



2018 Minerals Yearbook

CLAY AND SHALE [ADVANCE RELEASE]

CLAY AND SHALE

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In 2018, domestic production of clays decreased for the first time in 5 years. Domestic production decreased by 3% to 26.3 million metric tons (Mt) valued at \$1.76 billion compared with 27.0 Mt valued at \$1.75 billion in 2017 (table 1). Common clay and shale accounted for 48% of the tonnage sold or used by producers and kaolin accounted for 49% of the value (table 2). In 2018, exports were essentially unchanged at 4.0 Mt valued at \$1.02 billion. Imports of clays equaled 421,000 metric tons (t) valued at \$83.9 million in 2018 compared with 430,000 t valued at \$88.1 million in 2017 (table 1). World production of bentonite was essentially unchanged at 19 Mt in 2018, production of fuller's earth was essentially unchanged at 3.2 Mt in 2018, and production of kaolin was 42 Mt in 2018 compared with 41 Mt in 2017 (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 are composed of smectite minerals (usually montmorillonite) with minor amounts of feldspar, biotite, and quartz. Common clays contain illite and chlorite as major components. Fire clays are composed mainly of kaolinite, halloysite, and (or) diaspore. Fuller's earth consists primarily of palygorskite (attapulgite) or calcium-rich montmorillonite nonplastic clays with quartz. Kaolin is composed primarily of kaolinite or kaolin-group minerals; smectite minerals—mica, quartz, and rutile—are a few other 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. The terms ball clay, fire clay, and kaolin are sometimes used interchangeably because the kaolinite minerals in each can be distinguished based only on particle size and degree of ordering within the atomic structure. The term fuller's earth has no mineralogical meaning and often is applied to any clay with absorptive qualities (Eisenhour and Reisch, 2006; McCuiston and Wilson, 2006; Pickering and Heivilin, 2006). Consequently, data presented for one specific clay type may include one or more other varieties. The USGS does not attempt to precisely identify clay types, but rather uses the terminology as reported.

Domestic production data for clays were developed by the USGS from a voluntary survey of U.S. operations. A total of

224 operations were canvassed in 2018 with 151 responding to the voluntary survey. Responses to the survey and company production data available from other sources accounted for approximately 64% 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 industry trends and employment hours.

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 2018. The 20 leading companies, with 75 operations and 200 pits, accounted for 64% of the tonnage and 81% of the value for 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 producing States were, in decreasing order of tonnage, Georgia, Wyoming, Texas, Alabama, North Carolina, Missouri, Tennessee, Ohio, New York, and California. The combined production of the 10 leading States decreased slightly compared with that in 2017 and accounted for 77% of the national total (table 2).

Ball Clay

Production.—Production of domestic ball clay was 1.12 Mt in 2018, a decrease of 12% from 1.27 Mt in 2017 (tables 2, 3). The value of ball clay produced decreased by 4% to \$60.7 million compared with \$63.0 million in 2017. Ball clay was produced in four States and the leading producing State was Tennessee.

Consumption.—Consumption of ball clay decreased by 12% in 2018. The two principal domestic markets were, in decreasing order by tonnage, ceramic floor and wall tile (54%) and sanitaryware (17%). 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 by 10% to \$54 per metric ton in 2018 from \$49 per metric ton in 2017 (tables 2, 3). The average free alongside ship (f.a.s.) value for exported ball clay was \$169 per metric ton in 2018 compared with \$184 per metric ton in 2017 (table 12). The average customs value for imported ball clay was \$217 per metric ton in 2018 compared with \$261 per metric ton in 2017 (table 13).

Bentonite

Production.—In 2018, nonswelling and (or) swelling bentonite was produced in 10 States. About 4.7 Mt valued at \$463 million was sold or used in 2018, an increase of 5% in quantity from 4.4 Mt valued at \$437 million in 2017 (tables 2, 4). Production of swelling bentonite increased by 5% to 4.52 Mt valued at \$438 million in 2018 from 4.30 Mt valued at \$413 million in 2017 (table 4). Most of the increase was attributed to a 6% increase in sales by producers in Wyoming. Wyoming was the leading State in the production of swelling bentonite with 91% of the total production. Production of nonswelling bentonite was 146,000 t valued at \$25.5 million in 2018, a 7% increase from 137,000 t in 2017 and a slight decrease from 147,000 t in 2016. Alabama and Mississippi led in the production of nonswelling bentonite and accounted for 83% of the total produced in 2018.

Consumption.—In 2018, sales and use of bentonite increased by 5% to 4.7 Mt from 4.4 Mt in 2017, with increased sales for pet waste absorbents and drilling mud offsetting the decrease in sales of civil engineering applications (table 4). Sales for pet waste absorbents increased by 7% in 2018 compared with those in 2017 and accounted for 47% of the total sales of bentonite. Sales for drilling mud increased by 14% during the same period that rotary drilling markets served by the bentonite industry increased by 18% in the United States and by 9% globally (Baker Hughes Inc., 2020). Domestic sales for foundry sand increased by 4% in 2018. Decreases in sales were reported for adhesives, pelletizing (iron ore), waterproofing and sealing, and miscellaneous civil engineering applications. These product lines accounted for 12% of the total sales in 2018 and decreased by 35% compared with those in 2017. Domestic sales for pelletizing (iron ore) applications decreased by 14% compared with sales in 2017. Shipments of iron ore increased by 7.5% in 2018 from those in 2017 (Tuck, 2020). Most domestic iron ore is pelletized using bentonite prior to shipment so increased iron ore shipments could increase bentonite sales to that market.

The leading markets shown in table 4 are representative of those of swelling bentonite, which accounted for 97% of total bentonite sales. Swelling bentonite accounted for more than 99% of bentonite sales for pet waste absorbents, 100% of sales for drilling mud and pelletizing of iron ore, and more than 85% of sales for foundry sand bond. Nonswelling bentonite accounted for more than 50% of sales for water treatment and filtering.

For other uses, swelling bentonite accounted for more than 90% of the bentonite sold for adhesives; animal feed; clarifying, decolorizing, and filtering animal, mineral, and vegetable oils and greases; cosmetics, medical, and pharmaceutical applications; fertilizers; miscellaneous ceramics; miscellaneous fillers and extenders; oil and grease absorbents; paint; and plastics.

