



# 2008 Minerals Yearbook

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FELDSPAR [ADVANCE RELEASE]

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# FELDSPAR AND NEPHELINE SYENITE

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Based on a combination of reported and estimated data, U.S. feldspar production in 2008, was 650,000 metric tons (t) valued at about \$40 million. Exports of feldspar increased by 47% to 14,600 t valued at \$2.39 million, and imports decreased by 43% to 2,030 t valued at \$646,000. Nepheline syenite was produced in Arkansas. Imports of nepheline syenite (predominantly from Canada) decreased by 18% to 321,000 t valued at \$35 million. Apparent consumption of feldspar and nepheline syenite combined was about 1 million metric tons (Mt). World production of feldspar was about 22 Mt (table 1).

## Feldspar

**Production.**—Feldspar was mined in seven States, in descending order of estimated output, North Carolina, Virginia, California, Oklahoma, Georgia, Idaho, and South Dakota. North Carolina accounted for about 42% of the total. The U.S. Geological Survey (USGS) collected data on domestic production and sales and use of feldspar by means of a voluntary survey. Nine U.S. 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 the 12 beneficiation facilities to which survey forms were sent, 8 responded, representing about 70% of the 2008 production tonnages listed in tables 1 and 2. Production for the remaining operations was estimated from prior-year production levels.

Harbinger Capitol Partners sold one of its last remaining industrial minerals assets, U.S. Silica Co. (USS) to San Francisco, CA-based Golden Gate Capitol (Industrial Minerals, 2009b). USS produces sodium feldspar from a mine in Montpelier, VA.

In November, a fire at Unimin Corp.'s Spruce Pine operations in North Carolina resulted in substantial damage, affecting its 130,000-metric-ton-per-year (t/yr) quartz and feldspar production operation. Unimin's mine accounted for about a one-seventh of domestic feldspar production (Industrial Minerals, 2009c).

**Consumption.**—Feldspar is used in glassmaking, ceramics, and to some extent as a filler and extender in paint, plastics, and rubber. In glassmaking, alumina from feldspar improves product hardness, durability, and resistance to chemical corrosion. In ceramics, the alkalis in feldspar (calcium oxide, potassium oxide, and sodium oxide) act as a flux, lowering the melting temperature of a mixture. Fluxes melt at an early stage in the firing process, forming a glassy matrix that bonds the other components of the system together (Roskill Information Services Ltd., 2008, p. 200). 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. Pottery (including electrical insulators, sanitaryware, tableware, and tile) and other uses, such as fillers, accounted

for the remainder (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.

U.S. shipments of glass containers, the leading end use for feldspar, increased slightly in 2008 (U.S. Census Bureau, 2009a). Other feldspar uses included glass fiber for home insulation, sanitaryware, and tile. Because new U.S. housing starts of 900,000 were 36% lower than in 2007, feldspar consumption in these applications decreased (U.S. Census Bureau, 2009b).

**World Review.**—Feldspar was produced in more than 50 countries with economic deposits of feldspar occurring in at least 70 countries (table 8). Turkey was the leading producing country with an estimated 6.5 Mt of feldspathic materials in 2008, followed by Italy with an estimated 4.78 Mt. China's production was estimated to be about 2 Mt.

**Australia.**—In September, Monto Minerals Ltd. closed its Goodicum feldspar mine in central Queensland. The company's failure to ramp up production of other minerals forced the closure of the mine (Moore, 2008b). At yearend, Monto's mineral assets were for sale and the apatite, feldspar, and ilmenite mine had not reopened (Norton, 2009).

**Brazil.**—Extensive exploration by the Government's mineral research company, Companhia Baiaba de Pesquisa Mineral, identified a new pegmatite district in Castro Alves in the State of Bahia on the eastern coast of Brazil. The pegmatite resources contain about 856,000 t of feldspar and 3,230 t of industrial quartz (Industrial Minerals, 2008c).

**China.**—Although China reportedly exported about 900,000 t feldspar, it consumed about 1.1 Mt of the mineral for its domestic ceramics industry (Wan, 2008). China exported about one-half of its output. It was the leading producing country of sanitaryware, with an estimated 140 million pieces in 2007 (latest data available), or 40% of the estimated annual world market of about 350 million pieces (Moore, 2008a).

