

Feldspar, Nepheline Syenite, and Aplite

By J. Robert Wells ¹

Domestic production and consumption of crude feldspar declined slightly in 1972, amounting to 99% of the respective 1971 figures and to 97% of those for the record year 1969. Simultaneous increases in utilization of both domestic aplite and imported nepheline syenite, however, brought the 1972 total U.S. consumption of the three feldspathic materials substantially above the corresponding total for 1971 and even farther above that for 1969. A notable feature of the 1972 feldspar situation was the sharp drop in ground feldspar imports, although again that decrease was more than balanced by increased imports of nepheline syenite.

Until about World War I it was customary to report all feldspar statistics, both crude and ground, in terms of short tons, but at that time it became the practice to

record crude feldspar production, imports, and consumption in long tons. It is now felt that any advantages of that system have long been outweighed by the difficulty of direct comparisons and by the multiple opportunities for confusion, and that a return to the earlier practice is justified. Beginning with the present 1972 Minerals Yearbook chapter, all feldspar and nepheline syenite data, without exception will be reported in short tons.

Legislation and Government Programs.

—According to provisions of the Tax Reform Act of 1969, which continued in force throughout 1972, the depletion rate allowed on feldspar production (both domestic and foreign operations) was 14%.

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Table 1.—Salient feldspar statistics

	1968	1969	1970	1971	1972
United States:					
Crude:					
Sold or used by producers.....short tons..	747,800	754,863	726,069	742,810	732,439
Value.....thousands..	\$3,265	\$8,869	\$9,638	\$9,969	\$10,372
Average value per short ton.....	\$11.05	\$11.75	\$13.27	\$13.42	\$14.16
Imports for consumption.....short tons..	--	52	252	134	187
Value.....thousands..	--	\$7	\$23	\$19	\$23
Average value per short ton.....	--	\$134.62	\$91.27	\$141.79	\$123.00
Consumption, apparent ¹short tons..	747,800	754,915	726,321	742,944	732,626
Ground:					
Sold by merchant mills.....short tons..	730,737	793,052	647,995	601,618	580,801
Value.....thousands..	\$9,242	\$10,465	\$9,458	\$8,716	\$8,990
Average value per short ton.....	\$12.65	\$13.20	\$14.60	\$14.48	\$15.48
Exports.....short tons..	14,326	6,325	5,570	3,984	5,275
Value.....thousands..	\$366	\$358	\$195	\$141	\$184
Average value per short ton.....	\$25.55	\$56.60	\$35.01	\$35.39	\$34.88
Imports for consumption.....short tons..	3,782	5,201	3,637	2,375	945
Value.....thousands..	\$91	\$128	\$93	\$65	\$20
Average value per short ton.....	\$24.06	\$24.61	\$25.57	\$27.38	\$24.34
World: Production.....thousand short tons..	2,473	2,697	2,786	2,749	2,635

¹ Measured by quantity sold or used by producers plus imports.

FELDSPAR

DOMESTIC PRODUCTION

Crude Feldspar.—North Carolina, for many years in first place and without close rival as a feldspar-producing State, scored a fifth consecutive annual increase in tonnage in 1972, reaching a point 12% above the output of 1971 and 48% above that of 5 years ago. North Carolina was followed in descending order of tonnage by California, Connecticut, South Carolina, and

Georgia. The other four producing States (Arizona, Colorado, South Dakota, and Wyoming) together contributed 2% of the national totals for tonnage and value.

Leading 1972 producers of feldspar were the Feldspar Corp., from mines in Mitchell County, N. C., Middlesex County, Conn., and Jasper County, Ga.; International Minerals & Chemical Corp., from mines in Mitchell County, N. C., and Mohave County, Ariz. (the latter sold in mid-1972);

Table 2.—Crude feldspar sold or used by producers in the United States

(Short tons and thousand dollars)

Year	Hand-cobbed		Flotation concentrate		Feldspar-silica mixtures ¹		Total ²	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1968.....	87,809	670	479,102	5,845	180,889	1,750	747,800	8,265
1969.....	67,967	494	371,301	4,912	315,595	3,462	754,863	8,869
1970.....	52,770	543	415,075	5,395	258,224	3,699	726,069	9,638
1971.....	45,258	749	442,823	5,454	254,728	3,766	742,810	9,969
1972.....	25,259	392	535,058	7,354	172,122	2,627	732,439	10,372

¹ Feldspar content.

