



2014 Minerals Yearbook

FELDSPAR AND NEPHELINE SYENITE
[ADVANCE RELEASE]

FELDSPAR AND NEPHELINE SYENITE

By Arnold O. Tanner

Domestic survey data and tables were prepared by Raymond I. Eldridge III, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

In 2014, feldspar production in the United States was estimated to be 530,000 metric tons (t) valued at \$34.8 million, a decrease from 550,000 t valued at about \$40 million in 2013 (table 1). Exports of feldspar in 2014 decreased by 10% to 16,000 t, valued at \$5.9 million, and imports of feldspar increased by 84% to 7,910 t, valued at \$3.1 million. Imports of nepheline syenite (predominantly from Canada) increased slightly to 503,000 t valued at \$64.1 million. World production of feldspar was estimated to be 22.9 million metric tons (Mt) (tables 1, 7).

Feldspars, which constitute about 60% of the Earth's crust, are anhydrous aluminosilicate minerals of two main groupings, the alkali feldspars that range from potassium-rich to sodium-rich and the plagioclase feldspars that range from sodium-rich to calcium-rich. The alkali feldspars are most useful in glassmaking and ceramics and the plagioclase feldspars are most useful in ceramics (especially the higher sodium varieties) and various construction applications. Feldspar with higher calcium content is used more often for its alumina content or in construction. Nepheline syenite, which has uses similar to those of feldspar, is a rock consisting of alkali feldspars and nepheline feldspathoid minerals, which essentially form in place of alkali feldspars when the magma (melt) is deficient in silica (undersaturated); as a result, little to no quartz is present in the rock.

Apparent consumption of feldspar and nepheline syenite combined was more than 1 Mt, primarily for use in the ceramics and glass industries but also 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 was consumed in the production of ceramic and porcelain tiles, roofing granules, and in other construction applications. Discussion of nepheline syenite follows that of feldspar.

Feldspar

Production.—Feldspar was mined in seven States. North Carolina was by far the leading producer State; the other six were, in descending order of estimated output, Idaho, California, Virginia, Oklahoma, South Dakota, and Georgia. Nine companies mined and processed feldspar from 12 mines and beneficiating facilities—4 in North Carolina, 2 in California, 2 in Idaho, and 1 in each of the four remaining States (table 3). Data on domestic production, sales, and use of feldspar in this report are based on data collected by the U.S. Geological Survey (USGS) by means of a voluntary survey. Production for operations not reporting was estimated using prior-year reported output levels supplemented with worker-hour reports from the U.S. Department of Labor's Mine Safety and Health Administration (MSHA). Of the nine companies, six responded

to the canvass, representing about two-thirds of the totals of 2013 and 2014 production tonnages listed in tables 1 and 2. Production of feldspar in North Carolina decreased, owing mostly to decreased production at The Quartz Corp., which was preparing to shift production in 2015 to the company's K-T Feldspar Mine from the Wiseman-Sullins Mine, both in the Spruce Pine mining district.

I-Minerals Inc. announced output and sales of feldspathic sand mined from the Helmer-Bovill property in north-central Idaho. The company sold 680 t of feldspar-quartz sands from its WBL tailings deposit to Quarry Tile of Spokane, WA, for use in ceramic tiles. The WBL tailings deposit lies adjacent to the main Bovill kaolin deposit and is one of three deposits on the company's Helmer-Bovill property. This was the second significant sale of the feldspar-quartz sands in 2014. Sale of feldspar-quartz sand to Quarry Tile is expected to double in 2015 when Quarry Tile is to bring a new tile plant online. Besides holding economic value, the selling of portions of tailings contained on the property will reduce tailings storage requirements for the company (Marketwired L.P., 2014).

Consumption.—In 2014, about 50% 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 (table 4). In glassmaking, feldspar promotes the mixing of the melt components by fluxing (reducing the melting temperature and the viscosity of the system). The alkalis in feldspar (especially potassium and sodium ions) lower the melting temperature and chemically bond with and promote the fusing of the other glass batch minerals such as silica. 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 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 2014, a number of factors contributed to the decrease in the production and consumption of domestic feldspar—increased production costs, increased feldspar imports, substitution of nepheline syenite for feldspar in ceramic (especially porcelain) tile and glass, competition from imported ceramic tile, and decreased foreign demand for exports of domestic tile (Whitmire, 2015b).