Prices.—The average unit value reported by domestic producers for nonswelling bentonite was \$174 per metric ton in 2018 compared with \$170 per metric ton in 2017. The average value for swelling bentonite was \$97 per metric ton in 2018 compared with \$96 per metric ton in 2017 (table 4). The average f.a.s. value of exported bentonite was \$228 per metric ton in 2018 compared with \$207 per metric ton in 2017 (table 12). The average customs value of imported bentonite was \$420 per metric ton in 2018 compared with \$314 per metric ton in 2017

(table 13). Small shipments of high-value bentonite affected the unit value for both exports and imports.

Common Clay and Shale

Production.—The quantity of common clay and shale sold and used decreased by 5% to 12.6 Mt valued at \$199 million in 2018 compared with 13.3 Mt valued at \$205 million in 2017 (tables 2, 5). Common clay and shale for manufacturing products was produced in 36 States and Puerto Rico. An undetermined amount of common clay that was used for construction fill, landfill caps, and landscaping was produced in most, if not all, States. The five leading producing States were, in descending order of tonnage, Texas, Alabama, North Carolina, New York, and Oklahoma. These five States accounted for 55% of U.S. common clay and shale production (table 5).

Consumption.—In 2018, sales of common clay and shale decreased by 5% to 12.6 Mt from 13.3 Mt in 2017. Heavy-clay products, which included brick manufacture, remained the leading market for common clay and shale (44% of sales), although sales decreased by 4% to 5.5 Mt. Lightweight aggregate production was the second leading market for common clay and shale sales (30% of sales). Lightweight aggregate sales (3.7 Mt) were subdivided into several categories: miscellaneous lightweight aggregates and highway surfacing (20% of the total use of common clay and shale), concrete block (5%), and structural concrete (4%). The third leading market for common clay and shale, which accounted for 20% of common clay and shale sales, was for the manufacture of portland and other cements. This market increased by 8% in 2018, corresponding to a slight increase in production of portland and blended cements in 2018 (van Oss, 2019). Other markets for common clay and shale, including civil engineering, ceramic floor and wall tile, miscellaneous ceramics, heavy-clay (nonbrick) products, and refractory products, accounted for the remaining 7% of production in 2018 (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 in 2018, 2% higher than that in 2017 (tables 2, 5). 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 did not establish 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 decreased slightly to 567,000 t valued at \$6.6 million compared with 575,000 t valued at \$7.3 million in 2017 (table 2). Fire clay was produced in five States with Missouri being the leading producer in 2018. Annual production of fire clay had been variable in recent years as common clay producers randomly entered and exited the fire clay market in response to short-term customer demands.

Consumption.—Consumption of fire clay decreased slightly in 2018. Leading markets for fire clay were, in descending order of tonnage, structural concrete, common brick, portland cement, fire brick, and refractory grogs and calcines. Most data were

withheld to avoid disclosing company proprietary data. Fire clay also was sold for high-alumina brick and specialties, pottery, ramming and gunning mixes, refractory block and mortars, and refractory saggars.

Prices.—In 2018, the average unit value for fire clay reported by domestic producers decreased by 8% to \$12 per metric ton compared with \$13 per metric ton in 2017 (table 2). The average f.a.s. value of exported fire clay was \$244 per metric ton in 2018 compared with \$206 per metric ton in 2017 (table 12). The average customs value of imported fire clay was \$460 per metric ton in 2018 compared with \$389 per metric ton in 2017 (table 13). Small, high-value shipments for exports and imports affected the overall unit values.

Fuller's Earth

Production.—Fuller's earth deposits consist mainly of palygorskite (attapulgite) and occur in Florida, southwestern Georgia, and Nevada. Gellant grades of attapulgite, used as thickeners in such items as drilling muds and paints, were mined in western Florida and near 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 the montmorillonite-type fuller's earth, whose major market was sorbent applications. Production of the attapulgite variety of fuller's earth decreased by 8% in 2018. Attapulgite production data were withheld to avoid disclosing company proprietary data and are not included in tables.

Production of the montmorillonite variety of fuller's earth increased slightly to 1.88 Mt valued at \$166 million in 2018 compared with 1.84 Mt valued at \$171 million in 2017 (table 2). Montmorillonite-type fuller's earth was produced in nine States with Georgia, Virginia, and Missouri accounting for 61% of U.S. production.

Consumption.—Consumption of fuller's earth (excluding gellant-grade attapulgite-type fuller's earth) increased slightly in 2018 (table 6). Pet waste absorbent (61% of sales) was the leading market for the montmorillonite-type and sorbent-grade attapulgite-type of fuller's earth, followed by miscellaneous (unknown or unspecified uses) (14%), oil and grease absorbents (9%), vegetable oils and greases (4%), pesticide carriers (4%), and animal feed (4%).

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 increased by 8% in 2018 from that in 2017. The average value of montmorillonite-type fuller's earth was \$88.48 per metric ton in 2018 compared with \$92.77 per metric ton in 2017 (table 2) and \$88.91 per metric ton in 2016. The average f.a.s. value of exported fuller's earth was \$487 per metric ton in 2018 compared with \$408 per metric ton in 2017 (table 12). The average customs value of imported fuller's earth was \$516 per metric ton in 2018 compared with \$148 per metric ton in 2017 and \$582 per metric ton in 2016 (table 13).

Kaolin

Production.—In 2017, domestic production decreased slightly to 5.43 Mt valued at \$860 million compared with

5.56 Mt valued at \$866 million in 2017 (tables 2, 5). Kaolin was produced in six States with Georgia accounting for 90% of the U.S. kaolin production (table 7). Kaolin production in Georgia decreased slightly to 4.91 Mt valued at \$817 million in 2018 compared with 4.97 Mt valued at \$822 million in 2017 (table 9). Production in South Carolina, which accounted for 7% of U.S. kaolin production, increased by 8% to 365,000 t valued at \$32.3 million in 2018 compared with 338,000 t valued at \$29.9 million in 2017 (table 10).

Consumption.—Consumption of kaolin decreased slightly in 2018 from that in 2017. The major domestic markets for kaolin were, in descending order of tonnage, paper coating (36% of domestic sales), miscellaneous ceramics (16%), refractory products (15%), paint (8%), catalysts and rubber (6% each), and miscellaneous fillers, extenders, and binders (6%) (table 8). Smaller but significant domestic markets for kaolin 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. A similar market distribution was seen for kaolin producers in Georgia with paper coating and filling accounting for 41% of domestic sales and miscellaneous ceramics accounting for 23% of domestic sales (table 9).

