



2010 Minerals Yearbook

CLAY AND SHALE

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The amount of clay sold or used by domestic producers in 2010 increased by 4% to 25.4 million metric tons (Mt) valued at \$1.46 billion compared with 24.5 Mt valued at \$1.33 billion in 2009 (table 1). Common clay and shale accounted for 47% of the tonnage, and kaolin accounted for 54% of the value (tables 1, 5, and 8). In 2010, exports increased by 14% to 4.36 Mt valued at \$862 million compared with 3.83 Mt valued at \$702 million in 2009. Imports of clays were 284,000 metric tons (t) valued at \$92 million in 2010 compared with 325,000 t valued at \$104 million in 2009 (table 1). World production of bentonite was 10.7 Mt, production of fuller's earth was 3.36 Mt, and production of kaolin was 33.2 Mt.

About 170 companies mined clay and shale in the United States in 2010. The 20 leading companies, many with multiple operations, accounted for 55% of the tonnage and 74% of the value for all types of clay produced and sold or used. Clay production was reported in all States except Alaska, Delaware, Hawaii, Idaho, New Hampshire, 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, North Carolina, Ohio, Tennessee, Virginia, and Mississippi. The 10 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 Co. (bentonite); General Shale Products Corp. (common clay and shale); Imerys SA (ball clay and kaolin); Nestle S.A. (fuller's earth); Oil-Dri Corp. of America (fuller's earth); Texas Industries Inc. (common clay and shale); 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 2010, four companies mined ball clay in four States. Production of domestic ball clay increased by 10% to

912,000 t valued at \$41.3 million compared with 831,000 t valued at \$37.7 million in 2009 (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 amount of production in Indiana, but this probably was fire clay rather than ball clay.

Consumption.—Consumption of ball clay increased in 2010. The principal domestic markets were, in decreasing order by tonnage, ceramic floor and wall tile and sanitaryware. Ball clay also was sold to manufacture bricks, fiberglass, refractory products, and other types of ceramics and as fillers, extenders, and binders (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.

Although the reported tonnage of ball clay under the floor and wall tile category declined in 2010, most of the difference between 2010 and 2009 probably can be accounted for under the miscellaneous category. With housing starts in the United States increasing slightly in 2010 compared with those of 2009, sales of ball clay for floor and wall tile were likely to have increased slightly to about 320,000 t.

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 7.10 million square meters valued at \$68.4 million in 2010 from 6.95 million square meters valued at \$68.6 million in 2009 but was still much less than the 10.8 million square meters imported in 2008. Mexico, China, Italy, Brazil, and Spain were the five leading sources of tile imports, with 24%, 17%, 12%, 9%, and 6% of the import volume, respectively. Imports of sanitaryware under the 4-digit HTS Code 6910 increased to 24.4 million units in 2010 from 21.8 million units in 2009. This was still considerably less than 34 million units imported in 2008. China accounted for 11.6 million units or 48% of the U.S. sanitaryware imports in 2010, and Mexico accounted for 9.06 million units or 37% of the imports.

Imerys, the leading ball clay producer in the United States, had only a small increase in global sales of minerals for ceramics applications in 2010. This was attributed to low growth in construction markets in developed countries (Imerys SA, 2011, p. 7).

Prices.—The average unit value for ball clay reported by domestic producers was \$45.26 per metric ton. The average value for exported ball clay was \$67.40 per ton. The average value for imported ball clay was \$138.00 per ton.

Trade.—Ball clay exports were 45,000 t valued at \$3.03 million in 2010 compared with 35,000 t valued at \$2.43 million in 2009, according to the U.S. Census Bureau (table 14). Producers reported exports of 191,000 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 suggest that their kaolin import data included most of the imports of ball clay from the United States under the 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 (table 15).

Outlook.—The U.S. economy began to recover from the 2008–09 recession but commercial and residential construction activity continued to remain low. Overall construction spending for residential and commercial buildings remained stagnant, and other private residential housing statistics, such as housing completions, units authorized but not yet started, and units under construction, suggest that residential construction still is suffering from the effects of the recession with only a very slow recovery (U.S. Census Bureau, 2011a, d, e, g, undated). Mortgage foreclosures, tight credit, proposed new lending laws, and continued uncertainty in U.S. debt issues contributed to the slow recovery of the commercial and residential construction industry.

Because most sales of ball clay were for the manufacture of floor and wall tile, sanitaryware, and other construction-related ceramics, future growth in ball clay sales are likely to be slow for the next 2 years. Despite the slow recovery of the U.S. economy, it still may be sufficient for ball clay production and sales to increase slightly in 2011 compared with those of 2010. Growth in global construction markets also is likely to be slow as many world economies, particularly those in Europe, continue to struggle to recover from the recession. The exceptions are construction markets in Asia and some markets in South America, which were less affected by the 2008–09 global recession. Ball clay exports, mainly to Canadian and Central American ceramics producers, may increase slightly in 2011.

Bentonite

Production.—In 2010, 20 companies produced bentonite in 11 States. About 4.63 Mt valued at \$261 million was sold or used in 2010, 27% more than the 3.65 Mt valued at \$207 million of bentonite sold or used in 2009 (table 4). Production of nonswelling bentonite increased by 6% to 123,000 t valued at \$9.32 million in 2010 from 116,000 t valued at \$8.14 million in 2009. 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 4.51 Mt valued at \$252 million in 2010, an increase of 28% from 3.53 Mt valued at \$198 million in 2009. Wyoming led in the production of swelling bentonite, followed by Utah, Montana, Texas, California, Oregon, Nevada, and Colorado.

Wyo-Ben, Inc. began operating its bentonite plant in Lucerne, WY, after it was refurbished in 2009. The plant had a production capacity of 500,000 metric tons per year (t/yr) and served such markets as cat litter, drilling mud, and foundry sand.

The plant also had the capability to produce bentonite for iron ore pelletizing (Russell, 2010).

Black Hills Bentonite, LLC submitted plans to the U.S. Bureau of Land Management (BLM) to mine bentonite near Ten Sleep, WY. The company planned to extract about 72,900 t of bentonite during the 10-year life of the mine. A mine plan and environmental assessment were available from the BLM for review (U.S. Bureau of Land Management, 2009; 2010).

Consumption.—In 2010, domestic sales and use of bentonite increased from that of 2009. Reported domestic sales of bentonite were 1.02 Mt for drilling mud (all swelling bentonite), 423,000 t for foundry sand bond (more than 99% was swelling bentonite), 595,000 t for pelletizing iron ore (all swelling bentonite), and 967,000 t for pet waste absorbent (all 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).

Domestic sales of bentonite increased for pet litter, drilling mud, pelletizing iron ore, waterproofing and sealing, and miscellaneous uses. Domestic sales of bentonite for drilling mud use increased by 74%, and export sales increased by 52% (table 4). Drilling activity increased domestically and overseas in 2010 compared with 2009 (Baker Hughes Inc., undated). Sales reported in table 4, however, appeared to be unusually high for 2010, and it is likely that some of the sales were improperly categorized by respondents and that sales increased by 20% to 30% to about 750,000 t. Sales of bentonite for iron ore pelletizing increased by 34% in 2010. This corresponds with a reported 87% increase in iron ore production and a 65% increase in iron ore shipments in 2010 (Jorgenson, 2011b). Reported domestic sales for foundry sand bond applications decreased by 5% domestically, and sales for export decreased by 37%. This was contrary to a report on market conditions from a major supplier of bentonite, which indicated that sales for metal casting applications increased significantly in 2010 (AMCOL International Corp., 2011, p. 30). Some of the tonnage attributed to drilling mud and the “Miscellaneous” (domestic) category likely should have been attributed to foundry sand bond sales, with domestic sales of bentonite for foundry sand bond estimated to be 520,000 to 540,000 t, and export sales estimated to be 225,000 to 250,000 t.