**India.**—Mahavir Minerals Ltd. was expanding its processing capacity near its feldspar deposits in order to reduce freight costs. The additional capacity will add almost 50,000 t/yr of finished milled product (Industrial Minerals, 2008b). Ceramics and glass are the major markets for India's feldspar production.

**Italy.**—As the world's second ranked feldspar producer, Italy's domestic feldspar output supplied the country's ceramics industry. Italy also exported about 325,000 t of feldspar in 2008 and imported about 2.5 Mt, largely from Turkey (United Nations Statistics Division, [undated] a). Italy's ceramic tile production decreased by 6.4% in volume and sales decreased by 6.7% in 2008 compared with those of 2007 as a result of the downturn in the world economy (Industrial Minerals, 2009a).

**Turkey.**—The world's leading feldspar producer, Turkey exported about 4.6 Mt of feldspar and imported 46,000 t mainly from India (United Nations Statistics Division, [undated] a). The feldspar was mined in the southeast of the country and exported to major ceramic manufacturing countries around Europe.

## Nepheline Syenite

**Production.**—No nepheline syenite was produced in the United States for ceramic, glass, or filler use. In Arkansas, nepheline syenite with 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 (Rogers, 2009).

**Consumption.**—In glass and ceramics manufacture, nepheline syenite, like feldspar, provides alkalis that act as a flux to lower the melting temperature of a glass or ceramic mixture, prompting faster melting and fuel savings. In glass, nepheline syenite also supplies alumina, which gives improved thermal endurance, increased chemical durability, and increased resistance to scratching and breaking.

**World Review.**—Nepheline syenite, which was once only available from Canada, Norway, and Russia, was being produced in other countries. A number of 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, Ontario, deposit about 175 kilometers northeast of Toronto. Production of marketable nepheline syenite was estimated to be 685,000 t in 2008 (Rogers, 2009). 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 estimated to be about 412,000 t in 2008. The leading recipients were the United States, with 321,000 t; Italy, 52,000 t; Spain, 18,000 t; and the Netherlands, 6,000 t (United Nations Statistics Division, [undated] b).

**China.**—Yingde CT Mining Co. Ltd., a significant producer of ceramic minerals, owned three mines and two processing plants in southern China. In addition to producing ceramic products such as albite, potassium feldspar, quartz, and wollastonite, Yingde can produce high-purity nepheline syenite (20,000 t/yr) (Industrial Minerals, 2008a). Sales of nepheline syenite have been low in China; however, CT Mining has developed a product for use in the white ceramic tiles market.

**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 2008 (Rogers, 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 2008, total exports from Norway were 339,000 t. Leading recipients included the Netherlands, with about 87,000 t; Poland, 82,000 t; Germany, 56,000 t; the United Kingdom, 52,000 t; and Spain, 24,000 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 2009. Higher costs for reagent chemicals, natural gas, electric power, motor fuels, and regulatory compliance will continue to affect production costs. In addition, higher transportation charges for shipping feldspathic products by rail and truck in 2009 will increase delivered raw material costs for industrial consumers (Rogers, 2009).

According to the Freedonia Group, U.S. food container demand may rise modestly during the next few years, increasing feldspar consumption in glass containers. The glass industry has seen a recent decline in the use of flat glass because of declines in the automobile and construction industries; however, long-term growth is expected. New residential construction is forecast to decline in 2009 by about 6%; lower demand from that sector is likely to result in a decreased need for materials and components that use feldspar (Chase, 2009). However, commercial and residential remodeling could partially help to offset the reduced demand (Rogers, 2009).

Globally, the ceramics industry is said to be growing, and with it, the use of feldspar. The main centers of ceramic production are China, Italy, Latin America, Southeast Asia, and Spain. Although consuming much of its output internally, China could become an increasingly important exporter of ceramic tile. Demand in feldspar and associated materials is predicted to reach 29.5 Mt by 2012. Primary growth in feldspar demand is expected to be concentrated in Southeast Asia, Eastern Europe, and South America, representing an average growth of 5.5% annually (Roskill Information Services, Ltd., 2008, p. 310).

