

# VERMICULITE

By Michael J. Potter

Vermiculite is a mica-like mineral that rapidly expands upon heating to produce a lightweight material. This expanded (exfoliated) product is used as lightweight aggregate in concrete, plaster, and premixes. Vermiculite also is used in building boards of various types such as fire-resistant plaster board, some lightweight wall boards, various refractory board products, etc.<sup>1</sup> In 1994, the largest end use for vermiculite continued to be in potting soils and other horticultural products, as a soil conditioner, fertilizer carrier, etc.

## Production

U.S. vermiculite concentrate sold and used was 180,000 metric tons (mt), or down slightly from that of the previous year, according to the U.S. Bureau of Mines (USBM). The tonnage of exfoliated vermiculite sold and used was 130,000 mt, compared with 140,000 mt in 1993.

Domestic production data for vermiculite were developed by the USBM from two separate voluntary surveys, one for domestic mine operations and the other for exfoliation plant operations. Of the four known mine-mill operations to which a survey request was sent, data were obtained from three operations. This represented a response rate of 75%. Data for the one nonrespondent were estimated by the USBM. Of the 25 known active exfoliating plants to which a survey request was sent, data were obtained for 20. This represented a response rate of 80%. The five nonrespondents' data were estimated by the USBM using previous years' production levels.

W. R. Grace & Co. was again believed to have been the largest domestic producer of vermiculite concentrate from its operation at Enoree, SC. Other producers during the year were Virginia Vermiculite Ltd., with an operation near Woodruff, SC, and another in Louisa County, VA; and Patterson Vermiculite Co., near Enoree, SC.

Domestic sales of exfoliated vermiculite by 17 known producers shown in Table 3 came from 25 plants in 16 States. Of these plants, eight in seven States were operated by W. R. Grace. In descending order of output sold and used, the largest producing States of U.S. exfoliated vermiculite were estimated to be Ohio, South Carolina, Pennsylvania, Illinois,

Arizona, Arkansas, Florida, and New Jersey.

Prices for U.S. vermiculite concentrate, converted to dollars per metric ton, were approximately \$72 to \$149 for raw, FOB plant, bulk material. Prices for South African concentrate were approximately \$116 to \$187 per metric ton for crude, bulk, FOB barge, Gulf coast material.<sup>2</sup>

## World Review

**Capacity.**—The data in Table 4 are an approximation of rated annual capacity for vermiculite plants as of December 31, 1994. Rated capacity is defined as the maximum quantity of product that can be produced on a normally sustainable long-term operating rate, based on the physical equipment of the plant, and given acceptable routine operating procedures involving labor, energy, materials, and maintenance. Capacity includes both operating plants and plants temporarily closed that in the judgement of the author can be brought into production within a short period of time with minimum capital expenditure. Plant capacity would ideally be based on engineering capacity provided by the companies. However, because data were not available, plant capacity data in Table 4 were estimated by considering recent peak production during the past 5 years to be equal to rated capacity.

In Australia, Helix Resources NL announced its application for a mining lease for its vermiculite deposit at Hillview, Western Australia. The company had suspended development of the deposit earlier. However, Helix was planning to evaluate the viability of supplying the Australian vermiculite market from a small production operation at Hillview.<sup>3</sup>

In Russia, more than 20 vermiculite deposits had been discovered. The versatility of the mineral has been recognized for some time: it does not burn or rot; is chemically inert; is a heat and sound insulating material; is a medium for growing vegetables by hydroponic methods; is an excellent absorber of heavy metal ions and radionuclides; etc. In 1978, a vermiculite concentrate plant was installed in Kovdor in the Murmansk Region. Earlier, in 1957, the Branch Scientific Research Institute of Building Materials "UralNIStromproject" was established in Chelyabinsk. Its purpose was for the design and development of equipment and technology

