

# FELDSPAR AND NEPHELINE SYENITE

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Feldspars are the Earth's most abundant mineral group, estimated to constitute 60% of the Earth's crust (Kauffman and Van Dyk, 1994). They are aluminum silicate minerals that contain varying proportions of calcium, potassium, and sodium. Nepheline syenite is a light-colored, silica-deficient feldspathic rock made up mostly of sodium and potassium feldspars and nepheline. Although not mined in the United States for glass and ceramic use, nepheline syenite was imported from Canada.

## Feldspar

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, which lowers 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).

Glass containers continued to be a major end use of feldspar. In 2003, shipments by U.S. producers of glass containers were about 3% less than in 2002 (U.S. Census Bureau, 2003§<sup>1</sup>). In the housing and remodeling markets, feldspar was used in glass fiber insulation, sanitaryware, and tile. Housing starts were about 1.85 million, which was about 8% more than in 2002 (U.S. Census Bureau, 2004§). This construction activity appears to have maintained feldspar demand on a level comparable with that of 2002.

**Production.**—U.S. production of marketable feldspar in 2003, based on reported and estimated data, was about 800,000 metric tons (t) with a value of about \$43 million (tables 1, 2). Feldspar was mined in seven States, which were, in descending order of output, North Carolina, Virginia, California, Georgia, Oklahoma, Idaho, and South Dakota. North Carolina accounted for about 45% of the total. Ten companies mined feldspar, 9 of which operated 12 beneficiation facilities—4 in North Carolina, 3 in California, and 1 in each of the 5 remaining States listed in table 3.

Data on domestic production and sales and usage of data for 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. This represented about 64% of the 2003 production listed in tables 1 and 2. Production for the remaining 6 operations was estimated from prior-year production levels. For U.S. feldspar sold or used by producers, 3 of the 12 operations responded by the canvass closeout date, representing less than 20% of the data in table 4. Sales and usage data for the remaining nine operations were estimated from prior-year production levels.

Alchemy Ventures Ltd. continued with the development of its Helmer-Bovill property in Latah County, ID. Work completed thus far on the granitoid rocks indicated that a sodium feldspar can be produced. Also, significant areas of potassium feldspar mineralization have been identified, and earlier test work confirmed that a quality potassium feldspar product can be produced. Studies were ongoing to assess the market demand for the company's potassium feldspar products. The company was proceeding with its proposed name change to i-minerals inc. (Kauffman, 2004§). Zemex Corp. (the parent company of The Feldspar Corp.) signed an agreement with Cementos Pacasmayo SAA of Peru for the acquisition of 100% of Zemex's outstanding shares by a Pacasmayo-controlled company. Pacasmayo is a major producer of cement and lime in Peru and also owns deposits of clay, diatomite, sand, and zeolite, which it uses in the manufacture of cement (Industrial Minerals, 2003b).

**Consumption.**—Of the domestic feldspar sold or used, an estimated 70% 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 30% 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.

**Foreign Trade.**—U.S. feldspar exports were 8,950 t in 2003, about 7% less than in 2002. U.S. imports of feldspar were 7,980 t, which was 46% higher than in the previous year. For the first time, Turkey appeared as an exporter to the United States, with 1,800 t. However, the customs unit value of Turkish material, about \$177 per metric ton, appears somewhat high. The customs unit value of imported feldspar from Mexico was about \$96 per metric ton.

**World Review.**—Feldspar is produced in more than 50 countries. Italy produced an estimated 2.5 million metric tons (Mt) of feldspathic materials in 2003, followed by Turkey with 1.8 Mt, and the United States with 800,000 t. Although official production data are not available, China has been estimated, by some sources, to have output of 1 million to 2 million metric tons per year (Mt/yr) (Roskill Information Services Ltd., 2002, p. 46).

