USGS
science for a changing world

2006 Minerals Yearbook

CLAY AND SHALE

U.S. Department of the Interior
U.S. Geological Survey

January 2008

Clay and Shale

By Robert L. Virta

Domestic survey data and tables were prepared by Brian Jaskula, statistical assistant, and the world production tables were prepared by Linder Roberts, international data coordinator.

The amount of clay sold or used by domestic producers in 2006 was 41.2 million metric tons (Mt) valued at $1.77 billion compared with 41.2 Mt valued at $1.59 billion in 2005 (table 1). Common clay and shale accounted for 59% of the tonnage, and kaolin accounted for 55% of the value (tables 1, 5, and 8). In 2006, exports were 5.98 Mt valued at $1 billion compared with 5.62 Mt valued at $929 million in 2005. Imports of clays were 346,000 metric tons (t) valued at $79.2 million in 2006 compared with 301,000 t valued at $59.4 million in 2005 (table 1).

Major markets, in decreasing order by tonnage, for ball clay were floor and wall tile (41%), sanitaryware (31%), and pottery and miscellaneous ceramics (21%); for bentonite, absorbents (26%), drilling mud (23%), foundry sand bond (19%), and iron ore pelletizing (15%); for common clay and shale, brick (57%), portland cement (18%), and lightweight aggregate (17%); for fire clay, heavy clay products and lightweight aggregate (72%) and refractory products (22%); for fuller's earth, absorbents (70%); and for kaolin, paper coating and filling (62%). Data that were concealed on tables 3-7 and 11 were included when calculating the percentages.

Production

About 205 companies mined clay and shale in the United States in 2006. The 20 leading companies, many with multiple operations, accounted for 50% of the tonnage and 76% 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 not participating in the U.S. Geological Survey (USGS) canvass of the clay and shale industry probably mined clay for construction uses in States for which no production was reported.

The 10 leading producer States were, in decreasing order of tonnage, Georgia, Wyoming, Texas, Alabama, North Carolina, Ohio, Missouri, South Carolina, Arkansas, and Oklahoma. The 10 leading producer companies were, in alphabetical order, American Colloid Co. (bentonite); Cemex Inc. (common clay and shale); Engelhard Corp. (bentonite, fuller's earth, and kaolin); General Shale Products Corp. (common clay and shale); Glen Gery Corp. (common clay and shale); Imerys (ball clay and kaolin); J.M. Huber Corp. (kaolin); Oil-Dri Corp. (fuller's earth); Thiele Kaolin Co. (kaolin); and Unimin Corp. (ball clay and kaolin).

Most clay mining in the United States was by open pit methods; less than 1% of U.S. clay output was from underground mines. All underground production was in Ohio, where the clays are 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 60% 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 reported prior year production levels adjusted by trends in the industry and other guidelines.

Ball Clay.—In 2006, four companies mined ball clay in four States. Production of domestic ball clay was 1.19 Mt valued at $53.4 million compared with 1.21 Mt valued at $52.9 million in 2005 (table 3). Operations in Tennessee supplied 62% 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.

Franklin Industries Inc., which owns H.C. Spinks Clay Co. through its subsidiary Franklin Industrial Minerals, was sold to Chemical Lime Co. (a subsidiary of Lhoist Group, based in Belgium). Chemical Lime is a producer of lime and lime-based products in Canada and the United States. Franklin Industries is a U.S. supplier of industrial and agricultural minerals and specialty clays. Its products include aluminum trihydrate, ball clay, crushed stone and high-purity limestone (Industrial Minerals, 2006e; Harris Williams and Co., 2007).

Bentonite.—In 2006, 20 companies produced bentonite in 11 States. A little more than 4.94 Mt valued at $234 million was sold or used compared to 4.71 Mt valued at $215 million of bentonite sold or used in 2005 (table 4). Production of nonswelling bentonite decreased to 260,000 t valued at $11.8 million in 2006 from 300,000 t valued at $14.4 million in 2005. Alabama led in the production of nonswelling bentonite, followed by, in descending order of tonnage, Mississippi, Arizona, Texas, Nevada, and California.

Production of swelling bentonite increased to 4.68 Mt valued at $223 million in 2006, an increase from 4.41 Mt valued at $201 million in 2005. Two companies accounted for the bulk of the increase. Other producers reported production as either unchanged or slightly less than in 2005. Wyoming led in the production of swelling bentonite, followed by Montana, Utah, Texas, California, Oregon, Colorado, and Nevada.

Rockwood Holdings, Inc. finalized its acquisition of the rheological additives and carbonless developers businesses of Sud-Chemie AG. The deal included Southern Clay Products, Inc., which mines bentonite from a deposit in Texas and has a production facility in Germany. Southern Clay produced clays for coatings, ink, and personal care products (Rockwood Holdings, Inc., 2006).

Common Clay and Shale.—In 2006, 155 companies produced common clay and shale in 41 States and Puerto Rico. In States not reporting production, common clay and

shale probably was mined and sold for construction uses by companies not participating in the USGS canvass of the clay and shale industry.

Domestic sales or use of common clay and shale decreased to 24.2 Mt valued at $243 million in 2006 compared with 24.3 Mt valued at $176 million in 2005 (table 5). The increase in value should be viewed with caution because many producers did not sell their clay but use it to manufacture such products as brick, flower pots, flue linings, lightweight aggregate, roofing tile, and sewer pipe. Consequently, they often have difficulty assigning a value to their clay. With the large tonnages involved in common clay and shale, a small difference in unit value can greatly affect the total. It is likely that the actual sales value was about $185 million. The major producing States were, in descending order of tonnage, Texas, North Carolina, Alabama, Ohio, Georgia, Oklahoma, Arkansas, Kentucky, South Carolina, Indiana, Virginia, Missouri, California, and Pennsylvania.

Boral USA (a subsidiary of Boral Ltd.) announced it would build a plant near Ione, CA, to produce clay roof tile. The plant will have a capacity of 130,000 squares per year (1.21 million square meters or 13 million square feet). The plant will serve Southwestern markets and will increase clay tile manufacturing production capacity in the Western United States by 50% (Boral Industries Ltd., 2006).

General Shale Brick announced that it would spend more than $7 million to upgrade its Roanoke, VA, brick plant. The company will use robotics to set and unload bricks and update its brick firing procedures (Ceramic Industry, 2006b).

Fire Clay.—Fire clay producers were mostly refractory product manufacturers that used the clays in firebrick and various heavy clay products. In 2006, nine firms mined fire clay in six States. Fire clay sold or used by domestic producers increased to 848,000 t valued at $19.0 million from 353,000 t valued at $10.7 million in 2005 (table 6). The increase in production resulted because five companies that formerly mined common clay reported production of fire clay in 2006. The decrease in unit value resulted primarily from increased sales for the manufacture of low-value heavy clay products rather than higher-value refractory applications. Missouri was the leading producing State, followed by, in descending order of tonnage, Ohio, California, South Carolina, Alabama, and Washington.

Fuller's Earth.—In 2006, 15 companies produced fuller's earth in 10 States. Fuller's earth deposits grade from palygorskite (attapulgite) in Florida to montmorillonite, further northward in Georgia. Gellant grades of attapulgite, used as thickeners in such items as drilling muds and paints, are in western Florida and southwestern Georgia. Absorbent grades of attapulgite are further north in Georgia. Absorbent grades of attapulgite are grouped with the montmorillonite variety of fuller's earth in table 7 to be consistent with past reporting.

Gellant-grade attapulgite was mined or sold in the Florida Panhandle and southwestern Georgia by three companies. Attapulgite production decreased to 262,000 t valued at $42.2 million in 2006 compared with 282,000 t valued at $36.4 million in 2005 (table 7). All companies reported increases in sales value with one accounting for the larger share of the increase. Georgia led in the production of attapulgite, followed by Florida. Sepiolite, although not a fuller's earth, was mined in Nevada and included in the total for gellant-grade attapulgite to avoid disclosing company proprietary data.

Production of the montmorillonite variety of fuller's earth decreased to 2.28 Mt valued at $201 million in 2006 compared with 2.45 Mt valued at $238 million in 2005 (table 7). Several companies reported declines in sales in 2006 in response to weaker markets. Montmorillonite-type fuller's earth was produced, in decreasing order of tonnage, in Missouri, Mississippi, Virginia, California, Illinois, Florida, Tennessee, Georgia, Texas, and Kansas.

Kaolin.—In 2006, 19 firms mined kaolin in 10 States. Domestic production was 7.47 Mt valued at $980 million compared with 7.80 Mt valued at $860 million in 2005 (table 8). Declines were spread across several markets, although filler and extender and refractory applications took the greatest losses. The value increased considerably in 2006 despite lower production. One major producer and possibly a second appear to have undervalued their kaolin sales in 2005. After adjustment, the value probably increased by 7% rather than the indicated 14% in table 8. The increased value resulted mainly from energy surcharges applied to kaolin products. The leading producer State was Georgia, followed by, in descending order of tonnage, South Carolina, Arkansas, Alabama, California, Texas, Nevada, North Carolina, Florida, and Tennessee.

