

VERMICULITE

By Michael J. Potter

Vermiculite is a mica-like mineral that has the ion-exchange properties of zeolites and some clays. Beneficiation of vermiculite ore yields concentrate that is typically 90% vermiculite and 10% grit or rock. When a particle of vermiculite is heated rapidly to about 900 °C, the normally flat plate expands as much as twentyfold into an accordionlike, lightweight particle. This forms the basis for much of the commercial application of this mineral (Hindman, 1996).

Production

The total of U.S. vermiculite concentrate sold and used was withheld to avoid disclosing company proprietary data. The amount of exfoliated vermiculite sold and used was 135,000 metric tons compared with 130,000 tons in 1995. Domestic production data for vermiculite were derived by the U.S. Geological Survey (USGS) from two separate voluntary surveys—one for domestic mine-mill operations and the other for exfoliating plants. Of the four known mine-mill operations, data were obtained for two operations, representing a response rate of 50%. Production for the two nonrespondents was estimated by the USGS based on previous years' production levels and estimates. Of the 19 known active exfoliating plants, data were obtained from 16 for a response rate of 84%. Output for the three nonrespondents was estimated by the USGS by using previous years' production levels.

Domestic producers of vermiculite concentrate were W.R. Grace & Co. from its operation at Encore, SC, Virginia Vermiculite Ltd. with operations near Woodruff, SC, and in Louisa County, VA, and Patterson Vermiculite Co. near Enoree, SC.

U.S. output of exfoliated vermiculite from 15 known companies came from 19 plants in 11 States. (See table 3). Of these plants, four in four States were operated by W.R. Grace. The largest producing States of exfoliated vermiculite were estimated to be, in descending order of output sold and used, South Carolina, Ohio, Pennsylvania, Arizona, Illinois, Arkansas, New Jersey, and Florida.

Prices

Yearend prices for U.S. vermiculite concentrate, ex-plant, bulk, converted to dollars per metric ton ranged from \$143 to \$220. For South African material, crude, bulk, f.o.b. barge, Gulf Coast, converted to dollars per metric ton, prices ranged from \$127 to \$209 (Industrial Minerals, 1996).

World Review

Table 5 lists approximations of rated annual capacity for vermiculite concentrate plants as of December 31. Because actual capacity data were generally not available, capacities for most countries were considered to be equal to their highest production levels during the past 5 years.

In South Africa, the decrease in output of vermiculite concentrate was reportedly because of unusually high rainfall in the first quarter. Another factor was the delay in commissioning the new fluidized bed drying furnaces at Palabora Mining Co. Ltd., the world's largest producer (Palabora Mining Co. Ltd., 1996).

Dinidza Vermiculite Mining (Pvt.) Ltd. in Zimbabwe continued with an expansion program to increase concentrate production to 1,000 tons per month by July 1996 (Hindman, 1996).

Outlook

The largest enduse of vermiculite in recent years has been in potting soils and other horticultural and fertilizer products. Vermiculite also is used in building boards, such as plaster board, some lightweight wallboard, and various refractory board products. Potential new applications of vermiculite include detoxification of water and soil, nuclear waste containment and removal, and industrial spill containment and cleanup.

With the absence of large particle-sized vermiculite production in the United States and the use of imported concentrates to fill this void, there has been substantial interest in developing new vermiculite sources in the Western United States (Hindman, 1996).

References Cited

- Hindman, J.R., 1996, Vermiculite in Metals and minerals annual review—1996: Mining Journal Ltd., p. 84
Industrial Minerals, 1996, Prices: Industrial Minerals, no. 351, December, p. 73.
Palabora Mining Co. Ltd., 1996, Annual report: Sandton, South Africa, p. 9.

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.

Other

Harben, P.W., 1995, Vermiculite, *in* The industrial minerals handybook II (2d ed.): London, Industrial Minerals, p. 193-195.

Hindman, J.R., 1994, Vermiculite, *in* Carr, D.D., and others, eds., Industrial minerals and rocks (6th ed): Littleton, CO, Society for Mining, Metallurgy and Exploration, Inc., p. 1103-1111.

Roskill Information Services Ltd., 1991, The economics of

vermiculite 1991 (6th ed.): London, Roskill Information Services Ltd., 152 p.

———1995, Vermiculite—Market update, analysis and outlook: London, Roskill Information Services Ltd., 53 p.

Vermiculite. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675.

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

TABLE 1
SALIENT VERMICULITE STATISTICS 1/

(Thousand metric tons and thousand dollars)

	1992	1993	1994	1995	1996
United States:					
Sold and used by producers:					
Concentrate 2/	190	190	177	171	W
Exfoliated	140	140	130	130	135
Value	\$45,900	\$46,700	\$43,600	\$39,400	\$45,300
Average value 3/	\$328	\$338	\$335	\$306	\$334
Exports to Canada e/	8	7	7	6	8
Imports for consumption e/	40	30	30	30	48
World: Production 4/	456	490	484	482 r/	266

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

1/ 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.

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

(Metric tons)

	1995	1996
Aggregates:		
Concrete 2/	11,700	16,900
Plaster	1,400	3,220
Premixes 3/	W	W
Total	W	W
Insulation:		
Loose-fill	W	W
Block	14,200	12,000
Other 3/	W	W
Total	33,600	27,100
Agricultural:		
Horticultural	26,800	26,500
Soil conditioning	14,500	19,700
Fertilizer carrier e/	30,400	29,300
Total e/	71,700	75,500
Other 4/	W	W
Grand total	130,000	135,000

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

1/ Data rounded 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 EXFOLIATION
PLANTS IN THE UNITED STATES IN 1996

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.
Patterson Vermiculite Co.	Laurens	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	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 4
VERMICULITE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1992	1993	1994	1995	1996 e/
Argentina	--	38	32 r/	44 r/	50
Brazil	11,615	14,541	16,000	17,000 r/ e/	17,000
Egypt e/	500	500	500	500	500
India	1,609	1,485	1,903 r/	1,688 r/	1,750
Japan e/	15,000	15,000	15,000	15,000	15,000
Kenya	2,291	1,961	1,110 r/ e/	457 r/	500
Mexico	125	134	300	225 r/	225
Russia e/	60,000	50,000	40,000	40,000	30,000
South Africa	170,399	211,143	223,478	221,748	186,082 3/
United States (sold and used by producers) 4/	190,000	190,000	177,000	171,000	W
Zimbabwe	4,300	5,032	8,184	13,742 r/	15,000
Total	456,000	490,000	484,000	482,000 r/	266,000 5/

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 estimates. Table includes data available through July 22, 1997.

3/ Reported figure.

4/ Concentrate.

5/ Excludes U.S. data.

TABLE 5
WORLD VERMICULITE ANNUAL
PRODUCTION CAPACITY
DECEMBER 31, 1996

(Thousand metric tons)

Country	Rated capacity 1/ 2/
North America:	
Mexico	(3/)
United States	190
Total	<u>190</u>
South America:	
Argentina	(3/)
Brazil	17
Total	<u>17</u>
Europe:	
Russia e/	<u>60</u>
Africa:	
Egypt e/	1
Kenya	2
South Africa	223
Total	<u>226</u>
Asia:	
India	2
Japan e/	15
Total	<u>17</u>
World total	<u>510</u>

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.