The use of materials other than glass for containers for such products as baby food, fruit juices, mineral water, and wine and a recent trend to import less expensive

containers from China has reduced domestic consumption of traditional raw materials for glass manufacture. The use of cullet (recycled broken or waste glass), especially from the ongoing growth in post-consumer “bottle-to-bottle” recycling programs, continued to compete as a substitute for primary raw materials such as feldspar and tended to decrease the demand for them in the manufacture of glass containers (Glass Packaging Institute, 2013).

The construction industry is a major consumer of glass and ceramic products. In the United States, construction starts for new privately owned housing increased by 8.5% to slightly more than 1 million units in 2014. This continued the upward trend that began in 2010, following the low in 2009 when housing starts had decreased to 554,000 units. The 2014 starts still remained lower than annual starts reported from at least 1959 through 2007. Completions of privately owned housing increased by 16% to 884,000 units in 2014 from 764,000 units completed in 2013 and 649,000 units 2012 (U.S. Census Bureau, 2015b). The value of total construction, which uses significant quantities of flat glass and ceramic tile products, increased for the third consecutive year by about 9.6% to more than \$993 billion in 2014 from \$906 billion in 2013. Total construction spending peaked at \$1.17 trillion in 2006 (U.S. Census Bureau, 2015a).

In 2014, production increased by 3.4% in the domestic ceramic and porcelain tile industry (Ceramic World Web, 2015a). However, feldspar use in ceramics remained stable, perhaps the result of increased substitution of nepheline syenite for feldspar in darker colored tiles (table 4). For the fifth consecutive year, shipments of tile increased by about 2.8% to 75.8 million square meters from 73.7 million square meters in 2013. In 2014, imports of tile, which accounted for 68.7% of U.S. tile consumption, decreased slightly; major sources were, in descending order, Mexico, China, Italy, Spain, and Turkey. Exports of tile in 2014 decreased by 6%, with the majority going to Canada and Mexico (Whitmire, 2015a, b).

Porcelain tile, which is less porous than ceramic tile, increasingly is becoming the tile of choice in the United States; the majority of U.S. imports of floor tile were porcelain rather than ceramic in 2014. Dallas-based Dal-Tile Corp. (DalTile) (a subsidiary of Mohawk Industries Inc.) announced plans to construct a glazed porcelain and colorbody tile manufacturing plant in Dickson, TN, which was expected to be operational by late 2015 (Dal-Tile Corp., 2014). Owing to the high cost of shipping the typically heavy tile products to the United States, some European companies are finding it more cost-effective to build tile manufacturing plants in the United States to help fill the growing demand for porcelain tile. In January, Ceramica Del Conca S.P.A. (Italy) completed construction of a \$50 million porcelain ceramic tile plant in Loudon, TN; annual production was to be nearly 2.8 million square meters of tile (Davis, 2014). Citing Tennessee as having some of the most important raw materials used in the tile industry, such as necessary clays and feldspar, Italy-based Gruppo Concorde announced plans to build an \$80 million tile plant in Maury County; the plant was to be operational by yearend 2016 (Tennessee Department of Economic and Community Development, 2015).

The automobile industry is a major consumer of glass products; production of automobiles and light trucks in North America increased by 5.6% in 2014 (Ward’s Automotive Group, 2015). Sales of automobiles and light trucks in the United States increased for the fifth straight year, up by 5.8% in 2014 from 2013, following a 7.4% increase in 2013 from that of 2012 (Stoddard, 2015).

Foreign Trade.—In 2014, 52% of U.S. exports of feldspar went to Norway, 19% to Venezuela, 15% to Canada, 6% to Colombia, and most of the remainder to countries in Central America (table 5). In 2014, 71% of imports of feldspar were from Turkey, 10% each from India and Mexico, 6% from Germany, and 3% from Spain (table 6).

World Review.—More than 70 countries had significant resources of feldspar and more than 50 produced feldspar in 2014 (table 7). The leading feldspar-producing countries were Turkey and Italy in 2014, followed by China, Thailand, and India, in descending order of estimated production. Estimated world production was 22.9 Mt.

Worldwide ceramic tile production increased by 3.6% in 2014 to 11.9 billion square meters with increases in all producing regions, and global consumption increased by 4.2% to 12.1 billion square meters. Ceramic tile production, about 50% of which was for floor tile, increased most substantially in China, India, Indonesia, and Vietnam. Countries in Asia consumed about 68% of the world’s ceramic tile, and China, the world’s leading tile producer and consumer, accounted for 48% of world production and nearly 41% of world consumption; Brazil and India continued to be second and third, respectively, in each category. In Africa, the rate of growth in tile consumption continued to be highest, up by 6.4% to 746 million square meters. Although China continued to be the world-leading exporter with 41% of world exports, exports from China decreased for the first time in more than a decade, down by more than 3% to 1.1 million square meters. Ceramic tile exports from Spain and Italy, the second- and third-ranked exporting countries, continued to increase with nearly 13% and nearly 12% of world exports, respectively (Ceramic World Web, 2015a).

