CLAYS

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The amount of clay sold or used by domestic producers in 2000 was 40.8 million metric tons (Mt) valued at $1.52 billion, a decrease of 3% in tonnage and value from that of 1999. Production of fire clay and fuller's earth increased, but production of ball clay, bentonite, common clay and shale, and kaolin decreased. Of the clay and shale produced in 2000, common clay and shale accounted for 58% of the tonnage, and kaolin accounted for 61% of the value. Imports of clays increased to 95,500 metric tons (t) valued at $34.9 million. Exports increased to 5.26 Mt valued at $896 million (table 1).

Legislation and Government Programs

The U.S. Environmental Protection Agency continued its work on the maximum achievable control technology (MACT) emission standards for the clay processing and manufacturing industries. The MACT standards are required under the National Emissions Standards for Hazardous Air Pollutants Program, which was established by the 1990 Amendments to the Clean Air Act. The MACT standards cover clay processors and manufacturers of lightweight aggregate, brick and structural clay products, and ceramics. The agency will issue MACT standards for each category because each has different emissions, emission controls, and economic considerations (American Ceramic Society Bulletin, 2000).

The U.S. Food and Drug Administration (FDA) clarified its guidance document for dioxins in anticaking agents, including clay, used in animal feeds. At issue was the use of the terms "mined clay products" and "lime" in the guidance document. In the first case, nonclay anticaking agents also were covered. In the later, limestone rather than lime was covered. The wording was changed to "clay and nonclay anticaking agents" to avoid any confusion, and the FDA urged the animal feed industry to develop a more scientifically accurate naming scheme for its products to avoid confusion in the future (U.S. Food and Drug Administration, 2000).

Clay mining has an environmental impact because of the disturbance to the land. Overburden is moved, and clays are removed, leaving a depression or pit. State laws usually require leveling or contouring of the disturbed area and planting trees or grasses to prevent or minimize erosion. For processing, the impoundment of slimes and dust control are usually required. The rules for disposal of coarse tailings are similar to or included within those laws governing reclamation of the mined area.

Production

In 2000, 228 companies operated approximately 640 clay and shale pits or quarries. The largest 20 companies, many with multiple operations, accounted for 50% of the tonnage and 79% 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,

Clay and Shale in the 20th Century

By 1900, the domestic clay and shale industry was fairly well established. Production of all clay types was about 1.1 million metric tons per year; fire clay accounted for 69% of the clay and shale produced in the United States, followed by common and miscellaneous clays, 18%; stoneware clay, 9%; kaolin, 2%; ball clay, 1%; and fuller's earth, 1%. In the early 1900s, the major clay markets were fire brick and refractory mortars. Other large markets included brick, drain tile, sewer tile, and structural tile for both fire clay and common clay. Markets for the other clay types were much smaller. Major uses for ball clay were in ceramics. The major market for bentonite was foundry sand bond. Decolorizing oils and greases applications were major applications for bentonite and fuller's earth. Paper and ceramics were the major markets for kaolin. Fire clay production continued to dominate until the 1940s when it was surpassed by common clay and shale. Despite this, the time period between 1945 and 1970 were the boom years for fire clay. In contrast to the production of common clay and shale and fire clay, production of ball clay, bentonite, fuller's earth, and kaolin increased at a relatively steady pace from 1900 onward.

In 2000, domestic production of clays was 40.7 million tons. Common clay and shale accounted for 58% of production, followed by kaolin, 22%; bentonite, 9%; fuller's earth, 7%; ball clay, 3%; and fire clay, 1%. Major uses for ball clay in 2000 were ceramic tile (35%) and sanitaryware (22%); foundry sand bond (28%), pet waste absorbent (23%), drilling mud (17%), and iron ore pelletizing (13%) for bentonite; brick (56%), cement (17%), and lightweight aggregate (16%) for common clay and shale; refractories (73%) for fire clay; absorbents (75%) for fuller's earth; and paper (61%) and refractories (11%) for kaolin. In general, variations in sales of clay and shale tracked the rise and fall of the U.S. economy because much of the clay tonnage was associated with construction. A few specific factors that affected sales of clay and shale were increased oil drilling in the 1920s and its decline in the late 1980s, the Great Depression of the 1930s, changes in refractory demands beginning in the 1960s, decreased use of brick in housing beginning in the late 1970s, the energy crisis of the 1970s, and the popularity of clumping pet waste absorbents and the intrusion of precipitated calcium carbonate into the domestic paper market in the 1990s.

Vermont, Wisconsin, and the District of Columbia (table 2). For States not reporting production, clay probably was extracted for construction uses by companies not participating in the U.S. Geological Survey (USGS) canvass of the clay and shale industry.

The 10 leading producer States, in decreasing order by tonnage, were Georgia, Wyoming, Alabama, Texas, North Carolina, Missouri, Ohio, South Carolina, California, and Virginia. The 10 leading producing companies, in alphabetical order, were American Colloid Co. (bentonite); Engelhard Corp. (fuller's earth and kaolin); General Shale Products Corp. (common clay and shale); Glen Gery Corp. (common clay and shale); Holnam, Inc. (common clay and shale); J.M. Huber Corp. (kaolin) IMERYS (kaolin); Oil-Dri Corp. (fuller's earth); Radex Heraklith Industriesbeteilgungs AG (fire clay and kaolin); 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. All the 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 (354 of 544 sent) account for approximately 85% of the total clay and shale production sold or used listed in table 1. The bulk of the nonrespondents were producers of common clay and shale. Production data for the nonrespondents were estimated from reported prior-year production levels adjusted for trends in the industry and other guidelines.

Ball Clay.—In 2000, 4 companies mined ball clay from 38 quarries in 4 States. Production of domestic ball clay decreased to 1.14 Mt valued at $48.4 million in 2000 from 1.20 Mt valued at $48.0 million in 1999 (table 3). Tennessee supplied 60% of the Nation's output, followed by Texas, Kentucky, and Mississippi. Production increased in Mississippi and decreased in Kentucky, Tennessee, and Texas. Water-slurried ball clay was produced in Kentucky and Tennessee. Airfloat and shredded (unprocessed) ball clay was produced in Kentucky, Mississippi, Tennessee, and Texas.

Hecla Mining Co. sold its subsidiary Kentucky-Tennessee Clay Co. (K-T Clay) to the French investment group IMERYS. K-T Clay is the largest domestic producer of ball clay. The sale consisted of K-T Clay's ball clay operations in Kentucky, Mississippi, and Tennessee and its kaolin operations in Georgia and South Carolina. IMERYS also operates kaolin mines in Georgia (North American Minerals News, 2000b; Hecla Mining Co., 2001).

Unimin Corp. completed its acquisition of United Clays Inc., a division of Watts Blake Bearne & Co. plc (WBB). Unimin also is linked to WBB through its parent corporation SCR Sibelco SA, which has 100% ownership of WBB (North American Minerals News, 2000f).

Bentonite.—In 2000, 20 companies produced bentonite from approximately 82 pits in 11 States. The quantity and value of all varieties of bentonite sold or used decreased to 3.76 Mt valued at $155 million in 2000 from 4.07 Mt valued at $176 million in 1999 (table 5). Production of nonswelling bentonite increased to 400,000 t valued at $14.0 million in 2000 from 392,000 t valued at $13.2 million in 1999. Alabama led all States in the production of nonswelling bentonite, followed by Mississippi, Arizona, Texas, Nevada, California, and Colorado. Production increased in Colorado, Mississippi, and Nevada.

Production of swelling bentonite decreased to 3.36 Mt valued at $141 million in 2000 from 3.68 Mt valued at $163 million in 1999. Wyoming led all States in the production of swelling bentonite, followed by Montana, Utah, California, Texas, Oregon, and Nevada. Production increased in Nevada.

Laporte plc sold its subsidiary Southern Clay Products, Inc. (SCP), to Kohlberg, Kravis, Roberts & Co. LP for $1.18 billion. SCP sold bentonite, hectorite, and organoclay-based products for markets such as oil drilling fluids, cosmetics, and pharmaceuticals (North American Minerals News, 2000d). SCP also commissioned a specialty-products processing unit at its plant in Texas. The unit will produce smectite-based functional additives, including organoclays, nanoclays, and rheological additives (Southern Clay Products, Inc., 2000c). SCP also was awarded damages against Sud-Chemie, Inc., for patent infringement involving two of SCP's organoclay patents (Southern Clay Products, Inc., 2000d).

American Colloid began construction of a blending plant in Butler, GA. This will be the company's 10th blending plant in the United States and the 3d in Georgia. The plant will produce custom bentonite-based binders for foundry metal casting. The company also is diversifying its pet litter lineup through its agreement with The Andersons Inc. to distribute Andersons' corn-cob based litter. American Colloid already markets its clay-based scoopable pet litters (North American Minerals News, 2000a).

Common Clay and Shale.—In 2000, 175 companies produced common clay and shale from approximately 360 pits in 41 States and Puerto Rico. For 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. Most companies were manufacturers of structural clay products, such as brick, clay pipe, drain tile, and sewer pipe; lightweight aggregates; and cement. About 89% of the production was used to manufacture brick, lightweight aggregate, and cement.

Domestic sales or use of common clay and shale decreased to 23.7 Mt valued at $135 million in 2000 from 24.8 Mt valued at $155 million in 1999 (table 7). The major producing States, in decreasing order by tonnage, were North Carolina, Texas, Alabama, Georgia, Ohio, Missouri, Virginia, Kentucky, California, and Arkansas.

Fire Clay.—Fire clay producers were mostly refractories manufacturers that used the clays in firebrick and other refractories. In 2000, 42 pits were operated by 12 firms in 6 States.

Fire clay sold or used by domestic producers increased to 476,000 t valued at $7.56 million in 2000 from 402,000 t valued at $6.77 million in 1999 (table 9). Missouri was the leading producing State, followed by Ohio, South Carolina, California, Colorado, and Kentucky. Production increased in California, Colorado, Missouri, and South Carolina.

