



2018 Minerals Yearbook

FELDSPAR AND NEPHELINE SYENITE [ADVANCE RELEASE]

FELDSPAR AND NEPHELINE SYENITE

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In 2018, feldspar production in the United States was estimated to be 550,000 metric tons (t) valued at \$53.1 million, a 25% increase in quantity and a 95% increase in value compared with those in 2017 (table 1). Exports of feldspar in 2018 decreased by 18% to 4,400 t valued at \$1.4 million, and imports of feldspar decreased by 38% to 181,000 t valued at \$5.98 million. Imports of nepheline syenite (predominantly from Canada) decreased by 26% to 1.07 million metric tons (Mt) valued at \$81.8 million. However, imports of nepheline syenite were extremely high in 2017 when compared with the preceding years. Despite the decrease, imports in 2018 were still twice that of imports during 2014 through 2016. World production of feldspar in 2018 was estimated to be 25.6 Mt (tables 1, 7).

Feldspars, which constitute about 60% of the earth's crust, are anhydrous aluminosilicate minerals of two main groupings: potassium- to sodium-alkali feldspars and sodium- to calcium-plagioclase feldspars. The alkali feldspars are used mostly in glassmaking and ceramics and the plagioclase feldspars, especially the sodium-rich varieties, are used mainly in ceramics and various construction applications. Calcium-rich plagioclase is used for its alumina content in multiple construction products (such as fiberglass) or for strengthening glass-reinforced plastic products. By volume, much of the sand and gravel used as aggregate in concrete and asphalt is composed of plagioclase, and plagioclase is an important constituent of some building stones. Nepheline syenite is an essentially quartz-free igneous rock composed of alkali feldspars and nepheline, which is a feldspathoid mineral that forms in place of alkali feldspars when the magma (melt) is deficient in silica. The uses of nepheline syenite are similar to those of alkali feldspar.

In 2018, U.S. apparent consumption of feldspar and nepheline syenite (combined) was estimated to be 1.8 Mt (table 1). Feldspar and nepheline syenite were used in ceramics and glass production for the construction industry and glass for the automotive sector. Both materials also were used as filler in various products such as paints and coatings (table 4). Domestic feldspar production data include feldspar-quartz mixtures from silica producers and aplite (a rock with quartz and feldspar as the dominant minerals) from one producer. Domestic nepheline syenite production in the United States was not included in production figures because the material was not considered to be marketable as a flux. Nepheline syenite was used primarily in the production of roofing granules, but it was also used in the production of ceramic and porcelain tiles and other construction applications.

Feldspar

Production.—Data on domestic production, sales, and use of feldspar in this chapter were collected by the U.S. Geological Survey (USGS) using responses from voluntary company surveys. Production for nonrespondents was estimated using previous years' submissions and worker-hour reports from

the U.S. Department of Labor's Mine Safety and Health Administration. Of the seven companies that produced feldspar, six responded to the canvass, representing 55% of the 2018 production tonnages listed in tables 1 and 2. Feldspar was mined in six States; production was from 10 mines and beneficiating facilities—four in North Carolina, two in California, and one each in Idaho, Oklahoma, South Dakota, and Virginia (table 3).

In 2018, I-Minerals Inc. continued developing multiple deposits at its Helmer-Bovill property for which the Idaho Department of Lands had approved the mine permitting process in 2016 (I-Minerals Inc., 2018). The mine, located in north-central Idaho, would produce potassium feldspar, halloysite, kaolin, and quartz (I-Minerals Inc., 2017b). In 2016, pilot-plant work by an independent laboratory resulted in a potassium feldspar product with 13% to 14% potassium oxide (K_2O) and low iron [0.03% ferric oxide (Fe_2O_3)] content (I-Minerals Inc., 2017a).

