Kaolin production was about 38.2 Mt (table 18), including ball clay from Australia, Ukraine, and various other countries, and crude kaolin ore production that was reported by many countries. World sales of processed kaolin were estimated to be between 24 and 26 Mt, after accounting for processing losses and stockpiling and the inclusion of ball clay production as kaolin by some countries. The United States continued to be the leading supplier of processed clay for sale, followed by China and Greece for bentonite, Spain for fuller's earth, and Brazil and the United Kingdom for kaolin. Spain led all countries in the production of sepiolite. Senegal was the leading producer of palygorskite (attapulgate), followed by the United States. The rankings above were based on processed clay sold or used and not on crude ore production.

Australia.—WA Kaolin Holdings Pty. Ltd. began developing a mine near Wickepin, Western Australia. The deposit has proven reserves of more than 100 Mt of kaolin weathered from a granitic matrix. The company planned to expand its initial 150,000 t/yr plant to 350,000 t/yr (Ollett, 2012a).

Brazil.—KaMin LLC, a leading U.S. producer, purchased a majority share in CADAM SA, a major Brazilian kaolin producer. The purchase made KaMin the second ranked world supplier of refined kaolin with an estimated 1.7 million metric tons per year production capacity. The purchase included a mine near Amapá and a beneficiation plant and port near Pará (Ollett, 2012a; KaMin, 2012a). The company planned to restructure the CADAM operation, primarily reducing production capabilities at the plant to coincide with a decreased demand for paper-grade kaolin for fine printing and writing paper (KaMin LLC, 2012b).

India.—A leading Indian kaolin producer, 20 Microns, completed an expansion of its calcined kaolin plant in Bhuj to 65,000 t/yr from 40,000 t/yr (Ollett, 2012b).

Ukraine.—Proscopro Resources Ltd., a leading European producer of kaolin, planned construction of a spray-dried kaolin plant at its Prosyana deposit. Capacity will increase to 250,000 t/yr by 2014. Proscopro, which accounts for as much as 90% of the kaolin market in the Confederation of Independent

States (CIS), sold kaolin for ceramics, filler and extender applications, fiberglass, and paper markets (Ollett, 2012c).

United Kingdom.—In the United Kingdom, Imerys, the world's leading kaolin producer, purchased the kaolin operations of Goonvean Ltd. The Goonvean kaolin pit is adjacent to Imerys' Wheal Martyn pit. Imerys' plants in Greensplat and Trelarvour have a combined annual capacity of 200,000 metric tons of refined product, used mainly for ceramics, paper, and porcelain (Imerys SA, 2013, p. 22; Lismore, 2012b).

Outlook

Sales of ball clay and common clay and shale industries and portions of the fire clay, attapulgate-type fuller's earth, and kaolin industries are dependent on commercial and residential construction and renovation. These clays are used in the manufacture of many construction-related products, ranging from caulks to paints to sanitaryware. Reported starts for privately owned housing units were 781,000 in 2012 compared with 609,000 in 2011, a 28% increase (U.S. Census Bureau, undated). The annualized value of residential and nonresidential construction put in place, which provides a general indicator of commercial construction activity where clay-based materials may be used, increased by 9% to \$857 billion in 2012 from \$788 billion in 2011 (U.S. Census Bureau, 2013). Although housing starts remain lower than prerecession levels, the increase in building activity suggests that sales of these clays to construction-related markets may increase in 2013.

The fire clay industry and a portion of the common clay and shale and kaolin industries are dependent on refractory markets. Annual growth in global refractory markets was expected to increase from 3.5% to 5.2% through 2014. Growth in refractory brick and shapes markets, however, was expected to lag behind those for monolithics (Ceramic Industry, 2013; Industrial Minerals, 2012b; Lismore, 2012a). Thus, sales of these clays for refractory uses may remain unchanged in 2013.

Sales of swelling bentonite and montmorillonite-type fuller's earth for oil absorbent and pet waste absorbent markets increased in 2010 and 2011, suggesting that markets were improving and that sales may increase slightly in 2013.

Sales of bentonite for drilling mud applications may decline in 2013 compared with those of 2012 based on a slowdown in worldwide drilling activity reported by a major drilling services company (Baker Hughes Inc., 2013). Sales of attapulgate-type fuller's earth, which accounts for only a small portion of the overall drilling mud market, may remain unchanged or increase slightly in 2013.

Sales of bentonite were linked to the iron and steel industries because of its use for pelletizing iron ore (swelling bentonite) and as a foundry sand bond (swelling and nonswelling bentonite). Two suppliers of bentonite to the U.S. foundry industry indicated that the market increased in 2012 (AMCOL International Corp., 2013, p. 34; S&B Industrial Minerals S.A., 2013). Additionally, machinery and vehicle manufacture, which use many cast metal components, was reported by the Federal Reserve to have increased from 2010 to 2012 (Board of Governors of the Federal Reserve System, 2013). This suggests that demand for bentonite for foundry sand bond applications may increase in 2013. Shipments of iron ore and

steel production through July 2013, however, were less than in the same period in 2012 (Tuck, 2013). Consequently, demand for bentonite for iron ore pelletizing is likely to decline slightly or remain unchanged in 2013.