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 and water treatment and filtering.

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. Nonswelling bentonite accounted for most sales for chemical manufacturing and fertilizer and pesticide carriers.

In 2010, American Colloid Co. reported sales of 1.57 Mt of sodium bentonite and 81,700 t of calcium bentonite from mines in the United States compared with 1.25 Mt of sodium bentonite and 60,900 t of calcium bentonite in 2009. The company

reported a 46% increase in sales revenue for metal casting applications, its leading revenue market. Sales revenue for its other markets, with the exception of pet litter, also increased; sales revenue for pet litter declined 7% (AMCOL International, 2011, p. 11, 30).

Rockwood Holdings, Inc. (the parent company of Southern Clay Products, Inc.) reported increased sales in most clay-additive markets, particularly for oilfield applications. Pricing for clay additives also increased in 2010 (Rockwood Holdings, Inc., 2011, p. 38, 44).

Prices.—The average unit value reported by domestic producers for nonswelling bentonite was \$75.79 per metric ton. The average value for swelling bentonite was \$55.88 per ton. The average value for all bentonite was \$56.40 per ton. The average value of exported bentonite was \$149.85 per ton. The average value of imported bentonite was \$292.06 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 \$48 to \$55 per ton; foundry-grade that was bagged and shipped in railcars was \$90 to \$115 per ton; and American Petroleum Institute (API)-grade bentonite that was bagged and shipped in railcars was \$70 to \$100 per ton. Crushed, dried, loose in bulk bentonite from India was \$45 to \$50 per ton for pet litter grade. Crude and dried bentonite, sold in bulk, free on board, European port, was \$56 to \$80 per ton for foundry grade (Industrial Minerals, 2010).

The average annual producer price index (PPI) for bentonite under North American Industry Classification System (NAICS) code 212325C was 157.8 in 2010 (1984=100) compared with 155.3 in 2009. The PPI increased during the year from 154.7 in February to 161.8 in 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 953,000 t valued at \$143 million in 2010 from 709 Mt valued at \$100 million in 2009 (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 817,000 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 16,000 t valued at \$4.67 million. Imports of artificially activated material were 19,000 t valued at \$25.8 million (table 15).

Outlook.—The bentonite industry rebounded in 2010 after a major decline in sales in 2009 because of the global economic recession. Sales in 2010 were nearing the levels reached just

prior to the recession. Demand for bentonite increased in most markets as global economies began to recover. Overall bentonite sales may increase by 6% to 9% in 2011 because of growth in a few of the major markets for bentonite.

Growth in absorbent markets, particularly pet waste absorbents, slowed significantly in recent years. Overall sales for pet waste absorbents declined slightly during the past 2 years because of reduced consumer spending during the recession. With little significant change in consumer spending anticipated in 2011, pet litter markets may remain unchanged. Sales of bentonite for oil absorbent applications were likely to increase by 3% to 6% in 2011 compared with those of 2010 because of increased U.S. industrial output in the manufacturing sector (Board of Governors of the Federal Reserve System, 2011).

Sales of bentonite for drilling mud applications may increase slightly in 2011 compared with those of 2010 because of increased drilling activity in 2011. 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. Production of iron ore increased in 2010 but declined slightly in the first 5 months of 2011 (Jorgenson, 2011a). Demand for iron ore, however, is likely to increase in 2011 as global economies recover, so sales of bentonite for pelletizing iron ore may increase slightly in 2011.

The world foundry industry also began to recover from market losses in 2008 and 2009 (Roberts, 2010: S&B Industrial Minerals S.A., 2011, p. 8). Manufacturing of durable goods increased in 2011 compared with 2010 (Board of Governors of the Federal Reserve System, 2011). Consequently, sales of bentonite for foundry sand bond applications may increase slightly in 2011.

Sales of bentonite for civil engineering applications, such as waterproofing and sealing and landfill caps and liners, were affected by reduced construction activity during the recession. In the United States in 2010, construction activity continued to be relatively low compared with that of 2008. Sales of bentonite for waterproofing and sealing are likely to increase slightly in 2011. Other smaller markets for bentonite may increase slightly in 2011 as the U.S. economy slowly improves.

Common Clay and Shale

Production.—In 2010, 133 companies produced common clay and shale for manufacturing products in 38 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 by 3% to 12.1 Mt valued at \$148 million in 2010 compared with 12.5 Mt valued at \$156 million in 2009 (table 5). The 10 leading producing States were, in descending order of tonnage, Texas, Alabama, North Carolina, Ohio, Georgia, New York, Oklahoma, Arkansas, Virginia, and Missouri. These 10 States accounted for 66% of U.S. common clay and shale production. Sales declined in many States owing to low residential and commercial building activity in 2010.

Boral USA purchased the remaining 50% interest in MonierLifetile LLC, a division of Monier Group of Germany. MonierLifetile was based in Irving, CA, and produced clay and concrete roofing tile for residential and commercial use. Boral combined its roofing division with that of MonierLifetile under a new Boral Roofing division. The purchase gave Boral better access to the U.S. roofing market with 15 tile plants throughout the United States (Boral USA, 2010).

Mid America Brick received \$21.9 million in financing to open a former refractory brick plant to manufacture face brick. The former plant was owned by A.P. Green Inc. and had been idled since 2002. The plant was expected to produce 60 million bricks per year at full capacity (Advantage Capital Partners, 2010; Mid America Brick, 2010).

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 2010. Lightweight aggregate sales were subdivided into concrete block (1.34 Mt), structural concrete (701,000 t), highway surfacing (561,000 t), and miscellaneous lightweight aggregates (266,000 t). Other markets included civil engineering, ceramic floor and wall tile, miscellaneous ceramics, heavy-clay (nonbrick) products, and refractory products (table 5).

Production of brick was 3.61 billion bricks in 2010 compared with 3.28 billion bricks in 2009, and brick shipments were 3.50 billion bricks in 2010 compared with 3.59 billion bricks in 2009. Production of clay floor and wall tile, which is an important market for common clay and shale, was 66.1 million square meters in 2010 compared with 55.4 million square meters in 2009. Shipments were 60.3 million square meters in 2010 compared with 53.1 million square meters in 2009. Production of clay pipe and fittings was 43,100 t in 2010 compared with 45,000 t in 2009, and shipments were 48,000 t in 2010 compared with 45,500 t in 2009 (U.S. Census Bureau, 2011b, undated). The increase in shipments of tile and clay pipe and fittings corresponded with a slight increase in housing starts (588,000 units in 2010 compared with 554,000 units in 2009) although commercial construction, based on the value of construction put in place, appeared to have declined (\$563 trillion in 2010 compared with \$654 trillion in 2009) (U.S. Census Bureau, 2011a, undated).