Fuller's Earth.—In 2000, 17 companies produced fuller's earth (attapulgite and montmorillonite varieties) from 29 pits in 11 States. Production of fuller's earth increased to 2.91 Mt valued at $254 million in 2000 from 2.56 Mt valued at $231 million in 1999 (table 11; discussion under "Prices"). The fuller's earth deposits grade from attapulgite-rich in Florida to montmorillonite-rich further northward into Georgia. Only those clays for which attapulgite is the major clay component are classified as attapulgite. These basically are the gellant-grade fuller's earths in Florida and the southernmost part of

Georgia. Going northward into Georgia, the attapulgite content of the fuller's earth declines, and montmorillonite becomes the dominant clay present. This is classified under montmorillonite although it contains minor to trace amounts of attapulgite.

The attapulgite variety of fuller's earth was mined from eight pits in the Florida panhandle and southwestern Georgia. Attapulgite production was estimated to be 292,000 t in 2000, an increase from 289,000 t in 1999. Florida led in the production of attapulgite, followed by Georgia. Production of the montmorillonite variety of fuller's earth was 2.62 Mt in 2000, an increase from 2.28 Mt in 1999. Montmorillonite was produced, in decreasing order by tonnage, in Georgia, Mississippi, Illinois, Missouri, Virginia, California, Florida, Tennessee, Kansas, and Texas.

Sepiolite clay produced in Nevada is included under the attapulgite variety of fuller's earth to protect proprietary information. Production in Kansas is a saprolitic clay but is included under montmorillonite to protect proprietary information.

Kaolin.—In 2000, 22 firms mined kaolin from approximately 93 pits in 10 States. Domestic production decreased to 8.80 Mt valued at $929 million in 2000 from 9.16 Mt valued at $948 million in 1999 (table 13). The leading producing State was Georgia, followed by Alabama, South Carolina, California, Texas, North Carolina, Nevada, Florida, Arkansas, and Tennessee.

Approximately 55% of the kaolin produced was water washed; 16%, airfloat; 14%, calcined; 13%, delaminated; and 2%, unprocessed (table 14). A total of 1.19 Mt valued at $261 million of calcined kaolin was reported. Of this amount, 839,000 t valued at $247 million was pigment-grade (low-temperature). The remainder was refractory-grade (high-temperature) calcined kaolin (table 15). It is believed that refractory-grade calcined kaolin production was greatly underreported by producers in 2000. Actual U.S. production is estimated to be about 1.0 Mt rather than the 354,000 t reported by producers, based on past mining trends and economic conditions.

Kaolin production in Georgia decreased to 7.66 Mt valued at $877 million in 2000 from 8.16 Mt valued at $907 million in 1999. Approximately 62% of the production was sold as water washed; 11%, pigment-grade calcined; 15%, delaminated; 8%, airfloat; and 4%, refractory-grade calcined and unprocessed (table 16). Production of calcined kaolin in Georgia probably was about 1.4 Mt in 2000 rather than 1.07 Mt due to underreporting by refractory producers. Production in South Carolina decreased to 397,000 t valued at $21.9 million in 2000 from 408,000 t valued at $15.7 million in 1999. Approximately 85% of the production was airfloat kaolin, with the remainder being unprocessed (table 18).

Unimin Corp. began negotiations with Süd-Chemie Inc. for the purchase of Albion Kaolin Co. Albion Kaolin was owned by United Catalysts Inc., a subsidiary of Süd-Chemie Inc. Albion Kaolin is the largest producer of airfloat kaolin with plants in McIntrye and Hephzibah, GA. Its main market segment is fiberglass (48% of sales). Other markets were in adhesives, building materials, ceramics, paper, and rubber. Unimin also produces bentonite, feldspar, limestone, mica, nepheline syenite, olivine, quartz (high purity), silica sand, and tripoli (Industrial Minerals, 2000h).

C-E Minerals Inc., part of the French investment group IMERYS, bought North American Processing Co. (NAPCO) from Allied Mineral Products Inc. and Frank & Schulte GmbH. NAPCO has a 70,000-metric-ton-per-year (t/yr) plant in Newell, WV, for processing bauxite, fused alumina, magnesite, magnesia, silicon carbide, and toll processing for other users of refractory materials. C-E Minerals operates facilities in Andersonville, GA, processing kaolin for its alumina silica calcine products (Industrial Minerals, 2000b).

Sparta Kaolin Corp, a subsidiary of Kaoclay Resources Inc., completed its exploration program in east-central Georgia, within 40 kilometers of existing kaolin operations. The company estimates that its deposits contain 43 Mt of kaolin resources. About 35 Mt of this amount has a brightness of 90.9%. The company has about 53 Mt of inferred resources that it is currently investigating. Kaoclay Resources does not intend to enter into the mining industry but is seeking partners to develop the deposit (Industrial Minerals, 2000d).

Thiele Kaolin Co. announced talks with Companhia Vale do Rio Doce (CVRD) in Brazil to be their exclusive marketing agent for paper coating kaolins produced by Para Pigmentos SA (PPSA). PPSA operates a 600,000 t/yr plant in Para, Brazil. It sells its paper coating products mainly to Brazil, Europe, Japan, and other Southeast Asian countries. Thiele Kaolin also is trying to acquire a minority percentage of CVRD's controlling interest in PPSA (North American Minerals News, 2000e).

Consumption

Ball Clay.—The principal domestic ball clay markets, in decreasing order, were floor and wall tile, sanitaryware, and refractories (table 4). Consumption decreased to 1.14 Mt in 2000 from 1.20 Mt in 1999. The largest increase in sales was in miscellaneous ceramics, where sales for electrical porcelain, fiber glass, fine china and dinnerware, and mineral wool increased. Sales for floor tile, refractories, and wall tile applications also increased. Decreases were observed in sales for pottery and sanitaryware. Under miscellaneous sales, sales for waterproofing and sealing applications increased, and sales for brick and drilling mud declined significantly. In general, sales and use of ball clay had increased in recent years because growth in commercial and residential building construction and home renovations has increased demand for sanitaryware, tile, and whiteware. The slight decline in the housing market affected sales in 2000.

Bentonite.—Major markets for bentonite were drilling mud, foundry sand, iron ore pelletizing, and pet waste absorbents. These markets accounted for about 85% of the domestic sales (table 6). Total sales (domestic and exports) of bentonite were approximately 710,000 t for drilling mud (more than 99% was swelling bentonite), 1.07 Mt for foundry sand bond (833,000 t was swelling bentonite), 558,000 t for pelletizing iron ore (all swelling bentonite), 865,000 t for pet waste absorbent (more than 99% was swelling bentonite), and 285,000 t for waterproofing and sealing (more than 99% was swelling bentonite). These five markets accounted for 93% of total bentonite sales.

Data for other bentonite markets were withheld to avoid disclosing company proprietary data. However, more than 90% of the bentonite sold for absorbents, adhesive, animal feed, drilling, pelletizing iron ore, waterproofing, and water treatment and slightly more than 78% of bentonite sold for foundry sand applications was swelling bentonite. Bentonite sold for catalyst; desiccant; filtering, clarifying, and decolorizing of oils and

greases; and paint, pharmaceutical, and miscellaneous chemical manufacture applications was largely the nonswelling variety of bentonite.

The major domestic markets for swelling bentonite, in decreasing order, were pet waste absorbents, foundry sand, drilling mud, iron ore pelletizing, and waterproofing and sealing. Major export markets for swelling bentonite were foundry sand, drilling mud, and iron ore pelletizing applications. The major domestic uses for nonswelling bentonite, in decreasing order, were in clarifying, decolorizing, and filtering of oils and greases; foundry sand; catalyst; miscellaneous absorbents; animal feed; and chemical manufacture. Very little nonswelling bentonite was exported.

Common Clay and Shale.—Common clay was used most frequently in the manufacture of heavy clay products, such as building brick, drain tile, flue linings, lightweight aggregate, portland cement, sewer pipe, structural tile, and terra cotta (table 8). Consumption of common clay and shale decreased slightly to 23.7 Mt in 2000 from 24.8 Mt in 1999. The strong housing and commercial building market has helped maintain sales of common clay and shale for brick and lightweight aggregate manufacture for the past several years, but the industry was affected by a slight decline in housing starts in 2000.

Fire Clay.—Fire clay was used in refractory products, such as firebrick and block, grogs and calcines, high-alumina brick and specialties, saggers, refractory mortars and mixes, and ramming and gunning mixes. Fire clays also were used to produce such items as brick and pottery.

Consumption of fire clay increased to 476,000 t in 2000 from 402,000 t in 1999 (table 10). Major markets for fire clay, in decreasing order, were firebrick, refractory mortar and cement, portland cement, miscellaneous refractories, grogs and calcines, quarry tile, pottery, and common brick. Portland cement manufacture accounted for most of the increase in sales under heavy clay products and lightweight aggregates.

Fuller's Earth.—The major domestic uses for attapulgite and montmorillonite varieties of fuller's earth, in decreasing order, were pet waste absorbents; oil and grease absorbents; portland cement manufacture; animal feed; pesticide carrier; filtering, clarifying, and decolorizing of oils and greases; fertilizer carriers; cement manufacture; and pesticide carriers (table 12). Consumption of fuller's earth increased to 2.91 Mt in 2000 from 2.56 Mt in 1999.

Sales of montmorillonite increased to 2.62 Mt in 2000 from 2.28 Mt in 1999. Major domestic markets for montmorillonite, in decreasing order, were pet waste absorbents; oil and grease absorbents; portland cement; animal feed; clarifying, decolorizing, and filtering of oils and greases; and pesticide carrier.

Sales of attapulgite increased to 292,000 t in 2000 from 289,000 t in 1999. Most of the sales data were withheld to avoid disclosing company proprietary data; major markets, in decreasing order, were oil and grease absorbents; drilling mud; fertilizer carriers; paint; pet waste absorbents; adhesives; pesticide carriers; and animal feed.

Sales of montmorillonite variety of fuller's earth accounted for more than 70% of sales of fuller's earth for animal feed; clarifying, decolorizing, and filtering oils and greases; desiccant; oil and grease absorbents; pesticide carriers; and pet waste absorbents. Attapulgite accounted for more than 75% of the sales for adhesive and fertilizer carriers and all of the sales for asphalt tile, drilling mud, gypsum products, paint, pharmaceuticals, roofing granules, and textiles.