Sales of bentonite and common clay and shale for civil engineering applications, such as waterproofing and sealing and landfill caps and liners, may begin to improve slightly because of increased construction activity. Sales of bentonite and fuller's earth as carriers and suspension agents in fertilizers and pesticides may increase in 2013, based on increased acreage planted in 2012 and anticipated increases in planting in 2013 (U.S. Department of Agriculture, 2013). Sales of bentonite and fuller's earth for filtering, clarifying, and decolorizing of animal, mineral, and vegetable oils and greases are dependent on the quality of the oil source, and sales tend to vary yearly rather than follow economic trends. Sales of fuller's earth for fluid purification applications have increased since 2009, thus sales for fuller's earth may increase in 2013.

Kaolin is strongly dependent on paper markets for sales. Competition from calcium carbonate as a paper coating and filler and also a general downturn in the U.S. paper industry for the past several years resulted in a significant decline in domestic sales for paper. In the United States, industrial production of paper, the leading market for kaolin, declined 2.3% in 2012 for the second consecutive year (Board of Governors of the Federal Reserve System, 2013). Exports of kaolin to foreign paper markets, particularly in Asia, have partially offset declines in kaolin sales in the United States. Domestic sales of kaolin to paper markets may be unchanged or decline slightly in 2013, based on usage trends. Export sales of kaolin, primarily for paper use, may increase slightly, particularly to Asian markets.

The use of proppants increased significantly in the past decade because of increased hydrofracturing of gas- and oil-bearing formations to improve recovery (Beckwith, 2011). The two leading U.S. producers of kaolin-based ceramic proppants, however, expected only moderate expansion of the markets in 2013 because of a slowdown in the growth of drilling activity (CARBO Ceramics Inc., 2013, p. 27; Imerys SA, 2013, p. 15).

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TABLE 1
 SALIENT U.S. CLAY STATISTICS^{1,2}

(Thousand metric tons and thousand dollars)

	2008	2009	2010	2011	2012
Domestic clays sold or used by producers:					
Quantity	32,700	24,500	25,600	25,700 ^r	25,800
Value	1,650,000	1,330,000	1,480,000	1,540,000 ^r	1,540,000
Exports:					
Quantity	5,100	3,830	4,360	4,240 ^r	4,170
Value	938,000	702,000	862,000	988,000 ^r	963,000
Imports for consumption:					
Quantity	237	325	555	593	524
Value	86,600	104,000	81,200	97,400	108,000

^rRevised.

¹Excludes Puerto Rico.

²Data are rounded to no more than three significant digits.

TABLE 2
CLAYS SOLD OR USED BY PRODUCERS IN THE
UNITED STATES, BY STATE^{1,2}

(Thousand metric tons and thousand dollars)

State ³	2011		2012	
	Quantity	Value	Quantity	Value
Alabama	1,380	36,300	1,420	22,200
Arkansas	577 ^r	8,210 ^r	430	2,020
California	627 ^r	39,500 ^r	720	36,700
Colorado	137	298	105	595
Florida	98 ^r	19,300 ^r	92	19,000
Georgia	6,630 ^r	868,000 ^r	6,660	885,000
Indiana	351	7,740	392	7,520
Iowa	182	862	183	863
Kansas	327	3,320	335	3,280
Kentucky	362	8,450	305	6,420
Louisiana	144	1,280	145	1,330
Michigan	312	1,280	314	1,290
Mississippi	652	36,600	627	39,500
Missouri	1,050	40,700	1,150	36,300
New York	387	16,900	425	19,000
North Carolina	774	4,880	470	2,590
Ohio	632	13,300	693	13,900
Oklahoma	570	2,720	638	3,010
Oregon	205	1,300	203	1,110
South Carolina	472	20,900	443	18,400
Tennessee	755	31,800	816	34,800
Texas	2,140	41,300	2,250	40,500
Utah	459	15,100	464	21,500
Virginia	793 ^r	30,300 ^r	848	28,000
Wyoming	4,530 ^r	263,000 ^r	4,540	267,000
Other ⁴	1,130 ^r	22,900 ^r	1,100	26,200
Total	25,700 ^r	1,540,000 ^r	25,800	1,540,000

^rRevised.

¹Excludes Puerto Rico.

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

³Publishable totals used to avoid disclosing company proprietary data.

⁴Includes Arizona, Connecticut, Illinois, Maine, Maryland, Massachusetts, Montana, Nebraska, Nevada, New Mexico, North Dakota, Pennsylvania, South Dakota, Washington, and West Virginia.

TABLE 3
BALL CLAY SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY TYPE AND USE¹

(Thousand metric tons and thousand dollars)

	2011		2012	
	Quantity	Value	Quantity	Value
Type:				
Airfloat	615	27,600	653	29,500
Water-slurried	97	4,710	104	4,860
Unprocessed	173	8,610	215	10,700
Total	886	40,900	973	45,100
Use:				
Fillers, extenders, binders ²	40	NA	40	NA
Floor and wall tile	340	NA	426	NA
Miscellaneous ceramics ³	80	NA	85	NA
Pottery	4	NA	4	NA
Sanitaryware	181	NA	177	NA
Miscellaneous ⁴	31	NA	37	NA
Exports, reported by producers ⁵	208	NA	202	NA
Total	886	40,900	973	45,100

NA Not available.

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

²Includes animal feed; asphalt emulsions; rubber; and other fillers, extenders, and binders.

