



# 2009 Minerals Yearbook

---

## CLAY AND SHALE

---

# CLAY AND SHALE

By Robert L. Virta

**Domestic survey data and tables were prepared by Maria Arguelles, statistical assistant and the world production tables were prepared by Lisa D. Miller, international data coordinator.**

The amount of clay sold or used by domestic producers in 2009 declined 25% to 24.5 million metric tons (Mt) valued at \$1.33 billion compared with 32.7 Mt valued at \$1.65 billion in 2008 (table 1). Common clay and shale accounted for 51% of the tonnage, and kaolin accounted for 54% of the value (tables 1, 5, and 8). In 2009, exports declined 25% to 3.83 Mt valued at \$702 million compared with 5.1 Mt valued at \$938 million in 2008. Imports of clays were 325,000 metric tons (t) valued at \$104 million in 2009 compared with 237,000 t valued at \$86.6 million in 2008 (table 1).

About 170 companies mined clay and shale in the United States in 2009. The 20 leading companies, many with multiple operations, accounted for 57% of the tonnage and 81% 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, Virginia, Tennessee, and Mississippi. The 10 leading producer companies were, in alphabetical order, American Colloid Co. (bentonite); BASF SE (bentonite, fuller's earth, and kaolin); Black Hills Bentonite Co. (bentonite); General Shale Products Corp. (common clay and shale); Imerys SA (ball clay and kaolin); KaMin LLC (kaolin); Nestle S.A. (fuller's earth); Oil-Dri Corp. of America. (fuller's earth); Texas Industries Inc. (common clay and shale); and Thiele Kaolin Co. (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 55% of the total clay and shale tonnage sold or used quantity listed in table 1. Most nonrespondents were producers of common clay and shale. 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 2009, four companies mined ball clay in four States. Production of domestic ball clay declined 14% to 831,000 t valued at \$37.7 million in 2009 compared with 967,000 valued at \$44.3 million in 2008 (table 3). Operations

in Tennessee supplied 61% 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.**—The principal domestic ball clay markets were, in decreasing order by tonnage, 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.

Ball clay sales declined largely because the decrease in residential and commercial construction in the United States resulted in a reduced demand for ceramic tile and sanitaryware. Based on data from the U.S. Census Bureau (2010a), production and shipments of clay floor and wall tile were 9% and 10%, respectively, less than in 2008. Production was 55.4 million square meters in 2009 compared with 61 million square meters in 2008 and shipments were 53 million square meters in 2009 compared with 58.9 million square meters in 2008.

Domestic sales of ball clay can be affected by imports of products such as ceramic 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 decreased in quantity to 6.95 million square meters valued at \$68.6 million in 2009 from 10.8 million square meters valued at \$108 million in 2008. Mexico, China, and Italy were the three leading sources of tile imports, with 28%, 22%, and 18% of the import volume, respectively. Imports of sanitaryware under the 4-digit HTS Code 6910 decreased to 21.8 million units in 2009 from 28.7 million units in 2008. China accounted for 10.5 million units or 48% of the U.S. sanitaryware imports in 2009, while Mexico accounted for 7.81 million units or 36% of the imports.

Imerys, the leading ball clay producer in the United States, indicated that it experienced significant sales losses for ceramics as a result of the global economic recession in 2009 (Imerys SA, 2010, p. 17). It is likely that other ball clay producers experienced similar declines in sales.

**Prices.**—The average value for ball clay reported by domestic producers was \$45.37 per metric ton, slightly less than \$45.84 per ton in 2008 (table 3). The average value for exported ball clay was \$69.62 per ton (table 14).

**Trade.**—Ball clay exports were 34,900 t valued at \$2.43 million in 2009 compared with 64,900 t valued at \$4.58 million in 2008, according to the U.S. Census Bureau (table 14). Producers reported exports of 209,000 t (table 3). Most of the difference in exports reported by producers and the U.S. Census Bureau probably involves shipments to Mexico, whose trade statistics

suggest that their kaolin import data may have included some imports of ball clay. Also, 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.**—Most sales of ball clay were for the manufacture of floor and wall tile, sanitaryware, and other construction related ceramics; so the recovery of the housing and commercial construction markets is necessary if the ball clay production is to increase. Although new privately owned housing starts began to increase in 2010, the value of construction put in place continued to decline (U.S. Census Bureau, undated; 2011a). Also, issues remained with mortgage foreclosures and tight credit in the United States. Despite the sluggish economy and low construction activity, the U.S. Census Bureau (2010b) indicated that production and shipments of clay floor and wall tile began to increase.

With global economies gradually recovering from the economic recession, U.S. ball clay sales may increase 8% to 10% in 2010 compared with those of 2009. Even with these anticipated gains, production and sales in 2010 would still be less than those of the past 15 years.

## Bentonite

**Production.**—In 2009, 21 companies produced bentonite in 11 States. About 3.65 Mt valued at \$207 million was sold or used in 2009, 26% less than the 4.91 Mt valued at \$267 million of bentonite sold or used in 2008 (table 4). Production of nonswelling bentonite decreased 33% to 116,000 t valued at \$8.14 million in 2009 from 172,000 t valued at \$10.4 million in 2008. Alabama led in the production of nonswelling bentonite, followed by, in descending order of tonnage, Mississippi, Arizona, Colorado, California, and Nevada.

Production of swelling bentonite was 3.53 Mt valued at \$198 million in 2009, a decrease of 26% from 4.74 Mt valued at \$257 million in 2008. Wyoming led in the production of swelling bentonite, followed by Montana, Utah, Texas, California, Oregon, Nevada, and Mississippi.

Wyo-Ben, Inc. refurbished its bentonite plant in Lucerne, WY. The plant, built in 1980, had been on care-and-maintenance status for about 20 years. The fully automated plant had an annual production capacity of 500,000 metric tons per year (t/yr) and could produce bentonite products for cat litter, drilling mud, foundry sand, and iron ore pelletizing applications (Industrial Minerals, 2009f). The company also submitted a request to the U.S. Bureau of Land Management to mine claims in Hot Springs County, WY (Industrial Minerals, 2009g).

AMCOL International Corp. idled its Belle Fourche, SD, plant in response to declining markets in 2009 but also began investigating new mining sites near Belle Fourche (The Daily Republic, 2009).

**Consumption.**—In 2009, domestic sales and use of bentonite were 3.00 Mt and total sales (domestic and export) were 3.65 Mt compared with domestic sales of 4.09 Mt and total sales of 4.91 Mt in 2008. Domestic sales of bentonite were 587,000 t for drilling mud (all swelling bentonite), 443,000 t for foundry sand bond (more than 99% was swelling bentonite), 445,000 t for pelletizing iron ore (all swelling bentonite), and 925,000 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).

These markets are representative of those of swelling bentonite, which accounted for more than 97% of total bentonite sales. The leading use of nonswelling bentonite was in water treatment and filtering. The leading use of nonswelling bentonite was in water treatment and filtering.

For the smaller markets, swelling bentonite accounted for more than 95% of the bentonite sold for adhesives; animal feed; cosmetics, medical, and pharmaceutical; fertilizers; miscellaneous ceramics; miscellaneous chemical manufacturing applications; and paint but less than 30% of the bentonite sold for pesticide carriers and water treatment and filtering.

Sales to nearly all bentonite markets were lower than those of 2008 owing to the global recession.

**Prices.**—The average value reported by domestic producers for nonswelling bentonite was \$70.17 per ton. The average value for swelling bentonite was \$56.09 per ton. The average value for all bentonite was \$56.71 per ton (table 4). The average value of exported bentonite was \$141.04 per ton. The average value of imported bentonite was \$307.50 per ton (tables 14, 15).

The price of bentonite that was sold in bulk, crude form in railcars for iron ore pelletizing from the mill in Wyoming was \$53 to \$61 per ton; foundry-grade that was bagged and shipped in railcars was \$77 to \$99 per ton; and American Petroleum Institute (API)-grade bentonite that was bagged and shipped in railcars was \$77 to \$110 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, Milos, Greece, was \$72 to \$108 per ton for foundry grade (Industrial Minerals, 2009e).

The average annual producer price index (PPI) for bentonite under North American Industry Classification System code 212325C was 155.3 in 2009 (1984=100) compared with 150.2 in 2008. The PPI decreased during the year from 156.0 in January to 154.8 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 decreased to 709,000 t valued at \$100 million in 2009 from 1.09 Mt valued at \$161 million in 2008 (table 14). Canada, Japan, the Netherlands, and Poland accounted for the largest share of the decline in exports. Most of the decline was related to the downturn in demand by the iron ore, foundry, and oil drilling industries. Changes in trade with other countries were relatively minor. Domestic bentonite producers reported exports of 646,000 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 8,000 t valued at \$2.46 million. Imports of artificially activated material were 27,000 t valued at \$28.8 million (table 15).

**Outlook.**—After experiencing a large downturn in early to mid-2009, drilling mud and iron ore pelletizing markets rebounded toward the end of the year because of increased oil drilling and increased demand for steel. Foundry sand bond markets also may improve owing to increased activity in the automotive and heavy industries in 2010. As a result, overall bentonite sales may increase 8% to 10% in 2010. However, growth will not be the same for all markets.

Absorbent markets, particularly pet waste absorbents, were a major, seemingly imperturbable market for swelling bentonite for many years, but sales of bentonite for pet waste absorbents declined as a result of reduced consumer spending (AMCOL International Corp., 2010, p. 29, 33). Pet litter markets may remain unchanged or decline slightly in 2010. Sales of bentonite for oil absorbent applications were expected to increase 7% to 8% in 2010 compared with those of 2009 because the increase in U.S. industrial output in early 2010 compared with 2009 suggested some recovery in the U.S. economy (Federal Reserve, 2011).

AMCOL, a leading producer of bentonite for oil drilling applications, reported a decline in oil drilling in 2009 in response to the global recession and lesser demand for drilling mud (AMCOL International Corp., 2010, p. 29). U.S. drilling activity was less in 2009 than in 2008 (1,310 rotary drilling rigs in 2009 compared with 2,259 drilling rigs in 2008) but began to recover in late 2009 and early 2010. The global rotary drilling rig count was 3,336 in 2008 and 2,304 in 2009 (Baker-Hughes Inc., undated). Sales of bentonite for drilling mud applications may increase 15% to 20% in 2010 compared with those of 2009 because of increased drilling activity in 2010.