Kaolin.—The major domestic markets for kaolin, in decreasing order, were paper coating and filler, refractories (although reported as 425,000 t in 2000 by producers, sales are believed to be closer to 1.0 Mt), paint, fiber glass, rubber, catalyst, and brick (table 20). The largest increase in sales was for paint, which increased by 13% or 38,000 t in 2000. The largest decreases were in paper coating (180,000 t or 6%) and paper fillers (281,000 t or 36%). Both have been affected in recent years by competition from calcium carbonate and a lackluster paper market. Sales of kaolin for refractories were reported to be about 425,000 t in 2000 or about 55% of sales in 1999. Underreporting by refractory producers is believed to have occurred, and refractory sales probably have been about 1.0 Mt for the past 2 years, with 2000 being slightly less than in 1999. This corresponds more closely with recent sales patterns of clay refractories. Major domestic markets for kaolin from Georgia, in decreasing order, were paper coating, paper filling, refractories, paint, and fiberglass (table 17).

The major domestic market for kaolin from South Carolina was rubber, accounting for about 41% of sales. Other major markets, in decreasing order, were catalysts, face and common brick, fiber glass, and roofing granules (table 19).

Absorbent Uses.—Sales for absorbent uses were about 3.07 Mt, an increase of 16% compared with that of 1999. Fuller's earth accounted for 71% of the clay used for absorbents, followed by bentonite. Pet waste absorbents accounted for approximately 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 approximately 2.00 Mt, a slight increase from that of 1999. The largest ceramics market was ceramic floor and wall tile (48%), followed by sanitaryware (18%), catalyst (12%), roofing granules (9%), fine china (3%), and pottery (3%). Ball clay accounted for 38% of the clay used in ceramics, followed by common clay and shale (36%) and kaolin (23%). Small amounts of bentonite, fire clay, and fuller's earth also were used in the manufacture of ceramics. Ball clay dominated the electrical porcelain, glazing, and sanitaryware markets. Common clay and shale was the predominant clay used in 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 markets.

Sales of clay tile increased slightly. Apparent consumption of clay floor and wall tile was 212 million square meters valued at $1.95 billion in 2000, an increase from 195 million square meters valued at $1.84 billion in 1999. Domestic manufacturers shipped 60.2 million square meters of clay floor and wall tile valued at $857 million in 2000 compared with 59.1 million square meters valued at $843 million in 1999. Imports were 155 million square meters valued at $1.12 billion in 2000 and 139 million square meters valued at $1.02 billion in 1999 (U.S. Census Bureau, 2001a).

Data on sales of vitreous sanitaryware used in the United States were not available for 2000. In 1999, apparent consumption was valued at $976 million compared with $886 million in 1998. Manufacturer shipments were $932 million in 1999 versus $883 million in 1998. Imports increased to $101

million in 1999 from $68 million in 1998 (U.S. Census Bureau, 2000a).

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

Expanded Clay and Shale.—Approximately 3.85 Mt of clay and shale was used in the production of lightweight aggregate (table 21). Nearly all the clay used to manufacture lightweight aggregate was common clay and shale. Lightweight aggregates were used in concrete block, structural concrete, and highway surfacing, in decreasing order of consumption.

Hydraulic Cement.—Clays provide the alumina and silica required to manufacture hydraulic cements. In 2000, approximately 4.19 Mt of clays was consumed, a decrease from 5.32 Mt in 1999. In decreasing order, common clay and shale, fire clay, fuller's earth, and kaolin were used in the manufacture of portland cement clinker. More than 92% of the clay consumed by the cement industry was common clay and shale.

Structural Clay Products.—Approximately 14.0 Mt of clays was used in the manufacture of structural clay products, such as building brick, roofing tile, and sewer pipe. Common and face brick accounted for 97% of this total. Other markets, in decreasing order by tonnage, were flue linings, sewer pipe, flower pots, structural tile, terra cotta, drain tile, and roofing. Small amounts of bentonite, fire clay, and kaolin also were used.

In 2000, 8.62 billion building and face bricks valued at $1.69 billion were shipped compared with 8.93 billion bricks valued at $1.63 billion in 1999. Structural facing tile and ceramic glazed brick shipments totaled 28,100 units valued at $13.2 million in 2000 compared with 26,700 units valued at $14.6 million in 1999. Approximately 47,000 t of structural clay tile valued at $9.07 million was shipped in 2000 compared with 47,200 t valued at $8.49 million in 1999. Shipments of vitrified clay and sewer pipe fittings were 162,000 t valued at $61.7 million compared with 179,000 t valued at $56.6 million in 1999 (U.S. Census Bureau, 2001a).

Drilling Mud.—Sales (domestic and exports) for drilling mud applications were 764,000 t (676,000 t sold domestically and 88,100 t exported). Swelling-type bentonite accounted for approximately 93% of the clay used in drilling mud. Fuller's earth also was used in drilling mud applications.

Drilling activity increased in 2000 with the number of rotary rigs operating as of December 8, 2000, at 1,497 in Canada and the United States compared with 1,210 in 1999 (Oil & Gas Journal, 2000a). The number of exploratory wells drilled was predicted to increase to 2,550 in 2000 compared with 2,138 in 1999 (Oil & Gas Journal, 2000b).

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 4.61 Mt of clays was sold for use as fillers, extenders, and binders in 2000 compared with 5.18 Mt in 1999. The bulk of the decline was in sales of kaolin to the paper industry. Paper coating and filling accounted for 72% of domestic sales, followed by paint, 8%; rubber, 5%; and animal feed, 3%. Adhesive; asphalt tile; fertilizer carrier; gypsum products; ink; medical, cosmetic, and pharmaceutical; pesticide carrier; plastic; textile; and wallboard applications each accounted for less than 1.5% of the fillers and extenders markets.

Kaolin accounted for approximately 89% of the clay used in filler and extender applications, followed by fuller's earth, 6%; common clay and shale, 2%; bentonite, 2%; ball clay, 1%; and trace amounts of fire clay. Bentonite was the predominant clay used for ink applications; common clay and shale, in wallboard production; fuller's earth, in fertilizer and pesticide applications; and kaolin, in adhesive, gypsum products, paint, paper, plastics, rubber, and textile markets. Bentonite, fuller's earth, and kaolin were the predominant clays used in asphalt tile, and bentonite and fuller's earth were the predominant clays used in animal feeds and pharmaceuticals.

The U.S. Census Bureau reported shipments of paints and coatings to be 1.48 billion gallons valued at $17.8 billion in 2000 compared with 1.47 billion gallons valued at $17.8 billion in 1999. Architectural paints accounted for 645 million gallons; product coatings, for 453 million gallons; and special purpose coatings, for 181 million gallons compared with 660 million gallons, 440 million gallons, and 174 million gallons, respectively, in 1999 (U.S. Census Bureau, 2001b). Architectural paints are the major market for industrial mineral fillers among the paint types.

Fiberglass.—Domestic sales to the fiberglass industry were 304,000 t in 2000 compared with 329,000 t in 1999. Kaolin was the only clay type used for this application.

Iron Ore Pelletizing.—Sales (domestic and exports) were 558,000 t in 2000 compared with 598,000 t in 1999. Swelling bentonite was the only type of clay used for this application.

Paper Products.—Kaolin accounted for all of the clay sales used for paper coating (2.82 Mt sold domestically and 1.93 Mt exported) and essentially all the clay used for paper filling (506,000 t sold domestically and 100,000 t exported).

Approximately 86.8 Mt of paper and paperboard was produced in 1999. Paperboard accounted for 46.2 Mt of this amount and paper accounted for 40.6 Mt. Paper accounted for 62% of the value of these shipments (McGraw-Hill Companies and International Trade Administration, 2000). In general, slow growth in the paper industry, pressure to reduce paper prices, and increased fuel costs have resulted in reduced returns for the kaolin industry.

Refractories.—Producers reported that 2.15 Mt of clays was used for the domestic manufacture of refractories. As mentioned earlier, it is believed that underreporting occurred in 2000. It is estimated that the reported tonnage should be increased by between 600,000 to 700,000 t, bringing sales for refractory usage to about 2.80 Mt compared with 3.06 Mt in 1999. The largest domestic markets, as reported by producers, were foundry sand (50%), refractory mortar and cement (16%), firebrick (12%), grogs and calcines (10%), alumina specialties (2%), and high alumina brick (1%). The market percentages for refractories must be used with caution for all but the foundry sand and the refractory mortar and cement categories because of the uncertainty in the data for specific market destinations.

Bentonite accounted for 39% of domestic refractory sales, followed by common clay and shale with 22%; kaolin, 20%; fire clay, 16%; ball clay, 3%; and fuller's earth, less than 1%. Fire clay and common clay were the predominate clays used in firebrick; bentonite, in foundry sand; common clay, in refractory mortar and cement; and kaolin, in calcine, grog, high alumina brick, and kiln furniture.

The U.S. Census Bureau reported that shipments of clay refractories were $911 million compared with $971 million in 1998. In 1999, 861,000 t (292 million bricks) valued at $518 million of clay refractory brick and shapes was shipped by

manufacturers. This can be subdivided into fire clay brick and shapes, 384,000 t (118 million bricks) valued at $160 million; high alumina brick and shapes, 435,000 t (139 million bricks) valued at $301 million; and insulating brick and shapes, 41,800 t (36.0 million bricks) valued at $56.6 million. Shipments of unshaped clay refractories were 759,000 t valued at $393 million. This can be broken out into refractory mortars, 121,000 t valued at $60.6 million; plastic refractories, 144,000 t valued at $79.1 million; castable refractories, 325,000 t valued at $190 million; and fire clay gunning mixes, 169,000 t valued at $64.2 million. Approximately 150,000 t of miscellaneous refractories valued at $29.40 million and $24.9 million of other unknown types of clay refractories also was sold in 1999 (U.S. Census Bureau, 2000b).

Prices

Ball Clay.—The average value for ball clay reported by domestic producers was $42.46 per metric ton. The average values for imported and exported ball clay were $301.59 and $86.60 per ton, respectively.

