

FELDSPAR AND NEPHELINE SYENITE

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In 2004, feldspar production decreased by 4% to 770,000 metric tons (t) valued at \$44 million. Exports of feldspar increased by 8% to 9,630 t valued at \$1.42 million, and imports increased to 20,600 t valued at \$944,000. There was no U.S. production of nepheline syenite. Imports of nepheline syenite increased by 14% to 350,000 t valued at \$29 million. Apparent consumption of feldspar and nepheline syenite combined was 1.13 million metric tons (Mt). World production was 11.1 Mt, about the same as in 2003.

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, 7 responded with production data by the canvass closeout date. This represented about 68% of the 2004 production listed in tables 1 and 2. Production for the remaining five operations was estimated from prior-year production levels. Feldspar was mined in seven States, which were, in descending order of output, North Carolina, Virginia, California, Oklahoma, Georgia, Idaho, and South Dakota. North Carolina accounted for about 46% of the total. Ten companies mined feldspar, and 9 of these companies operated 12 beneficiation facilities—4 in North Carolina, 3 in California, and 1 in each of the 5 remaining States listed above (table 3). Only one company did not operate a beneficiation plant.

In Idaho, i-minerals inc. continued with development of its Helmer-Bovill (Kelly's Basin) feldspar-kaolin-quartz project. The company planned to provide test samples of feldspar and quartz to prospective customers. In 2005, i-minerals planned to make a more comprehensive assessment of its inferred resources of feldspar, proceed further with its engineering plans for the site, and complete testing on the kaolin and quartz present in the deposit (i-minerals inc., 2004§¹).

Consumption.—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 65% 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 35% by tonnage (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 sold-or-used value represents the final marketed feldspar product.

U.S. shipments of glass containers, the leading end use of feldspar, increased by 2% in 2004 (U.S. Census Bureau, 2005a§). Feldspar use was also reflected in glass fiber housing insulation, sanitaryware, and tile. New U.S. housing starts were about 6% higher than in 2003 (U.S. Census Bureau, 2005b§).

In June, Owens-Illinois, Inc. broke ground on a new glass container plant in Colorado. This is the company's first U.S.-built facility since 1980. Output is projected to be one billion bottles per year and will supply the Anheuser-Busch, Inc. brewery in Fort Collins, CO (Grahl, 2004§).

Foreign Trade.—U.S. feldspar exports were 9,630 t in 2004, about 8% higher than in 2003 (table 6). U.S. imports of feldspar were 20,600 t compared with 7,980 t in the previous year. Turkey supplied 71% and Mexico 29% (table 7). Turkey has recently become the leading exporting country to the United States.

World Review.—Feldspar is produced in more than 50 countries. Italy was the leading producing country with an estimated 2.5 Mt of feldspathic materials in 2004, followed by Turkey with 1.9 Mt, and the United States with 770,000 t (table 8). Although official production data are not available, China has been estimated, by some sources, to have output of 1 to 2 million metric tons per year (Mt/yr) (Roskill Information Services Ltd., 2002, p. 46).

Australia.—Monto Minerals Ltd. produced more than 1,500 t of separate bulk samples of apatite, feldspar, and ilmenite at its Goondicum test plant in central Queensland. The products were for testing by potential customers. Monto's stated aim was to supply Australian and international markets with apatite for fertilizer; feldspar for glassmaking; and ilmenite for pigment in paint, paper, and plastics. ACI Glass Packaging (a subsidiary of Own-Illinois, Inc.) was running full-scale production trials of Goondicum feldspar at its Brisbane glass manufacturing plant (Monto Minerals Ltd., 2004a§, b§).

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.

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

World Review.—Canada and Norway produced nepheline syenite for glass and ceramic use.

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, 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, 2004§).

Unimin Corp. announced completion of a major expansion that increased its micronized nepheline syenite production from its Blue Mountain operation by 50%. The company supplies functional fillers for architectural and industrial paint and coatings applications worldwide (Industrial Minerals, 2004).