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 (S&B Industrial Minerals S.A., 2010, p. 8). By mid-2009, production of iron ore began to improve and continued into 2010 (Jorgenson, 2011). Sales of bentonite for pelletizing iron ore may increase by 10% to 15% in 2010 based on this information. Sales of bentonite for foundry sand bond applications may increase 5% to 10% in 2010 because of increased U.S. industrial output (Federal Reserve, 2011).

Sales of bentonite for civil engineering applications such as waterproofing and sealing and landfill caps and liners probably will continue to increase gradually as societal needs increase. Other smaller markets for bentonite also may increase 3% to 6% in 2010 as the U.S. economy slowly improves.

## Common Clay and Shale

**Production.**—In 2009, 130 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 29% to 12.5 Mt valued at \$156 million in 2009 compared with 17.5 Mt valued at \$202 million in 2008 (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 Pennsylvania. These 10 States accounted for 64% of U.S. common clay and shale production.

Sales declined in nearly all States owing to decreased residential and commercial building activity in 2009.

Boral Bricks Inc. announced it would reopen a brick plant in Augusta, GA. The company closed the plant earlier in the year because low market demand resulted in a buildup of excess brick inventory at the plant. The company had three plants in Augusta, one of which still remained idle (Emerson, 2009).

Nevada Cement Co. received approval to operate a shale mine near Fernley, NV. The company was to mine shale from the Bureau of Land Management property for use in the production of cement. Mine life was expected to be 25 years with about 100,000 t of shale being extracted (Aggregate Research.com, 2009).

**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 90% of sales in 2009. Lightweight aggregate sales were subdivided into concrete block (1.31 Mt), structural concrete (731,000 t), miscellaneous lightweight aggregates (597,000 t), and highway surfacing (483,000 t). Other lesser markets included civil engineering, floor and wall tile and other ceramics, heavy-clay (nonbrick) products, and refractory products (table 5). Sales of products made from common clay and shale declined in 2009.

Production of brick was 40% less in 2009 than in 2008 (3.28 billion bricks in 2009 compared with 5.43 billion bricks in 2008), and brick shipments were 31% less (3.59 billion bricks in 2009 compared with 5.19 billion bricks in 2008). Production and shipments of vitrified clay sewer pipe and fittings in 2009 decreased 23% and 41%, respectively, from those of 2008. Production of clay pipe and fitting was 45,000 t in 2009 compared with 58,500 t in 2008, and shipments were 45,500 t in 2009 compared with 77,500 t in 2008 (U.S. Census Bureau, 2010a). These declines are in line with a decrease in housing starts (554,000 units in 2009 compared with 906,000 units in 2008) and value of construction put in place (\$908 billion in 2009 compared with \$1.07 trillion in 2008) (U.S. Census Bureau, undated; 2011a).

**Prices.**—The average value for all common clay and shale produced in the United States was \$12.48 per ton compared with \$11.54 per ton in 2008. The unit value of clay and shale used to produce lightweight aggregate was estimated to be \$29.17 per ton in 2009. Average prices for lightweight aggregate produced from clay and shale ranged from \$30 to \$70 per ton for most applications.

The annual average PPI for common (miscellaneous) clay and shales under North American Industry Classification System code 212325B was 171.7 in 2009 (1984=100) compared with 168.3 in 2008. The PPI increased during the year from 170.5 in January to 172.0 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 U.S. recession in 2009. The industry lost considerable sales because of the sharp decrease in residential and commercial construction in the United States. Sales declined for construction-related products such as brick, drain tile, floor and wall tile, portland cement, roofing granules and tile, and

sewer pipe in 2009. The U.S. Census Bureau (2010b) reported the production and shipments of brick, floor and wall tile, and vitrified clay sewer pipe and fitting began to improve in 2010. However, commercial, public, and residential construction did not show signs of improvement in 2010 (U.S. Census Bureau, undated; 2011a). Also, issues remained with mortgage foreclosures and tight credit in the United States. Until these issues are resolved, growth in sales of common clay to those housing-related markets likely will be relatively modest. Even with a sizable increase of up to 8% to 10%, common clay and shale production will remain considerably lower than production levels of the past 30 years.

## Fire Clay

**Production.**—Fire clay producers were mostly refractory product manufacturers that used the clays in firebrick and various heavy-clay products. In 2009, nine firms mined fire clay in six States. Fire clay mined by domestic producers increased 8% to 320,000 t valued at \$12.0 million from 296,000 t valued at \$11.8 million in 2008 (table 6). Missouri was the leading producing State, followed by, in descending order of tonnage, California, Ohio, Texas, Washington, and Colorado. The 8% increase in production took place primarily because several producers that sell common clay and shale indicated that they also mined fire clay in 2009; most of their fire clay production, however, was used for common clay applications. Sales of fire clay for the manufacture of products used by refractory markets declined because of decreased demand for fire brick.

A.P. Green (a subsidiary of ANH Refractories Co.) reopened its refractory plant in Fulton, MO, in late November in response to increased orders from the cement and steel manufacturing companies. Orders declined in early 2009 because customers were drawing down their inventories of fire brick before reordering (Norfleet, 2009).

Harbison-Walker Refractories Co. (a subsidiary of ANH Refractories Co.) decided to idle its refractory product plant in Fairfield, AL, because of an overall decline in U.S. demand for refractory products in 2009. The plant was expected to reopen when demand increased (Feytis, 2009).

**Consumption.**—Consumption of fire clay increased 8% to 320,000 t in 2009 from 296,000 t in 2008. Markets for fire clay were, in descending order of tonnage, refractory calcines and grogs, portland cement, floor and wall tile, refractory mortar and cement, firebrick, common brick, miscellaneous ceramics, and pottery (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 increased because several common clay and shale producers indicated that they also mined fire clay in 2009.

The U.S. Census Bureau (2010b) reported that the value of U.S. manufacturers' shipments of clay refractory products (based primarily on fire clay and kaolin) was \$764 million in 2009 compared with \$925 million in 2008. The value of U.S. apparent consumption (manufacturers' shipments plus imports minus exports) of all clay refractory products was \$368 million

in 2009 versus \$546 million in 2008. In 2009, shipments of fire clay, high-alumina, and insulating brick shapes in 9-inch equivalents, were 237,000 t, a decline of 43% from those of 2008. Shipments of castables, gunning mixes, and unshaped clay refractory bonding mortars were 374,000 t in 2009, a decline of 27% from those of 2008. Shipments of clay and high alumina refractory materials for reprocessing and direct sales were withheld by the Census Bureau in 2009 to avoid disclosing company proprietary data.

**Prices.**—In 2009, the average value for fire clay reported by domestic producers was \$37.53 per ton, a decrease from \$39.86 per ton in 2008 (table 6). The decrease in value in 2009 from that of 2008 resulted from a large decline in sales of higher-value fire clay for the manufacture of refractory products. The average value of exported fire clay was \$130.48 per ton. The average value of imported fire clay was \$943.26 per ton (tables 14, 15).

**Trade.**—In 2009, exports decreased to 328,000 t valued at \$42.8 million compared with 393,000 t valued at \$49.6 million in 2008 (table 14). A decrease in exports to Luxembourg, a major distribution center for European shipments, accounted for the largest share of the U.S. export decline. In general, exports declined because of lower global demand for refractory products. At least 43% 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 2009, imports were 141 t valued at \$133,000 (table 15).

**Outlook.**—After declining in 2009, sales for fire clay may increase 10% to 15% in 2010 compared with that of 2009. The Federal Reserve indicated that industrial output began to increase in 2010 (Federal Reserve, 2011). Consequently, major users of refractory products such as the aluminum, glass, iron, lime, and steel industries may plan to increase their production, possibly resulting in increased demand for refractory products for their furnaces.

RHI AG, a major world producer of refractory products, reported improved sales in the second half of 2009 and anticipated additional growth in 2010 (RHI AG, 2010).

Sales for construction-related products, such as brick, cement, lightweight aggregate, and tile, that are manufactured using fire clay face the same issues as common clay and shale, a dependence on growth in the private housing and commercial construction sections to support growth in heavy-clay markets. These fire clay markets may increase 5% to 7% in 2010 compared with those of 2009.

## Fuller's Earth

**Production.**—In 2009, 13 companies produced fuller's earth in 11 States. Fuller's earth deposits grade from palygorskite (attapulgitite) in Florida to montmorillonite, further northward in Georgia. Gellant grades of attapulgitite, used as thickeners in such items as drilling muds and paints, were mined in western Florida and southwestern Georgia. Absorbent grades of attapulgitite were mined further north in Georgia. Absorbent grades of attapulgitite were grouped with the montmorillonite variety of fuller's earth in table 7 to be consistent with past reporting.

Gellant-grade attapulgitite was mined or sold in the Florida Panhandle and southwestern Georgia by two companies.

Attapulgite production was withheld to avoid revealing company proprietary data but production decreased in 2009 compared with that of 2008 (table 7). Florida led in the production of attapulgite, followed by Georgia.

Production of the montmorillonite variety of fuller's earth decreased 14% to 2.01 Mt valued at \$206 million in 2009 compared with 2.34 Mt valued at \$230 million in 2008 (table 7). Montmorillonite-type fuller's earth was produced, in decreasing order of tonnage, in Georgia, Missouri, Mississippi, Virginia, California, Illinois, Florida, Tennessee, Nevada, Kansas, and Texas. Georgia, Missouri, and Mississippi accounted for 61% of U.S. production.

Active Minerals International, LLC, opened a mine and mill in Climax, GA. The partially processed attapulgite from the Climax operation was shipped to a Quincy, FL, facility for additional processing. The mine and mill had a design capacity of 180,000 t/yr (Active Minerals International LLC, undated).

Oil-Dri Corp. of America expanded its Ripley, MS, plant to produce a granular product for agricultural markets, specifically carriers for herbicides, insecticides, and fungicides. The \$7 million plant addition had a capacity of 10,000 to 15,000 t/yr. Oil-Dri planned to spend \$12 million on additional plant expansions at Ripley (Industrial Minerals, 2009d).