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

Paper-coating markets accounted for 44% of total (domestic and export) kaolin sales in 2018, unchanged from 2017. Domestic sales of kaolin for paper-coating markets increased by 6% in 2018. Total sales (domestic and export) for paper-coating markets were essentially unchanged in 2018 compared with those in 2017. Refractory products accounted for 15% of total kaolin sales in 2018, with sales decreasing by 4% compared with those in 2017. Sales included under "Miscellaneous" in the "Ceramics" category decreased by 13% compared with those in 2017. Total sales (domestic and export combined) for rubber markets increased by 9% in 2018 (table 8).

Prices.—In 2018, the average unit value of kaolin reported by domestic producers increased slightly to \$158 per metric ton for all kaolin grades compared with \$156 per metric ton in 2017. The average value for water washed was \$193 per metric ton; delaminated, \$148 per metric ton; airfloat, \$81 per metric ton; and unprocessed, \$41 per metric ton in 2018. All types of calcined kaolin combined were valued at \$166 per metric ton in 2018, an increase of 4% compared with that in 2017 (table 7). In 2018, the average f.a.s. value of exported kaolin was \$238 per metric ton compared with \$237 per ton in 2017 (table 12) and \$230 per metric ton in 2016. The average customs value of imported kaolin was \$116 per metric ton in 2018 compared with \$123 per metric ton in 2017 (table 13).

Foreign Trade

Exports.—Ball clay exports were 89,800 t valued at \$15 million in 2018 compared with 82,500 t valued at \$15 million in 2017, according to the U.S. Census Bureau.

Bentonite exports decreased by 12% to 845,000 t valued at \$192 million in 2018 from 961,000 t valued at \$199 million in 2017 (table 12). Canada and Japan received for the largest share of the bentonite exports with 48% and 13%, respectively. Exports of fire clay and refractory-grade kaolin appear to have been shipped under the same HTS code in recent years. More than 60% of the exports reported by the U.S. Census Bureau under the HTS code for fire clay was thought to be refractory-grade kaolin rather than fire clay, based on the locations of ports from which the material was exported. In 2018, exports of fire clay and refractory-grade kaolin increased by 11% to 250,000 t valued at \$60.8 million compared with 225,000 t valued at \$46.4 million in 2017. In 2018, the Netherlands and Mexico received 40% and 18% of United States fire clay exports, respectively. In 2018, exports of fuller's earth decreased by 10% to 70,100 t valued at \$34.1 million compared with 78,300 t valued at \$31.9 million in 2017. Kaolin exports increased by 4% in 2018 to 2.4 Mt valued at \$567 million compared with 2.3 Mt valued at \$546 million in 2017 (table 12). Producers reported kaolin exports of 1.6 Mt (table 8). Some of the kaolin exported to Canada and Mexico probably was reported under domestic consumption by United States 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.—Imports of artificially activated material were 23,200 t valued at \$14 million in 2018 compared with 28,500 t valued at \$17 million in 2017 (table 13). Ball clay imports were 433 t valued at \$94,000 compared with 404 t valued at \$105,000 t in 2017. Bentonite imports consisted mainly of untreated bentonite clay and chemically or artificially activated materials. Imports of untreated bentonite were 22,300 t valued at \$9.3 million in 2018 compared with 33,000 t valued at \$10 million in 2017. Kaolin imports were 330,000 t of kaolin valued at \$38 million in 2018 compared with 316,000 t valued at \$39 million in 2017. About 89% of kaolin imports were from Brazil and were used primarily in paper-coating applications. In 2018, imports of fire clay were 34,100 t valued at \$16 million compared with 39,500 t valued at \$15 million in 2017. China was the source for 96% of the United States import tonnage. Imports of decolorizing earth and fuller's earth were 25 t valued at \$13,000 in 2018 compared with 1,400 t valued at \$202,000 in 2017.

World Review

In 2018, world production of bentonite was essentially unchanged at approximately 19 Mt (table 14). Fuller's earth world production was essentially unchanged at 3.2 Mt in 2018 (table 15). In 2018, kaolin world production was 42.5 Mt, a 3% increase from that in 2017, including crude kaolin ore production that was reported by many countries (table 16). The United States continued to be the leading supplier of processed clay for sale, followed by China, Greece, India, and Turkey for bentonite, Spain and the Republic of Korea for fuller's earth, and China, Germany, Turkey, and Uzbekistan for kaolin. 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

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. U.S. shipments of ceramic tile decreased by 5% in 2018 and this is the first year that U.S. tile consumption has decreased since 2008. New housing starts and new single-family home sales continued to increase in 2018 (Whitmire, 2019). Despite a decrease in sales of common clay and shale for brick manufacture in 2018, sales of clays to construction-related markets may increase slightly in 2019 owing to the increased construction activity.

The continued increase in U.S. commercial and residential construction bodes well for sales of bentonite and common clay and shale used for civil engineering applications, such as waterproofing and sealing and landfill caps and liners. Sales may increase slightly in 2019. The paper market continues to decrease as more information is exchanged electronically, which typically affects print publications and print advertising. In the United States, industrial production of paper, the leading market for kaolin, was unchanged from the fourth quarter of 2017 to the fourth quarter of 2018 (Board of Governors of the Federal Reserve System, 2019, p. 7). Based on usage trends, domestic sales of kaolin to paper markets may be unchanged or decrease slightly in 2019.

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

(Thousand metric tons and thousand dollars)

	2014	2015	2016	2017	2018
Domestic clays sold or used by producers:					
Quantity	25,100	25,500	26,000	27,000	26,300
Value	1,560,000	1,680,000	1,630,000	1,750,000	1,760,000
Exports:					
Quantity	4,360	4,140	3,800	4,040	4,030
Value	1,040,000	1,000,000	934,000	985,000	1,020,000
Imports for consumption:					
Quantity	591	520	473	430	421
Value	107,000	79,500	78,500	88,100	83,900
World, production:					
Bentonite	18,000 ^r	20,000 ^r	19,000 ^r	19,000 ^r	19,000
Fuller's earth	3,400	3,300 ^r	3,300 ^r	3,200 ^r	3,200
Kaolin	39,000 ^r	37,000	36,000 ^r	41,000 ^r	42,000

^rRevised.