Of the 7.47 Mt sold or used in 2006, 3.61 Mt was reported as water washed, 1.27 Mt was calcined, 1.24 Mt was delaminated, 1.21 Mt was airfloat, and 141,000 t was unprocessed (table 8). This compares with an estimated 3.80 Mt (4.07 Mt reported) of water washed, 1.31 Mt of calcined, an estimated 1.28 Mt (1.01 Mt reported) of delaminated, 1.27 Mt of airfloat, and 139,000 t of unprocessed in 2005. Of the calcined kaolin, 827,000 t was pigment-grade (low-temperature calcined kaolin). Companies in Georgia accounted for nearly all the pigment-grade calcined kaolin produced in 2006. A small amount also was produced in Texas. The remainder was refractory-grade (high-temperature calcined kaolin) (table 8).

Kaolin production in Georgia was reported to be 6.92 Mt valued at $945 million in 2006 compared with 7.19 Mt valued at an estimated $875 million ($825 million reported) in 2005. Approximately 3.53 Mt of Georgia kaolin production was reported as sold as water washed, 1.24 Mt was delaminated, 1.18 Mt was calcined (high- and low-temperature calcined kaolin), and 966,000 t was airfloat in 2006. This compares with 3.97 Mt water washed, 1.01 Mt delaminated, 1.19 Mt calcined, and 1.01 Mt airfloat in 2005 (table 9). Production in South Carolina was 294,000 t valued at $17.9 million in 2006 compared with 287,000 t valued at $17.7 million in 2005 (table 10).

BASF AG, Ludwidshafen, Germany, acquired Engelhard Corp., Iselin, NJ. BASF, the world's largest chemical producer, was interested in Engelhard's catalyst business, which accounted for about 35% of the global market for automotive catalysts. The deal also included Engelhard's pigment business. Engelhard operates kaolin mines and mills in Georgia (BASF AG, 2006; Industrial Minerals, 2006c).

J.M. Huber Corp. announced plans to reduce capacity for paper-grade kaolin at its plant in Macon, GA. Some of the capacity will be transferred to Huber's Sandersville, GA, facility. This change was being made to improve the profitability

of the company and to focus on its core products for paper and industrial markets (O'Driscoll, 2006).

Clean Age Minerals Inc. (CAMI) (a subsidiary of Daleco Resources Corp.) continued its development work on its Sierra Kaolin deposit in New Mexico. Cores were collected across a 30-acre parcel and analyzed. While an interpretation of the analytical results was being made, CAMI contracted to have a computerized geological and resource model developed (Daleco Resources Corp., 2006).

Consumption

Ball Clay.—Ball clay sold or used in 2006, including exports, was 1.19 Mt, a slight decrease from that of 2005.The principal domestic ball clay markets were, in decreasing order, floor and wall tile, sanitaryware, and miscellaneous ceramics (table 3).

Bentonite.—Domestic sales and use were 4.12 Mt and total sales (domestic and export) in 2006 were 4.94 Mt compared with domestic sales of 4.31 Mt and total sales of 4.71 Mt in 2005 (table 4). Major domestic markets for bentonite were, in decreasing order by tonnage, pet waste absorbent, drilling mud, foundry sand, and iron ore pelletizing. Total sales (domestic and exports) of bentonite were approximately 939,000 t for foundry sand bond (more than 95% was swelling bentonite), 1.30 Mt for pet waste absorbent (all swelling bentonite), 1.15 Mt for drilling mud (all swelling bentonite), and 733,000 t for pelletizing iron ore (all swelling bentonite). Increased export sales for pet waste absorbents offset decreased domestic sales. Producers reported increased domestic and export sales for drilling mud applications resulting from increased drilling for gas and oil. Domestic foundry sales declined as heavy industry in the United States slowed slightly. Export foundry sales increased as world markets continued to remain strong. Pelletizing increased significantly with all except one of the Wyoming bentonite producers reporting increased demand for iron and steel worldwide.

Data for other bentonite markets were withheld to avoid disclosing company proprietary data. However, swelling bentonite accounted for more than 95% of the bentonite sold for adhesives, animal feed, civil engineering, cosmetics, drilling mud, fertilizers, iron ore pelletizing, miscellaneous chemical manufacture applications, medical, oil and grease absorbents, paint, pet waste absorbents, and waterproofing and more than 70% of the bentonite sold for foundry sand, and water treatment and filtering.

The major domestic markets for swelling bentonite were, in decreasing order, pet waste absorbents, drilling mud, foundry sand, iron ore pelletizing, civil engineering and sealing, waterproofing and sealing, and water treatment. Major export markets for swelling bentonite were, in decreasing order, foundry sand, pet waste absorbent, drilling mud, and iron ore pelletizing. The major domestic uses for nonswelling bentonite were, in descending order of tonnage, foundry sand bond; water treatment and filtering; waterproofing and sealing; and pesticide carriers.

Common Clay and Shale.—Consumption of common clay and shale decreased slightly to 24.2 Mt in 2006. Common clay and shale was used most frequently in the manufacture of heavy clay products (such as building brick, drain tile, flue linings, and terra cotta), lightweight aggregate, portland cement, sewer pipe, and structural tile (table 5). Brick manufacture remained the leading market for common clay and shale, followed by, in descending order of tonnage, portland cement, and lightweight aggregate. Residential and nonresidential construction, on which the common clay and shale industry is dependent, increased in value to $1.2 trillion in 2006 from $1.14 trillion in 2005 (U.S. Census Bureau, 2007a).

Fire Clay.—Consumption of fire clay increased to 848,000 t in 2006 from 353,000 t in 2005 because five companies that formerly mined common clay reported production of fire clay in 2006 (table 6). Fire clays were used in grogs and calcines; high-alumina brick and specialties; ramming and gunning mixes; refractory products, such as firebrick and block; mixes and mortars; and saggers. Fire clays also were used to produce such items as brick and pottery. Markets for fire clay were, in descending order of tonnage, portland cement, common brick applications, refractory calcines and grogs, lightweight aggregate, floor and wall tile, and refractory mortar and cement. The five former common clay producers accounted for most of the increased sales for non-refractory applications.

Fuller's Earth.—Consumption of fuller's earth was 2.54 Mt in 2006 compared with 2.73 Mt in 2005. Pet waste absorbent was the leading market for fuller's earth, followed by oil and grease absorbents, animal feed applications, and miscellaneous filler and extender uses (table 7).

Major domestic markets for montmorillonite were, in descending order of tonnage, pet waste absorbents; miscellaneous civil engineering and sealing; oil and grease absorbents; animal feed; miscellaneous fillers, extenders, and binders; pesticide carrier; miscellaneous absorbents; drilling mud; clarifying, decolorizing, and filtering of oils and greases; and fertilizer carrier. The leading export market was pet waste absorbent.

Major domestic markets for attapulgite were, in decreasing order, miscellaneous filler and extender applications; drilling mud; absorbents; miscellaneous civil engineering and sealing; fertilizer carrier; paint; asphalt emulsion; animal feed; clarifying, decolorizing, and filtering of mineral oils and greases; and cosmetic, medical, pharmaceutical applications. The major export market was drilling mud. The first three applications accounted for more than 65% of sales of attapulgite.

Montmorillonite grades accounted for more than 80% of sales of fuller's earth for asphalt tile; portland cement manufacture; clarifying, decolorizing, and filtering of oils and greases; oil and grease absorbents; pesticide carriers; pet waste absorbents; and exported products. Attapulgite accounted for most of the sales for asphalt emulsions; cosmetic, medical, and pharmaceutical applications; drilling mud; fertilizer carriers; miscellaneous civil engineering; and paint.

Kaolin.—Consumption of kaolin decreased to 7.47 Mt in 2006 from 7.80 Mt in 2005 (table 8). The major domestic markets for kaolin were, in descending order of tonnage, paper coating and filler, refractory products, fiberglass, paint, rubber, catalyst manufacture, and heavy clay products (included portland cement) (table 11). Sales of kaolin from Georgia

were 6.92 Mt in 2006 compared with 7.19 Mt in 2005. Major domestic markets for kaolin from Georgia were, in descending order by tonnage, paper coating, paper filling, refractory products, fiberglass, paint, rubber, and catalyst manufacture. The major export market for Georgia kaolin was in paper applications (table 9). Sales of kaolin from South Carolina were 294,000 t in 2006 compared with 287,000 t in 2005 (table 10). Major domestic markets for kaolin from South Carolina were, in descending order of tonnage, rubber, brick, catalyst, fiberglass, plastics, portland cement, adhesives, and roofing granules. The major export market for kaolin from South Carolina was rubber applications.

Uses.—By application, consumption of clays was as follows:

Absorbent Uses.—Sales reported by producers for absorbent uses were 3.07 Mt in 2006 compared with 3.3 Mt in 2005. Sales of bentonite for absorbents were unchanged from 2005 with a decrease in domestic sales being offset by increased exports. The decrease in domestic sales of fuller's earth for absorbents was greater than the increase in exports, so a net loss in sales was observed.

Fuller's earth accounted for 58% of the clay used for absorbents, followed by bentonite and a small amount of kaolin. Pet waste absorbents accounted for 90% of absorbent consumption, followed by oil and grease absorbents, and miscellaneous absorbent applications.

