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FELDSPAR AND NEPHELINE SYENITE

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Feldspar and Nepheline Syenite

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In 2019, feldspar production in the United States was estimated to be 450,000 metric tons (t) valued at $48.4 million, an 18% decrease in quantity and a 9% decrease in value compared with that in 2018 (table 1). Exports of feldspar in 2019 decreased by 12% to 3,890 t valued at $1.07 million, and imports of feldspar decreased by 65% to 63,800 t valued at $3.37 million. Imports of nepheline syenite (predominantly from Canada) decreased by 53% to 508,000 t valued at $79.0 million; however, imports of nepheline syenite were extremely high in 2017 and 2018 compared with preceding years. World production of feldspar in 2019 was estimated to be 23 million metric tons (Mt) and was essentially unchanged from that in 2018 (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 mostly are used in glassmaking and ceramics, and the plagioclase feldspars, especially the sodium-rich varieties, are used mainly in ceramics and various construction applications. Plagioclase of higher calcium content is used for its alumina content across multiple construction products, such as fiberglass or for the strengthening of glass-reinforced plastic products. In a broader sense, 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 formed in place of alkali feldspars because the magma (melt) was deficient in silica. Nepheline syenite has similar uses to those of alkali feldspar.

In 2019, U.S. apparent consumption of feldspar and nepheline syenite, combined, was estimated to be 1.0 Mt; feldspar and nepheline syenite were used primarily 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 (tables 1, 4). Domestic feldspar production data include feldspar-quartz mixtures from silica producers, one potassium feldspar producer, and one aplite (a rock with quartz and feldspar as the dominant minerals) producer. Domestic nepheline syenite production 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 also was used in the production of ceramic and porcelain tile and other construction applications. Discussion of nepheline syenite follows that of feldspar.

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 production company surveys. Production for nonreporting operations was estimated by using previous years' submissions and worker-hour reports from the U.S. Department of Labor's Mine Safety and Health Administration. Of the eight companies that produced feldspar, seven responded to the canvass, representing about 67% of the 2019 production tonnages listed in tables 1 and 2. Feldspar was mined in six States (table 3). Production was from eight mines and beneficiating facilities—two in North Carolina, two in California, and one each in Idaho, Oklahoma, South Dakota, and Virginia (table 3).

In 2019, I-Minerals Inc. continued developing multiple deposits at its Helmer-Bovill property and conducted a prefeasibility study of an operation in Salt Lake City, UT. The prefeasibility study was 60% complete as of September. Feldspathic sand production from this facility could be screened and sold as a byproduct (I-Minerals Inc., 2019b). 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 14.42% to 14.64% potassium oxide (K_2O) and low iron [0.03% ferric oxide (Fe_2O_3)] content (I-Minerals Inc., 2017a). In 2019, the pilot-plant continued to produce favorable production runs resulting in 14% K_2O, 17% aluminum oxide (Al_2O_3), and 0.02% Fe_2O_3, which I-Minerals believed would make these products competitive in the feldspar market (I-Minerals Inc., 2019a).

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 the production of ceramic tile. The WBL tailings are feldspar- and quartz-rich materials that were left on the property from 1960 to 1974 by the former mine operator, which then focused on 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 the WBL Tailings between June and October of each year through 2022 (I-Minerals Inc., undated).

Consumption.—In 2019, apparent consumption of feldspar and nepheline syenite was estimated to be 1.0 Mt, a decrease of 44% from estimated apparent consumption of 1.8 Mt in 2018 (table 1). The apparent consumption of feldspar alone was 510,000 t in 2019. Approximately 62% 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 decreased by 22% in 2019 (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 of 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 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 were used as fillers and extenders in paint, plastics, and rubber.

In 2019, several factors may have contributed to the decrease in consumption of domestic feldspar. A major factor was the significant decrease in feldspar and nepheline syenite imports, which were unusually high in 2017. Although imports were lower in 2018 compared with those in 2017, imports were still significantly higher than usual. Another contributing factor to decreased apparent consumption was lower production in 2019 compared with that in 2018. Feldspar is not often stockpiled, and production is often closely tied to consumer demand. Despite the estimated decrease in consumption, the unit value of feldspar increased by 11% from $97 per metric ton in 2018 to $107 per metric ton in 2019 (table 1).

