



2011 Minerals Yearbook

CLAY AND SHALE

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The quantity of clay sold or used by domestic producers in 2011 decreased slightly to 25.3 million metric tons (Mt) valued at \$1.53 billion compared with 25.6 Mt valued at \$1.48 billion in 2010 (table 1). Common clay and shale accounted for 46% of the tonnage, and kaolin accounted for 54% of the value (tables 1, 5, and 8). In 2011, exports increased slightly to 4.39 Mt valued at \$908 million compared with 4.36 Mt valued at \$862 million in 2010. Imports of clays were 593,000 metric tons (t) valued at \$97.4 million in 2011 compared with 555,000 t valued at \$81.2 million in 2010 (table 1). World production of bentonite was 10.3 Mt, production of fuller's earth was 3.21 Mt, and production of kaolin was 33.9 Mt (tables 16–18).

Approximately 180 companies mined clay and shale in the United States in 2011. The 20 leading companies, many with multiple operations, accounted for 59% 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, North Carolina, Tennessee, Mississippi, and Ohio. 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 underground production was in Ohio, where the clays were mainly underclays associated with coal.

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 50% 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 2011, four companies mined ball clay in five States. Production of domestic ball clay decreased by 3% to 886,000 t valued at \$40.9 million compared with 912,000 t valued at \$41.3 million in 2010 (table 3). Operations in Tennessee supplied 63% of the production, followed by, in descending order of tonnage, Texas, Mississippi, and Kentucky. One producer reported a small quantity of production in Indiana, but this probably was fire clay rather than ball clay.

Consumption.—Consumption of ball clay decreased in 2011. The two principal domestic markets were, in decreasing order by tonnage, ceramic floor and wall tile (38%) and sanitaryware (20%). Ball clay also was sold to manufacture bricks, fiberglass, refractory products, and other types of ceramics. Ball clay also was sold for filler, extender, and binder applications (table 3). Sales for fiberglass and some filler and extender applications were likely to have been kaolin mined or purchased by the ball clay producers. Domestic sales to the larger markets declined 4% to 6% while exports increased 9%. Exports accounted for 23% of total ball clay sales.

Domestic sales of ball clay can be affected by imports of products such as ceramics and sanitaryware because they compete with ball clay-based ceramic products manufactured in the United States. The U.S. International Trade Commission (undated) reported that imports of ceramic tile under Harmonized Tariff Schedule (HTS) of the United States Codes 6907.10.00, 6908.10.10, 6908.10.20, and 6908.10.50 increased in quantity to 7.80 million square meters valued at \$71.5 million in 2011 from 7.10 million square meters valued at \$68.4 million in 2010. Mexico, China, Italy, Brazil, and Peru were the five leading sources of tile imports, with 45%, 12%, 8%, 7%, and 5% of the import volume, respectively. Imports of sanitaryware under the 4-digit HTS Code 6910 decreased to 22.5 million units in 2011 from 24.4 million units in 2010. China accounted for 10.9 million units or 49% of the U.S. sanitaryware imports in 2011, and Mexico accounted for 8.40 million units or 37% of the imports.

Imerys, the leading ball clay producer in the United States and globally, indicated that North American and some western European ceramic markets did not change significantly in 2011. The company increased sales in Eastern Europe, the Middle East, Brazil, India, and Southeast Asia, regions which exhibited stronger economic growth (Imerys SA, 2012, p. 20).

Prices.—The average unit value for ball clay reported by domestic producers was \$46 per metric ton compared with \$45 per ton in 2010. The average f.a.s. value for exported ball clay was \$59 per ton. The average Customs value for imported ball clay was \$318 per ton.

Trade.—Ball clay exports were 49,400 t valued at \$2.89 million in 2011 compared with 44,900 t valued at \$3.03 million in 2010, according to the U.S. Census Bureau (table 14). Producers exported about 208,000 t (table 3). Most of the difference in exports reported by producers and the U.S. Census Bureau involves shipments to Mexico, whose trade statistics suggested that Mexican imports of ball clay from the United States were reported under their Harmonized Tariff Standard code for kaolin and other kaolinic clays. The water weight of slurry shipments (about 30% to 35% of the shipment weight) also may account for a portion of the extra tonnage reported by producers. Ball clay imports were 465 t valued at \$148,000 (table 15).

Outlook.—Commercial and residential construction activity was tepid in 2011 but increased significantly through October 2012. Increased commercial and residential building construction results in an increased use of ceramic tile and sanitaryware, which were the leading markets for ball clay. The annualized rate of housing starts through October 2012 increased 23% and the annualized rate of construction spending through October 2012 increased 9.6% compared with those of October 2011 (U.S. Census Bureau, 2012a–c, undated). An excess of foreclosed homes available in many areas of the country and tight credit, however, may moderate growth in ball clay sales in 2012.

With the lingering effects of the recession, growth in global construction markets also is likely to be slow. Ball clay exports to Mexico, which supplies finished ceramic products to the United States, may increase slightly in 2012.

Bentonite

Production.—In 2011, 21 companies produced nonswelling and (or) swelling bentonite in 11 States. About 4.81 Mt valued at \$327 million was sold or used in 2011, 5% more than the 4.60 Mt valued at \$266 million of bentonite sold or used in 2010 (table 4). Production of nonswelling bentonite was 123,000 t valued at \$9.55 million in 2011, unchanged from that of 2010. Alabama led in the production of nonswelling bentonite, followed by, in descending order of tonnage, Mississippi, Arizona, California, and Nevada.

Production of swelling bentonite was 4.68 Mt valued at \$317 million in 2011, an increase of 5% from 4.48 Mt valued at \$256 million in 2010. Wyoming led in the production of swelling bentonite, followed by Utah, Montana, Texas, California, Oregon, Nevada, and Colorado.

Elementis Specialties, Inc. (a subsidiary of Elementis plc) completed a multiyear expansion of its Newberry Springs, CA, plant. The \$6 million project included the installation of a new spray dryer system. The expansion will double the previous production capacity and be more energy efficient. Hectorite was sold for such products as cleaners, cosmetics, pharmaceuticals, paint, polishes, and waxes (Cejnar, 2011).

Wyo-Ben Inc. submitted plans to the Bureau of Land Management for a mine near Thermopolis, WY. Reserves at that deposit were expected to last 10 to 20 years. The mine will cover about 30 hectares during that time period but with cast-back mining methods, only 4 to 6 hectares would be disturbed each year (Groenenberg, 2011).

Consumption.—In 2011, domestic sales and use of bentonite increased 5% from that of 2010. Major domestic sales of bentonite were, in decreasing order by quantity, drilling mud (all swelling bentonite), pet waste absorbent (all swelling bentonite), pelletizing iron ore (all swelling bentonite), and foundry sand bond (more than 99% was swelling bentonite). Bentonite also was sold for civil engineering and sealing; fillers, extenders, and binders; waterproofing and sealing; and a variety of other applications (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.