**Consumption.**—Consumption of fuller's earth (excluding attapulgite-type fuller's earth) was 2.01 Mt in 2009 compared with 2.34 Mt in 2008. Pet waste absorbent was the leading market for fuller's earth, followed by oil and grease absorbents; fillers, extenders, and binders; and clarifying, decolorizing, and filtering of oils and greases (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 uses of attapulgite-type fuller's earth were in fillers, extenders, and binders; drilling mud; clarifying, decolorizing, and filtering of oils and greases; and oil and grease absorbents. Montmorillonite grades dominated sales to most fuller's earth markets although attapulgite accounted for most of the sales of fuller's earth for adhesives, cosmetic, medical, and pharmaceutical applications; and drilling mud.

**Prices.**—The average value of attapulgite-type fuller's earth was withheld to avoid disclosing company proprietary data but the value decreased from that of 2008. The average value of montmorillonite-type fuller's earth was \$102.48 per ton, an increase from \$98.29 in 2008 (table 7). The average value of exported fuller's earth was \$317.02 per ton. The average value of imported fuller's earth was \$75.51 per ton (tables 14, 15).

**Trade.**—In 2009, exports decreased to 89,900 t valued at \$28.5 million compared with 127,000 t valued at \$44.0 million in 2008 (table 14). Japan accounted for about 61% of the decline in exports. Exports to other countries declined only slightly or remained relatively unchanged. Imports of decolorizing earth and fuller's earth were 1,270 t valued at \$95,900 in 2009 (table 15).

**Outlook.**—Pet waste absorbent is the leading market for fuller's earth. The leading U.S. provider of fuller's earth for pet waste absorbent applications indicated that its retail and wholesale sales increased by 6% through part of 2010 (Oil Dri Corp., 2010b, p. 15). Based on this information, overall sales for pet waste applications may increase 4% to 6% in 2010.

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 2010, industrial output increased slightly (Federal Reserve, 2011). This suggests that 2010 sales of fuller's earth for oil and grease absorbent applications may increase 5% to 7% compared with those of 2009.

According to one major fuller's earth producer, sales as carriers and suspension agents in fertilizers and pesticides used for agriculture and lawn and garden products decreased in 2009 as a result of the economic slowdown. The same was true of sports products for baseball fields and golf courses as municipalities and other purchasers of sport-related products reduced spending (Oil-Dri Corp. of America, 2010a, p. 17). Consequently, only slight growth may take place in 2010 compared with 2009.

Other uses for fuller's earth are relatively small in volume compared to absorbent applications. Sales for clarifying, decolorizing, and filtering of animal, mineral, and vegetable oils and greases are dependent on the quality of the oil source. Consequently, sales tend to vary yearly rather than follow economic trends. However, one major producer of fuller's earth for this application increased sales by the end of 2009 and in early 2010 (Oil-Dri Corp. of America, 2010a, p. 17). Sales of attapulgite-type fuller's earth for construction-related filler and extender applications, such as in adhesives, asphalt emulsions, caulks, joint compounds, paint, and roof coatings, may increase 1% to 3% in 2010. Sales for drilling mud applications may increase 10% to 15% in 2010 compared with those of 2009, assuming the U.S. economy continues to improve and energy demand also increases.

In general, any improvement in the U.S. economy will likely result in slightly improved sales for nonabsorbent applications for fuller's earth. The factors discussed above suggest that overall sales of fuller's earth may increase 7% to 10% in 2010, an improvement compared with that of 2009 but still below the production and sales levels in recent years.

## **Kaolin**

**Production.**—In 2009, 17 firms mined kaolin in 9 States. Domestic production decreased 22% to 5.29 Mt valued at \$714 million compared with 6.74 Mt valued at \$900 million in 2008 (table 8). The leading producer State was Georgia, followed by, in descending order of tonnage, South Carolina, Alabama, Arkansas, Nevada, Florida, Texas, North Carolina, and California.

Of the 5.29 Mt sold or used in 2009, 2.33 Mt was reported as water washed, 1.18 Mt was calcined, 894,000 t was airfloat, 824,000 t was delaminated, and 55,300 t was unprocessed (table 8). This compares with 3.08 Mt of water washed, 1.39 Mt of calcined, 1.13 Mt of airfloat, 1.07 Mt of delaminated, and 78,000 t of unprocessed in 2008 (table 8). Pigment-grade (low-temperature calcined kaolin) accounted for more 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 2009. A small amount also was produced in Texas.

Kaolin production in Georgia decreased 21% to 4.97 Mt valued at \$693 million in 2009 compared with 6.29 Mt valued at \$872 million in 2008. Approximately 2.28 Mt of Georgia kaolin production sold was reported as water washed, 1.10 Mt was calcined (high- and low-temperature calcined kaolin), 824,000 t was delaminated, and 761,000 t was airfloat in 2009. This compares with 3.00 Mt water washed, 1.36 Mt calcined, 1.07 Mt delaminated, and 859,000 t airfloat in 2008 (table 9). Production in South Carolina declined 28% to 144,000 t valued at \$8.59 million in 2009 compared with 199,000 t valued at \$11.3 million in 2008 (table 10).

Imerys, one of the leading U.S. kaolin producers, indicated that sales in most markets declined in 2009. Sales to paper applications declined globally with the downturn in demand for printing and writing paper, partially resulting from decreased advertising and inventory reductions by major paper manufacturers. Sales for construction and manufacturing markets, such as adhesives, paint, plastics, and refractory products declined with the downturn in European and North American manufacturing (Imerys, 2010, p. 17, 18, 26, 30). Imerys reduced production capacity at its Sandersville, GA, plant in response to decreased U.S. sales (Imerys, 2010, p. 59).

Applied Minerals, Inc. (formerly Atlas Mining Co.) continued to develop its halloysite mine in Juab County, Utah. The company also signed an agreement to have KaMin LLC process up to 24,000 t of halloysite, with the option to adjust processing steps and increase capacity if indicated by the market (Business Wire, 2009; Industrial Minerals, 2009b).

Advanced Primary Minerals Corp. (APM) opened its kaolin processing plant in Dearing, GA. The plant produced air-float kaolin in its initial stage of operation for ceramic tile and sanitaryware. Tests were planned to determine the feasibility of producing calcined and hydrous kaolin products for catalyst and paint markets. Plant capacity, when fully operational, for air-float kaolin was to be 50,000 t/yr, and anticipated capacity for wet processed kaolin, if it is determined to be economically feasible, was to be 150,000 t/yr. APM processed kaolin mined in McDuffie County, GA (Advanced Primary Minerals Corp., 2009; Industrial Minerals, 2009a).

The U.S. Forest Service approved Daleco Resources Corp.'s plan to mine kaolin in Sierra County, NM. The deposit, located in the Gila National Forest, reportedly contains an estimated 55.3 Mt of recoverable mineralized material (Daleco Resources Corp., 2009, p. 10).

**Consumption.**—Consumption of kaolin decreased 22% to 5.29 Mt in 2009 from 6.74 Mt in 2008 (table 8). The major domestic markets for kaolin were, in descending order of tonnage, paper coating and filling, refractory products, catalyst manufacture, and fiberglass and mineral wool. Other large markets were paint, rubber, heavy-clay products (brick and portland cement), and ceramics (table 11).

Paper coating and filling markets accounted for 58% of kaolin sales in 2009 but also accounted for 65% of the decline experienced by the industry in 2009. Nearly all major kaolin end-use markets declined in 2009 in response to the global economic recession.

For Georgia producers, the slowdown in paper- and construction-related markets affected their sales. Sales of

kaolin produced in Georgia decreased 21% to 4.97 Mt in 2009 compared with 6.29 Mt in 2008. Major domestic markets for kaolin from Georgia were, in descending order by tonnage, paper coating and filling; refractory products; ceramics and glass; and fillers, extenders, and binders (table 9).

South Carolina producers were most affected by a slowdown in sales to rubber and construction markets. Sales by the South Carolina kaolin producers decreased 28% to 144,000 t in 2009 compared with 199,000 t in 2008. Major domestic markets for kaolin from South Carolina were, in descending order of tonnage, catalyst manufacture (under Ceramics), rubber, brick, fiberglass, and plastics (table 10).

**Prices.**—The average value of kaolin was \$134.97 per ton for all kaolin grades. The average value for airfloat was \$81.88 per ton; delaminated, \$143.20 per ton; unprocessed, \$21.64 per ton; and water washed, \$136.91 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 \$172.03 per ton (table 8). The value of pigment-grade kaolin declined slightly in 2009. The average value of exported kaolin was \$200.44 per ton. The average value of the imported kaolin was \$244.48 per ton (tables 14, 15).

The price of number 1 paper coating grades of kaolin from a plant in Georgia was \$161 to \$204 per ton and the price of number 2 paper coating grades was \$105 to \$162 per ton. The price of refractory clay products from Georgia, in bulk bags, was \$143 per ton (Industrial Minerals, 2009e).

The annual average PPI for ball clay and kaolin mining under North American Industry Classification System code 2123240 was 176.6 in 2009 (1984=100) compared with 156.5 in 2008. The PPI was relatively constant throughout the year with the largest increase being from 164.3 in December 2008 to 176.4 in January 2009. 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 declined in 2009 largely because the global economic downturn resulted in a reduced demand for kaolin for paper manufacture. In 2009, 2.29 Mt of kaolin valued at \$459 million was exported compared with 2.96 Mt valued at \$606 million in 2008 (table 14). Decreased shipments of kaolin to Canada and Japan accounted for 66% of the decline in U.S. exports. Producers reported exports of 1.52 Mt (table 11). Much of the 445,000 t destined for Canada and 264,000 t for 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 281,000 t of kaolin valued at \$68.7 million in 2009 compared with 194,000 t valued at \$46.1 million in 2008 (table 15). Inaccuracies have been observed in some of the kaolin import data from Brazil in the past, raising the possibility that imports in 2009 may have been 290,000 t to 300,000 t. If so, there would have been a slight decrease in imports in 2009, which would have been consistent with trends in the paper industry. About 89% of the kaolin was imported 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 continued to be hampered by a changing paper market. Kaolin faced competition from ground and precipitated calcium carbonate for many years and continues to do so. Additionally, U.S. paper production industry declined for several years. Paper production by the Confederation of European Paper Industries member countries declined an estimated 11% in 2009 (Confederation of European Paper Industries, 2010). However, paper shipments by U.S. manufacturers began to increase in 2010 as did the production of printing and writing paper (American Forest & Paper Association, 2010; U.S. Census Bureau, 2011b). Even a slight increase in paper production in many regions of the globe in 2010 will benefit the U.S. kaolin industry. Sales of kaolin for paper applications may remain unchanged or increase only slightly in the United States in 2010. Export sales of kaolin may increase 6% to 10%, particularly in Asian markets, where economic growth surpassed other parts of the world.

