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2019 Minerals Yearbook

CLAY AND SHALE [ADVANCE RELEASE]

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Clay and Shale

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In 2019, domestic production of clays decreased for the second consecutive year. Production decreased slightly to 25.7 million metric tons (Mt) valued at $1.70 billion compared with 26.1 Mt valued at $1.73 billion in 2018 and 26.9 Mt valued at $1.74 billion in 2017 (table 1). Common clay and shale accounted for 49% of the tonnage and 12% of the value of clays sold or used by producers in the United States and kaolin accounted for 20% of the tonnage and 48% of the value (table 2). In 2019, exports decreased by 4% to 3.9 Mt valued at $975,000. Imports of clays were 390,000 metric tons (t) valued at $82.3 million in 2019 compared with 421,000 t valued at $83.9 million in 2018 (table 1). World production of bentonite was essentially unchanged at 16.3 Mt in 2019 compared with that in 2018; global production of fuller's earth decreased by 5% to 3.18 Mt in 2019 compared with 3.33 Mt in 2018; and world production of kaolin was 44.3 Mt in 2019 compared with 45.8 Mt in 2018 (tables 14–16).

Production

The U.S. Geological Survey (USGS) has six classifications for clays mined in the United States: ball clay, bentonite, common clay, fire clay, fuller's earth, and kaolin. Ball clays consist primarily of kaolinite with varying amounts of illite, chlorite, smectite minerals, quartz, and organic materials. Bentonites consist of smectite minerals (usually montmorillonite) with minor amounts of feldspar, biotite, and quartz. The major components in common clay are illite and chlorite. Fire clay consists of mainly kaolinite, halloysite, and (or) diaspore. Fuller's earth consists primarily of palygorskite (attapulgite) or calcium-rich montmorillonite nonplastic clays with quartz. Kaolin consists primarily of kaolinite or kaolin-group minerals; smectite minerals, mica, quartz, and rutile are also components of kaolin deposits. Mineral composition, plasticity, color, absorption qualities, firing characteristics, and clarification properties are a few of the characteristics used to distinguish between the different clay types.

Clay-mineral terminology often is used inconsistently and can vary depending on geologic origin, mineralogy, and commercial application. For example, bentonite was originally defined as a clay produced by chemical alteration of igneous rock (usually tuff or volcanic ash), yet clay from many deposits of nonvolcanic origin is sold as bentonite. Ball clay, fire clay, and kaolin are sometimes interchangeably used because the kaolinite minerals in each can be distinguished only based on particle size and atomic structure. The term fuller's earth does not specify the mineralogical type of clay and is often applied to any clay with absorptive qualities (Eisenhour and Reisch, 2006; McCuistion and Wilson, 2006; Pickering and Heivilin, 2006). Consequently, data presented for one specific clay type may include one or more varieties of another. The USGS does not attempt to identify clay types but rather uses the reported terminology.

Clay production was reported in all States except Alaska, Delaware, Hawaii, Idaho, Minnesota, New Hampshire, New Jersey, Rhode Island, Vermont, and Wisconsin (table 2). Approximately 125 companies mined clay and shale in the United States in 2019. The 20 leading companies, with 78 operations and 202 pits, accounted for 64% of the tonnage and 84% of the value of all types of clay sold or used. Companies that mined clay for uses such as construction fill, landfill caps, and landscaping but did not operate mills or plants were not included in the USGS canvass of the clay and shale industry. The 10 leading producer States, in decreasing order of tonnage, were Georgia, Wyoming, Texas, Alabama, Missouri, North Carolina, Tennessee, New York, California, and Oklahoma. The combined production of the 10 leading States decreased slightly to 19.7 Mt compared with 19.9 Mt in 2018 and accounted for 77% of the National total (table 2).

Domestic production data for clays were developed by the USGS from a voluntary survey of U.S. operations. A total of 232 operations were surveyed in 2019, of which 135 responded to the voluntary survey. 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, listed in table 1. Production data for nonrespondents were estimated from preliminary survey data, company reports, trade reports, and (or) reported prior-year production levels adjusted by mine and mill employment hours published by the Mine Safety and Health Administration (MSHA).

Ball Clay

Production.—In 2019, ball clay accounted for 4% of the tonnage and value of total clay in the United States. Ball clay was produced in five States and the leading producing State was Tennessee. Other States producing ball clay were California, Indiana, Mississippi, and Texas. Production of domestic ball clay was 1.06 Mt in 2019, a decrease of 4% in quantity from 1.11 Mt in 2018 (table 2). The value of ball clay produced decreased slightly to $60.1 million compared with $60.7 million in 2018. Airfloat clay accounted for most of the decrease in production owing to an 11% decrease in production to 317,000 t in 2019 from 356,000 t in 2018 (table 3).

Consumption.—In 2019, consumption of ball clay decreased for the second consecutive year. The two principal domestic markets for ball clay were ceramic floor and wall tile (55%) and sanitaryware (18%). Ball clay also was sold to manufacture bricks, electrical porcelain, fine china, pottery, refractory products, roofing granules, and other types of ceramics. Ball clay producers also reported sales for fiberglass and filler, extender, and binder applications; those were likely to have been kaolin mined or purchased by the ball clay producers (table 3).

Prices.—The average unit value for ball clay reported by domestic producers increased slightly to $56 per metric ton in

2019 from $55 per metric ton in 2018 (table 2). The average free alongside ship (f.a.s.) unit value for exported ball clay was $191 per metric ton in 2019 compared with $169 per metric ton in 2018 (table 12). The average customs unit value for imported ball clay was $214 per metric ton in 2019 compared with $217 per metric ton in 2018 (table 13).

Bentonite

Production.—In 2019, bentonite was the third-ranked type of clay by tonnage (17%) and the second-ranked type of clay by value (26%) of all clay (table 2). About 4.49 Mt valued at $441 million was sold or used in 2019, a slight decrease in quantity and value from 4.56 Mt valued at $446 million in 2018. Nonswelling and (or) swelling bentonite was produced in the following States: Alabama, Arizona, California, Mississippi, Montana, Nevada, Oregon, Texas, Utah, and Wyoming. Production of swelling bentonite decreased slightly to 4.35 Mt valued at $409 million in 2019 from 4.39 Mt valued at $412 million in 2018 (table 4). Wyoming led all States in the production of swelling bentonite with 94% of the total production. Production of nonswelling bentonite was 139,000 t valued at $31.7 million in 2019, a 17% decrease in quantity from 167,000 t valued at $34.7 million in 2018. Alabama and Mississippi led the domestic production of nonswelling bentonite in 2019.

Consumption.—In 2019, bentonite sold or used decreased slightly to 4.49 Mt from 4.56 Mt in 2018 (table 4). Pet waste absorbents remained the largest use of bentonite with 1.84 Mt used in 2019, essentially unchanged from 1.85 Mt in 2018. Pet waste absorbents accounted for 49% of the total sales of bentonite in 2019 compared with 47% in 2018. Drilling mud, which was 23% of sales in 2019, decreased by 11% during the same period that natural gas and petroleum well drilling activity decreased by 9% in the United States and decreased slightly worldwide (Baker Hughes Inc., 2020). Decreases in domestic sales were reported for adhesives, foundry sand, and pelletizing (iron ore), but sales for waterproofing and sealing and miscellaneous civil engineering applications increased (table 4). These end uses accounted for 17% of the total domestic bentonite sales in 2019. Shipments of iron ore decreased by 6% in 2019 from those in 2018 (Tuck, 2020). Most domestic iron ore was pelletized using bentonite prior to shipment so decreased iron ore shipments were likely to result in a decrease of bentonite sales to the market. Primary uses for exported bentonite, in decreasing order, were foundry sand, pet waste absorbent, and drilling mud. Bentonite exports reported by producers increased by 16% compared with those in 2018.