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

**Australia.**—Monto Minerals Ltd. continued with development of its Goondicum Crater project near Monto, eastern Queensland. The site is 130 kilometers (km) south of Gladstone and has a significant deposit of apatite (used in fertilizer production), feldspar (used in glass and ceramics), and ilmenite (used to make white pigment). A pilot plant was to be constructed to produce in 12 weeks an estimated 2,500 t of feldspar, 1,000 t of ilmenite, and 500 t of apatite. Bulk samples would then be sent to specific potential customers to run full-scale plant trials (Monto Minerals Ltd., 2003§).

**Egypt.**—Gippsland Ltd. announced a purchase agreement with a major European group of companies for ceramic-grade feldspar from its Abu-Dabbab tantalum-feldspar project. Gippsland also was continuing to evaluate feldspar markets in France, Germany, the Middle East, Portugal, Spain, and Southeast Asia (Gippsland, Ltd., 2003§).

**France.**—Total feldspar production was an estimated 650,000 t according to data obtained by the USGS. Denain-Anzin Mineraux SA has been the sole producer with 80% of sales going into tiles, 15% to glass, and 5% to sanitaryware (Crossley, 2003d).

In recent years, production of sanitaryware has been about 5 million pieces per year of vitreous china. Consumption has been about 8 million pieces per year (including fire clay goods) with imports coming from Eastern Europe, the Middle East, Northern Africa, and Western Europe. About 70% of demand was said to go to renovation and replacement (Crossley, 2003b).

France has had a long heritage of tableware production, especially for porcelain. The country also has gained a reputation for brightly colored earthenware. However, growth of the tableware sector has been fairly modest. The tile industry has been declining slightly in recent years, but quality levels are increasing to supply the higher value market and to counteract competition from Northern Africa and Turkey. Tile demand was focused more on renovation than on new construction (Crossley, 2003b).

**Spain.**—Paris, France-based Denain Anzin Mineraux SA (DAM) acquired 80% of Minas de Alcantara (Minalca), a producer of potassium feldspar. Minalca began operation in 2000 and sold 43,000 t in 2002. Markets included glass, glazes, and tile producers in Portugal and Spain (Industrial Minerals, 2003a).

**Turkey.**—Kaltun Madencilik Tic. A.Ş. was the country's largest feldspar producer with 850,000 t in 2002. The company was planning completion of a new 150,000-metric-ton-per-year (t/yr) flotation plant in the second half of 2003. Çine Akmaden Madencilik, another large producer, was completing construction of a new 1.5-Mt/yr crushing and screening plant and a 120,000-t/yr flotation plant. Esan Eczacıbaşı Endüstriyel Hammadeler San. ve Tic. A.Ş. was planning to construct a new crushing and blending plant in the Cine region to supply feldspar for the local market and for export from Izmir Port. Some additional investments were being made at the Milas flotation plant and the Guluk crushing and blending facilities (Crossley, 2003a).

**Outlook.**—Growth in the United States in the glass container market, a major end use of feldspar, may be modest during the next few years according to a report from The Freedonia Group. Plastic containers continue to be more widely used for most beverages. Worldwide, possibilities for growth in glass containers appear greater in certain areas according to Owens-Illinois Inc., one of the world's largest glass container manufacturers. These areas include the Asia Pacific region, Central and Eastern Europe, and parts of South America (Grahl, 2003b).

Glass fiber insulation containing feldspar used in commercial, industrial, and residential acoustic and thermal insulation may see the greatest growth in Eastern Europe and the Commonwealth of Independent States. In some warmer parts of Asia, where the construction industry is less developed, growth in glass fiber insulation is less pronounced but still increasing (Crossley, 2003c).

Dinnerware in the United States, especially fine china and tableware, has seen reduced demand during the past 2 years. According to some sources, a shift by consumers away from more formal fine china dinnerware to less formal china patterns reflects a more informal lifestyle in the United States. This has led to some chinaware plant closures (Grahl, 2003a).

U.S. tile production was about 59 million square meters in 2002 (latest data). U.S. tile consumption was about 244 million square meters. Italy supplied about 27% of the U.S. market; Spain, 15%; Mexico, 11%; and Brazil, 9%. China, with about one-half of the world's capacity to make tile, has not yet been a major exporter to the United States. However, China's tilemaking technology is said to be very modern, and Chinese tile may become a significant competitor in the next few years (Daniels, 2003).