Industrial output for manufacturing improved in early 2010 (Federal Reserve, 2011). This suggested that sales for manufacturing-related applications in industries such as catalysts, chemicals, plastics, refractory products, and rubber may increase 5% to 10% in 2010 compared with 2009.

Commercial, public, and residential construction did not show signs of improvement in 2010 (U.S. Census Bureau, undated; 2011a). Also, issues remained with mortgage foreclosures and tight credit in the United States. Consequently, 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, 1% to 3%, in 2010 compared with those of 2009 if the construction trend continues through 2010.

## World Review

World production of bentonite was approximately 9.66 Mt (table 16). Fuller's earth production was 3.21 Mt (table 17). Kaolin production was about 33 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 20 and 22 Mt, after excluding 4.1 Mt for Uzbekistan, 2.8 Mt for Germany, 2 Mt for the Czech Republic, 1.4 Mt each for Bulgaria and Ukraine, 500,000 t for Italy, 300,000 t each for Turkey and Vietnam, 200,000 t for Egypt, and 100,000 t each for Australia and Iran, to account for processing losses and stockpiling. The United States continued to be the leading supplier of processed clay for sale, followed by Greece and Turkey 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.

**Azerbaijan.**—AzRospromInvest (a joint venture between Azerbaijan and Russia) completed construction of its bentonite

processing plant near its Dash Salahli bentonite deposit in the Gazakh region. Plant capacity was 250,000 t/yr of activated bentonite (Azeri Times, The, 2009).

**Brazil.**—Vale S.A. announced that kaolin production at its subsidiary, CADAM S.A., increased in the third quarter of 2009 because of strong demand in Asian markets. Production for its subsidiary, Pará Pigmentos S.A., decreased because of weak demand in other global markets. However, overall kaolin sales for Vale declined to 781,000 t in 2009 compared with 1.13 Mt in 2008 (Vale S.A., 2009, 2010).

**India.**—Italian bentonite producer, Laviosa, formed a joint venture with Trimex Industries Ltd. to mine bentonite in the State of Gujarat. The joint venture was to build a plant, scheduled to open in early 2010, with a 70,000-t/yr capacity for bentonite and 120,000-t/yr capacity for dried granular products. The joint venture planned to supply bentonite for cat litter, iron ore pelletizing, and drilling mud (Industrial Minerals, 2009c).

**Italy.**—S&B Industrial Minerals S.A. transferred its shares of Bentec S.p.A. to Laviosa Chimica Mineraria SpA, an Italian bentonite producer that is partially owned by S&B. The \$1.53 million share transfer gave Laviosa full ownership of Bentec, allowing the two companies to merge and simplify their organizational structures (S&B Industrial Minerals S.A., 2009).

**Venezuela.**—RusKaolin (a joint venture between the Venezuelan government and Russian Agapov-owned Kaolin Venezuela) planned to mine kaolin in the State of Bolivar. The deposit contained more than 38 Mt of reserves. Production was planned to be 300,000 t/yr (VHeadline.com, 2009).

## References Cited

- Active Minerals International, LLC, [undated], History: Huntsville, MD, Active Minerals International, LLC, 2 p. (Accessed January 7, 2010, at <http://www.stream-data.com/activeminerals/about/history.php>.)
- Advanced Primary Minerals Corp., 2009, APM opens processing plant to develop high quality primary kaolin: Halifax, Canada, Advanced Primary Minerals Corp. press release, October 13, 2 p.
- Aggregate Research.com, 2009, Council approves quarry permit for Nevada pozzolan plant: Aggregate Research.com, March 25. (Accessed August 24, 2009, at <http://www.aggregateresearch.com/article.aspx?id=15883>.)
- AMCOL International Corp., 2010, 10-K—2009: U.S. Securities and Exchange Commission, March 16, 113 p.
- American Forest & Paper Association, 2010, Total printing-writing paper shipments in April up 10% from 2009: Washington, DC, American Forest & Paper Association press release, May 21, 1 p. (Accessed June 7, 2010, at <http://www.statmill.org/detailedpressrelease.asp?rid=227&pid=APR2010>.)
- Azeri Times, The, 2009, Azerbaijan-Russia joint venture makes profit for first time: The Azeri Times [Baku, Azerbaijan], July 3, 1 p. (Accessed July 23, 2009, at <http://www.theazeritimes.com/site/economy/2173>.)
- Baker Hughes Inc., [undated], Worldwide rig count: Houston, TX, Baker Hughes Inc. (Accessed January 20, 2011, via [http://investor.shareholder.com/bhi/rig\\_counts/rc\\_index.cfm](http://investor.shareholder.com/bhi/rig_counts/rc_index.cfm).)
- Business Wire, 2009, Applied Minerals, Inc. (formerly Atlas Mining Company) announces entering into a memorandum of understanding with KaMin Performance Minerals LLC: New York, NY, Business Wire, November 11, 1 p. (Accessed March 20, 2011, at <http://www.businesswire.com/news/home/20091120005057/en/Applied-Minerals-Atlas-Mining-Company-Announces-Entering>.)
- Confederation of European Paper Industries, 2010, Preliminary Statistics 2009: Brussels, Belgium, Confederation of European Paper Industries press release, January 14, 2 p. (Accessed June 7, 2010, at <http://www.cepi.org/DocShare/Common/GetFile.asp?PortalSource=3640&DocID=26848&mfd=off&pdoc=1>.)
- Daily Republic, The, 2009, Company wants to expand mining near Belle Fourche: The Daily Republic [Mitchell, SD], October 20, 1 p. (Accessed



October 21, 2009, at <http://www.mitchellrepublic.com/event/apArticle/id/D9BEU4P81/>.)

Daleco Resources Corp., 2009, Form 10-K—2009: U.S. Securities and Exchange Commission, January 13, 68 p.

Emerson, LaTina, 2009, Boral Bricks Inc. to reopen; 33 get jobs back: The Augusta Chronicle [Augusta, GA], April 21, 1 p. (Accessed April 28, 2009, at [http://chronicle.augusta.com/cgi-bin/print\\_story.pl](http://chronicle.augusta.com/cgi-bin/print_story.pl).)

Federal Reserve, 2011, Industrial production and capacity utilization: Federal Reserve Statistical Release G.17, January 14, 4 p. (Accessed February 14, 2011, at <http://www.federalreserve.gov/releases/g17/Current/default.htm>.)

Feytis, Alexandra, 2009, Refractory clays stuck in the mud: Industrial Minerals, no. 505, October, p. 44–51.

Imerys SA, 2010, 2009 reference document including the annual financial report: Paris, France, Imerys SA, April 1, 228 p. (Accessed February 14, 2011, at [http://www.imerys.com/uniflip/uniflip\\_publication\\_DocdeRef2009vo/document.pdf](http://www.imerys.com/uniflip/uniflip_publication_DocdeRef2009vo/document.pdf).)

Industrial Minerals, 2009a, APM opens kaolin facility: Industrial Minerals, October 14, 1 p. (Accessed October 15, 2009, at <http://www.indmin.com/print.aspx?ArticleId=2315764>.)

Industrial Minerals, 2009b, Atlas develops Utah halloysite: Industrial Minerals, November 10, 1 p. (Accessed November 12, 2009, at <http://www.indmin.com/print.aspx?ArticleId=2335267>.)

Industrial Minerals, 2009c, Laviosa celebrates Indian bentonite j-v: Industrial Minerals, no. 499, April, p. 8.

Industrial Minerals, 2009d, Oil-Dri targets agrimarkets with new bentonite plant: Industrial Minerals, no. 502, July, p. 11.

Industrial Minerals, 2009e, Prices: Industrial Minerals, no. 507, December, p. 68–69.

Industrial Minerals, 2009f, Wyo-Ben completes Lucerne rebuild: Industrial Minerals, no. 504, September, p. 14.

Industrial Minerals, 2009g, Wyo-Ben ends bentonite refurb: Industrial Minerals, August 3, 1 p. (Accessed August 8, 2009, at <http://www.indmin.com/Print.aspx?ArticleId=2266348>.)

Jorgenson, J.D., 2011, Iron ore in July 2010: U.S. Geological Survey Mineral Industry Surveys, December, 7 p.

Norfleet, Don, 2009, Employees return to work at A.P. Green: Fulton Sun [Fulton, MO], December 30, 2 p. (Accessed January 4, 2010, at <http://www.fultonsun.com/articles/2009/12/30/news/080news01.txt>.)

Oil-Dri Corp. of America, 2010a, Form 10-Q: U.S. Securities and Exchange Commission, March 10, 31 p.

Oil-Dri Corp. of America, 2010b, Form 10-Q: U.S. Securities and Exchange Commission, December 8, 31 p.

RHI AG, 2010, Preliminary results of RHI AG: Vienna, Austria, RHI AG press release, March 11, 4 p. (Accessed February 14, 2011, at [http://www.rhi-ag.com/internet/en/refractories/News\\_20MR/2010\\_20News\\_20div/100311\\_\\_Results\\_\\_dl,templateId=default,property=Data.pdf](http://www.rhi-ag.com/internet/en/refractories/News_20MR/2010_20News_20div/100311__Results__dl,templateId=default,property=Data.pdf).)

