



2005 Minerals Yearbook

FELDSPAR AND NEPHELINE SYENITE

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By Michael J. Potter

Domestic survey data and tables were prepared by Hoa P. Phamdang, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

In 2005, U.S. feldspar production was estimated to have decreased by about 3% to 750,000 metric tons (t) valued at \$43 million. Exports of feldspar increased by 58% to 15,200 t valued at \$2.07 million, and imports increased by 27% to 26,200 t valued at \$1.7 million. There was no U.S. production of nepheline syenite, and imports of nepheline syenite (from Canada) decreased by 3% to 340,000 t valued at \$33.8 million. Apparent consumption of feldspar and nepheline syenite combined was 1.1 million metric tons (Mt). World production of feldspar was 12.9 Mt, slightly higher than in 2004.

This report includes information on feldspar, nepheline syenite, and aplite (one U.S. producer). Trade data in this report are from the U.S. Census Bureau.

Feldspar

Production.—Data on domestic production and sales and use of feldspar were collected by the U.S. Geological Survey (USGS) by means of a voluntary survey. Of the 12 known beneficiation facilities, 6 responded with production data by the canvass closeout date. These respondents represented about 58% of the 2005 production tonnages listed in tables 1 and 2. Production for the remaining operations was estimated from prior-year production levels. Feldspar was mined in seven States, which were, in descending order of estimated output, North Carolina, Virginia, California, Oklahoma, Georgia, Idaho, and South Dakota. North Carolina accounted for about almost 50% of the total. 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 listed above (table 3).

For the purposes of research and development, i-minerals inc., which was not yet in production, shipped a 40-t bulk sample of potassium feldspar and quartz material from its property in northwest Idaho to North Carolina State University's Minerals Research Laboratory in Asheville, NC. There, pilot-scale processing of the material was to be performed to produce a potassium feldspar glaze product for potential sales to the ceramics industry (i-minerals inc., 2005§¹).

Consumption.—Feldspar is used in glassmaking, ceramics, and to some extent as a filler/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 together the other components of the system (Roskill Information Services Ltd., 2002, p. 184). Of the domestic feldspar sold or used, an

estimated 63% 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 remaining 37% (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 the table 4 value represents the final marketed feldspar product.

U.S. shipments of glass containers, the leading end use of feldspar, increased by 1% in 2005 (U.S. Census Bureau, 2006a§). Feldspar use was also reflected in glass fiber for home insulation, sanitaryware, and tile. New U.S. housing starts were about 6% higher than in 2004 (U.S. Census Bureau, 2006b§). However, U.S. imports of sanitaryware and tile have captured a major portion of the U.S. markets. Narrow-neck beer bottles accounted for the largest segment in glass container demand. Cullet (recycled glass) was used in manufacturing most glass containers, but the amount handled and blended varies significantly from one glass plant to another (Freas, 2006).

The bathroom is becoming more of a centerpiece in the home in design and color. For example, a German manufacturer uses innovative production and glazing techniques to replicate the look of pebbles in sink basins, toilets, and corresponding accessories. A U.S. company has a new toilet design that is tankless and uses a quiet 0.2-horsepower electric pump fully enclosed within the toilet bowl that provides a powerful flush using just 1.6 gallons of water (Ceramic Industry, 2005c§).

StonePeak Ceramics, Inc. (a subsidiary of Italian company Graniti Fiandre Spa) opened a new porcelain tile manufacturing facility in Crossville, TN. The plant was producing glazed and unglazed porcelain tile and the company cited a strong U.S. demand for stone-look tile (Grahl, 2005§).

Foreign Trade.—U.S. feldspar exports were 15,200 t in 2005, about 58% higher than in 2004 (table 6). U.S. imports of feldspar were 26,200 t compared with 20,600 t in 2004. Turkey supplied 76%, and Mexico, 23% (table 7). Turkey has recently become the leading exporting country to the United States. The "other" category of U.S. imports in table 7 for 2005 has a high unit value and is probably material other than feldspar. The resulting total average unit value for U.S. imports for 2005 is about \$65 per metric ton compared with about \$46 per ton in 2004.

U.S. imports of ceramic tile composed 79% of the U.S. tile market in 2004. Italy was the leading supplier followed by Brazil. Other countries of origin were China, Columbia, Mexico, Spain, Thailand, and Venezuela (Ceramic Industry, 2005b§). Imports met about 47% of U.S. tile consumption in 1980 and 51% in 1990 (Tile Council of North America, Inc., undated§).

World Industry Structure.—Feldspar was produced in more than 50 countries. Italy was the leading producing country with an estimated 2.5 Mt of feldspathic materials in 2005, followed by Turkey with 2.2 Mt. Japan had an estimated production of

¹References that include a section mark (§) are found in the Internet References Cited section.