Pet waste absorbents, the leading end use of bentonite, were made from swelling bentonite. Primary uses for nonswelling bentonite, in decreasing order, were water treatment and filtering, foundry sand, and desiccants.

Prices.—The average unit value reported by domestic producers for nonswelling bentonite was $228 per metric ton in 2019 compared with $208 per metric ton in 2018 (table 4). The average value for swelling bentonite remained unchanged at $94 per metric ton in 2019 compared with that in 2018. The average f.a.s. value of exported bentonite was $211 per metric ton in 2019 compared with $228 per metric ton in 2018 (table 12). The average customs unit value of imported bentonite was $349 per metric ton in 2019 compared with $420 per metric ton in 2018 (table 13). Small shipments of high-value bentonite affected the unit value of exports and imports.

Common Clay and Shale

Production.—The quantity of common clay and shale production was essentially unchanged in 2019 from 12.6 Mt produced in 2018. The value increased slightly to $202 million compared with $199 million in 2018 (table 2). In 2019, common clay and shale accounted for 49% of the tonnage and 12% of the value of all clays produced in the United States. Common clay and shale used for manufacturing products was produced in 36 States and Puerto Rico. An undetermined amount of common clay was used for construction fill, landfill caps, and landscaping in most, if not all, States. The five leading producing States, in descending order of tonnage, were Texas, Alabama, North Carolina, New York, and Oklahoma. These States accounted for 55% of U.S. common clay and shale production (table 5). Production in Ohio decreased more than 30% owing in part to the closure of the Haydite Mine in Independence, OH, which had been in operation since 1892 (Cleveland.com, 2019). Brickworks Ltd. of Australia, which acquired Glen-Gery Corp. in November 2018, continued expanding its North American clay market by purchasing Sioux City Brick & Tile Co. in August 2019 and Redland Brick, Inc. in November 2019 (Glen-Gery Corp., 2019).

Consumption.—In 2019, heavy-clay products, which included brick manufacture, remained the leading market for common clay and shale, accounting for 44% of sales, but sales decreased by 5% to 5.5 Mt. Lightweight aggregate production was the second-ranked market for common clay and shale sales, accounting for 30% of sales. Lightweight aggregate sales (3.7 Mt) were subdivided into concrete block (41%), miscellaneous lightweight aggregates and highway surfacing (33%), and structural concrete (25%). The third-ranked market for common clay and shale, which accounted for 23% of common clay and shale sales, was for the manufacture of portland and other cements. This market increased by 13% in 2019, corresponding to an 8% increase in shipments of portland and blended cements in 2019 (Curry, 2020). Other markets for common clay and shale included civil engineering, ceramic floor and wall tile, miscellaneous ceramics, and refractory products and accounted for the remaining 3% of production in 2019 (table 5).

Prices.—The average unit value reported by domestic producers for all common clay and shale produced in the United States was $16 per metric ton, which was unchanged from that in 2018 (table 2). Unit values for common clay and shale should be used with caution. Most common clay and shale producers did not sell their clay but used it directly to manufacture products and had not established a selling price for their clays.

Fire Clay

Production.—Fire clay producers were mostly refractory product manufacturers that used clay in firebrick and various heavy-clay products. Fire clay production increased by 6%

to 603,000 t valued at $8.5 million compared with 567,000 t valued at $6.6 million in 2018 (table 2). In 2018 and 2019, fire clay production accounted for 2% of the tonnage and less than 1% of the value of all clays sold in the United States. In 2019, fire clay was produced in Colorado, Missouri, North Carolina, and Ohio. Year-to-year production of fire clay has become more variable in recent years as common clay producers entered and exited the fire clay market in response to short-term customer demands.

Consumption.—Consumption of fire clay increased in 2019. Structural concrete was the leading use of fire clay. Other markets for fire clay, in descending order of tonnage, were common brick, portland cement, fire brick, refractory grogs and calcines, pottery and miscellaneous civil engineering, and sealing. Most data were withheld to avoid disclosing company proprietary data.

Prices.—In 2019, the average unit value for fire clay reported by domestic producers increased by 17% to $14 per metric ton compared with $12 per metric ton in 2018 (table 2). The average f.a.s. value of exported fire clay was $251 per metric ton in 2019 compared with $244 per metric ton in 2018 (table 12). The average customs unit value of imported fire clay increased by 5% to $482 per metric ton in 2019 compared with $460 per metric ton in 2018 (table 13).

Fuller's Earth

Production.—Fuller's earth deposits consist mainly of palygorskite (attapulgite) in Florida, southwestern Georgia, and a small amount in Nevada. Gellant grades of attapulgite, used as thickeners in such items as drilling muds and paints, were mined near Quincy, FL, and Attapulgus, GA. Sorbent grades of attapulgite were mined a little farther north near Ochlocknee, GA. To be consistent with past reporting, sorbent grades of attapulgite were grouped with montmorillonite-type fuller's earth, whose major market also was sorbent applications. Production of the attapulgite variety of fuller's earth increased in 2019. Attapulgite production data were withheld to avoid disclosing company proprietary data and are not included in the tables.

Production of the montmorillonite variety of fuller's earth increased slightly to 1.92 Mt valued at $166 million in 2019 compared with 1.88 Mt valued at $166 million in 2018 (table 2). In 2019, montmorillonite accounted for 7% of the tonnage and 10% of the value of all clay produced in the United States. Montmorillonite-type fuller's earth was produced in nine States; Georgia, Missouri, and Virginia accounted for 61% of U.S. production. Other States with production were California, Illinois, Kansas, Mississippi, Tennessee, and Texas.

Consumption.—Consumption of fuller's earth (excluding gellant-grade attapulgite-type fuller's earth) increased slightly in 2019 (table 6). Absorbents (which included pet waste absorbents, oil and grease absorbents, and miscellaneous absorbents) were the leading markets for the montmorillonite-type and sorbent-grade attapulgite-type of fuller's earth, accounting for 81% of domestic and export sales, followed by miscellaneous (civil engineering, drilling mud, exports, filtering, clarifying and decolorizing, and unknown or unspecified uses) (12%); fillers, extenders and binders (4%); and animal feed (3%).

Prices.—The average unit value of attapulgite-type fuller's earth reported by domestic producers was withheld to avoid disclosing company proprietary data, but the unit value decreased by 19% in 2019 from that in 2018. The average value of montmorillonite-type fuller's earth was $86 per metric ton in 2019 compared with $88 per metric ton in 2018 (table 2). The average f.a.s. value of exported fuller's earth was $433 per metric ton in 2019 compared with $486 per metric ton in 2018 (table 12). The average customs unit value of imported fuller's earth was $2,800 per metric ton in 2019 compared with $520 per metric ton in 2018 (table 13).

