



2009 Minerals Yearbook

CLAY AND SHALE [ADVANCE RELEASE]

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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 and 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 and 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 and 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 and 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).

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

(Thousand metric tons and thousand dollars)

| | 2005 | 2006 | 2007 | 2008 ^t | 2009 |
|--|-----------|-----------|-----------|-------------------|-----------|
| Domestic clays sold or used by producers: | | | | | |
| 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 |
| Exports: | | | | | |
| Quantity | 5,620 | 5,980 | 5,650 | 5,100 | 3,830 |
| Value | 929,000 | 1,000,000 | 928,000 | 938,000 | 702,000 |
| Imports for consumption: | | | | | |
| Quantity | 301 | 346 | 231 | 237 | 325 |
| Value | 59,400 | 79,200 | 73,900 | 86,600 | 104,000 |

^tRevised.

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 | 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 ^r | 929,000 ^r | 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 ^r | 233,000 ^r | 3,270 | 172,000 |
| Other ⁴ | 3,360 ^r | 241,000 ^r | 3,760 | 269,000 |
| Total | 32,700 ^r | 1,650,000 ^r | 24,500 | 1,330,000 |

^rRevised. W Withheld to avoid disclosing company proprietary data; included in "Other."

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, 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 USE¹

(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 ² | 39 | NA | 37 | NA |
| Floor and wall tile | 340 | NA | 299 | NA |
| Miscellaneous ceramics ³ | 92 | NA | 77 | NA |
| Pottery | 12 | NA | 4 | NA |
| Sanitaryware | 202 | NA | 181 | NA |
| Miscellaneous ⁴ | 28 | NA | 24 | NA |
| Exports, reported by producers ⁵ | 255 | NA | 209 | NA |
| Total | 967 | 44,300 | 831 | 37,700 |

NA Not available.

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

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

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

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

⁵Includes ceramics and glass and floor and wall tile.

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

(Thousand metric tons and thousand dollars)

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

^eEstimated. ^rRevised. NA Not available.

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

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

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

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

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

(Thousand metric tons and thousand dollars)

| | 2008 | | 2009 | |
|----------------------------------|--------------------|----------------|---------------|----------------|
| | Quantity | Value | Quantity | Value |
| State: | | | | |
| 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 ³ | 2,050 | 9,140 | 1,330 | 6,170 |
| Total | 17,500 | 202,000 | 12,500 | 156,000 |
| Use: | | | | |
| Floor and wall tile ⁴ | 241 | NA | 181 | NA |
| Heavy-clay products: | | | | |
| Brick, extruded | 8,020 | NA | 5,680 | NA |
| Brick, other | 795 | NA | 547 | NA |
| Other ⁵ | 266 | NA | 165 | NA |
| Lightweight aggregate: | | | | |
| 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 ^r | NA | 1,900 | NA |
| Refractories ⁶ | 596 | NA | 360 | NA |
| Miscellaneous ⁷ | 947 ^r | NA | 493 | NA |
| Total | 17,500 | 202,000 | 12,500 | 156,000 |

^rRevised. NA Not available.

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

²Excludes Puerto Rico.

³Includes 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)

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

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

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

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

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

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

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

(Thousand metric tons and thousand dollars)

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

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

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

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

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

⁴Includes mineral and vegetable oils and greases.

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

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

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

(Thousand metric tons and thousand dollars)

| | 2008 | | 2009 | |
|------------------------|--------------|----------------|--------------|----------------|
| | Quantity | Value | Quantity | Value |
| State: | | | | |
| Georgia | 6,290 | 872,000 | 4,970 | 693,000 |
| South Carolina | 199 | 11,300 | 144 | 8,590 |
| Other ² | 257 | 16,800 | 180 | 12,700 |
| Total | 6,740 | 900,000 | 5,290 | 714,000 |
| Type: | | | | |
| Airfloat | 1,130 | 79,700 | 894 | 73,200 |
| Calcined: ³ | 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 |
| Total | 6,740 | 900,000 | 5,290 | 714,000 |

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 | 2008 | | 2009 | |
|--|------------------|---------|----------|---------|
| | Quantity | Value | Quantity | Value |
| Type: | | | | |
| Airfloat | 859 | 63,600 | 761 | 62,400 |
| Calcined ² | 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 |
| Use: | | | | |
| Domestic: | | | | |
| Ceramics and glass: | | | | |
| Catalysts (oil-refining) | W | NA | W | NA |
| Fiberglass, mineral wool | 251 | NA | 217 | NA |
| Roofing granules | 31 | NA | 34 | NA |
| Other ³ | 372 ^r | NA | 296 | NA |
| Fillers, extenders, binders: | | | | |
| 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 ⁴ | 28 | NA | 38 | NA |
| Heavy-clay products ⁵ | (6) | NA | (6) | NA |
| Refractories ⁷ | (6) | NA | (6) | NA |
| Undistributed ⁸ | 931 | NA | 757 | NA |
| Total | 4,220 | NA | 3,460 | NA |
| Exports, reported by producers: | | | | |
| Paint | 70 | NA | 53 | NA |
| Paper coating ⁹ | 1,760 | NA | 1,260 | NA |
| Paper filling ⁹ | 110 | NA | 46 | NA |
| Rubber | 46 | NA | 41 | NA |
| Undistributed ¹⁰ | 87 | NA | 105 | NA |
| Total | 2,070 | NA | 1,500 | NA |
| Grand total | 6,290 | 872,000 | 4,970 | 693,000 |

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

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

²Includes pigment- and refractory-grade calcined kaolin.