Ceramics.—All varieties of clays were used in ceramics. Demand for clay in the manufacture of ceramics, ranging from china to sanitaryware to roofing granules, was 2.29 Mt in 2006 compared with 2.31 Mt in 2005. The leading ceramics markets were ceramic floor and wall tile (38%), sanitaryware (18%), miscellaneous ceramics (13%), pottery (11%), roofing granules (10%), catalyst (7%), electrical porcelain (1%), and fine china (1%). Ball clay accounted for 48% of the clay used in ceramics; common clay and shale, 29%; and kaolin, 21%. Small amounts of bentonite and fire clay also were used in the manufacture of ceramics. Ball clay dominated the electrical porcelain and sanitaryware markets. Common clay and shale was the predominant category of clay used in pottery and roofing granules. Kaolin dominated the catalyst market. Ball clay and common clay and shale were the predominant clays used in floor and wall tile manufacture, and ball clay and kaolin dominated the fine china market.

In 2006, apparent consumption of clay floor and wall tile in the United States was 308 million square meters valued at $3.17 billion compared with 303 million square meters valued at $3.08 billion in 2005. Domestic producers shipped 58.5 million square meters (630 million square feet) of clay floor and wall tile in 2006 compared with 61.1 million square meters (658 million square feet) in 2005. In 2006, exports were 4.19 million square meters valued at $37.3 million compared with 3.44 million square meters valued at $31.5 million in 2005. Imports of clay floor and wall tile were 254 million square meters valued at $2.37 billion in 2006, compared with 245 million square meters valued at $2.26 billion in 2005 (U.S. Census Bureau, 2007b, p. 12).

The U.S. Department of Commerce, International Trade Administration (2007) reported that 30.9 million square meters valued at $227 million of glazed and unglazed ceramic tile with sides measuring less than 7 centimeters was imported compared with 31.5 million square meters valued at $218 million in 2006. Brazil, China, Italy, and Spain were the major sources of imported tile of these dimensions.

Imports of ceramic baths, bidets, flush tanks, lavatories, sinks, toilet bowls, and other ceramic sanitary fixtures increased in 2006. The U.S. Department of Commerce, International Trade Administration (2007) reported imports to be 36.2 million units compared with 35.1 million units in 2005. China and Mexico were the major sources of imported sanitaryware.

Construction.—Common clays and shales were used to manufacture a wide variety of construction materials, including expanded aggregates, hydraulic cement, and structural clay products.

Expanded Clay and Shale.—Approximately 4.05 Mt of clay and shale was used in the production of lightweight aggregates in 2006 compared with 3.85 Mt in 2005 (table 12). More than 99% of clay used to manufacture lightweight aggregates was common clay and shale. A small amount of fire clay also was used. Lightweight aggregates were used in concrete block, structural concrete, and highway surfacing, in decreasing order of tons consumed.

Hydraulic Cement.—Clays provide the alumina and silica required to manufacture hydraulic cements. In 2006, approximately 4.69 Mt of clays was consumed in the production of cement compared with 4.09 Mt in 2005. In descending order of tonnage, common clay and shale, fire clay, and kaolin were used in the manufacture of portland cement clinker. About 92% of the clay consumed by the cement industry was common clay and shale.

Structural Clay Products.—Approximately 14.5 Mt of clays was used in the manufacture of structural clay products, such as building brick, roofing tile, and sewer pipe compared with 15.4 Mt in 2005. Common and face brick accounted for about 98% of this total. Other markets were, in descending order of tonnage, flue linings, miscellaneous clay products, flower pots, sewer pipe, structural tile, sewer pipe, and drain tile. About 97% of the clay used to manufacture structural clay products was common clay and shale. Small amounts of ball clay, bentonite, fire clay, and kaolin also were used.

In 2006, domestic producers shipped 8.90 billion building and face bricks compared with 9.42 billion bricks in 2005. About 151,000 t of vitrified clay sewer pipe and fittings valued at $78 million was shipped in 2006 compared with 175,000 t valued at $72 million in 2005 (U.S. Census Bureau, 2007b, p. 2).

Drilling Mud.—Sales of clays for drilling mud applications were 1.08 Mt (domestic) and 126,000 t (exported) compared with 993,000 t and 75,800 t in 2005, respectively. Swelling-type bentonite accounted for 95% of the clay used in drilling mud. Fuller's earth also was used in drilling mud applications. Sales of drilling muds increased in 2006 as the result of increased oil drilling activity. The average number of rotary rigs in Canada and the United States operating in 2006 was 2,120 compared with 1,841 in 2005 (Baker Hughes Inc., 2007).

Fillers, Extenders, and Binders.—Clays are used as fillers, extenders, and binders in a wide variety of products, such as adhesives, flooring products, paint, paper, and rubber. About 4.35 Mt of clays was sold for use as fillers, extenders, and binders in the United States compared with 4.62 Mt in 2005.

An additional 1.93 Mt of clays was exported for filler and extender applications in 2006 compared with 1.98 Mt in 2005. Paper coating and filling accounted for 65% of domestic sales, followed by paint (10%), miscellaneous filler and extenders (8%), animal feed (5%), and rubber (5%). Adhesives; asphalt emulsion; cosmetic, medical, and pharmaceutical; fertilizer; pesticide carriers; and plastics each accounted for less than 2% of the domestic fillers and extenders markets.

Kaolin accounted for approximately 88% of the clay used in domestic and export filler and extender applications, followed by fuller's earth (5%), bentonite (2%), common clay and shale (3%), and ball clay (1%). Bentonite was the predominant clay used for cosmetic, medical, and pharmaceutical applications; fuller's earth dominated in fertilizer and pesticide applications. Kaolin was the predominant clay used for adhesives, paint, paper, plastics, and rubber markets.

The U.S. Census Bureau (2007c) reported shipments of paint and coatings for 2006 to be 5.80 billion liters (1.53 billion gallons) compared with 5.94 billion liters (1.57 billion gallons) in 2005. Of this amount, architectural paints, the major market for paint-grade fillers, was 2.83 billion liters (749 million gallons) in 2006 compared with 2.88 billion liters (759 million gallons) in 2005.

Fiberglass.—Sales, including exports, to the fiberglass and mineral wool industry were 402,000 t in 2006 compared with 407,000 t in 2005. Most of the clay used for fiberglass was kaolin. About 3.28 Mt of fiberglass was sold in 2006 compared with 3.27 Mt in 2005 (Freedonia Group, Inc., The, 2007, p. 50).

Iron Ore Pelletizing.—Sales of clays for iron ore pelletizing applications reported by producers were 733,000 t (662,000 t used domestically and 70,800 t exported) in 2006 compared with 595,000 t in 2005. This increase in sales was in response to strong iron and steel demand worldwide. Swelling bentonite was the only type of clay used for this application.

Paper Products.—Total sales for paper declined to 4.61 Mt in 2006 from 4.75 Mt in 2005. Kaolin accounted for all the clay sales used for paper coating (2.40 Mt sold domestically and 1.68 Mt exported), and essentially all the clay used for paper filling (420,000 t sold domestically and 112,000 t exported).

Refractory Products.—Producers reported that 2.38 Mt of clays was used for the manufacture of refractory products in 2006 (1.44 Mt with foundry sand excluded) compared with 2.49 Mt in 2005. Foundry sand accounted for 32% of domestic sales and all export sales under the refractory category. Other refractory markets for clays were firebrick; grogs and calcines; high-alumina brick and kiln furniture; and refractory mortar and cement. About 267,000 t was exported for refractory applications.

Bentonite accounted for 941,000 t of refractory sales (674,000 t domestic and 267,000 t exported), followed by common clay and shale (788,000 t), kaolin (452,000 t), fire clay (190,000 t), and ball clay (8,580 t).

The U.S. Census Bureau (2007d) reported clay refractory shipments valued at $912 million in 2006 compared with $861 million in 2005. Unshaped clay refractory bonding mortars accounted for 855,000 t valued at $412 million of shipments followed by fireclay, high alumina, and insulating brick shapes (507,000 t valued at $468 million). The remainder was other refractory clay raw materials and refractory materials sold in lump or ground form.

Prices

Ball Clay.—The average value for ball clay reported by domestic producers was $44.94 per metric ton. The average values for exported and imported ball clay were $56 per ton and $233 per ton, respectively.

Bentonite.—The average value reported by domestic producers for nonswelling bentonite was $45.20 per ton. The average value for swelling bentonite was $47.56 per ton. The average value for all bentonite was $47.44 per ton. The average value of exported bentonite was $104 per ton. The average value of imported bentonite was $238 per ton.

The price, ex-works, Wyoming, crude, bulk, railcars, was $36 to $82 per ton; foundry-grade, bagged, railcars, $55 to $80 per ton; and American Petroleum Institute (API)-grade, bagged, railcars, $55 to $80 per ton. The price for bentonite, India, crushed, dried, loose in bulk, was $43 to $53 per ton for API-grade; $32 to $40 per ton for pet litter grade; and $59 to $76 per ton for foundry grade (Industrial Minerals, 2006h).

Common Clay and Shale.—The average value for all common clay and shale produced in the United States and Puerto Rico was $10.06 per ton. The unit value of clay and shale used to produce lightweight aggregate was $27.29 per ton. Average prices for lightweight aggregate produced from clay and shale ranged from $30 to $70 per ton for most applications.

Fire Clay.—The average value for fire clay reported by domestic producers was $22.36 per ton. The average value declined because a larger portion of fire clay sales were for heavy clay applications rather than higher-value refractory uses. The average value of exported fire clay was $110 per ton. The average value of imported fire clay was $312 per ton.