Data may not add to totals shown because of independent rounding.

Table 3.—Production of ground feldspar, by use

(Short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Hand-cobbed:				
Glass.....	W	W	1,800	45
Pottery.....	12,294	285	12,186	263
Enamel.....	W	W	8,371	165
Soap.....	W	W	2,627	55
Other.....	24,435	530	168	4
Total.....	36,729	815	25,152	532
Flotation concentrate:				
Glass.....	W	W	256,584	3,034
Pottery.....	174,660	2,902	196,443	3,631
Other.....	255,513	2,760	5,614	127
Total.....	430,173	5,662	458,641	6,792
Feldspar-silica mixture:¹				
Glass.....	W	W	29,352	347
Pottery.....	W	W	49,284	778
Other.....	134,716	2,238	18,372	543
Total.....	134,716	2,238	97,008	1,668
Total:				
Glass.....	306,919	3,533	287,736	3,426
Pottery.....	W	W	257,913	4,672
Enamel.....	W	W	8,371	165
Soap.....	W	W	2,627	55
Other ²	294,699	5,183	24,154	674
Total ³	601,618	8,716	580,801	8,990

W Withheld to avoid disclosing individual company confidential data; included with "Other."

¹ Feldspar content.² Includes plastics, refractories, and rubber.³ Data may not add to totals shown because of independent rounding.

and Lawson-United Feldspar and Mineral Co., from mines in Mitchell County, N. C.

In 1972, 73% of the total tonnage of feldspar sold or used by producers was flotation concentrate, 24% was feldspar in feldspar-silica mixtures, and only 3% was hand-cobbed, the lowest such proportion since comparable statistics have been kept. The respective corresponding figures for 1971 were 60%, 34%, and 6%; for 1962 they were 66%, 11%, and 23%. Prior to 1952, hand-cobbed feldspar comprised virtually the entire output.

Ground Feldspar.—Most of the feldspar used in glassmaking is ground no finer than 20 mesh, but feldspar to be used in ceramics and filler applications is usually pulverized to minus 200 mesh or finer. Ten companies, operating 14 plants in eight States, ground feldspar for market in 1972, supplying ground material (total tonnage 3% less than in 1971) for shipment to destinations in at least 25 States and a number of foreign countries. Listed in descending order of output tonnages, North Carolina had six grinding mills, while Connecticut, South Carolina, and Georgia had one each. These were the leaders in ground feldspar production and jointly accounted for 94% of the 1972 total. California with one mill, South Dakota with two, Arizona with one, and Wyoming with one, were the four States making up the remaining 6%. Colorado was

the only crude feldspar-producing State in 1972 in which no grinding mill was operated.

CONSUMPTION AND USES

Crude Feldspar.—In 1972 there was, as usual, no significant domestic consumption of feldspar in the raw, unprocessed state in which it was taken from the mine; the majority of users purchased their supplies of the mineral already ground and sized either by the primary producers or by merchant grinders. Some manufacturers of pottery, soaps, and enamels, however, continued their customary practice of acquiring relatively small quantities of crude feldspar for grinding to their preferred specifications in their own mills.

Ground Feldspar.—The 1972 pattern of ground feldspar consumption in the United States was not strikingly different from that of the previous year, but the confidential status of some of the 1971 data precludes a detailed comparison. The 1971 end-use distribution, insofar as it was publishable, showed that 51% of the total was consumed for glassmaking and 49% went for pottery, enamel, and miscellaneous uses, compared with 1972 data showing 50% for glass, 44% for pottery, and 6% for enamel and other uses. These data, compared with the averages recorded in the decade of the 1960's (55% for glass,

Table 4.—Ground feldspar shipped from merchant mills in the United States

(Short tons)