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

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

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

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

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

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

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

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

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

(Thousand metric tons and thousand dollars)

| | 2008 | | 2009 | |
|---|----------|--------|----------|-------|
| | Quantity | Value | Quantity | Value |
| Production ² | 199 | 11,300 | 144 | 8,590 |
| Use: | | | | |
| Ceramics ³ | 79 | NA | 68 | NA |
| Rubber | 45 | NA | 30 | NA |
| Other uses ⁴ | 75 | NA | 46 | NA |
| Exports, reported by producers ⁵ | 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."

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

²Includes airfloat, unprocessed, and calcined kaolin.

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

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

⁵Includes fillers, extenders, and binders.

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

(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 ^r | 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 ^r | 39 |
| Heavy-clay products: | | |
| Brick, common and face | 52 | 54 |
| Portland cement | 64 | 55 |
| Refractories ² | 804 | 614 |
| Miscellaneous applications | 167 ^r | 137 |
| Total | 4,650 ^r | 3,770 |
| Exports, reported by producers: | | |
| Ceramics ³ | 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 |

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

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 ^c |
| 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 [†] | 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 |

^cEstimated. [†]Revised. -- Zero.

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

²Includes highway surfacing.

³Less than ½ unit.

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

(Thousand metric tons and thousand dollars)

| State | 2008 | | 2009 | |
|-----------------------|----------|--------------------|----------|--------------------|
| | Quantity | Value ^e | Quantity | Value ^e |
| 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 ^r | 581 | 3,620 |
| Kentucky ³ | 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 ^r | 301 | 1,250 |
| Tennessee | 155 | 1,090 | 113 | 817 |
| Texas | 604 | 4,080 | 429 | 2,150 |
| Virginia | 502 | 2,670 | 312 | 1,420 |
| Other ⁴ | 1,480 | 8,660 | 1,110 | 6,590 |
| Total | 8,820 | 62,200 | 6,230 | 41,000 |

^eEstimated. ^rRevised.

¹Includes extruded and other brick.

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

³Extruded brick only.

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

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

(Thousand metric tons and thousand dollars)

| Material | 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 ^r | 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 ^r | 72,700 ^r | 374 | 69,500 | Canada, 70%; Mexico, 4%; Republic of Korea, 3%; other, 23%. |
| Total | 5,100 ^r | 938,000 ^r | 3,830 | 702,000 | |

^rRevised.

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

Source: U.S. Census Bureau.

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

(Thousand metric tons and thousand dollars)

| Material | 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) ^r | 79 ^r | (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 ^r | 8 | 2,460 | Greece, 46%; Mexico, 23%; Canada, 17%; Other, 14%. |
| Common blue clay and other ball clay | -- | -- | -- | -- | |
| Other clay | 5 ^r | 3,230 | 8 | 3,940 | Peru, 41%; Canada, 38%; Mexico, 6%; Germany, 4%; Other, 11%. |
| Chamotte or Dina's Earth | (2) ^r | 42 ^r | (2) | 165 | Czech Republic, 69%; Sweden, 21%; United Kingdom, 10%. |
| Artificially activated clay and earth | 30 ^r | 34,400 ^r | 27 | 28,800 | Mexico, 73%; Germany, 17%; Other, 10%. |
| Total | 237 ^r | 86,600 ^r | 325 | 104,000 | |

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

See footnotes at end of table.

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

(Metric tons)

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

^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, 2010.

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.

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

⁸Montmorillite type bleaching clay.

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

¹⁰May include other clays.

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

(Metric tons)

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

See footnotes at end of table.

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

(Metric tons)

| Country ³ | 2005 | 2006 | 2007 | 2008 | 2009 ^c |
|-------------------------------|-----------|-----------|-----------|------------------------|------------------------|
| United Kingdom ^{e,5} | 115,000 | -- | -- | -- | -- |
| United States ^{6,7} | 2,730,000 | 2,540,000 | 2,600,000 | 2,340,000 ^r | 2,010,000 ⁴ |
| Total | 3,980,000 | 3,700,000 | 3,720,000 | 3,510,000 | 3,210,000 |

^cEstimated. ^rRevised. -- Zero.

¹Excludes centrally planned economy countries and former such countries, some of which presumably produce fuller's earth but for which no information is available. Table includes data available through September 25, 2010.

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.

⁵Salable product.

⁶Sold or used by producers.

⁷Excludes attapulgitite.

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

(Metric tons)

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

(Metric tons)

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

^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, 2010.

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.

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

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

⁸Dry weight.

⁹Kaolin sold or used by producers.