Prices.—The unit average value for all common clay and shale produced in the United States was \$12.25 per metric ton. The value of clay and shale used to produce lightweight aggregate was estimated to be \$25.28 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 because most producers do not sell their clay, but use it directly to manufacture products.

The annual average PPI for common (miscellaneous) clay and shale under NAICS code 212325B was 176.6 in 2010 (1984=100) compared with 171.7 in 2009. The PPI increased to 179.9 in July and declined to 177.9 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 continued to be affected by the sluggish U.S. economy in 2010. Although housing starts increased slightly through mid-2011, overall construction spending for residential and commercial buildings remained stagnant. Other private residential housing statistics, such as housing completions and units under construction, also suggest that residential construction still was feeling the effects of the recession (U.S. Census Bureau, 2011a, d, e, g, undated). Mortgage foreclosures, tight credit, proposed new lending laws, and continued uncertainty in U.S. debt issues contributed to the slow recovery of the commercial and residential construction industry. These issues are likely to constrain the sales of common clay, with only slight growth expected in 2011.

Fire clay

Production.—Fire clay producers were mostly refractory product manufacturers that used the clays in firebrick and various heavy-clay products. In 2010, six firms mined fire clay in four States. Fire clay mined by domestic producers decreased by 32% to 216,000 t valued at \$6.12 million from 320,000 t valued at \$12 million in 2009 (table 6). Missouri was the leading producing State, followed by, in descending order of tonnage, Washington, Texas, and Ohio. The decrease in production took place because several common clay producers that occasionally mine fire clay indicated that they did not do so in 2010.

Consumption.—Consumption of fire clay decreased in 2010. Leading markets for fire clay were, in descending order of tonnage, portland cement, refractory calcines and grogs, ceramic floor and wall tile, firebrick, common brick, miscellaneous ceramics, and roofing granules (table 6).

Fire clay products sold included grogs and calcines; high-alumina brick and specialties; ramming and gunning mixes; refractory products, such as firebrick and block; mixes and mortars; and saggars. Fire clays also were used to produce such items as brick and pottery. Sales for these nonrefractory products decreased because several common clay and shale producers indicated that they did not mine fire clay in 2010.

The U.S. Census Bureau (2011f) reported that the value of U.S. manufacturers' shipments of clay refractory products (based primarily on fire clay and kaolin) was \$818 million in 2010 compared with \$638 million in 2009. The value of U.S. apparent consumption (manufacturers' shipments plus imports minus exports) of all clay refractory products was \$774 million in 2010 versus \$596 million in 2009. In 2010, shipments of fire clay, high-alumina, and insulating brick shapes in 9-inch equivalents, were 312,000 t compared with 258,000 t in 2009. Shipments of castables, gunning mixes, and unshaped clay refractory bonding mortars were 386,000 t in 2010 compared with 321,000 t in 2009. Shipments of clay and high alumina refractory materials for reprocessing and direct sales were withheld by the Census Bureau in 2010 to avoid disclosing company proprietary data.

Prices.—In 2010, the average unit value for fire clay reported by domestic producers was \$28.31 per metric ton, a decrease from \$37.48 in 2009. The decrease in value in 2010 resulted from lower values reported by two fire clay producers. The average value of exported fire clay was \$152.22 per ton. The average value of imported fire clay was \$599.33 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 2010, exports of fire clay and refractory-grade kaolin increased to 404,000 t valued at \$61.5 million compared with 328,000 t valued at \$42.8 million in 2009 (table 14). An increase in exports to Luxembourg, a major distribution center for European shipments, accounted for the largest share of the U.S. export increase. In 2010, imports were 299 t valued at \$179,000 (table 15).

Outlook.—Sales of fire clay for refractory uses were expected to increase in 2011. The Federal Reserve indicated that industrial output increased in 2010 with the increase continuing into 2011 (Board of Governors of the Federal Reserve System, 2011). Major users of refractory products such as the aluminum, glass, iron, lime, and steel industries increased production in 2010 and 2011, suggesting an increased demand for refractory products for their furnaces. Sales of fire clay for refractory applications may increase slightly in 2011.

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 2011 compared with those of 2010 if construction activity increases.

Fuller's earth

Production.—In 2010, 12 companies produced fuller's earth in 11 States. Fuller's earth deposits grade from palygorskite (attapulgite) in Florida to montmorillonite further north in Georgia. Gellant grades of attapulgite, used as thickeners in such items as drilling muds and paints, were mined in western Florida and southwestern Georgia. Absorbent grades of attapulgite were mined further north in Georgia. Absorbent grades of attapulgite were grouped with the montmorillonite variety of fuller's earth in table 7 to be consistent with past reporting.

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 2010 compared with that of 2009. Florida led in the production of attapulgite, followed by Georgia.

Production of the montmorillonite variety of fuller's earth increased slightly to 2.05 Mt valued at \$201 million in 2010 compared with 2.01 Mt valued at \$206 million in 2009 (table 7). Montmorillonite-type fuller's earth was produced, in decreasing order of tonnage, in Georgia, Missouri, Virginia, Mississippi, California, Tennessee, Florida, Illinois, Nevada, Kansas, and Texas. Georgia, Mississippi, Missouri, and Virginia accounted for 74% of U.S. production.

Consumption.—Consumption of fuller's earth (excluding attapulgite-type fuller's earth) increased slightly in 2010. Pet waste absorbent was the leading market for fuller's earth, followed by oil and grease absorbents; civil engineering applications; clarifying, decolorizing, and filtering of animal, mineral, and vegetable oils and greases; fertilizer carriers; animal feed; unknown filler and extender uses; pesticide carriers; miscellaneous ceramics; paint; and water treatment (table 7). These markets were representative of those of montmorillonite-type fuller's earth, which accounted for most of the total fuller's earth sales. The leading use of attapulgite-type fuller's earth was in fillers, extenders, and binders. Fillers and extenders included, in decreasing order of tonnage, unknown filler and extender uses; pesticide carrier; paint; adhesives; animal feed; fertilizer carrier; 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. 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; drilling mud; cosmetic, medical, and pharmaceutical applications; and paint. Table 7 indicates that sales of fuller's earth for pet waste absorbent increased by 14% to 1.38 million tons in 2010. That probably was an overestimate based on declining sales for pet waste absorbent from 2005 to 2009. From 80,000 to 110,000 t of pet waste absorbent sales may have been for oil absorbent use, based on increased industrial manufacturing activity in 2010.

Oil-Dri Corp. of America reported a 2% increase in value of its sales by its Business-to-Business Group (sales to companies that further process Oil-Dri's products) but a 4% decrease in tonnage sold for its fiscal year ending July 31. Sales in that group increased for fluid purification and animal health and nutrition and decreased for pet litter and agricultural chemical carriers; export sales also increased. Sales by Oil-Dri's Retail and Wholesale Products Group declined by 12% in value and 9% in tonnage. Cat litter accounted for most of the decline with additional slight decreases in the oil absorbent markets (Oil-Dri Corp. of America, 2011a, p. 28–29).