Domestic sales of bentonite for pet litter were reported to have increased 15% in 2011 but that may be an artifact of better reporting by producers rather than an actual increase from 2010. A leading supplier to the pet litter market reported that sales decreased in 2011 (AMCOL International Corp., 2012, p. 33). Other suppliers reported only slightly higher sales for pet litter. Sales of bentonite for drilling mud, foundry sand bond, and pelletizing iron ore increased because of increases in oil drilling, industrial output, and steel production, respectively (Board of Governors of the Federal Reserve System, 2012; Virta, 2012; Baker Hughes Inc., 2013) (table 4).

For smaller markets, swelling bentonite accounted for more than 95% of the bentonite sold for adhesives; animal feed; clarifying and decolorizing animal, mineral, and vegetable oils and greases; cosmetics, medical, and pharmaceutical; fertilizers; miscellaneous ceramics; miscellaneous fillers and extenders; oil and grease absorbents; paint; and plastics. Swelling bentonite accounted for less than 50% of sales for water treatment and filtering.

In 2011, American Colloid Co. (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 and European agricultural sales. Increased revenue was a combination of higher prices and increased tonnage sales (AMCOL International Corp., 2012, p. 33).

Rockwood Holdings, Inc. (the parent company of Southern Clay Products, Inc.) reported increased sales in most of its clay-additive markets with oilfield applications experiencing the greatest growth. Revenues also increased because of higher clay pricing (Rockwood Holdings, Inc., 2012, p. 54).

Prices.—The average unit value reported by domestic producers for nonswelling bentonite was \$78 per metric ton in 2011 compared with \$76 per ton in 2010. The average value for swelling bentonite was \$68 per ton compared with \$57 per ton in 2010. The average value for all bentonite was \$68 per ton in 2011 compared with \$58 per ton in 2010, with generally higher unit values reported by most producers of swelling bentonite in 2011 because of increased costs and high demand. The average f.a.s. value of exported bentonite was \$163 per ton. The average Customs value of imported bentonite was \$787 per ton.

The price of bentonite that was sold in bulk, crude form in railcars for iron ore pelletizing from the mill in Wyoming was

\$61 to \$66 per ton; foundry-grade that was bagged and shipped in railcars was \$99 to \$127 per ton; and American Petroleum Institute (API)-grade bentonite that was bagged and shipped in railcars was \$86 to \$132 per ton. Crushed, dried, loose in bulk bentonite from India was \$34 to \$38 per ton for pet litter grade. Crude and dried bentonite, sold in bulk, free on board, European port, was \$54 to \$78 per ton for pet litter (Industrial Minerals, 2011).

The average annual producer price index (PPI) for bentonite under North American Industry Classification System (NAICS) code 212325C was 161.6 in 2011 (1984=100) compared with 157.8 in 2010. The PPI decreased during the year from 164.4 in March to 159.3 in April but slowly increased to 160.9 by December. The PPI measured the average change in the selling prices charged by domestic producers of bentonite over time (U.S. Bureau of Labor Statistics, undated).

Trade.—Bentonite exports increased to 1.02 Mt valued at \$167 million in 2011 from 953 Mt valued at \$143 million in 2010 (table 14). Canada and Japan accounted for the largest share of the increase in exports. Most of the increase was related to the improving economies with increased demand for bentonite by the iron ore, foundry, and oil drilling industries. Changes in trade with other countries were relatively minor. Domestic bentonite producers reported exports of 785,000 t (table 4). Much of the discrepancy between data reported by producers and the U.S. Census Bureau data probably resulted from producers including 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 cat litter. Sales through U.S. mineral brokers, where producers do not know if the bentonite is used domestically or exported, could also explain part of the discrepancy.

Bentonite imports consisted mainly of untreated bentonite clay and chemically or artificially activated materials. Imports of untreated bentonite were 9,000 t valued at \$7.08 million. Imports of artificially activated material were 31,000 t valued at \$32.9 million (table 15).

Outlook.—After rebounding from the recession of 2008–09, the bentonite industry reached prerecession levels of consumption, mainly on the strength of the foundry sand and drilling mud markets. Other global markets for bentonite were relatively unchanged or declined slightly. Overall bentonite sales may increase slightly in 2012.

Growth in absorbent markets, particularly pet waste absorbents, declined during the past 2 years because of reduced consumer spending. With only a slightly better outlook for increased consumer spending anticipated in 2012, pet litter markets may remain unchanged or increase slightly. Sales of bentonite for oil absorbent applications may increase slightly in 2012 compared with those of 2011 based on a slight increase in U.S. industrial output in the manufacturing sector through July 2012 (Board of Governors of the Federal Reserve System, 2012).

Sales of bentonite for drilling mud applications may increase slightly in 2012 compared with those of 2011 because of increased drilling activity in 2012. Sales of bentonite also were tied to the iron and steel industries because of its use

for pelletizing iron ore and as a foundry sand bond. Through September 2012, shipments of iron ore increased slightly compared with that of the first 9 months of 2011 (Tuck, 2012). Demand for iron ore is likely to continue to increase in 2012 as global economies recover.

Two major suppliers of bentonite to the foundry industry indicated that the market increased in 2011 (AMCOL International Corp., 2012, p. 29; S&B Industrial Minerals S.A., 2012, p. 23). Additionally, manufacturing of durable goods increased through July 2012 compared with the same period in 2011 (Board of Governors of the Federal Reserve System, 2012). Consequently, sales of bentonite for foundry sand bond applications may increase slightly in 2012.

Sales of bentonite for civil engineering applications, such as waterproofing and sealing and landfill caps and liners, continued to be affected by reduced construction activity during the recession and may be unchanged or increase slightly in 2012. Other smaller markets for bentonite may increase slightly in 2012 as U.S. economic activity increases.

Common Clay and Shale

Production.—In 2011, 135 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.

Domestic sales or use of common clay and shale decreased slightly to 11.7 Mt valued at \$141 million in 2011 compared with 11.9 Mt valued at \$146 million in 2010 (table 5). The 10 leading producing States were, in descending order of tonnage, Texas, Alabama, North Carolina, Georgia, Ohio, Oklahoma, Arkansas, Virginia, Missouri, and California. These 10 States accounted for 64% of U.S. common clay and shale production.

The Belden Brick Co. (Canton, OH) purchased Lawrenceville Brick Inc., which operated two brick plants near Lawrenceville, VA, with a capacity of 115 million bricks per year. The purchase also included Lawrenceville Brick's clay reserves. The purchase increased Belden Brick's capacity to more than 500 million bricks per year (Mackinnon, 2012).

Acme Brick Co. (Ft. Worth, TX) purchased the assets of Jenkins Brick & Tile Co. LLC. Jenkins Brick operated three brick plants in Alabama and sales facilities in Alabama, Florida, Georgia, South Carolina, and Tennessee. The company also distributed ceramic tile and fabricated stone building materials. The purchase allowed Acme Brick, which marketed brick primarily in the Midwest, to extend its sales area to the Atlantic seaboard (Acme Brick Co., undated).

Mid America Brick & Structural Clay Products, LLC restarted its modernized Mexico, MO, plant and shipped its first load of bricks in July. The company operated one kiln with a capacity of 30 million bricks per year but planned to start up a second kiln in 2012, doubling its brick-making capacity (Sims, 2011).

