



2009 Minerals Yearbook

FELDSPAR AND NEPHELINE SYENITE

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In 2009, feldspar production in the United States decreased to 550,000 metric tons (t), valued at about \$36 million, from 650,000 t produced in 2008, valued at \$40 million, based upon a combination of reported and estimated U.S. Geological Survey (USGS) data. Exports of feldspar decreased by 49% to 7,520 t valued at \$1.15 million, and imports of feldspar increased by 5% to 2,120 t valued at \$646,000. Imports of nepheline syenite (predominantly from Canada) decreased by 4% to 308,000 t valued at about \$37 million. World production of feldspar was about 20 million metric tons (Mt) (table 1).

Feldspar was mined and produced in seven States. Apparent consumption of feldspar and imported nepheline syenite combined was about 850,000 t, primarily for use in the glass and ceramics industries and also as fillers in various products such as paints and coatings. Data on feldspar includes that of aplite (one U.S. producer), a rock in which quartz and feldspar (potassium and sodic plagioclase) are the dominant minerals. Nepheline syenite was produced in one State but was consumed for use as roofing granules and in other construction applications. Trade data in this report are from the U.S. Census Bureau.

Feldspar

Production.—Feldspar was mined, in descending order of estimated output, in North Carolina, Virginia, California, Idaho, Oklahoma, Georgia, and South Dakota. North Carolina accounted for about 38% of the total. Data on domestic production and sales and use of feldspar in this report are based upon data collected by the USGS by means of a voluntary survey. Nine companies mined feldspar and operated 12 beneficiation facilities—4 in North Carolina, 3 in California, and 1 in each of the 5 remaining States (table 3). Of these 12 beneficiation facilities, 8 responded to the canvass, representing about 70% of the 2009 production tonnages listed in tables 1 and 2, comparable with that of 2008. Production for the remaining operations was estimated from prior-year production levels.

Consumption.—Feldspar is used in glassmaking, ceramics, and to some extent as a filler and extender in paint, plastics, and rubber. Of the domestic feldspar sold or used, an estimated two-thirds by tonnage went into the manufacture of glass, including glass containers and glass fiber. In glassmaking, feldspar fluxes the system—lowering the melting temperature and helping promote the mixing of the melt components. The alumina from feldspar improves product hardness, durability, and resistance to chemical corrosion. In ceramics, the alkalis in feldspar (calcium, potassium, and sodium ions) act as a flux, lowering the melting temperature of a mixture as in glassmaking. Feldspar melts at an early stage in the firing process, forming a glassy phase or matrix in which the alkali ions help to lower the melting temperature and soften the small

crystalline and glassy components of the system and promote an increased fusing of the same (Roskill Information Services Ltd., 2008, p. 200). Pottery (including electrical insulators, sanitaryware, tableware, and tile) and other uses, such as fillers, accounted for the remainder of the feldspar consumed (table 4). The value of total feldspar sold or used in table 4 is higher than the feldspar production value listed in tables 1 and 2 because table 4 values represent the final marketed feldspar products.

The U.S. Census Bureau discontinued container glass reports in 2008, and authoritative data are no longer publicly available. Feldspar consumption in container glass probably declined in 2009 because of continued declines in the U.S. economy.

Other feldspar uses included glass fiber for home insulation, sanitaryware, and tile. Because new U.S. housing starts of 570,000 were 37% lower than in 2008, feldspar consumption in these applications decreased (U.S. Census Bureau, 2010). In 2009, U.S. tile consumption decreased overall by 14%, but shipments of domestic tile increased by 10% from those of 2008, indicating a corresponding increase of feldspar consumption for that end use. In 2009, domestic shipments of tile totaled nearly 50 million square meters, approximately the same level as in 2007 (Tile Council of North America, Inc., 2010).

World Review.—Feldspar was produced in more than 50 countries, with significant and potentially economic deposits of feldspar occurring in at least 70 countries (table 7). Italy was the leading producing country with an estimated 4.7 Mt of feldspar in 2009, followed by Turkey, with an estimated 4.2 Mt. China's production was estimated to be about 2 Mt. World production decreased by an estimated 3 Mt to 19.8 Mt (table 7).