Kaolin

Production.—In 2019, domestic kaolin production decreased by 6% to 5.06 Mt valued at $820 million compared with 5.35 Mt valued at $855 million in 2018 (table 2). Kaolin was produced in Alabama, California, Florida, Georgia, Nevada, and South Carolina. Georgia accounted for 92% of the U.S. kaolin production. Kaolin production in Georgia decreased by 6% to 4.63 Mt valued at $781 million in 2019 compared with 4.91 Mt valued at $817 million in 2018. Production in South Carolina, which accounted for 7% of U.S. kaolin production, increased by 3% to 375,000 t valued at $33.7 million in 2019 compared with 365,000 t valued at $32.3 million in 2018 (table 7). In 2019, kaolin was the highest valued type of clay (48% of total value) and the second-ranked clay produced (20% of tonnage) of all clay in the United States.

Consumption.—Consumption of kaolin decreased in 2019 from that in 2018. The major domestic markets for kaolin, in descending order of tonnage, were paper coating (31% of domestic sales), refractory products (14%), miscellaneous ceramics (14%), paint (8%), catalysts (6%), rubber (6%), and miscellaneous fillers, extenders, and binders (6%) (table 8). Smaller but significant domestic markets were adhesives, chemical manufacture, floor and wall tile, heavy-clay products (brick and portland cement), plastics, and sanitaryware. The leading export market for kaolin was paper coating and filling (78%). A similar market distribution was seen for producers in Georgia—paper coating accounted for 35% of domestic sales and miscellaneous ceramics accounted for 23% of domestic sales (table 9).

The sales distribution for South Carolina kaolin producers, in descending order of tonnage, was rubber, fiberglass, oil refining catalysts, brick, adhesives, sanitaryware, paint, portland cement, plastics, paper coating, and fertilizers. Much of the data for individual markets were withheld to avoid disclosing company proprietary data (table 10).

Paper coating markets accounted for 45% of total (domestic and export) kaolin sales in 2019, unchanged from those in 2018. Domestic sales of kaolin for paper coating markets decreased by 9% in 2019. Total sales (domestic and export combined) for paper coating markets decreased by 7% compared with those in 2018. Domestic sales of refractory products decreased by 9% to 513,000 t in 2019 from 566,000 t in 2018. Sales included under "Miscellaneous" in the "Domestic: Ceramics" category decreased by 5% compared with those 2018. Total sales (domestic and export combined) for rubber markets decreased slightly in 2019 (table 8).

Prices.—In 2019, the average unit value of kaolin reported by domestic producers increased slightly to $162 per metric ton for all kaolin grades compared with $160 per metric ton in 2018 (table 2). The average value for airfloat was $83 per metric ton in 2019; delaminated, $149 per metric ton; unprocessed, $35 per metric ton; and water washed, $197 per metric ton. All types of calcined kaolin combined were valued at $165 per metric ton in 2019, a slight decrease compared with that in 2018 (table 7). In 2019, the average f.a.s. value of exported kaolin was $242 per metric ton compared with $237 per ton in 2018 (table 12). The average customs unit value of imported kaolin was $126 per metric ton in 2019 compared with $116 per metric ton in 2018 (table 13).

Foreign Trade

Exports.—Ball clay exports were 85,300 t valued at $16 million in 2019 compared with 89,800 t valued at $15 million in 2018, according to the U.S. Census Bureau. Approximately 80% of exported ball clay in 2019 was sent to Mexico. Bentonite exports increased by 7% to 906,000 t valued at $191 million in 2019 from 845,000 t valued at $192 million in 2018 (table 12). Canada and Japan were the leading destinations for bentonite exports, accounting for 51% and 16%, respectively. Exports of fire clay and refractory-grade kaolin appear to have been shipped under the same Harmonized Tariff Schedule of the United States (HTS) code in recent years. Approximately 75% of the exports reported by the U.S. Census Bureau under the HTS code for fire clay was thought to be refractory-grade kaolin rather than fire clay. This analysis was based on the port locations from which the respective clays were exported. In 2019, exports of fire clay and refractory-grade kaolin decreased by 22% to 194,000 t valued at $48.7 million compared with 250,000 t valued at $60.8 million in 2018. In 2019, the Netherlands and Mexico accounted for 36% and 20% of United States fire clay exports, respectively. In 2019, exports of fuller's earth increased by 5% to 73,400 t valued at $31.8 million compared with 70,100 t valued at $34.1 million in 2018. Kaolin was the leading type of clay exported in 2019, but kaolin exports decreased by 5% to 2.3 Mt valued at $552 million compared with 2.4 Mt valued at $567 million in 2018 (table 12). In 2019, China and Mexico were the leading destinations of kaolin with 19% and 18%, respectively. Kaolin producers reported exports of 1.5 Mt, much less than the 2.3 Mt reported by the U.S. Census Bureau (table 8). Some of the kaolin exported to Canada and Mexico may have been reported under domestic consumption by U.S. producers. Sales through U.S. mineral brokers, where producers do not know if the kaolin is used domestically or exported, also could explain part of the discrepancy.

Imports.—Ball clay imports were 679 t valued at $145,000 in 2019 compared with 433 t valued at $94,000 t in 2018 (table 13). Bentonite imports consisted mainly of untreated bentonite clay and chemically or artificially activated materials. Imports of untreated bentonite were 33,800 t valued at $11.8 million in 2019 compared with 22,200 t valued at $9.3 million in 2018. Imports of artificially activated material were 30,800 t valued at $17 million in 2019 compared with 23,200 t valued at $14 million in 2018. In 2019, imports of fire clay were 20,600 t valued at $10 million compared with 34,100 t valued at $16 million in 2018. China was the source of 94% of the United States imports of fire clay. Imports of decolorizing earth and fuller's earth were 5 t valued at $14,000 in 2019 compared with 25 t valued at $13,000 in 2018. Kaolin was the type of clay with the most imports in 2019. Imports of kaolin were 293,000 t valued at $37 million in 2019 compared with 333,000 t valued at $38 million in 2018. About 91% of kaolin imports were from Brazil and were used primarily in paper coating applications (table 13).

World Review

In 2019, world production of bentonite was essentially unchanged at 16.3 Mt (table 14). Fuller's earth world production was slightly lower at 3.18 Mt in 2019 compared with 3.33 Mt in 2018 (table 15). In 2019, kaolin world production was 44.4 Mt, a 3% decrease from that in 2018, including crude kaolin ore production that was reported by many countries (table 16). The United States continued to be the leading producer of bentonite and fuller's earth, followed by China and India for bentonite, and Spain and the Republic of Korea for fuller's earth. Germany was the leading producer of kaolin, followed by the United States and China. The United States was the leading producer of palygorskite (attapulgite), followed by Senegal. The rankings above were based on processed clay sold or used and not on crude ore production.

Outlook

Production of clay in 2020 in the United States is expected to decrease compared with that in 2019. Ball clay, common clay and shale, fire clay, attapulgite-type fuller's earth, and kaolin are used to manufacture several construction-related products, including brick, caulk, paint, sanitaryware, and ceramic tile.