China.—Feldspar was mined in the eastern and southeastern Provinces of China. Ranking third globally, China produced an estimated 2.5 Mt of feldspar in 2014, which was used in the production of ceramic tile, sanitaryware, and tableware. Porcelain tile was the main type of ceramic tile produced, followed by polished and antique-style tile. The country’s ceramic tile output increased by 5.3% to 6 billion square meters, of which nearly 1.11 billion square meters was exported (Ceramic World Web, 2015a). China produced more than one-third of the world’s sanitaryware and accounted for about 45% of world exports (Ceramic World Web, 2015b).

Greenland.—Hudson Resources Inc. progressed with work on its 100%-owned Naajat (White Mountain) anorthosite (calcium feldspar) project in western Greenland. In July, Hudson Resources announced that a successful trial of the project’s anorthosite had been completed with Owens Corning Inc. in the production of electrical glass (E-glass) fiberglass in a commercial glass fiber furnace (Hudson Resources Inc., 2014b). E-glass is the most common glass fiber used in composites, fabrics, and glass-reinforced plastics for products where

strength and high electrical resistivity are required. Near yearend, Hudson also announced that it had produced calcined alumina from the White Mountain anorthosite of a quality suited to specialty nonmetallurgical applications typically used for refractories and ceramics. Other potential high-value applications for the alumina being evaluated and marketed were as filler and coating material for paints, paper, and plastics and as a feed for aluminum smelters (Hudson Resources Inc., 2014a). The project's environmental impacts are expected to be low because it is essentially a rock quarry and dock facility with nearby access to shipping on the tidewater, and because the purity of the ore does not require chemicals or water for onsite processing (Hudson Resources Inc., 2013).

India.—Of the 1.4 Mt of feldspar that was produced in India during fiscal year (FY) 2014, 31% of feldspar production was exported, up from 28% (revised) in FY 2013 but significantly lower than the 47% that was exported in FY 2012 (Indian Bureau of Mines, 2015a, b).

Italy.—Italy, which consumed most of its feldspar output in the domestic ceramics industry, exported about 236,000 t of feldspar in 2014 and imported more than 1.8 Mt, nearly 92% of which came from Turkey (United Nations Statistics Division, undated a). Production of ceramic tile, the leading sector of the country's ceramics industry and a significant consumer of feldspar, increased by 5.2% to 382 million square meters in 2014 from 363 million square meters in 2013 (Ceramic World Web, 2015a). Total domestic sales for the ceramic tile industry decreased by 6.5% (6 million square meters) in 2014, more than offset by a 4% increase (12 million square meters) in exports (Confindustria Ceramica, 2015).

Turkey.—Turkey was the world's leading feldspar producer with an estimated 5.1 Mt in 2014 (table 7). Slightly more than 4.6 Mt of its production was exported, 40% to Italy, 22% to Spain, 9% to Russia, and slightly less than 3% each to Bulgaria, Egypt, and Poland (United Nations Statistics Division, undated a). Feldspar was mined in the southwestern part of Anatolia, mainly from the Menderes Massif. Turkey was the leading supplier of feldspar to Italy and the Middle East, and accounted for most of the feldspar entering Israel, Saudi Arabia, and the United Arab Emirates.

Nepheline Syenite

Production.—Nepheline syenite was produced in Arkansas for use as a flux in the manufacture of porcelain and ceramic floor tile and as roofing granules for the asphalt shingle industry in the southern and southeastern United States. It also was used in the manufacture of ceramic bricks and for asphalt and concrete aggregates and related products. Nepheline syenite, most of which contained 3% or more iron oxide, was produced by two companies. The 3M Co., Industrial Mineral Products Division, the leading U.S. producer supplying the tile industry, mined nepheline syenite from the Arch Street Mine, also a crushed-stone-producing facility that has been active since the 1930s. Granite Mountain Quarries Co. (a subsidiary of McGeorge Contracting Co. Inc.) produced nepheline syenite from Granite Mountain Quarry #1 and Granite Mountain Quarry #2. All properties are to the south and southeast of Little Rock, AR (Jay Lukkarila, Mining Engineer,

3M Co. Industrial Products Division, written commun., February 18, 2016; U.S. Department of Labor, Mine Safety and Health Administration, 2016).

