VERMICULITE

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Flakes of raw vermiculite concentrate are micaceous in appearance and contain interlayer water in their structure. When the flakes are heated rapidly at a temperature above 870^N C, the water flashes into steam, and the flakes expand into accordionlike particles. This process is called exfoliation, or expansion, and the resulting lightweight material is chemically inert, fire resistant, and odorless. In lightweight plaster and concrete, vermiculite provides good thermal insulation. Vermiculite can absorb such liquids as fertilizers, herbicides, and insecticides, which can then be transported as free-flowing solids (Harben and Kuzvart, 1996, p. 432).

Production

Since 1995, data regarding the total amount of U.S. vermiculite sold and used as concentrate have been proprietary and have been withheld. In 1998, domestic producers of vermiculite concentrate were W.R. Grace & Co., from its operation at Enoree, SC, and Virginia Vermiculite Ltd., with operations near Woodruff, SC, and in Louisa County, VA.

Output of exfoliated vermiculite sold or used in 1998 was an estimated 170,000 metric tons (t) (table 1). Domestic production of exfoliated vermiculite sold or used was by 13 companies operating 20 plants in 11 States (table 2). Of these plants, four in four States were believed to have been operated by W.R. Grace. The largest producing States of exfoliated vermiculite, based on partly estimated data and in descending order of output sold and used, were South Carolina, Ohio, Arkansas, Arizona, Pennsylvania, New Jersey, and Illinois.

Domestic production data for vermiculite were collected by the U.S. Geological Survey from two voluntary surveys—one for mine/mill operations and the other for exfoliation plants. Of three mine/mill operations, data were obtained for one. Production for the two nonrespondents was estimated on the basis of previous years' production levels and estimates. Of the 20 exfoliation plants, data were obtained from 11 for a response rate of 55%. By tonnage, the 11 operations represented an estimated 56% of the output. Production for the nine nonrespondents was estimated on the basis of previous years' production levels.

Stansbury Holdings Corp., Warminster, PA, was planning to enter a joint-venture agreement with Nevada Vermiculite LLC to mine and mill vermiculite concentrates (North American Mineral News, 1999). The joint-venture company would be known as International Vermiculite Ltd. Stansbury owned a large vermiculite deposit at Hamilton, MT. Channel and Basin Reclamation Inc., a California-based sand and gravel producer, would contribute capital, equipment, and operational expertise

to the mining and milling operation.

W.R. Grace & Co. completed construction on a \$1.5 million Microlite (vermiculite dispersion) production facility in South Carolina (Moeller, 1999).

Consumption

Most vermiculite concentrate is exfoliated prior to use; end uses are shown in table 3. Because of its heat-resisting properties, exfoliated vermiculite can be used in friction materials such as brakes and clutches. It may also be used as an insulator to slow the cooling of molten metal or to clean molten steel by capturing some of the slag in the ingot molds (Harben and Kuzvart, 1996).

New uses for vermiculite included liquid vermiculite dispersions in, for example, flexible films for packing and gaskets. Other uses included fire-resistant construction boards and panels and hazardous waste solidification (Moeller, 1999).

Prices

Published prices are meant to serve as a general guide only. According to Industrial Minerals (1998), yearend prices for U.S. bulk vermiculite concentrate (explant) were about \$143 to \$220 per ton, depending on particle size. For imported South African crude, bulk, vermiculite, (f.o.b. barge, Gulf Coast), prices ranged from \$187 to \$243 per ton.

Foreign Trade

Trade data for vermiculite are not collected as a separate category by the Bureau of the Census, but are included with a number of other mineral commodities in a basket category. According to preliminary data (Vagt, 1998), exports of vermiculite concentrate from the United States to Canada were about 11,000 t. About 1,800 t of U.S. material was exported in 1998 to destinations other than Canada and Mexico, according to the Journal of Commerce Port Import/Export Reporting Service. (The Journal of Commerce data do not include material imported from or exported to or through Canada and Mexico.) Total U.S. imports of vermiculite were about 68,000 t, according to the Journal of Commerce. South Africa supplied more than 60%, and China, about 35% of this total.

World Review

In 1998, world production, excluding the United States, was estimated to be 292,000 t (table 4). South Africa continued to

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be the largest producer of vermiculite, with an estimated 210,000 t. In Australia (not shown in table 4), Australian Vermiculite Industries Pty. Ltd. produced about 10,000 tons from its operation near Alice Springs; the company began operation in 1995. In China (not shown in table 4), vermiculite was produced in Xingiang Province, with exports to Asia and North America (Russell, 1998).

Outlook

Some of the commercial applications of vermiculite overlap those of expanded perlite, such as in horticulture (Lin, 1998). A potential use of vermiculite in the raw (unexfoliated) form may be in the production of high-quality cement. Other possible future applications for raw vermiculite include use in formulations of fireproofing pastes or powders for structures in the building industry, as an additive in coal-fired electric powerplants to treat the exhaust gases, in the initial mixtures for the production of ceramic materials, and in development of fire-impeding materials in paints, plastics, and wallboard. These new applications may allow the use of finely granulated fractions of vermiculite, which are unsuitable for flash expansion. New applications could lead to increased production of vermiculite in the future.

References Cited

Harben, P.W., and Kuzvart, Milos, 1996, Vermiculite, in Global geology:
London, Industrial Minerals Information Ltd., p. 432-437.
Industrial Minerals., 1998, Prices: Industrial Minerals, issue 375, December, p. 79.