Fuller's earth sales are expected to increase slightly as the absorbent market remains steady owing in part to the consistent market for cat litter. The paper market, the leading market for kaolin, is expected to continue to decrease as more information exchange is conducted electronically. In the United States, industrial production of paper decreased from the fourth quarter of 2018 to the fourth quarter of 2019 (Board of Governors of the Federal Reserve System, 2019, p. 7). Based on usage trends, domestic sales of kaolin to paper markets are likely to continue to decrease.

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TABLE 1
SALIENT U.S. CLAY STATISTICS[1, 2]

(Thousand metric tons and thousand dollars)

	2015	2016	2017	2018	2019
Domestic clays sold or used by producers:					
Quantity	25,400 r	25,900 r	26,900 r	26,100 r	25,700
Value	1,680,000	1,630,000	1,740,000 r	1,730,000 r, e	1,700,000 e
Exports:					
Quantity	4,140	3,800	4,040	4,030	3,880
Value	1,000,000	934,000	985,000	1,020,000	975,000
Imports for consumption:					
Quantity	520	473	430	421	390
Value	79,500	78,500	88,100	83,900	82,300
World, production:					
Bentonite	16,500 r	15,000 r	15,800 r	16,400 r	16,300 e
Fuller's earth	3,260 r	3,170 r	3,210 r	3,330 r	3,180 e
Kaolin	43,600 r	41,600 r	44,300 r	45,800 r	44,300 e

eEstimated. rRevised.
[1]Table includes data available through October 2, 2020. Data are rounded to no more than three significant digits.
[2]Excludes Puerto Rico.

TABLE 2
CLAYS SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY STATE[1, 2]

(Thousand metric tons and thousand dollars)

	2018		2019	
	Quantity	Value	Quantity	Value
State:				
Alabama	1,620 r	25,200 r, e	1,580	23,300 e
Alaska	--	--	--	--
Arizona	W	W	W	W
Arkansas	272 e	1,880 e	W	W
California[e]	657	46,600	689	50,300
Colorado	274	7,720	W	W
Connecticut	W	W	W	W
Delaware	--	--	--	--
Florida[e]	14	2,800	12	2,700
Georgia[e]	5,740	862,000	5,360	823,000
Hawaii	--	--	--	--
Idaho	--	--	--	--
Illinois	W	W	W	W
Indiana[e]	381	6,070	357	6,050
Iowa	168	628 e	158	609 e
Kansas	319	3,520 e	375	3,610 e
Kentucky[e]	151	5,100	207	8,090
Louisiana	W	W	W	W
Maine	W	W	W	W
Maryland	W	W	W	W
Massachusetts	W	W	W	W
Michigan	W	W	W	W
Minnesota	--	--	--	--
Mississippi[e]	505	40,800	490	39,100
Missouri	1,080	23,500 e	1,340	29,400 e
Montana	W	W	W	W
Nebraska	W	W	W	W
Nevada	W	W	W	W
New Hampshire	--	--	--	--
New Jersey	--	--	--	--
New Mexico	W	W	W	W
New York	675	31,200 e	735	34,600 e
North Carolina	1,320	38,500	1,270	38,500
North Dakota	50	425	51	365
Ohio	759	16,300	530	7,220
Oklahoma	655	2,170 e	613 e	2,030 e
Oregon	W	W	W	W
Pennsylvania	281	1,870	272 e	1,840
Rhode Island	--	--	--	--
South Carolina[e]	545	33,400	568	34,800
South Dakota	W	W	W	W
Tennessee	896	67,500	857 e	67,400 e
Texas	3,080 r	57,300 r	3,090	59,500
Utah	440	13,400	456	12,700 e
Vermont	--	--	--	--
Virginia	W	W	W	W
Washington	W	W	W	W
West Virginia	W	W	W	W
Wisconsin	--	--	--	--
Wyoming	4,190 r	392,000 r, e	4,140	389,000 e
Other	2,030	54,300 e	2,560	62,600 e
Total	26,100 r	1,730,000 r, e	25,700	1,700,000 e

See footnotes at end of table.

TABLE 2—Continued
CLAYS SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY STATE[1, 2]

(Thousand metric tons and thousand dollars)

	2018		2019	
	Quantity	Value	Quantity	Value
Type:				
Ball clay	1,110 r	60,700	1,060 e	60,100 e
Bentonite	4,560 r	446,000 r, e	4,490	441,000 e
Common clay and shale	12,600	199,000	12,600	202,000
Fire clay	567	6,610	603	8,490
Fuller's earth[e]	1,880	166,000	1,920	166,000
Kaolin[e]	5,350 r	855,000 r	5,060	820,000
Total	26,100 r	1,730,000 r, e	25,700	1,700,000 e

[e]Estimated. [r]Revised. W Withheld to avoid disclosing company proprietary data; included with "State: Other."
-- Zero.
[1]Table includes data available through October 2, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Excludes Puerto Rico and attapulgite production.

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

(Thousand metric tons and thousand dollars)

	2018		2019	
Type and use	Quantity	Value	Quantity	Value
Type:				
Airfloat[e]	356	26,900	317	25,300
Unprocessed	665 r	29,600 r	663 e	30,700 e
Water-slurried[e]	86	4,180	84	4,080
Total	1,110 r	60,700	1,060 e	60,100 e
Use:[e]				
Fillers, extenders, and binders[2]	28	NA	26	NA
Floor and wall tile	605 r	NA	588	NA
Miscellaneous ceramics[3]	164 r	NA	138	NA
Sanitaryware	185	NA	187	NA
Miscellaneous[4]	126 r	NA	125	NA
Exports, reported by producers[5]	W	NA	W	NA
Total	1,110 r	60,700	1,060	60,100

[e]Estimated. [r]Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; included in "Use: Miscellaneous ceramics."
[1]Table includes data available through October 2, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes adhesives; animal feed; fertilizer carriers; medical, pharmaceutical, cosmetics; paint; pesticides and related products and other fillers, extenders, and binders.
[3]Includes catalysts, dinnerware and fine china, electrical porcelain, fiberglass, mineral wool, miscellaneous ceramics, and roofing granules.
[4]Includes chemical manufacturing, heavy-clay products, refractories, paint, and unknown uses.
[5]Includes miscellaneous ceramics and unknown uses.

TABLE 4
BENTONITE SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY TYPE AND USE[1]

(Thousand metric tons and thousand dollars)

Type and use	2018		2019	
	Quantity	Value	Quantity	Value
Type:				
Nonswelling[e]	167 [r]	34,700 [r]	139	31,700
Swelling	4,390 [r]	412,000 [r, e]	4,350	409,000 [e]
Total	4,560 [r]	446,000 [r, e]	4,490	441,000 [e]
Use:[e]				
Domestic:				
Pet waste absorbents	1,850 [r]	NA	1,840	NA
Adhesives	W	NA	W	NA
Animal feed	45 [r]	NA	45	NA
Drilling mud	959 [r]	NA	856	NA
Filler and extender applications[2]	37 [r]	NA	24	NA
Foundry sand	W	NA	W	NA
Pelletizing (iron ore)	W	NA	W	NA
Waterproofing and sealing	89	NA	99	NA
Miscellaneous civil engineering[3]	123	NA	126	NA
Miscellaneous[4]	870 [r]	NA	809	NA
Total	3,970 [r]	NA	3,800	NA
Exports, reported by producers:				
Drilling mud	(5)	NA	(5)	NA
Foundry sand	157 [r]	NA	200	NA
Other[6]	434	NA	488	NA
Total	591 [r]	NA	688	NA
Grand total	4,560 [r]	446,000 [r]	4,490	441,000

[e]Estimated. [r]Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; included in "Use: Domestic: Miscellaneous."