Fuller's Earth.—The average value of attapulgite-type fuller's earth was $160.90 in 2006. The average value of montmorillonite-type fuller's earth was $88.02 per ton. The average value for all fuller's earth was $95.53 per ton. The average value of exported fuller's earth was $238 per ton. The average value of imported fuller's earth was $74 per ton.

Kaolin.—The average value of kaolin was $131.24 per ton for all kaolin grades. The average value for airfloat was $67.76 per ton; refractory-grade (high-temperature calcined), $31.69 per ton; pigment-grade (low-temperature calcined), $312.73 per ton; all types of calcined, $214.84 per ton; delaminated, $123.24 per ton; unprocessed, $16.87 per ton; and water washed, $130.36 per ton. The average value of exported kaolin was $177 per ton. The average value of the imported kaolin was $184 per ton.

The price, ex-works, Georgia, filler, bulk, was $80 to $100 per ton; coating, bulk, $85 to $185 per ton; sanitaryware-grade, bagged, $65 to $75 per ton; tableware-grade, bagged, $125 per ton; and calcined, bulk, $320 to $375 per ton (Industrial Minerals, 2006h).

Foreign Trade

Ball Clay.—Ball clay exports were 140,000 t valued at $7.89 million in 2006 compared with 141,000 t valued at $8.84

million in 2005, according to the U.S. Census Bureau (table 14). Producers reported exports of 228,000 t. Some of the extra tonnage reported by ball clay producers was likely accounted for by shipments to Mexico. Exports to Mexico reported by the U.S. Census Bureau typically are less than indicated by ball clay producers. The water weight of slurry shipments (about 30% to 35% of the shipment weight) may also account for a portion of the extra tonnage reported by producers. Imports were 662 t of ball clay valued at $233,000 (table 15).

Bentonite.—Bentonite exports increased to 1.27 Mt valued at $132 million in 2006 from 847,000 t valued at $98.5 million in 2005 (table 14). Exports increased by 120,000 t to Canada and 290,000 t to Japan. Domestic bentonite producers reported exports of 820,000 t (table 4). The large discrepancy between data reported by producers and the U.S. Census Bureau resulted from producers including most of the exports destined for Canadian and Mexican markets (491,000 t) 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 13,000 t valued at $3.10 million. Imports of chemically activated material were 21,000 t valued at $16.2 million (table 15).

Fire Clay.—In 2006, exports decreased to 348,000 t valued at $38.1 million compared with 368,000 t valued at $34.4 million in 2005 (table 14). At least 46% of the exports reported by the U.S. Census Bureau under the Harmonized Tariff Schedule of the United States 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. Imports were 453 t valued at $168,000 (table 15).

Fuller's Earth.—In 2006, exports increased to 69,000 t valued at $16.4 million compared with 55,000 t valued at $13.5 million in 2005 (table 14). Imports of decolorizing earth and fuller's earth were 3,000 t valued at $223,000 (table 15).

Kaolin.—In 2006, 3.54 Mt of kaolin valued at $626 million was exported compared with 3.58 Mt valued at $601 million in 2005 (table 14). Producers reported exports of 2.04 Mt (table 11). Of the 1.50 Mt difference, probably much of the 607,000 t destined for Canada and 328,000 t for Mexico was reported under domestic consumption. Sales through U.S. mineral brokers, where producers do not know if the kaolin is used domestically or exported, could also explain part of the discrepancy.

Kaolin imports increased to 303,000 t valued at $55.6 million in 2006 compared with 262,000 t valued at $40.2 million in 2005 (table 15). About 97% of the kaolin was imported from Brazil followed by the United Kingdom. Imports from Brazil were primarily for paper coating applications, and those from the United Kingdom were primarily for paper filler applications.

World Review

World production of bentonite was approximately 11.7 Mt (table 16). Fuller's earth production was 3.98 Mt (table 17). Kaolin production was about 37.5 Mt (table 18); this includes ball clay from Australia and crude kaolin ore production tonnages from many other countries. World sales of processed kaolin were estimated to be between 23 and 24 Mt, after excluding 4 Mt for Uzbekistan, 3.4 Mt for the Czech Republic, 3.1 Mt for Germany, 2.2 Mt for the Republic of Korea, 450,000 t for Iran, 300,000 t for Mexico, 200,000 t for Egypt, and 100,000 t for Australia to account for processing losses. The United States continued to be the leading supplier of processed clay for sale, followed by Greece, Turkey, and the Commonwealth of Independent States for bentonite; Spain for fuller's earth; and the United Kingdom and Brazil for kaolin. Spain led all countries in the production of sepiolite.

Australia.—Boral Ltd. began operating a new plant in Wacol, Queensland (926 kilometers north of Canberra), for manufacturing clay pavers. Increased demand for pavers by industry and the general public for landscaping projects prompted Boral to replace its manufacturing plant in Prospect, a suburb of Adelaide, South Australia, which could not meet demand for large format pavers (Ceramic Industry, 2006a).

AMCOL International Corp. acquired mining rights on bentonite leases owned by Phoslock Water Solutions Ltd. Phoslock's leases were located near Miles, central Queensland. The deal also included a processing facility. Volclay Pty Ltd. (an international subsidiary of AMCOL) was to manage the operation (Industrial Minerals, 2006a).

Belgium.—Ashapura Minchem Ltd. and AMCOL formed a joint venture to construct a processing plant. The plant was to have a capacity to grind 100,000 metric tons per year (t/yr) of bleaching clay and other speciality products (Industrial Minerals, 2006b).

China.—Shandong Loizhou Gold Corp. and Beijing Headmen Consultants Co. Ltd. announced plans to begin work on a kaolin mine near Wulanhaote in Inner Mongolia. Production capacity is expected to be 150,000 to 200,000 t/yr (Industrial Minerals, 2006d).

Meng Sheng Minerals Co. Ltd. opened an 80,000-t/yr plant in Jungar, Inner Mongolia. The plant utilizes kaolin from a company-owned mine, which has 80 Mt of reserves (Industrial Minerals, 2006g).

India.—Ashapura Minchem Ltd. expanded a clay processing plant in the State of Gujarat to grind 60,000 t/yr of attapulgite. The plant had a mill capacity of 910,000 t/yr for bentonite and 50,000 t/yr for ceramic clays (Industrial Minerals, 2006b).

France.—Imerys, a French investment group with clay operations worldwide, acquired French clay group AGS S.A. AGS produces specialty clays for the refractory market with an output of 130,000 t in 2004. AGS was evaluating a new kaolin deposit near Clerac to determine if it is suitable for mullite-grade products (Industrial Minerals, 2006f).

Mongolia.—Erdene Gold Inc. agreed to a deal with Kaoclay Resources Inc. with Erdene acquiring all shares of Kaoclay in exchange for shares and warrants in Erdene. The deal provides cash flow for Erdene while giving Kaoclay access to Erdene's mineral ventures in Mongolia. Kaoclay owns Sparta Kaolin Corp., which has kaolin reserves in Georgia in the United States. J.M. Huber Corp. began mining kaolin from Sparta's deposits in 2005 for paper applications (Erdene Gold Inc., 2006).

United Kingdom.—Imerys announced a reorganization of its kaolin operations in the United Kingdom. The company will stop production of paper coating grades of kaolin at the Cornwall facility by the end of 2007. The facility will continue to produce paper filler grades. Imerys also will stop production of hydrous grades of kaolin at its Devon facility and consolidate United Kingdom kaolin production for ceramics and performance minerals in Cornwall. The reorganization was made to counter rising costs of production (Imerys, 2006).

Venezuela.—Ruscalolin, a Russian company, announced plans to open mine and mill facilities in Bolivar. The operation will mine 500,000 t/yr of kaolin, with ore being shipped to Puerto Ordaz for processing. Ruscalolin was applying for environmental permits for mining (Business News Americas, 2006).

Outlook

In the United States, the housing market declined in the second half of 2006. Construction-oriented markets for clay-based products, such as brick, cement, ceramic tile, lightweight aggregate, and whiteware, and therefore sales of ball clay and common clay probably will slow in 2007. Sales of fire clay probably will decline for refractory products, but use of fire clay for the manufacture of cement and heavy clay products may enable sales to be maintained through 2007.

The overall market for fuller's earth may remain unchanged during the next couple of years following a large decline in 2006. Demand for pet litter, which has traditionally been strong, accounted for most of the decline in 2006. Pet ownership in the United States remains high and alternative litters have not yet made significant inroads into the clay markets. Consequently, large future declines are not anticipated, and sales levels probably will remain at current levels for the near future. Overall sales for fuller's earth probably will remain unchanged for the next couple of years.

Drilling for oil continued at a high level worldwide so demand for bentonite for drilling mud applications has improved in the past 2 years. Drilling mud sales may continue at current levels for the next couple of years although bentonite may face challenges from changing drilling mud technologies in the future. Pet litter sales, the leading market for bentonite, are expected to remain unchanged although there may be shifts in the ratio of domestic to export sales. Strong demand for steel, mainly overseas, has aided sales of bentonite for pelletizing of iron ore. Slowing U.S. industrial output may affect foundry sales for a few years. Other markets for bentonite probably will remain relatively unchanged for the short term.