³Includes catalysts, electrical porcelain, fiberglass, fine china and dinnerware, mineral wool, and roofing granules.

⁴Includes heavy-clay products, waterproofing seals, refractories, and unknown uses.

⁵Includes miscellaneous ceramics and unknown uses.

TABLE 4
BENTONITE SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY TYPE AND USE¹

(Thousand metric tons and thousand dollars)

	2011		2012	
	Quantity	Value	Quantity	Value
Type:				
Nonswelling	148 ^r	10,800 ^r	140	10,700
Swelling	4,840 ^r	293,000 ^r	4,840	300,000
Total	4,990^r	304,000^r	4,980	311,000
Use:				
Domestic:				
Pet waste absorbents	1,080 ^r	NA	1,050	NA
Adhesives	9	NA	9	NA
Animal feed	36	NA	52	NA
Drilling mud	1,190 ^r	NA	1,190	NA
Filler and extender applications ²	74 ^r	NA	77	NA
Foundry sand	496 ^r	NA	475	NA
Pelletizing (iron ore)	532 ^r	NA	508	NA
Waterproofing and sealing	186 ^r	NA	126	NA
Miscellaneous civil engineering	70 ^r	NA	136	NA
Miscellaneous ³	178 ^r	NA	162	NA
Total	3,850^r	NA	3,790	NA
Exports, reported by producers:				
Drilling mud	303 ^r	NA	176	NA
Foundry sand	233 ^r	NA	196	NA
Other ⁴	604 ^r	NA	817	NA
Total	1,140^r	NA	1,190	NA
Grand total	4,990^r	304,000^r	4,980	311,000

^rRevised. NA Not available.

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

²Includes asphalt tiles, asphalt emulsions, cosmetics, fertilizers, ink, medical, miscellaneous fillers and extenders applications, paint, paper coating, paper filling, pesticides and related products, pharmaceuticals, and plastics.

³Includes ceramics, chemical manufacturing, clarifying and decolorizing, heavy-clay products, oil and grease absorbents, refractories, and unknown uses.

⁴Includes absorbents, fillers and extenders, refractories, pelletizing, and unknown uses.

TABLE 5
COMMON CLAY AND SHALE SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY STATE AND USE^{1,2,3}

(Thousand metric tons and thousand dollars)

	2011		2012	
	Quantity	Value	Quantity	Value
State:				
Alabama	1,190	24,100	1,210	9,070
Arkansas	532	7,580	384	1,400
California	398	6,990	519	7,780
Colorado	123	293	100	503
Georgia	644	6,880	687	3,770
Indiana	332	6,620	369	6,240
Iowa	182	862	183	863
Kansas	291	1,880	296	1,750
Kentucky	328	6,430	271	4,390
Michigan	312	1,280	314	1,290
Mississippi	264	1,570	221	1,330
Missouri	431	3,370	409	3,190
New York	388	16,900	425	19,000
North Carolina	764	4,460	459	2,150
Ohio	632	13,300	693	13,900
Oklahoma	570	2,720	638	3,010
Oregon	194	538	195	542
South Carolina	227	1,250	197	1,120
Tennessee	113	817	114	817
Texas	1,840	13,300	1,940	13,400
Utah	334	7,260	332	12,100
Virginia	503 ^r	6,030 ^r	605	6,780
West Virginia	138	210	123	142
Other ⁴	959	6,550 ^r	975	6,500
Total	11,700	141,000	11,700	121,000
Use:				
Floor and wall tile ⁵	359 ^r	NA	179	NA
Heavy-clay products:				
Brick, extruded	4,490	NA	4,360	NA
Brick, other	869 ^r	NA	943	NA
Other ⁶	115	NA	103	NA
Lightweight aggregate:				
Concrete block	1,200	NA	1,240	NA
Highway surfacing	489	NA	493	NA
Structural concrete	586	NA	516	NA
Miscellaneous	577	NA	502	NA
Portland and other cements	2,380	NA	2,800	NA
Refractories ⁷	338	NA	247	NA
Miscellaneous ⁸	290 ^r	NA	273	NA
Total	11,700	141,000	11,700	121,000

^rRevised. NA Not available.

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

²Excludes Puerto Rico.

³Includes only production for companies with mills or plants.

⁴Includes Arizona, Connecticut, Florida, Illinois, Louisiana, Maine, Maryland, Massachusetts, Montana, Nebraska, New Mexico, North Dakota, Pennsylvania, South Dakota, Washington, and Wyoming.

⁵Includes ceramic tile, quarry tile, and miscellaneous floor and wall tiles.

⁶Includes drain tile, flower pots, flue linings, sewer pipe, structural tile, and miscellaneous clay products.

⁷Includes firebrick, blocks and shapes, mortar and cement, grogs and calcines, and miscellaneous refractories.

⁸Includes exports, reported by producers; miscellaneous civil engineering and sealings; miscellaneous fillers, extenders, and binders; pottery; roofing granules; and unknown uses.

TABLE 6
FIRE CLAY SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY USE¹

(Thousand metric tons and thousand dollars)

	2011		2012	
	Quantity	Value	Quantity	Value
Production	215	6,360 ^r	183	4,870
Use:				
Heavy-clay products and lightweight aggregates ²	87	NA	73	NA
Refractories:				
Firebrick, block, shapes	1	NA	4	NA
Grog and calcines	W	NA	W	NA
Other refractories ³	W	NA	W	NA
Miscellaneous ⁴	126	NA	70	NA
Total	215	6,360 ^r	183	4,870

NA Not available. ^rRevised. W Withheld to avoid disclosing company proprietary data; included in "Miscellaneous."