The construction industry was a significant consumer of glass and ceramic products, such as flat glass and ceramic tile, particularly for windows, flooring, and sanitaryware. In the United States, construction starts for new private housing increased by 3% to 1.29 million units in 2019 compared with 1.25 million units in 2018. This upward trend has continued since 2010 (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 by 4.5% to nearly $1.39 trillion in 2019 from $1.33 trillion in 2018. Since 2012, the value of total construction put in place has increased every year, and in 2016 surpassed its previous peak of $1.16 trillion, which was reached in 2006 (U.S. Census Bureau, 2019a).

In 2019, U.S. production and shipments of ceramic and porcelain tile decreased again, after decreasing for the first time in 8 years in 2018. Production decreased by 4.6% to 83 million square meters (Biraldi, 2020a, p. 54). Shipments of tile decreased by 4.8% compared with those in 2018. Sales decreased by 4% to a value of $1.33 billion compared with that in 2018 (Whitmire, 2020). The United States remained the leading importer of ceramic and porcelain tile in 2019. Imports accounted for nearly 74.7% of domestic tile consumption (Biraldi, 2020a, p. 54). The five leading import sources, based on volume, were China (21%), Mexico (17%), Spain (17%), Italy (16%), and Brazil (10%). Exports of tile increased by 6.8% in 2019 with the majority going to Canada (71%) and Mexico (11%) (Whitmire, 2020).

Porcelain tile, which is less porous than ceramic tile, increasingly was becoming the tile of choice in the United States; the majority of 2019 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 2019, about 60% of United States exports of feldspar, by quantity, went to Canada, 12% to Colombia, 7% to Mexico, 6% to El Salvador, and most of the remainder to countries in Central America and South America (table 5). In 2019, nearly all imports of feldspar continued to be sourced from Turkey, with substantially less coming from Spain, Germany, Canada, India, Italy, Mexico, and Slovenia, in descending order of tonnage (table 6). Feldspar imports from Turkey decreased by 65% to 62,700 t from 179,000 t in 2018, and the average unit value of Turkish feldspar imports increased from $30 per metric ton to $45 per metric ton. Two companies imported most of the shipments of feldspar from Turkey: one a manufacturer of ceramic and porcelain floor and wall tile and the other a producer and supplier of raw materials used in the production of ceramic tile and sanitaryware.

World Review.—More than 70 countries had significant resources of feldspar and more than 40 produced feldspar in 2019; estimated world production was 23 Mt. The leading feldspar-producing countries in 2019 were Turkey, India, and Italy, each with 4 Mt or more of production, followed by China, Thailand, and Spain, in descending order of estimated production (table 7).

As in the United States, feldspar consumption worldwide was mostly for glassware and ceramics. Global ceramic tile production decreased by 3.7% to nearly 12.7 billion square meters, but there was a significant increase in tile production throughout Africa (Biraldi, 2020a, p. 40). Of the top manufacturing countries, ceramic tile production increased most notably in India (by 11%) and Brazil and Iran (by 4% each). China, the world's leading tile producer, accounted for 41% of world production. India and Brazil ranked second and third, accounting for 10% and 7% of world production, respectively. Global consumption of ceramic tile decreased by 4% to 12.4 billion square meters. China, the world's leading ceramic tile consumer, accounted for 36% of world consumption, and Brazil and India ranked second and third, with 7% and 6%, respectively (Biraldi, 2020a, p. 44, 46).

Although China continued to be the leading exporter of tile by volume, accounting for 28% of world exports, exports from China decreased by approximately 9% in 2019. This was the 6th consecutive year China's exports had decreased (Biraldi, 2020a, p. 46). Spain ranked second, accounting for 15% of global tile exports, and India was third with 13% of exports. Compared with those in 2018, exports in 2019 increased from India by 31%, Poland by 16%, Turkey by 15%, and Iran and the United Arab Emirates by 7% each, whereas exports decreased from Egypt by 3% and Italy by 2%.

China.—Feldspar was mined in the eastern and southeastern Provinces of China. China ranked fourth in production globally and produced an estimated 2.0 Mt of feldspar in 2019 (table 7).