Consumption.—Brick manufacture remained the leading market for common clay and shale, followed by, in descending order of tonnage, lightweight aggregate and portland cement. These three markets accounted for 91% of sales in 2011. Lightweight aggregate sales (2.85 Mt) were subdivided into

concrete block (42%), structural concrete (21%), highway surfacing (17%), and miscellaneous lightweight aggregates (20%). 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 unit average value for all common clay and shale produced in the United States was \$12 per ton, essentially unchanged from that of 2010. The value of clay and shale used to produce lightweight aggregate was estimated to be \$27 per ton in 2011 compared with \$30 per ton in 2010. 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 producers do not sell their clay, but use it directly to manufacture products and have not established a selling price for their clays.

The annual average PPI for common (miscellaneous) clay and shale under NAICS code 212325B was 183 in 2011 (1984=100) compared with 176.6 in 2010. The PPI increased from 179.9 in January to 186 in December. The PPI measured the average change in the selling prices charged by domestic producers of common (miscellaneous) clay and shale over time (U.S. Bureau of Labor Statistics, undated).

Outlook.—Common clay and shale sales again were affected by the sluggish U.S. economy in 2011. The seasonally adjusted annual rate for housing starts, however, increased 23% through October 2012 and overall construction spending for commercial buildings increased 9.6% through October compared with those of October 2011 (U.S. Census Bureau, 2012a, c). Although mortgage foreclosure issues had lessened, tight credit and an excess of foreclosed homes available in many regions of the country may result in a moderate growth in common clay sales in 2012.

Fire clay

Production.—Fire clay producers were mostly refractory product manufacturers that used the clays in firebrick and various heavy-clay products. In 2011, four firms mined fire clay in three States. Fire clay mined by domestic producers was almost unchanged with production of 215,000 t valued at \$6.16 million in 2011 and 216,000 t valued at \$6.12 million in 2010 (table 6). Missouri was the leading producing State, followed by, in descending order of tonnage, Colorado and Texas. Several common clay producers that occasionally mine fire clay indicated that they did not do so in 2011.

Consumption.—Consumption of fire clay decreased slightly in 2011. Leading markets for fire clay were, in descending order of tonnage, refractory calcines and grogs, portland cement, ceramic floor and wall tile, common brick, pottery, miscellaneous ceramics, and firebrick. 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; and refractory saggars. Fire clays also were used to produce such items as brick and pottery.

Prices.—In 2011, the average unit value for fire clay reported by domestic producers was \$29 per metric ton in 2011 compared

with \$29 per ton in 2010. The average f.a.s. value of exported fire clay was \$166 per ton. The average Customs value of imported fire clay was \$447 per ton.

Trade.—Exports of fire clay and refractory-grade kaolin appear to have been combined under the same HTS code in recent years. At least 43%, 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 2011, exports of fire clay and refractory-grade kaolin decreased to 371,000 t valued at \$61.6 million compared with 404,000 t valued at \$61.5 million in 2010 (table 14). In 2011, imports were 2,000 t valued at \$893,000 (table 15).

Outlook.—Major users of refractory products such as the aluminum, glass, iron, lime, and steel industries increased production in 2011 and maintained those levels through mid-2012, suggesting possible growth in demand for refractory products for their furnaces.

Sales of fire clay for construction-related products, such as brick, cement, lightweight aggregate, and tile, face the same issues as common clay and shale, a dependence on growth in the private housing and commercial construction sectors to support growth in heavy-clay markets. Sales of fire clay for these applications have been erratic in recent years, with producers of common clay venturing into and out of fire clay mining depending on their needs. Fire clay sales for heavy-clay products may increase slightly in 2012 compared with those of 2011 if construction activity continues to increase.

Fuller's earth

Production.—In 2011, 12 companies produced fuller's earth in 10 States. Fuller's earth deposits consist mainly of palygorskite (attapulgitite) in Florida and southwestern Georgia and montmorillonite in middle Georgia and other States. Gelling grades of attapulgitite, used as thickeners in such items as drilling muds and paints, were mined in western Florida and near Attapulcus, GA. Sorbent grades of attapulgitite were mined a little further north near Ochlocknee, GA. Sorbent grades of attapulgitite were grouped with the montmorillonite variety of fuller's earth, whose major use also was for sorbent applications, in table 7 to be consistent with past reporting.

Gelling-grade attapulgitite was mined or sold in the Florida Panhandle and southwestern Georgia by two companies. Production data were withheld to avoid revealing company proprietary data, but production increased in 2011 compared with that of 2010, with a significant increase in production reported by the leading producer. Florida led in the production of gelling-grade attapulgitite, followed by Georgia.

Production of the sorbent-grade fuller's earth decreased 5% to 1.95 Mt valued at \$194 million in 2011 compared with 2.05 Mt valued at \$201 million in 2010 (table 7). Sorbent-grade fuller's earth was produced, in decreasing order of tonnage, in Georgia, Missouri, Virginia, Mississippi, California, Tennessee, Florida, Illinois, Kansas, and Texas. Georgia, Mississippi, Missouri, and Virginia accounted for 76% of U.S. production.

Consumption.—Consumption of sorbent-grade fuller's earth decreased in 2011. Pet waste absorbent was the leading market, followed by oil and grease absorbents; civil engineering;

clarifying, decolorizing, and filtering of animal, mineral, and vegetable oils and greases; fertilizer carriers; animal feed; pesticide carriers; miscellaneous ceramics; unknown uses; and paint (table 7).

Consumption of gelling-grade fuller's earth increased in 2011. The leading market was exports (unknown uses). Exports were followed by fillers, extenders, and binders which included, in decreasing order of tonnage, unknown filler and extender uses; pesticide carrier; paint; fertilizer carrier; animal feed; and cosmetic, medical, and pharmaceutical applications. Fillers and extenders were followed by drilling mud; clarifying, decolorizing, and filtering of animal, mineral, and vegetable oils and greases; and oil and grease absorbents.

Sorbent-grades dominated sales to most fuller's earth markets, but gelling-grades accounted for most of the sales of fuller's earth, in decreasing order of tonnage, for paint; drilling mud; and cosmetic, medical, and pharmaceutical applications.

Oil-Dri completed a \$9 million expansion of its Blue Mountain Production Co. facility in Mississippi. The expansion increased floor space and expanded automation of the production system, increasing productivity (Oil-Dri Corp. of America, 2011).

Prices.—The average unit value of gelling-grade fuller's earth was withheld to avoid disclosing company proprietary data but the value was unchanged from that of 2010. The average value of sorbent-grade fuller's earth was \$100 per metric ton in 2011 compared with \$98 per ton in 2010. The average f.a.s. value of exported fuller's earth was \$450 per ton. The average Customs value of imported fuller's earth was \$76 per ton.

Trade.—In 2011, exports increased slightly to 102,000 t valued at \$45.9 million compared with 100,000 t valued at \$35.4 million in 2010 (table 14). Imports of decolorizing earth and fuller's earth were 1,860 t valued at \$142,000 in 2011 (table 15).