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

²Includes common brick, concrete block, portland cement, and structural concrete.

³Includes kiln furniture, mortar and cement, and miscellaneous refractories.

⁴Includes floor tile, wall tile, and unknown uses.

TABLE 7
FULLER'S EARTH SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY TYPE AND USE¹

(Thousand metric tons and thousand dollars)

	2011		2012	
	Quantity	Value	Quantity	Value
Type:				
Attapulgite	(2)	(2)	(2)	(2)
Montmorillonite	1,950	194,000	1,980	182,000
Total	1,950	194,000	1,980	182,000
Use:				
Absorbents:				
Oil and grease	167	NA	153	NA
Pet waste	1,280	NA	1,340	NA
Animal feed	54	NA	58	NA
Fillers, extenders, binders ³	83	NA	100	NA
Filtering, clarifying, and decolorizing ⁴	125	NA	139	NA
Miscellaneous ⁵	213	NA	181	NA
Exports, reported by producers ⁶	27 ^r	NA	13	NA
Total	1,950	194,000	1,980	182,000

^rRevised. NA Not available.

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

²Withheld to avoid disclosing company proprietary data. Primarily gellant-grade fuller's earth. More information can be found in the "Fuller's Earth" section of this report.

³Includes asphalt emulsions; medical, pharmaceuticals, and cosmetics; paints; pesticides and related products; and unknown uses.

⁴Includes mineral and vegetable oils and greases.

⁵Includes civil engineering, drilling mud, miscellaneous absorbents, and unknown uses.

⁶Includes oil and grease absorbents, pet waste absorbents, drilling mud, paint, and unknown uses.

TABLE 8
KAOLIN SOLD OR USED BY PRODUCERS IN THE UNITED STATES,
BY STATE AND TYPE¹

(Thousand metric tons and thousand dollars)

	2011		2012	
	Quantity	Value	Quantity	Value
State:				
Georgia	5,480 ^r	814,000 ^r	5,500	836,000
South Carolina	245	19,700	246	19,800
Other ²	225 ^r	17,300 ^r	236	16,900
Total	5,950 ^r	851,000 ^r	5,980	873,000
Type:				
Airfloat	792	67,600	807	60,600
Calcined: ³	1,300 ^r	249,000 ^r	1,370	284,000
Delaminated	902 ^r	133,000 ^r	927	139,000
Unprocessed	671	35,400	566	29,900
Water washed	2,280 ^r	366,000 ^r	2,310	359,000
Total	5,950	851,000 ^r	5,980	873,000

^rRevised.

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

²Includes Alabama, California, Florida, Nevada, North Carolina, and Texas.

³Includes pigment-grade kaolin (low-temperature calcined kaolin) and refractory-grade kaolin (high-temperature calcined kaolin).

TABLE 9
 GEORGIA KAOLIN SOLD OR USED BY PRODUCERS, BY TYPE AND USE¹

(Thousand metric tons and thousand dollars)

Type and Use	2011		2012	
	Quantity	Value	Quantity	Value
Type:				
Airfloat	549	45,600	567	38,300
Calcined ²	1,270 ^r	241,000 ^r	1,300	276,000
Delaminated	902 ^r	133,000 ^r	927	139,000
Unprocessed	525	29,000	453	25,000
Water washed	2,230 ^r	365,000 ^r	2,250	358,000
Total	5,480^r	814,000^r	5,490	836,000
Use:				
Domestic:				
Ceramics and glass:				
Catalysts (oil-refining)	W	NA	W	NA
Fiberglass, mineral wool	218	NA	214	NA
Roofing granules	26	NA	15	NA
Other ³	715	NA	757	NA
Fillers, extenders, binders:				
Adhesives	20 ^r	NA	19	NA
Paint	181 ^r	NA	239	NA
Paper coating	1,620 ^r	NA	1,190	NA
Paper filling	130	NA	181	NA
Plastic	43 ^r	NA	51	NA
Rubber	102	NA	80	NA
Other ⁴	82	NA	42	NA
Heavy-clay products ⁵	(6)	NA	(6)	NA
Refractories ⁷	(6)	NA	(6)	NA
Undistributed ⁸	864 ^r	NA	772	NA
Total	4,000^r	NA	3,560	NA
Exports, reported by producers:				
Paint	48 ^r	NA	123	NA
Paper coating ⁹	1,210 ^r	NA	1,280	NA
Paper filling ⁹	46	NA	231	NA
Rubber	39 ^r	NA	58	NA
Undistributed ¹⁰	135	NA	240	NA
Total	1,470^r	NA	1,930	NA
Grand total	5,480^r	814,000^r	5,490	836,000

^rRevised. NA Not available. W Withheld to avoid disclosing company proprietary data.

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

²Includes pigment- and refractory-grade calcined kaolin.

³Includes catalysts (oil-refining), electrical porcelain, fine china and dinnerware, pottery, miscellaneous ceramics, and sanitaryware.

⁴Includes animal feed; asphalt tile; fertilizers; medical, pharmaceuticals, and cosmetics; pesticides and related products; and miscellaneous fillers, extenders, and binders.