The company produced small quantities of feldspathic (feldspar-quartz) sands from its WBL Tailings resource area, which was adjacent to the Helmer-Bovill property, for use in ceramic tile production. About 5,000 t of feldspathic sands was produced in 2014 and 2015. In 2016 and 2017, production decreased to 500 t. There was no production in 2018 owing to road improvement needs (I-Minerals Inc., 2019, p. 6). The WBL Tailings area contained feldspar- and quartz-rich materials left on the property from 1960 to 1974 by the former mine operator, which had switched focus to kaolin production from the ores. I-Minerals' reclamation mining permit allowed it to mine about 50,000 metric tons per year of feldspathic sand from WBL Tailings between June and October of each year through 2022 (I-Minerals Inc., undated). Feldspar-quartz sand from WBL Tailings was sold to Quarry Tile Co.'s tile plant in Spokane, WA. In addition to providing a revenue stream, the sale of sands from WBL reduced the tailings storage requirements for the company (I-Minerals Inc., 2014). WBL Tailings was one of three mineral resource areas on the Helmer-Bovill property, a multiminer project from which the company expected annual production of 47,000 t of potassium feldspar during a projected 25-year mine life (I-Minerals Inc., 2016).

Consumption.—In 2018, apparent consumption of feldspar and nepheline syenite (combined) was estimated to be 1.8 Mt, a decrease of 18% from 2017's estimated apparent consumption of 2.2 Mt (table 1). Approximately 65% of domestic feldspar sold or used was consumed in the manufacture of glass, including glass containers, flat glass, specialty glass, and fiberglass for home insulation. Feldspar use for glass increased by 24% (table 4). In glassmaking, feldspar promotes the mixing of the melt components by fluxing (reducing the melt viscosity and the melting temperature) the system. The alkalis in feldspar (especially potassium and sodium ions) lower the melting temperature within the mix and promote the melting and chemical bonding of the other glass-batch minerals such as

quartz to produce glass. Alumina and calcium ions in feldspar impart increased resistance to physical and chemical breakdown of the glass product.

Much of the remaining feldspar consumption was used in the manufacture of ceramics, including ceramic and porcelain tile, electrical insulators, sanitaryware, and tableware. In ceramics, as in glassmaking, the alkalis (calcium, potassium, and sodium) in feldspar act as a flux, working with soda ash to lower the melting temperature of the mixture while increasing the fusibility of the batch materials. Feldspar also controls the degree of vitrification of the ceramic body during firing. Smaller quantities of feldspar are used as fillers and extenders in paint, plastics, and rubber.

In 2018, several factors may have contributed to the decrease in consumption of domestic feldspar. One of these was the significant decrease in feldspar and nepheline syenite imports, which were unusually high in 2017. Although imports were lower in 2018, imports were still significantly higher than in years prior to 2017. Other possible factors included the substitution of nepheline syenite for feldspar in ceramic (especially porcelain) tile and competition from imported ceramic tile (up by 1.5% in 2018 from imports in 2017) (Whitmire, 2019a). Despite the estimated decrease in consumption, the unit value of U.S. feldspar production increased by 56% from about \$64 per metric ton in 2017 to approximately \$97 per metric ton in 2018 (table 1).

The construction industry is a significant consumer of glass and ceramic products, particularly for windows, flooring, and sanitaryware. In the United States, construction starts for new private housing increased by 4% to 1.25 million units in 2018 compared with 1.2 million units in 2017. This upward trend had continued since 2010. The 2018 housing starts, however, remained lower than most years from 1959 through 2007 (U.S. Census Bureau, 2019b). The value of total construction put in place, which uses significant quantities of flat glass and ceramic tile products, increased for the seventh consecutive year, by 3.9% to nearly \$1.33 trillion in 2018 from \$1.28 trillion in 2017, both years surpassing the previous peak of \$1.16 trillion in 2006 (U.S. Census Bureau, 2019a).

In 2018, U.S. production and shipments of ceramic and porcelain tiles decreased for the first time in 8 years. Production decreased by 4% to 87 million square meters (Biral di, 2019a, p. 62). Shipments of tile decreased by 5% compared with those in 2017. Sales decreased by 4% to a value of \$1.39 billion from \$1.45 billion in 2017 (Whitmire, 2019a). The United States remained the leading importer of ceramic and porcelain tiles in 2018. Imports accounted for 72% of domestic tile consumption (Biral di, 2019a, p. 62). The four key suppliers were China (32%), Mexico (17%), Italy (16%), and Spain (14%) (Whitmire, 2019a). Exports of tile increased by 4%, in 2018 with the majority going to Canada (80%) and Mexico (5%) (Whitmire, 2019a).