Bentonite.—The average value reported by domestic producers for nonswelling bentonite was $35.00 per ton. The average value for swelling bentonite was $41.96 per ton. The average value for all bentonite was $41.22 per ton. The average value of imported bentonite was $345.93 per ton. The average value of exported bentonite was $105.52 per ton.

The price per ton, ex-works, Wyoming, crude, bulk, rail cars, was $23 to $54; foundry grade, bagged, rail cars, $42 to $65 per ton; API-grade, bagged, rail cars, $34 to $44 (Industrial Minerals, 2000f).

Southern Clay Products, Inc., announced average price increases of 6% for its wet-processed organoclay additives and 5% to 7% for its dry-processed organoclay additives (Southern Clay Products, 2000a, b).

Common Clay and Shale.—The average value for all common clay and shale produced in the United States and Puerto Rico was $5.70 per ton. The average value of clay and shale used in lightweight aggregate was $13.40 per ton. The value for lightweight aggregate is an estimate of the clay value. Average prices for lightweight aggregate produced from clay and shale range from $30 per ton to $50 per ton for most applications.

Fire Clay.—The average value for fire clay reported by domestic producers was $15.88 per ton. The average of imported fire clay was $383.56 per ton. The average value of exported fire clay was $86.11 per ton.

Fuller's Earth.—The average value of attapulgite-type fuller's earth was estimated to be $110 per ton. The value reported by producers on the USGS canvass and given in table 11 was believed to be greatly undervalued based on available pricing for attapulgite. The average value of montmorillonite-type fuller's earth was $90.00 per ton. The average value of all fuller's earth was estimated to be $91.83 per ton. The average value of imported fuller's earth was $171.43 per ton. The average value of exported fuller's earth was $183.82 per ton.

The price per ton, ex-plant, Georgia, 40% to 100% less than 325 mesh, truckload, was $181 to $454; granular processed, 40% to 100% less than 4/8 mesh, truckload, $159 to $454; granular, 6/30 mesh, truckload, $109 to $181; and granular, 6/30 mesh, gel grade, bagged, $295 to $635 (Industrial Minerals, 2000f).

Kaolin.—The average value of kaolin was $105.57 per ton for all kaolin grades. The average value for airfloat was $45.99 per ton; refractory grade (high-temperature calcined), $27.57; pigment grade (low-temperature calcined), $294.40; all types of calcined, $219.38 per ton; delaminated, $102.59 per ton; water washed, $100.00 per ton; and unprocessed, $12.57 per ton. The average value of the imported kaolin was $312.00 per ton. The average value of exported kaolin was $168.29 per ton.

The price per ton, ex-works, Georgia, filler, bulk, was $73 to $91; coating, bulk, $76 to $167; sanitaryware-grade, bagged, $53 to $62; tableware-grade, bagged, $114; and calcined, bulk, $305 to $357 (Industrial Minerals, 2000f).

IMERYS announced price increases of 8% for paper-grade kaolin prices. The company also will add energy surcharges of $3.30, $6.60, and $19.80 per ton for its hydrous slurry, hydrous dry, and calcined products, respectively (Chemical Market Reporter, 2000).

Foreign Trade

Ball Clay.—Ball clay exports decreased to 100,000 t valued at $8.66 million, according to the U.S. Census Bureau (table 23). Domestic ball clay producers reported that 164,000 t of ball clay was exported in 2000 (table 4). Some discrepancy may occur if water weight for slurry products is not taken into account. Sales through U.S. mineral brokers, where producers do not know if the ball clay is used domestically or exported, also could explain part of the discrepancy. Imports were 504 t of ball clay valued at $152,000 (table 24).

Bentonite.—Bentonite exports increased to 761,000 t valued at $80.3 million (table 23). Domestic bentonite producers reported exports of 404,000 t (table 6). The discrepancy between producers and the U.S. Census Bureau may result from producers including most of the exports destined for Canadian and Mexican markets (approximately 212,000 t) under domestic sales. Sales through U.S. mineral brokers, where producers do not know if the bentonite is used domestically or exported, also could explain part of the discrepancy.

Bentonite imports consisted mainly of untreated bentonite clay and chemically or artificially activated materials. Imports of untreated bentonite were 8,470 t valued at $2.93 million. Imports of chemically activated material were 17,600 t valued at $8.92 million (table 24).

Fire Clay.—Approximately 216,000 t of fire clay valued at $18.6 million was exported (table 23). In 2000, 73 t of fire clay valued at $28,000 was imported (table 24).

Fuller's Earth.—Approximately 136,000 t of fuller's earth valued at $25.0 million was exported (table 23). Approximately 70 t of decolorizing earth and fuller's earth valued at $12,000 was imported in 2000 (table 24).

Kaolin.—The U.S. Census Bureau reported that 3.69 Mt of kaolin valued at $621 million was exported in 2000 (table 23). Producers reported exports of 2.74 Mt (table 20). Much of the kaolin destined for Canadian paper markets (839,000 t) and some of the 219,000 t of kaolin exports for Mexican markets probably was reported under domestic consumption.

Kaolin imports increased to 62,500 t valued at $19.5 million (table 24). Approximately 75% of the imports was from Brazil, followed by the United Kingdom with 22%.

World Review

World production of bentonite was approximately 9.86 Mt (table 25), fuller's earth production was estimated to be 3.87 Mt

(table 26), and kaolin production was 41.2 Mt (common clay and kaolin combined for Colombia, table 27). The United States continued to be the leading producer of all three varieties of clays, followed by Greece and countries of the former Soviet Union for bentonite, Germany for fuller's earth, and Uzbekistan, the United Kingdom, and the Republic of Korea for kaolin. Spain led all countries in the production of sepiolite.

The European Commission set a maximum dioxin concentration of 5 nanograms per kilogram in kaolinitic clay products used for binder, anticaking agents, and coagulants. This standard was established because of the high levels of dioxin in some of the kaolinitic clay from Germany (Industrial Minerals, 2000c).

Brazil.—Rio Capim Caulim SA, partially owned by IMERYS, plans to double its current production capacity of 400,000 t/yr and to introduce new calcined kaolin products for paint applications (Industrial Minerals, 2000a).

Czech Republic.—WBB purchased shares of Kaolin Hlubany, a.s., from Villeroy and Boch AG. Villeroy and Boch owned 94% of Kaolin Hlubany. The company sells about 80,000 t of clay for tableware, sanitaryware, refractory, and tile applications (Ceramic Industry, 2000).

Mexico.—KT Clay completed a $3.5 million expansion of its ball clay slurry plant at Monterrey. The plant, with the most recent expansion, has a capacity exceeding 100,000 t/yr (North American Minerals News, 2000c).

Namibia.—Afhold Ltd. obtained a 15-year license from the Namibian Government to mine sepiolite near Gobabis. The company plans to export the sepiolite to Europe for cat litter applications. The deposit contains 4 Mt of high-grade sepiolite and 5 Mt of lower quality sepiolite. The company will mine the lower quality material first (Mining Journal, 2000).

New Zealand.—IMERYS purchased all shares of New Zealand China Clays Ltd. from Ceramico Corp. Ltd. New Zealand China Clays produced about 15,000 t/yr of halloysite for the tableware market (CI Cybernews, 2000).

Portugal.—WBB created the management group WBB Portugal to handle its clay interests in that country. Portugal has become an important market for exports from the WBB Devon Clays Ltd. operation in the United Kingdom and its joint venture Donbas Clays JSC in Ukraine (Industrial Minerals, 2000i).

Turkmenistan.—Bentonite from the Oglanlinsky clay deposit will be processed at a new bentonite plant in Nebit-Dag, in the Balkansky District. The plant will have a capacity of 50,000 t/yr. The output will be used in ceramic, drilling-mud, and foundry applications (Industrial Minerals, 2000e).

Uzbekistan.—Kaolin, a joint venture between German and Uzbekistani interests, has commissioned a second kaolin processing plant at Angren. The new plant will increase capacity to 200,000 t/yr. The plant processes kaolin primarily for Uzbekistan's ceramic and paper industries, although its kaolin is suitable for pharmaceutical, pigment, and refractory applications (Industrial Minerals, 2000g).

Outlook

The outlook for the clay industry will be mixed for the next few years. Construction-oriented markets are likely to experience very little growth or even slight declines if the U.S. and world economies continue to slow. This will affect sales of clays for adhesives, brick, ceramics, fiber glass, lightweight aggregate, paint, and other construction-oriented markets. Similarly, a slowing economy will affect sales of clays for industrial manufacturing applications, such as foundry sand bond, iron ore pelletizing, and refractories. Interest in oil exploration and processing should provide a slight boost in sales for catalysts and drilling muds. Pet litter markets also should remain strong. Competition in the paper-filler and coating markets and increased fuel costs will continue to hamper the kaolin industry.