Destination	1968	1969	1970	1971	1972
Arkansas	W	W	W	W	5,148
California	W	W	W	W	22,863
Illinois	64,628	51,899	44,801	W	43,361
Indiana	25,897	21,944	23,853	25,344	26,869
Kentucky	10,180	9,077	15,004	8,732	14,978
Louisiana	W	W	W	W	21,176
Maryland	W	5,057	W	W	1,037
Massachusetts	3,896	4,072	W	W	W
Michigan	W	1,438	W	W	527
Mississippi	8,685	8,931	15,187	16,060	16,057
Missouri	W	—	—	W	4,595
New Jersey	W	W	W	W	44,425
New York	20,311	19,668	W	W	17,178
Ohio	87,202	120,756	94,010	56,783	63,472
Oklahoma	18,385	31,203	14,200	W	12,546
Pennsylvania	27,333	23,566	21,884	19,479	20,175
Tennessee	26,898	29,153	W	W	34,332
Texas	24,449	21,776	32,365	31,984	20,607
West Virginia	34,720	29,465	30,339	W	35,658
Wisconsin	—	—	W	—	6,775
Other destinations ¹	378,153	415,047	356,352	443,236	169,022
Total	730,737	793,052	647,995	601,618	580,801

W Withheld to avoid disclosing individual company confidential data; included with "Other destinations."
¹ Includes Colorado, Minnesota, Rhode Island, Washington, and States indicated by symbol W. Also includes exports to Canada, Mexico, and other countries.

30% for pottery, 4% for enamel, and 11% for other purposes), suggest a trend toward relatively greater consumption of feldspar for pottery and less for enamel and the other minor applications. In contrast, the proportion of feldspar consumption allotted to glass manufacture has remained comparatively stable since the early 1950's even though the container-glass industry has grown notably in the interim (shipments of glass containers more than doubled in volume from 1952 to 1972). The relatively static position of glass-grade feldspar in the consumption pattern appears to be a reflection of the progressively increasing utilization of imported nepheline syenite (seven times more tonnage in 1972 than in 1952) at the expense of feldspar, as a feldspathic material for glassmaking.

STOCKS

Comparison of the figures reported for 1972 domestic production and sales of feldspar indicated that industrial stocks of that mineral may have risen by approximately one-half during the year. It was estimated that U.S. producers had 440,000 short tons of mined feldspar on hand (crude, ground, or in process) on December 31, 1972, compared with 288,000 tons on that date in 1971 and 149,000 tons in 1970.

PRICES

Engineering and Mining Journal, December 1972, listed the following prices for feldspar per short ton, f.o.b. mine or mill, carload lots, bulk, depending on grade (substantially unchanged from the respective 1971 quotations):

North Carolina:	
20 mesh, flotation.....	\$12.00
40 mesh, flotation.....	14.00- 21.00
200 mesh, flotation.....	21.50- 27.50
Georgia:	
40 mesh, granular.....	20.00
200 mesh.....	24.50
325 mesh.....	25.50
Connecticut:	
20 mesh, granular.....	15.50
200 mesh.....	22.50
325 mesh.....	23.50

Feldspar prices were quoted by Industrial Minerals (London), December 1972, as follows (converted from pounds sterling per long ton to dollars per short ton):

Ceramic grade, powder, 200 mesh, bagged, ex-store.....	\$47- 51
Lump, imported, c.i.f. main European port.....	23- 28

As of July 3, 1972, International Minerals & Chemical Corp. (Canada), Ltd., increased prices for two classifications of its B-grade nepheline syenite (0.5% Fe₂O₃, used for various industrial purposes), minus 30-mesh material from \$8.00 per ton to \$8.60 per ton, and 40 DD material from \$8.50 per ton to \$9.15 per ton, in bulk, f.o.b. Blue Mountain, Ontario. Prices for the firm's low-iron grades (0.07% Fe₂O₃, used in the making of glass and fine ceramics) ranged up to \$22.00 per ton.

Ceramic Industry Magazine, January 1973, quoted prices for aplite in the range from \$6.30 to \$12.40 per ton.

Although the foregoing quotations presumably were indicative of price ranges, it is to be understood that most actual sales of feldspar and feldspathic materials in 1972 were concluded as is customary both in the United States and abroad, at negotiated prices not on public record.

FOREIGN TRADE

In 1972, U.S. exports included 5,275 short tons of material indeterminately classified as feldspar, leucite, nepheline, or nepheline syenite (but presumably all or mostly feldspar) with a total value of \$183,649, up 32% and 30% from the respective comparable figures for 1971.