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TABLE 1  
SALIENT FELDSPAR AND NEPHELINE SYENITE STATISTICS<sup>1</sup>

		2004	2005	2006	2007	2008
United States:						
Produced, feldspar:						
Quantity <sup>e,2,3</sup>	metric tons	770,000	750,000	760,000	730,000	650,000
Value <sup>e,2</sup>	thousands	\$44,200	\$42,700	\$44,600	\$43,800	\$43,100
Exports, feldspar: <sup>4</sup>						
Quantity	metric tons	9,630	15,200	10,400	9,980	14,600
Value <sup>5</sup>	thousands	\$1,420	\$2,070	\$1,930	\$1,950	\$2,390
Imports for consumption <sup>4</sup>						
Feldspar:						
Quantity	metric tons	20,600	26,200	5,180	3,570	2,030
Value <sup>6</sup>	thousands	\$944	\$1,700	\$549	\$642	\$646
Nepheline syenite: <sup>7</sup>						
Quantity	metric tons	350,000	340,000	426,000	391,000	321,000
Value <sup>6</sup>	thousands	\$29,000	\$33,800	\$36,000	\$38,900	\$35,000
Consumption, apparent <sup>e,8</sup>	thousand metric tons	1,130	1,100	1,180	1,120 <sup>r</sup>	957
World, production <sup>9</sup>	do.	15,100	16,700 <sup>r</sup>	20,500 <sup>r</sup>	21,400 <sup>r</sup>	21,900 <sup>e</sup>

<sup>e</sup>Estimated. <sup>r</sup>Revised. do. Ditto.

<sup>1</sup>Data are rounded to no more than three significant digits.

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

<sup>3</sup>Rounded to two significant digits.

<sup>4</sup>Source: U.S. Census Bureau.

<sup>5</sup>Free alongside ship (f.a.s.) value.

<sup>6</sup>Customs value.

<sup>7</sup>No nepheline syenite produced in the United States for glass and ceramic use.

<sup>8</sup>Production plus imports minus exports. Includes feldspar and nepheline syenite.

<sup>9</sup>Feldspar only.

TABLE 2  
ESTIMATED FELDSPAR PRODUCTION IN THE UNITED STATES<sup>1</sup>

(Thousand metric tons and thousand dollars)

Year	Flotation concentrate		Other <sup>2</sup>		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
2007	330	18,500	400	25,300	730	43,800
2008	280	18,900	370	24,300	650	43,100

<sup>1</sup>Quantity data are rounded to two significant digits, and value data are rounded to three significant digits; may not add to totals shown.

<sup>2</sup>Includes hand-cobbed feldspar, feldspar content of feldspar-quartz mixtures, and aplite; excludes nepheline syenite.

TABLE 3  
U.S. PRODUCERS OF FELDSPAR IN 2008

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 Corp.	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<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

Use	2007		2008	
	Quantity	Value	Quantity	Value
Glass <sup>3</sup>	480	29,400	430	26,600
Pottery and miscellaneous	250	18,300	220	16,500
Total	730	47,700 <sup>4</sup>	650	43,100 <sup>4</sup>

<sup>1</sup>Includes hand-cobbed feldspar, flotation-concentrate feldspar, feldspar in feldspar-quartz mixtures, and aplite.

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

<sup>3</sup>Includes container glass, glass fiber, and other glass.

<sup>4</sup>Represents final marketable product; value higher than that listed in tables 1 and 2.

TABLE 5  
PRICES FOR U.S. FELDSPAR, YEAREND 2008

(Dollars per metric ton)

	Price <sup>1</sup>
Ceramic grade:	
170 to 200 mesh, sodium	66-83
200 mesh, potassium	138
Glass grade:	
30 mesh, sodium	44-57
80 mesh, potassium	94-99

<sup>1</sup>Bulk, ex-works, United States.

Source: Industrial Minerals, no. 495, December 2008, p. 88.