1 Mt of feldspathic minerals, including altered granite, aplite, pegmatitic feldspar, and roseki (a type of china stone). Thailand had an estimated production of 1 Mt; output was largely sodium feldspar (table 8). Although official production data were not available, China has been estimated, by some sources, to have an output of 1 million to 2 million metric tons per year (Mt/yr) (Roskill Information Services Ltd., 2002, p. 46, 90, 136).

China has had major growth in the production of sanitaryware, tableware, and tile in recent years. Other countries, including Asian countries, that also produce these products, have been affected by the Chinese competition. Such countries as Indonesia, the Philippines, and Sri Lanka have been seeking state protection, including tariff increases on imported ceramic products (King, 2005).

World Review.—Australia.—Monto Minerals Ltd. continued with development of its Goondicum Industrial Minerals Project. Commercial testing of a bulk sample of feldspar was said to have been successfully completed at a glass manufacturer in the Philippines. An additional 2 to 3 t of material for fine grinding was slated to be processed for customer trials in paint manufacture (Monto Minerals Ltd., 2006§).

Czech Republic.—With an output of more than 400,000 metric tons per year (t/yr), the country is a significant producer of feldspar. Feldspar is among the country's most important industrial minerals in terms of production and regional exports. Feldspathic sand and gravel and leucocratic granitoid deposits are the most important feldspar sources at present. The mineral is consumed in the domestic ceramic and glass industries; Czech exports were 144,000 t in 2004, with Hungary, Poland, and Slovakia being the leading recipients (Stary and Kavina, 2005).

France.—Paris-based Imerys Group signed an agreement in September to acquire Denain-Anzin Mineraux Group (DAM) from Nord Est Group, a French industrial group. DAM is one of Europe's leading producers of feldspar, kaolin, mica, and quartz. The deal remained subject to the approval of regulatory authorities (O'Driscoll, 2005a).

Nepheline Syenite

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.—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, Ontario. Production of marketable nepheline syenite was estimated to be about 710,000 t in 2004. For 2002 (latest data), the British Geological Survey (2004, p. 308) reported output to be 721,000 t. Detailed end-use data in recent years have not been available, but historically, end uses have been in glass, ceramics, and pigments and fillers. Total nepheline syenite exports were 476,000 t in 2004. The leading recipients were the United States, 350,000 t; Italy, 54,000 t; the Netherlands, 39,000 t; and Spain, 20,000 t (United Nations Statistics Division, undated§).

China.—Fineton Industrial Minerals Ltd. of Hong Kong was planning to expand capacity of its Jiulong Mining (Anyang) Co. Ltd. nepheline syenite operation in Anyang, Henan Province, to 100,000 t/yr in 2006. Fineton initially looked for markets in Europe because of resistance of consumers in China to switching from feldspar to nepheline syenite, a less known product. In 2003 and 2004, exports were primarily to Italy and Spain. In 2005, the company again began concentrating on markets in the Asia-Pacific region because of anticipated faster growth there (O'Driscoll, 2005b).

Norway.—North Cape Minerals AS produced nepheline syenite from an underground mine on the arctic island of Stjernoya; output was estimated to be about 340,000 t in 2004. End-use data for this material have not been available in recent years, but uses in the past have included glass (including amber glass), ceramics, and fillers. In 2004, total exports were 336,000 t. The leading recipients were Poland, 65,000 t; Germany, 58,000 t; the United Kingdom, 55,000 t; the Netherlands, 38,000 t; France, 32,000 t; and Spain, 24,000 t (United Nations Statistics Division, undated§).

Outlook

Glass containers and whiteware ceramics, especially sanitaryware and tiles, continue to be major end uses of feldspar and nepheline syenite. Glass containers have continued to face competition from plastic and metal containers. Also, the use of cullet (recycled glass) in glassmaking and making glass containers more lightweight by reducing wall thickness have moderated the consumption of glass raw materials, including feldspar and nepheline syenite. However, the glass container market appears to be stable to slowly growing (Freas, 2006). Glass manufacturers have reported increased glass container demand in such developing regions as China and Latin America (Ceramic Industry, 2005a§).

Chinese companies have been a major source of feldspar for domestic ceramic use and for other Southeast Asia countries. Turkey has been a major supplier to European countries and could possibly develop markets elsewhere. As feldspar use increases in the ceramic tile industry, ceramic-producing regions in China, Italy, Latin America, Southeast Asia, and Spain have been and are projected to continue to be major factors in feldspathic consumption (Roskill Information Services Ltd., 2002, p. 202-203, 301).