⁵Includes brick (common and face), portland cement, and miscellaneous products.

⁶Withheld to avoid disclosing company proprietary data; included in "Domestic: Undistributed."

⁷Includes firebricks, blocks and shapes, grogs and calcines, high-alumina specialties, kiln furniture, and miscellaneous refractories.

⁸Includes absorbents, chemical manufacturing, floor and wall tiles, heavy-clay products, refractories products, waterproofing seals, and unknown uses.

⁹Some export sales, by producers, may be included with domestic sales.

¹⁰Includes miscellaneous ceramics; miscellaneous fillers, extenders, and binders; and unknown uses.

TABLE 10
SOUTH CAROLINA KAOLIN SOLD OR USED BY PRODUCERS, BY USE¹

(Thousand metric tons and thousand dollars)

	2011		2012	
	Quantity	Value	Quantity	Value
Production ²	245	19,700	246	19,800
Use:				
Ceramics ³	118	NA	49	NA
Rubber	41	NA	27	NA
Other ⁴	87	NA	171	NA
Total	245	19,700	246	19,800

NA Not available.

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

²Includes airfloat, unprocessed, and calcined kaolin.

³Includes catalysts (oil-refining), fiberglass, roofing granules, and sanitaryware.

⁴Includes adhesives, animal feed, brick (common), floor and wall tile, paper coating, plastics, and refractories.

TABLE 11
KAOLIN SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY USE¹

(Thousand metric tons)

Use	2011	2012
Domestic:		
Ceramics:		
Catalyst (oil and gas refining)	162	252
Fine china and dinnerware	6	7
Floor and wall tile	93	82
Pottery ²	W	W
Roofing granules	27	15
Sanitaryware	27	21
Miscellaneous	681 ^r	605
Chemical manufacture	W	W
Fiberglass, mineral wool	279	261
Fillers, extenders, binders:		
Adhesive	37 ^r	31
Paint	190 ^r	256
Paper coating	1,630 ^r	1,190
Paper filling	130	181
Pesticide ²	W	W
Plastic	45 ^r	52
Rubber	143 ^r	129
Miscellaneous	86	103
Heavy-clay products:		
Brick, common and face	25	23
Portland cement	64	13
Refractories ³	701	719
Miscellaneous applications	105 ^r	58
Total	4,430 ^r	4,000
Exports, reported by producers:		
Ceramics ²	W	W
Paint	62 ^r	124
Paper coating	1,210 ^r	1,280
Paper filling	46	231
Rubber	69 ^r	86
Miscellaneous	137 ^r	252
Total	1,520 ^r	1,980
Grand total	5,950 ^r	5,980

^rRevised. W Withheld to avoid disclosing company proprietary data.

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

²Included in "Miscellaneous."

³Includes firebrick (blocks and shapes), grogs and calcines, and miscellaneous refractories.

TABLE 12
COMMON CLAY AND SHALE USED IN LIGHTWEIGHT AGGREGATE
PRODUCTION IN THE UNITED STATES BY STATE¹

(Thousand metric tons and thousand dollars)

State	Concrete block	Structural concrete	Other ²	Total	
				Quantity	Value ^c
2011:					
Alabama	328	--	--	328	14,500
Arkansas	128	32	--	160	6,240
California	2	53	--	55	3,470
Indiana	22	36	88	145	6,000
Kansas	--	--	38	38	26
Kentucky	49	34	9	92	4,700
Louisiana	62	19	29	110	1,030
Missouri	--	--	126	126	1,360
Nebraska	--	--	1	1	5
New York	122	136	117	375	16,000
Ohio	72	40	68	180	7,820
Oklahoma	20	3	--	23	703
Texas	162	174	427	763	6,050
Utah	91	57	112	260	5,820
Virginia	145	2	50	197	4,490
Total	1,200	586	1,070	2,850	78,200
2012:					
Alabama	426	--	--	426	1,920
California	2	53	--	56	3,470
Indiana	116	12	10	139	5,500
Kansas	--	--	46	46	31
Kentucky	38	22	7	67	3,260
Louisiana	64	19	31	114	1,100
Missouri	--	--	122	122	1,230
Nebraska	--	--	2	2	9
New York	115	165	118	398	17,300
Ohio	72	40	69	181	7,890
Oklahoma	24	3	--	27	851
Texas	142	142	426	710	5,630
Utah	92	58	113	263	5,820
Virginia	146	2	50	199	4,490
Total	1,240	516	994	2,750	58,500

^cEstimated. -- Zero.

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

²Includes highway surfacing.

TABLE 13
COMMON CLAY AND SHALE USED IN BUILDING BRICK
PRODUCTION IN THE UNITED STATES, BY STATE^{1,2}

(Thousand metric tons and thousand dollars)

State	2011		2012	
	Quantity	Value ^c	Quantity	Value ^c
Alabama	537	6,200	363	3,130
Arkansas	154	705	158	728
California	117	710	119	717
Colorado	90	237	94	475
Georgia	593	6,640	636	3,440
Kentucky ³	232	2,080 ^r	174	849
Mississippi	264	1,570	221	1,330
North Carolina	538	2,720	459	1,910
Ohio	323	4,070	353	4,280
Oklahoma	404	1,540	418	1,590
Pennsylvania	279	1,530	256	1,430
South Carolina	217	1,210	186	605
Tennessee	113	817	114	817
Texas	310	2,100 ^r	411	2,250
Virginia	279 ^r	1,440 ^r	406	2,280
Other ⁴	904 ^r	4,130 ^r	931	4,620
Total	5,350	37,700 ^r	5,300	30,500

^cEstimated. ^rRevised.