## 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.

Canada and Norway produced nepheline syenite for glass and ceramic use. In Canada, Unimin Canada, Ltd., the sole producer, operated two plants at its Blue Mountain deposit, about 175 km northeast of Toronto, Ontario. Production of marketable nepheline syenite was estimated to be about 710,000 t in 2003. [The British Geological Survey (2003, p. 308) reported output to be 719,000 t in 2001 (latest data)]. About one-half of the output was sold in Canada, and most of the remainder was exported to the United States (Roskill Information Services Ltd., 2002, p. 44). Detailed end-use data in recent years have not been available, but historically end uses have been in glass, ceramics, and pigments and fillers.

Unimin Canada was planning to increase its micronized nepheline syenite capacity at the Blue Mountain operation by 30%. The fine-ground products are sold as functional additives, fillers or pigment extenders in coatings, paints, and plastics (Mineral Price Watch, 2003).

In Norway, North Cape Minerals AS produced nepheline syenite from an underground mine on the arctic island of Stjernoya; output was estimated to be about 330,000 t in 2003. [The British Geological Survey (2003, p. 308) reported output of about 330,000 t in 2001 (latest data)]. End-use data have not been available in recent years, but end uses in the past have included glass (including amber glass), ceramics, and fillers. In 2001 (latest data), the nepheline syenite was exported to Germany, Poland, the United Kingdom, and other countries (Roskill Information Services Ltd., 2002, p. 107).

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

		1999	2000	2001	2002	2003
United States:						
Feldspar, produced:						
Quantity <sup>e, 2</sup>	metric tons	875,000	790,000	800,000	790,000	800,000
Value <sup>e, 2</sup>	thousands	\$42,700	\$44,500	\$44,100	\$42,800	\$43,000 <sup>3</sup>
Exports: <sup>4</sup>						
Quantity	metric tons	9,880	11,400	5,460	9,590	8,950
Value <sup>5</sup>	thousands	\$1,160	\$1,490	\$1,410	\$1,370	\$1,310
Imports for consumption: <sup>4</sup>						
Quantity	metric tons	6,840	7,220	6,140	5,450	7,980
Value <sup>6</sup>	thousands	\$757	\$726	\$749	\$775	\$1,020
Nepheline syenite, imports for consumption: <sup>4, 7</sup>						
Quantity	metric tons	311,000	356,000	336,000	333,000	308,000
Value <sup>6</sup>	thousands	\$23,200	\$24,800	\$24,100	\$26,100	\$28,200
Consumption, apparent <sup>e, 8</sup>	thousand metric tons	1,180	1,140	1,140	1,120	1,100 <sup>3</sup>
World, production <sup>e, 9</sup>	do.	9,980	9,540 <sup>r</sup>	10,400 <sup>r</sup>	10,700 <sup>r</sup>	10,800 <sup>e</sup>

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

<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.

<sup>3</sup>Rounded to two significant digits because of estimated data.

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

<sup>5</sup>Free alongside ship 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
2002	340 <sup>r</sup>	19,000 <sup>r</sup>	450 <sup>r</sup>	24,000 <sup>r</sup>	790	43,000 <sup>r</sup>
2003	330	17,000	470	26,000	800	43,000

<sup>r</sup>Revised.

<sup>1</sup>Data are rounded to two significant digits because of estimated data.

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

TABLE 3  
U.S. PRODUCERS OF FELDSPAR IN 2003

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.	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<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

Use	2002		2003	
	Quantity	Value <sup>r</sup>	Quantity	Value
Glass <sup>3</sup>	530 <sup>r</sup>	28,000	560	29,000
Pottery and miscellaneous	260 <sup>r</sup>	17,000	240	16,000
Total	790	45,000 <sup>4</sup>	800	46,000 <sup>4</sup>

<sup>r</sup>Revised.

<sup>1</sup>Data are rounded to two significant digits because of estimated data; may not add to total shown.

<sup>2</sup>Includes hand-cobbed feldspar, flotation-concentrate feldspar, feldspar in feldspar-quartz mixtures, and aplite.