S&B Industrial Minerals S.A., 2009, S&B Industrial Minerals S.A. simplifies its minority participation in Laviosa Chimica Mineraria S.p.A. and Bentec S.p.A.: Kifissia, Greece, S&B Industrial Minerals S.A. press release, June 1, 1 p.

S&B Industrial Minerals S.A., 2010, Annual financial report for the year ending December 31, 2009: Kifissia, Greece, S&B Industrial Minerals S.A., March 10, 132 p. (Accessed February 14, 2011, at [http://www.s.andb.gr/en/economy/etisies/S&B\\_2009\\_Annual\\_Financial\\_Report\\_in\\_accordance\\_with\\_IFRS.pdf](http://www.s.andb.gr/en/economy/etisies/S&B_2009_Annual_Financial_Report_in_accordance_with_IFRS.pdf).)

U.S. Bureau of Labor Statistics, [undated], Producer price index—Industry data: U.S. Bureau of Labor Statistics. (Accessed March 18, 2010, via <http://www.bls.gov/data>.)

U.S. Census Bureau, [undated], New privately owned housing units started: U.S. Census Bureau. (Accessed February 10, 2011, via <http://www.census.gov/const/startsan.pdf>.)

U.S. Census Bureau, 2010a, Clay construction products—Summary 2009: U.S. Census Bureau MQ327D(09)–5, May, 8 p. (Accessed February 14, 2011, at [http://www.census.gov/manufacturing/cir/historical\\_data/mq327d/index.html](http://www.census.gov/manufacturing/cir/historical_data/mq327d/index.html).)

U.S. Census Bureau, 2010b, Refractories—2009: U.S. Census Bureau MA327C(09)–1, July, 7 p. (Accessed February 14, 2011, at [http://www.census.gov/manufacturing/cir/historical\\_data/ma327c/index.html](http://www.census.gov/manufacturing/cir/historical_data/ma327c/index.html).)

U.S. Census Bureau, 2011a, Annual value of construction put in place: U.S. Census Bureau, February 2. (Accessed June 3, 2010, via <http://www.census.gov/const/C30/total.pdf>.)

U.S. Census Bureau, 2011b, Full report on manufacturers' shipments, inventories and orders: U.S. Census Bureau M3–2 (10)–12, February 3, 9 p.

U.S. International Trade Commission, [undated], International trade database: U.S. International Trade Commission. (Accessed April 20, 2009, at [http://dataweb.usitc.gov/scripts/user\\_set.asp](http://dataweb.usitc.gov/scripts/user_set.asp).)

Vale S.A., 2009, 3Q09 production report: Rio de Janeiro, Brazil, Vale S.A., October 28, 13 p. (Accessed June 21, 2010, at [http://www.vale.com/vale\\_us/media/REPORT3T09i.pdf](http://www.vale.com/vale_us/media/REPORT3T09i.pdf).)

Vale S.A., 2010, 2009 production report: Rio de Janeiro, Brazil, Vale S.A., February 10, 14 p. (Accessed June 21, 2010, at [http://www.vale.com/vale\\_us/media/REPORT4T09i.pdf](http://www.vale.com/vale_us/media/REPORT4T09i.pdf).)

VHeadline.com, 2009, 38 million metric tones of caolin expected to last for more than 100 years: Worth, IL, VHeadline.com, August 8, 4 p. (Accessed August 11, 2009, at <http://www.vheadline.com/readnews.asp?id=82721>.)

## GENERAL SOURCES OF INFORMATION

### U.S. Geological Survey Publications

Clays. Ch. in United States Mineral Resources, Professional Paper 820, 1973.

Clays. Ch. in Mineral Commodity Summaries, annual.

### Other

China Clay Producers Association.

Clays. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

TABLE 1  
SALIENT U.S. CLAY STATISTICS<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

	2005	2006	2007	2008 <sup>r</sup>	2009
<b>Domestic clays sold or used by producers:</b>					
Quantity	41,200	41,200	36,700	32,700	24,500
Value	1,590,000	1,770,000	1,750,000	1,650,000	1,330,000
<b>Exports:</b>					
Quantity	5,620	5,980	5,650	5,100	3,830
Value	929,000	1,000,000	928,000	938,000	702,000
<b>Imports for consumption:</b>					
Quantity	301	346	231	237	325
Value	59,400	79,200	73,900	86,600	104,000

<sup>r</sup>Revised.

<sup>1</sup>Excludes Puerto Rico.

TABLE 2  
CLAYS SOLD OR USED BY PRODUCERS IN THE  
UNITED STATES, BY STATE<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

State <sup>3</sup>	2008		2009	
	Quantity	Value	Quantity	Value
Alabama	1,970	34,400	1,340	25,300
Arkansas	796	10,700	539	7,630
California	618	6,930	340	4,690
Colorado	143	684	61	435
Florida	21	2,520	18	3,000
Georgia	7,880 <sup>r</sup>	929,000 <sup>r</sup>	5,600	697,000
Indiana	667	8,080	413	6,610
Iowa	269	1,140	184	828
Kansas	548	2,840	381	2,430
Kentucky	419	8,170	288	5,980
Louisiana	509	12,900	353	9,120
Michigan	365	1,730	318	1,310
Mississippi	869	6,030	263	1,540
Missouri	496	3,470	421	3,020
New York	745	28,200	605	30,200
North Carolina	1,270	12,900	828	4,980
Ohio	983	15,900	770	13,400
Oklahoma	756	3,900	572	2,800
Pennsylvania	640	4,840	451	3,040
South Carolina	690	13,500	455	9,890
South Dakota	155	W	W	W
Tennessee	723	27,000	624	23,600
Texas	2,140	25,700	1,850	21,600
Utah	479	10,200	342	7,230
Virginia	766	8,540	505	5,830
Wyoming	4,440 <sup>r</sup>	233,000 <sup>r</sup>	3,270	172,000
Other <sup>4</sup>	3,360 <sup>r</sup>	241,000 <sup>r</sup>	3,760	269,000
Total	32,700 <sup>r</sup>	1,650,000 <sup>r</sup>	24,500	1,330,000

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data; included in "Other."

<sup>1</sup>Excludes Puerto Rico.

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

<sup>3</sup>Publishable totals used to avoid disclosing company proprietary data.

<sup>4</sup>Includes all other producer States, concealed data within States, and data represented by symbol W.

TABLE 3  
BALL CLAY SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY TYPE AND USE<sup>1</sup>

(Thousand metric tons and thousand dollars)

	2008		2009	
	Quantity	Value	Quantity	Value
Type:				
Airfloat	690	31,000	588	26,000
Water-slurried	103	4,920	93	4,440
Unprocessed	174	8,380	151	7,230
Total	967	44,300	831	37,700
Use:				
Fillers, extenders, binders <sup>2</sup>	39	NA	37	NA
Floor and wall tile	340	NA	299	NA
Miscellaneous ceramics <sup>3</sup>	92	NA	77	NA
Pottery	12	NA	4	NA
Sanitaryware	202	NA	181	NA
Miscellaneous <sup>4</sup>	28	NA	24	NA
Exports, reported by producers <sup>5</sup>	255	NA	209	NA
Total	967	44,300	831	37,700

NA Not available.

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

<sup>2</sup>Includes animal feed; asphalt emulsions; rubber; and other fillers, extenders, and binders.

<sup>3</sup>Includes catalysts, electrical porcelain, fiberglass, fine china/dinnerware, glass, mineral wool, and roofing granules.

<sup>4</sup>Includes heavy-clay products, waterproofing seals, refractories, and other unknown uses.

<sup>5</sup>Includes ceramics and glass and floor and wall tile.

TABLE 4  
BENTONITE SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY TYPE AND USE<sup>1</sup>

(Thousand metric tons and thousand dollars)

	2008		2009	
	Quantity	Value	Quantity	Value
<b>Type:</b>				
Nonswelling	172	10,400	116	8,140
Swelling	4,740 <sup>r</sup>	257,000 <sup>r</sup>	3,530	198,000
Total	4,910 <sup>r</sup>	267,000 <sup>r</sup>	3,650	207,000
<b>Use:</b>				
<b>Domestic:</b>				
Pet waste absorbents	1,040 <sup>r,e</sup>	NA	925 <sup>e</sup>	NA
Adhesives	31 <sup>r</sup>	NA	9	NA
Animal feed	95	NA	60	NA
Drilling mud	954	NA	587	NA
Filler and extender applications <sup>2</sup>	84	NA	69	NA
Foundry sand	567 <sup>r,e</sup>	NA	443 <sup>e</sup>	NA
Pelletizing (iron ore)	686 <sup>r,e</sup>	NA	445 <sup>e</sup>	NA
Waterproofing and sealing	168	NA	102	NA
Miscellaneous civil engineering	305 <sup>r,e</sup>	NA	190 <sup>e</sup>	NA
Miscellaneous <sup>3</sup>	160 <sup>r</sup>	NA	170	NA
Total	4,090 <sup>r,e</sup>	NA	3,000 <sup>e</sup>	NA
<b>Exports, reported by producers:</b>				
Drilling mud	149 <sup>r,e</sup>	NA	105 <sup>e</sup>	NA
Foundry sand	259	NA	192	NA
Other <sup>4</sup>	410 <sup>r</sup>	NA	349	NA
Total	818 <sup>r,e</sup>	NA	646 <sup>e</sup>	NA
Grand total	4,910 <sup>r</sup>	267,000 <sup>r</sup>	3,650	207,000

<sup>e</sup>Estimated. <sup>r</sup>Revised. NA Not available.

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

<sup>2</sup>Includes 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.