¹Includes extruded and other brick.

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

³Extruded brick only.

⁴Includes all other States except Alaska, Nevada, New Hampshire, Rhode Island, Vermont, and Wisconsin.

TABLE 14
U.S. EXPORTS OF CLAYS, BY TYPE¹

(Thousand metric tons and thousand dollars)

Type of Clay	2011		2012		Principal destinations in 2012
	Quantity	Value	Quantity	Value	
Ball clay	49	2,890	74	4,580	Belgium, 18%; Nicaragua, 15%; Japan, 13%; Costa Rica, 11%.
Bentonite	1,020	167,000	1,040	165,000	Canada, 26%; Japan 12%; United Kingdom, 10%; Mexico, 6%.
Fire clay	371	61,600	289	47,200	Luxembourg, 44%; Mexico, 20%; Japan, 11%; Taiwan, 5%.
Fuller's earth	102	45,900	105	36,200	Japan, 10%; Brazil, 9%; Italy, 8%; China 6%; Netherlands, 6%.
Kaolin	2,490	555,000	2,450	549,000	Japan, 18%; China, 10%; Finland, 10%; Mexico, 8%; Taiwan, 5%.
Clays ²	209 ^r	156,000 ^r	213	162,000	Canada, 18%; Japan, 9%; India, 5%; Germany, 4%; Mexico, 4%.
Total	4,240 ^r	988,000 ^r	4,170	963,000	

^rRevised.

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

²Not elsewhere classified.

Source: U.S. Census Bureau.

TABLE 15
U.S. IMPORTS FOR CONSUMPTION OF CLAY, BY TYPE¹

(Thousand metric tons and thousand dollars)

Type of Clay	2011		2012		Principal sources in 2012
	Quantity	Value	Quantity	Value	
China clay or kaolin	549	56,200	472	56,800	Brazil 85%; United Kingdom, 9%; Canada, 3%; China, 3%.
Fire clay	2	893	8	1,380	China, 82%; Hong Kong, 7%; South Africa, 4%.
Ball clay	(2)	148	(2)	137	United Kingdom, 67%; China, 24%; Canada, 5%; Brazil, 4%.
Bentonite	9	7,080	12	15,300	Egypt, 32%; China, 27%; United Kingdom 18%; Mexico 16%.
Fullers's earth	2	142	1	160	China, 55%; Japan, 34%; Canada, 11%.
Chamotte or Dina's Earth	(2)	121	(2)	109	Czech Republic, 90%; United Kingdom, 10%.
Artificially activated clay and earth	31	32,900	31	34,000	Mexico, 34%; Germany, 18%; United Kingdom, 18%; China 14%.
Total	593	97,400	524	108,000	

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

²Less than ½ unit.

Source: U.S. Census Bureau; data adjusted by U.S. Geological Survey.

TABLE 16
BENTONITE: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

Country ³	2008	2009	2010	2011	2012
Algeria	30,595	31,612 ^r	34,126 ^r	29,000 ^r	30,000 ^e
Argentina	256,182	148,099	229,301 ^r	228,357 ^r	228,400
Armenia	40,000 ^r	38,000 ^r	1,397	835 ^r	4,987
Australia	-- ^r	-- ^r	-- ^r	-- ^r	--
Azerbaijan	40,683	10,581	18,073	55,000 ^r	60,000 ^e
Bolivia	1	323	440	591	745
Bosnia and Herzegovina	30,504	16,042	314	--	--
Brazil, beneficiated	340,141	264,243	531,693	566,267 ^r	512,975 ^p
Bulgaria	178,000	108,000	100,000 ^e	54,000 ^r	78,000
Burma ^{c,4}	1,000	1,000	1,000	1,000	1,000
Chile	--	--	--	1,255	893
China ^e	3,300,000 ^r	3,400,000	3,400,000	3,500,000	3,500,000
Croatia	19,759	--	--	--	--
Cyprus	155,125 ^r	152,722 ^r	162,169 ^r	160,625 ^r	160,180
Czech Republic, includes montmorillonite clays	235,000	177,000	183,000	160,000	221,000 ^e
Denmark	22,458	24,040	23,832	38,300	36,000
Egypt	32,000	29,000 ^r	33,132 ^r	18,000 ^r	20,000
Georgia ^e	5,000	5,000	5,000	4,800 ^r	4,900
Germany	414,336	326,461	362,623	375,332 ^r	366,000
Greece	1,389,800 ^r	926,186 ^r	1,381,643 ^r	1,188,442 ^r	1,235,105
Guatemala	62,749	14,284	22,423	44,463 ^r	131,843
Hungary	7,464 ^r	5,298	17,200 ^{r,e}	17,308 ^r	17,000 ^e
Indonesia ^e	6,000	6,000	6,500	6,500	7,000
Iran ⁴	357,898	387,437	350,208 ^r	377,398 ^r	400,000 ^e
Italy	281,119	146,318	111,000	102,000 ^r	144,000
Japan	435,000	432,000	430,000	425,000 ^e	420,000 ^e
Kenya ^e	70	65 ^r	70	75 ^r	75
Macedonia	22,890	15,350	12,798	14,466	6,900
Malawi	7,023	8,050	2,100 ^r	2,850 ^r	2,900 ^e
Mexico	374,933	511,429	590,998	563,795	956,224
Morocco	50,125 ^r	84,097 ^r	110,700 ^r	97,071 ^r	100,000 ^e
Mozambique	17,661	92,098 ^r	11,417 ^r	423 ^r	24,000
New Zealand, processed ^e	753	880	1,216	-- ^r	--
Pakistan	31,500	33,300 ^r	42,100 ^r	44,500 ^r	41,000
Peru	31,557	119,452	44,266 ^r	27,534	22,977
Philippines	1,422	1,413	1,475	2,087 ^r	2,000 ^e
Poland ⁵	3,000	3,000	2,000 ^r	3,000 ^e	3,000 ^e
Romania	16,643	13,756	20,000 ^r	18,008 ^r	17,942
Slovakia	145,000	109,000	130,521 ^r	119,323 ^r	129,930
South Africa ⁶	44,067	40,340	54,311	120,417 ^r	120,566
Spain	154,534 ^r	140,000 ^r	157,001 ^r	110,271 ^r	110,750
Turkey	1,553,588	932,487	798,397 ^r	379,918 ^r	400,000 ^e
Turkmenistan, includes bentonite powder	50,250 ^r	50,250 ^r	50,250 ^r	50,250 ^r	53,225
Ukraine ^e	200,000	195,000	185,000	211,000 ^r	210,000
United States	4,910,000	3,650,000	4,600,000	4,990,000 ^r	4,980,000
Uzbekistan ^e	20,000 ^r	20,000 ^r	20,000 ^r	25,000 ^r	25,000
Zimbabwe	100 ⁶	--	--	--	--
Total	15,300,000 ^r	12,700,000 ^r	14,200,000 ^r	14,100,000 ^r	14,800,000