Porcelain tile was the primary type of ceramic tile produced, followed by polished and antique-style tile. The country's ceramic tile output decreased by 8.7% to 5.2 billion square meters, of which 779 million square meters was exported (Biraldi, 2020a, p. 46). China was a leading exporter of the world's sanitaryware and accounted for 60.6% of world exports in 2019 (Biraldi, 2020b, p. 54).

Greenland.—In 2019, Hudson Resources Inc. decided to temporarily place its Naajat (White Mountain) anorthosite (calcium-rich plagioclase feldspar) mine in western Greenland on care-and-maintenance status while production equipment was shipped and installed at the plant. A rotary drum dryer was expected to be installed by late December to help improve in the extraction and production quality (Hudson Resources Inc., 2019b). In 2019, Hudson completed the construction of the White Mountain anorthosite mine and began operations in August (Hudson Resources Inc., 2019a). The project's defined resources were 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 was the most common glass fiber used in composites, fabrics, and glass-reinforced plastics for products where strength and high electrical resistivity were required. Additional potential applications for the anorthosite were as an alumina source in making refractories and ceramics and as filler and coating material for paints, paper, and plastics (Hudson Resources Inc., 2014). The high purity ore did not require processing with chemicals and the deposit was located near docking facilities that would enable easy shipping (Hudson Resources Inc., 2013).

India.—In 2019, India was one of the top three feldspar producers in the world. Feldspar production in India during 2019 was estimated to be 4 Mt, unchanged from that in 2018 (table 7). About 634,000 t were exported, representing 16% of total domestic exports. Approximately 7,100 t of feldspar were imported in 2019 (United Nations Statistics Division, undated a). Feldspar was produced in three States—Telangana, Karnataka, and Gujarat—in decreasing order of tonnage. India has large feldspar reserves and resources. As of 2015, India's reserves and remaining resources were estimated to be 320 Mt and 314 Mt, respectively (Indian Bureau of Mines, 2020).

Italy.—In 2019, Italy was among the top three leading global feldspar producers, with an estimated feldspar production of 4 Mt (table 7). Most of Italy's feldspar output was consumed in the domestic ceramics industry. In 2019, the country exported 301,000 t of feldspar, 92% of which went to Spain. Italy imported about 2.7 Mt of feldspar, of which 94% was from Turkey and about 5% was from France (United Nations Statistics Division, undated a). Production of ceramic tile, the leading sector of the country's ceramics industry, decreased for the second year in a row to 401 million square meters in 2019 from 416 million square meters in 2018. Total exports of ceramic tile decreased to 323 million square meters in 2019, with 70% of exports going to European markets (Biraldi, 2020a, p. 50, 52).

Turkey.—Turkey was the world's leading feldspar producer with an estimated 5.5 Mt in 2019 (table 7). Feldspar was mined in southwestern Anatolia, mainly from the Menderes Massif. Most of the country's production was exported, the majority of which went to Italy and Spain (38% each), Russia (5%), and the United States and Poland (3% each) (United Nations Statistics Division, undated a). Ceramic tile production decreased by nearly 12% to 296 million square meters (Biraldi, 2020a, p. 52).

Nepheline Syenite

Production.—The only deposit of nepheline syenite mined in the United States was in Arkansas, where three operations produced the material primarily for use as roofing granules by the asphalt shingle industry. It also was used in the manufacture of ceramic bricks and for asphalt and concrete aggregates and related products. In the production of bricks and darker body ceramic tile, 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. 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 located 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, 2020).

Consumption.—Nepheline syenite, like feldspar, provides alkalis that act as a flux in glass and ceramics manufacture. In glass, nepheline syenite also supplies alumina, imparting the same benefits as feldspar. Nepheline syenite also typically is used as a filler in adhesives, paint, plastics, and sealants, and can be used in the production of aluminum and fertilizers and also as a construction aggregate.

Foreign Trade.—Imports of nepheline syenite decreased by 53% to 508,000 t from 1.07 Mt in 2018 (table 1). Approximately 99% of the nepheline syenite imported in 2019 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 Fineton Industrial Minerals Ltd. in China and OJSC Apatit AG and United Company RUSAL Plc in Russia (Fortune Business Insights, 2020).