Prices.—The average unit value of attapulgite-type fuller's earth was withheld to avoid disclosing company proprietary data but the value was unchanged from that of 2009. The average value of montmorillonite-type fuller's earth was \$98.35 per metric ton, a decrease from \$102.71 per ton in 2009. The average value declined by 4% in 2010 mainly because one large producer reported a significantly lower unit value. Average values for other producers increased. The average value of exported fuller's earth was \$353.56 per ton. The average value of imported fuller's earth was \$80 per ton.

Trade.—In 2010, exports increased to 100,000 t valued at \$35.4 million compared with 90,000 t valued at \$28.5 million in 2009 (table 14). Imports of decolorizing earth and fuller's earth were 2,000 t valued at \$160,900 in 2010 (table 15).

Outlook.—Pet waste absorbent is the leading market for fuller's earth. In early 2011, Oil-Dri indicated that its sales of fuller's earth for cat litter applications decreased in tonnage (Oil-Dri Corp. of America, 2011b, p. 17–18). Because Oil-Dri

was the leading U.S. provider of fuller's earth for cat litter, it is likely that overall U.S. sales for this application may remain unchanged or decrease slightly in 2011.

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 2011, industrial output increased slightly (Board of Governors of the Federal Reserve System, 2011). This suggests that 2011 sales of fuller's earth for oil and grease absorbent applications may increase slightly compared with those of 2010.

According to Oil-Dri, sales as carriers and suspension agents in fertilizers and pesticides used for agriculture and lawn and garden products increased from mid-2010 to mid-2011 (Oil-Dri Corp. of America, 2011b, p. 17–18). This suggests that overall U.S. sales for this application may increase slightly in 2011.

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. Sales increased in 2010 and appeared to be doing the same in early 2011. Consequently, sales for fluid purification may increase slightly in 2011. Attapulgite-type 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. Because sales of these products are constrained by the slow housing markets, sales of attapulgite-type fuller's earth for construction-related products may increase only slightly in 2011. Sales for drilling mud applications may increase slightly in 2011 compared with those of 2010, based on global oil drilling activity.

In general, any improvement in the U.S. economy will likely result in slightly improved sales for nonabsorbent applications for fuller's earth in 2011.

Kaolin

Production.—In 2010, 19 firms mined kaolin in 9 States. Domestic production increased by 3% to 5.42 Mt valued at \$788 million compared with 5.29 Mt valued at \$714 million in 2009 (table 8). The leading producer State was Georgia, followed by, in descending order of tonnage, South Carolina, Alabama, Texas, Arkansas, Nevada, Florida, North Carolina, and California.

Of the 5.42 Mt sold or used in 2010, 2.28 Mt was reported as water washed, 1.34 Mt was calcined, 984,000 t was delaminated, 758,000 t was airfloat, and 58,000 t was unprocessed (table 8). Pigment-grade (low-temperature calcined kaolin) accounted for less than 50% of the tonnage of the total calcined kaolin sales. Actual 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 2010. A small amount also was produced in Texas.

Kaolin production in Georgia increased slightly to 5.05 Mt valued at \$757 million in 2010 compared with 4.97 Mt valued at \$693 million in 2009. Approximately 2.20 Mt of Georgia kaolin production sold was reported as water washed, 1.24 Mt was

calcined (high- and low-temperature calcined kaolin), 984,000 t was delaminated, and 621,000 t was airfloat in 2010 (table 9). Production in South Carolina increased by 10% to 158,000 t valued at \$10.5 million in 2010 compared with 144,000 t valued at \$8.59 million in 2009 (table 10). High-temperature calcined kaolin production increased because of increased demand from the refractory industry, and sales of delaminated and low-temperature calcined kaolin increased because of increased demand from the paper industry.

Imerys, one of the leading U.S. kaolin producers, indicated that global sales in most markets declined in 2010, although sales to paper applications increased by 6% globally as the printing and writing paper markets began to recover from the 2008–09 economic recession. Worldwide sales of kaolin for manufacturing, including adhesives, paint, plastics, and refractory products, increased in 2010. Construction markets in the United States remained flat while those in Europe increased (Imerys SA, 2011, p. 7–9).

Drilling activity in 2009–10 in Applied Minerals, Inc.'s Dragon Pit Mine, in the Tintic District of north-central Utah, indicated that resources totaled 552,000 t of halloysitic clay, averaging 65% halloysite, 18% kaolinite, and 10.6% illite and smectite. Some areas of the deposit contained up to 100% halloysite (Applied Minerals Inc., 2011).

Consumption.—Consumption of kaolin increased in 2010 from that of 2009 (table 8). The major domestic markets for kaolin were, in descending order of tonnage, paper coating and filling, refractory products, fiberglass and mineral wool, paint, catalyst manufacture, rubber, and heavy-clay products (brick and portland cement). Other smaller but significant markets were ceramics, chemical manufacture, and plastics (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, catalyst manufacture (included in ceramics in table 10), rubber, brick, fiberglass, and plastics.

Paper coating and filling markets accounted for 57% of kaolin sales in 2010. Sales increased in response to increased manufacture of paper in the North America. Refractory products accounted for 13% of kaolin sales in 2010, with sales increasing because of increased U.S. industrial production. These two markets accounted for about 57% of the increase in kaolin sales in 2010. Other increases were distributed across many end-use markets.

Prices.—The average unit value of kaolin was \$145.32 per metric ton for all kaolin grades. The average value for airfloat was \$86.77 per ton; delaminated, \$139.07 per ton; unprocessed, \$14.19 per ton; and water washed, \$145.56 per ton. Values for refractory-grade (high-temperature calcined) and pigment-grade (low-temperature calcined) kaolin were concealed to avoid revealing company proprietary data, but all types of calcined kaolin combined were valued at \$188.45 per ton. The average value of exported kaolin was \$217.18 per ton. The average value of imported kaolin was \$236.67 per ton.

The price of number 1 paper coating grades of kaolin from a plant in Georgia ranged from \$146 to \$185 per ton, and the price of number 2 paper coating grades varied from \$95 to \$147 per ton (Industrial Minerals, 2010).

The annual average PPI for ball clay and kaolin mining under North American Industry Classification System code 2123240 was 182.9 in 2010 (1984=100) compared with 176.5 in 2008. The PPI was increased from 182 in January to 183.6 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 2010 as the economies of many countries began to improve. In 2010, 2.47 Mt of kaolin valued at \$537 million was exported compared with 2.29 Mt valued at \$459 million in 2009 (table 14). Producers reported exports of 1.45 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 an estimated 239,000 t of kaolin valued at \$56.3 million in 2010 compared with 281,000 t valued at \$68.7 million in 2009 (table 15). Inaccuracies have been observed in kaolin import data from Brazil in the past, raising the possibility that imports in 2010 may have been higher. Some kaolin imports from Brazil may have been shipped to Canadian paper manufacturers via ports in New England and not used in the United States. About 94% of kaolin imports were from Brazil, followed by Canada and the United Kingdom. Imports from Brazil were primarily for paper coating applications, and those from the United Kingdom were primarily for paper filler applications.