TABLE 6  
U.S. EXPORTS OF FELDSPAR, BY COUNTRY<sup>1</sup>

(Metric tons and dollars)

Country	2007		2008	
	Quantity	Value <sup>2</sup>	Quantity	Value <sup>2</sup>
Canada	1,150	278,000	1,590	370,000
China	36	36,400	261	27,600
Colombia	2,510	542,000	2,440	517,000
Costa Rica	2,170	303,000	2,060	275,000
Dominican Republic	17	4,620	--	--
Ecuador	--	--	496	69,100
Guatemala	392	53,300	177	23,300
Italy	1,150	293,000	1,040	280,000
Mexico	247	62,000	723	175,000
Nicaragua	1,890	263,000	1,600	212,000
Norway	10	4,330	3,270	275,000
Thailand	--	--	172	25,800
Trinidad and Tobago	237	54,900	107	15,600
Venezuela	154	37,000	688	105,000
Other	18 <sup>†</sup>	16,900 <sup>†</sup>	23	20,300
Total	9,980	1,950,000	14,600	2,390,000

<sup>†</sup>Revised. -- Zero.

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

<sup>2</sup>Free alongside ship value.

Source: U.S. Census Bureau.

TABLE 7  
 U.S. IMPORTS FOR CONSUMPTION OF FELDSPAR, BY COUNTRY<sup>1,2</sup>

(Metric tons and dollars)

Country	2007		2008	
	Quantity	Value <sup>3</sup>	Quantity	Value <sup>3</sup>
Australia	--	--	138	43,300
Canada	832 <sup>r</sup>	231,000	65	206,000
Germany	40	20,200	224	97,300
Mexico	2,670	370,000	1,550	267,000
Other	21 <sup>r</sup>	20,200 <sup>r</sup>	45	31,600
Total	3,570	642,000	2,030	646,000

<sup>r</sup>Revised. -- Zero.

<sup>1</sup>Excludes nepheline syenite, which is listed in table 1.

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

<sup>3</sup>Customs value.

Source: U.S. Census Bureau.