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 end 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, 2004§).

Outlook

Plastic containers have continued to compete with glass in some industry segments, such as beverage and food packaging. However, glass is projected to perform well in higher end packaging applications, such as beer, wine, and specialty foods. Glass fiber insulation was expected to see continuing robust demand. There is more intensive use of glass fiber insulation per new housing unit, driven by an increasing desire for energy efficiency and sound transmission reduction (Grahil, 2004§).

Feldspar markets also have been aided by increased demand for ceramic tile. Since the 1990s, porcelain tile demand has continued to grow. These durable, hard wearing tiles are highly impermeable and have a high mechanical performance. According to at least one producer, there is increased demand for larger sized tiles, 12-by-12 inch to 20-by-20 inch (Ceramic Industry, 2004§).

Europe had been a major producer of tile, but in recent years output from Asian countries, such as China, has been more than 50% of world total. In order to compete, European producers

are concentrating on style, design, and developing good customer relations (King, 2004).

References Cited

- British Geological Survey, 2004, World mineral statistics, 1998-2002: Keyworth, United Kingdom, British Geological Survey, 312 p. plus appendix.
- Industrial Minerals, 2004, Unimin completes nepheline syenite expansion: Industrial Minerals, no. 444, September, p. 8.
- King, Laura, 2004, Ceramic tiles: Industrial Minerals, no. 445, October, p. 50-53.
- Roskill Information Services Ltd., 2002, The economics of feldspar: London, United Kingdom, Roskill Information Services Ltd., 309 p. plus appendices.

Internet References Cited

- Ceramic Industry, 2004 (October 1), Tile market overview—U.S. tile market sees continued growth; outlook remains positive, accessed October 15, 2004, via URL <http://www.ceramicindustry.com>.
- Grahil, C.L., 2004 (October 1), Glass market overview—Prospects look promising for the glass industry, accessed October 13, 2004, via URL <http://www.ceramicindustry.com>.
- i-minerals inc., 2004 (September 7), 2004 annual report, accessed December 17, 2004, via URL <http://www.sedar.com>.
- Monto Minerals Ltd., 2004a, Fourth quarter report 2003/2004 for 3 months to 30 June 2004, accessed August 30, 2004, via URL <http://www.montominerals.com>.
- Monto Minerals Ltd., 2004b (October 12), Goondicum industrial minerals project marketing update, accessed May 10, 2005, via URL <http://www.montominerals.com>.
- United Nations Statistics Division, 2004, Leucite; nepheline and nepheline syenite, accessed June 2, 2005, via URL <http://unstats.un.org/unsd/comtrade>.
- U.S. Census Bureau, 2005a (February), Glass containers—December 2004, Current Industrial Reports, accessed May 16, 2005, at URL <http://www.census.gov/cir/www/327/m327g.html>.
- U.S. Census Bureau, 2005b (March 16), New residential construction in February 2005, accessed May 18, 2005, at URL http://www.census.gov/const/newresconst_0502.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.
- Silica. Ch. in Minerals Yearbook, annual.
- Soda Ash. Ch. in Minerals Yearbook, annual.

Other

- Feldspar. Ch. in Industrial Minerals and Rocks (6th ed.), Society for Mining, Metallurgy, and Exploration, Inc., 1994.
- Feldspar. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.
- Freedonia Group, The.