Outlook.—Pet waste absorbent is the leading market for fuller's earth. This market has exhibited essentially no growth in the past 2 years, and domestic sales are likely to remain unchanged in 2012. The second leading market for fuller's earth is in oil and grease absorbents. These sales are tied to industrial output where increased heavy manufacturing and machining results in increased use of oil and grease absorbents. In early 2012, industrial output increased slightly, suggesting that 2012 sales of fuller's earth for oil and grease absorbent applications may increase slightly compared with those of 2011 (Board of Governors of the Federal Reserve System, 2012).

The acreage of corn planted increased in 2012. As a result, a major supplier indicated higher sales of fuller's earth as carriers and suspension agents in fertilizers and pesticides (Oil-Dri Corp. of America, 2012, p. 17; U.S. Department of Agriculture, 2012). Other uses for fuller's earth are relatively small in volume. Sales for clarifying, decolorizing, and filtering 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. Production of fats and oils increased in 2011 and Oil-Dri, a leading supplier of fuller's earth for fluid purification products, indicated that sales had increased in the first 4 months of 2012 (Oil-Dri Corp. of America, 2012, p. 19). Consequently, sales for fluid purification may increase slightly in 2012. Gelling-grade fuller's earth was sold for construction-

related filler and extender applications, such as in adhesives, asphalt emulsions, caulks, joint compounds, paint, and roof coatings. Sales of these products are constrained by the slow housing markets so sales of gelling grades for construction-related products may increase slightly in 2012. Sales for drilling mud applications may increase slightly in 2012 compared with those of 2011, based on increased global oil drilling activity in early 2012.

In general, any improvement in the U.S. economy will likely result in slightly improved sales for nonabsorbent applications for fuller's earth in 2012.

Kaolin

Production.—In 2011, 19 firms mined kaolin in 8 States. Domestic production decreased by 3% to 5.77 Mt valued at \$817 million compared with 5.95 Mt valued at \$817 million in 2010 (table 8). The leading producer State was Georgia, followed by, in descending order of tonnage, South Carolina, Alabama, Texas, Nevada, Florida, North Carolina, and California.

About 37% of the kaolin produced was water washed, 22% was calcined, 15% was delaminated, 14% was airfloat, and 12% was unprocessed (table 8). Pigment-grade (low-temperature calcined kaolin) accounted for less than 50% of the tonnage of the total calcined kaolin sales. Sales of pigment-grade calcined kaolin were withheld to avoid revealing company proprietary data. Companies in Georgia accounted for nearly all the pigment-grade calcined kaolin produced in 2011. A small amount also was produced in Texas.

Georgia accounted for 93% of the kaolin production in the United States. Kaolin production in Georgia decreased slightly to 5.34 Mt valued at \$781 million in 2011 compared with 5.47 Mt valued at \$780 million in 2010. Approximately 40% of Georgia kaolin sold was water washed, 23% was calcined (high- and low-temperature calcined kaolin), 17% was delaminated, 10% was airfloat, and 10% was unprocessed in 2011 (table 9). Production in South Carolina increased significantly to 245,000 t valued at \$19.7 million in 2011 compared with 158,000 t valued at \$10.5 million in 2010 (table 10). One producer in South Carolina accounted for most of the increased production.

Imerys, one of the leading U.S. kaolin producers, completed construction of a plant at its Andersonville, GA, site to manufacture ceramic proppants for the gas and oil production industry. The \$60 million plant was designed with a capacity exceeding 100,000 t/yr (Imerys, 2012, p. 21).

Consumption.—Consumption of kaolin decreased in 2011 from that of 2010 (table 8). The major domestic markets for kaolin were, in descending order of tonnage, paper coating and filling (40% of domestic sales), refractory products and miscellaneous ceramics (16% each), and fiberglass and mineral wool (6%). Other smaller but significant markets were ceramics, 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, paper coating, portland cement, fertilizer, firebrick, plastics, sanitaryware, roofing granules, miscellaneous fillers and extenders, and miscellaneous ceramics. Much of the data for individual markets were withheld to avoid disclosing company proprietary data (table 10).

Paper coating and filling markets accounted for 50% of total (domestic and export) kaolin sales in 2011. Sales for paper markets decreased slightly in response to decreased manufacture of paper in the North America. Refractory products accounted for 12% of total kaolin sales in 2011, with sales increasing slightly because of a small improvement in U.S. industrial production. Other increases were distributed across many end-use markets.

Prices.—The average unit value of kaolin was \$142 per metric ton for all kaolin grades. The average value for airfloat was \$85 per ton; delaminated, \$147 per ton; unprocessed, \$53 per ton; and water washed, \$162 per ton. The unit value of water washed increased significantly as a result of higher values reported by one producer. All types of calcined kaolin combined were valued at \$185 per ton. The average f.a.s. value of exported kaolin was \$223 per ton. The average Customs value of imported kaolin was \$102 per ton.

The price of number 1 paper coating grades of kaolin from a plant in Georgia ranged from \$160 to \$215 per ton, and the price of number 2 paper coating grades varied from \$110 to \$171 per ton (Industrial Minerals, 2011).

The annual average PPI for ball clay and kaolin mining under North American Industry Classification System code 2123240 was 190.9 in 2011 (1984=100) compared with 184.1 in 2010. The PPI increased from 186 in January to 193.2 in December. The PPI measured the average change in the selling prices charged by domestic producers of ball clay and kaolin over time (U.S. Bureau of Labor Statistics, undated).

Trade.—Exports increased in 2011 to 2.49 Mt of kaolin valued at \$555 million compared with 2.47 Mt valued at \$537 million in 2010 (table 14). Producers reported exports of 1.44 Mt (table 11). Much 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 549,000 t of kaolin valued at \$56.2 million in 2011 compared with 510,000 t valued at \$51.4 million in 2010 (table 15). About 95% of kaolin imports was from Brazil and was used primarily in paper coating applications.

Outlook.—Sales by the kaolin industry are likely to remain unchanged in 2012. In the United States, industrial production of paper, the leading market for kaolin, declined 2.9% through July 2012 compared with the same time period in 2011 (Board of Governors of the Federal Reserve System, 2012). Paper markets in Western Europe were weak while those in Southeast Asia and South America increased by 6% (Confederation of European Paper Industries, 2012, p. 11; Imerys, 2012, p. 34). Export sales of kaolin, primarily for paper use, may increase slightly, particularly to Asian markets.

U.S. industrial manufacturing output increased through mid-2012 (Board of Governors of the Federal Reserve System, 2012). Sales of kaolin used to manufacture such products as catalysts, chemicals, plastics, refractory products, and rubber may increase slightly in 2012.

A relatively new growth market for kaolin is ceramic proppants. The market for all proppants increased significantly in the past decade because of increased drilling and fracturing of gas- and oil-bearing formations to improve recovery (Beckwith, 2011). With the entry of Imerys into the market in 2012 and expansion by a current manufacturer of kaolin-based ceramic proppants, sales and use of kaolin for this market is likely to increase significantly in 2012 and 2013 (Carbo Ceramics Inc., 2012; Imerys, 2012, p. 22)

As with ball clay, common clay and shale, and some fire clay sales, kaolin also has been affected by the slowdown in residential and commercial construction. Sales into construction-related markets, such as caulks, fiberglass, floor and wall tile, paint, and sanitaryware, slowed and have not yet recovered to levels achieved prior to the 2008–09 recession. The outlook for these markets is improving with seasonally adjusted annual rate for housing starts increasing by 23% through November 2012 from December 2011. Overall construction spending for commercial buildings increased 9.6% from October 2011 to October 2012 (U.S. Census Bureau, 2012a, c). Imerys (2012, p. 20) reported improved sales for ceramics, sanitaryware, and tile in Brazil, Eastern Europe, India, the Middle East, and Southeast Asia but lower sales in North America. Sales of kaolin to construction-related markets may see moderate increases in 2012.