Outlook.—Sales by the kaolin industry improved in 2010 after a large decline in 2009 because of the economic recession. An increase in global paper production contributed significantly to the expanding kaolin markets in 2010. Overall global paper production increased more than 6% in 2010 (Imerys SA, 2011). Year-to-date U.S. manufacturer's shipments from pulp, paper, and paperboard mills increased through mid-2011 compared with the same time period in 2010 (Board of Governors of the Federal Reserve System, 2011; U.S. Census Bureau, 2011c). Domestic sales of kaolin for paper applications may increase slightly in 2011. Export sales of kaolin, primarily for paper use, may increase slightly, particularly to Asian markets, where economic growth surpassed other parts of the world. Sales of paper for most applications increased in Europe (Confederation of European Paper Industries, 2011).

U.S. industrial manufacturing output increased in 2010 and through mid-2011 (Board of Governors of the Federal Reserve System, 2011). If this trend continues, sales of kaolin used to manufacture such products as catalysts, chemicals, plastics, refractory products (see discussion under Fire clay), and rubber may increase slightly in 2011 compared with 2010.

Commercial and residential construction remained slow in 2010 and early 2011. Residential construction increased only slightly in 2010 and through May 2011, but the value put in place for all forms of construction decreased (U.S. Census Bureau, 2011a, d, e, undated). Concerns about mortgage foreclosures, tight credit, proposed new lending laws, and continued uncertainty in U.S. debt issues hampered growth in the construction industry. Sales for construction-related applications, such as the manufacture of brick, electrical

porcelain, fiberglass, floor and wall tile, paint, portland cement, roofing granules, and sanitaryware may increase only slightly in 2011 compared with those of 2010 if the construction trend continues through 2011.

World Review

World production of bentonite was approximately 10.7 Mt (table 16) and fuller's earth production was 3.36 Mt (table 17). Kaolin production was about 33.2 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.

Brazil.—Imerys purchased an 86% share of Pará Pigmentos S.A. (PPSA) from Vale S.A. The \$70 million purchase included the kaolin deposits, a 400,000-t/yr processing plant, a harbor facility at Barcarena, and mining rights in the State of Pará. Imerys already owned Rio Capim Caulim, a leading Brazilian kaolin producer with 1.6 million metric tons per year (Mt/yr) of production capacity. Imerys' combined kaolin production capacity was 4.8 Mt/yr from operations in Australia, Brazil, France, New Zealand, Portugal, Thailand, Ukraine, the United Kingdom, and the United States. The purchase of PPSA increased Imerys' reserves of kaolin suitable for paper and packaging markets and was expected to allow the company to control long-term mining costs more effectively (O'Driscoll, 2010b; Imerys, 2011, p. 9).

India.—Ashapura Volclay Ltd. (a joint venture between Ashapura Minechem Ltd. and AMCOL International Corp.) announced that it began operating a third plant for producing acid-activated bleaching clay. The plant, in Kutch, Gujarat, had a capacity of 25,000 t/yr. With the opening of the plant, the joint venture had the capacity to produce more than 100,000 t/yr of bleaching clay and 10,000 t/yr of catalyst clay. All the clay used at this facility was calcium bentonite (O'Driscoll, 2010a).

South Africa.—G&W Mineral Resources (Pty.) Ltd. completed a new \$6 million bentonite plant near Koppies, Free State Province. The plant enabled the company to process dry and wet ores and provided dry storage for the bentonite ore. Previously, the operation closed during rainy seasons because the company could not process wet ore and lacked adequate dry storage for bentonite ore (Roberts, 2011).

Ukraine.—Société Kaolinière Armoricaïne (SOKA) announced that it would build a 75,000-t/yr kaolin plant near Pervomaisk, Mykolaiv. The plant was scheduled to be built in three stages, by increasing 25,000 t/yr at each stage. SOKA will process kaolin for ceramic markets. SOKA had been selling its

crude kaolin for the manufacture of brick, tile, and white cement (Watts, 2010).

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

(Thousand metric tons and thousand dollars)

	2006	2007	2008	2009	2010
<u>Domestic clays sold or used by producers:</u>					
Quantity	41,200	36,700	32,700	24,500	25,400
Value	1,770,000	1,750,000	1,650,000	1,330,000	1,460,000
<u>Exports:</u>					
Quantity	5,980	5,650	5,100	3,830	4,360
Value	1,000,000	928,000	938,000	702,000	862,000
<u>Imports for consumption:</u>					
Quantity	346	231	237	325	284
Value	79,200	73,900	86,600	104,000	92,000

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	2009		2010	
	Quantity	Value	Quantity	Value
Alabama	1,340	25,300	1,450	29,900
Arkansas	539	7,630	579	8,210
California	340	4,690	570	33,300
Colorado	61	435	110	350
Florida	18	3,000	202	33,600
Georgia	5,600	697,000	6,300	819,000
Indiana	413	6,610	381	8,260
Iowa	184	828	201	827
Kansas	381	2,430	380	2,940
Kentucky	288	5,980	323	8,080
Louisiana	353	9,120	151	1,330
Michigan	318	1,310	312	1,290
Mississippi	263	1,540	642	35,600
Missouri	421	3,020	1,030	40,800
New York	605	30,200	595	30,000
North Carolina	828	4,980	856	5,300
Ohio	770	13,400	817	14,600
Oklahoma	572	2,800	554	2,600
Pennsylvania	451	3,040	344	2,490
South Carolina	455	9,890	426	11,700
Tennessee	624	23,600	776	32,300
Texas	1,850	21,600	2,080	48,600
Utah	342	7,230	482	11,800
Virginia	505	5,830	775	27,500
Wyoming	3,270	172,000	4,160	225,000
Other ⁴	3,760	269,000	979	26,900
Total	24,500	1,330,000	25,400	1,460,000

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 all other producer States.

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

(Thousand metric tons and thousand dollars)

	2009		2010	
	Quantity	Value	Quantity	Value
Type:				
Airfloat	588	26,000	629	27,500
Water-slurried	93	4,440	105	5,100
Unprocessed	151	7,230	178	8,680
Total	831	37,700	912	41,300
Use:				
Fillers, extenders, binders ²	37	NA	40	NA
Floor and wall tile	299	NA	240	NA
Miscellaneous ceramics ³	77	NA	85	NA
Pottery	4	NA	10	NA
Sanitaryware	181	NA	188	NA
Miscellaneous ⁴	24	NA	156	NA
Exports, reported by producers ⁵	209	NA	191	NA
Total	831	37,700	912	41,300

NA Not available.

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

²Includes 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)

	2009		2010	
	Quantity	Value	Quantity	Value
Type:				
Nonswelling	116	8,140	123	9,320
Swelling	3,530	198,000	4,510	252,000
Total	3,650	207,000	4,630	261,000
Use:				
Domestic:				
Pet waste absorbents	925 ^e	NA	967 ^{e,2}	NA
Adhesives	9	NA	8	NA
Animal feed	60	NA	71	NA
Drilling mud	587	NA	1,020 ²	NA
Filler and extender applications ³	69	NA	104	NA
Foundry sand	443 ^e	NA	423 ^{e,2}	NA
Pelletizing (iron ore)	445 ^e	NA	595 ^{e,2}	NA
Waterproofing and sealing	102	NA	122	NA
Miscellaneous civil engineering	190 ^e	NA	192 ^e	NA
Miscellaneous ⁴	170	NA	310	NA
Total	3,000^e	NA	3,810^e	NA
Exports, reported by producers:				
Drilling mud	105 ^e	NA	160 ^e	NA
Foundry sand	192	NA	121 ²	NA
Other ⁵	349	NA	536	NA
Total	646^e	NA	817^e	NA
Grand total	3,650	207,000	4,630	261,000

^eEstimated. NA Not available.