¹Table includes data available through May 28, 2020. Data are rounded to no more than three significant digits.

²Excludes Puerto Rico.

TABLE 2
CLAYS SOLD OR USED BY PRODUCERS IN THE
UNITED STATES, BY STATE AND TYPE^{1,2}

(Thousand metric tons and thousand dollars)

State and type	2017		2018	
	Quantity	Value	Quantity	Value
State:				
Alabama	1,760	20,700	1,700	29,600
Alaska	--	--	--	--
Arizona	W	W	W	W
Arkansas	297	2,220	272	1,880
California	780	51,400	657	46,600
Colorado	278	8,730	274	7,720
Connecticut	W	W	W	W
Delaware	--	--	--	--
Florida	15	3,190	14	2,800
Georgia	5,730	864,000	5,740	862,000
Hawaii	--	--	--	--
Idaho	--	--	--	--
Illinois	W	W	W	W
Indiana	442	6,720	381	6,070
Iowa	173	662	168	628
Kansas	315	3,170	319	3,520
Kentucky	141	4,860	151	5,100
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	489	42,900	505	40,800
Missouri	1,060	24,100	1,080	23,500
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	831	33,000	675	31,200
North Carolina	1,630	35,000	1,320	38,500
North Dakota	48	373	50	425
Ohio	844	17,400	759	16,300
Oklahoma	688	2,380	655	2,170
Oregon	W	W	W	W
Pennsylvania	406	3,360	281	1,870
Rhode Island	--	--	--	--
South Carolina	529	31,000	545	33,400
South Dakota	W	W	W	W
Tennessee	1,020	68,400	896	67,500
Texas	3,020	66,600	3,090	57,400
Utah	432	13,800	440	13,400
Vermont	--	--	--	--
Virginia	W	W	W	W
Washington	W	W	W	W
West Virginia	W	W	W	W
Wisconsin	--	--	--	--
Wyoming	4,040	385,000	4,300	409,000
Other	2,030	60,200	2,030	54,300
Total	27,000	1,750,000	26,300	1,760,000

See footnotes at end of table.

TABLE 2—Continued
CLAYS SOLD OR USED BY PRODUCERS IN THE
UNITED STATES, BY STATE AND TYPE^{1,2}

(Thousand metric tons and thousand dollars)

State and type	2017		2018	
	Quantity	Value	Quantity	Value
Type:				
Ball clay	1,270	63,000	1,120	60,700
Bentonite	4,430	437,000	4,670	463,000
Common clay and shale	13,300	205,000	12,600	199,000
Fire clay	575	7,330	567	6,610
Fuller's earth	1,840	171,000	1,880	166,000
Kaolin	5,560	866,000	5,430	860,000
Total	27,000	1,750,000	26,300	1,760,000

W Withheld to avoid disclosing company proprietary data; included in "State: Other." -- Zero.

¹Table includes data available through May 28, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

²Excludes Puerto Rico and attapulgitic production.

TABLE 3
BALL CLAY SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY TYPE AND USE¹

(Thousand metric tons and thousand dollars)

Type and use	2017		2018	
	Quantity	Value	Quantity	Value
Type:				
Airfloat	366	26,500	356	26,900
Unprocessed	833	32,900	674	29,700
Water-slurried	75	3,660	86	4,180
Total	1,270	63,000	1,120	60,700
Use:				
Fillers, extenders, and binders ²	32	NA	28	NA
Floor and wall tile	745	NA	603	NA
Miscellaneous ceramics ³	202 ^r	NA	172	NA
Sanitaryware	185	NA	185	NA
Miscellaneous ⁴	110	NA	128	NA
Exports, reported by producers ⁵	W	NA	W	NA
Total	1,270	63,000	1,120	60,700

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

¹Table includes data available through May 28, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes adhesives; animal feed; fertilizer carriers; medical, pharmaceutical, cosmetics; paint; pesticides and related products; and other fillers, extenders, and binders.

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

⁴Includes chemical manufacturing, heavy-clay products, refractories, paint and unknown uses.

⁵Includes miscellaneous ceramics and unknown uses.

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

(Thousand metric tons and thousand dollars)

Type and use	2017		2018	
	Quantity	Value	Quantity	Value
Type:				
Nonswelling	137	23,300	146	25,500
Swelling	4,300	413,000	4,520	438,000
Total	4,430	437,000	4,670	463,000
Use:				
Domestic:				
Pet waste absorbents	1,770	NA	1,900	NA
Adhesives	W	NA	W	NA
Animal feed	45	NA	47	NA
Drilling mud	843	NA	961	NA
Filler and extender applications ²	34	NA	38	NA
Foundry sand	W	NA	W	NA
Pelletizing (iron ore)	W	NA	W	NA
Waterproofing and sealing	108	NA	89	NA
Miscellaneous civil engineering ³	315	NA	123	NA
Miscellaneous ⁴	919	NA	908	NA
Total	4,040	NA	4,060	NA
Exports, reported by producers:				
Drilling mud	(5)	NA	(5)	NA
Foundry sand	162	NA	170	NA
Other ⁶	234	NA	434	NA
Total	396	NA	605	NA
Grand total	4,430	437,000	4,670	463,000

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

¹Table includes data available through May 28, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes 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.

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

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

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

⁶Includes 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	2017		2018	
	Quantity	Value	Quantity	Value
State:				
Alabama	1,540	5,560	1,510	15,500
Arkansas	270	1,840	272	1,880
California	501	12,800	406	9,800
Colorado	269	8,580	266	7,590
Connecticut	W	W	W	W
Georgia	W	W	W	W
Illinois	W	W	W	W
Indiana	421	5,090	359	4,380
Iowa	173	662	168	628
Kansas	286	W	282	W
Kentucky	141	4,860	151	5,100
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	322	2,660	W	W
Montana	W	W	W	W
Nebraska	W	W	W	W
New Mexico	W	W	W	W
New York	831	33,000	675	31,200
North Carolina	1,620	34,900	1,320	W
North Dakota	48	373	50	425
Ohio	689	15,000	598	13,800
Oklahoma	688	2,380	655	2,170
Oregon	W	W	W	W
Pennsylvania	406	3,360	281	1,870
South Carolina	191	1,130	180	1,110
South Dakota	W	W	W	W
Texas	2,680	43,400	2,790	33,600
Utah	315	4,860	345	5,430
Virginia	W	W	W	W
Washington	W	W	W	W
West Virginia	W	W	W	W
Wyoming	38	54	45	149
Other	1,880	25,000	2,290	63,900
Total	13,300	205,000	12,600	199,000
Use:				
Floor and wall tile ⁴	216	NA	240	NA
Heavy-clay products:				
Brick, extruded	5,410 ^r	NA	5,280	NA
Brick, other	290	NA	196	NA
Other ⁵	27	NA	27	NA
Lightweight aggregate:				
Concrete block	685	NA	662	NA
Structural concrete	571	NA	511	NA
Miscellaneous ⁶	2,810	NA	2,560	NA
Portland and other cements	2,390	NA	2,570	NA
Refractories ⁷	349	NA	243	NA
Miscellaneous ⁸	563	NA	345	NA
Total	13,300	205,000	12,600	199,000