[1]Table includes data available through October 2, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

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

[3]Includes water treatment and filtering and other civil engineering applications.

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

[5]Withheld to avoid disclosing company proprietary data; included in "Use: Exports, reported by producers: Other."

[6]Includes absorbents, fillers and extenders, iron ore pelletizing, refractories, and unknown uses.

TABLE 5
COMMON CLAY AND SHALE SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY STATE AND USE[1, 2, 3]

(Thousand metric tons and thousand dollars)

State and use	2018		2019	
	Quantity	Value	Quantity	Value
State:				
Alabama	1,510	15,500 e	1,510	17,100 e
Arkansas	272 e	1,880 e	W	W
California	406	9,800 e	429	W
Colorado	266	7,590	W	W
Connecticut	W	W	W	W
Georgia	W	W	W	W
Illinois	W	W	W	W
Indiana	359	4,380 e	336	4,430 e
Iowa	168	628 e	158	609 e
Kansas	282	W	339	W
Kentucky[e]	151	5,100	207	8,090
Louisiana	W	W	W	W
Maine	W	W	W	W
Maryland	W	W	W	W
Massachusetts	W	W	W	W
Michigan	W	W	W	W
Mississippi	W	W	W	W
Missouri	W	W	W	W
Montana	W	W	W	W
Nebraska	W	W	W	W
New Mexico	W	W	W	W
New York	675	31,200 e	735	34,600 e
North Carolina	1,320	W	1,270	W
North Dakota	50	425	51	365
Ohio	598	13,800 e	414	5,330
Oklahoma	655	2,170	613 e	2,030 e
Oregon	W	W	W	W
Pennsylvania	281	1,870	272 e	1,840
South Carolina[e]	179 r	1,110	194	1,180
South Dakota	W	W	W	W
Texas	2,790	33,600	2,800	36,100
Utah	345	5,430 e	365	4,910 e
Virginia	W	W	W	W
Washington	W	W	W	W
West Virginia	W	W	W	W
Wyoming	45	149	47	104
Other	2,290	63,900	2,840	85,100 e
Total	12,600	199,000	12,600	202,000
Use:[e]				
Floor and wall tile[4]	240	NA	181	NA
Heavy-clay products:				
Brick, extruded	5,520 r	NA	5,240	NA
Brick, other	196	NA	205	NA
Other[5]	27	NA	37	NA
Lightweight aggregate:				
Concrete block	1,550 r	NA	1,540	NA
Structural concrete	875 r	NA	950	NA
Miscellaneous[6]	1,320 r	NA	1,240	NA
Portland and other cements	2,570	NA	2,910	NA
Refractories[7]	243	NA	123	NA
Miscellaneous[8]	102 r	NA	153	NA
Total	12,600	199,000	12,600	202,000

See footnotes at end of table.

TABLE 5—Continued
COMMON CLAY AND SHALE SOLD OR USED BY PRODUCERS
IN THE UNITED STATES, BY STATE AND USE[1, 2, 3]

[e]Estimated. [r]Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; included in "State: Other."
[1]Table includes data available through October 2, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Excludes Puerto Rico.
[3]Includes only production for companies with mills or plants.
[4]Includes ceramic tile, quarry tile, and miscellaneous floor and wall tiles.
[5]Includes drain tile, flowerpots, flue linings, sewer pipes, structural tile, and miscellaneous heavy-clay products.
[6]Includes highway surfacing and miscellaneous aggregate products.
[7]Includes block and shapes, firebrick, grogs and calcines, mortar and cement, and miscellaneous refractories.
[8]Includes exports reported by producers; miscellaneous civil engineering and sealings; miscellaneous fillers, extenders, and binders; pottery; roofing granules; miscellaneous ceramics and unknown uses.

TABLE 6
ESTIMATED FULLER'S EARTH SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY TYPE AND USE[1]

(Thousand metric tons and thousand dollars)

	2018		2019	
Type and use	Quantity	Value	Quantity	Value
Type:				
Attapulgite	(2)	(2)	(2)	(2)
Montmorillonite	1,880	166,000	1,920	166,000
Total	1,880	166,000	1,920	166,000
Use:				
Absorbents[3]	1,490	NA	1,560	NA
Animal feed	54	NA	55	NA
Fillers, extenders, and binders[4]	72	NA	70	NA
Filtering, clarifying, and decolorizing[5]	W	NA	W	NA
Miscellaneous[6]	263	NA	235	NA
Exports, reported by producers[7]	W	NA	W	NA
Total	1,880	166,000	1,920	166,000

NA Not available. W Withheld to avoid disclosing company proprietary data; included in "Use: Miscellaneous."
[1]Table includes data available through October 2, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Withheld to avoid disclosing company proprietary data. Primarily gellant-grade fuller's earth. More information can be found in the "Fuller's Earth" section of this report.
[3]Includes oil and grease absorbents, pet waste absorbents, and miscellaneous absorbents.
[4]Includes asphalt emulsions; medical, pharmaceuticals, and cosmetics; paints; pesticides and related products; and miscellaneous filler, extender, and binder applications.
[5]Includes mineral and vegetable oils and greases.
[6]Includes civil engineering, drilling mud, and unknown uses.
[7]Includes drilling mud, oil and grease absorbents, paint, pet waste absorbents, and unknown uses.

TABLE 7
ESTIMATED KAOLIN SOLD OR USED BY PRODUCERS IN THE UNITED STATES,
BY STATE AND TYPE[1]

(Thousand metric tons and thousand dollars)

State and type	2018		2019	
	Quantity	Value	Quantity	Value
State:				
Alabama	W	W	W	W
California	W	W	W	W
Florida	14	2,800	12	2,700
Georgia	4,910	817,000	4,630	781,000
Nevada	W	W	W	W
South Carolina	365	32,300	375	33,700
Other	61 r	3,080 r	40	1,980
Total	5,350 r	855,000 r	5,060	820,000
Type:				
Airfloat	870	70,800	810	67,500
Calcined[2]	841	140,000	845	139,000
Delaminated	667	98,600	600	89,700
Unprocessed	174 r	5,930 r	173	6,020
Water washed	2,800	540,000	2,630	517,000
Total	5,350 r	855,000 r	5,060	820,000

rRevised. W Withheld to avoid disclosing company proprietary data; included with "State: Other."
[1]Table includes data available through October 2, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes pigment-grade kaolin (low-temperature calcined kaolin) and refractory-grade kaolin (high-temperature calcined kaolin).