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

²More information can be found in the Consumption section under Bentonite.

³Includes 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.

⁴Includes ceramics, chemical manufacturing, clarifying and decolorizing, heavy-clay products, oil and grease absorbents, refractories, and other unknown uses.

⁵Includes 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}

(Thousand metric tons and thousand dollars)

	2009		2010	
	Quantity	Value	Quantity	Value
State:				
Alabama	1,340	25,300	1,300	21,500
Arkansas	539	7,630	534	7,580
California	318	2,370	355	5,000
Georgia	631	3,870	657	3,910
Indiana	413	6,610	358	7,110
Kansas	381	2,430	353	1,850
Kentucky	288	5,980	284	5,780
Louisiana	353	9,120	151	1,330
Mississippi	263	1,540	259	1,540
Missouri	421	3,020	412	3,060
New York	605	30,200	595	30,000
North Carolina	828	4,980	846	4,890
Ohio	770	13,400	814	14,600
Oklahoma	572	2,800	554	2,600
Pennsylvania	451	3,040	343	2,490
South Carolina	311	1,300	267	1,190
Texas	1,800	13,000	1,740	14,000
Utah	342	7,230	322	7,020
Virginia	505	5,830	503	6,010
Other ³	1,330	6,170	1,410	6,220
Total	12,500	156,000	12,100	148,000
Use:				
Floor and wall tile ⁴	181	NA	358	NA
Heavy-clay products:				
Brick, extruded	5,680	NA	5,380	NA
Brick, other	547	NA	608	NA
Other ⁵	165	NA	55	NA
Lightweight aggregate:				
Concrete block	1,310	NA	1,340	NA
Highway surfacing	483	NA	561	NA
Structural concrete	731	NA	701	NA
Miscellaneous	597	NA	266	NA
Portland and other cements	1,900	NA	2,070	NA
Refractories ⁶	360	NA	364	NA
Miscellaneous ⁷	493	NA	353	NA
Total	12,500	156,000	12,100	148,000

NA Not available.

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

²Excludes Puerto Rico.

³Includes all other States except Alaska, Delaware, Hawaii, Idaho, Nevada, New Hampshire, Rhode Island, Vermont, and Wisconsin.

⁴Includes ceramic tile, quarry tile, and miscellaneous floor and wall tiles.

⁵Includes drain tile, flower pots, flue linings, sewer pipe, structural tile, and miscellaneous clay products.

⁶Includes firebrick, blocks and shapes, mortar and cement, grogs and calcines, and miscellaneous refractories.

⁷Includes 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)

	2009		2010	
	Quantity	Value	Quantity	Value
Production	320	12,000	216	6,120
Use:				
Heavy-clay products and lightweight aggregates ²	146	NA	123	NA
Refractories:				
Firebrick, block, shapes	19	NA	19	NA
Grog and calcines	W	NA	W	NA
Other refractories ³	W	NA	W	NA
Miscellaneous ⁴	155	NA	74	NA
Total	320	12,000	216	6,120

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)

	2009		2010	
	Quantity	Value	Quantity	Value
Type:				
Attapulgite	(2)	(2)	(2)	(2)
Montmorillonite	2,010	206,000	2,050	201,000
Total	2,010	206,000	2,050	201,000
Use:				
Absorbents:				
Oil and grease absorbent	255	NA	153	NA
Pet waste absorbent	1,220	NA	1,380	NA
Animal feed	63	NA	54	NA
Fertilizers	W	NA	W	NA
Fillers, extenders, binders ³	107	NA	111	NA
Filtering, clarifying, and decolorizing ⁴	72	NA	89	NA
Miscellaneous ⁵	261	NA	223	NA
Exports, reported by producers ⁶	33	NA	34	NA
Total	2,010	206,000	2,040	201,000

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.

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 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)

	2009		2010	
	Quantity	Value	Quantity	Value
State:				
Georgia	4,970	693,000	5,050	757,000
South Carolina	144	8,590	158	10,500
Other ²	180	12,700	214	20,500
Total	5,290	714,000	5,420	788,000
Type:				
Airfloat	894	73,200	758	65,800
Calcined ³	1,180	203,000	1,340	252,000
Delaminated	824	118,000	984	137,000
Unprocessed	55	1,190	58	823
Water washed	2,330	319,000	2,280	332,000
Total	5,290	714,000	5,420	788,000

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

²Includes Alabama, Arkansas, 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	2009		2010	
	Quantity	Value	Quantity	Value
Type:				
Airfloat	761	62,400	621	54,100
Calcined ²	1,100	195,000	1,240	242,000
Delaminated	824	118,000	984	137,000
Water washed	2,280	318,000	2,200	324,000
Total	4,970	693,000	5,050	757,000
Use:				
Domestic:				
Ceramics and glass:				
Catalysts (oil-refining)	W	NA	W	NA
Fiberglass, mineral wool	217	NA	185	NA
Roofing granules	34	NA	27	NA
Other ³	296	NA	820	NA
Fillers, extenders, binders:				
Adhesives	17	NA	19	NA
Paint	164	NA	176	NA
Paper coating	1,560	NA	1,460	NA
Paper filling	196	NA	75	NA
Plastic	57	NA	21	NA
Rubber	121	NA	118	NA
Other ⁴	38	NA	48	NA
Heavy-clay products ⁵	(6)	NA	(6)	NA
Refractories ⁷	(6)	NA	(6)	NA
Undistributed ⁸	757	NA	785	NA
Total	3,460	NA	3,730	NA
Exports, reported by producers:				
Paint	53	NA	48	NA
Paper coating ⁹	1,260	NA	1,070	NA
Paper filling ⁹	46	NA	37	NA
Rubber	41	NA	36	NA
Undistributed ¹⁰	105	NA	125	NA
Total	1,500	NA	1,320	NA
Grand total	4,970	693,000	5,050	757,000

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)

	2009		2010	
	Quantity	Value	Quantity	Value
Production ²	144	8,590	158	10,500
Use:				
Ceramics ³	68	NA	67	NA
Rubber	30	NA	31	NA
Other uses ⁴	46	NA	60	NA
Total	144	8,590	158	10,500

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), exports, 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	2009	2010
Domestic:		
Ceramics:		
Catalyst (oil and gas refining)	233	179
Electrical porcelain	W	W
Fine china and dinnerware	7	6
Floor and wall tile	82	84
Pottery	W	W
Roofing granules	34	35
Sanitaryware	35	42
Miscellaneous ceramics	84	54
Chemical manufacture	W	W
Fiberglass, mineral wool	224	244
Fillers, extenders, binders:		
Adhesive	19	20
Fertilizer	W	W
Paint	176	190
Paper coating	1,570	1,720
Paper filling	196	149
Pesticide	W	W
Plastic	63	50
Rubber	150	172
Miscellaneous fillers, extenders, binders	39	44
Heavy-clay products:		
Brick, common and face	54	37
Portland cement	55	86
Refractories ²	614	695
Miscellaneous applications	137	167
Total	3,770	3,970
Exports, reported by producers:		
Ceramics ³	W	W
Paint	61	84
Paper coating	1,260	1,190
Paper filling	46	44
Rubber	45	40
Miscellaneous	107	91
Total	1,520	1,450
Grand total	5,290	5,420

W Withheld to avoid disclosing company proprietary data; included in "Miscellaneous ceramics and Miscellaneous fillers, extenders, binders."