<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 2003

(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. 435, December 2003, p. 74.

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

Country	2002		2003	
	Quantity (metric tons)	Value <sup>2</sup>	Quantity (metric tons)	Value <sup>2</sup>
Canada	1,370	\$183,000	1,080	\$149,000
Chile	--	--	816	124,000
Costa Rica	1,860	239,000	1,390	180,000
Dominican Republic	125	28,200	159	33,200
Guatemala	322	42,000	389	51,700
Italy	1,180	264,000	1,320	200,000
Malaysia	280	57,600	81	22,300
Mexico	475	68,800	863	104,000
Nicaragua	1,260	167,000	2,170	277,000
Panama	2,050	145,000	--	--
Other	669 <sup>r</sup>	172,000 <sup>r</sup>	690	169,000
Total	9,590	1,370,000	8,950	1,310,000

<sup>r</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>

Country	2002		2003	
	Quantity (metric tons)	Value <sup>3</sup>	Quantity (metric tons)	Value <sup>3</sup>
Mexico	5,250	\$536,000	6,050	\$583,000
Turkey	--	--	1,800	319,000
Other	192	238,000	135	113,000
Total	5,450	775,000	7,980	1,010,000

-- 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>	1999	2000	2001	2002	2003 <sup>e</sup>
Algeria <sup>c</sup>	2,820	707 <sup>4</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
Argentina	62,926	59,466 <sup>r</sup>	62,119 <sup>r</sup>	57,801 <sup>r</sup>	60,000
Australia, includes nepheline syenite <sup>c</sup>	49,600	50,000	50,000	50,000	50,000
Brazil, processed	97,661 <sup>5</sup>	117,715 <sup>5</sup>	75,000 <sup>r,5</sup>	75,000 <sup>r,e</sup>	75,000
Bulgaria	28,000	22,000	23,000	24,000 <sup>r,e</sup>	35,000
Burma <sup>e,6</sup>	12,000	12,000	10,000 <sup>r</sup>	10,000 <sup>r</sup>	10,000
Chile	1,346	2,311	2,867	3,069 <sup>r</sup>	3,100
Colombia <sup>c</sup>	55,000	55,000	55,000	93,452 <sup>r,4</sup>	100,000
Cuba	4,800	6,700	7,000 <sup>e</sup>	7,000 <sup>e</sup>	7,000
Czech Republic	244,000	337,000	373,000 <sup>r</sup>	401,000 <sup>r,e</sup>	350,000
Ecuador	33,142	47,041	60,688 <sup>r</sup>	39,068 <sup>r</sup>	39,100
Egypt <sup>c</sup>	330,000	330,000	300,000	350,000	350,000
Ethiopia	391	285	310 <sup>e</sup>	310 <sup>e</sup>	310
Finland	40,000 <sup>e</sup>	33,200	34,289	35,000 <sup>e</sup>	36,000
France, crude <sup>c</sup>	638,000	642,000	650,000	650,000	650,000
Germany <sup>c</sup>	450,000	450,000	450,000	450,000	450,000
Greece <sup>c</sup>	78,500	96,000	95,000	95,000	95,000
Guatemala	17,072	17,804	17,000 <sup>e</sup>	17,000 <sup>e</sup>	17,100
India <sup>c</sup>	105,000	110,000	110,000	110,000	150,000
Iran	239,779	156,000 <sup>r</sup>	204,078 <sup>r</sup>	191,316 <sup>r</sup>	190,000
Italy <sup>c</sup>	2,700,000	2,500,000	2,600,000	2,500,000	2,500,000
Japan <sup>e,7</sup>	52,000	52,000	50,000	50,000	50,000
Jordan	1,000	11,112	11,500 <sup>e</sup>	12,400 <sup>r,e</sup>	12,100
Kenya	115 <sup>e</sup>	82	73	75 <sup>e</sup>	75
Korea, Republic of	409,334	330,417	389,361	415,580 <sup>r</sup>	400,000