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TABLE 1
SALIENT FELDSPAR AND NEPHELINE SYENITE STATISTICS¹

		2001	2002	2003	2004	2005
United States:						
Produced, feldspar:						
Quantity ^{e,2}	metric tons	800,000	790,000	800,000	770,000	750,000 ³
Value ^{e,2}	thousands	\$44,100	\$42,800	\$43,400	\$44,000 ³	\$43,000 ³
Exports, feldspar:⁴						
Quantity	metric tons	5,460	9,590	8,950	9,630	15,200
Value ⁵	thousands	\$1,410	\$1,370	\$1,310	\$1,420	\$2,070
Imports for consumption:⁴						
Feldspar:						
Quantity	metric tons	6,140	5,450	7,980	20,600	26,200
Value ⁶	thousands	\$749	\$775	\$1,020	\$944	\$1,700
Nepheline syenite:⁷						
Quantity	metric tons	336,000	333,000	308,000	350,000	340,000
Value ⁶	thousands	\$24,100	\$26,100	\$28,200	\$29,000	\$33,800
Consumption, apparent ^{e,8}	thousand metric tons	1,140	1,120	1,110	1,130	1,100
World, production ^{e,9}	do.	11,800 ^r	12,000 ^r	12,200 ^r	12,600 ^r	12,900 ^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; 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.

⁷No nepheline syenite produced in the United States for glass and ceramic use.

⁸Production plus imports minus exports. Includes feldspar and nepheline syenite.

⁹Feldspar 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
2004	340	19,000	430	25,000	770	44,000
2005	350	19,000	400	23,000	750	43,000

¹Data are rounded to two significant digits; may not add to totals shown.

²Includes hand-cobbed feldspar, feldspar-quartz mixtures (feldspar content), and aplite; excludes nepheline syenite.

TABLE 3
U.S. PRODUCERS OF FELDSPAR IN 2005

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; feldspar-quartz mixture.
Granite Rock Co.	Felton, CA	Feldspar-quartz mixture.
Kings Mountain Mining LLC	Kings Mountain, NC	Do.
K-T Feldspar Corp.	Spruce Pine, NC	Sodium-potassium feldspar; feldspar-quartz mixture.
Pacer Corp.	Custer, SD	Potassium feldspar.
PW Gillibrand Co.	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.

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

(Thousand metric tons and thousand dollars)

Use	2004		2005	
	Quantity	Value	Quantity	Value
Glass ³	500 ^r	27,000	470	27,000
Pottery and miscellaneous	270	19,000	270	18,000
Total	770 ^r	46,000 ⁴	750	45,000 ⁴

^rRevised.

¹Data are rounded to two significant digits; may not add to totals shown.

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

³Includes container glass, glass fiber, and other glass.

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

TABLE 5
PRICES FOR U.S. FELDSPAR, YEAREND 2005

(Dollars per metric ton)

	Price ¹
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

¹Bulk, ex-works, United States.

Source: Industrial Minerals, no. 459, December 2005, p. 70.

TABLE 6
U.S. EXPORTS OF FELDSPAR, BY COUNTRY¹

(Metric tons and dollars)

Country	2004		2005	
	Quantity	Value ²	Quantity	Value ²
Canada	1,110	182,000	1,030	196,000
Colombia	883	194,000	1,410	320,000
Costa Rica	1,590	205,000	2,820	358,000
Dominican Republic	370	79,100	128	19,000
Guatemala	632	70,200	306	40,500
Italy	1,680	166,000	2,350	343,000
Mexico	768	140,000	1,100	184,000
Nicaragua	2,180	280,000	2,210	298,000
Panama	--	--	3,140	174,000
Other	258	55,400	725	135,000
Total	9,470	1,370,000	15,200	2,070,000

-- 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 7
U.S. IMPORTS FOR CONSUMPTION OF FELDSPAR, BY COUNTRY^{1,2}

(Metric tons and dollars)

Country	2004		2005	
	Quantity	Value ³	Quantity	Value ³
Mexico	5,890	588,000	6,030	579,000
Turkey	14,700	308,000	20,000	780,000
Other	71	48,400	194	343,000
Total	20,600	944,000	26,200	1,700,000

¹Excludes nepheline syenite, 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 8
FELDSPAR: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

Country ³	2001	2002	2003	2004	2005 ^e
Argentina	48,522	82,642	90,854 ^r	104,631 ^r	105,000
Australia, includes nepheline syenite ^e	50,000	50,000	50,000	50,000	60,000
Brazil, processed	69,209 ^{r,4}	45,194 ^r	53,476 ^r	115,952 ^r	120,000 ⁵
Bulgaria	23,000	34,000	35,000	35,000 ^e	35,000
Burma ^{e,6}	10,000	10,000	10,000	10,000	10,000
Chile	2,867	3,069	6,690	4,838 ^r	5,000
Colombia ^e	55,000	93,452 ⁵	100,000	100,000	100,000
Cuba ^e	7,000	7,000	7,000	7,000	7,000
Czech Republic	373,000	401,000 ^e	421,000	400,000 ^e	400,000
Ecuador	60,688	31,254	44,268 ^r	48,700 ^r	49,000 ⁵

See footnotes at end of table.