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TABLE 1
SALIENT U.S. CLAY STATISTICS 1/ 2/

(Thousand metric tons and thousand dollars)

	1996	1997	1998	1999	2000
Domestic clays sold or used by producers:					
Quantity	43,100	42,000	41,900	42,200	40,800
Value	1,710,000	1,670,000	1,670,000	1,570,000	1,520,000
Exports:					
Quantity	4,830	5,080	5,230	4,800	5,260
Value	825,000	860,000	843,000	823,000	896,000
Imports for consumption:					
Quantity	45	64	86	90	96
Value	21,000	23,200	27,700	23,000	34,900

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 IN 2000, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars)

State	Ball clay	Bentonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
Alabama	--	W	2,090	--	--	W	2,090	23,200
Arizona	--	W	W	--	--	--	W	W
Arkansas	--	--	958	--	--	W	958	1,170
California	--	21	969	W	W	W	990	19,000
Colorado	--	W	296	W	--	--	296	2,000
Connecticut	--	--	55	--	--	--	55	183
Florida	--	--	W	--	W	33	33	3,420
Georgia	--	--	1,500	--	919	7,660	10,100	964,000
Illinois	--	--	200	--	W	--	200	905
Indiana	--	--	639	--	--	--	639	1,560
Iowa	--	--	306	--	--	--	306	1,060
Kansas	--	--	594	--	W	--	594	3,970
Kentucky	W	--	1,000	10	--	--	1,010	4,220
Louisiana	--	--	636	--	--	--	636	1,530
Maine	--	--	49	--	--	--	49	125
Maryland	--	--	271	--	--	--	271	982
Massachusetts	--	--	36	--	--	--	36	321
Michigan	--	--	594	--	--	--	594	3,210
Minnesota	--	--	14	--	--	--	14	15
Mississippi	W	W	484	--	371	--	856	32,300
Missouri	--	--	1,050	351	W	--	1,400	7,860
Montana	--	W	W	--	--	--	W	W
Nebraska	--	--	133	--	--	--	133	338
Nevada	--	6	--	--	28	W	35	4,670
New Jersey	--	--	W	--	--	--	W	130
New Mexico	--	--	34		--	--	34	256
New York	--	--	630	--	--	--	630	7,820
North Carolina	--	--	2,430	--	--	W	2,430	18,600
North Dakota	--	--	79	--	--	--	79	W
Ohio	--	--	1,370	W	--	--	1,370	7,380
Oklahoma	--	--	757	--	--	--	757	2,060
Oregon	--	W	227	--	--	--	227	632
Pennsylvania	--	--	840	--	--	--	840	1,870
South Carolina	--	--	890	40	--	397	1,330	24,700
South Dakota	--	--	171	--	--	--	191	W
Tennessee	685	--	W	--	W	W	685	29,300
Texas	W	W	2,210	--	W	W	2,210	9,460
Utah	--	W	335	--	--	--	335	5,380
Virginia	--	--	1,010	--	W	--	1,010	2,380
Washington	--	--	116	--	--	--	116	425

See footnotes at end of table.

TABLE 2--Continued
CLAYS SOLD OR USED BY PRODUCERS IN THE UNITED STATES IN 2000, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars)

State	Ball clay	Bentonite	Common clay and shale	Fire clay	Fuller's earth	Kaolin	Total	Total value
West Virginia	--	--	199	--	--	--	199	560
Wyoming	--	3,080	W	--	--	--	3,080	126,000
Total	1,140	3,760	23,700	476	2,910	8,800	40,800	1,520,000

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.
1/ Excludes Puerto Rico.
2/ Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 3
BALL CLAY SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY STATE 1/

(Thousand metric tons and thousand dollars)

	Airfloat		Water-slurried		Unprocessed		Total	
State	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1999:								
Tennessee	323	15,700	184	7,410	218	7,000	725	30,100
Other 2/	194	9,230	9	400	270	8,330	472	18,000
Total	517	24,900	193	7,810	488	15,300	1,200	48,000
2000:								
Tennessee	287	14,400	180	7,660	218	7,160	685	29,300
Other 2/	212	11,500	W	W	W	W	456	19,100
Total	499	26,000	180	7,660	218	7,160	1,140	48,400

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes Kentucky, Mississippi, and Texas.

TABLE 4
BALL CLAY SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY USE 1/

(Metric tons)

Use	1999	2000
Fillers, extenders, binders 2/	W	W
Floor and wall tile	353,000	400,000
Miscellaneous ceramics 3/	72,900	151,000
Pottery	121,000	22,700
Refractories 4/	42,200	68,500
Sanitaryware	292,000	256,000
Miscellaneous 5/	155,000	78,600
Exports 6/	161,000	164,000
Total	1,200,000	1,140,000

W Withheld to avoid disclosing company proprietary data; included with "Miscellaneous."
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes animal feed (1999), asphalt emulsions (1999), rubber (2000), and other fillers, extenders, and binders.
3/ Includes catalysts, electrical porcelain, fiber glass (2000), fine china/dinnerware, glazes, mineral wool, and miscellaneous ceramics.
4/ Includes firebrick, blocks, shapes, high-alumina brick and specialties (1999), and kiln furniture (2000).
5/ Includes brick (common), waterproofing seals, drilling mud (1999), and other unknown uses (1999).
6/ Includes ceramics and glass, fillers, extenders and binders, and floor and wall tile.

TABLE 5
BENTONITE SOLD OR USED BY PRODUCERS IN THE UNITED STATES,
BY STATE 1/

(Thousand metric tons and thousand dollars)

State	Nonswelling		Swelling		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1999:						
California	W	W	W	W	23	2,110
Mississippi	W	W	--	--	W	W
Nevada	W	W	W	W	6	W
Oregon	--	--	W	W	W	W
Wyoming	--	--	3,370	146,000	3,370	146,000
Other 2/	392	13,200	305	16,400	668	27,500
Total	392	13,200	3,680	163,000	4,070	176,000
2000:						
California	W	W	W	W	21	2,160
Mississippi	W	W	--	--	W	W
Nevada	W	W	W	W	6	W
Oregon	--	--	W	W	W	W
Wyoming	--	--	3,080	126,000	3,080	126,000
Other 2/	400	14,000	285	14,400	658	26,200
Total	400	14,000	3,360	141,000	3,760	155,000

W Withheld to avoid disclosing company proprietary data; included with "Other" or "Total." -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes Alabama, Arizona, Colorado, Montana, Texas, and Utah.

TABLE 6
BENTONITE SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY USE 1/

(Metric tons)

Use	1999	2000
Domestic:		
Absorbents:		
Pet waste absorbents	788,000	862,000
Other absorbents	W	W
Adhesives	14,200	5,680
Animal feed	74,200	46,800
Ceramics (except refractories) 2/	W	W
Drilling mud	667,000	654,000
Filler and extender applications 3/	24,700	35,400
Filtering, clarifying, decolorizing mineral oils and greases, vegetable oils, dessicants	81,400	93,800
Foundry sand	888,000	835,000
Pelletizing (iron ore) 4/	540,000	500,000
Miscellaneous refractories 5/	201,000	4,050
Miscellaneous 6/	83,300	66,800
Waterproofing and sealing	268,000	254,000
Total	3,630,000	3,360,000
Exports:		
Drilling mud	68,800	56,400
Foundry sand	251,000	233,000
Other 7/	121,000	115,000
Total	440,000	404,000
Grand total	4,070,000	3,760,000

See footnotes at end of table.

TABLE 6--Continued
BENTONITE SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY USE 1/

W Withheld to avoid disclosing company proprietary data; included with "Miscellaneous."
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes catalysts and pottery.
3/ Includes medical, pharmaceutical, cosmetics, paint, paperfilling (2000), pesticides and related products (1999), plastics, asphalt tiles, ink, and miscellaneous fillers and extenders applications.
4/ Excludes shipments to Canada. Total sales in North America were 598,000 metric tons in 1999 and 558,000 metric tons in 2000.
5/ Includes kiln furniture and miscellaneous refractories.
6/ Includes chemical manufacturing, heavy clay products, and other unknown uses.
7/ Includes absorbents, waterproofing and sealing, fillers and extenders, pelletizing, miscellaneous refractories, and other unknown uses.

TABLE 7
COMMON CLAY AND SHALE SOLD OR USED BY
PRODUCERS IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars)

	1999		2000	
State	Quantity	Value	Quantity	Value
Alabama	2,320	23,700	2,090	23,200
Arkansas	1,010	1,510	958	1,170
California	829	13,100	969	16,800
Georgia	1,600	5,130	1,500	5,200
Indiana	752	1,480	639	1,560
Kansas	592	2,770	594	3,970
Kentucky	892	3,790	1,000	4,190
Michigan	615	3,550	594	3,210
Mississippi	497	3,390	484	2,200
Missouri	1,080	4,180	1,050	3,240
New York	W	W	630	7,820
North Carolina	2,430	18,700	2,430	18,600
Ohio	1,710	8,170	1,370	7,380
Oklahoma	757	2,050	757	2,060
Pennsylvania	816	1,760	840	1,870
South Carolina	1,130	4,930	890	2,790
Texas	2,100	9,890	2,210	9,460
Virginia	881	3,240	1,010	2,380
Other 3/	4,820	44,100	3,730	17,400
Total	24,800	155,000	23,700	135,000

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

TABLE 8
COMMON CLAY AND SHALE SOLD OR USED BY
PRODUCERS IN THE UNITED STATES, BY USE 1/ 2/

(Metric tons)

Use	1999	2000
Ceramics and glass 3/	181,000	W
Civil engineering and sealing	34,800	28,000
Floor and wall tile:		
Ceramic	400,000	517,000
Other 4/	W	W
Heavy clay products:		
Brick, extruded	12,000,000	11,600,000
Brick, other	1,800,000	1,730,000
Drain tile and sewer pipe	27,000	71,900
Flowerpots	W	W
Flue linings	58,900	259,000
Structural tile	22,700	W
Other 5/	160,000	108,000
Lightweight aggregate:		
Concrete block	2,430,000	2,330,000
Highway surfacing	317,000	239,000
Structural concrete	929,000	941,000
Miscellaneous 6/	259,000	344,000
Portland and other cements	5,010,000	4,030,000
Refractories 7/	785,000	472,000
Miscellaneous 8/	429,000	1,060,000
Total	24,800,000	23,700,000

W Withheld to avoid disclosing company proprietary data; included with "Other" or "Miscellaneous."
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Excludes Puerto Rico.
3/ Includes pottery and roofing granules.
4/ Includes quarry tile and miscellaneous floor and wall tiles.
5/ Includes flower pots, roofing tile, terra cotta (2000), and miscellaneous clay products.
6/ Includes miscellaneous lightweight aggregates.
7/ Includes firebrick, block and shapes, mortar and cement, and miscellaneous refractories.
8/ Includes exports, miscellaneous fillers and extenders, asphalt emulsion, asphalt tile (2000), wall board, and other unknown uses.

TABLE 9
FIRE CLAY SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars)

	1999		2000	
State	Quantity	Value	Quantity	Value
Missouri	293	3,980	351	4,630
Other 3/	109	2,790	125	2,940
Total	402	6,770	476	7,560

1/ Refractory uses only.
2/ Data are rounded to no more than three significant digits; may not add to totals shown.
3/ Includes California, Colorado (2000), Kentucky, New Mexico (1999), Ohio, and South Carolina.