TABLE 8
ESTIMATED KAOLIN SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY USE[1]

(Thousand metric tons)

Use	2018	2019
Domestic:		
Ceramics:		
Catalyst (oil and gas refining)	234	227
Fiberglass, mineral wool	W	W
Fine china and dinnerware	11	11
Floor and wall tile	44 r	38
Pottery	W	W
Roofing granules	W	W
Sanitaryware	93	86
Miscellaneous[2]	535 r	510
Chemical manufacture[3]	W	W
Fillers, extenders, binders:		
Adhesives	51	52
Paint	312	295
Paper coating	1,210	1,100
Paper filling	W	W
Pesticide	W	W
Plastics	105	102
Rubber	220	218
Miscellaneous[4]	216	203
Heavy-clay products[5]	75	99
Refractories[6]	566	513
Miscellaneous applications	127	126
Total	3,800 r	3,580
Exports, reported by producers:		
Ceramics	W	W
Paint	87	90
Paper coating	1,200	1,150
Paper filling	W	W
Rubber	50	48
Unknown uses[7]	211	188
Total	1,550	1,480
Grand total	5,350 r	5,060

rRevised. W Withheld to avoid disclosing company proprietary data.

[1]Table includes data available through October 2, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes electrical porcelain, miscellaneous ceramics, and withheld data under "Domestic: Ceramics."

[3]Withheld to avoid disclosing company proprietary data; included in "Domestic: Miscellaneous applications."

[4]Includes animal feed; medical, pharmaceuticals, and cosmetics; miscellaneous fillers, extenders, and binders; and withheld data under "Domestic: Fillers, extenders, binders."

[5]Includes brick (common) and portland and other cements.

[6]Includes block and shapes, firebrick, grogs and calcines, kiln furniture, and miscellaneous refractories.

[7]Includes withheld data under "Exports, reported by producers."

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

(Thousand metric tons and thousand dollars)

Type and use	2018		2019	
	Quantity	Value	Quantity	Value
Type:				
Airfloat	544	38,800	473	34,200
Calcined[2]	784	137,000	811	137,000
Delaminated	667	98,600	600	89,700
Unprocessed	131	5,630	128	5,610
Water washed	2,790	537,000	2,620	515,000
Total	4,910	817,000	4,630	781,000
Use:				
Domestic:				
Ceramics:				
Catalysts (oil-refining)	W	NA	W	NA
Fiberglass, mineral wool	W	NA	W	NA
Roofing granules	W	NA	W	NA
Other[3]	785	NA	733	NA
Fillers, extenders, and binders:				
Adhesives	49	NA	48	NA
Paint	309	NA	292	NA
Paper coating	1,210	NA	1,100	NA
Paper filling	W	NA	W	NA
Plastic	103	NA	100	NA
Rubber	79	NA	69	NA
Other[4]	216	NA	204	NA
Heavy-clay products[5]	(6)	NA	(6)	NA
Refractories[7]	(6)	NA	(6)	NA
Undistributed[8]	618	NA	614	NA
Total	3,370	NA	3,160	NA
Exports, reported by producers:				
Paint	W	NA	W	NA
Paper coating[9]	1,200	NA	1,150	NA
Paper filling[9]	W	NA	W	NA
Rubber	44	NA	42	NA
Undistributed[10]	297	NA	277	NA
Total	1,540	NA	1,470	NA
Grand total	4,910	817,000	4,630	781,000

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

[1]Table includes data available through October 2, 2020. 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]Includes fine china and dinnerware, floor and wall tile, pottery, sanitaryware, miscellaneous ceramics, and withheld data under "Use: Domestic: Ceramics."

[4]Includes animal feed; asphalt tile; fertilizers; medical, pharmaceuticals, and cosmetics; pesticides and related products; miscellaneous fillers, extenders, and binders; and withheld data under "Use: Domestic: Fillers, extenders, and binders."

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

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

[7]Includes block and shapes, firebrick, grogs and calcines, high-alumina specialties, kiln furniture, and miscellaneous refractories.

[8]Includes chemical manufacturing, waterproofing seals, and unknown uses.

[9]Some export sales by producers may be included with domestic sales.

[10]Includes miscellaneous ceramics; miscellaneous fillers, extenders, and binders; unknown uses; and withheld data under "Use: Domestic: Exports, reported by producers."

TABLE 10
ESTIMATED SOUTH CAROLINA KAOLIN SOLD OR USED BY PRODUCERS, BY USE[1, 2]

(Thousand metric tons and thousand dollars)

Use	2018		2019	
	Quantity	Value	Quantity	Value
Ceramics[3]	123	NA	126	NA
Rubber (includes exports)	146	NA	153	NA
Other[4]	96	NA	95	NA
Total	365	32,300	375	33,700

NA Not available.

[1]Table includes data available through October 2, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

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

[3]Includes catalysts (oil-refining), fiberglass, and sanitaryware.

[4]Includes adhesives, brick (common), fertilizers, paint, paper coating, plastics, portland cement, and refractories.

TABLE 11
COMMON CLAY AND SHALE USED IN BUILDING BRICK
PRODUCTION IN THE UNITED STATES, BY STATE[1, 2]

(Thousand metric tons and thousand dollars)

State	2018		2019	
	Quantity	Value	Quantity	Value
Alabama	597	W	637	W
Arkansas	W	W	W	W
California	W	W	W	W
Colorado	W	W	W	W
Connecticut	W	W	W	W
Georgia	W	W	W	W
Illinois	W	W	W	W
Indiana	W	W	W	W
Iowa	W	W	W	W
Kansas	76	W	75	W
Kentucky	W	W	W	W
Louisiana	W	W	W	W
Maine	W	W	W	W
Maryland	W	W	W	W
Massachusetts	W	W	W	W
Michigan	W	W	W	W
Mississippi	W	W	W	W
Nebraska	W	W	W	W
New Mexico	W	W	W	W
North Carolina	749 r	3,840 r, e	680	3,580
North Dakota	50	425	51	365
Ohio	254	3,300	229	2,920 e
Oklahoma	515	1,570 e	441 e	1,300 e
Oregon	W	W	W	W
Pennsylvania	243	933	233 e	904 e
South Carolina	W	W	W	W
Texas[e]	1,360	6,980	1,280	6,680
Utah	36	78	78	172
Virginia	W	W	W	W
Washington	W	W	W	W
West Virginia	W	W	W	W
Wyoming	45	149	47	104
Other	1,790	12,500 e	1,690	12,600 e
Total	5,710 r	29,800 r, e	5,440 e	28,600 e

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

[1]Table includes data available through October 2, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes extruded and other brick.