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

<sup>4</sup>Includes 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<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

	2008		2009	
	Quantity	Value	Quantity	Value
<b>State:</b>				
Alabama	1,970	34,400	1,340	25,300
Arkansas	796	10,700	539	7,630
California	469	3,570	318	2,370
Georgia	952	6,020	631	3,870
Indiana	667	8,080	413	6,610
Kansas	548	2,840	381	2,430
Kentucky	419	8,170	288	5,980
Louisiana	509	12,900	353	9,120
Mississippi	433	2,340	263	1,540
Missouri	496	3,470	421	3,020
New York	745	28,200	605	30,200
North Carolina	1,260	12,900	828	4,980
Ohio	983	15,900	770	13,400
Oklahoma	756	3,900	572	2,800
Pennsylvania	640	4,840	451	3,040
South Carolina	461	2,130	311	1,300
Texas	2,070	13,700	1,800	13,000
Utah	479	10,200	342	7,230
Virginia	766	8,540	505	5,830
Other <sup>3</sup>	2,050	9,140	1,330	6,170
<b>Total</b>	<b>17,500</b>	<b>202,000</b>	<b>12,500</b>	<b>156,000</b>
<b>Use:</b>				
Floor and wall tile <sup>4</sup>	241	NA	181	NA
<b>Heavy-clay products:</b>				
Brick, extruded	8,020	NA	5,680	NA
Brick, other	795	NA	547	NA
Other <sup>5</sup>	266	NA	165	NA
<b>Lightweight aggregate:</b>				
Concrete block	1,890	NA	1,310	NA
Highway surfacing	341	NA	483	NA
Structural concrete	897	NA	731	NA
Miscellaneous	810	NA	597	NA
Portland and other cements	2,670 <sup>r</sup>	NA	1,900	NA
Refractories <sup>6</sup>	596	NA	360	NA
Miscellaneous <sup>7</sup>	947 <sup>r</sup>	NA	493	NA
<b>Total</b>	<b>17,500</b>	<b>202,000</b>	<b>12,500</b>	<b>156,000</b>

<sup>r</sup>Revised. NA Not available.

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

<sup>2</sup>Excludes Puerto Rico.

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

<sup>4</sup>Includes ceramic tile, quarry tile, and miscellaneous floor and wall tiles.

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

<sup>6</sup>Includes firebrick, blocks and shapes, mortar and cement, grogs and calcines, and miscellaneous refractories.

<sup>7</sup>Includes 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 USE<sup>1</sup>

(Thousand metric tons and thousand dollars)

	2008		2009	
	Quantity	Value	Quantity	Value
Production	296 <sup>r</sup>	11,800 <sup>r</sup>	320	12,000
Use:				
Heavy-clay products and lightweight aggregates <sup>2</sup>	127 <sup>r</sup>	NA	146	NA
Refractories:				
Firebrick, block, shapes	W	NA	19	NA
Groggs and calcines	W	NA	W	NA
Other refractories <sup>3</sup>	W	NA	W	NA
Miscellaneous <sup>4</sup>	169	NA	155	NA
Total	296 <sup>r</sup>	11,800 <sup>r</sup>	320	12,000

<sup>r</sup>Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; included in "Miscellaneous."

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

<sup>2</sup>Includes common brick, concrete block, portland cement, and structural concrete.

<sup>3</sup>Includes kiln furniture, mortar and cement, and miscellaneous refractories.

<sup>4</sup>Includes 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 USE<sup>1</sup>

(Thousand metric tons and thousand dollars)

	2008		2009	
	Quantity	Value	Quantity	Value
Type:				
Attapulgite	(2)	(2)	(2)	(2)
Montmorillonite	2,340 <sup>r</sup>	230,000 <sup>r</sup>	2,010	206,000
Total	2,340 <sup>r</sup>	230,000 <sup>r</sup>	2,010	206,000
Use:				
Absorbents:				
Oil and grease absorbent	316 <sup>r</sup>	NA	255	NA
Pet waste absorbent	1,160 <sup>r</sup>	NA	1,220	NA
Animal feed	51 <sup>r</sup>	NA	63	NA
Fertilizers	W	NA	W	NA
Fillers, extenders, binders <sup>3</sup>	130 <sup>r</sup>	NA	107	NA
Filtering, clarifying, and decolorizing <sup>4</sup>	80 <sup>r</sup>	NA	72	NA
Miscellaneous <sup>5</sup>	581 <sup>r</sup>	NA	261	NA
Exports, reported by producers <sup>6</sup>	22 <sup>r</sup>	NA	33	NA
Total	2,340 <sup>r</sup>	230,000 <sup>r</sup>	2,010	206,000

<sup>r</sup>Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; included in "Miscellaneous."

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

<sup>2</sup>Withheld 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.

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

<sup>4</sup>Includes mineral and vegetable oils and greases.

<sup>5</sup>Includes civil engineering, drilling mud, miscellaneous absorbents, and other unknown uses.

<sup>6</sup>Includes 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 TYPE<sup>1</sup>

(Thousand metric tons and thousand dollars)

	2008		2009	
	Quantity	Value	Quantity	Value
<b>State:</b>				
Georgia	6,290	872,000	4,970	693,000
South Carolina	199	11,300	144	8,590
Other <sup>2</sup>	257	16,800	180	12,700
<b>Total</b>	<b>6,740</b>	<b>900,000</b>	<b>5,290</b>	<b>714,000</b>
<b>Type:</b>				
Airfloat	1,130	79,700	894	73,200
Calcined: <sup>3</sup>	1,390	260,000	1,180	203,000
Delaminated	1,070	144,000	824	118,000
Unprocessed	78	1,530	55	1,190
Water washed	3,080	414,000	2,330	319,000
<b>Total</b>	<b>6,740</b>	<b>900,000</b>	<b>5,290</b>	<b>714,000</b>

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

<sup>2</sup>Includes Alabama, Arkansas, California, Florida, Nevada, North Carolina, and Texas.

<sup>3</sup>Includes 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 USE<sup>1</sup>

(Thousand metric tons and thousand dollars)

Kind	2008		2009	
	Quantity	Value	Quantity	Value
<b>Type:</b>				
Airfloat	859	63,600	761	62,400
Calcined <sup>2</sup>	1,360	251,000	1,100	195,000
Delaminated	1,070	144,000	824	118,000
Water washed	3,000	413,000	2,280	318,000
Total	6,290	872,000	4,970	693,000
<b>Use:</b>				
<b>Domestic:</b>				
<b>Ceramics and glass:</b>				
Catalysts (oil-refining)	W	NA	W	NA
Fiberglass, mineral wool	251	NA	217	NA
Roofing granules	31	NA	34	NA
Other <sup>3</sup>	372 <sup>r</sup>	NA	296	NA
<b>Fillers, extenders, binders:</b>				
Adhesives	33	NA	17	NA
Paint	237	NA	164	NA
Paper coating	1,880	NA	1,560	NA
Paper filling	250	NA	196	NA
Plastic	81	NA	57	NA
Rubber	124	NA	121	NA
Other <sup>4</sup>	28	NA	38	NA
Heavy-clay products <sup>5</sup>	(6)	NA	(6)	NA
Refractories <sup>7</sup>	(6)	NA	(6)	NA
Undistributed <sup>8</sup>	931	NA	757	NA
Total	4,220	NA	3,460	NA
<b>Exports, reported by producers:</b>				
Paint	70	NA	53	NA
Paper coating <sup>9</sup>	1,760	NA	1,260	NA
Paper filling <sup>9</sup>	110	NA	46	NA
Rubber	46	NA	41	NA
Undistributed <sup>10</sup>	87	NA	105	NA
Total	2,070	NA	1,500	NA
Grand total	6,290	872,000	4,970	693,000

<sup>r</sup>Revised. NA Not available. W Withheld to avoid disclosing company proprietary data.

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

<sup>2</sup>Includes pigment- and refractory-grade calcined kaolin.

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

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

<sup>5</sup>Includes brick (common and face), portland cement, and miscellaneous clay products.

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

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

<sup>8</sup>Includes absorbents, chemical manufacturing, floor and wall tiles, heavy-clay products, refractory products, waterproofing seals, and other unknown uses.

<sup>9</sup>Some export sales, by producers, may be included under domestic sales.

<sup>10</sup>Includes miscellaneous ceramics and miscellaneous fillers, extenders, and other unknown uses.



TABLE 10  
SOUTH CAROLINA KAOLIN SOLD OR USED BY PRODUCERS, BY USE<sup>1</sup>

(Thousand metric tons and thousand dollars)

	2008		2009	
	Quantity	Value	Quantity	Value
Production <sup>2</sup>	199	11,300	144	8,590
Use:				
Ceramics <sup>3</sup>	79	NA	68	NA
Rubber	45	NA	30	NA
Other uses <sup>4</sup>	75	NA	46	NA
Exports, reported by producers <sup>5</sup>	W	NA	W	NA
Total	199	11,300	144	8,590

NA Not available. W Withheld to avoid disclosing company proprietary data; included in "Other uses."

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

<sup>2</sup>Includes airfloat, unprocessed, and calcined kaolin.

<sup>3</sup>Includes catalysts (oil-refining), fiberglass, roofing granules, and sanitaryware.

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

<sup>5</sup>Includes fillers, extenders, and binders.

TABLE 11  
KAOLIN SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY USE<sup>1</sup>

(Thousand metric tons)

Use	2008	2009
Domestic:		
Ceramics:		
Catalyst (oil and gas refining)	295	233
Electrical porcelain	W	W
Fine china and dinnerware	12	7
Floor and wall tile	106	82
Pottery	4	W
Roofing granules	31	34
Sanitaryware	25	35
Miscellaneous ceramics	110 <sup>r</sup>	84
Chemical manufacture	W	W
Fiberglass, mineral wool	262	224
Fillers, extenders, binders:		
Adhesive	35	19
Fertilizer	W	W
Medical, pharmaceutical, cosmetic	W	--
Paint	255	176
Paper coating	1,890	1,570
Paper filling	250	196
Pesticide	W	W
Plastic	88	63
Rubber	169	150
Miscellaneous fillers, extenders, binders	33 <sup>r</sup>	39
Heavy-clay products:		
Brick, common and face	52	54
Portland cement	64	55
Refractories <sup>2</sup>	804	614
Miscellaneous applications	167 <sup>r</sup>	137
Total	4,650 <sup>r</sup>	3,770
Exports, reported by producers:		
Ceramics <sup>3</sup>	W	W
Paint	83	61
Paper coating	1,760	1,260
Paper filling	110	46
Rubber	52	45
Miscellaneous	91	107
Total	2,090	1,520
Grand total	6,740	5,290

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data; included in "Miscellaneous ceramics and Miscellaneous fillers, extenders, binders." -- Zero.