Statistics on U.S. feldspar imports, substantially all from Canada, were first reported in a separate category toward the end of 1922. Thereafter, feldspar imports (with the exception of those in the depression years 1932 and 1933) averaged in the neighborhood of 20,000 short tons per year until 1952, when large-scale domestic production of flotation concentrate feldspar overturned existing market patterns. After 1957, imports of feldspar in all forms held relatively steady around an annual average of 4,500 tons, but fell to 2,509 tons in 1971 and (coinciding with the closure of Canada's only remaining feldspar mine) to 1,132 tons in 1972. Imports of Canadian nepheline syenite (one of feldspar's most effective competitors as a feldspathic material) amounted in 1972 to 11% more quantity and 16% more total value than in 1971, the eleventh in a consecutive series of annual increases, pointing to an obvious rationale for feldspar's reciprocally waning significance as an import item. In 1972, U.S. imports included, besides materials definitely in the feldspathic cate-

Table 5.—U.S. imports for consumption of feldspar

Country	1971		1972	
	Short tons	Value	Short tons	Value
Crude: Canada.....	184	\$19,020	187	\$23,105
Ground, crushed or pulverized:				
Canada.....	2,051	54,858	748	16,940
Japan.....	1	432	--	--
Mexico.....	16	288	--	--
Sweden.....	121	4,230	49	1,742
United Kingdom.....	186	5,113	148	1,125
Total.....	2,375	64,921	945	19,807

gory, 4,700 short tons of material valued at \$305,227 and classified as "natural mineral fluxes, crushed, ground, or pulverized," at least part of which may have been consigned to uses similar to those served by feldspar.

The tariff schedule in force throughout 1972 provided for a 3½% ad valorem duty on ground feldspar. Imports of crude feldspar and of nepheline syenite, crude or ground, were not subject to duty.

WORLD REVIEW

Significant quantities of feldspar were produced in 1972 in at least 35 countries. Feldspar flotation plants were in essentially full-time operation in the United States, Finland, Mexico, and Norway, while dry grinding of feldspar was reported in the United States, France, Italy, and West Germany. Other countries, including several in the Communist group, also processed the mineral in local facilities for their own domestic industries. Nepheline syenite was produced in Canada, mainly for consumption in the United States, and in Norway for markets in western Europe. The U.S.S.R. probably had substantial production of this material also, but definite information was not published.

Brazil.—Feldspar was produced from pegmatitic deposits in east and southeast Brazil and was used in the major industrial centers, especially São Paulo and Rio de Janeiro, mostly for the manufacture of glass and ceramics. Specific data were not released, but the year's output was estimated to lie somewhere in the range of 70,000 to 80,000 tons.

Canada.—International Minerals & Chemical Corp. (Canada), Ltd., Canada's only feldspar producer in recent years, suspended operations at its Buckingham plant in Quebec, reportedly because of declining

demand for that mineral. That same firm is Canada's second-largest producer (after Indusmin, Ltd., a subsidiary of Falconbridge Nickel Mines, Ltd.) of the leading alternative feldspathic material, nepheline syenite.

Germany, West.—Besides being among the world's top two or three feldspar producers, West Germany is also a large importer of feldspathic materials. Imports of feldspar, leucite, and nepheline syenite totaled 90,000 short tons in 1970 and 97,000 short tons in 1971. At Hirschau (Bavaria) in what is now West Germany, a private company was founded in 1895 by the Dorfner brothers for manufacturing stoneware and mining kaolin to use as a raw material. The enterprise has remained in the hands of succeeding generations of the same family for nearly eight decades, although making of stoneware stopped in 1920. Present activities of the company concentrate on the mining, processing, and marketing of water-washed kaolin, ground quartz, quartz sands, and potash feldspar.

India.—Total minehead value of India's 1971 production of feldspar was reported at 336,000 rupees, equivalent to \$45,000, compared with 275,000 rupees (\$37,000) in 1970. Exports accounted for 31% of the output in 1971 (36% in 1970), but different systems of reporting preclude a direct comparison between value of exports and value of production.

Israel.—One of the announced results of a 5-year scientific survey of the Sinai Peninsula was the discovery of a large feldspar deposit (described as "a whole mountain several kilometers square"). No analysis was mentioned, but quality of the mineral was said to be good. The site of the discovery, "only half an hour's drive from Sharm el-Sheikh," would seem to justify rating the deposit as a potentially valuable resource for the not-distant future.