Recovery for feldspar's two major consumer industries, glass and ceramics, from the generally worldwide economic recession of 2008 and early 2009, was slow in 2009. In Europe and North America, there was a general decrease in glass consumption. Alternative packaging from competing materials in some market segments and a recent trend toward importation of less expensive containers from China were factors causing this decline. In 2009, the leading producers of glass containers in France, Germany, Italy, Spain, and the United Kingdom decreased glass production. Germany, Europe's leading producer, saw its output decline to 3.8 Mt in 2009 from 4.1 Mt in 2008. Flat glass production used in construction, however, increased in some rapidly growing economies, including Brazil, China, and India (Feytis, 2010a).

In 2008, the world ceramic tile industry experienced its first real slowdown in growth in more than a decade owing to its close links with the building construction industry; sluggish growth in the industry continued in 2009. In 2008 and early 2009, ceramic tile production levels, sales, and exports in dominant manufacturing countries such as China, Italy, and

Spain were lower than previously expected. China's ceramic tile export growth slowed because of the economic downturn's effects in Europe and the United States, which were important international customers for China's ceramic tile. Less affected were Brazil and India, whose ceramic industries depend more on domestic consumption than on exports. Increases in those two countries' construction projects resulted in increased domestic sales of ceramic tiles. India's ceramic tile industry has neither a large export nor import component. Brazil's ceramic tile industry has a more significant export component, which decreased by 20% in 2008 and by 25% in 2009 (Maynard, 2010).

Italy.—Italy was the world's leading feldspar producer in 2009; most of its output was used in the country's ceramics industry. Italy also exported about 142,000 t of feldspar in 2009 and imported about 1.6 Mt, largely from Turkey (United Nations Statistics Division, undated a). Italy's ceramic tile production decreased by 30% in volume, and its sales volumes decreased by 19.4% in 2009 compared with those of 2008 as a result of the downturn in the world economy. In 2009, exports declined by nearly 20%, the largest decreases taking place in the first 9 months of the year for shipments to Russia and the United States, which decreased by 46% and 39%, respectively (O'Driscoll, 2009b).

Saudi Arabia.—A shortage in affordable housing and a growing need for more schools and hospitals were driving opportunities for growth in Saudi Arabia's construction industry. Several leading ceramic companies in the country were developing new mines and plants and were expanding existing ones. The country's ceramic tile industry planned to increase use of local raw materials with the exception of some specialized materials required for products such as white porcelain tile and white sanitaryware. Flat glass producers supplying the new housing market would also draw from these local sources (O'Driscoll, 2009c). Development was underway for one new feldspar project in southern Saudi Arabia.

Turkey.—Ranked as the world's second leading feldspar producer, Turkey exported about 2.9 Mt of feldspar (United Nations Statistics Division, undated a). Feldspar was mined in the southeast part of the country and exported to major ceramic manufacturing countries throughout Europe.

Nepheline Syenite

Production.—No nepheline syenite was produced in the United States for ceramic, glass, or filler use. However, in Arkansas, nepheline syenite with a high iron content was produced for use in roofing granules, road materials, asphalt and concrete aggregate, and related products. Estimated total production of Arkansas nepheline syenite used for nonaggregate applications was 520,000 t in 2008, but published estimates for 2009 were not available (Rogers, 2009).

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.

World Review.—Nepheline syenite, which was once only available from Canada, Norway, and Russia, is being produced in other countries as well. Nepheline syenite projects have

been brought into production in Brazil, China, and Turkey for feldspathic uses. Iran was conducting a feasibility study for use of nepheline syenite in alumina production (Sutton, 2009).

Canada.—Canada's sole nepheline syenite producer, Unimin Canada, Ltd., operated two plants at its Blue Mountain and Nephton, Ontario, deposits, about 175 kilometers northeast of Toronto. Production of marketable nepheline syenite was 527,000 t in 2009 (Natural Resources Canada, 2011). Detailed end-use data have not been available in recent years, but historically, consumption has been in glass, ceramics, filler, and abrasive markets. Total Canadian nepheline syenite exports were about 366,000 t in 2009 (United Nations Statistics Division, undated b). The dominant recipient in 2009 was the United States, with 308,000 t.