Canada.—Canada's sole nepheline syenite producer, Unimin, operated two mines about 175 kilometers northeast of Toronto, Ontario—one at Blue Mountain quarry and the other at Nephton quarry. Production of marketable nepheline syenite was reported to be 506,000 t in 2019, a decrease of 10% from 565,000 t in 2018 (Natural Resources Canada, 2021). The material was consumed, in descending order of volume, by the glass, ceramics, filler, and abrasives markets. Canada's estimated nepheline syenite exports were 519,000 t in 2019, 52% less than 1.09 Mt in 2018 (United Nations Statistics Division, undated b); 508,000 t was exported to the United States, 53% less than 1.07 Mt in 2018 (U.S. Census Bureau, 2019c).

Norway.—Sibelco Europe produced nepheline syenite in the summer and autumn from an open pit on the Arctic Island of Stjernoy. Onsite processed ore (crushing, drying, milling, sieving, magnetic separation, and air classification) was used in various products for the glass, ceramics, and paint industries and desulfurization of steel. In 2019, exports of nepheline syenite from Norway were 301,000 t. About 28% of the exports went to the Netherlands, 26% to Poland, 13% to Spain, 9% each to the United Kingdom and Italy, 7% to Germany, and 5% to France (United Nations Statistics Division, undated b).

Russia.—The Kiya-Shaltyr Mine on the Goryachegorsk Massif in east-central Siberia, operated by RUSAL, produced 4.24 Mt of nepheline ore, a slight decrease from 4.29 Mt produced in 2018, for use in the production of alumina (United Company RUSAL Plc, 2020, p. 8, 53, 160). In 2019, 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 2019, nepheline concentrate production increased by 21% to 1.19 Mt and the sales volume also increased to 1.19 Mt from 982,000 t in 2018 (PJSC PhosAgro AG, 2020, p. 12, 67).

Outlook

Production and transportation costs for U.S. producers of feldspar and nepheline syenite are expected to increase, and feldspar reserves at some U.S. operations are decreasing. 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 environmentally friendly and recyclable food and beverage packaging; this increase would likely increase feldspar consumption by glass container manufacturers.

In the United States, if new residential construction and commercial and residential remodeling increase, it is expected to create a higher demand for ceramics, fiberglass, and glass, and thus for feldspar and nepheline syenite. Worldwide, demand for ceramic tile is expected to rise because of increases in construction and the residential replacement (remodeling) market, especially in the growing economies of China, India, and Japan.

Worldwide, demand for ceramic tile is expected to rise as a result of increases in construction and in the residential replacement market, especially in the growing economies of China, India, and Japan where increasing construction spending is expected to drive regional market size for ceramic tiles. Also, an increasing trend towards replacing marble floors, metal slabs, and paints with ceramic tile and increasing use of ceramic tiles for wall coverings, such as in kitchens because of their easy-to-clean characteristics, is anticipated to further drive regional growth. Although consuming much of its own output, China is likely to continue to be the leading exporter of ceramic tile by far. Residential replacement, which typically accounts for more than one-half of the total market globally, was projected to be the fastest growing market for ceramic tile, and the compound annual growth rate (CAGR) of the global ceramic tiles market is estimated to be more than 9.8% from 2015 through 2024. Increased use of ceramic and porcelain floor tiles as replacement for hardwood and other flooring items is expected because of high durability and frost and thermal shock resistance (GlobeNewswire, Inc., 2016a, b). A trend in recent years of innovative ideas and products in ceramics, such as thinner, stronger ceramic sheets that can be laid without removing existing floor tiles, and an increasing percentage of porcelain tile production (especially in China and India) that offers superior physical and chemical characteristics, in part owing to increased feldspar content, are likely to help expand their use in the ceramics industry and thus the demand for feldspar. Another factor in growth is the relatively new and innovative use of inkjet technology in designing ceramic tiles, making realistic designs that are affordable and stylish (Business Wire Inc., 2017).