TABLE 8—Continued
 FELDSPAR: WORLD PRODUCTION, BY COUNTRY^{1, 2}

(Metric tons)

Country ³	2001	2002	2003	2004	2005 ^e
Egypt ^e	300,000	350,000	350,000	350,000	350,000
Ethiopia ⁷	250 ^{r, e}	230 ^{r, e}	208 ^r	361 ^r	370
Finland	34,289	46,715	48,353 ^r	57,149 ^r	60,000
France, crude ^e	650,000	650,000	650,000	650,000	650,000
Germany ^e	500,000 ^r	500,000 ^r	500,000 ^r	500,000 ^r	500,000
Greece ^e	95,000	95,000	95,000	95,000	95,000
Guatemala	6,809	11,843	9,320	4,473 ^r	4,500
India ^e	110,000	110,000	150,000	150,000	150,000
Iran	204,078	191,316	242,898 ^r	252,713 ^r	250,000
Italy ^e	2,600,000	2,500,000	2,500,000	2,500,000	2,500,000
Japan, includes aplite ^e	1,330,000 ^r	1,140,000 ^r	1,010,000 ^r	900,000 ^r	1,000,000
Jordan	611	530	13,057 ^r	13,060 ^r	14,000
Kenya ^e	73 ⁵	75	75	80 ^r	80
Korea, Republic of	467,161 ^r	519,125 ^r	477,012	541,788 ^r	540,000
Macedonia	20,449	21,000	21,000 ^e	20,000 ^e	20,000
Madagascar ^e	3	3	3	3	3
Malaysia	40,509	30,819	42,662 ^r	79,220 ^r	80,000
Mexico	329,591	332,101	346,315	364,315 ^r	349,109 ⁵
Morocco	8,979	19,401	20,000 ^e	20,000 ^e	20,000
Nigeria	1,811	1,800	1,800 ^e	1,700 ^e	1,700
Norway ^e	73,000	75,000	74,000	75,000	76,000
Pakistan ^e	44,000	45,000	47,000	47,000	50,000
Peru	4,253	6,018	7,349	6,005 ^r	7,000
Philippines ^e	33,122 ⁵	30,000	30,000	30,000	30,000
Poland ⁸	220,600	293,000	320,000	300,000 ^e	300,000
Portugal ^e	120,000	120,000	120,000	120,000	120,000
Romania	43,047	51,959	71,717	70,000 ^e	70,000
Russia ^e	45,000	45,000	45,000	45,000	45,000
Serbia and Montenegro ^e	4,451 ⁵	4,500	4,500	4,500	4,000
Slovakia ^e	6,000	4,000	5,000	5,000	5,000
South Africa	66,736	57,197	57,738 ^r	53,044 ^r	56,574 ⁵
Spain, includes pegmatite ^e	450,000	450,000	450,000	450,000	450,000
Sri Lanka	27,438	28,866	32,586	33,000 ^e	34,000
Sweden, salable, crude and ground ^e	40,450 ⁵	40,000	41,000	42,000	43,000
Thailand	710,543	783,733	824,990	1,001,053 ^r	1,000,000
Turkey	1,510,293	1,766,387	1,862,310	1,983,336 ^r	2,200,000
United Kingdom, china stone ^e	2,000	2,000	2,000	2,000	2,000
United States	800,000	790,000	800,000	770,000	750,000 ^{5, 9}
Uruguay	4,722	1,550 ^r	2,450 ^r	1,950 ^r	2,000
Uzbekistan ^e	4,300	4,300	4,300	4,300	4,300
Venezuela	142,000	147,000	149,000	176,000 ^r	180,000
Zimbabwe	1,055	728	816	1	--
Total	11,800,000 ^r	12,000,000 ^r	12,200,000 ^r	12,600,000 ^r	12,900,000

^eEstimated. ^rRevised. -- Zero.

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

²Table includes data available through April 24, 2006.

³In addition to the countries listed, China, 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.

⁴Source: Departamento Nacional de Produção Mineral (DNPM) [Brazilian Bureau of Mines], Feldspar, Mineral Summary 2001, accessed May 13, 2003, at URL <http://www.dnpm.gov.br/dnpmengl.html>.

⁵Reported figure.

⁶Data are for fiscal years beginning April 1 of year stated.

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

⁸Of the amounts shown, the dedicated feldspar mine production accounts for only part of total feldspar production.

⁹Rounded to two significant digits.