Norway.—North Cape Minerals AS produced nepheline syenite from an underground mine on the arctic island of Stjernoya; output was estimated to be 350,000 t in 2009. End-use data for this material have not been available in recent years, but uses in the past included glass (including amber glass), ceramics, and fillers. In 2009, total exports from Norway were about 335,000 t, the large majority of which went to Poland, about 93,000 t; Germany, 85,000 t; Netherlands, 61,000 t; and the United Kingdom, 35,000 t (United Nations Statistics Division, undated b).

Outlook

Producers of feldspar and nepheline syenite face continuing challenges related to excess supply and increased production costs in 2010. Higher costs for reagent chemicals, natural gas, electric power, motor fuels, and regulatory compliance are expected to continue to affect production costs. In addition, higher transportation charges for shipping feldspathic products by rail and truck in 2010 are likely to increase delivered raw material costs for industrial consumers.

According to the Freedonia Group, U.S. food container demand may rise modestly during the next few years, increasing feldspar consumption by glass container manufacturers. The use of glass containers in the United States was expected to increase in future years as a result of consumer demand and Federal and State government appeal for pure, "green" (environmentally friendly), and sustainable (economic and recyclable) food and beverage packaging. The glass industry has seen a recent decrease in the use of flat glass because of declines in the automobile and construction industries; however, long-term growth is expected. As economic conditions improve, new residential construction was expected to increase in 2010 creating increased need for glass and ceramics and thus feldspar. Increased commercial and residential remodeling might result in increased demand for glass and ceramics.

Globally, ceramics industry growth significantly slowed during the recession, and with it, the use of feldspar lessened. However, it is anticipated that the ceramic industry will rebound in the next few years. The main centers of ceramic production are China, Italy, Latin America, Southeast Asia, and Spain. Although consuming much of its output internally, China is likely to continue as an important exporter of ceramic tile. Owing to an anticipated recovery in the construction sector, demand for feldspar and associated raw materials is likely

to follow. Innovative ideas and products in ceramics, such as thinner and stronger ceramic sheets that can be laid over existing tiled floors without the need for removal and porcelain tiles that offer superior physical and chemical characteristics, are likely to help strengthen that sector (Feytis, 2010b). Main growth in feldspar demand is expected to be concentrated in Southeast Asia, Eastern Europe, and South America, potentially representing an average growth of about 5% annually (Roskill Information Services, Ltd., 2008, p. 310).

Fiberglass demand in the United States is forecast to increase by 3.3% per year through 2013. Growth in the industry will be driven by efforts to reduce costs and broaden markets, with best growth prospects anticipated for glass wool fiber (O'Driscoll, 2009a)

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TABLE 1
SALIENT FELDSPAR AND NEPHELINE SYENITE STATISTICS¹

		2005	2006	2007	2008	2009
United States:						
Produced, feldspar:						
Quantity ^{e, 2, 3}	metric tons	750,000	760,000	730,000	650,000	550,000
Value ^{e, 2}	thousands	\$42,700	\$44,600	\$43,800	\$40,000 ^r	\$35,600
Exports, feldspar: ⁴						
Quantity	metric tons	15,200	10,400	9,980	14,600	7,520
Value ⁵	thousands	\$2,070	\$1,930	\$1,950	\$2,390	\$1,150
Imports for consumption ⁴						
Feldspar:						
Quantity	metric tons	26,200	5,180	3,570	2,030	2,120
Value ⁶	thousands	\$1,700	\$549	\$642	\$646	\$646
Nepheline syenite:						
Quantity	metric tons	340,000	426,000	391,000	321,000	308,000
Value ⁶	thousands	\$33,800	\$36,000	\$38,900	\$35,000	\$36,800
Consumption, apparent ^{e, 7}	thousand metric tons	1,100	1,180	1,120	957	856
World, production ⁸	do.	16,800 ^r	20,500 ^r	21,500 ^r	22,800 ^r	19,800 ^e

^eEstimated. ^rRevised. do. Ditto.

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

²Includes hand-cobbed feldspar, flotation-concentrate feldspar, feldspar in feldspar-quartz mixtures, and aplite; may differ from sales in table 4.

³Rounded to two significant digits.

⁴Source: U.S. Census Bureau.

⁵Free alongside ship (f.a.s.) value.