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TABLE 1
SALIENT FELDSPAR AND NEPHELINE SYENITE STATISTICS[1]

		2015	2016	2017	2018	2019
United States:						
Production, feldspar:[e, 2]						
Quantity[3]	metric tons	520,000	480,000	440,000	550,000	450,000
Value	thousands	$37,300	$33,100	$27,200	$53,100	$48,400
Exports, feldspar:[4]						
Quantity	metric tons	15,100	5,890	5,340	4,400	3,890
Value[5]	thousands	$4,920	$1,520	$1,210	$1,400	$1,070
Imports for consumption:[4]						
Feldspar:						
Quantity	metric tons	120,000	36,900	290,000	181,000	63,800
Value[6]	thousands	$7,090	$3,450 [r]	$7,510	$5,980	$3,370
Nepheline syenite:						
Quantity	metric tons	449,000	572,000	1,460,000	1,070,000	508,000
Value[6]	thousands	$67,600	$73,000	$88,400	$81,800	$79,000
Consumption, apparent[e, 3, 7]	metric tons	1,100,000	1,100,000	2,200,000	1,800,000	1,000,000
World, production[8]	thousand metric tons	25,000 [r]	26,600 [r]	26,700 [r]	23,200 [r, e]	23,000 [e]

[e]Estimated. [r]Revised.
[1]Table includes data available through July 24, 2020. Data are rounded to no more than three significant digits.
[2]Includes 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.
[3]Rounded to two significant digits to avoid disclosing company proprietary data.
[4]Source: U.S. Census Bureau.
[5]Free alongside ship (f.a.s.) value.
[6]Customs value.
[7]Production plus imports minus exports. Includes feldspar and imported nepheline syenite.
[8]Feldspar only.

TABLE 2
ESTIMATED FELDSPAR PRODUCTION IN THE UNITED STATES[1]

(Thousand metric tons and thousand dollars)

	Flotation concentrate		Other[2]		Total	
Year	Quantity	Value	Quantity	Value	Quantity	Value
2018	70	4,120	480	49,200	550	53,100
2019	60	6,740	390	41,600	450	48,400

[1]Table includes data available through July 24, 2020. Quantity data are rounded to two significant digits and value data are rounded to three significant digits; may not add to totals shown.
[2]Includes hand-cobbed feldspar, feldspar content of feldspar-quartz mixtures, and aplite; excludes nepheline syenite.

TABLE 3
U.S. PRODUCERS OF FELDSPAR IN 2019

Company	Location	Product
APAC-Central, Inc.	Muskogee, OK	Feldspar-quartz mixture.
Covia Holdings Corp.	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; feldspar-quartz mixture.
Silbelco North America, Inc.	do.	Do.
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	2018		2019	
	Quantity	Value	Quantity	Value
Glass[3]	360	41,400	280	30,600
Ceramics and pottery and miscellaneous	190	11,900	170	17,800
Total	550	53,300	450	48,400

[1]Table includes data available through July 24, 2020. Quantity data are rounded to two significant digits and value data are rounded to three significant digits; may not add to totals shown.
[2]Includes hand-cobbed feldspar, flotation-concentrate feldspar, feldspar in feldspar-quartz mixtures, and aplite.
[3]Includes container glass, fiberglass, and other glass.

TABLE 5
U.S. EXPORTS OF FELDSPAR, BY COUNTRY OR LOCALITY[1]

(Metric tons and dollars)

Country or locality	2018		2019	
	Quantity	Value[2]	Quantity	Value[2]
Brazil	--	--	31	12,000
Canada	2,520	712,000	2,350	607,000
China	17	27,000	--	--
Colombia	638	377,000	460	145,000
Costa Rica	186	47,200	100	43,600
El Salvador	119	25,000	224	58,600
Hong Kong	4	2,730	--	--
India	3	5,290	6	12,600
Malaysia	69	59,900	18	8,880
Mexico	691	78,200	279	56,700
Nicaragua	--	--	159	16,800
Panama	143	50,900	198	59,500
Peru	10	14,200	66	52,000
Total	4,400	1,400,000	3,890	1,070,000

-- Zero.
[1]Table includes data available through July 12, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Free 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	2018		2019	
	Quantity	Value[3]	Quantity	Value[3]
Brazil	13	12,700	--	--
Canada	--	--	464	116,000
Germany	528	173,000	518	181,000
India	120	31,200	141	36,400
Israel	208	27,000	--	--
Italy	--	--	60	5,750
Mexico	430	115,000	40	12,200
Slovenia	--	--	1	3,150
Spain	726	217,000	764	222,000
Sweden	12	3,960	--	--
Turkey	179,000	5,400,000	61,700	2,770,000
United Kingdom	--	--	80	20,400
Total	181,000	5,980,000	63,800	3,370,000

-- Zero.
[1]Table includes data available through July 12, 2020. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Excludes nepheline syenite (mostly from Canada), which is listed in table 1.
[3]Customs value.