Consumption.—In glass and ceramics manufacture, 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 typically is used as a filler in adhesives, paint, plastics, and sealants and can be used in the production of aluminum and fertilizers.

During the past several years, the consumption of Arkansas nepheline syenite in the manufacture of porcelain floor tile has been increasing. Small quantities of the material were exported to Mexico in 2014. Additionally, a significant quantity of Arkansas nepheline syenite was used in the manufacture of brick. The 3M Co. test marketed a nepheline syenite product containing a lower iron content to sectors of the ceramics industries (Jay Lukkarila, Mining Engineer, 3M Co. Industrial Products Division, written commun., February 18, 2016).

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. Others included Finetion Industrial Minerals Ltd. in China and OJSC Apatit AG and UC RUSAL in Russia.

Canada.—Canada's sole nepheline syenite producer, Unimin, operated two mines at its Blue Mountain and Nephon, Ontario, deposits, about 175 kilometers northeast of Toronto. Production of marketable nepheline syenite was estimated to be about 654,000 t in 2014, up from about 646,000 t in 2013 (Natural Resources Canada, 2016). The material was consumed in the glass, ceramics, filler, and abrasives industries. Canada's nepheline syenite exports were 556,000 t in 2014; 503,000 t was exported to the United States (table 1; 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 for desulfurization of steel. In 2014, exports of nepheline syenite from Norway were 336,000 t, most of which went to other European countries, including about 28% to Poland, 20% to the Netherlands, 14% to Germany, 11% to Spain, 10% to the United Kingdom, and 7% to France (United Nations Statistics Division, undated b).

Russia.—From its Kiya-Shaltyr Mine on the Goryachegorsk Massif in east-central Siberia, UC RUSAL produced 4.40 Mt of nepheline syenite, a 6% decrease from 4.66 Mt produced in 2013, for use in the production of alumina. The company's production accounted for approximately 7% and 8% of global production of alumina and aluminum, respectively. The decrease in nepheline syenite production was mainly owing to reduced alumina production at the Achinsk Alumina Refinery (UC RUSAL, 2015).

In 2014, phosphate producer PhosAgro AG, through its subsidiary OJSC Apatit, was Russia's only producer of marketed nepheline concentrate. At the Apatit mining and beneficiation

complex, the company mined and processed apatite-nepheline ore from its reserves at 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, including nepheline syenite for the glass and ceramics industries. In 2014, nepheline concentrate production decreased by 5% to 940,000 t and sales decreased by slightly more, with all sales going to Basel Cement Pikalevo (OJSC PhosAgro AG, 2015, p. 37).

Outlook

U.S. producers of feldspar and nepheline syenite are expected to continue to face challenges during the next several years related to excess supply and increased production and transportation costs, and U.S. feldspar producers may find increasing competition from domestic nepheline syenite for use in the production of ceramic tiles. Higher charges for shipping feldspathic products by rail and truck likely will continue to increase delivered raw material costs to industrial consumers and could increase the cost of glass and tile. Demand for glass food containers in the United States, nonetheless, is expected to increase slightly during the next several years as a result of consumer demand and Federal and State government initiatives for environmentally friendly and recyclable food and beverage packaging, potentially increasing feldspar consumption by glass container manufacturers. However, significant increases in glass container recycling and use of cullet could reduce the quantities of raw materials needed to manufacture these containers.

The improving U.S. economy of the past several years is expected to continue. New residential construction and commercial and residential remodeling is expected to increase, creating increased demand for ceramics, fiberglass, and glass, and thus 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 likely will also increase the use of feldspar and nepheline syenite. Domestic consumption of ceramic tile is expected to continue to increase in 2015 with continued growth in the construction industry (Whitmire, 2015b). Worldwide, demand for ceramic tile is expected to be especially driven by increases in construction in the growing economies of Brazil, China, India, and Indonesia, where most ceramic tile is consumed in the residential replacement market. Although consuming much of its own output, China is likely to continue as an important exporter of ceramic tile. Residential replacement, which typically accounts for more than one-half of the total market globally, is projected to be the fastest growing market for ceramic tile at an estimated annual rate of growth of more than 8% from 2012 to 2018 (PR Newswire Association LLC, 2013). 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 tiled floors, 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.