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

<sup>2</sup>Includes firebrick (blocks and shapes), grogs and calcines, and miscellaneous refractories.

<sup>3</sup>Withheld 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 STATE<sup>1</sup>

(Thousand metric tons and thousand dollars)

State	Concrete block	Structural concrete	Other <sup>2</sup>	Total	
				Quantity	Value <sup>e</sup>
2008:					
Alabama	593	42	71	705	21,000
Arkansas	169	56	--	225	8,690
Indiana	57	41	18	116	3,190
Kansas	--	--	55	55	480
Kentucky	66	72	--	138	6,400
Louisiana	192	77	185	454	12,500
Missouri	--	--	133	133	1,160
Nebraska	--	--	(3)	(3)	2
New York	259	305	--	564	24,900
North Carolina	--	--	6	6	48
Ohio	98	54	93	245	10,300
Oklahoma	28	4	--	32	952
Texas	206	165	360 <sup>r</sup>	730	5,200
Utah	127	80	200	407	9,270
Virginia	91	1	31	124	2,750
Total	1,890	897	1,150	3,930	107,000
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

<sup>e</sup>Estimated. <sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Includes highway surfacing.

<sup>3</sup>Less than ½ unit.

TABLE 13  
COMMON CLAY AND SHALE USED IN BUILDING BRICK  
PRODUCTION IN THE UNITED STATES, BY STATE<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

State	2008		2009	
	Quantity	Value <sup>e</sup>	Quantity	Value <sup>e</sup>
Alabama	782	9,260	571	6,950
Arkansas	257	1,100	147	705
California	164	978	120	734
Colorado	108	467	42	309
Georgia	884	5,690 <sup>f</sup>	581	3,620
Kentucky <sup>3</sup>	273	1,620	200	1,210
Mississippi	433	2,340	263	1,540
North Carolina	1,250	12,800	828	4,980
Ohio	379	3,450	405	4,770
Oklahoma	541	2,460	415	1,720
Pennsylvania	555	3,450	398	2,230
South Carolina	453	2,080 <sup>f</sup>	301	1,250
Tennessee	155	1,090	113	817
Texas	604	4,080	429	2,150
Virginia	502	2,670	312	1,420
Other <sup>4</sup>	1,480	8,660	1,110	6,590
Total	8,820	62,200	6,230	41,000

<sup>e</sup>Estimated. <sup>f</sup>Revised.

<sup>1</sup>Includes extruded and other brick.

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

<sup>3</sup>Extruded brick only.

<sup>4</sup>Includes all other States except for Alaska, Nevada, New Hampshire, Rhode Island, Vermont, and Wisconsin.

TABLE 14  
U.S. EXPORTS OF CLAYS, BY TYPE<sup>1</sup>

(Thousand metric tons and thousand dollars)

Material	2008		2009		Principal destinations in 2009
	Quantity	Value	Quantity	Value	
Ball clay	65	4,580	35	2,430	Mexico, 30%; Venezuela, 13%; Costa Rica, 11%; other, 46%.
Bentonite	1,090	161,000	709	100,000	Canada, 45%; Japan, 11%; Saudi Arabia, 8%; China, 6%; other, 30%.
Fire clay	393	49,600	328	42,800	Mexico, 54%; Luxembourg, 22%; Japan, 9%; other, 15%.
Fuller's earth	127	44,000 <sup>f</sup>	90	28,500	Japan, 18%; China, 9%; United Kingdom, 7%; Germany, 5%; other, 61%.
Kaolin	2,960	606,000	2,290	459,000	Japan, 17%; Canada, 13%; Chile, 11%; Finland, 11%; Mexico, 11%; Germany, 7%; Taiwan, 6%; other, 24%.
Clays, n.e.c.	466 <sup>f</sup>	72,700 <sup>f</sup>	374	69,500	Canada, 70%; Mexico, 4%; Republic of Korea, 3%; other, 23%.
Total	5,100 <sup>f</sup>	938,000 <sup>f</sup>	3,830	702,000	

<sup>f</sup>Revised.

<sup>1</sup>Data 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 TYPE<sup>1</sup>

(Thousand metric tons and thousand dollars)

Material	2008		2009		Principal sources in 2009
	Quantity	Value	Quantity	Value	
China clay or kaolin	194	46,100	281	68,700	Brazil, 93%; Canada, 5%; Other, 2%.
Fire clay	(2) <sup>r</sup>	79 <sup>r</sup>	(2)	133	Canada, 50%; Germany, 48%; Other, 2%.
Decolorizing earths and fuller's earth	1	100	1	96	Japan, 79%; China, 21%.
Bentonite	7	2,670 <sup>r</sup>	8	2,460	Greece, 46%; Mexico, 23%; Canada, 17%; Other, 14%.
Common blue clay and other ball clay	--	--	--	--	
Other clay	5 <sup>r</sup>	3,230	8	3,940	Peru, 41%; Canada, 38%; Mexico, 6%; Germany, 4%; Other, 11%.
Chamotte or Dina's Earth	(2) <sup>r</sup>	42 <sup>r</sup>	(2)	165	Czech Republic, 69%; Sweden, 21%; United Kingdom, 10%.
Artificially activated clay and earth	30 <sup>r</sup>	34,400 <sup>r</sup>	27	28,800	Mexico, 73%; Germany, 17%; Other, 10%.
Total	237 <sup>r</sup>	86,600 <sup>r</sup>	325	104,000	

<sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Less than ½ unit.

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

TABLE 16  
BENTONITE: WORLD PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2005	2006	2007	2008	2009 <sup>c</sup>
Algeria <sup>4</sup>	29,029	27,110	32,600	30,595	31,000
Argentina	247,101	246,165	250,260	256,182 <sup>r</sup>	250,000
Armenia	732	720	1,129	1,100 <sup>e</sup>	1,100
Australia <sup>e,4</sup>	223,000	220,000	255,000	250,000	240,000
Azerbaijan	40,000 <sup>e</sup>	40,644	50,459	50,000 <sup>e</sup>	50,000
Bolivia <sup>c</sup>	59 <sup>r,5</sup>	--	--	1,000 <sup>r</sup>	1,000
Bosnia and Herzegovina	24,882	24,645	32,912	30,504 <sup>r</sup>	30,000
Brazil, beneficiated	221,300	235,481	238,746 <sup>r</sup>	238,800	239,000 <sup>p</sup>
Bulgaria	181,000	134,000	99,000	178,000	170,000
Burma	602	904 <sup>6</sup>	971 <sup>r,6</sup>	1,000 <sup>r,e,6</sup>	1,000 <sup>6</sup>
Chile	--	--	533	--	--
Commonwealth of Independent States <sup>e,7</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
Croatia	17,391	16,410	19,578	19,500 <sup>e</sup>	19,500
Cyprus <sup>c</sup>	150,000	150,000	150,000	150,000	150,000
Czech Republic	216,000	267,000	335,000	174,000 <sup>e</sup>	116,000
Egypt <sup>c</sup>	30,000	30,000	29,800 <sup>r,5</sup>	32,000 <sup>r,5</sup>	32,000
Georgia	7,876	4,487	5,000 <sup>e</sup>	5,000 <sup>e</sup>	5,000
Germany	352,374	363,998	384,709	414,336 <sup>r</sup>	350,000
Greece	1,124,795 <sup>r</sup>	1,125,000 <sup>r</sup>	950,000	1,500,000 <sup>r</sup>	844,804 <sup>5</sup>
Guatemala	135,451	20,034	23,569 <sup>r</sup>	62,749 <sup>r</sup>	14,287 <sup>5</sup>
Hungary	9,000	6,600	54,000 <sup>r</sup>	50,000 <sup>r</sup>	50,000
Indonesia <sup>c</sup>	5,000	5,500	5,500	6,000	6,000
Iran <sup>7</sup>	261,888	260,000 <sup>c</sup>	254,084 <sup>r</sup>	240,000 <sup>c</sup>	250,000
Italy	446,000 <sup>e</sup>	470,000	305,905 <sup>r</sup>	281,119 <sup>r</sup>	146,318 <sup>5</sup>
Japan	421,629	425,000	430,000	435,000 <sup>r</sup>	432,000
Kenya <sup>e</sup>	50	60 <sup>r</sup>	70 <sup>r</sup>	70 <sup>r</sup>	70
Macedonia	25,767	32,507	35,234	22,890	9,033 <sup>5</sup>
Mexico	425,630	435,273	613,895	374,933	511,429 <sup>5</sup>

See footnotes at end of table.

TABLE 16—Continued  
BENTONITE: WORLD PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2005	2006	2007	2008	2009 <sup>e</sup>
Morocco	85,400 <sup>e</sup>	80,400	81,000	80,000	80,000
Mozambique	17,318	3,515	9,707 <sup>r</sup>	17,047 <sup>r</sup>	15,000
New Zealand, processed	7,590	3,028	6,154	753	880 <sup>5</sup>
Pakistan	15,671	23,773	24,000	25,000	26,000
Peru	18,500	19,000	21,451	31,557	119,495 <sup>5</sup>
Philippines	1,000	1,000 <sup>e</sup>	1,148	1,422 <sup>r</sup>	1,500
Poland <sup>8</sup>	86,331	93,880	105,943	121,031	120,000
Romania	20,226	21,165	16,911	16,600 <sup>e</sup>	16,600
Serbia	75 <sup>9</sup>	75	75	75	75
Slovakia	97,000 <sup>r</sup>	136,000 <sup>r</sup>	149,000 <sup>r</sup>	145,000 <sup>r</sup>	145,000
South Africa <sup>10</sup>	139,833	32,878	45,778	44,067	40,340 <sup>5</sup>
Spain	105,000 <sup>e</sup>	154,746	155,000 <sup>e</sup>	155,000 <sup>r</sup>	155,000
Turkey <sup>e</sup>	925,000	950,000	930,000	900,000	1,000,000
Turkmenistan <sup>e</sup>	50,000	50,000	50,000	50,000	50,000
Ukraine <sup>e</sup>	300,000	300,000	300,000	300,000	300,000
United States	4,710,000	4,940,000	4,820,000	4,910,000 <sup>r</sup>	3,650,000 <sup>5</sup>
Zimbabwe <sup>10</sup>	500	500	100	100	100
Total	11,200,000 <sup>r</sup>	11,400,000 <sup>r</sup>	11,300,000 <sup>r</sup>	11,600,000 <sup>r</sup>	9,660,000

<sup>e</sup>Estimated. <sup>p</sup>Preliminary. <sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Table includes data available through September 25, 2010.