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

²Includes firebrick (blocks and shapes), grogs and calcines, and miscellaneous refractories.

³Withheld to avoid disclosing company proprietary data; included 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
2009:					
Alabama	356	25	43	424	14,900
Arkansas	130	32	--	162	6,250
Indiana	91	54	72	218	6,000
Kansas	--	--	62	62	541
Kentucky	46	38	--	84	4,660
Louisiana	132	53	129	314	8,820
Missouri	--	--	124	124	1,080
Nebraska	--	--	1	1	3
New York	153	257	--	411	26,200
Ohio	72	40	68	179	7,700
Oklahoma	20	3	--	23	714
Texas	156	168	409	733	5,270
Utah	93	58	149	300	7,050
Virginia	67	1	23	90	2,060
Total	1,310	731	1,080	3,130	91,300
2010:					
Alabama	361	25	43	430	11,900
Arkansas	128	32	--	160	6,240
Indiana	63	32	65	162	6,500
Kansas	19	3	201	28	188
Kentucky	44	36	--	80	4,470
Louisiana	62	19	29	110	1,030
Missouri	22	18	63	103	1,110
Nebraska	--	--	454	454	2
New York	163	272	--	435	28,200
Ohio	72	40	68	180	7,820
Oklahoma	20	3	--	25	703
Texas	149	161	385	699	5,540
Utah	91	57	112	260	5,820
Virginia	145	2	51	196	4,490
Total	1,340	700	1,470	3,320	84,000

^eEstimated. -- 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	2009		2010	
	Quantity	Value ^c	Quantity	Value ^c
Alabama	571	6,950	541	6,210
Arkansas	147	705	22	47
California	120	734	117	710
Colorado	42	309	93	242
Georgia	581	3,620	607	3,670
Kentucky ³	200	1,210	200	1,210
Mississippi	263	1,540	259	1,540
North Carolina	828	4,980	621	2,830
Ohio	405	4,770	439	4,990
Oklahoma	415	1,720	404	1,540
Pennsylvania	398	2,230	288	1,650
South Carolina	301	1,250	257	1,140
Tennessee	113	817	114	817
Texas	429	2,150	457	2,460
Virginia	312	1,420	306	1,520
Other ⁴	1,110	6,590	1,270	7,260
Total	6,230	41,000	6,000	37,800

^cEstimated.

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	2009		2010		Principal destinations in 2010
	Quantity	Value	Quantity	Value	
Ball clay	35	2,430	45	3,030	Mexico, 40%; Venezuela, 15%; Costa Rica, 12%.
Bentonite	709	100,000	953	143,000	Canada, 45%; Japan, 11%; Saudi Arabia, 8%; China, 6%.
Fire clay	328	42,800	404	61,500	Mexico, 54%; Luxembourg, 22%; Japan, 9%.
Fuller's earth	90	28,500	100	35,400	Japan, 20%; China, 10%; United Kingdom, 8%.
Kaolin	2,290	459,000	2,470	537,000	Japan, 17%; Canada, 13%; Chile, 11%; Finland, 11%; Mexico, 11%.
Clays, n.e.c.	374	69,500	383	82,600	Canada, 70%.
Total	3,830	702,000	4,360	862,000	

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	2009		2010		Principal sources in 2010
	Quantity	Value	Quantity	Value	
China clay or kaolin	281	68,700	239	56,300	Brazil, 94%.
Fire clay	(2)	133	(2)	179	Canada, 50%; Germany, 48%.
Decolorizing earths and fuller's earth	1	96	2	160	Japan, 79%; China, 21%.
Bentonite	8	2,460	16	4,670	Greece, 46%; Mexico, 23%; Canada, 17%.
Common blue clay and other ball clay	--	--	1	138	United Kingdom, 70%; Canada, 30%.
Other clay	8	3,940	7	4,560	Peru, 41%; Canada, 38%.
Chamotte or Dina's Earth	(2)	165	(2)	110	Czech Republic, 69%; Sweden, 21%.
Artificially activated clay and earth	27	28,800	19	25,800	Mexico, 70%; Germany, 17%.
Total	325	104,000	284	92,000	

-- Zero.

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; as adjusted by U.S. Geological Survey.

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

(Metric tons)

Country ³	2006	2007	2008	2009	2010 ^e
Algeria ⁴	27,100	32,600	30,600	31,000	31,000
Argentina	246,000	250,000	256,000	148,000 ^r	200,000
Armenia ^e	720	1,130	50 ^r	238 ^r	1,400 ⁵
Australia ^{e,4}	220,000	255,000	250,000	240,000	230,000
Azerbaijan ^e	40,600	50,500	40,700 ^r	10,600 ^r	18,100 ⁵
Bolivia	--	--	1 ^r	323 ^r	440 ⁵
Bosnia and Herzegovina	24,600	32,900	30,500	16,000 ^r	16,000
Brazil, beneficiated	235,000	330,000 ^r	340,000 ^r	264,000 ^r	265,000
Bulgaria	134,000	99,000	178,000	108,000 ^r	110,000
Burma	904	971	1,000 ^e	1,000 ^e	1,000
Chile	--	533	--	--	--
Croatia	16,400	19,600	19,800 ^r	-- ^r	--
Cyprus	150,000	150,000	150,000	150,000	150,000
Czech Republic	267,000	335,000	174,000 ^e	116,000	183,000
Egypt ^e	30,000	29,800 ⁵	32,000 ⁵	32,000	30,000
Georgia ^e	4,490 ⁵	5,000	5,000	5,000	5,000
Germany	364,000	385,000	414,000	326,000 ^r	350,000
Greece ^e	1,130,000 ⁵	950,000	1,500,000 ^r	845,000 ^{r,5}	850,000
Guatemala	20,000	23,600	62,700	14,300 ^r	22,400 ⁵
Hungary	6,600	54,000	50,000	45,000 ^{r,e}	50,000
Indonesia ^e	5,500	5,500	6,000	6,000	6,500
Iran ⁶	260,000	254,000 ⁵	358,000 ^{r,5}	380,000 ^r	400,000
Italy ^e	470,000	306,000 ^r	281,000	146,000	111,000
Japan	425,000	430,000	435,000	432,000	430,000
Kenya ^e	60	70	70	70	70
Macedonia ^e	32,500	35,200	22,900	15,400 ^r	15,400
Malawi	--	2,080	7,020	8,050	1,020
Mexico	435,000	614,000	375,000	511,000 ^r	591,000
Morocco	80,400	81,000	80,000	80,000	80,000
Mozambique	3,520	10,500 ^r	17,700 ^r	7,390 ^r	12,000
New Zealand, processed ^e	3,030	6,150	753	880	900
Pakistan	23,800	32,400 ^r	33,000 ^r	34,000 ^r	35,000
Peru	19,000	21,500	31,600	119,000	44,300 ⁵
Philippines	1,000 ^e	1,150	1,420	1,410 ^r	1,500
Poland ⁷	93,900	106,000	121,000	81,400 ^r	81,000
Romania	21,200	16,900	16,600 ^r	13,800 ^r	14,000
Serbia	-- ^r	-- ^r	-- ^r	-- ^r	--
Slovakia	136,000	149,000	145,000	109,000 ^r	110,000
South Africa ⁸	32,900	45,800	44,100	40,300	54,300 ⁵
Spain ^e	155,000 ⁵	155,000	155,000	155,000	155,000
Turkey	1,130,000 ^r	1,740,000 ^r	1,550,000 ^r	932,000 ^r	1,200,000
Turkmenistan ^e	50,000	50,000	50,000	50,000	50,000
Ukraine ^e	300,000	300,000	200,000 ^r	195,000 ^r	200,000
United States	4,940,000	4,820,000	5,030,000	3,650,000	4,630,000 ⁵
Zimbabwe ⁸	500	100	100	-- ^{r,e}	--
Total	11,500,000 ^r	12,200,000 ^r	12,500,000 ^r	9,320,000 ^r	10,700,000

^eEstimated. ^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.