Porcelain tile, which is less porous than typical types of ceramic tile, was becoming increasingly the tile of choice in the United States; the majority of 2018 U.S. imports for flooring were of porcelain tile rather than ceramic tile. In 2016, Dallas-based Dal-Tile Group Inc. (Dal-Tile) (a subsidiary of Mohawk Industries Inc.) began operation of its first tile kiln at its \$180 million, 167,000-square-meter glazed porcelain and

colorbody tile manufacturing plant in Dickson, TN (Gadd, 2016). Dal-Tile began construction of a second plant in Dickson in 2017 (Gadd, 2017). In 2018, the company announced plans to fill 100 vacancies in preparation for the opening of the second Dickson plant. Dal-Tile planned to invest \$140 million by 2023 for operational and construction costs for the new facility and create 245 additional jobs by the end of 2023 (Gadd, 2018).

Foreign Trade.—In 2018, 57% of United States exports of feldspar went to Canada, 16% to Mexico, 15% to Colombia, 4% to Costa Rica, and most of the remainder to countries in Central America (table 5). In 2018, most imports of feldspar continued to be sourced from Turkey, with substantially less coming from Spain, Germany, Mexico, Israel, India, Brazil, and Sweden, in descending order by tonnage (table 6). Feldspar imports from Turkey decreased by 38% to 179,000 t from 288,000 t in 2017, whereas the average unit value of Turkish feldspar imports increased from \$24 per metric ton to \$30 per metric ton. Two companies imported most of the shipments of feldspar from Turkey—one a manufacturer of ceramic and porcelain floor and wall tiles and the other a producer and supplier of raw materials used in the production of ceramic tiles and sanitaryware.

World Review.—More than 70 countries had significant resources of feldspar and more than 40 produced feldspar in 2018; estimated world production was 25.6 Mt (table 7). The leading feldspar-producing countries in 2018 were Turkey (7.5 Mt), India and Italy (each with 4 Mt), China (2 Mt), Thailand (1.5 Mt), and Iran (0.75 Mt) (table 7).

Feldspar consumption worldwide was used mostly for glassware and ceramics, similar to the United States. Global ceramic tile production decreased by 3.6% to 13.1 billion square meters, although there were significant increases throughout Africa. However, Asia remained the world's leading ceramic tile producer, accounting for 68.8% of production (Biral di, 2019a, p. 48). China, the world's leading tile producer, accounted for 43% of world production. India and Brazil ranked second and third, accounting for 9% and 6% of world production, respectively. Of the top manufacturing countries, ceramic tile production increased most notably in Indonesia (by 25%), Vietnam (by 8%), and India (by 6%). Global consumption of ceramic tile decreased by 4% to 12.8 billion square meters. China, the world's leading ceramic tile consumer, accounted for 38% of world consumption and India and Brazil ranked second and third with 6% each (Biral di, 2019a, p. 52, 54).

Although China continued to be the leading exporter of tile with 31% of world exports, exports from China decreased, by 6%, for the fifth consecutive year. Spain ranked second, accounting for 15% of global tile exports, and Italy was third with 12% of exports. Exports from Spain increased slightly, and exports from Italy decreased by 3% when compared with those of the previous year. The remaining major exporting countries, in descending order of increases, were India, Brazil, Turkey, and Iran (Biral di, 2019a, p. 56).

China.—Feldspar was mined in the eastern and southeastern Provinces of China. Ranked fourth globally, China produced an estimated 2.0 Mt of feldspar in 2018 (table 7), which was used in the production of ceramic tile, sanitaryware, and tableware. Porcelain tile was the primary type of ceramic tile produced. The country's ceramic tile output decreased

slightly to 5.7 billion square meters, of which approximately 850 million square meters was exported (Biraldi, 2019a, p. 52–56). China produced about one-third of the world's sanitaryware and accounted for 53.2% of world exports in 2018 (Biraldi, 2019b, p. 86).