World Review

World production of bentonite was approximately 10.3 Mt (table 16), and fuller's earth production was 3.21 Mt (table 17). Kaolin production was about 33.9 Mt (table 18), including ball clay from Australia, Ukraine, and various other countries, and crude kaolin ore production tonnages were reported by many countries. World sales of processed kaolin were estimated to be between 22 and 24 Mt, after accounting for processing losses and stockpiling and the inclusion of ball clay production under kaolin by some countries. The United States continued to be the leading supplier of processed clay for sale, followed by Turkey 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 (attapulgitite), followed by the United States. The rankings above were based on processed clay sold or used and not on crude ore production.

Clariant AG acquired 96.15% of the shares of Süd-Chemie AG, Munich, Germany (Süd-Chemie AG, 2011). Süd-Chemie AG was a major global supplier of bentonite with mines in China, Germany, Mexico, and Spain (Watts, 2011).

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

(Thousand metric tons and thousand dollars)

	2007	2008	2009	2010	2011
Domestic clays sold or used by producers:					
Quantity	36,700	32,700	24,500	25,600 ^r	25,300
Value	1,750,000	1,650,000	1,330,000	1,480,000 ^r	1,530,000
Exports:					
Quantity	5,650	5,100	3,830	4,360	4,390
Value	928,000	938,000	702,000	862,000	908,000
Imports for consumption:					
Quantity	231	237	325	555 ^r	593
Value	73,900	86,600	104,000	81,200 ^r	97,400

^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	2010		2011	
	Quantity	Value	Quantity	Value
Alabama	1,560 ^r	35,800 ^r	1,380	36,300
Arkansas	579	8,210	532	7,580
California	570	33,300	603	38,300
Colorado	110	350	137	298
Florida	202	33,600	98	19,300
Georgia	6,300	819,000	6,490	835,000
Indiana	381	8,260	351	7,740
Iowa	201	827	182	862
Kansas	380	2,940	327	3,320
Kentucky	323	8,080	362	8,450
Louisiana	151	1,330	144	1,280
Michigan	312	1,290	312	1,280
Mississippi	642	35,600	652	36,600
Missouri	1,030	40,800	1,050	40,700
New York	595	30,000	387	16,900
North Carolina	856	5,300	774	4,880
Ohio	673 ^r	12,700 ^r	632	13,300
Oklahoma	554	2,600	570	2,720
Oregon	9	672	205	1,300
South Carolina	426	11,700	472	20,900
Tennessee	776	32,300	755	31,800
Texas	2,080	48,600	2,140	41,300
Utah	482	11,800	459	15,100
Virginia	775	27,500	790	30,200
West Virginia	138	199	138	210
Wyoming	4,130 ^r	230,000 ^r	4,370	287,000
Other ⁴	1,410 ^r	34,400 ^r	992	22,500
Total	25,600 ^r	1,480,000 ^r	25,300	1,530,000

^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, and Washington.

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

(Thousand metric tons and thousand dollars)

	2010		2011	
	Quantity	Value	Quantity	Value
Type:				
Airfloat	629	27,500	615	27,600
Water-slurried	105	5,100	97	4,710
Unprocessed	178	8,680	173	8,610
Total	912	41,300	886	40,900
Use:				
Fillers, extenders, binders ²	40	NA	40	NA
Floor and wall tile	360 ^r	NA	340	NA
Miscellaneous ceramics ³	85	NA	80	NA
Pottery	10	NA	4	NA
Sanitaryware	188	NA	181	NA
Miscellaneous ⁴	36 ^r	NA	31	NA
Exports, reported by producers ⁵	191	NA	208	NA
Total	912	41,300	886	40,900

^rRevised. 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/dinnerware, glass, mineral wool, and roofing granules.

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

⁵Includes ceramics and glass and floor and wall tile.

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

(Thousand metric tons and thousand dollars)

	2010		2011	
	Quantity	Value	Quantity	Value
Type:				
Nonswelling	123	9,410 ^r	123	9,550
Swelling	4,480 ^r	256,000 ^r	4,680	317,000
Total	4,600 ^r	266,000 ^r	4,810	327,000
Use:				
Domestic:				
Pet waste absorbents	961 ^r	NA	1,110	NA
Adhesives	8	NA	9	NA
Animal feed	64 ^r	NA	36	NA
Drilling mud	1,040 ^r	NA	1,160	NA
Filler and extender applications ²	104	NA	68	NA
Foundry sand	534 ^r	NA	592	NA
Pelletizing (iron ore)	586 ^r	NA	649	NA
Waterproofing and sealing	103 ^r	NA	181	NA
Miscellaneous civil engineering	213 ^r	NA	124	NA
Miscellaneous ³	245 ^r	NA	93	NA
Total	3,860 ^r	NA	4,020	NA
Exports, reported by producers:				
Drilling mud	136 ^r	NA	289	NA
Foundry sand	135 ^r	NA	158	NA
Other ⁴	472 ^r	NA	337	NA
Total	743 ^r	NA	785	NA
Grand total	4,600 ^r	266,000 ^r	4,810	327,000

^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 other unknown uses.

⁴Includes absorbents, fillers and extenders, refractories, pelletizing, and other 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)

	2010		2011	
	Quantity	Value	Quantity	Value
State:				
Alabama	1,300	21,500	1,190	24,100
Arkansas	534	7,580	532	7,580
California	355	5,000	398	6,990
Colorado	109	352	123	293
Georgia	657	3,910	644	6,880
Indiana	358	7,110	332	6,620
Iowa	201	827	182	862
Kansas	353	1,850	291	1,880
Kentucky	284	5,780	328	6,430
Michigan	312	1,280	312	1,280
Mississippi	259	1,540	264	1,570
Missouri	412	3,060	431	3,370
New York	595	30,000	388	16,900
North Carolina	846	4,890	764	4,460
Ohio	671 ^r	12,600 ^r	632	13,300
Oklahoma	554	2,600	570	2,720
Oregon	--	--	194	538
South Carolina	267	1,190	227	1,250
Tennessee	113	817	113	817
Texas	1,730 ^r	14,000	1,840	13,300
Utah	322	7,020	334	7,260
Virginia	503	6,010	500	6,000
West Virginia	138	199	138	210
Other ⁴	1,030 ^r	6,580 ^r	959	6,220
Total	11,900 ^r	146,000 ^r	11,700	141,000
Use:				
Floor and wall tile ⁵	376 ^r	NA	364	NA
Heavy-clay products:				
Brick, extruded	5,080 ^r	NA	4,490	NA
Brick, other	770 ^r	NA	864	NA
Other ⁶	122 ^r	NA	115	NA
Lightweight aggregate:				
Concrete block	1,340	NA	1,200	NA
Highway surfacing	561	NA	489	NA
Structural concrete	734 ^r	NA	586	NA
Miscellaneous	266	NA	577	NA
Portland and other cements	2,070	NA	2,380	NA
Refractories ⁷	366 ^r	NA	338	NA
Miscellaneous ⁸	224 ^r	NA	285	NA
Total	11,900 ^r	146,000 ^r	11,700	141,000

^rRevised. NA Not available. -- Zero.