<sup>3</sup>In 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.

<sup>4</sup>Includes bentonitic clays.

<sup>5</sup>Reported figure.

<sup>6</sup>Year beginning March 21 of that stated.

<sup>7</sup>Information is inadequate to formulate reliable estimates for individual countries, except Armenia, Georgia, Turkmenistan, and Ukraine.

<sup>8</sup>Montmorillite type bleaching clay.

<sup>9</sup>Montenegro and Serbia formally declared independence in June 2006 from each other and dissolved their union.

<sup>10</sup>May include other clays.

TABLE 17  
FULLER'S EARTH: WORLD PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2005	2006	2007	2008	2009 <sup>e</sup>
Algeria	831	--	--	--	--
Australia, attapulgite <sup>e</sup>	9,800	10,000	10,000	10,000	9,500
Guatemala	--	19	109	-- <sup>r</sup>	-- <sup>4</sup>
Italy <sup>e</sup>	3,000	3,000	3,000	3,000	3,000
Mexico	107,265	102,400	34,175	66,123	108,139 <sup>4</sup>
Morocco, smectite <sup>e</sup>	15,000	15,000	15,000	15,000	15,000
Pakistan <sup>e</sup>	17,001 <sup>4</sup>	18,000	19,000	20,000	21,000
Senegal, attapulgite	127,000	140,000	150,000 <sup>e</sup>	167,000	170,000
South Africa, attapulgite	34,340 <sup>r</sup>	49,225	68,377	69,876	52,102 <sup>4</sup>
Spain: <sup>e</sup>					
Attapulgite	20,000	20,000	20,000	20,000	20,000
Sepiolite	800,000	800,000	800,000 <sup>r</sup>	800,000	800,000

See footnotes at end of table.

TABLE 17—Continued  
FULLER'S EARTH: WORLD PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2005	2006	2007	2008	2009 <sup>e</sup>
United Kingdom <sup>e,5</sup>	115,000	--	--	--	--
United States <sup>6,7</sup>	2,730,000	2,540,000	2,600,000	2,340,000 <sup>r</sup>	2,010,000 <sup>4</sup>
Total	3,980,000	3,700,000	3,720,000	3,510,000	3,210,000

<sup>e</sup>Estimated. <sup>r</sup>Revised. -- Zero.

<sup>1</sup>Excludes 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, 2010.

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

<sup>3</sup>In 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.

<sup>4</sup>Reported figure.

<sup>5</sup>Salable product.

<sup>6</sup>Sold or used by producers.

<sup>7</sup>Excludes attapulgitite.

TABLE 18  
KAOLIN: WORLD PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2005	2006	2007	2008	2009 <sup>e</sup>
Algeria	34,386	32,523	106,567	50,788	50,000
Argentina	54,903	49,619	69,354	55,000 <sup>r</sup>	60,000
Australia, includes ball clay <sup>e</sup>	230,000	250,000	250,000	230,000	230,000
Austria, marketable	55,508	51,900	56,690	49,527 <sup>r</sup>	45,000
Bangladesh <sup>e,4</sup>	8,400	8,500	8,600	8,500 <sup>r</sup>	8,500
Belgium <sup>e</sup>	300,000	300,000	300,000	300,000	300,000
Bosnia and Herzegovina, crude	14,500 <sup>r</sup>	69,643 <sup>r</sup>	188,033 <sup>r</sup>	259,325 <sup>r</sup>	259,000
Brazil, beneficiated	2,410,000	2,455,000	2,480,000 <sup>r</sup>	2,674,000 <sup>r</sup>	2,680,000 <sup>p</sup>
Bulgaria	1,380,000	1,658,000	1,631,000	1,530,000 <sup>r</sup>	1,530,000
Chile	15,183	44,642	87,901	63,526	48,354 <sup>5</sup>
Czech Republic	3,882,000	3,768,000	3,604,000	3,833,000	2,886,000 <sup>5</sup>
Denmark, sales <sup>e</sup>	2,500	2,500	2,500	2,500	2,500
Ecuador	25,078	11,504	18,618	12,000	13,000
Egypt	415,400	416,000 <sup>e</sup>	331,671 <sup>r</sup>	523,327 <sup>r</sup>	550,000
Eritrea	100	100	100	100	100
Ethiopia	3,726	1,641	1,400 <sup>r,e</sup>	1,275 <sup>r</sup>	3,534 <sup>5</sup>
France, marketable <sup>e</sup>	316,000	300,000	307,253 <sup>5</sup>	300,000	300,000
Germany	3,767,662	3,815,173	3,842,514	3,611,851 <sup>r</sup>	3,200,000
Greece	49,912 <sup>r</sup>	50,000 <sup>r</sup>	40,000 <sup>r</sup>	4,360 <sup>r</sup>	-- <sup>5</sup>
Guatemala	4,107	4,395	2,663 <sup>r</sup>	2,803 <sup>r</sup>	1,879 <sup>5</sup>
Hungary, processed	7,000	7,000	3,000	3,000	3,000
India: <sup>e</sup>					
Processed	190,000	200,000	200,000	210,000	210,000
Salable crude	560,000	560,000	570,000	570,000	580,000

See footnotes at end of table.

TABLE 18—Continued  
KAOLIN: WORLD PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2005	2006	2007	2008	2009 <sup>e</sup>
Indonesia <sup>e</sup>	15,000	15,000	15,000	15,000	15,000
Iran <sup>e</sup>	311,501 <sup>5</sup>	310,000	350,000	320,000	320,000
Italy, kaolinitic earth	506,597	469,702	635,297 <sup>r</sup>	591,298 <sup>r</sup>	1,069,938 <sup>5</sup>
Japan	10,500	10,500	11,000	11,000 <sup>e</sup>	12,000
Jordan	168,264	112,787	101,000	181,018 <sup>r</sup>	177,470 <sup>5</sup>
Kenya	780	810	910	940	850
Korea, Republic of	2,767,091	2,399,458	688,330 <sup>r</sup>	954,584	960,000
Kyrgyzstan <sup>e</sup>	400,000	400,000	400,000	400,000	400,000
Malaysia	494,511	341,223	587,508	506,462 <sup>r</sup>	463,736 <sup>5</sup>
Mexico	877,147	961,800	86,784	85,091	78,086 <sup>5</sup>
New Zealand	15,750	14,864	14,130	12,761	9,016 <sup>5</sup>
Nigeria <sup>e</sup>	93,000	100,000	100,000	100,000	100,000
Pakistan	37,732	38,000 <sup>e</sup>	39,000	40,000 <sup>e</sup>	40,000
Paraguay <sup>e</sup>	66,600	66,000	66,000	66,000	66,000
Peru	2,700	5,750	7,532	13,215	9,347 <sup>4</sup>
Poland, washed	159,207	199,755	210,373	221,275	220,000
Portugal	164,072	167,792	183,598 <sup>r</sup>	-- <sup>r</sup>	--
Romania	20,266	11,063	7,576	4,000 <sup>e</sup>	1,000
Russia, concentrate <sup>e</sup>	45,000	45,000	45,000	45,000	45,000
Saudi Arabia	1,500	4,000	4,400	4,400	50,000
Serbia: <sup>e</sup>					
Crude	95,000 <sup>6</sup>	110,000	110,000	110,000	110,000
Washed	16,000 <sup>6</sup>	18,000	10,000	10,000	10,000
Slovakia	31,000	58,000	46,000	44,000 <sup>r</sup>	44,000
South Africa	59,356	51,602	50,839	39,505	31,048 <sup>5</sup>
Spain, marketable, crude and washed <sup>7</sup>	456,000 <sup>r</sup>	464,049	450,000 <sup>r</sup>	465,000 <sup>r</sup>	465,000 <sup>p</sup>
Sri Lanka	9,400 <sup>e</sup>	10,914 <sup>r</sup>	11,178 <sup>r</sup>	10,039 <sup>r</sup>	10,000
Thailand, beneficiated	156,853	157,900	159,186 <sup>r</sup>	162,215	160,000
Turkey	908,862 <sup>r</sup>	1,064,107 <sup>r</sup>	914,117 <sup>r</sup>	900,000 <sup>r,e</sup>	800,000
Uganda <sup>e</sup>	31,000	30,000	30,000	30,000	30,000
Ukraine	1,566,000	1,731,000 <sup>r</sup>	2,172,000 <sup>r</sup>	1,775,000 <sup>r</sup>	1,119,000 <sup>5</sup>
United Kingdom, sales <sup>8</sup>	1,911,000	1,800,000	1,800,000 <sup>e</sup>	1,800,000 <sup>e</sup>	1,800,000
United States <sup>9</sup>	7,800,000	7,470,000	7,110,000	6,740,000	5,290,000 <sup>5</sup>
Uzbekistan <sup>e</sup>	5,500,000	5,500,000	5,500,000	5,500,000	5,500,000
Venezuela <sup>e</sup>	10,000	10,000	10,000	10,000	10,000
Vietnam <sup>e</sup>	650,000	650,000	650,000	650,000	650,000
Zambia <sup>e</sup>	200	200	200	200	200
Total	39,100,000 <sup>r</sup>	38,900,000 <sup>r</sup>	36,700,000 <sup>r</sup>	36,100,000 <sup>r</sup>	33,000,000

<sup>e</sup>Estimated. <sup>p</sup>Preliminary. <sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Table includes data available through September 25, 2010.

<sup>3</sup>In 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.

<sup>4</sup>Data for year ending June 30 of that stated.

<sup>5</sup>Reported figure.

<sup>6</sup>Montenegro and Serbia formally declared independence in June 2006 from each other and dissolved their union.

<sup>7</sup>Includes crude and washed kaolin and refractory clays not further described.

<sup>8</sup>Dry weight.

<sup>9</sup>Kaolin sold or used by producers.