TABLE 10
FIRE CLAY SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY USE 1/

(Metric tons)

Use	1999	2000
Ceramics and glass 2/	W	W
Heavy clay products and lightweight aggregates 3/	47,400 r/	101,000
Refractories:		
Firebrick, block, shapes	154,000	140,000
Other refractories 4/	172,000	208,000
Miscellaneous 5/	28,800 r/	26,900
Total	402,000	476,000

r/ Revised. W Withheld to avoid disclosing company proprietary data; included with "Miscellaneous."
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes pottery.
3/ Includes common brick, portland cement, terra cotta.
4/ Includes foundry sand, grogs and calcines, high alumina brick and specialties (1999), mortar and cement, and miscellaneous refractories.
5/ Includes animal feed, quarry tile, and other unknown uses.

TABLE 11
FULLER'S EARTH SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY STATE 1/

(Thousand metric tons and thousand dollars)

	Attapulgite 2/		Montmorillonite		Total	
State	Quantity	Value	Quantity	Value	Quantity	Value
1999:						
Georgia	W	W	W	W	725	73,800
Southern States 3/	--	--	1,030	79,000	1,030	79,000
Western States 4/	W	W	W	W	808	78,600
Total	289 r/	13,200 r/	2,280 r/	218,000 r/	2,560	231,000
2000:						
Georgia	W	W	W	W	919	81,400
Southern States 3/	--	--	996	79,400	996	79,400
Western States 4/	W	W	W	W	995	93,100
Total	292	13,500 5/	2,620	240,000	2,910	254,000

r/ Revised. W Withheld to avoid disclosing company proprietary data; included with "Southern States." -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Primaily gellent-grade fuller's earth. See discussion under "Production: Fuller's earth."
3/ Includes Florida, Mississippi, Tennessee, and Virginia.
4/ Includes California, Illinois, Kansas, Missouri, Nevada, and Texas.
5/ See discussion of fuller's earth under "Prices."

TABLE 12
FULLER'S EARTH SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY USE 1/

(Metric tons)

Use	1999	2000
Absorbents:		
Oil and grease absorbent	275,000	276,000
Pet waste absorbent	1,580,000	1,920,000
Miscellaneous absorbent	W	--
Animal feed	82,900	83,100
Drilling mud	W	W
Fertilizers	137,000	62,500
Fillers, extenders, binders 2/	63,900	70,200
Filtering, clarifying, decolorizing animal, mineral, vegetable oils and greases	W	72,300
Pesticides and related products	67,800	79,500
Miscellaneous 3/	245,000	347,000
Exports 4/	114,000	W
Total	2,560,000	2,910,000

W Withheld to avoid disclosing company proprietary data; included with "Miscellaneous." -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes adhesives; asphalt emulsions and tiles; gypsum products; medical, pharmaceutical, and cosmetics; paint; textiles; and other unknown uses.
3/ Includes portland cement, refractories, roofing granules, and other unknown uses.
4/ Includes absorbents; drilling mud; fillers, extenders, and binders; floor and wall tiles; and other unknown uses.

TABLE 13
KAOLIN SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY STATE 1/

(Thousand metric tons and thousand dollars)

	1999		2000	
State	Quantity	Value	Quantity	Value
Georgia	8,160	907,000	7,660	877,000
South Carolina	408	15,700	397	21,900
Other 2/	588	25,800	742	30,400
Total	9,160	948,000	8,800	929,000

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.

TABLE 14
KAOLIN SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY KIND 1/

(Thousand metric tons and thousand dollars)

	1999		2000	
Kind	Quantity	Value	Quantity	Value
Airfloat	1,030	46,100	1,420	65,300
Calcined 2/	1,830	272,000	1,190	261,000
Delaminated	1,350	132,000	1,160	119,000
Unprocessed	363	3,250	210	2,640
Water washed	4,590	495,000	4,820	482,000
Total	9,160	948,000	8,800	929,000

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; see discussion under "Production: Kaolin."

TABLE 15
CALCINED KAOLIN SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY STATE 1/

(Thousand metric tons and thousand dollars)

State	Refractory-grade		Pigment-grade	
	Quantity	Value	Quantity	Value
1999:				
Alabama and Georgia	W	W	799	250,000
Other 2/	W	W	(3/)	(3/)
Total	1,030	22,400	799	250,000
2000:				
Alabama and Georgia	W	W	839	247,000
Other 2/	W	W	(3/)	(3/)
Total	354 4/	9,760	839	247,000

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes Arkansas, California, and Texas.
3/ Included with refractory-grade kaolin to avoid disclosing company proprietary data.
4/ See discussion under "Production: Kaolin."

TABLE 16
GEORGIA KAOLIN SOLD OR USED BY PRODUCERS,
BY KIND 1/

(Thousand metric tons and thousand dollars)

Kind	1999		2000	
	Quantity	Value	Quantity	Value
Airfloat	654	26,800	616	29,200
Calcined 2/	799	250,000 3/	1,070	248,000
Delaminated	1,350	132,000	1,160	119,000
Unprocessed	W	W	61	655
Water washed	4,540	494,000	4,760	480,000
Total	8,160	907,000	7,660	877,000

W Withheld to avoid disclosing company proprietary data; included in "Total."
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; also see discussion under "Production: Kaolin."
3/ Excludes value for refractory-grade kaolin; included in "Total."

TABLE 17
GEORGIA KAOLIN SOLD OR USED BY PRODUCERS,
BY USE 1/ 2/

(Metric tons)

Use	1999	2000
Domestic:		
Ceramics and glass:		
Catalysts (oil-refining)	W	W
Electrical porcelain	8,550	W
Fiber glass	301,000	277,000
Roofing granules	25,000	22,200
Sanitaryware	67,000	82,900
Other 3/	212,000	218,000

See footnotes at end of table.

TABLE 17--Continued
GEORGIA KAOLIN SOLD OR USED BY PRODUCERS,
BY USE 1/ 2/

(Metric tons)

Use	1999	2000
Fillers, extenders, binders:		
Adhesives	66,500	55,600
Paint	263,000	290,000
Paper coating	2,990,000	2,810,000
Paper filling	784,000	505,000
Plastic	34,600	49,600
Rubber	85,200	64,400
Other 4/	104,000	100,000
Heavy clay products 5/	W	17,400
Refractories 6/	650,000	278,000
Undistributed 7/	179,000	182,000
Total	5,770,000	4,960,000
Exports:		
Paint	81,500	400,000
Paper coating 8/	1,970,000	1,930,000
Paper filling 8/	110,000	100,000
Rubber	4,670	7,670
Undistributed 9/	234,000	263,000
Total	2,400,000	2,700,000
Grand total	8,160,000	7,660,000

W Withheld to avoid disclosing company proprietary data; included with "Other" or "Undistributed."
1/ Includes airfloat, high- and low-temperature calcined and delaminated, water-washed, and unprocessed kaolin.
2/ Data are rounded to no more than three significant digits; may not add to totals shown.
3/ Includes crockery/earthenware, fine china/dinnerware, pottery, and miscellaneous ceramics.
4/ Includes animal feed; asphalt tile; fertilizers; gypsum products; medical, pharmaceutical, and cosmetics applications; pesticides and related products; textiles; and miscellaneous fillers, extenders, and binders.
5/ Includes brick (common and face), portland cement (1999), and miscellaneous clay products.
6/ Includes firebricks, blocks and shapes, grogs and calcines, high-alumina specialties, kiln furniture (2000), and miscellaneous refractories; also see discussion under "Production: Kaolin."
7/ Includes chemical manufacturing, floor and wall tiles, and other unknown uses.
8/ Some export sales may be included under domestic sales.
9/ Includes adhesives; catalyst (oil-refining); fiberglass; sanitaryware; miscellaneous fillers, extenders, and binders; portland cement; miscellaneous refractories (1999); and other unknown uses (1999).

TABLE 18
SOUTH CAROLINA KAOLIN SOLD OR USED
BY PRODUCERS, BY KIND 1/

(Thousand metric tons and thousand dollars)

	1999		2000	
Kind	Quantity	Value	Quantity	Value
Airfloat	338	15,100	337	21,400
Unprocessed	70	554	61	485
Total	408	15,700	397	21,900

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

TABLE 19
SOUTH CAROLINA KAOLIN SOLD OR USED
BY PRODUCERS, BY KIND AND USE 1/

(Metric tons)

Kind and use	1999	2000
Adhesives	15,000	12,700
Ceramics 2/	W	W
Fertilizers, pesticides, related products	W	W
Fiberglass	W	W
Paper coating and filling	W	W
Plastics	W	W
Rubber	137,000	161,000
Refractories 3/	W	W
Other 4/	215,000	224,000
Exports 5/	41,100	W
Total	408,000	397,000

W Withheld to avoid disclosing company proprietary data; included with "Other."
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes fine china/dinnerware; glazes, glass, and enamels; pottery; roofing granules; sanitaryware; and miscellaneous ceramics.
3/ Includes firebrick, blocks and shapes, and miscellaneous refractories.
4/ Includes asphalt tile; brick (common and face); catalysts (oil-refining); civil engineering and sealings; gypsum products; paint; miscellaneous fillers, extenders, and binders; and other unknown uses.
5/ Includes fillers, extenders, and binders.

TABLE 20
KAOLIN SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY USE 1/

(Metric tons)

Use	1999	2000
Domestic:		
Ceramics:		
Catalyst (oil and gas refining)	208,000	219,000
Electrical porcelain	12,700	7,890
Fine china and dinnerware	23,500	28,700
Floor and wall tile	39,800	49,400
Pottery	11,200	13,500
Roofing granules	43,200	38,700
Sanitaryware	75,600	90,600
Miscellaneous	26,300	8,420
Chemical manufacture	23,200	31,200
Civil engineering	W	W
Fiberglass, mineral wool	329,000	304,000
Fillers, extenders, binders:		
Adhesive	81,500	68,300
Fertilizer	W	4,050
Medical, pharmaceutical, cosmetic	W	W
Paint	288,000	326,000
Paper coating	3,000,000	2,820,000
Paper filling	791,000	506,000
Pesticides	13,100	W
Plastic	39,700	53,100
Rubber	222,000	226,000
Miscellaneous	115,000	115,000
Heavy clay products:		
Brick, common and face	126,000	126,000
Portland cement	54,200	81,100

See footnotes at end of table.