References Cited

- Ceramic World Web, 2015a, World production and consumption of ceramic tiles: Modena, Italy, Ceramic World Review, August/October, p. 48–60. (Accessed January 9, 2016, via <http://www.ceramicworldweb.it/cww-en/statistics-and-markets/world-ceramic-tile-production-passes-the-12-billion-sqm-mark/>.)
- Ceramic World Web, 2015b, World sanitaryware production and exports: Modena, Italy, Ceramic World Review, November/December, p. 56–62. (Accessed December 8, 2015, via <http://www.ceramicworldweb.it/cww-en/news/world-sanitaryware-production-and-exports/>.)
- Confindustria Ceramica, 2015, Press conference 9th June 2015: Sassuolo, Italy, Confindustria Ceramica press release, June 9. (Accessed February 23, 2016, via http://press.confindustriaceramica.smart.it/en/p_index.php?YEAR=2015&C_ID=412#go.)
- Dal-Tile Corp., 2014, Dal-Tile to build new tile manufacturing plant and distribution center in Dickson, Tenn.: Dallas, TX, Dal-Tile Corp. press release, March 6. (Accessed February 11, 2016, at <http://presskit.daltile.com/press-releases/dal-tile-to-build-new-tile-manufacturing-plant-and-distribution-center-in-dickson-tenn/>.)
- Davis, Joel, 2014, Del Conca USA opens in Loudon: The Daily Times [Maryville, TN], March 27. (Accessed February 23, 2016, at http://www.thedailytimes.com/news/del-conca-usa-opens-in-loudon/article_b6c4a9f7-d109-5711-ad47-d712ca0f78f6.html.)
- Glass Packaging Institute, 2013, Why recycle glass?: Arlington, VA, Glass Packaging Institute. (Accessed March 23, 2015, at <http://www.gpi.org/recycling/why-recycle-glass/>.)
- Hudson Resources Inc., 2013, Hudson completes community meetings for the White Mountain project in Greenland and provides project update: Vancouver, British Columbia, Canada, Hudson Resources Inc., November 27, 3 p. (Accessed December 10, 2014, at <http://www.hudsonresources.ca/files/NR2013-08.pdf>.)
- Hudson Resources Inc., 2014a, Hudson produces specialty grade calcined alumina using White Mountain anorthosite: Vancouver, British Columbia, Canada, Hudson Resources Inc., December 11, 2 p. (Accessed February, 15, 2015, at <http://www.hudsonresources.ca/files/NR2014-05.pdf>.)
- Hudson Resources Inc., 2014b, Hudson's White Mountain calcium feldspar used successfully in Owens Corning furnace test: Vancouver, British Columbia, Canada, Hudson Resources Inc. press release, July 29, 1 p. (Accessed July 31, 2014, at <http://www.hudsonresources.ca/files/NR2014-04.pdf>.)
- Indian Bureau of Mines, 2015a, Felspar, in Part III—Mineral reviews (52d ed.) (final release): Nagpur, India, Indian Minerals Yearbook 2013, v. III, July, p. 19–1 to 19–11. (Accessed February 1, 2016, at http://ibm.gov.in/writereaddata/files/07302015125329IMYB2013_Felspar.pdf.)
- Indian Bureau of Mines, 2015b, Felspar, in Part III—Mineral reviews (53d ed.) (advance release): Nagpur, India, Indian Minerals Yearbook 2014, v. III, December, p. 19–1 to 19–10. (Accessed February 1, 2016, at [http://ibm.gov.in/writereaddata/files/12182015100119IMYB-2014_Felspar\(Adv\).pdf](http://ibm.gov.in/writereaddata/files/12182015100119IMYB-2014_Felspar(Adv).pdf).)
- Marketwired L.P., 2014, I-Minerals Inc. completes sale of quartz-feldspar sands to Quarry Tile: El Segundo, CA, Marketwired L.P., October 29. (Accessed October 30, 2014, at <http://www.marketwired.com/press-release/i-minerals-inc-completes-sale-of-quartz-feldspar-sands-to-quarry-tile-otcqx-imahf-1962204.htm>.)
- Natural Resources Canada, 2016, Annual statistics—Mineral production of Canada, by province and territory: Ottawa, Ontario, Canada, Natural Resources Canada, March 4. (Accessed May 9, 2016, via <http://sead.nrcan.gc.ca/prod-prod/ann-ann-eng.aspx>.)
- OJSC PhosAgro AG, 2015, 2014 integrated report—Moving closer to key markets...: Moscow, Russia, OJSC PhosAgro AG, April 28, 132 p. (Accessed February 16, 2016, via <http://www.phosagro.com/investors/reports/>.)
- PR Newswire Association LLC, 2013, Ceramic tiles market is expected to reach USD 102.79 billion in 2018: Beltsville, MD, PRWeb news release, November 4. (Accessed January 14, 2014, at <http://www.prweb.com/releases/2013/11/prweb11294189.htm>.)
- Stoddard, Haig, 2015, U.S. light-vehicle sales hit 8-year high in 2014: Detroit, MI, Ward's Automotive Group news release, January 5. (Accessed February 9, 2016, at <http://wardsauto.com/miscellaneous/us-light-vehicle-sales-hit-8-year-high-2014>.)