Construction-oriented markets for kaolin such as ceramic tile, fiberglass, paint, and sanitaryware are facing a declining U.S. housing market. Sales into such construction applications as fiberglass and paint and various other filler and extenders were unchanged or declined in 2006. A continued strong commercial construction market temporarily may provide a cushion against this housing slump so kaolin sales for the construction-related markets may decline only slightly over the next year or two. The leading markets for kaolin, paper coating and filling, continue to be affected by a slow paper industry in the United States and foreign competition in overseas markets. Paper sales probably will decline slightly during the next few years. Overall sales of kaolin by U.S. producers for all markets may decline slightly for the near future.

References Cited

Baker Hughes Inc., 2007, North American rotary rig count: Houston, TX, Baker Hughes Inc., September 21. (Accessed September 24, 2007, at http://www.bakerhughes.com/investor/rig/rig_na.htm.)

BASF AG, 2006, BASF completes acquisition of Engelhard Corporation: Ludwigshafen, Germany, BASF AG press release, 1 p.

Boral Industries Ltd., 2006, Boral to build new clay roof tile plant in Ione, California: Roswell, GA, Boral Industries Ltd. press release, 1 p.

Business News Americas, 2006, IAMIB—Ruscaolin aim to reactivate US$500mn kaolin project: Business News Americas, March 17. (Accessed March 20, 2006, at http://www.bnamericas.com/content_print.jsp?id=347779&idioma=I&sector=7&type=NEWS.)

Ceramic Industry, 2006a, Boral opens new production facility: Ceramic Industry, v. 156, no. 11, November, p. 84.

Ceramic Industry, 2006b, General Shale Brick updates Roanoke Plant: Ceramic Industry, v. 156, no. 11, November, p. 84.

Daleco Resources Corporation, 2006, Daleco Resources Corporation advances kaolin project: West Chester, PA, Daleco Resources Corporation press release, 1 p.

Erdene Gold Inc., 2006, Erdene announces planned acquisition of Kaoclay: Halifax, Nova Scotia, Canada, Erdene Gold Inc. press release, 4 p.

Freedonia Group Inc., The, 2007, Industry study—Glass fibers: Cleveland, OH, The Freedonia Group, Inc., 287 p.

Harris Williams & Co., 2007, [Untitled]: Richmond, VA, Harris Williams & Co., [undated]. (Accessed March 8, 2007, at http://www.harriswilliams.com/pdf/franklin.pdf.)

Imerys, 2006, Imerys announces reorganization of its UK kaolin operations: Paris, France, Imerys press release, 1 p.

Industrial Minerals, 2006a, Amcol secures Australian bentonite source: Industrial Minerals, no. 468, September, p. 17.

Industrial Minerals, 2006b, Ashapura clay plant expansions: Industrial Minerals, no. 467, August, p. 17.

Industrial Minerals, 2006c, BASF buys Engelhard: Industrial Minerals, no. 466, July, p. 10.

Industrial Minerals, 2006d, Chinese kaolin deposit: Industrial Minerals, no. 460, January, p. 13.

Industrial Minerals, 2006e, Franklin Industrial Minerals for sale: Industrial Minerals, no. 467, August, p. 8.

Industrial Minerals, 2006f, Imerys acquires AGS on back of "satisfactory" 2005: Industrial Minerals, no. 463, April, p. 8-9.

Industrial Minerals, 2006g, Mullite from Inner Mongolia: Industrial Minerals, no. 467, August, p. 10.

Industrial Minerals, 2006h, Prices: Industrial Minerals, no. 471, December, p. 74.

O'Driscoll, Mike, 2006, Huber reduces paper grade capacity: Industrial Minerals, no. 468, September, p. 6-7.

Rockwood Holdings, Inc., 2006, Rockwood Holdings, Inc. acquires Sud-Chemie AG: Austin, TX, Rockwood Holdings, Inc. press release, 1 p.

U.S. Census Bureau, 2007a, Annual value of construction put in place. U.S. Census Bureau, August 31. (Accessed September 18, 2007, at http://www.census.gov/const/C30/total.pdf.)

U.S. Census Bureau, 2007b, Clay construction products—2006: U.S. Census Bureau MQ327D(06)-5, July, 16 p.

U.S. Census Bureau, 2007c, Paint, varnish, and lacquer—2006: U.S. Census Bureau MQ325F(06)-1, June, 10 p.

U.S. Census Bureau, 2007d, Refractories— 2006: U.S. Census Bureau MA327C(06)-1, June, 9 p.

U.S. Department of Commerce, International Trade Administration, 2007, International trade database: U.S. Department of Commerce, [undated]. (Accessed September 5, 2007, via http://dataweb.usitc.gov/scripts/user_set.asp.)

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

Clays. Ch. in Mineral Commodity Summaries, annual.

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

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[1, 2]

(Thousand metric tons and thousand dollars)

	2002	2003	2004	2005	2006
Domestic clays sold or used by producers:					
Quantity	39,300	40,000	41,200	41,200 r	41,200
Value	1,580,000	1,660,000	1,680,000	1,590,000 r	1,770,000
Exports:					
Quantity	4,960	5,130	5,630	5,620	5,980
Value	817,000	859,000	936,000	929,000	1,000,000
Imports for consumption:					
Quantity	217	279	251	301	346
Value	39,400	51,200	61,700	59,400	79,200

rRevised.
[1]Excludes Puerto Rico.
[2]Data 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	2005		2006	
	Quantity	Value	Quantity	Value
Alabama	2,470	34,600	2,430	44,200
Arkansas	1,280	2,760	1,200	3,180
California	1,260	44,300	1,140	43,300
Colorado	258	1,680	213	1,340
Florida	312	43,300	285	27,300
Georgia	9,590 r	917,000 r	9,170	1,020,000
Illinois	344	26,200	227	13,900
Indiana	823	14,500	793	17,300
Iowa	630	4,740	356	2,750
Kansas	680	5,620	724	8,480
Kentucky	1,150	8,930	1,090	9,720
Louisiana	416	13,100	563	23,700
Maryland	317	686	286	851
Michigan	334	514	405	1,010
Mississippi	1,270	50,800	1,100	49,700
Missouri	1,460	38,300	1,530	43,000
Montana	135	5,460	172	7,380
Nevada	67	6,110	97	12,100
New Jersey	W	W	W	216
New York	785	11,700	813	30,400
North Carolina	2,210	14,400	2,370	25,100
Ohio	1,360	9,180	1,780	21,500
Oklahoma	903	2,520	1,180	4,700
Oregon	79	1,090	284	1,620
Pennsylvania	705	3,460	742	5,630
South Carolina	1,360	22,200	1,350	22,500
South Dakota	183	W	176	W
Tennessee	1,210	41,000	1,060	39,300
Texas	2,680	28,600	2,710	35,600
Utah	541	8,990	603	11,900
Virginia	1,240	32,200	1,030	31,900
West Virginia	186	524	W	W
Wyoming	4,220	190,000	4,420	209,000
Other[3]	718	4,730	902	5,480
Total	41,200 r	1,590,000 r	41,200	1,770,000

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

[1]Excludes Puerto Rico.

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

[3]Includes all other States and data represented by symbol W.

TABLE 3
BALL CLAY SOLD OR USED BY PRODUCERS IN
THE UNITED STATES, BY TYPE AND USE[1]

(Thousand metric tons and thousand dollars)

	2005		2006	
	Quantity	Value	Quantity	Value
Type:				
Airfloat	677	31,700	872	38,300
Water-slurried	145	7,090	135	6,650
Unprocessed	388	14,100	181	8,490
Total	1,210	52,900	1,190	53,400
Use:				
Fillers, extenders, binders[2]	51	NA	44	NA
Floor and wall tile	485	NA	448	NA
Miscellaneous ceramics[3]	132	NA	123	NA
Pottery	18	NA	21	NA
Sanitaryware	297	NA	303	NA
Miscellaneous[4]	23	NA	21	NA
Exports[5]	204	NA	228	NA
Total	1,210	52,900	1,190	53,400

NA Not available.

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

[2]Includes adhesives, animal feed, asphalt tile, asphalt emulsions, gypsum, paper filling, pesticides and related products, plastics, rubber, and other fillers, extenders, and binders.

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

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

[5]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[1]

(Thousand metric tons and thousand dollars)

	2005		2006	
	Quantity	Value	Quantity	Value
Type:				
Nonswelling	300	14,400	260	11,800
Swelling	4,410	201,000	4,680	223,000
Total	4,710	215,000	4,940	234,000
Use:				
Domestic:				
Pet waste absorbents	1,240	NA	1,060	NA
Adhesives	2	NA	6	NA
Animal feed	53	NA	110	NA
Drilling mud	945	NA	1,030	NA
Filler and extender applications[2]	61	NA	69	NA
Foundry sand	893	NA	672	NA
Pelletizing (iron ore)[3]	579	NA	662	NA
Waterproofing and sealing	176	NA	162	NA
Miscellaneous civil engineering	316	NA	313	NA
Miscellaneous[4]	40 r	NA	40	NA
Total	4,310	NA	4,120	NA
Exports:				
Drilling mud	76	NA	120	NA
Foundry sand	205	NA	267	NA
Other[5]	123	NA	432	NA
Total	404	NA	819	NA
Grand total	4,710	215,000	4,940	234,000

[r]Revised. NA Not available.