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 other unknown uses.

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

(Thousand metric tons and thousand dollars)

	2010		2011	
	Quantity	Value	Quantity	Value
Production	216	6,120	215	6,160
Use:				
Heavy-clay products and lightweight aggregates ²	87 ^r	NA	87	NA
Refractories:				
Firebrick, block, shapes	19	NA	1	NA
Grog and calcines	W	NA	W	NA
Other refractories ³	W	NA	W	NA
Miscellaneous ⁴	109 ^r	NA	126	NA
Total	216	6,120	215	6,160

^rRevised. NA Not available. 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 other 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)

	2010		2011	
	Quantity	Value	Quantity	Value
Type:				
Attapulgite	(2)	(2)	(2)	(2)
Montmorillonite	2,050	201,000	1,950	194,000
Total	2,050	201,000	1,950	194,000
Use:				
Absorbents:				
Oil and grease absorbent	150 ^r	NA	167	NA
Pet waste absorbent	1,380	NA	1,280	NA
Animal feed	52 ^r	NA	54	NA
Fillers, extenders, binders ³	122 ^r	NA	83	NA
Filtering, clarifying, and decolorizing ⁴	80 ^r	NA	125	NA
Miscellaneous ⁵	236 ^r	NA	213	NA
Exports, reported by producers ⁶	23 ^r	NA	22	NA
Total	2,050	201,000	1,950	194,000

^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" portion of the production section of this report.

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

⁴Includes mineral and vegetable oils and greases.

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

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

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

(Thousand metric tons and thousand dollars)

	2010		2011	
	Quantity	Value	Quantity	Value
State:				
Georgia	5,470 ^r	780,000 ^r	5,340	781,000
South Carolina	158	10,500	245	19,700
Other ²	318 ^r	26,300 ^r	179	16,600
Total	5,950 ^r	817,000 ^r	5,770	817,000
Type:				
Airfloat	758	65,800	792	67,600
Calcined: ³	1,340	252,000	1,280	237,000
Delaminated	984	137,000	883	129,000
Unprocessed	584 ^r	29,800 ^r	671	35,400
Water washed	2,280	332,000	2,140	348,000
Total	5,950 ^r	817,000 ^r	5,770	817,000

^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)

Kind	2010		2011	
	Quantity	Value	Quantity	Value
Type:				
Airfloat	621	54,100	549	45,600
Calcined ²	1,240	242,000	1,260	229,000
Delaminated	984	137,000	884	129,000
Unprocessed	422	23,300	525	29,000
Water washed	2,200	324,000	2,130	347,000
Total	5,470 ^r	780,000 ^r	5,340	781,000
Use:				
Domestic:				
Ceramics and glass:				
Catalysts (oil-refining)	W	NA	W	NA
Fiberglass, mineral wool	238 ^r	NA	218	NA
Roofing granules	35 ^r	NA	26	NA
Other ³	641 ^r	NA	715	NA
Fillers, extenders, binders:				
Adhesives	19	NA	18	NA
Paint	179 ^r	NA	176	NA
Paper coating	1,710 ^r	NA	1,580	NA
Paper filling	149 ^r	NA	130	NA
Plastic	44 ^r	NA	41	NA
Rubber	141 ^r	NA	102	NA
Other ⁴	46 ^r	NA	82	NA
Heavy-clay products ⁵	(6)	NA	(6)	NA
Refractories ⁷	(6)	NA	(6)	NA
Undistributed ⁸	828 ^r	NA	860	NA
Total	4,030 ^r	NA	3,950	NA
Exports, reported by producers:				
Paint	48	NA	45	NA
Paper coating ⁹	1,190 ^r	NA	1,130	NA
Paper filling ⁹	44 ^r	NA	46	NA
Rubber	36	NA	36	NA
Undistributed ¹⁰	124 ^r	NA	135	NA
Total	1,440 ^r	NA	1,390	NA
Grand total	5,470 ^r	780,000 ^r	5,340	781,000

^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/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 clay 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, refractory products, waterproofing seals, and other unknown uses.

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

¹⁰Includes miscellaneous ceramics and miscellaneous fillers, extenders, and other unknown uses.

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

(Thousand metric tons and thousand dollars)

	2010		2011	
	Quantity	Value	Quantity	Value
Production ²	158	10,500	245	19,700
Use:				
Ceramics ³	67	NA	118	NA
Rubber	31	NA	41	NA
Other uses ⁴	60	NA	87	NA
Total	158	10,500	245	19,700

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	2010	2011
Domestic:		
Ceramics:		
Catalyst (oil and gas refining)	179	162
Fine china and dinnerware	6	6
Floor and wall tile	84	93
Pottery ²	W	W
Roofing granules	35	27
Sanitaryware	42	27
Miscellaneous ceramics	584 ^r	686
Chemical manufacture	W	W
Fiberglass, mineral wool	245 ^r	279
Fillers, extenders, binders:		
Adhesive	20	36
Paint	190	185
Paper coating	1,720	1,590
Paper filling	149	130
Pesticide ³	W	W
Plastic	50	43
Rubber	173 ^r	142
Miscellaneous fillers, extenders, binders	46 ^r	86
Heavy-clay products:		
Brick, common and face	37	25
Portland cement	86	64
Refractories ⁴	695	701
Miscellaneous applications	124 ^r	45
Total	4,470 ^r	4,330
Exports, reported by producers:		
Ceramics ⁵	W	W
Paint	84	59
Paper coating	1,190	1,130
Paper filling	44	46
Rubber	40	67
Miscellaneous	124 ^r	138
Total	1,480 ^r	1,440
Grand total	5,950 ^r	5,770

^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 ceramics."

³Included in "Miscellaneous fillers, extenders, binders."

⁴Includes firebrick (blocks and shapes), grogs and calcines, and miscellaneous refractories.

⁵Included in "Exports, reported by producers: Miscellaneous."

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 ^e
2010:					
Alabama	361	25	43	430	11,900
Arkansas	128	32	--	160	6,240
California	--	34	--	34	2,140
Indiana	65 ^r	32	65	162	6,500
Kansas	19	3	5 ^r	28	188
Kentucky	44	36	--	80	4,470
Louisiana	62	19	29	110	1,030
Missouri	22	18	63	103	1,110
Nebraska	--	--	(3) ^r	(3) ^r	2
New York	163	272	--	435	28,200
Ohio	72	40	68	180	7,820
Oklahoma	20	3	--	25	703
Texas	149	161	389 ^r	699	5,540
Utah	91	57	112	260	5,820
Virginia	145	2	51	196	4,490
Total	1,340	734^r	825^r	2,900^r	86,100^r
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

^eEstimated. ^rRevised. -- Zero.