TABLE 12
U.S. EXPORTS OF CLAYS, BY TYPE[1]

(Metric tons and thousand dollars)

Type of clay	2018		2019		Principal destinations in 2019 by quantity
	Quantity	Value	Quantity	Value	
Artificially activated clay and earth	149,000	82,000	138,000	73,800	Canada, 14%; Germany, 8%; Japan, 6%; Thailand, 6%.
Ball clay	89,800	15,200	85,300	16,300	Mexico, 80%; China, 3%; Guatemala, 3%; Japan, 3%.
Bentonite	845,000	192,000	906,000	191,000	Canada, 51%; Japan, 16%; China, 5%; Mexico, 5%.
Fire clay	250,000	60,800	194,000	48,700	Netherlands, 36%; Mexico, 20%; Japan, 14%; Taiwan, 8%.
Fuller's earth	70,100	34,100	73,400	31,800	Colombia, 9%; Mexico, 8%; Netherlands, 8%; Brazil, 7%.
Kaolin	2,390,000	567,000	2,280,000	552,000	China, 19%; Mexico, 18%; Japan, 13%; Finland, 7%.
Clay, not elsewhere classified	244,000	68,300	204,000	61,100	Canada, 74%; Mexico, 4%; China, 3%; Netherlands, 3%.
Total	4,030,000	1,020,000	3,880,000	975,000	

[1]Table includes data available through June 19, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 13
U.S. IMPORTS FOR CONSUMPTION OF CLAYS, BY TYPE[1]

(Metric tons and thousand dollars)

Type of clay	2018		2019		Principal sources in 2019 by quantity
	Quantity	Value	Quantity	Value	
Artificially activated clay and earth	23,200	14,100	30,800	17,100	Mexico, 88%; Germany, 4%; Egypt, 3%.
Ball clay	433	94	679	145	United Kingdom, 50%; Portugal, 31%; Canada, 18%.
Bentonite	22,200 [r]	9,330	33,800	11,800	Mexico, 63%; Turkey, 17%; China, 6%.
Chamotte or Dinas Earth	439	172	329	133	Czechia, 53%; Sweden, 20%; Canada, 12%.
Kaolin	330,000	38,500	293,000	36,900	Brazil, 91%; United Kingdom, 4%; Germany, 3%.
Fire clay	34,100	15,700	20,600	9,920	China, 94%; Canada, 5%.
Fuller's earth	25	13	5	14	Germany, 80%; China, 20%.
Clays, not elsewhere classified	10,400 [r]	6,010	10,600	6,300	Spain, 36%; Canada, 24%; China, 15%; Mexico, 11%.
Total	421,000	83,900	390,000	82,300	

[r]Revised.
[1]Table includes data available through June 19, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

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

TABLE 14
BENTONITE: WORLD PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Metric tons)

Country or locality[3]	2015	2016	2017	2018	2019
Algeria	34,400	37,100	35,600	36,000 e	36,000 e
Argentina	229,715	145,723	121,735	52,044 r	52,000 e
Armenia	1,592	5,543	11,724	21,029	32,434
Australia[e]	76,000	92,000	90,000	90,000	90,000
Azerbaijan	53,958	49,328	225,288	212,336 r	222,519
Bolivia	1,023	525	68	2	2 e
Bosnia and Herzegovina	67,261	102,858	92,344	174,715 r	94,601
Brazil	517,607	448,004 r	616,929 r	600,000 r, e	610,000 e
Bulgaria[e]	41,000	43,000	52,000	44,000	44,000
Burma	700	600	600	600 e	600 e
Canada[e]	583 r	600	600	600	600
Chile	1,434	1,288	1,584	525 r	395
China	1,755,000 r	1,558,000 r	2,014,000 r	2,000,000 r, e	2,000,000 e
Colombia	154,552 r	116,537 r	98,550 r	166,778 r	144,407
Cuba	500	389	589	630	600 e
Cyprus	127,036	117,184	95,593	98,800	83,113
Czechia	369,000	374,000	254,000	277,000	357,000
Denmark	54,272	66,278 r	69,594 r	56,173 r	57,000 e
Egypt	32,679	45,553 r	40,000 e	40,000 e	40,000 e
France	36,404	36,000 e	24,497	35,696	36,000 e
Georgia	135,500	138,600	140,000 e	140,000 e	140,000 e
Germany[e]	395,000 r	395,000 r	395,000 r	395,000 r	395,000
Greece:					
Crude	1,123,320	883,220	1,100,000	1,365,374 r	1,300,000
Processed	807,550	787,000	880,000	824,000	840,500
Guatemala	718 r, e	18,081	20,542	16,953 r	17,000 e
Hungary	10,100	14,300 r, e	19,673	18,000 e	18,000 e
India[e]	802,000 r	1,368,000 r	1,520,000 r	1,693,000 r	1,700,000
Indonesia[e]	6,000	6,000	6,000	6,000	6,000
Iran[e]	436,000 r	356,000 r	356,000 r	360,000	360,000
Italy	12,840	45,978	86,106	100,067	100,000 e
Japan	250,000 e	253,602	250,000 e	250,000 e	250,000 e
Kenya[e]	130	130	140	140	140
Korea, Republic of	78,439	63,834	47,306	31,824	32,000 e
Macedonia	9,000 e	1,968	912	2,945	--
Mexico	294,236	109,176	148,475 r	264,800 r	250,000 e
Morocco, crude	92,290	103,230	174,546	172,749 r	170,000 e
Mozambique:					
Crude	70,917	71,000 e	71,000 e	84,276	80,000 e
Processed	3,300 e	1,250	2,847	4,000 e	4,000 e
Nigeria	NA	3,200	3,200 e	3,200 e	3,200 e
Pakistan	33,612	31,384	79,417	42,932 r	53,100 e
Peru	21,341 r	19,246	756	2,384	46,887
Philippines	3,477	3,231	2,618	2,412	2,000 e
Poland	450	1,000	--	560	500
Romania	15,612	24,996	28,005	34,809	41,964
Russia	497,900	603,000	91,000	50,100	50,000 e
Slovakia	163,877	128,681	159,272	171,478	134,524
Slovenia	232	182	147	113	99
South Africa	165,535	148,742	165,141	173,486 r	180,000 e
Spain	102,000	155,038	177,565	178,463 r	160,477
Turkey	3,134,911	1,744,912	1,481,617	1,331,955 r	1,300,000 e
Turkmenistan:					
Powder[e]	400	400	420	450	450
Other, unspecified	8,000 e	8,000 e	8,400 e	9,000 e	10,000
Ukraine	210,000 e	210,000 e	113,200	178,200 r	180,000 e
United States	4,080,000 r	4,000,000	4,430,000	4,560,000 r	4,490,000

See footnotes at end of table.

TABLE 14—Continued
BENTONITE: WORLD PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Metric tons)

Country or locality[3]	2015	2016	2017	2018	2019
Uruguay	4,250	6,650	6,640	7,760 r	6,726
Uzbekistan e	26,000	26,000	26,000	26,000	26,000
Total	16,500,000 r	15,000,000 r	15,800,000 r	16,400,000 r	16,300,000 e

eEstimated. rRevised. NA Not available. -- Zero.

[1]Table includes data available through October 5, 2020. All data are reported unless otherwise noted. Totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Production may include fuller's earth for some countries and (or) localities.

[3]In addition to the countries and (or) localities listed, France and Vietnam may have produced bentonite, but available information was inadequate to make reliable estimates of output.