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

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

[3]Excludes shipments to Canada. Total sales in North America were 595,000 metric tons (t) in 2005 and 730,000 metric tons (t) in 2006.

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

[5]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[1, 2]

(Thousand metric tons and thousand dollars)

	2005		2006	
	Quantity	Value	Quantity	Value
State:				
Alabama	2,280	29,000	2,210	38,800
Arkansas	1,210	1,900	1,140	2,550
California	1,010	16,600	744	7,640
Georgia	1,530	8,730	1,510	9,150
Indiana	809	13,500	779	16,400
Kansas	654	4,590	697	7,440
Kentucky	1,060	4,370	1,000	5,140
Louisiana	416	13,100	563	23,700
Mississippi	642	2,860	549	3,100
Missouri	822	3,400	750	4,160
New York	785	11,700	813	30,400
North Carolina	2,180	13,900	2,340	24,200
Ohio	1,310	6,880	1,580	17,800
Oklahoma	903	2,520	1,180	4,700
Pennsylvania	705	3,460	742	5,630
South Carolina	1,020	3,610	992	4,250
Texas	2,340	8,680	2,360	12,600
Utah	478	6,710	526	10,700
Virginia	982	4,690	762	1,810
Other[3]	3,220 r	15,600 r	2,960	13,100
Total	24,300 r	176,000	24,200	243,000
Use:				
Floor and wall tile[4]	409	NA	249	NA
Heavy clay products:				
Brick, extruded	13,200	NA	12,200	NA
Brick, other	1,680	NA	1,610	NA
Other[5]	273	NA	266	NA
Lightweight aggregate:				
Concrete block	1,950	NA	2,040	NA
Highway surfacing	325	NA	323	NA
Structural concrete	903	NA	927	NA
Miscellaneous	666	NA	762	NA
Portland and other cements	3,690	NA	4,340	NA
Refractories[6]	696	NA	788	NA
Miscellaneous[7]	547 r	NA	696	NA
Total	24,300 r	176,000	24,200	243,000

rRevised. NA Not available.

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

[2]Excludes Puerto Rico.

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

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

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

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

[7]Includes exports, 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[1]

(Thousand metric tons and thousand dollars)

	2005		2006	
	Quantity	Value	Quantity	Value
Production	353	10,700	848	19,000
Use:				
Heavy clay products and lightweight aggregates[2]	190	NA	609	NA
Refractories:				
Firebrick, block, shapes	--	NA	3	NA
Grogs and calcines	--	NA	140	NA
Other refractories[3]	163	NA	46	NA
Miscellaneous[4]	--	NA	50	NA
Total	353	10,700	848	19,000

NA Not available. -- Zero.

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

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

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

[4]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[1]

(Thousand metric tons and thousand dollars)

	2005		2006	
	Quantity	Value	Quantity	Value
Type:				
Attapulgite[2]	282	36,400	262	42,200
Montmorillonite	2,450 r	238,000 r	2,280	201,000
Total	2,730 r	275,000 r	2,540	243,000
Use:				
Absorbents:				
Oil and grease absorbent	266 r	NA	253	NA
Pet waste absorbent	1,820 r	NA	1,440	NA
Animal feed	43 r	NA	112	NA
Fertilizers	W	NA	25	NA
Fillers, extenders, binders[3]	124 r	NA	111	NA
Filtering, clarifying, and decolorizing animal, mineral, and vegetable oils and greases	W	NA	55	NA
Pesticides and related products	W	NA	W	NA
Miscellaneous[4]	483 r	NA	549	NA
Exports[5]	W	NA	W	NA
Total	2,730 r	275,000 r	2,540	243,000

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

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

[2]Primarily gellant-grade fuller's earth. More information can be found in the "Fuller's Earth" portion of the production section of this report.

[3]Includes adhesives, asphalt tiles, gypsum products, medical, pharmaceuticals and cosmetics, paints, and other unknown uses in 2005, and asphalt emulsions, medical, pharmaceuticals and cosmetics, paint, and other unknown uses in 2006.

[4]Includes drilling mud, fertilizers, filtering, miscellaneous absorbents, pesticides, portland cement, refractories, and other unknown uses in 2005, and civil engineering, drilling mud, miscellaneous absorbents, and pesticides in 2006 and exports.

[5]Includes pet waste absorbents in 2005, and absorbents, drilling mud, and other unknown uses in 2006.

TABLE 8
KAOLIN SOLD OR USED BY PRODUCERS IN THE UNITED STATES,
BY STATE AND TYPE[1]

(Thousand metric tons and thousand dollars)

	2005		2006	
	Quantity	Value	Quantity	Value
State:				
Georgia	7,190	825,000	6,920	945,000
South Carolina	287	17,700	294	17,900
Other[2]	326	17,100	258	16,900
Total	7,800	860,000	7,470	980,000
Type:				
Airfloat	1,270	81,900	1,210	82,100
Calcined:[3]				
Pigment-grade	837	250,000	827	259,000
Refractory-grade	474	14,800	442	14,000
Total	1,310	265,000	1,270	273,000
Delaminated	1,010 [4]	113,000 [4]	1,240	153,000
Unprocessed	139	2,130	141	2,380
Water washed	4,070 [4]	398,000 [4]	3,610	471,000
Grand total	7,800	860,000	7,470	980,000

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

[2]Includes Alabama, Arkansas, California, Florida, Nevada, North Carolina, Tennessee, and Texas.

[3]Pigment-grade kaolin is low-temperature calcined kaolin, and refractory-grade kaolin is high-temperature calcined kaolin.

[4]Some delaminated kaolin production included under "Water washed."

TABLE 9
GEORGIA KAOLIN SOLD OR USED BY PRODUCERS, BY TYPE AND USE[1]

(Thousand metric tons and thousand dollars)

	2005		2006	
	Quantity	Value	Quantity	Value
Type:				
Airfloat	1,010	61,700	966	61,800
Calcined[2]	1,190	255,000	1,180	262,000
Delaminated	1,010	113,000	1,240	153,000
Unprocessed	W	W	--	--
Water washed	3,970	396,000	3,530	469,000
Total	7,190 r	825,000 r	6,920	945,000
Use:				
Domestic:				
Ceramics and glass:				
Catalysts (oil-refining)	(3)	NA	106	NA
Fiberglass	348	NA	359	NA
Roofing granules	(3)	NA	33	NA
Other[4]	425	NA	139	NA
Fillers, extenders, binders:				
Adhesives	18	NA	30	NA
Paint	423	NA	343	NA
Paper coating	2,310	NA	2,400	NA
Paper filling	574	NA	420	NA
Plastic	139	NA	49	NA
Rubber	206	NA	151	NA
Other[5]	180	NA	73	NA
Heavy clay products[6]	(7)	NA	(7)	NA
Refractories[8]	413	NA	(7)	NA
Undistributed[9]	85	NA	852	NA
Total	5,120	NA	4,950	NA
Exports:				
Paint	55	NA	74	NA
Paper coating[10]	1,740	NA	1,680	NA
Paper filling[10]	121	NA	112	NA
Rubber	14	NA	13	NA
Undistributed[11]	135	NA	86	NA
Total	2,070	NA	1,970	NA
Grand total	7,190	825,000	6,920	945,000

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

-- Zero.

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

[2]Includes pigment- and refractory-grade calcined kaolin.

[3]Withheld to avoid disclosing company proprietary data; included in "Use: Domestic: Ceramics and glass: Other."

[4]Includes catalysts (oil-refining), electrical porcelain, fine china/dinnerware, pottery, miscellaneous ceramics, roofing granules, and sanitaryware.

[5]Includes animal feed, asphalt tile, fertilizers, gypsum products, medical, pharmaceuticals and cosmetics, pesticides and related products, textiles, and miscellaneous fillers, extenders, and binders.

[6]Includes brick (common and face), portland cement, and miscellaneous clay products.

[7]Withheld to avoid disclosing company proprietary data; included in "Use: Domestic: Undistributed."

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

[9]Includes absorbents, chemical manufacturing, floor and wall tiles, heavy clay products, refractories (2006), waterproofing seals, and other unknown uses.

[10]Some export sales may be included under domestic sales.

[11]Includes adhesives, catalysts (oil-refining), fiberglass, sanitaryware; miscellaneous fillers, extenders, and binders; portland cement; and miscellaneous refractories.

TABLE 10
SOUTH CAROLINA KAOLIN SOLD OR USED
BY PRODUCERS, BY USE[1]

(Thousand metric tons and thousand dollars)

	2005		2006	
	Quantity	Value	Quantity	Value
Production[2]	287	17,700	294	17,900
Use:				
Ceramics[3]	86	NA	83	NA
Rubber	87	NA	79	NA
Other uses[4]	90 r	NA	110	NA
Exports[5]	24	NA	22	NA
Total	287	17,700	294	17,900

rRevised. NA Not available.

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

[2]Includes airfloat, unprocessed, and calcined kaolin.

[3]Includes catalysts (oil-refining), fine china/dinnerware, glazes, glass, and enamels, pottery, roofing granules, sanitaryware, and miscellaneous ceramics.

[4]Includes adhesives, animal feed, asphalt tile, brick (common and face), heavy clay products, lightweight aggregates, paints, paper coating, plastics, and refractories.