TABLE 20--Continued
KAOLIN SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY USE 1/

(Metric tons)

Use	1999	2000
Domestic--Continued:		
Refractories: 2/		
Firebrick, block and shapes	13,800	13,600
Grogs and calcines	135,000	153,000
High-alumina brick, specialties, kiln furniture	W	W
Foundry sand, mortar, cement, miscellaneous refractories	621,000	257,000
Miscellaneous applications	430,000	514,000
Total	6,720,000	6,050,000
Exports:		
Ceramics	210,000	228,000
Foundry sand, grogs and calcines, other refractories	W	--
Paint	88,100	412,000
Paper coating	1,970,000	1,930,000
Paper filling	110,000	100,000
Rubber	45,700	33,700
Miscellaneous	23,800	38,100
Total	2,440,000	2,740,000
Grand total	9,160,000	8,800,000

W Withheld to avoid disclosing company proprietary data; included with "Miscellaneous" or "Miscellaneous applications." -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Also see discussion under "Consumption: Kaolin" and "Consumption: Refractories."

TABLE 21
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	Highway surfacing	Other	Total	Total value e/
1999:						
Alabama and Arkansas	713	8	8	--	729	15,000
California e/	41	160	--	--	201	7,990
Florida and Indiana	229	48	--	--	277	1,520
Kansas, Kentucky, Louisiana	358	219	86	76	740	12,000
Missouri	--	--	--	135	135	1,780
New York	284	220	--	--	503	15,300
North Carolina e/	300	52	--	--	352	4,050
Ohio and Oklahoma	258	16	--	--	274	1,620
Texas e/	49	157	222	31	459	2,520
Utah and Virginia	193	48	--	16	259	3,520
Total	2,430	929	317	259	3,930	65,200
2000:						
Alabama and Arkansas	848	131	8	--	987	15,300
California	53	220	--	--	272	10,600
Florida and Indiana	205	34	--	--	236	1,570
Kansas, Kentucky, Louisiana	409	227	9	91	735	2,830
Missouri	--	--	--	122	122	1,820
New York	82	54	--	--	136	5,600
North Carolina e/	301	52	--	--	353	4,050
Ohio and Oklahoma	170	11	--	--	182	1,420
Texas e/	49	157	222	31	459	2,520
Utah and Virginia	209	59	--	100	367	5,860
Total	2,330	941	239	344	3,850	51,600

e/ Estimated. -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 22
COMMON CLAY AND SHALE USED IN BUILDING BRICK PRODUCTION
IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars)

State	1999		2000	
	Quantity	Value	Quantity	Value
Alabama	877	2,120 r/	910	2,200
Arkansas	739	704 r/	479	366
California	249	1,030	251	734
Colorado	286	2,240	224	1,790
Connecticut, New Jersey, 3/ New York 3/	247	1,070	358	1,640
Georgia	1,300	3,540	1,150	3,140
Illinois	133 r/	609 r/	188	804
Indiana and Iowa	389	1,250 r/	395	1,250
Kentucky 3/ and Tennessee 3/	906 r/	2,300	789	2,100
Maryland and West Virginia 4/	385	1,480	317	1,060
Mississippi and Missouri	508	2,190	531	2,240
North Carolina	1,980	13,300	1,990	13,300
Ohio	929	4,500	845	4,370
Oklahoma	476	1,110	455	975
Pennsylvania	718	1,360	743	1,470
South Carolina	919	3,780 r/	876	2,720
Texas	1,000	5,890 r/	1,110	4,960
Virginia	740	2,580 r/	687	1,200
Other 5/	1,000 r/	3,350 r/	1,050	3,480
Total	13,800	54,400 r/	13,300	49,800

r/ Revised.
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 other brick only.
5/ Includes Arizona, Kansas, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Nebraska, New Mexico, North Dakota, Utah, Washington, and Wyoming (1999).

TABLE 23
U.S. EXPORTS OF CLAYS IN 2000, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

Country	Ball clay		Bentonite		Fire clay		Fuller's earth	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Argentina	--	--	1	194	(2/)	33	(2/)	122
Australia	4	86	11	855	10	843	--	--
Belgium	(2/)	4	1	401	--	--	2	222
Brazil	(2/)	72	14	5,140	(2/)	92	1	882
Canada	38	3,850	188	14,600	5	984	76	13,000
Finland	--	--	--	--	--	--	(2/)	11
France	--	--	66	3,040	(2/)	6	(2/)	6
Germany	8	225	10	1,060	(2/)	32	1	128
Indonesia	--	--	5	1,170	(2/)	39	5	733
Italy	2	1,000	9	606	--	--	3	857
Japan	5	153	157	16,500	66	3,960	1	245
Korea, Republic of	(2/)	30	27	3,340	5	2,000	--	--
Malaysia	(2/)	41	23	1,780	--	--	2	195
Mexico	11	385	24	1,690	66	4,750	1	145
Netherlands	(2/)	60	41	3,860	23	1,260	24	3,450
Singapore	(2/)	53	10	1,480	--	--	1	268
South Africa	(2/)	10	1	311	--	--	(2/)	13
Taiwan	(2/)	68	25	3,860	7	399	(2/)	21
Thailand	(2/)	107	20	2,030	--	--	(2/)	33
United Kingdom	1	34	79	5,680	(2/)	87	5	813
Venezuela	16	1,350	12	2,020	1	238	1	144
Other	15	1,140	37	10,700	33	3,930	13	3,720
Total	100	8,660	761	80,300	216	18,600	136	25,000

See footnotes at end of table.

TABLE 23--Continued
U.S. EXPORTS OF CLAYS IN 2000, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

Country	Kaolin		Clays, n.e.c. 3/		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
Argentina	4	1,040	2	2,070	7	3,460
Australia	28	12,900	4	2,870	57	17,600
Belgium	21	6,220	1	1,850	25	8,690
Brazil	4	1,260	6	3,470	25	10,900
Canada	839	89,900	144	32,700	1,290	155,000
Finland	374	66,000	1	2,170	375	68,200
France	7	2,060	1	1,070	75	6,190
Germany	22	8,640	5	4,600	46	14,700
Indonesia	86	18,900	3	1,600	100	22,400
Italy	156	32,200	2	787	171	35,500
Japan	947	165,000	13	7,760	1,190	194,000
Korea, Republic of	161	38,300	9	5,720	203	49,400
Malaysia	2	663	1	1,050	28	3,730
Mexico	219	20,800	34	6,560	356	34,300
Netherlands	282	46,100	17	12,900	387	67,700
Singapore	2	686	3	3,580	16	6,060
South Africa	7	2,280	4	1,840	13	4,450
Taiwan	158	19,800	7	2,930	198	27,000
Thailand	21	5,680	3	1,800	44	9,650
United Kingdom	37	9,990	19	13,100	142	29,700
Venezuela	14	1,440	9	3,920	52	9,110
Other	300	70,400	69	27,900	463	118,000
Total	3,690	621,000	357	142,000	5,260	896,000

-- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Less than 1/2 unit.
3/ Also includes chamotte or dina's earth, activated clays and earths, and artificially activated clays.

Source: U.S. Census Bureau.

TABLE 24
U.S. IMPORTS FOR CONSUMPTION OF CLAY IN 2000, BY KIND 1/

Kind	Quantity (metric tons)	Value 2/ (thousands)
China clay or kaolin:		
Brazil	47,000	14,300
Canada	641	220
France	296	92
Germany	459	151
Japan	119	169
Mexico	138	115
United Kingdom	13,700	4,370
Other	187	159
Total	62,500	19,500
Fire clay:		
Burkina	70	18
Italy	2	5
Korea, Republic of	1	5
Total	73	28
Decolorizing earths and fuller's earth, China	70	12
Bentonite:		
Canada	225	127
Germany	183	107
Japan	28	118

See footnotes at end of table.

TABLE 24--Continued
U.S. IMPORTS FOR CONSUMPTION OF CLAY IN 2000, BY KIND 1/

Kind	Quantity (metric tons)	Value 2/ (thousands)
Bentonite--Continued:		
Mexico	110	115
Netherlands	569	95
Turkey	4,830	1,350
United Kingdom	2,420	966
Other	99	58
Total	8,470	2,930
Common blue clay and other ball clay:		
China	1	3
United Kingdom	503	149
Total	504	152
Other clay:		
Canada	2,460	789
China	586	554
Germany	448	320
Spain	1,030	532
United Kingdom	837	490
Other	867	628
Total	6,220	3,310
Chamotte or dina's earth, Germany	2	11
Artificially activated clay and activated earth:		
Austria	302	436
Canada	2,320	1,090
Germany	2,280	2,370
Mexico	11,900	4,070
Netherlands	130	61
Norway	72	23
Slovenia	177	232
Venezuela	155	60
Other	315	570
Total	17,600	8,920
Grand total	95,500	34,900

1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ U.S. Customs declared value.

Source: U.S. Census Bureau.

TABLE 25
BENTONITE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1996	1997	1998	1999	2000 e/
Algeria 4/	17,200	17,657	15,655	15,491 r/	22,708 5/
Argentina	134,588	113,572	131,320	152,300 r/	150,000
Armenia	2,750	2,750 e/	3,000 e/	3,993 r/	2,807 5/
Australia e/ 4/	79,200 r/	73,100 r/	104,000 r/	180,000 r/	180,000
Bosnia and Herzegovina e/	800	800	800	800	800
Brazil (beneficiated)	186,000	230,000 r/	220,000 r/	274,623 r/	275,000
Bulgaria	202,000	171,000 e/	175,000 e/	175,000	150,000
Burma	4,769	4,908	3,871	728 r/	600
Chile	1,191	717	721	1,104 r/	1,314 5/
Croatia	9,728	7,331	7,581	8,441	10,013 5/
Cyprus	70,927	98,700 r/	121,850 r/	138,853 r/	126,313 5/
Czech Republic	59,000	110,000	125,000	160,000	150,000
Egypt e/	50,000 r/	50,000 r/	50,000 r/	50,000 r/	50,000
Georgia	13,000	12,000	11,000 e/	12,000	12,000
Germany	491,000	510,000 e/	500,000 e/	500,000	500,000
Greece	973,517	950,000 e/	950,000 e/	950,000	950,000

See footnotes at end of table.