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}

(Thousand metric tons and thousand dollars)

- ¹Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; included in “State: Other.”
¹Table includes data available through May 28, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.
²Excludes Puerto Rico.
³Includes only production for companies with mills or plants.
⁴Includes ceramic tile, quarry tile, and miscellaneous floor and wall tiles.
⁵Includes drain tile, flowerpots, flue linings, sewer pipes, structural tile, and miscellaneous heavy-clay products.
⁶Includes highway surfacing and miscellaneous aggregate products.
⁷Includes block and shapes, firebrick, grogs and calcines, mortar and cement, and miscellaneous refractories.
⁸Includes exports reported by producers; miscellaneous civil engineering and sealings; miscellaneous fillers, extenders, and binders; pottery; roofing granules; miscellaneous ceramics and unknown uses.

TABLE 6
FULLER’S EARTH SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY TYPE AND USE¹

(Thousand metric tons and thousand dollars)

Type and use	2017		2018	
	Quantity	Value	Quantity	Value
Type:				
Attapulgite	(2)	(2)	(2)	(2)
Montmorillonite	1,840	171,000	1,880	166,000
Total	1,840	171,000	1,880	166,000
Use:				
Absorbents ³	1,480	NA	1,490	NA
Animal feed	50	NA	54	NA
Fillers, extenders, and binders ⁴	80	NA	72	NA
Filtering, clarifying, and decolorizing ⁵	W	NA	W	NA
Miscellaneous ⁶	229	NA	263	NA
Exports, reported by producers ⁷	W	NA	W	NA
Total	1,840	171,000	1,880	166,000

NA Not available. W Withheld to avoid disclosing company proprietary data; included in “Use: Miscellaneous.”

¹Table includes data available through May 28, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

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

³Includes oil and grease absorbents, pet waste absorbents, and miscellaneous absorbents.

⁴Includes asphalt emulsions; medical, pharmaceuticals, and cosmetics; paints; pesticides and related products; and miscellaneous filler, extender, and binder applications.

⁵Includes mineral and vegetable oils and greases.

⁶Includes civil engineering, drilling mud, and unknown uses.

⁷Includes drilling mud, oil and grease absorbents, paint, pet waste absorbents, and unknown uses.

TABLE 7
KAOLIN SOLD OR USED BY PRODUCERS IN THE UNITED STATES,
BY STATE AND TYPE¹

(Thousand metric tons and thousand dollars)

State and type	2017		2018	
	Quantity	Value	Quantity	Value
State:				
Alabama	161	8,280	134	6,780
Arkansas	27	387	--	--
California	W	W	W	W
Florida	15	3,190	14	2,800
Georgia	4,970	822,000	4,910	817,000
Nevada	W	W	W	W
South Carolina	338	29,900	365	32,300
Other	48	2,400	7	679
Total	5,560	866,000	5,430	860,000
Type:				
Airfloat	820	67,200	870	70,800
Calcined ²	858	137,000	841	140,000
Delaminated	624	92,700	667	98,600
Unprocessed	335	12,900	254	10,300
Water washed	2,920	556,000	2,800	540,000
Total	5,560	866,000	5,430	860,000

W Withheld to avoid disclosing company proprietary data; included with "State: Other." -- Zero.

¹Table includes data available through May 28, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes pigment-grade kaolin (low-temperature calcined kaolin) and refractory-grade kaolin (high-temperature calcined kaolin).

TABLE 8
KAOLIN SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY USE¹

(Thousand metric tons)

Use	2017	2018
Domestic:		
Ceramics:		
Catalyst (oil and gas refining)	269	234
Fiberglass, mineral wool	W	W
Fine china and dinnerware	12	11
Floor and wall tile	46	45
Pottery	W	W
Roofing granules	W	W
Sanitaryware	89 ^f	93
Miscellaneous ²	707 ^f	614
Chemical manufacture	(3)	(3)
Fillers, extenders, binders:		
Adhesives	51	51
Paint	312	312
Paper coating	1,140	1,210
Paper filling	W	W
Pesticide	W	W
Plastics	105	105
Rubber	198	220
Miscellaneous ⁴	207	216
Heavy-clay products ⁵	93	75
Refractories ⁶	587	566
Miscellaneous applications	142	127
Total	3,960	3,880
Exports, reported by producers:		
Ceramics	W	W
Paint	78	87
Paper coating	1,290	1,200
Paper filling	W	W
Rubber	49	50
Unknown uses ⁷	191	211
Total	1,600	1,550
Grand total	5,560	5,430

^fRevised. W Withheld to avoid disclosing company proprietary data.

¹Table includes data available through May 28, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

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

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

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

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

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

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

TABLE 9
 GEORGIA KAOLIN SOLD OR USED BY PRODUCERS, BY TYPE AND USE¹

(Thousand metric tons and thousand dollars)

Type and use	2017		2018	
	Quantity	Value	Quantity	Value
Type:				
Airfloat	505	36,200	544	38,800
Calcined ²	800	134,000	784	137,000
Delaminated	624	92,700	667	98,600
Unprocessed	132	5,730	131	5,630
Water washed	2,910	553,000	2,790	537,000
Total	4,970	822,000	4,910	817,000
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	885	NA	785	NA
Fillers, extenders, and binders:				
Adhesives	49	NA	49	NA
Paint	309	NA	309	NA
Paper coating	1,140	NA	1,210	NA
Paper filling	W	NA	W	NA
Plastic	103	NA	103	NA
Rubber	68	NA	79	NA
Other ⁴	208	NA	216	NA
Heavy-clay products ⁵	(6)	NA	(6)	NA
Refractories ⁷	(6)	NA	(6)	NA
Undistributed ⁸	614	NA	618	NA
Total	3,370 ^r	NA	3,370	NA
Exports, reported by producers:				
Paint	W	NA	W	NA
Paper coating ⁹	1,290	NA	1,200	NA
Paper filling ⁹	W	NA	W	NA
Rubber	44 ^r	NA	44	NA
Undistributed ¹⁰	268 ^r	NA	297	NA
Total	1,600	NA	1,540	NA
Grand total	4,970	822,000	4,910	817,000

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

¹Table includes data available through May 28, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes pigment- and refractory-grade calcined kaolin.