Greenland.—Hudson Resources Inc. continued work on its Naajat (White Mountain) anorthosite (calcium-rich plagioclase feldspar) project in western Greenland. In 2018, Hudson made significant progress on project infrastructure construction and by the end of the year construction was about 95% complete (Hudson Resources Inc., 2018). The project's mine life was expected to last for more than a century. In 2016, the company acquired a 50-year mining license to produce anorthosite, with a substantial portion to be sold to Owens Corning Inc. for use as feed material at its fiberglass plants. Hudson had a 10-year supply contract with Owens Corning with an option to extend for successive 10-year periods (Patel, 2015; Hudson Resources Inc., 2017). Owens Corning planned to use the Naajat anorthosite to make electrical-grade glass (E-glass), which is the most common glass fiber used in composites, fabrics, and glass-reinforced plastics for products where strength and high electrical resistivity are required. Additional potential applications for the anorthosite were as an alumina source in making refractories and ceramics; as filler and coating material for paints, paper, and plastics; and potentially as a feed for aluminum smelters (Hudson Resources Inc., 2014). The high-purity ore does not require processing with chemicals and the deposit is located near docking facilities that will enable easy shipping (Hudson Resources Inc., 2013).

India.—In 2018, India was one of the top three feldspar producers in the world. Feldspar production in India in 2018 was estimated to be 4 Mt, a 32% decrease in output from that in 2017 (table 7); about 640,000 t (16%) was exported. Approximately 12,000 t of feldspar was imported in 2018 (United Nations Statistics Division, undated a). Feldspar was produced in four States, Rajasthan, Telangana, Andhra Pradesh, and Gujarat, in decreasing order of tonnage. About 95% of India's feldspar production took place in Rajasthan (76%) and Telangana (19%). India had large feldspar reserves and resources. As of 2015, India's reserves and other resources were estimated to be 320 Mt and 314 Mt, respectively (Indian Bureau of Mines, 2019).

Italy.—In 2018, Italy was one of the three leading global feldspar producers, with an estimated production of 4 Mt (table 7). Most of Italy's feldspar output was consumed in the domestic ceramics industry. In 2018, the country exported 278,000 t of feldspar, 90% of which went to Spain. Italy imported 2.7 Mt of feldspar, 93% of which was from Turkey and nearly 6% from France (United Nations Statistics Division, undated a). Production of ceramic tile, the leading sector of the country's ceramics industry, decreased for the first time in 5 years to 416 million square meters in 2018 from 423 million square meters in 2017 (Biraldi, 2019a, p. 58). Total exports of ceramic tile decreased to 328 million square meters in 2018, with 68% of exports going to European markets (Biraldi, 2019a, p. 60).

Turkey.—Turkey was the world's leading feldspar producer with an estimated 7.5 Mt in 2018 (table 7). Feldspar was mined in southwestern Anatolia, mainly from the Menderes Massif (Global Investment Holdings, undated). Most of the country's

production was exported, the majority of which went to Italy (40%), Spain (38%), Russia (4%), and the United States (3%) (United Nations Statistics Division, undated a).

Nepheline Syenite

Production.—The only deposit of nepheline syenite mined in the United States was in Arkansas, where three operations produced the material. The mined product was used primarily for roofing granules by the asphalt shingle industry and, in lesser quantities, as a flux in the manufacture of ceramic and porcelain floor tile in the southern and southeastern United States. Nepheline syenite also was used in the manufacture of ceramic bricks, asphalt, and concrete aggregates and related products. Use of nepheline syenite from the Arkansas deposit, which typically contained 3% or more iron oxide, lowered the temperature of the melt more than a nepheline syenite (or feldspar) of lower iron content and resulted in a darker colored product, making it ideal for the production of bricks and darker body ceramic tiles. Nepheline syenite was produced by two companies—3M Co. (Industrial Mineral Products Division) and Granite Mountain Quarries Co. (a subsidiary of McGeorge Contracting Co. Inc.). 3M mined nepheline syenite from the Arch Street Mine, which was also a crushed-stone-producing facility that had been active since the 1930s. Although 3M primarily produced roofing granules from its nepheline syenite, it was the leading U.S. producer of nepheline syenite for the tile industry and supplied nepheline syenite to the brick industry. Granite Mountain Quarries Co. produced nepheline syenite from Granite Mountain Quarry #1 and Granite Mountain Quarry #2 mostly for use as construction aggregates supplied to its sister construction companies and for use as railroad ballast. All three properties are to the south and southeast of Little Rock, AR (Jay Lukkarila, Mining Engineer, 3M Co. Industrial Products Division, written commun., June 15, 2017; U.S. Department of Labor, Mine Safety and Health Administration, 2019).