TABLE 1
SALIENT FELDSPAR AND NEPHELINE SYENITE STATISTICS¹

		2000	2001	2002	2003	2004
United States:						
Produced, feldspar:						
Quantity ^{e, 2}	metric tons	790,000	800,000	790,000	800,000	770,000
Value ^{e, 2}	thousands	\$44,500	\$44,100	\$42,800	\$43,000 ³	\$44,000 ³
Exports, feldspar: ⁴						
Quantity	metric tons	11,400	5,460	9,590	8,950	9,630
Value ⁵	thousands	\$1,490	\$1,410	\$1,370	\$1,310	\$1,420
Imports for consumption: ⁴						
Feldspar:						
Quantity	metric tons	7,220	6,140	5,450	7,980	20,600
Value ⁶	thousands	\$726	\$749	\$775	\$1,020	\$944
Nepheline syenite: ⁷						
Quantity	metric tons	356,000	336,000	333,000	308,000	350,000
Value ⁶	thousands	\$24,800	\$24,100	\$26,100	\$28,200	\$29,000
Consumption, apparent ^{e, 8}	thousand metric tons	1,140	1,140	1,120	1,110	1,130
World, production ^{e, 9}	do.	9,540	10,400	10,800 ^r	11,200 ^r	11,100 ^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 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
2003	330	17,000	470	26,000	800	43,000
2004	340	19,000	430	25,000	770	44,000

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 2004

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.
K-T Feldspar Corp.	Spruce Pine, NC	Sodium-potassium feldspar; feldspar-quartz mixture.
Oglebay Norton Specialty Minerals Inc.	Kings Mountain, NC	Feldspar-quartz mixture.
Pacer Corp.	Custer, SD	Potassium feldspar.
PW Gillibrand Co.	Simi Valley, CA	Feldspar-quartz mixture.
Tinton Enterprises Ltd. (mine only)	Newell, SD	Potassium feldspar.
Unimin Corp.	Byron, CA	Feldspar-quartz mixture.
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	2003		2004	
	Quantity	Value	Quantity	Value
Glass ³	560	29,000	500	27,000
Pottery and miscellaneous	240	16,000	270	19,000
Total	800	46,000 ⁴	770	46,000 ⁴

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.

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 2004

(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. 446, December 2004, p. 72.

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

Country	2003		2004	
	Quantity	Value ²	Quantity	Value ²
Canada	1,080	149,000	1,110	182,000
Chile	816	124,000	--	--
Colombia	--	--	883	194,000
Costa Rica	1,390	180,000	1,590	205,000
Dominican Republic	159	33,200	370	79,100
Guatemala	389	51,700	632	70,200
Italy	1,320	200,000	1,680	166,000
Malaysia	81	22,300	80	24,000
Mexico	863	104,000	768	140,000
Nicaragua	2,170	277,000	2,180	280,000
Other	690	169,000	338	79,400
Total	8,950	1,310,000	9,630	1,420,000

-- 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	2003		2004	
	Quantity	Value ³	Quantity	Value ³
Mexico	6,050	583,000	5,890	588,000
Turkey	1,800	319,000	14,700	308,000
Other	135	113,000	71	48,400
Total	7,980	1,010,000	20,600	944,000

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	2000	2001	2002	2003	2004 ^e
Algeria ^c	707 ⁴	--	--	--	--
Argentina	59,466	48,522 ^r	82,642 ^r	88,427 ^r	90,000
Australia, includes nepheline syenite ^c	50,000	50,000	50,000	50,000	50,000
Brazil, processed	117,715 ⁵	75,000 ⁵	75,000 ^e	75,000 ^e	75,000
Bulgaria	22,000	23,000	34,000 ^r	35,000	35,000
Burma ^{e,6}	12,000	10,000	10,000	10,000	10,000
Chile	2,311	2,867	3,069	6,690 ^r	6,000
Colombia ^c	55,000	55,000	93,452 ⁴	100,000	100,000
Cuba ^c	6,700 ⁴	7,000	7,000	7,000	7,000
Czech Republic	337,000	373,000	401,000 ^e	421,000 ^r	400,000
Ecuador	47,041	60,688	31,254 ^r	34,400 ^{r,e}	35,000
Egypt ^e	330,000	300,000	350,000	350,000	350,000

See footnotes at end of table.