Source: U.S. Census Bureau.

TABLE 7
FELDSPAR: WORLD PRODUCTION, BY COUNTRY OR LOCALITY[1]

(Metric tons)

Country or locality[2]	2015	2016	2017	2018	2019
Algeria	154,500	168,000	168,400	170,000 e	170,000 e
Argentina	186,974	155,217	88,465 r	56,500 r	57,000 e
Australia, includes nepheline syenite[e]	45,000	10,000	10,000	10,000	10,000
Austria[e]	35,000	35,000	35,000	35,000	35,000
Brazil, beneficiated, marketable	456,308	295,778	300,000 r, e	300,000 r, e	300,000 e
Chile	6,577	6,352	4,421	2,789	55
China	2,060,000 r	2,684,000 r	1,618,000	2,000,000 e	2,000,000 e
Cuba	3,300 e	3,900	3,600	3,000	3,000 e
Czechia	433,000	454,000	368,000	449,000	441,000
Ecuador	253,253 r	148,506	92,871	43,197 r	40,000 e
Egypt	420,508 r	400,000	400,000 e	400,000 e	400,000 e
Ethiopia[e]	600	600	600	600	600
Finland	38,026	18,549	14,926	17,469	17,997
Germany	200,000 e	284,569	276,747 r	252,693 r	260,000 e
Greenland	--	--	--	--	17,000
Guatemala	10,340	30,428	29,145	30,257 r	30,000 e
India[e]	4,120,000	5,890,000	5,900,000	4,000,000	4,000,000
Iran	736,149	784,412	750,000 e	750,000 e	750,000 e
Italy[e]	4,500,000	4,000,000	4,000,000	4,000,000	4,000,000
Kenya	--	3	-- e	-- e	-- e
Korea, Republic of	601,030	654,398	717,177	617,166	620,000 e
Macedonia	20,289	19,919	21,237	30,813	29,519
Malaysia	442,980	441,857	411,204	414,441 r	201,798
Mexico	159,372	122,176	233,050	209,770	210,000 e
Morocco[e]	45,000	35,000	40,000	40,000	40,000
Nigeria	13,238	35,092 r	27,660	41,355	40,000 e
Norway	76	70 r, e	63 r, e	103 r, e	54 e
Pakistan[3]	141,582	305,308	253,185 r	167,308	200,000 e
Peru	16,979	16,629	14,929	31,588	29,134
Philippines	38,067	46,630	47,000 r, e	47,000 r, e	47,000 e
Poland	76,540	88,140	91,200	71,480	42,160
Portugal	93,789	132,105	126,211	130,475 r	130,000 e
Romania[e, 4]	8,200	4,500	7,500	23,000	20,000
Russia	232,995	278,142	281,326 r	294,411 r	290,000 e
Saudi Arabia	179,000	188,000	197,000	206,000	210,000 e
Slovakia	4,000	8,400	15,800	17,000 r	18,000 e
South Africa	130,184	127,872	116,705	76,803 r	75,000 e
Spain, includes pegmatite	558,273	634,519	819,218 r	800,000 r, e	800,000 e
Sri Lanka, crude and ground[e]	95,000 r	96,000 r	96,000 r	96,000	95,000
Sudan	94,354	92,172	29,000	30,000 e	30,000 e
Sweden, crude and ground, marketable	21,000	22,000	22,000	28,000 r	28,000 e
Thailand	1,329,096 r	1,163,947 r	1,385,925	1,117,803 r	1,200,000 e
Turkey	6,368,079	6,120,978	7,153,908	5,540,010 r	5,500,000 e
Ukraine	44,460	33,627	35,000 e	35,000 e	35,000 e
United States[e, 4, 5]	520,000	480,000	440,000	550,000	450,000
Venezuela	75,500	80,000 e	75,000 e	80,000 e	80,000 e
Total	25,000,000 r	26,600,000 r	26,700,000 r	23,200,000 r, e	23,000,000 e

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

[1]Table includes data available through July 17, 2020. 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.

[2]In 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.

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

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

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