to produce exfoliated vermiculite and products that contain vermiculite. During subsequent years, a subbranch was established for the production of building materials. The enterprise "Techservice Vermiculite" was established and developed technology for processing lower-grade vermiculite ores without losing quality in final products. The technology can treat ores from small deposits that occur in many countries of the world. Detailed analyses had been carried out on vermiculite ores from Bulgaria, Egypt, India, Korea, Turkey, and other countries. Vermiculite exfoliation plant projects had been developed for Australia, Cyprus, and Spain. Production operations established in other countries were using raw material from Russia. In cooperation with foreign business partners, new production projects can be carried out, including raw material investigation, project design, and equipment manufacture, mounting, and startup. Marketing services can be rendered and raw material supplied. Technology was also available to produce vermiculite products, including ceramic-vermiculite products for insulation of furnace installations with operating temperatures up to 1100<sup>o</sup> C.<sup>4</sup>

In Zimbabwe, Shawa Vermiculite Pvt. Ltd. completed a new processing plant with a capacity of 24,000 metric tons per year. When combined with the existing operations, this gave the company a total production capacity of 39,000 metric tons per year. Some of the equipment at the new plant included a rotary drier, screening tables and winnowers. With a new, fully equipped quality control lab, the company was said to be able to manufacture products that are well within international specifications.

Shawa was said to have high-quality ore. Over the past several years the company has had the approval of a number of overseas countries, including Denmark. No asbestos had been found in Shawa's material.<sup>5</sup>

## Outlook

The cation exchange potential of vermiculite is one of its properties that can be used as a basis for various products such as intumescent coatings and gaskets. For example, this gasketing material is used extensively as wrap-around mats to cushion catalytic converter

assemblies in automotive applications.

Possible new applications for vermiculite in all of its forms include detoxification of water and soil, nuclear waste containment and removal, and industrial spill containment and cleanup. A comprehensive list of 350 patents issued in 1994 was published which apply to basic vermiculite technologies, or mention vermiculite in the description of the invention.<sup>6</sup>

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<sup>1</sup>Hindman, J. R. Vermiculite. Chapter in Industrial Minerals and Rocks, 6th ed., 1994, Society for Mining, Metallurgy, and Exploration, p. 1109.

<sup>2</sup>Industrial Minerals (London). Prices. No. 327, Dec. 1994, p. 63.

<sup>3</sup>———. Mineral Notes. No. 327, Dec. 1994, p. 57.

<sup>4</sup>Businessman (special issue to "Technology from Russia 94" exhibition, Washington, DC, May 1994). Interview with R. Akhtyamov, Director, Scientific-Design Production Enterprise "Techservice Vermiculite." No. 2, May 1994, p. 4.

<sup>5</sup>Industrial Minerals (London). World of Minerals. No. 318, Mar. 1994, p. 21.

<sup>6</sup>Hindman, J. R. Vermiculite Technology Newsletter. V. 5, No. 1, Spring 1995, pp. 1-49.

TABLE 1  
SALIENT VERMICULITE STATISTICS 1/

(Thousand metric tons and thousand dollars)

	1990	1991	1992	1993	1994
United States:					
Sold and used by producers:					
Concentrate	209 e/	180	190	190	180
Value	\$19,100 e/	W	W	W	W
Average value 2/	\$91 e/	W	W	W	W
Exfoliated	142	136	140	140	130
Value	\$39,400	\$38,600	\$45,900	\$46,700	\$43,600
Average value 2/	\$277	\$284	\$328	\$338	\$335
Exports to Canada	18 e/	10 e/	8 e/	7 e/	7 e/
Imports for consumption	45 e/	38 e/	40 e/	30 e/	30 e/
World: Production 3/	572 r/	517 r/	463 r/	494 r/	486 e/

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits.

2/ Based on rounded data.

3/ Excludes production by countries for which data were not available.