- Lin, Israel, 1998, Perlite and vermiculite: Industrial Minerals, no. 368, May, p. 55-59.
- Moeller, E.M., 1999, Vermiculite, *in* Industrial minerals 1998 (annual review): Mining Engineering, v. 51, no. 6, June, p. 52-53.
- North American Mineral News, 1999, New j-v company to develop Montana vermiculite deposit: North American Mineral News, issue 44, January, p. 16.
- Russell, Alison, 1998, Vermiculite. Mining Journal [London], Industrial Minerals Annual Review Supplement, v. 331, no. 8496, September 4, p. 8.
- Vagt, Oliver, 1998, Mineral aggregates, in Mineral and metal commodity reviews, Canadian Minerals Yearbook: Ottawa, Canada, Na0tural Resources Canada.

SOURCES OF INFORMATION

U.S. Geological Survey Publications

Vermiculite. Ch. in Mineral Commodity Summaries, annual.¹

Lightweight aggregates. Ch. in United States mineral resources, U.S. Geological Survey Professional Paper 820, 1973.

Other

Vermiculite. Ch. in Industrial minerals and rocks (6th ed.), Littleton, CO, Society for Mining, Metallurgy, and Exploration, Inc., 1994.

Vermiculite. Ch. in Mineral facts and problems, U.S. Bureau of Mines Bulletin 675, 1985.

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¹Prior to January 1996, published by U.S. Bureau of Mines.

TABLE 1 SALIENT VERMICULITE STATISTICS 1/

(Thousand metric tons and thousand dollars)

	1994	1995	1996	1997	1998
United States:					
Sold and used by producers:					
Concentrate 2/	177	171	W	W	W
Exfoliated	130	130	135	155 e/	170 e/
Value	\$43,600	\$39,400	\$45,300	\$49,400 e/	\$53,300 e/
Average value 3/	\$335	\$306	\$334	\$318 e/	\$313 e/
Exports to Canada e/	7	6	8	8	11
Imports for consumption e/	30	30	48	67 r/	68
World: Production 4/	485	484	267 r/ 5/	293 r/ 5/	292 e/ 5/

- e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data.
- $1/\,\mbox{Data}$ are rounded to three significant digits.
- 2/ Values are withheld to avoid disclosing company proprietary data.
- 3/ Based on unrounded data.
- 4/ Excludes production by countries for which data were not available.
- 5/ Excludes U.S. data.

 ${\bf TABLE~2}$ ACTIVE VERMICULITE EXFOLIATION PLANTS IN THE UNITED STATES IN 1998

Company	County	State	
A-Tops Corp.	Beaver	Pennsylvania.	
W.R. Grace & Co., Construction Products Div.	Jefferson	Alabama.	
Do.	Maricopa	Arizona.	
Do.	Broward	Florida.	
Do.	Greenville	South Carolina.	
Palmetto Vermiculite Co., Inc.	Spartanburg	Do.	
P.V.P. Industries	Trumbull	Ohio.	
The Schundler Co.	Middlesex	New Jersey.	
The Scotts Company	Hempstead	Arkansas.	
Do.	Union	Ohio.	
Do.	Greenville	South Carolina.	
Southwest Vermiculite Co., Inc.	Bernalillo	New Mexico.	
Strong-Lite Products Corp.	Jefferson	Arkansas.	
Strong Products Corp.	La Salle	Illinois.	
Thermic Refractories, Inc.	Macoupin	Do.	
Thermo-O-Rock, Inc.	Maricopa	Arizona.	
Do.	Washington	Pennsylvania.	
Verlite Co.	Hillsborough	Florida.	
Vermiculite Industrial Corp.	Allegheny	Pennsylvania.	
Vermiculite Products, Inc.	Harris	Texas.	

TABLE 3 EXFOLIATED VERMICULITE SOLD AND USED IN THE UNITED STATES, BY END USE 1/

(Metric tons)

	1997	1998 e/
Aggregates:		
Concrete	19,200 e/	20,700
Plaster	2,600 e/	4,770
Premixes 2/	5,960	4,980
Total	27,700 e/	30,500
Insulation:		
Loose-fill	_ W	W
Block	W	W
Other 3/	1,400	2,010
Total	W	W
Agricultural:		
Horticultural	25,100	20,900
Soil conditioning	29,900 e/	43,300
Fertilizer carrier	_ W	W
Total	W	W
Other 4/	7,660	6,420
Grand total	155,000 e/	170,000

- e/ Estimated. W Withheld to avoid disclosing company proprietary data; included in "Grand total."
- $1/\operatorname{Data}$ rounded to three significant digits; may not add to totals shown.
- 2/ Includes acoustic insulation, fireproofing, and texturizing uses.
- 3/ Includes high-temperature and packing insulation and sealants.
- 4/ Includes various industrial and other uses not specified.

 ${\bf TABLE~4}$ VERMICULITE: WORLD PRODUCTION, BY COUNTRY 1/2/

(Metric tons)

Country	1994	1995	1996	1997	1998 e/
Argentina	32	44	40 e/	r/	822 3/
Brazil	17,233	18,806	21,999 r/	23,000 r/	23,000
Egypt	500 e/	483 r/	447 r/	500 e/	500
India	1,903	1,696	2,405	2,400 e/	2,200
Japan e/	15,000	15,000	15,000	15,000	15,000
Kenya	1,110 e/	457	734	800 e/	500
Mexico	300	225	350	295	3/
Russia e/	40,000	40,000	30,000	25,000	25,000
South Africa	223,478	221,748	186,082	211,001 r/	210,000
United States (sold and used by producers) 4/	177,000	171,000	W	W	W
Zimbabwe	8,184	13,742	10,249	14,841 r/	14,804 3/
Total	485,000	484,000	267,000 r/	293,000 r/	292,000

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total."

^{1/}World totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

^{2/} Excludes production by countries for which data are not available and for which general information is inadequate for formulation of reliable estmates. Table includes data available through July 22, 1999.

^{3/} Reported figure.

^{4/} Concentrate.