Consumption.—In glass and ceramics manufacturing, nepheline syenite (like feldspar) provides alkalis that act as a flux. In glass, nepheline syenite also supplies alumina, imparting the same benefits as feldspar. Nepheline syenite also is used as a filler in adhesives, paint, plastics, and sealants, can be used in the production of aluminum and fertilizers, and as a construction aggregate. During the past several years, the consumption of Arkansas nepheline syenite for the manufacture of porcelain floor tile in the United States has increased.

Foreign Trade.—Exports of nepheline syenite increased by 62% in 2018 from those in 2017. In 2018, 10,400 t of the material was exported to several countries, most notably to Canada (45%), Mexico (18%), and Belgium (13%) (U.S. Census Bureau, 2019c). Imports decreased by 27% to 1.1 Mt from that of 1.5 Mt in 2017. Approximately 99% of the nepheline syenite imported in 2018 was imported from Canada (U.S. Census Bureau, 2019c).

World Review.—Nepheline syenite was produced in Brazil, Canada, China, Norway, Russia, and Turkey for feldspathic uses. The leading producing company was Belgium-based SCR-Sibelco NV, through its subsidiaries Sibelco Europe in Norway and Unimin Corp. in Canada. Other companies included Finetron Industrial Minerals Ltd. in China and OJSC Apatit AG and United Company RUSAL Plc in Russia.

Canada.—Canada's sole nepheline syenite producer, Unimin, operated two mines about 175 kilometers northeast of Toronto, Ontario—one at Blue Mountain and the other at Nephtho. Production of marketable nepheline syenite was estimated to be 565,000 t in 2018, a decrease of 8% from 612,000 t in 2017 (Natural Resources Canada, 2019). The material was used in abrasives, ceramics, fillers, and glass. Canada's estimated nepheline syenite exports were 1.1 Mt t in 2018, a decrease of 26% from 1.48 Mt in 2017; 1.07 Mt was exported to the United States, a decrease of 27% from 1.46 Mt in 2017 (United Nations Statistics Division, undated b).

Norway.—Sibelco Europe produced nepheline syenite in the summer and autumn from an open pit on the Arctic Island of Stjernoy. Onsite processing of the ore (crushing, drying, milling, sieving, magnetic separation, and air classification) resulted in various products for the glass, ceramics, and paint industries and desulfurization of steel. In 2018, exports of nepheline syenite from Norway were 308,000 t. About 26% of the exports were to the Netherlands, 23% to Poland, 11% to Spain, 10% to Germany, 9% to the United Kingdom, and 8% to Italy (United Nations Statistics Division, undated b).

Russia.—The Kiya-Shaltyr Mine on the Goryachegorsk Massif in east-central Siberia, operated by RUSAL, produced 4.29 Mt of nepheline ore, a slight decrease from 4.33 Mt produced in 2017, for use in the production of alumina. RUSAL accounted for approximately 6% of the global production of alumina and aluminum (United Company RUSAL Plc, 2019, p. 7, 51).

In 2018, phosphate producer PJSC PhosAgro AG, through its subsidiary OJSC Apatit, was Russia's only producer of nepheline concentrate. At the Apatit mining and beneficiation complex, the company mined and processed apatite-nepheline ore from the Khibiny deposit on the Kola Peninsula in the Murmansk region of northwest Russia. The Apatit operation produced phosphate rock, nepheline concentrates, and other mineral concentrates. In 2018, nepheline concentrate production decreased slightly to 986,000 t and sales also decreased slightly to 983,000 t from 998,000 t in 2017 (PJSC PhosAgro AG, 2019, p. 54).

Outlook

Production and transportation costs for U.S. producers of feldspar and nepheline syenite are expected to increase and feldspar reserves at some operations are decreasing. Domestic feldspar producers may find increasing competition from imports of feldspar, which have increased significantly in the past several years, especially with the recent decrease in quantities of economically minable domestic potassium feldspar. Feldspar producers also may continue to face competition from domestic nepheline syenite used in the production of some ceramic tiles and imported nepheline syenite in the production of glass and ceramic products. Higher transportation charges for delivered raw materials could increase the cost of producing glass and tile.