³Includes fine china and dinnerware, floor and wall tile, pottery, sanitaryware, miscellaneous ceramics, and withheld data under "Use: Domestic: Ceramics."

⁴Includes 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."

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

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

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

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

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

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

TABLE 10
SOUTH CAROLINA KAOLIN SOLD OR USED BY PRODUCERS, BY USE^{1,2}

(Thousand metric tons and thousand dollars)

Use	2017		2018	
	Quantity	Value	Quantity	Value
Ceramics ³	113	NA	123	NA
Rubber (includes exports)	135	NA	146	NA
Other ⁴	90	NA	96	NA
Total	338	29,900	365	32,300

NA Not available.

¹Table includes data available through May 28, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes airfloat, calcined, and unprocessed kaolin.

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

⁴Includes adhesives, animal feed, brick (common), floor and wall tile, 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	2017		2018	
	Quantity	Value	Quantity	Value
Alabama	671	W	597	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	78	W	76	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	529	2,460	506	2,380
North Dakota	48	373	50	425
Ohio	258	3,310	254	3,300
Oklahoma	561	1,940	515	1,570
Oregon	W	W	W	W
Pennsylvania	371	2,610	243	933
South Carolina	W	W	W	W
Texas	1,320	6,720	1,360	6,980
Utah	29	103	36	78
Virginia	W	W	W	W
Washington	W	W	W	W
West Virginia	W	W	W	W
Wyoming	38	54	45	149
Other	1,800	12,600	1,790	12,500
Total	5,700	30,100	5,470	28,300

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

¹Table includes data available through May 28, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes extruded and other brick.

TABLE 12
U.S. EXPORTS OF CLAYS, BY TYPE¹

(Metric tons and thousand dollars)

Type of clay	2017		2018		Principal destinations in 2018, by quantity
	Quantity	Value	Quantity	Value	
Artificially activated clay and earth	147,000	77,700	149,000	82,000	Canada, 13%; Germany, 8%; Japan, 5%; Thailand, 5%.
Ball clay	82,500	15,200	89,800	15,200	Mexico, 76%; China, 3%; Germany, 3%; Japan, 3%.
Bentonite	961,000	199,000	845,000	192,000	Canada, 48%; Japan, 13%; China, 6%; Mexico, 6%.
Fire clay	225,000	46,400	250,000	60,800	Netherlands, 40%; Mexico, 18%; Japan, 11%; Taiwan, 10%.
Fuller's earth	78,300	31,900	70,100	34,100	Colombia, 9%; Netherlands, 9%; Brazil, 7%; Mexico, 5%.
Kaolin	2,310,000	546,000	2,390,000	567,000	China, 21%; Mexico, 16%; Japan, 15%; Finland, 7%.
Clay, not elsewhere classified	244,000	67,700	244,000	68,300	Canada, 73%; Mexico, 4%; China, 3%.
Total	4,040,000	985,000	4,030,000	1,020,000	

¹Table includes data available through May 28, 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 TYPE¹

(Metric tons and thousand dollars)

Type of clay	2017		2018		Principal sources in 2018, by quantity
	Quantity	Value	Quantity	Value	
Artificially activated clay and earth	28,500	16,900	23,200	14,100	Mexico, 87%; Germany, 6%; Egypt, 4%.
Ball clay	404	105	433	94	United Kingdom, 65%; Portugal, 18%; Germany, 15%.
Bentonite	33,000	10,400	22,300	9,330	Turkey, 32%; Greece, 31%; Mexico, 16%; China, 11%.
Chamotte or Dinas Earth	484	169	439	172	Czechia, 68%; Sweden, 18%; France, 9%.
Kaolin	316,000	38,700	330,000	38,500	Brazil, 89%; Germany, 5%.
Fire clay	39,500	15,400	34,100	15,700	China, 96%; Singapore, 4%.
Fuller's earth	1,370	202	25	13	United Kingdom, 72%; Canada, 20%.
Clays, not elsewhere classified	11,300	6,270	10,600	6,010	Spain, 41%; Canada, 23%; China, 15%; Mexico, 7%.
Total	430,000	88,100	421,000	83,900	