Macedonia	11,275 <sup>r</sup>	10,057 <sup>r</sup>	20,449 <sup>r</sup>	21,000 <sup>r</sup>	20,000
Madagascar <sup>c</sup>	3	7 <sup>4</sup>	3	2 <sup>r</sup>	3
Malaysia	26,940	29,895 <sup>r</sup>	40,509 <sup>r</sup>	30,819 <sup>r</sup>	31,000
Mexico	262,241	334,439	329,591	332,101 <sup>r</sup>	330,000
Morocco	1,112	6,052	8,979	19,401 <sup>r</sup>	20,000
Nigeria <sup>c</sup>	500	1,449 <sup>r,4</sup>	1,811 <sup>r,4</sup>	1,800 <sup>r</sup>	1,800
Norway <sup>e</sup>	72,777 <sup>4</sup>	75,000	73,000	75,000	74,000
Pakistan	29,235	43,186	44,000 <sup>e</sup>	45,000 <sup>e</sup>	47,000
Peru	1,594	5,642	4,253	6,018 <sup>r</sup>	7,345 <sup>4</sup>
Philippines	16,909	3,440	33,122	30,000 <sup>e</sup>	30,000
Poland <sup>8</sup>	120,100	165,200	220,600	249,000 <sup>r</sup>	240,000
Portugal	114,688	119,837	120,000 <sup>e</sup>	120,000 <sup>e</sup>	120,000
Romania	36,635	37,157	43,047	50,864 <sup>r</sup>	50,000
Russia <sup>c</sup>	45,000	45,000	45,000	45,000	45,000
Serbia and Montenegro	3,453	4,254	4,000 <sup>e</sup>	4,000 <sup>e</sup>	4,000
Slovakia	6,000	6,000	6,000 <sup>e</sup>	6,000 <sup>e</sup>	6,000
South Africa	58,986	66,774	66,736	57,197	57,343 <sup>4</sup>
Spain, includes pegmatite <sup>c</sup>	450,000	460,000	450,000	450,000	450,000
Sri Lanka	26,012	28,638	27,438	28,866 <sup>r</sup>	29,000
Sweden, salable, crude and ground	45,000 <sup>e</sup>	35,000	40,450	40,000 <sup>e</sup>	41,000
Thailand	626,415	542,991	710,543 <sup>r</sup>	783,733 <sup>r</sup>	780,000
Turkey	1,369,655	1,147,716	1,510,293 <sup>r</sup>	1,766,887 <sup>r</sup>	1,800,000
United Kingdom, china stone <sup>c</sup>	3,000	2,000	2,000	2,000	2,000
United States <sup>c</sup>	875,000	790,000	800,000	790,000	800,000
Uruguay	1,556	2,493	4,722 <sup>r</sup>	4,700 <sup>r,e</sup>	4,750
Uzbekistan	300	4,300	4,300 <sup>e</sup>	4,300 <sup>e</sup>	4,300
Venezuela	125,000	130,000	142,000	147,000 <sup>r,e</sup>	150,000
Zimbabwe	2,250 <sup>e</sup>	2,059	1,055	591 <sup>r</sup>	400
Total	9,980,000	9,540,000 <sup>r</sup>	10,400,000 <sup>r</sup>	10,700,000 <sup>r</sup>	10,800,000

See footnotes at end of table.

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

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<sup>6</sup>Estimated. <sup>7</sup>Revised. -- Zero.

<sup>1</sup>World totals, U.S. data, 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 29, 2004.

<sup>3</sup>In addition to the countries listed, 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.

<sup>4</sup>Reported figure.

<sup>5</sup>Source: Brazilian Bureau of Mines, 2002, Feldspar, Mineral Summary 2001, accessed May 13, 2003, via URL <http://www.dnpm.gov.br/dnpgmengl.html>.

<sup>6</sup>Data are for fiscal years beginning April 1 of year stated.

<sup>7</sup>In addition, the following quantities of aplite ore were produced in metric tons: 1999--330,000; 2000--330,000 (estimated); 2001--310,000 (estimated); and 2002-2003--300,000 (estimated).

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