^eEstimated. ^pPreliminary. ^rRevised. -- Zero.

¹World total, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Includes data available through July 15, 2014.

³In addition to the countries listed, Canada produced bentonite, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

⁴Year beginning March 21 of that stated.

⁵Montmorillonite-type bleaching clay.

⁶May include other clays.

TABLE 17
FULLER'S EARTH: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

Country ³	2008	2009	2010	2011	2012
Algeria	NA	NA	NA	NA	NA
Australia, attapulgite	-- ^r	-- ^r	-- ^r	-- ^r	--
Italy ^e	3,000	3,000	3,000	3,000	3,000
Mexico	66,123	108,139	170,350	107,436	227,496
Morocco, smectite	140,875 ^r	132,110 ^r	82,570 ^r	103,682 ^r	100,000 ^e
Pakistan	10,500	11,055 ^r	6,370 ^r	4,761 ^r	9,000 ^e
Senegal, attapulgite	167,000	181,000	204,000	181,000 ^r	180,000
South Africa, attapulgite	69,876	54,418	85,336	14,448 ^r	15,580
Spain:					
Attapulgite	27,348 ^r	21,110 ^r	27,841 ^r	26,021 ^r	26,000 ^e
Sepiolite	737,659 ^r	573,937 ^r	557,862 ^r	566,970 ^r	567,000 ^e
United States ^{4,5}	2,340,000	2,010,000	2,050,000	1,950,000	1,980,000
Total	3,560,000 ^r	3,090,000 ^r	3,180,000 ^r	2,950,000 ^r	3,110,000

^eEstimated. ^rRevised. NA Not available. -- Zero.

¹Excludes centrally planned economy countries and former such countries, some of which presumably produce fuller's earth but for which no information is available. Includes data available through July 15, 2014.

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

³In addition to the market economy countries listed, Algeria, France, India, Iran, Japan, and Turkey have reportedly produced fuller's earth in the past and may continue to do so, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

⁴Sold or used by producers.

⁵Excludes attapulgite.