Tennessee Department of Economic and Community Development, 2015, Governor Haslam, Commissioner Boyd announce Gruppo Concorde to open first U.S. manufacturing facility in Maury County: Nashville, TN, Tennessee Department of Economic and Community Development press release, March 5. (Accessed February 11, 2016, at <https://www.tn.gov/ecd/news/10431>.)

UC RUSAL, 2015, UC RUSAL announces fourth quarter and full year 2014 operating results: Moscow, Russia, UC RUSAL press release, January 30, 5 p. (Accessed February 16, 2016, at http://www.rusal.ru/upload/iblock/323/30.01.2015%20RUSAL_2014%20Production%20Results.pdf.)

United Nations Statistics Division, [undated]a, Feldspar: United Nations Comtrade Database. (Accessed December 10, 2015, via <http://comtrade.un.org/db/>.)

United Nations Statistics Division, [undated]b, Leucite, nepheline and nepheline syenite: United Nations Comtrade Database. (Accessed December 10, 2015, via <http://comtrade.un.org/db/>.)

U.S. Census Bureau, 2015a, Construction spending—Historical value put in place: U.S. Census Bureau. (Accessed November 22, 2015, via http://www.census.gov/construction/c30/historical_data.html.)

U.S. Census Bureau, 2015b, Historical data, new residential construction: U.S. Census Bureau. (Accessed November 22, 2015, via http://www.census.gov/construction/nrc/historical_data/.)

U.S. Department of Labor, Mine Safety and Health Administration, 2016, Mine data retrieval system: U.S. Department of Labor, Mine Safety and Health Administration. (Accessed February 8, 2016, via <http://www.msha.gov/drs/drshome.htm>.)

Ward's Automotive Group, 2015, North America car and truck production, 1951–2014: Detroit, MI, Ward's Automotive Group news release. (Accessed February 9, 2016, via <http://wardsauto.com/public-data>.)

Whitmire, Andrew, 2015a, 2014 Ceramic tile industry update: Anderson, SC, Tile Council of North America, Inc., April 13. (Accessed September 9, 2015, at https://www.tcnatile.com/images/pdfs/2014_US_Ceramic_Tile_Industry_Update.pdf.)

Whitmire, Andrew, 2015b, 2Q 2015 ceramic tile industry update: Anderson, SC, Tile Council of North America, Inc., October 1, 9 p. (Accessed February 9, 2016, at http://www.tcnatile.com/images/pdfs/Market_Reports/2Q-2015-US-Tile-Industry-Update.pdf.)

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

Feldspar. Ch. in Mineral Commodity Summaries, annual.

Feldspar. Ch. in United States Mineral Resources, Professional Paper 820, 1973.

Historical Statistics for Mineral and Material Commodities in the United States. Data Series 140.

Silica. Ch. in Minerals Yearbook, annual.

Soda Ash. Ch. in Minerals Yearbook, annual.

Other

Feldspar. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

Feldspars. Ch. in Industrial Minerals and Rocks (7th ed.), Society for Mining, Metallurgy, and Exploration, Inc., 2006.

Nepheline Syenite. Ch. in Industrial Minerals and Rocks (7th ed.), Society for Mining, Metallurgy, and Exploration, Inc., 2006.

TABLE 1
SALIENT FELDSPAR AND NEPHELINE SYENITE STATISTICS¹

		2010	2011	2012	2013	2014
United States:						
Production, feldspar:²						
Quantity ^{e,3}	metric tons	500,000	580,000	560,000	550,000	530,000
Value ^e	thousands	\$37,800	\$45,400	\$36,500	\$40,100	\$34,800
Exports, feldspar:⁴						
Quantity	metric tons	16,800	17,000	13,000	17,700	16,000
Value ⁵	thousands	\$2,280	\$3,020	\$4,390	\$5,310	\$5,880
Imports for consumption:⁴						
Feldspar:						
Quantity	metric tons	2,050	1,710	1,640	4,310	7,910
Value ⁶	thousands	\$503	\$476	\$342	\$1,110	\$3,120
Nepheline syenite:						
Quantity	metric tons	368,000	394,000	386,000	491,000	503,000
Value ⁶	thousands	\$52,400	\$41,500	\$44,200	\$59,300	\$64,100
Consumption, apparent ^{e,3,7}	metric tons	850,000	960,000	930,000	1,000,000	1,000,000
World, production ⁸	thousand metric tons	21,900 ^r	21,000 ^r	20,700 ^r	21,900 ^r	22,900 ^e

^eEstimated. ^rRevised.