¹Table includes data available through May 28, 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	2014	2015	2016	2017	2018
Algeria	30,800 ^r	34,400 ^r	37,100 ^r	35,600 ^r	36,000 ^e
Argentina	280,407 ^r	229,715 ^r	145,723 ^r	121,735 ^r	130,000 ^e
Armenia	798	1,592	5,543 ^r	11,724 ^r	21,029
Australia ^e	66,000	76,000 ^r	92,000 ^r	90,000 ^r	90,000
Azerbaijan	81,900	53,958 ^r	49,328	225,288 ^r	201,539
Bolivia	886	1,023 ^r	525 ^r	68 ^r	2
Bosnia and Herzegovina	80,952	67,261	102,858 ^r	92,344 ^r	87,358
Brazil	405,169	517,607 ^r	520,000 ^{r,e}	520,000 ^{r,e}	520,000 ^e
Bulgaria ^c	36,000 ^r	41,000 ^r	43,000 ^r	52,000 ^r	44,000
Burma	NA	700	600 ^r	600 ^r	600 ^e
Canada	2,083	580 ^e	600 ^{r,e}	600 ^e	600 ^e
Chile	1,083	1,434	1,288 ^r	1,584 ^r	1,500 ^e
China ^e	5,000,000	5,600,000	5,600,000	5,600,000	5,600,000
Colombia	90,000 ^{r,e}	139,144 ^r	104,917 ^r	66,869 ^r	70,000 ^e
Cuba	700	500	389 ^r	589 ^r	630
Cyprus	140,174	127,036	117,184 ^r	95,593	98,800
Czechia	301,000	369,000	374,000 ^r	254,000 ^r	277,000
Denmark	66,388	54,000 ^{r,e}	66,000 ^e	78,284	75,935
Egypt	3,615	32,679 ^r	40,000 ^e	40,000 ^e	40,000 ^e
Georgia	126,400	135,500	138,600	140,000 ^e	140,000 ^e
Germany	395,000	400,000 ^e	400,000 ^e	400,000 ^e	400,000 ^e
Greece:					
Crude	1,011,480	1,123,320	883,220	1,100,000	1,355,000
Processed	850,000	807,550	787,000 ^r	880,000	824,000
Guatemala	38,368	720 ^e	18,081 ^r	20,542 ^r	20,000 ^e
Hungary	9,900	10,100	14,000 ^e	19,673 ^r	18,000 ^e
India ^e	800,000	800,000	1,400,000 ^r	800,000	800,000
Indonesia ^c	6,000	6,000	6,000	6,000	6,000
Iran ^e	420,000 ^r	440,000	360,000 ^r	360,000 ^r	360,000
Iraq	255	-- ^e	-- ^e	-- ^e	-- ^e
Italy	20,000 ^{r,e}	12,840 ^r	45,978 ^r	86,106 ^r	100,067
Japan	250,000 ^{r,e}	250,000 ^{r,e}	253,602 ^r	250,000 ^{r,e}	250,000 ^e
Kenya ^c	110	130	130	140	140
Korea, Republic of	71,850	78,439	63,834 ^r	47,306 ^r	31,824
Macedonia	11,691	9,000 ^e	1,968	912	2,945
Mexico	474,025	294,236 ^r	109,176 ^r	470,000 ^e	470,000 ^e
Morocco, crude	98,757	92,290	103,230 ^r	174,546 ^r	170,000 ^e
Mozambique:					
Crude	27,167	70,917	71,000 ^e	71,000 ^e	84,276
Processed	1,250	3,300 ^e	1,250 ^r	2,847 ^r	4,000 ^e
Nigeria	NA	NA	3,200	3,200 ^e	3,200 ^e
Pakistan	44,115 ^r	33,612	31,384 ^r	79,417 ^r	36,999
Peru	37,375	21,000 ^{r,e}	19,246	756	2,384
Philippines	3,369	3,477	3,231 ^r	2,618 ^r	2,412
Poland	650	450	1,000 ^r	-- ^r	560
Romania	19,171	15,612 ^r	24,996 ^r	28,005 ^r	34,809
Russia	560,000 ^e	497,900 ^r	603,000 ^r	91,000 ^r	50,100
Slovakia	134,131	163,877	128,681 ^r	159,272	171,478
Slovenia	199	232	182 ^r	147 ^r	113
South Africa	171,119	165,535	148,742	165,141 ^r	160,000 ^e
Spain	105,627 ^r	102,000 ^r	155,038 ^r	177,565 ^r	180,000 ^e
Turkey	1,098,817	3,134,911	1,744,912 ^r	1,481,617 ^r	1,500,000 ^e
Turkmenistan:					
Powder ^e	400	400	400	420	450
Other, unspecified	7,387	8,000 ^e	8,000 ^e	8,400 ^e	9,000 ^e

See footnotes at end of table.

TABLE 14—Continued
BENTONITE: WORLD PRODUCTION, BY COUNTRY OR LOCALITY^{1,2}

(Metric tons)

Country or locality ³	2014	2015	2016	2017	2018
Ukraine	210,000 ^e	210,000 ^e	210,000 ^e	113,200 ^r	110,000 ^e
United States	4,830,000	4,080,000	4,000,000	4,430,000	4,670,000
Uruguay	7,800	4,250	6,650	6,640 ^r	6,600 ^e
Uzbekistan ^e	26,000	26,000	26,000	26,000	26,000
Total	18,000,000 ^r	20,000,000 ^r	19,000,000 ^r	19,000,000 ^r	19,000,000

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

¹Table includes data available through October 22, 2019. All data are reported unless otherwise noted. Totals and estimated data are rounded to no more than two significant digits, and U.S. data are rounded to no more than three significant digits; may not add to totals shown.

²Production may include fuller's earth for some countries.

³In 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	2014	2015	2016	2017	2018
Angola ^e	98,000	98,000	98,000	98,000	98,000
Australia, attapulgite	10,176	16,216 ^r	12,000 ^{r,e}	12,000 ^{r,e}	12,000 ^e
Greece, attapulgite, treated	45,000	107,740	44,500	54,280	53,000 ^e
India	-- ^r	-- ^r	-- ^r	5,600 ^e	5,600 ^e
Korea, Republic of	54,001	87,094 ^r	81,688 ^r	115,568 ^r	118,177
Mexico	245,147	108,215 ^r	111,713 ^r	110,860 ^r	110,000 ^e
Morocco, smectite	73,500	85,000 ^e	141,760 ^r	85,000 ^e	85,000 ^e
Pakistan	9,914	10,396	22,880 ^r	9,162 ^r	13,690
Senegal, attapulgite	191,000	188,000 ^r	172,000	165,900	177,900
South Africa, attapulgite	17,668	17,627	16,374	18,333 ^r	18,000 ^e
Spain:					
Attapulgite ^e	25,000	25,000	25,000	25,000	25,000
Sepiolite	555,581 ^r	524,915 ^r	524,000 ^r	620,000 ^e	600,000 ^e
Turkey, sepiolite	53,110 ^r	28,804 ^r	56,038 ^r	15,624 ^r	20,000 ^e
United States ⁴	2,040,000	1,960,000	1,860,000	1,840,000	1,880,000
Total	3,400,000	3,300,000 ^r	3,300,000 ^r	3,200,000 ^r	3,200,000

^eEstimated. ^rRevised. -- Zero.

¹Table includes data available through October 16, 2019. All data are reported unless otherwise noted. Totals and estimated data are rounded to no more than two significant digits, and U.S. data are rounded to no more than three significant digits; may not add to totals shown.

²Does 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.

³In 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.

⁴Does not include attapulgite.