Sales of glass food containers in the United States are expected to continue to increase slightly during the next several years because of consumer demand and Federal and State government initiatives for recyclable food and beverage packaging; this increase would likely increase feldspar consumption by glass container manufacturers. However,

significant growth in glass container recycling and the use of cullet could reduce the quantities of raw materials needed to manufacture these containers.

In the United States, new residential construction and commercial and residential remodeling are expected to increase, creating a higher demand for ceramics, fiberglass, and glass, and thus for feldspar and nepheline syenite. Following the trend of the past several years, the ceramics industry is expected to continue to recover for the next several years, which is likely to increase the use of feldspar and nepheline syenite. Consumption of domestic ceramic tile is expected to continue to rise in 2019 (Whitmire, 2019b).

Worldwide, demand for ceramic tile is expected to increase because of increases in construction and the residential replacement (remodeling) market, especially in the growing economies of China, India, and Japan. Although consuming much of its output, China is likely to continue to be the leading exporter of ceramic tile. An increasing trend toward replacing marble floors, metal slabs, and paint with ceramic tile and the growing trend of using ceramic tiles for wall coverings (especially in kitchens, because they are easy to clean) are anticipated to drive regional growth in the residential replacement market further (GlobeNewswire, Inc., 2016a, b).

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TABLE 1
SALIENT FELDSPAR AND NEPHELINE SYENITE STATISTICS¹

		2014	2015	2016	2017	2018
United States:						
Production, feldspar: ^{c, 2}						
Quantity ³	metric tons	530,000	520,000	480,000 ^r	440,000	550,000
Value	thousands	\$34,800	\$37,300	\$33,100	\$27,200 ^r	\$53,100
Exports, feldspar: ⁴						
Quantity	metric tons	16,000	15,100	5,890	5,340	4,400
Value ⁵	thousands	\$5,880	\$4,920	\$1,520	\$1,210	\$1,400
Imports for consumption: ⁴						
Feldspar:						
Quantity	metric tons	7,910	120,000	36,900	290,000	181,000
Value ⁶	thousands	\$3,120	\$7,090	\$3,430	\$7,510	\$5,980
Nepheline syenite:						
Quantity	metric tons	503,000	449,000	572,000	1,460,000	1,070,000
Value ⁶	thousands	\$64,000	\$67,600	\$73,000	\$88,400	\$81,800
Consumption, apparent ^{c, 3, 7}	metric tons	1,000,000	1,100,000	1,100,000	2,200,000	1,800,000
World, production ^{c, 8}	thousand metric tons	23,200 ^r	26,700 ^r	27,700 ^r	26,500 ^r	25,600

^cEstimated. ^rRevised.

¹Table includes data available through August 19, 2019. Data are rounded to no more than three significant digits.

²Includes hand-cobbed feldspar, flotation-concentrate feldspar, feldspar in feldspar-quartz mixtures, and aplite for use predominantly in the production of ceramics and glass; may differ from sales in table 4.

³Rounded to two significant digits to avoid disclosing company proprietary data.

⁴Source: U.S. Census Bureau.

⁵Free alongside ship (f.a.s.) value.

⁶Customs value.

⁷Production plus imports minus exports. Includes feldspar and imported nepheline syenite.

⁸Feldspar only.

TABLE 2
ESTIMATED FELDSPAR PRODUCTION IN THE UNITED STATES¹

(Thousand metric tons and thousand dollars)

Year	Flotation concentrate		Other ²		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
2017	60	3,860	380	23,900	440	27,200 ^r
2018	70	4,120	480	49,200	550	53,100

^rRevised.

¹Table includes data available through August 19, 2019. Quantity data are rounded to two significant digits and value data are rounded to three significant digits; may not add to totals shown.

²Includes hand-cobbed feldspar, feldspar content of feldspar-quartz mixtures, and aplite; does not include nepheline syenite.