TABLE 8  
FELDSPAR: WORLD PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2004	2005	2006	2007	2008 <sup>e</sup>
Argentina	125,684	151,307	170,728	170,728 <sup>r</sup>	291,562 <sup>4</sup>
Australia, includes nepheline syenite <sup>c</sup>	50,000	50,000	50,000	50,000	50,000
Brazil, processed, marketable	121,452	122,887	77,285 <sup>r</sup>	171,589 <sup>r</sup>	172,000
Bulgaria	86,608	72,867	93,091	90,000 <sup>e</sup>	90,000
Burma <sup>e,5</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
Chile	4,838	5,820	5,847	6,704 <sup>r</sup>	6,500
China <sup>c</sup>	1,800,000	1,850,000	1,950,000	2,000,000	2,000,000
Colombia <sup>c</sup>	78,000 <sup>r</sup>	81,000 <sup>r</sup>	86,000 <sup>r</sup>	91,000 <sup>r</sup>	92,000
Cuba <sup>c</sup>	10,500	8,000	5,500	5,600 <sup>r</sup>	5,600
Czech Republic	488,000	472,000	487,000	514,000 <sup>r</sup>	510,000
Ecuador	53,469	38,250	67,844	14,308 <sup>r</sup>	20,000
Egypt <sup>c</sup>	178,000 <sup>r</sup>	357,000 <sup>r</sup>	360,000 <sup>r</sup>	360,000 <sup>r</sup>	360,000
Ethiopia <sup>6</sup>	361	445	478	510 <sup>r,e</sup>	510
Finland <sup>c</sup>	57,149 <sup>4</sup>	60,000	60,000	60,000	60,000
France, crude <sup>c</sup>	650,000	650,000	650,000	650,000	650,000
Germany	182,842	168,640	167,332	171,303	170,000
Greece <sup>c</sup>	95,000	95,000	95,000	95,000	95,000
Guatemala	4,473	3,808	17,176	30,234 <sup>r</sup>	30,000
India	367,346 <sup>r</sup>	414,637 <sup>r</sup>	386,685 <sup>r</sup>	397,328 <sup>r</sup>	400,000
Iran	252,713	286,033 <sup>r</sup>	290,000 <sup>r,e</sup>	290,000 <sup>r,e</sup>	300,000
Italy	3,251,264	3,995,233	4,019,495	4,200,000 <sup>e</sup>	4,727,000 <sup>4</sup>
Japan, includes aplite <sup>c</sup>	900,000	800,000	800,000	750,000	700,000
Jordan	13,063	1,000	11,054	9,800 <sup>r</sup>	10,000
Kenya <sup>c</sup>	40	22	25	25	25
Korea, Republic of	541,788	508,644	427,378	398,513	400,000
Macedonia	22,925 <sup>r</sup>	27,076	32,824 <sup>r</sup>	32,814 <sup>r</sup>	32,000
Madagascar <sup>c</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
Malaysia	79,220	117,180	142,358	358,775 <sup>r</sup>	300,000
Mexico	364,315	349,109	459,209	438,696 <sup>r</sup>	432,840 <sup>4</sup>
Morocco <sup>c</sup>	20,000	20,000	20,000	20,000	20,000
Nigeria <sup>c</sup>	1,700	1,700	1,700	1,700	1,700
Norway <sup>c</sup>	75,000	76,000	75,000	75,000	75,000
Pakistan	30,373	25,032	15,085 <sup>r</sup>	22,000	20,000
Peru	6,005	6,000	6,010 <sup>e</sup>	15,450 <sup>r</sup>	13,063 <sup>4</sup>
Philippines	32,110	11,850	15,176 <sup>r</sup>	14,837 <sup>r</sup>	15,000
Poland <sup>7</sup>	336,900	457,400 <sup>r</sup>	431,300 <sup>r</sup>	440,000 <sup>r,e</sup>	440,000
Portugal	98,262	133,344	257,570 <sup>r</sup>	371,952 <sup>r</sup>	372,000
Romania	60,924	74,920	33,100 <sup>r</sup>	44,897 <sup>r</sup>	45,000
Russia <sup>c</sup>	45,000	45,000	45,000	45,000	45,000
Serbia	3,045 <sup>8</sup>	3,500 <sup>8</sup>	3,500 <sup>e</sup>	3,500 <sup>e</sup>	3,500
Slovakia <sup>c</sup>	5,000	5,000	5,000	5,000	5,000
South Africa	53,721	57,534	75,400 <sup>r</sup>	90,232	105,815 <sup>p,4</sup>
Spain, includes pegmatite	552,507	580,000	674,766 <sup>r</sup>	675,000 <sup>r</sup>	675,000
Sri Lanka	33,000 <sup>e</sup>	34,000	35,000	36,000 <sup>e</sup>	37,000
Sweden, salable, crude and ground <sup>c</sup>	42,000	43,000	42,000	42,000	42,000
Thailand	1,001,053	1,149,717	1,067,684	684,668 <sup>r</sup>	678,000
Turkey	1,983,336	2,331,971 <sup>r</sup>	5,771,892 <sup>r</sup>	6,548,796 <sup>r</sup>	6,500,000
United Kingdom, china stone	2,274	1,835	2,000 <sup>e</sup>	2,000 <sup>e</sup>	1,000
United States	770,000 <sup>9</sup>	750,000 <sup>9</sup>	760,000 <sup>9</sup>	730,000 <sup>9</sup>	650,000 <sup>4,9</sup>
Uruguay	2,450	2,150	2,470	2,500	2,500
Uzbekistan <sup>c</sup>	4,300	4,300	4,300	4,300	4,300
Venezuela	176,000	202,000	200,000 <sup>e</sup>	200,000	200,000

See footnotes at end of table.



TABLE 8—Continued  
 FELDSPAR: WORLD PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2004	2005	2006	2007	2008 <sup>c</sup>
Zimbabwe	1	--	--	--	--
Total	15,100,000	16,700,000 <sup>r</sup>	20,500,000 <sup>r</sup>	21,400,000 <sup>r</sup>	21,900,000

<sup>6</sup>Estimated. <sup>9</sup>Preliminary. <sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Table includes data available through April 21, 2009.

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

<sup>4</sup>Reported figure.

<sup>5</sup>Data are for fiscal years beginning April 1 of year stated.

<sup>6</sup>Data are for fiscal years ending July 7 of year stated.

<sup>7</sup>Of the amounts shown, the dedicated feldspar mine production accounts for only part of total feldspar production.

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

<sup>9</sup>Rounded to two significant digits.