TABLE 2  
EXFOLIATED VERMICULITE  
SOLD AND USED IN THE UNITED STATES, BY END USE 1/

(Metric tons unless otherwise specified)

	1993	1994
Aggregates:		
Concrete	18,600	16,300
Plaster	800	600
Premixes 2/	8,800	4,500
Total	28,200	21,400
Insulation:		
Loose-fill	W	W
Block	W	W
Other 3/	1,400	1,400
Total	32,800	30,500
Agricultural:		
Horticultural	25,100	26,300
Soil conditioning	13,100	15,300
Fertilizer carrier e/	32,100	30,500
Total e/	70,300	72,000
Other 4/	6,400	5,400
Grand total	140,000	130,000

e/ Estimated. W Withheld to avoid disclosing company proprietary data; included in "Total."

1/ Data rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Includes acoustic, fireproofing, and texturizing uses.

3/ Includes high-temperature and packing insulation and sealants.

4/ Includes various industrial, etc., uses not specified.

TABLE 3  
ACTIVE VERMICULITE EXFOLIATING  
PLANTS IN THE UNITED STATES IN 1994

Company	County	State
A-Tops Corp.	Beaver	Pennsylvania.
Brouk Co.	St. Louis	Missouri.
W. R. Grace & Co., Construction Products Div.	Jefferson	Alabama.
Do.	Maricopa	Arizona.
Do.	Orange	Do.
Do.	Broward	Florida.
Do.	Du Page	Illinois.
Do.	Campbell	Kentucky.
Do.	Multnomah	Oregon.
Do.	Laurens	South Carolina.
Koos Inc.	Kenosha	Wisconsin.
Palmetto Vermiculite Co., Inc.	Laurens	South Carolina.
Patterson Vermiculite Co.	do.	Do.
P.V.P. Industries	Trumbull	Ohio.
The Schundler Co.	Middlesex	New Jersey.
O.M. Scott & Sons.	Union	Ohio.
Southwest Vermiculite Co., Inc.	Bernalillo	New Mexico.
Strong-Lite Products Corp.	Jefferson	Arkansas.
Strong Products Corporation	Lesalle	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 4  
WORLD VERMICULITE ANNUAL  
PRODUCTION CAPACITY  
DECEMBER 31, 1994

(Thousand metric tons)

Country	Rated capacity 1/ 2/
North America:	
Mexico	(3/)
United States	190
Total	190
South America: e/	
Argentina	4
Brazil	23
Total	27
Europe:	
Russia e/	95
Africa:	
Egypt	1
Kenya	3
South Africa, Republic of	223
Total	227
Asia:	
India	2
Japan e/	15
Total	17
World total 4/	560

e/ Estimated.

1/ Includes capacity at operating plants as well as at plants on standby basis.

2/ Excludes countries for which data were not available.

3/ Less than 1/2 unit.

4/ Rounded.

TABLE 5  
VERMICULITE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1990	1991	1992	1993	1994 e/
Argentina	3,330	3,950	4,450	4,500 e/	3,000
Brazil	23,300	11,000 r/	14,000 r/	14,000 r/	14,000
Egypt	28	519	500 e/	500 e/	500
India	1,770	1,770	1,610 r/	1,410 r/	1,500
Japan e/	15,000	15,000	15,000	15,000	15,000
Kenya e/	2,660 4/	2,600	2,600	2,600	2,600
Mexico	132	117	125	134	300 4/
Russia e/ 5/	XX	XX	60,000	50,000	40,000
South Africa, Republic of	220,000	215,000	170,000	211,000 r/	223,000 4/
U.S.S.R. e/ 5/ 6/	95,000	85,000	XX	XX	XX
United States (sold and used by producers)	209,000	180,000	190,000	190,000	177,000 4/
Zimbabwe	1,000 e/	2,320	4,300	5,030	8,180 4/
Total	572,000 r/	517,000 r/	463,000 r/	494,000 r/	486,000

e/ Estimated. r/ Revised. XX Not applicable.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines 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 estimates. Table includes data available through July 26, 1995.

3/ In addition to the countries listed, Tanzania may produce vermiculite, but available information is inadequate to make reliable estimates of output levels.

4/ Reported figure.

5/ All production in the former U.S.S.R. for 1990-91 came from Russia.

6/ Dissolved in Dec. 1991.