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

²Table includes data available through September 25, 2011.

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	2006	2007	2008	2009	2010 ^c
Australia, attapulgite ^c	10,000	10,000	10,000	9,500	10,000
Guatemala	19	109	--	--	-- ⁴
Italy ^c	3,000	3,000	3,000	3,000	3,000
Mexico	102,400	34,175	66,123	108,139	179,000
Morocco, smectite ^c	15,000	15,000	15,000	15,000	15,000
Pakistan	15,848 ^r	12,884 ^r	13,000 ^{r,e}	15,000 ^{r,e}	17,000
Senegal, attapulgite	140,000	150,000 ^e	167,000	180,000 ^r	204,000
South Africa, attapulgite	49,225	68,377	69,876	54,418 ^r	65,336 ⁴
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}	2,540,000	2,600,000	2,340,000	2,010,000	2,050,000 ⁴
Total	3,700,000	3,720,000	3,500,000 ^r	3,210,000	3,360,000

^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 September 25, 2011.

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	2006	2007	2008	2009	2010 ^e
Algeria	32,523	106,567	50,788	50,000 ^e	50,000
Argentina	49,619	69,354	55,000	78,792 ^r	75,000
Australia, includes ball clay ^e	250,000	250,000	230,000	230,000	240,000
Austria, marketable	51,900	56,690	49,527	83,980 ^r	80,000
Bangladesh ^{e,4}	8,500	8,600	8,500	8,500	8,500
Belgium ^e	300,000	300,000	300,000	300,000	300,000
Bosnia and Herzegovina, crude	69,643	188,033	259,325	148,384 ^r	150,000
Brazil, beneficiated	2,455,000	2,456,000 ^r	2,674,000	1,987,000 ^r	2,000,000 ^p
Bulgaria	1,658,000	1,631,000	1,530,000	939,000 ^r	940,000
Chile	44,642	87,901	63,526	48,354	62,226 ⁵
Czech Republic	3,768,000	3,604,000	3,833,000	2,886,000	3,493,000 ⁵
Denmark, sales ^e	2,500	2,500	2,500	2,500	2,500
Ecuador	11,504	18,618	15,000 ^{r,e}	15,000 ^{r,e}	15,000
Egypt	416,000 ^e	331,671	523,327	550,000	500,000
Eritrea	100	100	100	100	100
Ethiopia	1,641	1,400 ^e	1,275	3,534	3,600
France, marketable ^e	300,000	307,253 ⁵	300,000	300,000	300,000
Germany	3,815,173	3,842,514	3,622,159 ^r	4,513,753 ^r	4,500,000
Greece ^e	50,000	40,000	4,360	-- ⁵	--
Guatemala	4,395	2,663	2,803	1,879	2,143 ⁵
Hungary, processed	7,000	3,000	3,000	2,800 ^{r,e}	3,000
India: ^e					
Processed	200,000	200,000	210,000	210,000	220,000
Salable crude	560,000	570,000	570,000	580,000	580,000
Indonesia ^e	15,000	15,000	15,000	15,000	15,000
Iran ^e	310,000	350,000	320,000	320,000	330,000
Italy, kaolinitic earth	469,702	635,297	591,298	1,069,938	641,000
Japan	10,500	11,000	11,000 ^e	12,000 ^e	12,000
Jordan	112,787	101,000	181,018	177,470	180,000 ⁵
Kenya	810	900 ^r	930 ^r	890 ^r	900
Korea, Republic of	2,399,458	688,330	954,584	659,351 ^r	764,008 ⁵
Kyrgyzstan ^e	400,000	400,000	400,000	400,000	400,000
Malawi	920	1,000	1,100	--	--
Malaysia	341,223	587,508	506,462	463,732 ^r	530,331 ⁵
Mexico	961,800	86,784	85,091	78,086	120,094 ⁵
New Zealand	14,864	14,130	12,761	9,016	10,000
Nigeria ^e	100,000	100,000	100,000	100,000	100,000
Pakistan	443,402 ^r	756,536 ^r	750,000 ^r	760,000 ^r	770,000
Paraguay ^e	66,000	66,000	66,000	66,000	66,000
Peru	5,750	7,532	13,215	9,347	16,678 ⁵
Poland, washed	144,000 ^r	153,000 ^r	166,000 ^r	143,000 ^r	145,000
Portugal	167,792	183,598	231,346 ^r	274,925 ^r	284,715 ⁵
Romania	11,063	7,576	3,166 ^r	1,000 ^e	1,000
Russia, concentrate ^e	45,000	45,000	45,000	45,000	45,000
Saudi Arabia	4,000	4,400	4,400	5,000 ^{r,e}	5,000
Serbia: ^e					
Crude	110,000	110,000	110,000	110,000	110,000
Washed	18,000	10,000	10,000	10,000	10,000

See footnotes at end of table.

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

(Metric tons)

Country ³	2006	2007	2008	2009	2010 ^e
Slovakia	58,000	46,000	44,000	10,000 ^r	10,000
South Africa	51,602	50,839	39,505	31,048	29,929 ⁵
Spain, marketable, crude and washed ⁶	464,049	450,000	465,000	465,000	485,000
Sri Lanka	10,914	11,178	10,039	10,000 ^e	11,000
Thailand, beneficiated	157,900	159,186	162,215	160,000 ^e	160,000
Turkey	1,064,107	914,117	792,044 ^r	727,649 ^r	800,000
Uganda ^e	30,000	30,000	30,000	30,000	30,000
Ukraine	1,731,000	2,172,000	1,775,000	1,119,000	1,120,000
United Kingdom, sales ⁷	1,800,000	1,800,000	1,800,000	1,800,000	900,000
United States ⁸	7,470,000	7,110,000	6,740,000	5,290,000	5,420,000 ⁵
Uzbekistan ^e	5,500,000	5,500,000	5,500,000	5,500,000	5,500,000
Venezuela ^e	10,000	10,000	10,000	10,000	10,000
Vietnam ^e	650,000	650,000	650,000	650,000	650,000
Zambia ^e	200	200	200	200	200
Total	39,200,000 ^r	37,300,000 ^r	36,900,000 ^r	33,500,000 ^r	33,200,000

^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 September 25, 2011.

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.