⁶Customs value.

⁷Production plus imports minus exports. Includes feldspar and 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
2008	280	15,800	370	24,200	650	40,000
2009	210	13,600	340	22,000	550	35,600

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 2009

Company	Location	Product
APAC-Arkansas, Inc.	Muskogee, OK	Feldspar-quartz mixture.
Feldspar Corp., The	Monticello, GA	Potassium feldspar.
Do.	Spruce Pine, NC	Sodium-potassium feldspar.
Graniterock Co.	Felton, CA	Feldspar-quartz mixture.
Kings Mountain Minerals Inc.	Kings Mountain, NC	Do.
K-T Feldspar Corp.	Spruce Pine, NC	Sodium-potassium feldspar; feldspar-quartz mixture.
Pacer Corp.	Custer, SD	Potassium feldspar.
P.W. Gillibrand Co. Inc.	Simi Valley, CA	Feldspar-quartz mixture.
Unimin Corp.	Byron, CA	Do.
Do.	Emmett, ID	Do.
Do.	Spruce Pine, NC	Sodium-potassium feldspar.
U.S. Silica Co.	Montpelier, VA	Aplite.
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	2008		2009	
	Quantity	Value	Quantity	Value
Glass ³	430	26,600	360	23,200
Pottery and miscellaneous	220	16,500	200	14,400
Total	650	43,100 ⁴	550	37,600 ⁴

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, glass fiber, and other glass.

⁴Represents final marketable product; value higher than that listed for production in tables 1 and 2.

TABLE 5
U.S. EXPORTS OF FELDSPAR, BY COUNTRY^{1,2}

(Metric tons and dollars)

Country	2008		2009	
	Quantity	Value ³	Quantity	Value ³
Canada	1,590	370,000	880	230,000
China	261	27,600	14	13,200
Colombia	2,440	517,000	2,160	522,000
Costa Rica	2,060	275,000	231	32,200
French Polynesia	16	16,200	28	27,600
Hong Kong	--	--	24	3,010
Italy	1,040	280,000	20	5,450
Nicaragua	1,600	212,000	153	21,200
Norway	3,270	275,000	3,520	220,000
Trinidad and Tobago	107	15,600	464	70,400
Other (23 countries)	2,260	402,000	20	5,250
Total	14,600	2,390,000	7,520	1,150,000

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Presentation of annual data is based on the quantities (gross weight) of the 10 leading countries in 2009.

³Free alongside ship value.

Source: U.S. Census Bureau.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF FELDSPAR, BY COUNTRY^{1,2,3}

(Metric tons and dollars)

Country	2008		2009	
	Quantity	Value ⁴	Quantity	Value ⁴
Australia	138	43,300	3	2,340
Canada	65	206,000	--	--
Germany	224	97,300	836	371,000
Mexico	1,550	267,000	1,240	252,000
United Kingdom	23	21,200	40	19,800
Other (9 countries)	22	10,400	--	--
Total	2,030	646,000	2,120	646,000

-- 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.

³Presentation of annual data is based on the quantities (gross weight) of the five leading countries in 2009.

⁴Customs value.

Source: U.S. Census Bureau.

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

(Metric tons)