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

²Includes highway surfacing.

³Less than ½ unit.

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	2010		2011	
	Quantity	Value ^e	Quantity	Value ^e
Alabama	541	6,210	537	6,200
Arkansas	22	47	154	705
California	117	710	117	710
Colorado	93	242	90	237
Georgia	607	3,670	593	6,640
Kentucky ³	200	1,210	232	1,430
Mississippi	259	1,540	264	1,570
North Carolina	621	2,830	538	2,400
Ohio	296 ^r	3,320 ^r	323	4,070
Oklahoma	404	1,540	404	1,540
Pennsylvania	288	1,650	279	1,530
South Carolina	257	1,140	217	1,210
Tennessee	114	817	113	817
Texas	457	2,460	310	1,820
Virginia	306	1,520	276	1,450
Other ⁴	1,270	7,650 ^r	903	4,170
Total	5,850 ^r	36,600 ^r	5,350	36,500

^eEstimated. ^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 for Alaska, Nevada, New Hampshire, Rhode Island, Vermont, and Wisconsin.

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

(Thousand metric tons and thousand dollars)

Material	2010		2011		Principal destinations in 2011
	Quantity	Value	Quantity	Value	
Ball clay	45	3,030	49	2,890	Mexico, 36%; Switzerland, 36%; Costa Rica, 20%.
Bentonite	953	143,000	1,020	167,000	Mexico, 70%; Peru, 14%; Taiwan, 16%.
Fire clay	404	61,500	371	61,600	Taiwan, 51%; Spain, 22%; New Zealand, 3%.
Fuller's earth	100	35,400	102	45,900	Japan, 18%; China, 9%; United Kingdom, 7%.
Kaolin	2,470	537,000	2,490	555,000	Netherlands, 79%; Spain, 21%.
Clays, n.e.c.	382 ^r	82,200 ^r	358	76,400	Canada, 62%; Mexico, 33%.
Total	4,360	862,000	4,390	908,000	

^rRevised.

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

Source: U.S. Census Bureau.

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

(Thousand metric tons and thousand dollars)

Material	2010		2011		Principal sources in 2011
	Quantity	Value	Quantity	Value	
China clay or kaolin	510 ^r	51,400 ^r	549	56,200	Brazil, 95%; Taiwan, 2%; Canada, 1%.
Fire clay	(2)	195 ^r	2	893	China, 81%; Czech Republic, 10%; Canada, 4%.
Ball clay	1	138	(2)	148	United Kingdom, 89%; China, 11%.
Bentonite	15 ^r	5,080 ^r	9	7,080	Greece, 34%; China, 18%; Egypt, 13%; Turkey, 11%.
Fullers's earth	1	160	2	142	China, 96%; Japan, 2%; Netherlands, 2%.
Chamotte or Dina's Earth	(2)	110	(2)	121	Czech Republic, 99%; Mexico, 1%.
Artificially activated clay and earth	28 ^r	24,100 ^r	31	32,900	Mexico, 59%; Germany, 22%; United Kingdom, 7%.
Total	555 ^r	81,200 ^r	593	97,500	

^rRevised.

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	2007	2008	2009	2010	2011 ^e
Algeria ⁴	32,600	30,600	31,000	34,000 ^r	34,000
Argentina	250,000	256,000	148,000	204,000 ^r	200,000
Armenia ^e	1,130 ⁵	1,100 ^r	1,000 ^r	1,400 ⁵	1,400
Australia ^{e,4}	255,000	250,000	240,000	230,000	230,000
Azerbaijan ^e	50,500	40,700	10,600	18,100	20,000
Bolivia	--	1	323	440	591
Bosnia and Herzegovina	32,900	30,500	16,000	314 ^r	--
Brazil, beneficiated	330,000	340,000	264,000	532,000 ^r	532,000 ^p
Bulgaria	99,000	178,000	108,000	100,000 ^{r,e}	100,000
Burma ⁶	971 ⁵	1,000	1,000	1,000	1,000
Chile	533	--	--	--	1,260 ⁵
Croatia	19,600	19,800	--	--	--
Cyprus	150,000	150,000	150,000	150,000	150,000
Czech Republic, includes montmorillonite clays ^e	335,000	235,000 ^r	177,000 ^r	183,000	160,000
Egypt ^e	29,800 ⁵	32,000 ⁵	32,000	27,000 ^r	32,000
Georgia ^e	5,000	5,000	5,000	5,000	5,000
Germany	385,000	414,000	326,000	363,000 ^r	350,000
Greece ^e	950,000	1,500,000	845,000 ⁵	850,000	850,000
Guatemala	23,600	62,700	14,300	22,400	20,000
Hungary	5,400 ^r	5,000 ^r	5,300 ^{r,5}	3,000 ^r	3,000
Indonesia ^e	5,500	6,000	6,000	6,500	6,500
Iran ⁶	254,000	358,000	387,000 ^r	400,000 ^e	400,000
Italy ^e	306,000	281,000	146,000	111,000	110,000
Japan	430,000	435,000	432,000	430,000	425,000
Kenya ^e	70	70	70	70	70
Macedonia ^e	35,200	22,900	15,400	12,800 ^r	14,500 ⁵
Malawi	2,080	7,020	8,050	1,020	1,000
Mexico	614,000	375,000	511,000	591,000 ^r	53,800 ⁵
Morocco	81,000	80,000	80,000	80,000	80,000
Mozambique	10,500	17,700	7,390	6,990 ^r	24,000
New Zealand, processed ^e	6,150	753	880	1,220 ^r	1,000
Pakistan	32,400	31,500 ^r	33,500 ^r	35,000	36,000
Peru	21,500	31,600	119,000 ^r	119,000 ^r	27,500 ⁵
Philippines	1,150	1,420	1,410	1,480 ^r	1,500
Poland ⁷	1,300 ^r	3,000 ^r	3,000 ^r	3,000 ^{r,e}	3,000
Romania	16,900	16,600	13,800	14,000	14,000
Slovakia	149,000	145,000	109,000	110,000	110,000
South Africa ⁸	45,800	44,100	40,300	54,300	61,000
Spain ^e	155,000	155,000	155,000	155,000	155,000
Turkey	1,740,000	1,550,000	932,000	900,000 ^{r,e}	1,000,000
Turkmenistan, includes bentonite powder ^e	50,300 ^r	50,300 ^r	50,300 ^r	50,300 ^r	50,300
Ukraine ^e	300,000	200,000	195,000	185,000 ^r	185,000
United States	4,820,000	4,910,000 ^r	3,650,000	4,600,000 ^r	4,810,000 ⁵
Uzbekistan ^e	15,000	15,000	15,000	15,000	15,000
Zimbabwe ⁸	100	100	-- ^e	-- ^e	--
Total	12,000,000 ^r	12,300,000 ^r	9,280,000 ^r	10,600,000 ^r	10,300,000

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

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

²Table includes data available through July 26, 2012.

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

⁴Includes bentonitic clays.

⁵Reported figure.

⁶Year beginning March 21 of that stated.

⁷Montmorillite type bleaching clay.

⁸May include other clays.