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

(Metric tons)

Country ³	2000	2001	2002	2003	2004 ^e
Ethiopia ^e	285 ⁴	310	310	310	310
Finland	33,200	34,289	46,715 ^r	36,000 ^e	35,000
France, crude ^e	642,000	650,000	650,000	650,000	650,000
Germany ^e	450,000	450,000	450,000	450,000	450,000
Greece ^e	96,000	95,000	95,000	95,000	95,000
Guatemala	17,804	6,809 ^r	11,843 ^r	9,320 ^{r,e}	9,000
India ^e	110,000	110,000	110,000	150,000	150,000
Iran	156,000	204,078	191,316	190,000 ^e	200,000
Italy ^e	2,500,000	2,600,000	2,500,000	2,500,000	2,500,000
Japan ^{e,7}	52,000	50,000	50,000	50,000	50,000
Jordan	11,112	611 ^r	530 ^r	530 ^{r,e}	530
Kenya	82	73	75 ^e	75 ^e	75
Korea, Republic of	330,417	389,361	415,580	477,012 ^r	480,000
Macedonia	10,057	20,449	21,000	21,000 ^{r,e}	20,000
Madagascar ^e	7 ⁴	3	3 ^r	3	3
Malaysia	29,895 ^r	40,509	30,819	31,000 ^e	31,000
Mexico	334,439	329,591	332,101	346,315 ^r	350,000
Morocco	6,052	8,979	19,401	20,000 ^e	20,000
Nigeria	1,449	1,811	1,800	1,800 ^e	1,700
Norway ^e	75,000	73,000	75,000	74,000	75,000
Pakistan ^e	43,186 ⁴	44,000	45,000	47,000	47,000
Peru	5,642	4,253	6,018	7,349 ^r	7,000
Philippines	3,440	33,122	30,000 ^e	30,000 ^e	30,000
Poland ⁸	165,200	220,600	293,000 ^r	320,000 ^r	300,000
Portugal ^e	119,837 ⁴	120,000	120,000	120,000	120,000
Romania	37,157	43,047	51,959 ^r	71,717 ^r	70,000
Russia ^e	45,000	45,000	45,000	45,000	45,000
Serbia and Montenegro	4,254	4,451 ^r	4,500 ^{r,e}	4,500 ^{r,e}	4,500
Slovakia ^e	6,000 ⁴	6,000	4,000 ^r	5,000 ^r	5,000
South Africa	66,774	66,736	57,197	57,343	53,045 ⁴
Spain, includes pegmatite ^e	460,000	450,000	450,000	450,000	450,000
Sri Lanka	28,638	27,438	28,866	32,586 ^r	33,000
Sweden, salable, crude and ground	35,000	40,450	40,000 ^e	41,000 ^e	42,000
Thailand	542,991	710,543	783,733	824,990 ^r	825,000
Turkey	1,147,716	1,510,293	1,766,387 ^r	1,862,310 ^r	1,900,000
United Kingdom, china stone ^e	2,000	2,000	2,000	2,000	2,000
United States ^e	790,000	800,000	790,000	800,000	770,000
Uruguay	2,493	4,722	4,700 ^e	4,700 ^{r,e}	4,700
Uzbekistan ^e	4,300 ⁴	4,300	4,300	4,300	4,300
Venezuela	130,000	142,000	147,000 ^e	149,000 ^r	150,000
Zimbabwe	2,059	1,055	728 ^r	816 ^r	1 ⁴
Total	9,540,000	10,400,000	10,800,000 ^r	11,200,000 ^r	11,100,000

^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 22, 2005.

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

⁴Reported figure.

⁵Source: Departamento Nacional de Produção Mineral (DNPM) [Brazilian Bureau of Mines], Mineral summary 2001, Feldspar, accessed May 13, 2003, at URL <http://www.dnpm.gov.br/dnptmengl.html>.

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

⁷In addition, the following quantities of aplite ore were produced in metric tons: 2000—330,000 (estimated); 2001—310,000 (estimated); 2002—403,000 (revised estimate); and 2003-04—300,000 (estimated).

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