Italy.—In 1971, last year for which data have been released, Italy exported 30,000 short tons of feldspar, 4% more than in 1970. West Germany and Greece were, as usual, the principal recipients of the exported mineral.

Norway.—Norway customarily exports more than half her feldspar output and a much larger share of her production of nepheline syenite. Feldspar output in 1971 was 165,000 short tons, of which 87,500 short tons (53%) was exported; nepheline syenite production was 176,500 short tons, of which nearly all (98%) was shipped to foreign destinations.

South Africa, Republic of.—In a catalogue of working mines, as of December

31, 1969, 11 mines were listed as producing feldspar. Mica and silica were mentioned as coproducts from a number of those operations. Active feldspar mines were situated in the Namaqualand district (one mine) and the Kenhardt district (two mines) of Cape Province; and the Lataba district (eight mines) of Transvaal Province. About 70% of the 1970 feldspar production was exported (14,500 out of 20,800 short tons), while in 1971 exports slightly exceeded the year's mine output (13,500 short tons produced, 13,600 short tons exported).

United Kingdom.—Charter Exploration, Ltd., a London-based mining firm, announced plans to undertake the mining

Table 6.—Feldspar: World production by country

(Short tons)

Country ¹	1970	1971	1972 ²
North America:			
Canada (shipments).....	10,656	10,774	10,000
Mexico.....	† 94,518	109,506	† 110,000
United States (sold or used).....	726,069	742,810	732,439
South America:			
Argentina.....	32,558	39,996	† 40,000
Chile.....	3,963	992	1,771
Colombia.....	25,521	27,377	29,055
Peru.....	3,156	† 3,300	† 3,300
Uruguay.....	1,218	1,332	1,070
Europe:			
Austria.....	1,329	2,928	3,391
Finland.....	68,482	70,616	65,982
France.....	† 260,000	212,000	146,000
Germany, West.....	450,634	389,879	336,814
Italy.....	† 195,004	212,192	193,805
Norway ²	167,711	† 165,000	† 165,000
Poland ^e	33,000	33,000	33,000
Portugal.....	33,961	20,691	17,187
Spain ³	60,720	68,050	† 68,000
Sweden.....	† 35,180	† 35,000	† 35,000
U.S.S.R. ^e	276,000	276,000	287,000
United Kingdom (china stone) ^e	37,000	37,000	37,000
Yugoslavia.....	54,568	59,103	† 61,000
Africa:			
Egypt, Arab Republic of.....	1,970	3,495	† 3,300
Kenya.....	987	2,921	2,163
Malagasy Republic.....	1	NA	NA
Mozambique.....	32,690	17,960	16,085
South Africa, Republic of.....	20,829	13,492	27,912
Asia:			
Burma.....	4,895	4,766	881
Hong Kong.....	1,787	1,262	1,267
India.....	† 32,656	48,762	54,991
Japan ⁵	64,354	57,843	63,662
Korea, Republic of.....	30,998	18,615	31,939
Pakistan (formerly West-Pakistan).....	152	336	265
Philippines.....	22,306	61,539	50,774
Sri Lanka (formerly Ceylon).....	1,425	234	638
Oceania: Australia.....	† 3,896	4,017	† 4,000
Total.....	† 2,786,199	2,748,838	2,634,691

^e Estimate. ² Preliminary. [†] Revised. NA Not available.

¹ In addition to the countries listed, Brazil, People's Republic of China, Czechoslovakia, Romania and Territory of South-West Africa produce feldspar, but available information is inadequate to make reliable estimates of output.

² Described in source as lump feldspar; does not include nepheline syenite as follows, in short tons: 1970—162,088; 1971—176,470; 1972—^e 176,000.

³ Includes pegmatite.

⁴ Data are for years ending June 30 of that stated.

⁵ In addition the following quantities of apatite and saba were produced: apatite: 1970—514,508; 1971—448,162; 1972—501,648; saba: 1970—10,748; 1971—6,005; 1972—1,336.

and processing of feldspar from a newly discovered deposit, near Durness in Scotland's Sutherland County. The deposit contains at least 2 million tons of recoverable mineral of industrial quality. It was anticipated that expenditure of \$1.2-\$1.7 million would be sufficient to set up facilities to initiate operations at the rate of 50,000 tons per year. At present, all feldspar consumed in the United Kingdom is obtained by importation, mostly from Finland, Norway, and Yugoslavia.