TABLE 15
FULLER'S EARTH: WORLD PRODUCTION, BY COUNTRY OR LOCALITY [1, 2]

(Metric tons)

Country or locality[3]	2015	2016	2017	2018	2019
Angola e	98,000	98,000	98,000	98,000	98,000
Australia, attapulgite	16,216	12,200 e	12,000 e	12,000 e	12,000 e
Greece, attapulgite, crude	107,740	44,500	54,280	53,300 r	36,700
India	--	--	5,600 e	5,600 e	5,600 e
Korea, Republic of	87,094	81,688	115,568	118,177	120,000 e
Mexico	108,215	111,713	110,860	110,000 e	110,000 e
Morocco, smectite	84,600 r, e	141,760	119,070 r	99,256 r	100,000 e
Pakistan	10,396	22,880	9,162	13,592 r	2,090 e
Senegal, attapulgite	188,000	172,000	165,900	177,900	117,070
South Africa, attapulgite	17,627	16,374	18,333	17,121 r	17,000 e
Spain:					
Attapulgite	25,400 r, e	25,400 r, e	25,400 r, e	28,021 r	30,348
Sepiolite	524,915	524,000	622,000 r, e	698,058 r	595,448
Turkey, sepiolite	28,804	56,038	15,624	20,000 e	20,000 e
United States[4]	1,960,000	1,860,000	1,840,000	1,880,000 e	1,920,000 e
Total	3,260,000 r	3,170,000 r	3,210,000 r	3,330,000 r	3,180,000 e

eEstimated. rRevised. -- Zero.

[1]Table includes data available through September 30, 2020. All data are reported unless otherwise noted. Totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Does not include centrally planned economy countries and former such countries, some of which presumably produce fuller's earth but for which no information is available.

[3]In addition to the countries and (or) localities listed, Algeria, France, Iran, and Italy may have produced fuller's earth, but available information was inadequate to make reliable estimates of output.

[4]Does not include attapulgite.

TABLE 16
KAOLIN: WORLD PRODUCTION, BY COUNTRY OR LOCALITY[1]

(Metric tons)

Country or locality[2]	2015	2016	2017	2018	2019
Albania	1,140,708	827,086	954,765	708,311	750,000 e
Algeria	51,000	96,000	100,000 e	100,000 e	100,000 e
Argentina	62,214	26,198	19,940	6,000 r	5,000 e
Australia[e]	209,000 r	205,000 r	200,000	200,000	200,000
Austria, crude	32,126	36,520	32,000 e	32,000 e	32,000 e
Bosnia and Herzegovina, crude	252,268	286,461 r	252,959	303,626	118,005
Brazil, beneficiated	1,802,000 r	1,737,000 r	1,771,000 r	1,700,000 r, e	1,700,000 e
Bulgaria[e]	210,000	190,000	220,000	230,000	220,000
Chile	60,000	60,000 e	60,000	88,262	34,081
China	6,414,000 r	5,643,000 r	5,215,000 r	5,000,000 r, e	5,000,000 e
Cuba	1,500	2,500	1,500	2,700	2,700 e
Czechia, crude	3,454,000	3,540,000	3,669,000	3,622,000	3,446,000
Ecuador	63,829	40,000 r, e	40,000 r, e	40,000 r, e	40,000 e
Egypt	232,351	232,000	232,000 e	230,000 e	230,000 e
Ethiopia, china clay[3]	4,600 e	4,600 e	4,600 e	10,000 r	250
France, marketable, including kaolinitic clay	275,150	274,472	279,120	301,842	302,000 e
Germany, marketable	4,300,000 e	4,300,000 e	5,200,000 r	5,200,000 r, e	5,200,000 e
Guatemala	1,101 r, e	793	657	725 r	700 e
Hungary, beneficiated	1,900	1,400	--	--	-- e
India, marketable:[e]					
Crude	4,036,000 r	1,450,000 r	4,110,000 r	4,000,000	4,000,000
Processed	73,600 r	31,000	74,000	74,000	74,000
Indonesia[e]	700,000	2,300,000	750,000	1,400,000 r	1,400,000
Iran	791,193	790,000	790,000 e	790,000 e	790,000 e
Jordan	105,000 r, e	110,082	175,167	180,000 r, e	190,000 e
Korea, Republic of	356,866	366,511	416,648	369,274 r	317,626
Kyrgyzstan	1,332,600	1,332,600	1,320,000 r, e	1,400,000 e	1,400,000 e
Madagascar[e]	220	220	220	220	220
Malaysia	255,448	285,940	321,685	496,219 r	417,222
Mexico	155,100	259,272	279,225 r	143,156 r	140,000 e
New Zealand, pottery	13,659	61,650	50,454	51,369 r	51,000 e
Nigeria	25,280 r	26,710 r	46,935	11,707 r	12,000 e
Oman	170,000	188,000	218,600	110,300 r	12,500
Pakistan	23,064	27,576	20,666	16,887 r	19,800 e
Peru	43,251 r	19,098 r	17,700	16,004	9,208
Philippines	8,179	10,059	10,000 e	10,000 e	10,000 e
Poland:					
Crude	287,000	299,830	284,650	310,850	317,190
Beneficiated	172,000	176,000	177,051	192,447	187,184
Portugal, washed and unwashed	252,000	283,571	307,982	355,829 r	304,677
Romania, marketable	30,000	30,000 e	--	--	--
Russia, including kaolinitic clay	786,000	1,064,800	1,226,000	1,593,000	1,530,000
Saudi Arabia	187,000	196,000	206,000	216,000	220,000 e
Serbia	216,210	253,000	255,000	279,000 r	280,000 e
Slovakia	10,502	11,923	13,584	21,209	16,620
South Africa	20,126	21,141	31,295	23,724 r	24,000 e
Spain, marketable, crude	350,000	347,258	475,074	474,462 r	450,000
Sri Lanka	2,238 r	1,767 r	1,941 r	2,000 r, e	2,000 e
Sudan	14,490	15,000	6,000	11,000	15,000 e
Sweden	157,000	180,000	174,000	200,000	200,000 e
Taiwan	732	4,035	1,665	20	500
Tanzania	1,953	656	13,816	129,383	15,343
Thailand:					
Beneficiated	102,763	101,618	102,659	96,666	80,776
Nonbeneficiated	655,196	830,393	401,450	403,225	551,674
Turkey	1,887,302	1,283,260	1,362,799	1,515,609 r	1,500,000 e
Uganda	34,697	45,909	55,317	32,183 r	17,000 e

See footnotes at end of table.

TABLE 16—Continued
KAOLIN: WORLD PRODUCTION, BY COUNTRY OR LOCALITY[1]

(Metric tons)

Country or locality[2]	2015	2016	2017	2018	2019
Ukraine	1,815,000	2,335,000	2,379,600	2,091,525 r	1,843,561
United Kingdom, china clay[e]	1,010,000	940,000	970,000	996,000 r	1,000,000
United States	5,710,000 r	5,200,000 r	5,450,000 r	5,350,000 r, e	5,060,000 e
Uzbekistan	3,200,000 r, e	3,200,000 r, e	3,519,000	4,688,700	4,500,000 e
Venezuela[e]	2,400	2,400	2,400	2,400	2,400
Total	43,600,000 r	41,600,000 r	44,300,000 r	45,800,000 r	44,300,000 e

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

[1]Table includes data available through October 6, 2020. All data are reported unless otherwise noted. Totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]In addition to the countries and (or) localities listed, Belgium, Denmark, Nigeria, Paraguay, Vietnam, and Zambia may have produced kaolin, but available information was inadequate to make reliable estimates of output.

[3]Production is based on fiscal year, with a starting date of July 7 of the year shown.