¹Data are rounded to no more than three significant digits.

²Includes hand-cobbed feldspar, flotation-concentrate feldspar, feldspar in feldspar-quartz mixtures, and aplite; 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
2013	30	3,310	520	36,800	550	40,100
2014	50	959	490	33,900	530	34,800

¹Quantity 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; excludes nepheline syenite.

TABLE 3
U.S. PRODUCERS OF FELDSPAR IN 2014

Company	Location	Product
APAC-Central, Inc.	Muskogee, OK	Feldspar-quartz mixture.
G3 Enterprises Inc.	Byron, CA	Do.
Graniterock Co.	Felton, CA	Do.
I-Minerals Inc.	Bovill, ID	Potassium feldspar-quartz-halloysite mixture.
Pacer Corp.	Custer, SD	Potassium feldspar.
Imerys Ceramics	Monticello, GA	Do.
Quartz Corp., The	Spruce Pine, NC	Sodium-potassium feldspar.
Do.	do.	Sodium-potassium feldspar; feldspar-quartz mixture.
Unimin Corp.	Emmett, ID	Feldspar-quartz mixture.
Do.	Spruce Pine, NC	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	2013		2014	
	Quantity	Value ¹	Quantity	Value
Glass ³	300	21,800	270	18,600
Ceramics/pottery and miscellaneous	250	18,300	250	15,800
Total	550	40,100	520	34,400

¹Revised.

¹Includes hand-cobbed feldspar, flotation-concentrate feldspar, feldspar in feldspar-quartz mixtures, and aplite.

²Quantity data are rounded to two significant digits, and value data are rounded to three significant digits; may not add to totals shown.

³Includes container glass, fiberglass, and other glass.

TABLE 5
U.S. EXPORTS OF FELDSPAR, BY COUNTRY¹

(Metric tons and dollars)

Country	2013		2014	
	Quantity	Value ²	Quantity	Value ²
Brazil	100	14,800	2	6,260
Canada	3,150	740,000	2,430	655,000
Chile	--	--	294	69,100
China	126	41,900	--	--
Colombia	1,410	300,000	926	205,000
Costa Rica	350	70,200	273	69,200
El Salvador	60	18,200	99	30,800
Italy	103	7,240	--	--
Nicaragua	210	31,700	190	29,100
Norway	6,730	3,150,000	8,290	4,030,000
Panama	181	54,800	220	70,600
Trinidad and Tobago	123	29,600	120	19,900
Venezuela	4,980	703,000	3,040	669,000
Other (6 countries)	226	147,000	82	27,700
Total	17,700	5,300,000	16,000	5,880,000

-- Zero.

¹Data 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 OF
ORIGIN^{1,2}

(Metric tons and dollars)

Country	2013		2014	
	Quantity	Value ³	Quantity	Value ³
China	--	--	16	8,670
Germany	85	52,200	446	180,000
India	--	--	774	246,000
Mexico	725	175,000	784	200,000
Norway	--	--	5	12,200
Spain	226	35,000	274	80,300
Sweden	1	5,540	--	--
Turkey	3,230	809,000	5,590	2,380,000
United Kingdom	39	32,400	20	17,800
Total	4,310	1,110,000	7,910	3,120,000

-- Zero.

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

²Data are rounded to no more than three significant digits; may not add to totals shown.

³Customs value.

Source: U.S. Census Bureau.