A symposium, designated as the Advanced Study Institute on Feldspars, was held at the University of Manchester in July 1972. Membership of the Institute, which was sponsored by NATO, consisted of lecturers and students, many of whom presented research papers dealing with specific aspects of the study of feldspars and related disciplines. Publication of the Institute's act was expected in late 1972 or early 1973.

TECHNOLOGY

Magazine articles were published that outlined the mining, milling, and flotation procedures being used by a West German firm in the production of a number of ceramic raw materials including 18,000 tons per year of glass-grade feldspar,² and by a company in Finland that has an annual output of 70,000 tons of feldspar concentrate and 30,000 tons of quartz concentrate for the making of glass and ceramics.³

The technological aspects of the selection, quality control, and preparation of ceramic materials, including feldspar, and of their fabrication into special-purpose insulators were some of the subjects dealt with in a journal article.⁴ Feldspar was one of the raw materials mentioned in a magazine article as an ingredient in body formulations for efficient production of ceramic tile.⁵ Important advances in white-ware firing technology were discussed in an industrial journal. It was stated that, for best results, the fluxes used have to be specially selected. Economy of soaking time at maximum temperature, for example, was achieved by the use of nepheline syenite in lieu of feldspar in the body mixtures.⁶

Although porcelain enameling on metal has been a feature of a number of human cultures for at least twenty centuries, no end is yet in sight for advances in this ancient art. Feldspar in varying proportions enters into most enamel formulas, and the

permutations of those variations with the large number of other compositional possibilities permits the compounding of literally thousands of different types of enamel frits suitable for a range of applications extending from multicolored jewelry for personal adornment to large expanses of weather-resistant paneling for major buildings. How well porcelain enameling is keeping pace with today's metallurgical and structural progress was the subject of a journal article.⁷

The one most important outlet for feldspathic materials is in the manufacture of glass bottles and jars to contain beverages, foods, and pharmaceutical products. A substantial majority of such containers, for reasons of convenience and even of actual economy, are discarded after a single use. Salvaged glass, crushed to sand size and amounting to 5 percent of the furnace charge, was mixed with customary raw materials at a Pennsylvania glass works and melted down in a 24-hour, commercial-scale test to produce $3\frac{1}{2}$ thousand gross of new beverage bottles. The waste glass for this successful test, of which the environmental and conservational implications are obvious, was recovered from city incinerator residues by a process and in a pilot plant both developed by the Bureau of Mines. As another part of its continuing research program in quest of advantageous outlets for scrap glass, the Bureau of Mines issued a report concerning experimental production of glass wool from the glass fractions of urban solid waste.⁸

A booklet⁹ published by an association of concerned industrialists presented a chalk-talk discussion of the contribution of container glass to the urban refuse situation and outlined some of the association's

² Industrial Minerals (London). Operations of Gebruder Dornier at Hirschau. No. 53, February 1972, pp. 17-19.

³ Mining Magazine (London). Finnish Feldspar Plant. V. 127, No. 5, November 1972, pp. 439, 441.

⁴ Jordan, Roy E., Jr. Ceramic Insulator Co.: Newcomer With Experience. *Ceram. Age*, v. 88, No. 3, March 1972, pp. 11-12, 21.

⁵ Ceramic Industry Magazine. The Ideal Tile Plant! V. 99, No. 2, pp. 36-37.

⁶ Harkort, Dietrich, and Ulrich Hoffman. Germany Streamlines Firing Operations. *Ceram. Ind. Mag.*, V. 99, No. 4, October 1972, pp. 26-29.

⁷ Spencer-Strong, G. H. Porcelain Enamels—A Concept in Transition. *Materials Research and Standards*, v. 12, No. 4, April 1972, pp. 20-23.

⁸ Goode, Alan H., M. E. Tyrrell, and I. L. Feld. Glass Wool From Waste Glass. *BuMines Rept. of Inv.* 7708, 1972, 16 pp.