Country ³	2005	2006	2007	2008	2009
Argentina	151,307	170,728	291,562 ^r	220,234 ^r	213,671
Australia, includes nepheline syenite ^e	50,000	50,000	50,000	50,000	50,000
Brazil, processed, marketable	122,887	77,285	171,589	170,000 ^r	150,000
Bulgaria ^e	72,867 ⁴	93,091 ⁴	90,000	90,000	90,000
Chile	5,820	5,847	6,704	17,834 ^r	9,079
China ^e	1,850,000	1,950,000	2,000,000	2,000,000	2,000,000
Colombia ^e	81,000	86,000	91,000	86,000 ^r	85,000
Cuba ^e	8,000	5,500	5,600	4,300 ^r	4,500
Czech Republic	472,000	487,000	514,000	488,000 ^r	431,000
Ecuador	38,250	67,844	14,308	14,000 ^{r,e}	10,000 ^e
Egypt	357,000 ^e	360,000 ^e	135,290 ^{r,5}	407,320 ^r	353,623
Ethiopia ⁶	445	478	459 ^r	424 ^r	420 ^e
Finland	60,000 ^e	56,263 ^r	55,124 ^r	NA ^r	NA
France, crude ^e	650,000	650,000	650,000	650,000	650,000
Germany	168,640	167,332	171,303	161,416 ^r	140,000 ^e
Greece ^e	95,000	95,000	95,000	62,000 ^{r,4}	28,617 ⁴
Guatemala	3,808	17,176	30,234	45,854 ^r	5,762
India	414,637	386,685	397,328	400,000 ^e	410,000 ^e
Iran	286,033	290,000 ^e	512,261 ^r	501,821 ^r	500,000 ^e
Italy	3,995,233	4,019,495	4,200,000 ^e	4,727,000	4,700,000 ^e
Japan, includes aplite ^e	800,000	800,000	750,000	700,000	700,000
Jordan	1,000	11,054	9,800	2,950 ^r	--
Kenya ^e	22	25	30 ^r	30 ^r	30
Korea, Republic of	508,644	427,378	398,513	344,257 ^r	622,700
Macedonia	27,076	32,824	32,814	28,920 ^r	19,377
Malaysia	117,180	142,358	358,775	457,377 ^r	356,620
Mexico	349,109	459,209	438,696	445,519 ^r	383,113 ^p
Morocco ^e	20,000	20,000	20,000	20,000	20,000
Nigeria ^e	1,700	1,700	1,700	1,700	13,631 ⁴
Norway ^e	76,000	75,000	75,000	62,000 ^{r,4}	48,000
Pakistan	25,032	15,085	22,000	26,000 ^r	19,000
Peru	6,000	6,010 ^e	15,450	13,063	5,006
Philippines	11,850	15,176	14,837	15,838 ^r	16,394
Poland ⁶	457,400	431,300	497,900 ^r	599,100 ^r	550,000 ^e
Portugal	133,344	257,570	168,606 ^r	157,359 ^r	320,000
Romania ⁷	74,920	33,100	44,897	25,974 ^r	14,317
Russia ^e	45,000	45,000	45,000	45,000	45,000
Saudi Arabia	42,000	42,300	73,000	550,000	500,000 ^e
Serbia ^e	3,500 ⁸	3,500	3,500	3,500	3,500
Slovakia ^e	5,000	5,000	5,000	5,000	13,000 ⁴
South Africa	57,534	75,400	90,185 ^r	105,815	101,394
Spain, includes pegmatite	650,000 ^r	674,766	680,000 ^r	690,000 ^{r,e}	550,000 ^e
Sri Lanka	34,000	56,864 ^r	46,583 ^r	55,212 ^r	73,365
Sweden, salable, crude and ground ^e	43,000	42,000	42,000	42,000	42,000 ^e
Thailand	1,149,717	1,067,684	684,668	670,618 ^r	600,000 ^e
Turkey	2,331,971	5,771,892	6,548,796	6,767,500 ^r	4,212,547
United Kingdom, china stone ^e	1,835 ⁴	2,000	2,000	1,000	1,000
United States ⁹	750,000	760,000	730,000	650,000	550,000

See footnotes at end of table.

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

(Metric tons)

Country ³	2005	2006	2007	2008	2009
Uruguay	2,150	2,470	2,500	2,500	2,500 ^e
Uzbekistan ^e	4,300	4,300	4,300	4,300	4,300
Venezuela ^e	202,000 ⁴	200,000 ⁴	200,000	200,000	200,000
Total	16,800,000 ^r	20,500,000 ^r	21,500,000 ^r	22,800,000 ^r	19,800,000

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

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

²Table includes data available through April 21, 2010.

³In addition to the countries listed, Namibia, the United Arab Emirates, and Yemen may produce feldspar, but output is not officially reported; and available information is inadequate for the formulation of reliable estimates of output levels.

⁴Reported figure.

⁵Data are for fiscal years ending July 7 of year stated.

⁶Of the amounts shown, the dedicated feldspar mine production accounts for only part of total feldspar production.

⁷Rounded to two significant digits to avoid disclosing proprietary data.

⁸Montenegro and Serbia formally declared independence in June 2006 from each other and dissolved their union.

⁹Rounded to two significant digits.