TABLE 16
KAOLIN: WORLD PRODUCTION, BY COUNTRY OR LOCALITY¹

(Metric tons)

Country or locality ²	2014	2015	2016	2017	2018
Albania	1,050,471 ^r	1,140,708 ^r	827,086 ^r	954,765	708,311
Algeria	181,068	51,000 ^r	96,000 ^r	100,000 ^{r,e}	100,000 ^e
Argentina	45,892 ^r	62,214 ^r	26,198 ^r	19,940 ^r	20,000 ^e
Australia ^e	190,000 ^r	210,000 ^r	200,000 ^r	200,000 ^r	200,000
Austria, crude	36,334	32,126	36,520 ^r	32,000 ^e	32,000 ^e
Bosnia and Herzegovina, crude	21,610	252,268	248,685 ^r	252,959 ^r	303,626
Brazil, beneficiated	2,055,000	1,809,000 ^r	1,800,000 ^{r,e}	1,800,000 ^{r,e}	1,800,000 ^e
Bulgaria ^e	320,000 ^r	210,000 ^r	190,000 ^r	220,000 ^r	230,000
Chile	60,000 ^e	60,000 ^e	60,000 ^e	60,000 ^e	88,262
China ^e	3,200,000	3,200,000	3,200,000	3,200,000	3,200,000
Cuba	1,700	1,500	2,500 ^r	1,500	2,700
Czechia, crude	3,281,000	3,454,000	3,540,000 ^r	3,669,000 ^r	3,622,000
Ecuador	40,236	63,829	55,000 ^{r,e}	55,000 ^{r,e}	55,000 ^e
Egypt	300,000 ^e	232,351	232,000 ^r	232,000 ^{r,e}	230,000 ^e
Ethiopia, china clay ³	4,530	4,600 ^e	4,600 ^e	4,600 ^e	4,600 ^e
France, marketable, including kaolinitic clay	316,652 ^r	275,150 ^r	274,472 ^r	279,120 ^r	301,842
Germany, marketable	4,275,000	4,300,000 ^e	4,300,000 ^e	4,300,000 ^e	4,300,000 ^e
Guatemala	1,285	1,100 ^e	793 ^r	657 ^r	700 ^e
Hungary, beneficiated	330	1,900	1,400	--	--
India, marketable: ^e					
Crude	4,600,000	4,000,000	1,400,000 ^r	4,100,000	4,000,000
Processed	86,000	74,000	31,000 ^r	74,000	74,000
Indonesia ^e	1,900,000 ^r	700,000 ^r	2,300,000 ^r	750,000 ^r	750,000
Iran	820,067	791,193	790,000	790,000 ^e	790,000 ^e
Jordan	10,414 ^r	581 ^r	110,082 ^r	175,167 ^r	3,396
Korea, Republic of	429,081	356,866 ^r	366,511 ^r	416,648 ^r	364,249
Kyrgyzstan	1,121,800	1,332,600	1,332,600 ^r	1,320,000 ^{r,e}	1,400,000 ^e
Madagascar	221	220 ^e	220 ^e	220 ^e	220 ^e
Malaysia	207,694	255,448	285,940 ^r	321,685 ^r	320,000 ^e
Mexico	342,917	155,100 ^r	259,272 ^r	330,000 ^{r,e}	330,000
New Zealand, pottery	61,382	13,659	61,650 ^r	50,454 ^r	50,000 ^e
Nigeria	35,180 ^r	44,952 ^r	24,105 ^r	46,935 ^r	45,000 ^e
Oman	67,000	170,000 ^r	188,000 ^r	218,600 ^r	101,100
Pakistan	13,803	23,064	27,576 ^r	20,666 ^r	16,655
Peru	19,964	43,500 ^{r,e}	19,262	17,700	16,004
Philippines	7,050	8,179	10,059 ^r	10,000 ^{r,e}	10,000 ^e
Poland:					
Crude	278,000	287,000	299,830 ^r	284,650 ^r	310,850
Beneficiated	197,000 ^r	172,000 ^r	176,000 ^r	177,051 ^r	192,447
Portugal, washed and unwashed	269,073	252,000	283,571 ^r	307,982 ^r	300,265
Romania, marketable	30,638	30,000 ^r	30,000 ^{r,e}	-- ^r	--
Russia, including kaolinitic clays	787,000	786,000	1,064,800 ^r	1,226,000 ^r	1,593,000
Saudi Arabia	106,000	187,000 ^r	196,000 ^r	206,000 ^r	216,000
Serbia	214,000	216,210	253,000 ^r	255,000 ^r	260,000 ^e
Slovakia	6,000 ^e	10,502	11,923 ^r	13,584	21,209
South Africa	27,258	20,126 ^r	21,141	31,295 ^r	31,000 ^e
Spain, marketable, crude	344,414 ^r	350,000 ^r	347,258 ^r	475,074 ^r	450,000 ^e
Sri Lanka ^e	12,000 ^r	12,000 ^r	13,000 ^r	13,000 ^r	13,000
Sudan	33,770	14,490	15,000	6,000 ^r	11,000
Taiwan	1,808	732	4,035 ^r	1,665 ^r	20
Tanzania	3,809	1,953	656 ^r	13,816	129,383
Thailand:					
Beneficiated	123,621	102,763	101,618	102,659	96,666
Nonbeneficiated	755,913	655,196	830,393 ^r	401,450 ^r	403,225
Turkey	2,032,103	1,887,302	1,283,260 ^r	1,362,799 ^r	1,400,000 ^e

See footnotes at end of table.

TABLE 16—Continued
KAOLIN: WORLD PRODUCTION, BY COUNTRY OR LOCALITY¹

(Metric tons)

Country or locality ²	2014	2015	2016	2017	2018
Uganda	46,286	34,697	45,909 ^r	55,317 ^r	55,000 ^e
Ukraine	1,426,000	1,815,000	2,335,000 ^r	2,379,600 ^r	2,400,000 ^e
United Kingdom, china clay ^e	1,100,000	1,000,000	940,000 ^r	970,000 ^r	1,000,000
United States	6,020,000	5,810,000	5,290,000	5,560,000	5,430,000
Uzbekistan	64,605	303,600	320,500 ^r	3,519,000 ^r	4,688,700
Venezuela	2,500	2,400 ^e	2,400 ^e	2,400 ^e	2,400 ^e
Total	39,000,000 ^r	37,000,000	36,000,000 ^r	41,000,000 ^r	42,000,000

^eEstimated. ^rRevised. -- Zero.

¹Table includes data available through October 23, 2019. All data are reported unless otherwise noted. Totals and estimated data are rounded to no more than two significant digits, and U.S. data are rounded to no more than three significant digits; may not add to totals shown.

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

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