TABLE 18
KAOLIN: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

Country ³	2008	2009	2010	2011	2012
Algeria	50,788	87,766	71,065	71,000 ^r	70,000 ^e
Argentina	73,838 ^r	78,792	78,722	54,166 ^r	54,200 ^e
Australia, includes ball clay	-- ^r	-- ^r	-- ^r	-- ^r	--
Austria, marketable	49,527	83,980	58,956	56,976 ^r	43,174
Bangladesh ^{e,4}	8,500	8,500	8,500	8,500	8,500
Belgium ^e	300,000	300,000	300,000	300,000	300,000
Bosnia and Herzegovina, crude	259,325	148,384	41,808	232,147	149,495
Brazil, beneficiated	2,456,000	1,987,000	2,000,000 ^r	1,927,000 ^r	2,189,000 ^p
Bulgaria ^e	1,530,000 ^s	939,000 ^s	900,000	900,000	900,000
Canada	NA ^r	NA ^r	NA ^r	NA ^r	NA
Chile	63,526	48,354	62,226	59,912	60,429
China ^e	3,200,000	3,000,000	3,260,000	3,200,000	3,300,000
Czech Republic	3,833,000	2,886,000	3,493,000	3,606,000	3,318,000
Denmark	NA ^r	NA ^r	NA ^r	NA ^r	NA
Ecuador	42,614 ^r	28,775 ^r	41,089 ^r	76,660 ^r	50,000 ^e
Egypt	523,327	523,000 ^r	304,200 ^r	304,000 ^{r,c}	304,000 ^e
Eritrea ^e	183 ^r	200 ^r	175 ^r	200	200
Ethiopia ⁶	1,275	3,534	3,600 ^{r,c}	4,000	3,300 ^e
France, marketable	624,000 ^r	519,000 ^r	315,000 ^r	315,000 ^{r,c}	315,000 ^e
Germany	3,622,159	4,513,753	4,560,086 ^r	4,898,516 ^r	4,600,000 ^e
Greece	4,360	--	--	--	--
Guatemala	2,803	1,879	2,143	4,057 ^r	1,866
Hungary, beneficiated	584,339 ^r	266,408 ^r	238,921 ^r	248,263 ^r	250,000 ^e
India ^e					
Processed	210,000	210,000	220,000	220,000	230,000
Salable crude	570,000	580,000	580,000	600,000	600,000
Indonesia ^e	150,000	186,010 ^s	170,000	175,000	180,000
Iran	320,000	907,487	1,480,291 ^r	2,000,000 ^r	1,500,000
Israel	151	--	--	--	--
Italy, kaolinitic earth ^e	5,000 ^r	5,000 ^r	6,000 ^r	8,000 ^r	8,000
Japan ^e	11,000	12,000	12,000	13,000	13,000
Jordan	181,018	177,470	115,000 ^r	89,903 ^r	76,000 ^e
Kenya ^e	940 ^r	900 ^r	980 ^r	1,100 ^r	1,100
Korea, Republic of	954,584	659,351	764,008	798,690	515,000
Kyrgyzstan	NA ^r	NA ^r	NA ^r	NA ^r	NA
Madagascar	--	90	259	260 ^e	260 ^e
Malawi	1,100	--	--	--	--
Malaysia	506,462	487,632 ^r	530,331	442,560 ^r	393,068
Mexico	85,092 ^r	78,086	120,094	120,003	163,148
New Zealand	12,761	9,016	10,700 ^r	21,545 ^r	11,578
Nigeria	108,000 ^r	154,000 ^r	139,000 ^r	155,000 ^r	140,000
Pakistan	24,500	15,318	27,265	16,481 ^r	25,000 ^e
Paraguay	-- ^r	-- ^r	-- ^r	-- ^r	--
Peru	13,215 ^r	9,655 ^r	16,678	18,169	33,863
Poland, washed	155,000 ^r	136,000 ^r	125,000 ^r	125,000 ^{r,c}	125,000 ^e
Portugal	231,346	274,925	273,890 ^r	322,091 ^r	317,489 ^p
Romania	3,166	1,000 ^e	500 ^r	-- ^r	--
Russia, concentrate	107,500 ^r	90,300 ^r	105,000 ^r	120,000 ^r	120,000 ^e
Saudi Arabia ^e	15,000	4,166 ^s	6,200 ^r	5,000 ^r	58,000
Slovakia ^e	44,000 ^s	44,000 ^r	44,000 ^r	4,000 ^r	3,000
South Africa	39,197	31,048	29,929	15,220 ^r	20,499
Spain, marketable ⁷	355,739 ^r	300,000 ^r	310,993 ^r	302,580 ^r	303,000 ^{p,c}
Sri Lanka	10,039	9,538	8,207	8,000 ^e	8,500 ^e
Sudan	87,151	36,799 ^r	32,696	15,096	11,579
Tanzania	13,926	18,624	58 ^r	178 ^r	1,422

See footnotes at end of table.

TABLE 18—Continued
KAOLIN: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

Country ³	2008	2009	2010	2011	2012
Thailand, beneficiated ^c	162,215 ⁵	160,000	160,000	160,000	160,000
Turkey	792,044	727,649	711,493	1,002,409 ^r	1,200,000 ^e
Uganda	3,738 ^r	4,721 ^r	27,237 ^r	20,883 ^r	30,806
Ukraine	1,457,000	764,000	1,085,000	1,317,000 ^r	1,300,000 ^e
United Kingdom, sales ⁸	1,355,000 ^r	1,060,000 ^{r,e}	900,000	1,000,000 ^r	1,150,000
United States ⁹	6,740,000	5,290,000	5,420,000 ^r	5,950,000 ^r	5,980,000
Uzbekistan ^e	5,500,000	5,500,000	5,500,000	7,000,000 ^r	7,000,000
Venezuela	-- ^r	-- ^r	-- ^r	-- ^r	--
Vietnam ^e	650,000	650,000	650,000	650,000	650,000
Zambia ^e	200	200	200	200	200
Total	38,100,000 ^r	34,000,000 ^r	35,300,000 ^r	39,000,000 ^r	38,200,000

^cEstimated. ^pPreliminary. ^rRevised. NA Not available. -- Zero.

¹World total, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Includes data available through July 15, 2014.

³In addition to the countries listed, Canada, Denmark, and Kyrgyzstan produced kaolin, but information is inadequate to make reliable estimates of output levels.

⁴Data for year ending June 30 of that stated.

⁵Reported figure.

⁶Data for year ending July 7 of that stated.

⁷Includes crude and washed kaolin and refractory clays not further described.

⁸Dry weight.

⁹Sold or used by producers.