[5]Includes fillers, extenders, and binders.

TABLE 11
KAOLIN SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY USE[1]

(Thousand metric tons)

Use	2005	2006
Domestic:		
Ceramics:		
Catalyst (oil and gas refining)	180	163
Electrical porcelain	W	W
Fine china and dinnerware	13	W
Floor and wall tile	97	70
Pottery	6	5
Roofing granules	65	38
Sanitaryware	48	33
Miscellaneous	106	111
Chemical manufacture	W	W
Civil engineering	W	W
Fiberglass, mineral wool	367	377
Fillers, extenders, binders:		
Adhesive	28	39
Fertilizer	W	W
Medical, pharmaceutical, cosmetic	1	W
Paint	445	365
Paper coating	2,310	2,400
Paper filling	574	420
Pesticide	W	W
Plastic	152	64
Rubber	290	229
Miscellaneous	182	75
Heavy clay products:		
Brick, common and face	118	115
Portland cement	80	84
Refractories[2]	498	452
Miscellaneous applications	89 r	394
Total	5,650	5,430
Exports:		
Ceramics	(3)	58
Paint	72	91
Paper coating	1,740	1,680
Paper filling	121	112
Portland cement	--	(3)
Rubber	38	35
Miscellaneous	176	60
Total	2,150	2,040
Grand total	7,800	7,470

rRevised. W Withheld to avoid disclosing company proprietary data; included in "Miscellaneous." -- Zero.

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

[2]Includes firebrick (blocks and shapes), grogs and calcines, kiln furniture, and miscellaneous refractories.

[3]Withheld to avoid disclosing company proprietary data; included in "Exports: miscellaneous."

TABLE 12
COMMON CLAY AND SHALE USED IN LIGHTWEIGHT AGGREGATE PRODUCTION IN THE UNITED STATES BY STATE[1]

(Thousand metric tons and thousand dollars)

State	Concrete block	Structural concrete	Other[2]	Total	
				Quantity	Value
2005:					
Alabama	575	42	78	695	22,900
Arkansas	417	--	--	417	1,010
California	21	265	--	286	14,100
Indiana[e]	113	36	91	240	11,400
Kansas	--	--	70	70	972
Kentucky	143	48	48	239	683
Louisiana	140	32	125	297	12,600
Missouri	--	--	113	113	1,680
Nebraska	--	--	(3)	(3)	2
New York	220	233	--	454	8,900
North Carolina[e]	--	--	10	10	11
Ohio	134	8	17	159	701
Oklahoma	43	6	--	49	1,300
Texas[e]	49	162	265	476	2,730
Utah	96	71	173	340	6,330
Total	1,950	903	990	3,850	85,300
2006:					
Alabama	639	46	76	761	25,800
Arkansas	401	--	--	401	1,040
California	20	63	--	83	3,430
Indiana	135	66	99	299	8,250
Kansas	--	--	78	78	684
Kentucky	137	46	--	183	649
Louisiana	224	51	200	475	23,100
Missouri	--	--	130	130	1,130
Nebraska	--	--	1	1	2
New York	167	352	--	519	25,900
North Carolina[e]	--	--	11	11	95
Ohio[e]	106	63	87	257	9,640
Oklahoma	41	6	--	47	1,340
Texas	47	155	255	457	2,810
Utah	120	79	147	347	6,750
Total	2,040	927	1,080	4,050	110,000

[e]Estimated. -- Zero.

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

[2]Includes highway surfacing.

[3]Less 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	2005		2006	
	Quantity	Value[e]	Quantity	Value[e]
Alabama	1,290	2,960 [r]	1,260	10,400
Arkansas	480	559 [r]	460	698
California	307	1,000	294	1,030
Colorado	222	1,590 [r]	181	1,140
Georgia	1,370	7,660	1,350	8,020
Kentucky[3]	429	1,660	476	2,650
Maryland	248	373 [r]	219	W
Mississippi	565	2,730	549	3,100
North Carolina	2,120	14,100 [r]	2,250	23,500
Ohio	752	3,780 [r]	438	2,410
Oklahoma	788	1,030	737	1,940
Pennsylvania	643	3,000 [r]	662	4,800
South Carolina	810	2,250 [r]	651	2,270
Tennessee	372	3,830	231	1,530
Texas	1,140	3,660 [r]	1,070	4,670
Virginia	983	4,520	762	1,810
Other[4]	2,380 [r]	8,740 [r]	2,210	15,000
Total	14,900 [r]	63,400 [r]	13,800	85,000

[e]Estimated. [r]Revised. W Withheld to avoid disclosing company proprietary data; included in "Other."

[1]Includes extruded and other brick.

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

[3]Extruded brick only.

[4]Includes all other States and data represented by symbol W. Excludes Alaska, Nevada, New Hampshire, Rhode Island, Vermont, and Wisconsin.

TABLE 14
U.S. EXPORTS OF CLAYS, BY TYPE[1]

(Thousand metric tons and thousand dollars)

Material	2005		2006		Principal destinations, 2006
	Quantity	Value	Quantity	Value	
Ball clay	141	8,840	140	7,890	Mexico, 35%; United Kingdom, 19%; Venezuela, 11%.
Bentonite	847	98,500	1,270	132,000	Canada, 36%; Japan, 33%; Saudi Arabia, 7%.
Fire clay	368	34,400	348	38,100	Mexico, 52%; Luxembourg, 24%.
Fuller's earth	55	13,500	69	16,400	Netherlands, 19%; Canada, 16%; United Kingdom, 14%.
Kaolin	3,580	601,000	3,540	626,000	Japan, 21%; Canada, 17%; Finland, 10%; Mexico, 9%; China, 8%; Taiwan, 6%.
Clays, n.e.c.	634	173,000	607	181,000	Canada, 43%; Japan, 17%; Mexico, 9%.
Total	5,620	929,000	5,980	1,000,000	

[1]Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 15
U.S. IMPORTS FOR CONSUMPTION OF CLAY, BY TYPE[1]

(Thousand metric tons and thousand dollars)

Material	2005		2006		Principal sources, 2006
	Quantity	Value	Quantity	Value	
China clay or kaolin	262	40,200	303	55,600	Brazil, 97%; United Kingdom, 3%.
Fire clay	(2)	156	(2)	168	Canada, 57%; Germany, 22%; Austria, 19%.
Decolorizing earths and fuller's earth	2	286	3	223	China, 94%; Germany, 6%.
Bentonite	10	3,550	13	3,100	Greece, 66%; Mexico, 19%; China 6%.
Common blue clay and other ball clay	1	261	1	233	United Kingdom, 95%.
Other clay	8 r	4,660	5	3,650	Canada, 50%; Germany, 18%; Mexico, 17%.
Chamotte or Dina's Earth	(2)	9	(2)	18	Germany, 76%; Austria, 24%.
Artificially activated clay and activated earth	17 r	10,300	21	16,200	Mexico, 62%; Germany, 21%; Canada, 5%.
Total	301 r	59,400	346	79,200	

rRevised.
[1]Data are rounded to no more than three significant digits.
[2]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 16
BENTONITE: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country[3]	2002	2003	2004	2005	2006[e]
Algeria[4]	27,178	25,346	30,319	29,029	27,110 [5]
Argentina	120,006	146,845	163,028	243,590 [r]	25,000
Armenia[e]	258 [5]	642	561	732 [5]	750
Australia[e, 4]	113,000 [r]	145,000 [r]	265,000 [r]	223,000 [r]	220,000
Bolivia	216	227	548	590 [r]	600
Bosnia and Herzegovina	9,829	13,050	16,500 [e]	17,000 [e]	15,000
Brazil, beneficiated	184,909	198,981	226,874	221,035 [r]	221,100 [p]
Bulgaria	212,000	146,000	225,000 [r]	181,000 [r]	200,000
Burma	1,104 [r]	856 [r]	800 [r, e]	800 [r, e]	800
Chile	632	748	101	--	--
Commonwealth of Indepedent States[e, 6]	750,000	750,000	750,000	750,000	750,000
Croatia	12,102	13,568	13,500 [e]	13,000 [e]	13,000
Cyprus	128,400	144,859	155,717	150,000 [e]	150,000
Czech Republic	174,000	199,000 [e]	201,000	186,000 [r]	220,000
Egypt[e]	50,000	50,000	50,000	50,000	50,000
Georgia[e]	7,000	9,700	1,800 [5]	1,800 [5]	1,800
Germany	495,310	478,796	404,549	352,374 [r]	350,000
Greece[e]	950,000	950,000	950,000	950,000	950,000
Guatemala	4,436	6,438	81,688	135,451	20,034 [5]
Hungary	3,700	87,290	10,000 [r]	9,000 [r]	4,444 [5]
Indonesia[e]	5,000	5,000	5,000	5,000	5,000
Iran[7]	125,510	140,528	193,046	200,000 [e]	200,000
Italy[e]	463,000 [r]	474,000 [r]	475,000 [r]	446,000 [r]	470,000 [5]
Japan	437,772	425,945	455,282	421,629 [r]	420,000
Kenya[e]	50	50	50	60 [r]	60
Macedonia[e]	25,000	25,000	25,000	25,000	25,000
Mexico	488,215	464,056	564,015	425,630	450,000
Morocco	58,754	67,700	85,400	85,400 [e]	80,400
Mozambique	--	--	3,336	--	--
New Zealand, processed[e]	7,800	10,940 [r]	10,050	7,590 [r]	7,800
Nicaragua[e]	6,000	6,300	6,300	6,300	6,000
Pakistan	11,476 [r]	11,290 [r]	6,316	15,671	16,000
Peru	20,760	14,980	18,471	18,500	18,500
Philippines	5,500	5,500 [r, e]	3,560 [r, 5]	-- [r]	--
Poland[8]	26,200	31,648	66,143	86,331 [r]	85,000
Romania	15,389	17,637	18,161	17,890 [r]	18,000
Serbia and Montenegro[e, 9]	75 [5]	75	75	75	75
Slovakia	66,128	74,938	73,273	70,000 [e]	70,000
South Africa[10]	101,100	145,060	55,859	139,833	32,878 [p]
Spain[e]	123,457 [r]	103,174 [r]	156,760 [r]	105,000 [r]	110,000
Turkey	559,224	831,146	850,000 [e]	925,000 [e]	950,000
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	3,970,000	3,770,000	4,550,000	4,710,000	4,940,000 [5]
Zimbabwe[10]	3,780 [r]	-- [e]	500 [e]	500	500
Total	10,100,000 [r]	10,300,000 [r]	11,500,000 [r]	11,600,000 [r]	11,700,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