TABLE 3
U.S. PRODUCERS OF FELDSPAR IN 2018

Company	Location	Product
APAC-Central, Inc.	Muskogee, OK	Feldspar-quartz mixture.
Covia Holding Corporation	Emmett, ID	Do.
G3 Enterprises Inc.	Byron, CA	Do.
Graniterock Co.	Felton, CA	Do.
Pacer Minerals LLC	Custer, SD	Potassium feldspar.
Quartz Corp., The	Spruce Pine, NC	Sodium-potassium feldspar.
Do.	do.	Sodium-potassium feldspar; feldspar-quartz mixture.
Sileco North America	do.	Sodium-potassium feldspar.
Do.	do.	Sodium-potassium feldspar; feldspar-quartz mixture.
U.S. Silica Holdings, Inc.	Montpelier, VA	Aplite.
Do., do. Ditto.		

TABLE 4
ESTIMATED FELDSPAR SOLD OR USED BY PRODUCERS IN
THE UNITED STATES, BY USE^{1,2}

(Thousand metric tons and thousand dollars)

Use	2017		2018	
	Quantity	Value	Quantity	Value
Glass ³	290	16,700	360	41,400
Ceramics/pottery and miscellaneous	150	11,100	190	11,900
Total	440	27,800	550	53,300

¹Table includes data available through August 19, 2019. Quantity data are rounded to two significant digits and value data are rounded to three significant digits; may not add to totals shown.

²Includes hand-cobbed feldspar, flotation-concentrate feldspar, feldspar in feldspar-quartz mixtures, and aplite.

³Includes container glass, fiberglass, and other glass.

TABLE 5
U.S. EXPORTS OF FELDSPAR, BY COUNTRY OR LOCALITY¹

(Metric tons and dollars)

Country or locality	2017		2018	
	Quantity	Value ²	Quantity	Value ²
Canada	4,090	819,000	2,520	712,000
China	--	--	17	27,000
Colombia	417	122,000	638	377,000
Costa Rica	160	51,400	186	47,200
El Salvador	178	47,600	119	25,000
French Polynesia	7	6,800	--	--
Hong Kong	--	--	4	2,730
India	--	--	3	5,290
Japan	214	64,000	--	--
Malaysia	18	9,600	69	59,900
Mexico	1	4,580	691	78,200
Panama	240	78,600	143	50,900
Peru	--	--	10	14,200
Trinidad and Tobago	19	3,320	--	--
Total	5,340	1,210,000	4,400	1,400,000

-- Zero.

¹Table includes data available through August 19, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

²Free alongside ship value.

Source: U.S. Census Bureau.

TABLE 6
 U.S. IMPORTS FOR CONSUMPTION OF FELDSPAR, BY COUNTRY OR
 LOCALITY^{1,2}

(Metric tons and dollars)

Country or locality	2017		2018	
	Quantity	Value ³	Quantity	Value ³
Brazil	81	47,700	13	12,700
Germany	437	145,000	528	173,000
India	272	62,400	120	31,200
Israel	--	--	208	27,000
Japan	1	7,200	--	--
Mexico	622	165,000	430	115,000
Spain	617	179,000	726	217,000
Sweden	--	--	12	3,960
Turkey	288,000 ⁴	6,880,000 ⁴	179,000 ⁴	5,400,000 ⁴
United Kingdom	20	14,100	--	--
Total	290,000	7,500,000	181,000	5,980,000

-- Zero.

¹Table includes data available through August 19, 2019. Data are rounded to no more than three significant digits; may not add to totals shown.

²Excludes nepheline syenite (mostly from Canada), which is listed in table 1.

³Customs value.

⁴Referred to the U.S. Census Bureau for verification.

Source: U.S. Census Bureau as adjusted by U.S. Geological Survey.

TABLE 7
 FELDSPAR: WORLD PRODUCTION, BY COUNTRY OR LOCALITY¹

(Metric tons)