TABLE 7
FELDSPAR: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

Country and grade ³	2010	2011	2012	2013	2014
Algeria	164,000	148,000	163,000	259,000	230,000
Argentina	217,213	216,721	273,896	226,435 ^r	250,000 ^e
Australia, includes nepheline syenite ^e	50,000	50,000	50,000	45,000	45,000
Austria ^e	27,000	27,000	32,000	35,000	35,000
Brazil, processed, marketable	276,448	333,352	247,152 ^r	294,357 ^r	294,000 ^e
Chile	7,723	7,563	6,399	3,874	4,233
China ^e	2,000,000	2,100,000	2,100,000	2,500,000	2,500,000
Cuba ^e	2,800	3,100	3,800	3,200	3,500 ⁴
Czech Republic	388,000	407,000	445,000	411,000	422,000
Ecuador	156,888	103,948 ^r	152,590 ^r	210,142 ^r	183,259
Egypt ^e	405,600 ⁴	210,000	200,000	200,000	200,000 ⁴
Ethiopia ^e	1,500 ⁴	441 ⁴	500	530	510
Finland	28,013	26,292	43,124	47,636	46,233
Germany ^e	203,000	218,000	205,000	200,000 ^r	200,000 ⁴
Greece	45,200 ^r	27,500 ^r	33,800 ^r	12,000 ^e	10,000 ^e
Guatemala	402	2,890	19,356	19,611	10,410
India ⁵	506,256	763,263	1,177,702	1,459,008 ^r	1,412,518
Indonesia ^e	20,000	18,000	19,000	18,000	18,000
Iran	533,117 ^r	576,643	600,000 ^{r,e}	1,313,233 ^r	1,300,000 ^e
Italy ^e	4,700,000	4,700,000	4,700,000	4,700,000	4,700,000
Japan, includes aplite ^e	110,000	104,109 ⁴	100,000	100,000 ^r	100,000
Kenya ^e	30	35	35	35	40
Korea, Republic of	496,511	384,221	360,413	343,241	544,058
Macedonia	32,209 ^r	36,163 ^r	26,506 ^r	24,854 ^r	26,156
Malaysia	455,497	379,628	482,906	348,112 ^r	350,000 ^e
Mexico	398,849	382,497	380,441	164,484 ^r	150,726
Morocco ^e	--	43,889 ⁴	45,000	45,000	45,000
Nigeria ^e	1,616 ⁴	-- ^r	9,080 ^r	11,000 ^r	12,000
Norway	56,000	25,000	--	--	154,000
Pakistan ⁶	54,198 ^r	23,254 ^r	53,235	38,218	81,858
Peru	3,589	11,645	26,359	22,695	18,019
Philippines	15,882	22,050	24,969	30,388	34,232
Poland, run of mine ⁷	513,700	550,000	376,500	374,000	400,000 ^e
Portugal	121,827	114,600	109,273	70,057	70,865
Romania ^e	5,500	2,500	6,500	6,800	6,000
Russia ^e	405,000 ^r	400,000 ^r	400,000 ^r	390,000 ^r	400,000
Saudi Arabia	42,300 ^e	44,000 ^r	227,000 ^r	160,000 ^r	168,000
Slovakia ^e	10,000	--	--	5,000 ^r	6,000
South Africa	94,307	101,559	94,458	191,443	102,541
Spain, includes pegmatite	691,894	662,418	530,238 ^r	602,908	603,000
Sri Lanka ^e	75,405 ⁴	53,337 ⁴	55,000	57,000	60,000
Sudan	923	9,519	26,283	31,700	50,680
Sweden, salable, crude and ground ^e	44,000	30,000	27,000	30,000	27,000
Thailand	641,900	1,041,152	1,100,723 ^r	1,072,656 ^r	1,413,428
Turkey	6,281,597	4,355,003	4,524,943	4,545,197	5,120,000 ^e
Ukraine	146,000	179,000	146,000	134,000	95,000
United Kingdom, china stone ^e	500	500	--	--	--
United States ^{e,8,9}	500,000	580,000	560,000	550,000	530,000
Venezuela	925,000	1,715,000	584,000	580,000 ^r	500,000 ^p
Total	21,900,000 ^r	21,200,000 ^r	20,700,000 ^r	21,900,000 ^r	22,900,000

^eEstimated. ^pPreliminary. ^rRevised. -- Zero.

¹World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Includes data available through August 22, 2016.

³In addition to the countries listed, Bulgaria, Burma, Colombia, France, Namibia, the United Arab Emirates, and Yemen may produce feldspar, but output is not officially reported and available information is inadequate to make reliable estimates of output levels.

⁴Reported figure.

TABLE 7—Continued
FELDSPAR: WORLD PRODUCTION, BY COUNTRY^{1,2}

⁵Data are for fiscal year ending March 31 of the following year.

⁶Data are for fiscal year ending June 30 of the following year.

⁷The dedicated feldspar run of mine production accounts for only part of total feldspar production.

⁸Rounded to two significant digits to avoid disclosing company proprietary data.

⁹Includes hand-cobbed feldspar, flotation-concentrate feldspar, feldspar in feldspar-quartz mixtures, and aplite.