TABLE 25--Continued
BENTONITE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1996	1997	1998	1999	2000 e/
Guatemala	3,755	3,750	3,800 e/	3,800	3,800
Hungary	15,376	14,848	17,000	16,000	15,000
Indonesia	26,000 e/	653,623	840	5,213	6,000
Iran 6/	85,000 e/	105,300	83,279 r/	64,957 r/	70,000
Italy	475,000	513,000	592,000	500,000	500,000
Japan	468,728	495,646	443,566	428,247 r/	445,115 5/
Macedonia e/	30,000	30,000	30,000	30,000	30,000
Mexico	69,810	111,503	185,729	208,611	269,730 5/
Morocco	39,680	49,633	47,881	36,528 r/	21,352 5/
Mozambique	11,051	13,799	14,000 e/	10,828 r/	16,144 5/
New Zealand (processed)	13,734	12,802	14,000 e/	15,000	10,000
Pakistan	15,290	16,450	14,196	15,349	27,700 5/
Peru	18,592	20,171 r/	19,659 r/	19,659 r/	21,059 5/
Philippines	8,000 e/	8,000 e/	3,900 r/	1,844	2,000
Poland 7/	6,200 r/	6,100 r/	5,400 r/	6,000 r/	6,000
Romania	43,543	27,133	25,434	19,577 r/	35,789 5/
Serbia and Montenegro	95	100 e/	68	77	75
South Africa 8/	48,076	33,326	48,382	50,363 r/	85,187 5/
Spain	151,155	150,000 e/	150,000 e/	150,000	150,000
Tanzania e/	75	75	75	75	75
Turkey	515,452	521,158	565,708	560,000	560,000
Turkmenistan e/	50,000	50,000	50,000	50,000	50,000
Ukraine e/	300,000	300,000	300,000	300,000	300,000
U.S.S.R., former e/ 9/	900,000	800,000	600,000	700,000	750,000
United States	3,740,000	4,020,000	3,820,000	4,070,000	3,760,000 5/
Zimbabwe 8/	185,953	186,000 e/	135,785	140,000	140,000
Total	9,510,000 r/	10,500,000 r/	9,590,000 r/	10,000,000 r/	9,860,000

e/ Estimated. r/ Revised.
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, 2001.
3/ In addition to the countries listed, Canada and China are believed 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/ Year beginning March 21 of that stated.
7/ Montmorillite type bleaching clay.
8/ May include other clays.
9/ Dissolved in December 1991; however, information is inadequate to formulate reliable estimates for individual countries, except Armenia, Georgia, Turkmenistan, and Ukraine.

TABLE 26
FULLER'S EARTH: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1996	1997	1998	1999	2000 e/
Algeria e/	4,500	4,500	4,500	2,489 r/ 4/	3,431 4/
Argentina e/	1,500	1,500	1,500	1,500	1,500
Australia (attapulgite)	17,173 r/	28,262 r/	15,670 r/	5,639 r/	5,000
Germany (unprocessed)	491,000	511,000	500,000 e/	500,000 e/	500,000
Italy	26,000	30,000	30,000 e/	30,000 e/	30,000
Mexico	41,800	51,430	48,016	47,522	51,685 4/
Morocco (smectite)	17,223	24,425	27,650	21,956 r/	30,665 4/
Pakistan	13,415	12,307	14,659	15,565	15,288 4/
Senegal (attapulgite) e/	100,000	80,000	80,000	80,000	80,000
South Africa (attapulgite)	14,318	9,349	7,830 r/	7,067 r/	7,337 4/
Spain (attapulgite) e/	94,000	90,000	90,000	90,000	90,000
United Kingdom 5/	143,000	140,000	140,000 e/	140,000 e/	140,000
United States 6/	2,600,000	2,370,000	2,420,000	2,560,000	2,910,000 4/
Total	3,570,000 r/	3,350,000 r/	3,380,000	3,510,000 r/	3,870,000

See footnotes at end of table.

TABLE 26--Continued
FULLER'S EARTH: WORLD PRODUCTION, BY COUNTRY 1/ 2/

e/ Estimated. r/ Revised.
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/ 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, 2001.
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 27
KAOLIN: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1996	1997	1998	1999	2000 e/
Algeria	25,000 e/	18,533	13,640	16,833 r/	11,616 4/
Argentina	64,241	47,365	46,832	45,000	45,000
Australia (includes ball clay) e/	210,000	220,000	180,000 r/	200,000 r/	220,000
Austria (marketable) e/	60,000	60,000	60,000	50,000 r/	50,000
Bangladesh e/ 5/	7,000	7,200	7,500	7,700	7,900
Belgium e/	300,000	300,000	300,000	300,000	300,000
Bosnia and Herzegovina e/	3,000	3,000	3,000	3,000	3,000
Brazil (beneficiated)	1,057,671	1,165,047 r/	1,373,892 r/	1,516,700 r/	1,500,000
Bulgaria e/	115,000	115,000	110,000	110,000	110,000
Burundi e/	1,000	1,000	1,000	800	800
Chile	13,452	14,238	11,530	4,361 r/	6,445 4/
Colombia (includes common clay)	3,957,000	8,040,000	8,000,000 e/	8,000,000	8,000,000
Czech Republic	2,798,000	2,982,000	3,049,000	5,183,000 4/	5,200,000 4/
Denmark (sales) e/	3,000	3,000	2,500	2,500	2,500
Ecuador	86,541	7,345	7,000 e/	7,000	7,000
Egypt	258,725	258,869	285,497	290,000	290,000
Eritrea	2,620	4,670 e/	3,809	474 r/	393 4/
Ethiopia	1,428 r/	3,512 r/	378 r/	681 r/	1,654 4/
France (marketable)	326,000	332,000	330,000 e/	325,000	300,000
Germany	1,794,000	1,800,000 e/	1,800,000 e/	1,800,000	1,800,000
Greece	60,453	60,000	60,000 e/	60,000	60,000
Guatemala e/	109	110	110	110	100
Hungary (processed) e/	5,000	6,000	7,000	7,000	7,000
India:					
Processed	183,268	175,000	148,000	150,000	160,000
Salable crude	557,778	402,000 r/	540,000 r/	520,000	530,000
Indonesia	15,000 e/	1,956	8,567	21,389	22,000
Iran	350,000	510,000	582,485 r/	837,277 r/	800,000
Israel	14,000 r/	16,000 r/	27,000 r/	27,300 r/	26,700
Italy, kaolinitic earth e/	10,000	9,000	9,000	9,000	10,000
Japan	141,230	110,915	83,257	53,092	26,000 4/
Jordan	47,500	57,255	78,000	34,040	36,795 4/
Kazakhstan e/	40,000	50,000	60,000	70,000	70,000
Kenya e/	595 4/	500	500	500	500
Korea, Republic of	2,501,600	2,688,489	2,259,809	1,858,359	2,098,499 4/
Madagascar e/	34 r/ 4/	166 r/ 4/	160 r/	110 r/	115
Malaysia	324,578 r /	221,769 r/	198,930 r/	208,187 r/	225,139 4/
Mexico	253,602	235,278	339,013	489,993	532,268 4/
New Zealand	26,325	21,874	26,000	25,000	25,000
Nigeria	102,078	100,000 e/	110,000 e/	110,000	110,000
Pakistan	54,860	66,235	70,777	64,692	49,574 4/
Paraguay	66,500	66,700	66,600 r/	66,600 r/	66,500
Peru	14,295	7,875	4,968 r/	1,332 r/	6,165 4/
Poland (washed)	71,700	83,600	82,450 e/	88,792 r/	99,382 4/

See footnotes at end of table.

TABLE 27--Continued
KAOLIN: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1996	1997	1998	1999	2000 e/
Portugal e/	177,423 4/	180,000	180,000	175,000 r/	175,000
Romania	45,199	29,169	24,724	25,456 r/	19,007 4/
Russia (concentrate)	50,000	50,000	50,000	40,600 r/	45,000
Serbia and Montenegro: e/					
Crude	55,000	55,000	75,092 4/	40,321 4/	40,000
Washed	5,000	5,000	7,000	3,000	4,000
Slovakia	23,240	24,000 e/	28,000	22,000 r/	25,000
Slovenia: e/					
Crude	10,000	10,000	10,000	10,000	10,000
Washed	7,000	7,000	4,000	4,000	4,000
South Africa	191,900 r/	164,400 r/	138,300 r/	122,400 r/	98,897 4/
Spain (marketable), crude and washed e/ 6/	315,000	315,000	300,000	320,000 r/	365,000 4/
Sri Lanka	7,700	15,800 r/	11,110 r/	12,573 r/	12,230 4/
Sweden e/	460	450	450	450	440
Taiwan e/	100,000	100,000	70,000	70,000	68,000
Thailand (beneficiated)	553,770	306,835 r/	266,455 r/	113,005 r/	201,226 4/
Turkey	449,561	472,646	403,733	400,000	400,000
Ukraine e/	250,000 r/	250,000 r/	201,670 r/ 4/	221,526 r/	225,000
United Kingdom (sales) 7/	2,281,000	2,400,000 e/	2,391,595	2,303,607	2,420,000 4/
United States 8/	9,120,000	9,280,000	9,640,000	9,160,000	8,800,000
Uzbekistan e/	5,500,000	5,500,000	5,500,000	5,500,000	5,500,000
Venezuela	7,542	5,000	4,000 r/	12,000 r/	--
Vietnam e/	1,000	1,100	1,100	1,100	1,200
Total	35,100,000 r/	39,400,000 r/	39,700,000 r/	41,100,000 r/	41,200,000

e/ Estimated. 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, 2001.

3/ In addition to the countries listed, China, Morocco, and Suriname also may 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/ Includes crude and washed kaolin and refractory clays not further described.

7/ Dry weight.

8/ Kaolin sold or used by producers.