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

[2]Table includes data available through August 21, 2007.

[3]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.

[4]Includes bentonitic clays.

[5]Reported figure.

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

[7]Year beginning March 21 of that stated.

[8]Montmorillite type bleaching clay.

[9]In June 2006, Montenegro and Serbia formally declared independence from each other and dissolved their union. Mineral production data for 2006, however, still reflect the unified country.

[10]May include other clays.

TABLE 17
FULLER'S EARTH: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country[3]	2002	2003	2004	2005	2006[e]
Algeria	3,521	2,573	2,284	831	--
Argentina[e]	-- [r]	-- [r]	-- [r]	-- [r]	--
Australia, attapulgite	12,000 [r]	11,000 [r]	10,000 [r]	9,800 [r]	10,000
Germany, unprocessed[e]	-- [r]	-- [r]	-- [r]	-- [r]	--
Guatemala	10	9	9	--	19 [4]
Israel	-- [r]	-- [r]	-- [r]	-- [r]	--
Italy[e]	30,000	30,000	30,000	30,000	30,000
Mexico	147,064	152,917	129,502	107,265	110,000
Morocco, smectite	43,243	14,944	15,000 [e]	15,000 [e]	15,000
Pakistan[e]	15,521 [r]	16,670 [r]	13,986 [r]	17,001 [r]	18,000
Senegal, attapulgite	138,400	194,900	200,000 [e]	200,000 [e]	200,000
South Africa, attapulgite	13,288	14,585	20,419	34,340 [r]	49,225 [p, 4]
Spain:					
Attapulgite	22,918	18,975	20,796 [r]	20,000 [e]	20,000
Sepiolite	733,134	690,395	851,647 [r]	850,000 [r, e]	850,000
United Kingdom[e, 5]	140,000	140,000	140,000	140,000	140,000
United States[6]	2,730,000	3,600,000	3,260,000	2,730,000 [r]	2,540,000 [4]
Total	4,030,000 [r]	4,890,000 [r]	4,690,000 [r]	4,160,000 [r]	3,980,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]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 August 21, 2007.

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

[3]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.

[4]Reported figure.

[5]Salable product.

[6]Sold or used by producers.

TABLE 18
KAOLIN: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country[3]	2002	2003	2004	2005	2006[e]
Algeria	9,505	16,591	24,299	34,386	32,523 [4]
Argentina	13,865	19,219	27,883	54,703 [r]	50,000
Australia, includes ball clay[e]	230,000	280,000 [r]	285,000 [r]	230,000	250,000
Austria, marketable[e]	50,000	50,000	50,000	50,000	50,000
Bangladesh[e, 5]	8,100	8,200	8,300	8,400	8,500
Belgium[e]	300,000	300,000	300,000	300,000	300,000
Bosnia and Herzegovina, crude	6,500	20,000 [r]	20,000 [r]	24,352 [r]	24,882 [4]
Brazil, beneficiated	1,757,488	2,081,039	2,381,000 [r]	2,410,000 [r]	2,410,000 [p]
Bulgaria	160,000	170,000	1,291,000 [r]	1,381,000 [r]	1,300,000
Chile	6,164	11,500	7,133	15,183	44,642 [4]
Colombia, includes common clay[e]	-- [r]	-- [r]	-- [r]	-- [r]	--
Czech Republic	3,650,000	4,155,000	3,862,000	3,882,000 [r]	3,768,000 [4]
Denmark, sales[e]	2,500	2,500	2,500	2,500	2,500
Ecuador	8,483	11,883	5,646	25,078 [r]	25,000
Egypt[e]	300,000 [4]	300,000	300,000	300,000	300,000
Eritrea	250	281	101	100	100
Ethiopia	3,534	3,088	4,251	3,726 [r]	1,641 [4]
France, marketable[e]	300,000 [4]	300,000	300,000	300,000	300,000
Germany	3,681,953 [r]	3,503,589 [r]	3,751,874 [r]	3,767,662 [r]	3,770,000
Greece[e]	60,000 [4]	60,000	60,000	60,000	60,000
Guatemala	372	1,497	2,000 [r, e]	4,107	4,395 [4]
Hungary, processed[e]	4,300	13,250 [4]	13,300 [4]	7,000 [r]	10,000
India:[e]					
Processed	170,000 [4]	180,000	180,000	190,000	200,000
Salable crude	540,000 [4]	550,000	550,000	560,000	560,000
Indonesia[e]	15,000 [4]	15,000	15,000	15,000	15,000
Iran	553,782	484,507	531,109	500,000	550,000
Italy, kaolinitic earth[e]	450,000 [r]	450,000 [r]	450,000 [r]	450,000 [r]	469,702 [4]
Japan	11,756	12,409	11,553	10,500 [r]	10,000
Jordan	100,000 [e]	179,153	216,566	220,000	220,000
Kazakhstan[e]	70,000	70,000	70,000	70,000	70,000
Kenya	720 [r]	740 [r]	760 [r]	780 [r]	780
Korea, Republic of	2,727,481	3,009,245	2,773,220 [r]	2,767,091	2,399,458 [4]
Kyrgyzstan[e]	237,100 [4]	381,100 [4]	400,000	400,000	400,000
Madagascar[e]	170	170	170	170	170
Malaysia	323,916	425,942	326,928	494,511 [r]	450,000
Mexico	745,498	798,407	654,711	877,147	875,000
New Zealand	17,200 [r]	14,770 [r]	15,500 [r]	15,700 [r]	15,000
Nigeria[e]	200,000	200,000	210,000	200,000 [r]	220,000
Pakistan	53,542 [r]	39,575 [r]	25,204	37,732	38,000
Paraguay[e]	66,700	66,600	66,600	66,600	66,000 [p]
Peru	1,934	2,653	2,720	2,720	2,720 [p]
Poland, washed	113,500	169,034	191,312	159,207 [r]	148,579 [4]
Portugal[e]	148,706 [r]	150,000 [r]	152,077 [r]	160,000 [r]	160,000
Romania	22,514	25,741	22,337	22,000	11,063 [4]
Russia, concentrate[e]	45,000 [4]	45,000	45,000	45,000	45,000
Serbia and Montenegro:[e, 6]					
Crude	60,000 [4]	60,000	60,000	60,000	60,000
Washed	10,000	10,000	10,000	10,000	10,000
Slovakia	33,000	24,800	89,424	85,000	85,000
South Africa	86,700	86,365	81,901	59,356 [r]	51,602 [p]
Spain, marketable, crude and washed[7]	419,493 [r]	450,000 [r, e]	437,990 [r]	450,000 [r]	450,000
Sri Lanka	8,613	9,073	9,200 [e]	9,400 [e]	9,500
Thailand, beneficiated	127,132	184,562	200,761	201,000 [e]	200,000
Turkey	372,344	370,455	536,008	580,000 [e]	580,000
Uganda	178	--	537	31,000 [e]	30,000
Ukraine[e]	225,000 [4]	225,000	225,000	225,000	225,000
United Kingdom, sales[e, 8]	2,400,000 [4]	2,400,000	2,400,000	2,400,000	2,500,000

See footnotes at end of table.

TABLE 18—Continued
KAOLIN: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country[3]	2002	2003	2004	2005	2006[e]
United States[9]	8,010,000	7,680,000	7,760,000	7,800,000	7,470,000 [4]
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]	600,000	650,000	650,000	650,000	650,000
Zambia[e]	200	200	200	200	200
Total	35,000,000 [r]	36,200,000 [r]	37,600,000 [r]	38,200,000 [r]	37,500,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

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

[2]Table includes data available through August 21, 2007.

[3]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.

[4]Reported figure.

[5]Data for year ending June 30 of that stated.

[6]In June 2006, Montenegro and Serbia formally declared independence from each other and dissolved their union. Mineral production data for 2006, however, still reflect the unified country.

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

[8]Dry weight.

[9]Kaolin sold or used by producers.