Country or locality ²	2014	2015	2016	2017	2018
Algeria	230,372	154,500 ^r	168,000 ^r	168,400 ^r	170,000 ^e
Argentina	162,854	186,974	155,217	86,763 ^r	90,000 ^e
Australia, includes nepheline syenite ^e	45,000	45,000	10,000	10,000	10,000
Austria ^e	35,000	35,000	35,000	35,000	35,000
Brazil, beneficiated, marketable	418,000 ^e	456,308 ^r	295,778 ^r	400,000 ^e	400,000 ^e
Chile	4,233	6,577	6,352	4,421 ^r	2,789
China	3,670,000 ^e	3,820,000	3,800,000	1,618,000 ^r	2,000,000 ^e
Cuba	3,600 ^e	3,300 ^e	3,900	3,600 ^r	3,000
Czechia	422,000	433,000	454,000	368,000 ^r	449,000
Ecuador	183,000 ^e	253,000 ^e	148,506	92,871 ^r	90,000 ^e
Egypt ^e	400,000	421,000	400,000	400,000	400,000
Ethiopia ^e	596	600	600	600	600
Finland	46,233	38,026	18,549	14,926 ^r	17,469
Germany	200,000 ^e	200,000 ^e	284,569 ^r	285,000 ^{r,e}	285,000 ^e
Guatemala	10,410	10,340	30,428	29,145 ^r	30,000 ^e
India	1,634,240	4,120,000 ^{r,e}	5,890,000 ^{r,e}	5,900,000 ^{r,e}	4,000,000 ^e
Iran	1,055,368 ^r	736,149 ^r	784,412 ^r	750,000 ^{r,e}	750,000
Italy ^e	4,700,000	4,500,000	4,000,000	4,000,000 ^r	4,000,000
Kenya	--	--	3	-- ^e	-- ^e
Korea, Republic of	528,958	601,030	654,398	717,177 ^r	617,166
Macedonia	18,076	20,289	19,919	21,237	30,813
Malaysia	378,446	442,980	441,857 ^r	411,204 ^r	420,000 ^e
Mexico	150,726	159,372	122,176	233,050 ^r	209,770
Morocco ^e	45,000	45,000	35,000 ^r	40,000	40,000
Nigeria	52,080 ^r	13,238 ^r	34,144	27,660	41,355
Norway	154 ^r	76 ^r	-- ^r	-- ^{r,e}	-- ^e
Pakistan ³	38,126	141,582	305,308	160,999	167,308
Peru	18,019	16,979	16,629	14,929	31,588
Philippines	34,232	38,067	46,630 ^r	-- ^{r,e}	-- ^e
Poland	68,910 ^r	76,540 ^r	88,140 ^r	91,200 ^r	71,480
Portugal	70,865	93,789	132,105	126,211	130,000 ^e
Romania ^{e,4}	9,200	8,200 ^r	4,500 ^r	7,500 ^r	23,000
Russia	400,000 ^e	232,995 ^r	278,142 ^r	294,411 ^r	300,000 ^e
Saudi Arabia	168,000	179,000	188,000	197,000	206,000
Slovakia	6,000 ^e	4,000	8,400	15,800 ^r	15,000 ^e
South Africa	102,541	130,184	127,872 ^r	116,705 ^r	120,000 ^e
Spain, includes pegmatite	533,328	558,273	634,519	595,666 ^r	600,000 ^e
Sri Lanka, crude and ground ^e	96,000	96,000	95,000	90,000	96,000
Sudan	50,680	94,354	92,172	29,000 ^r	30,000 ^e
Sweden, crude and ground, marketable	27,000 ^e	21,000 ^r	22,000 ^r	22,000 ^r	22,000 ^e
Thailand	1,413,428	1,331,916	1,167,147	1,385,925	1,500,000 ^e
Turkey	5,092,560	6,368,079	6,120,978	7,153,908	7,500,000 ^e
Ukraine	94,506	44,460	33,627 ^r	35,000 ^{r,e}	35,000 ^e
United States ^{e,4,5}	530,000	520,000	480,000 ^r	440,000	550,000
Venezuela	93,900	75,500	80,000 ^e	75,000 ^{r,e}	80,000 ^e
Total	23,200,000 ^r	26,700,000 ^r	27,700,000 ^r	26,500,000 ^r	25,600,000 ^e

^eEstimated. ^rRevised. -- Zero.

¹Table includes data available through August 8, 2019. All data are reported unless otherwise noted. Totals and estimated 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, Bulgaria, Burma, Colombia, France, Namibia, the United Arab Emirates, and Yemen may have produced feldspar, but available information was inadequate to make reliable estimates of output.

³Production is based on fiscal year, with a starting date of June 30 of the year shown.

⁴Rounded to two significant digits to avoid disclosing company proprietary data.

⁵Includes hand-cobbed feldspar, flotation-concentrate feldspar, feldspar in feldspar-quartz mixtures, and aplite.