⁹ Glass Container Manufacturers Institute, Inc. *The Solid Waste Fact Book*. New York, 1972, 27 pp.

activities that are being devoted to efforts to defuse that component of the problem. Toward that end, the organization has undertaken a program to investigate the possibilities, technologies, and economic involvements of the salvaging and reutilization of waste container glass in potentially profitable enterprises. Goals of this research include the development of economical processes for mechanically separating glass from other solid wastes, for using the maximum amount of the material so recovered in the making of new glass containers, and for channeling the rest into commercially viable applications.

NEPHELINE SYENITE

Nepheline syenite is a feldspathic igneous rock with a texture similar to that of granite that is extensively used in place of feldspar as an alumina-bearing raw material for glassmaking and in the white-ware industry both as a body component and in frits for glazing. In a relatively recent development, increasing quantities of nepheline syenite are being ground to extreme fineness for use as a filler in plastics, foam latex products, paper, and paint. Nepheline syenite mined in the United States (Arkansas) is used only as stone (mostly for roofing granules or road metal); all nepheline syenite consumed here for glass and ceramics is imported from Canada, the world's foremost producer. Canada's 1972 shipments of nepheline syenite (all from two operations at Blue Mountain, Ontario) were estimated at 560,000 short tons, valued at \$7.07 million. The average unit values reported for

A number of articles appeared in industrial journals that dealt with the current status of glass recycling technology.¹⁰ Possible applications for the reclaimed material were discussed that, in addition to the reworking into new containers, included use in the production of road-surfacing aggregates, building blocks, bricks, structural panels, terrazzo tiles for flooring, sewer and drain pipes, insulating materials, and decorative or light-reflecting paints. Also mentioned were several smaller scale uses ranging from costume jewelry to poultry grit.

Canadian production and U.S. imports of ground nepheline syenite in 1972 were \$12.62 and \$12.45 per short ton, respectively, or about 5% more than the comparable figures for 1971. The world's second-largest producer of glass- and ceramic-grade nepheline syenite is Norway; shipments from that source in 1971 amounted to 165,000 short tons. The U.S.S.R. also mines nepheline syenite on a commercial scale, but reportedly the output is used only for production of metallurgical-grade alumina.

Table 7.—U.S. imports for consumption of nepheline syenite

Year	Crude		Ground	
	Short tons	Value (thousands)	Short tons	Value (thousands)
1970 -----	603	\$2	395,289	\$4,634
1971 -----	636	12	413,862	4,912
1972 -----	3,027	43	456,406	5,681

APLITE

Aplite is a granitic rock with a high proportion of albite (soda feldspar) or plagioclase (lime-soda feldspar), either of which makes it potentially useful as a raw material for the manufacture of container glass. To become acceptable for that purpose, however, the mined material usually must first be processed to eliminate all but a trace of the iron-bearing minerals it contains. Aplite of glassmaking quality was produced in the United States in 1972 from two open pit mines in central Virginia. The Feldspar Corp. mined aplite ore near Montpelier, Hanover County, and re-

moved iron from it by an electrostatic process. International Minerals & Chemical

¹⁰ Svec, J. J. Industry Involvement Speeds Glass Recycling. *Ceram. Ind. Mag.*, v. 96, No. 2, February 1971, pp. 22-24.

Hanot, William. 40 Years of Recycling. *Am. Ceram. Soc. Bull.*, v. 51, No. 6, June 1972, pp. 519-522.

Pincus, Alexis G. Recycling High on Glass Horizon. *Glass Ind.*, v. 53, No. 6, June 1972, p. 10.

Environmental Science & Technology. Building Bricks From the Waste Pile. V. 6, No. 6, June 1972, pp. 502-503.

Shutt, T. C., H. Campbell, and J. H. Abrahams, Jr. New Building Materials Containing Waste Glass. *Am. Ceram. Soc. Bull.*, v. 51, No. 9, September 1972, pp. 670-671.

Environmental Science & Technology. Glass Recycling Makes Strides. V. 6, No. 12, November 1972, pp. 988-990.

Corp. operated a mine near Piney River, Nelson County, and subjected the crude aplite to a high-intensity treatment to separate iron minerals. Aplite mine production in 1972 continued the upward trend of recent years and was 6% greater in ton-

nage than in 1971, although the reported total value was sharply lower. Specific annual data on aplite production, sales, and value have not been released for publication since 1962. That year's output was 140,000 short tons, valued at \$0.9 million.