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

(Metric tons)

Country ³	2007	2008	2009	2010	2011 ^e
Australia, attapulgite ^c	10,000	10,000	9,500	10,000	10,000
Guatemala	109	--	--	--	--
Italy ^c	3,000	3,000	3,000	3,000	3,000
Mexico	34,200	66,100	108,000	170,000 ^r	107,000 ⁴
Morocco, smectite ^c	15,000	15,000	15,000	15,000	15,000
Pakistan ^c	12,900 ⁴	10,500 ^r	10,500 ^r	15,000 ^r	17,000
Senegal, attapulgite	150,000 ^c	167,000	181,000 ^r	204,000	200,000
South Africa, attapulgite	68,400	69,900	54,400	85,300 ^r	92,000
Spain: ^c					
Attapulgite	20,000	20,000	20,000	20,000	20,000
Sepiolite	800,000	800,000	800,000	800,000	800,000
United States ^{5,6}	2,600,000	2,340,000	2,010,000	2,050,000	1,950,000 ⁴
Total	3,720,000	3,500,000	3,210,000	3,370,000 ^r	3,210,000

^cEstimated. ^rRevised. -- 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. Table includes data available through July 26, 2012.

²World totals, 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, 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.

⁴Reported figure.

⁵Sold or used by producers.

⁶Excludes attapulgite.

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

(Metric tons)

Country ³	2007	2008	2009	2010	2011 ^e
Algeria	107,000	50,800	87,800 ^r	71,100 ^r	75,000
Argentina	69,400	55,000	78,800	78,700 ^r	78,000
Australia, includes ball clay ^c	250,000	230,000	230,000	240,000	240,000
Austria, marketable	56,700	49,500	84,000	59,000 ^r	60,000
Bangladesh ^{c,4}	8,600	8,500	8,500	8,500	8,500
Belgium ^c	300,000	300,000	300,000	300,000	300,000
Bosnia and Herzegovina, crude	188,000	259,000	148,000	41,800 ^r	232,000 ⁵
Brazil, beneficiated	2,530,000 ^r	2,460,000 ^r	1,990,000	2,200,000 ^r	2,200,000
Bulgaria	1,630,000	1,530,000	939,000	900,000 ^{r,e}	900,000
Canada	--	13,000	3,000	5,000	--
Chile	87,900	63,500	48,400	62,200	59,900 ⁵
Czech Republic	3,600,000	3,830,000	2,890,000	3,490,000	3,610,000 ⁵
Denmark, sales ^c	2,500	2,500	2,500	2,500	2,500
Ecuador ^c	18,600 ⁵	15,000	15,000	15,000	15,000
Egypt	332,000	523,000	550,000	304,000 ^r	305,000
Eritrea ^c	184 ^{r,5}	200 ^r	175 ^r	200 ^r	200
Ethiopia	1,400 ^e	1,280	3,530	3,700 ^{r,e}	4,000
France, marketable ^c	307,000 ⁵	300,000	300,000	300,000	300,000
Germany	3,840,000	3,620,000	4,510,000	4,580,000 ^r	4,900,000
Greece ^c	40,000	4,360	-- ⁵	--	--

See footnotes at end of table.

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

(Metric tons)

Country ³	2007	2008	2009	2010	2011 ^c
Guatemala	2,660	2,800	1,880	2,140	2,000
Hungary, processed ^c	3,000	3,000	2,800	3,000	3,000
India: ^c					
Processed	200,000	210,000	210,000	220,000	220,000
Salable crude	570,000	570,000	580,000	580,000	600,000
Indonesia ^c	150,000 ^r	150,000 ^r	186,000 ^{r,5}	170,000 ^r	175,000
Iran ^c	350,000	320,000	907,000 ^r	900,000 ^{r,c}	900,000
Italy, kaolinitic earth	635,000	591,000	1,070,000	641,000 ^c	640,000
Japan ^c	11,000 ⁵	11,000	12,000	12,000	13,000
Jordan	101,000	181,000	177,000	114,000 ^r	150,000
Kenya	900	930	890	970 ^r	1,000
Korea, Republic of	688,000	955,000	659,000	764,000	799,000 ⁵
Kyrgyzstan ^c	400,000	400,000	400,000	400,000	400,000
Malawi	1,000	1,100	--	--	--
Malaysia	588,000	506,000	464,000	530,000	500,000
Mexico	86,800	85,100	78,100	120,000	120,000 ⁵
New Zealand	14,100	12,800	9,020	10,000	10,000
Nigeria ^c	100,000	100,000	100,000	100,000	100,000
Pakistan	25,700 ^r	24,500 ^r	15,300 ^r	27,300 ^r	26,000
Paraguay ^c	66,000	66,000	66,000	66,000	66,000
Peru	4,770 ^r	13,200 ^r	955 ^r	16,700	18,200 ⁵
Poland, washed	153,000	166,000	143,000	140,000 ^{r,c}	140,000
Portugal	184,000	231,000	275,000	285,000	285,000 ^{p,5}
Romania	7,580	3,170	1,000 ^c	1,000	1,000
Russia, concentrate ^c	45,000	45,000	45,000	45,000	45,000
Saudi Arabia	4,420 ^r	15,000 ^r	4,170 ^r	62,000 ^r	65,000
Serbia: ^c					
Crude	-- ^r	-- ^r	-- ^r	-- ^r	--
Washed	-- ^r	-- ^r	-- ^r	-- ^r	--
Slovakia	46,000	44,000	10,000	10,000	10,000
South Africa	50,800	39,200 ^r	31,000	29,900	15,000
Spain, marketable, crude and washed ⁶	450,000	465,000	465,000	485,000	486,000
Sri Lanka	11,200	10,000	9,540 ^r	8,210 ^r	8,000 ^p
Thailand, beneficiated	159,000	162,000	160,000 ^c	160,000	160,000
Turkey	914,000	792,000	728,000	711,000 ^r	700,000
Uganda ^c	30,000	30,000	30,000	30,000	30,000
Ukraine	1,740,000 ^r	1,460,000 ^r	764,000 ^r	1,090,000 ^r	1,100,000
United Kingdom, sales ^{c,7}	1,800,000	1,800,000	1,800,000	900,000	900,000
United States ⁸	7,110,000	6,740,000	5,290,000	5,950,000 ^r	5,770,000 ⁵
Uzbekistan ^c	5,500,000	5,500,000	5,500,000	5,500,000	5,500,000
Venezuela ^c	10,000	10,000	10,000	10,000	10,000
Vietnam ^c	650,000	650,000	650,000	650,000	650,000
Zambia ^c	200	200	200	200	200
Total	36,200,000 ^r	35,700,000 ^r	33,000,000 ^r	33,400,000 ^r	33,900,000

^cEstimated. ^pPreliminary. ^rRevised. -- Zero.

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

²Table includes data available through July 26, 2012.

³In addition to the countries listed, China, Morocco, and Suriname may also have produced kaolin, but information is inadequate to make reliable estimates of output levels.

⁴Data for year ending June 30 of that stated.

⁵Reported figure.

⁶Includes crude and washed kaolin and refractory clays not further described.

⁷Dry weight.

⁸Kaolin sold or used by producers.