

VERMICULITE

By Michael J. Potter

Domestic survey data and tables were prepared by Nicholas Muniz, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

Vermiculite is a hydrated magnesium-aluminum-iron silicate. Flakes of raw vermiculite concentrate are mica-like in appearance and contain water molecules within their internal structure. When the flakes are heated rapidly at a temperature of 900^o C or higher, the water flashes into steam, and the flakes expand into accordion like particles. The color, which can range from black and various shades of brown to yellow for the raw flakes, changes to gold, gold brown, or bronze. This expansion process is also called exfoliation, 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 liquids such as fertilizers, herbicides, and insecticides, which can then be transported as free-flowing solids (Harben and Kuzvart, 1996, p. 432).

Production

Domestic production (sold or used) data for vermiculite were collected by the U.S. Geological Survey (USGS) 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. Output for the two nonrespondents was estimated on the basis of previous years' production levels and estimates. Of the 19 known exfoliation plants, some responded, but data for the remainder were estimated from previous years' production levels.

Because there have only been three U.S. mining operations of vermiculite concentrate in recent years, any data collected by the USGS would have to be withheld. However, according to Roskill Information Services, Ltd. (1999), an estimate of U.S. output in 1999 was 175,000 metric tons (t). The two U.S. 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.

Most of the vermiculite concentrate was shipped to exfoliating plants for conversion into lightweight material. Output of exfoliated vermiculite sold or used in 1999, using partly estimated data, was also about 175,000 t (table 1). Domestic production of exfoliated vermiculite sold or used was by 13 known companies operating 19 plants in 10 States (table 2). States that produced exfoliated vermiculite, in descending order of partly estimated output sold and used, were South Carolina, Ohio, Arizona, Pennsylvania, New Jersey, Arkansas, Florida, Illinois, Texas, and New Mexico.

Stansbury Holdings Corp. was expecting to begin production

near yearend 1999 at its Dillon, MT, joint-venture vermiculite project. The plant was permitted for production of 30,000 tons per year of vermiculite concentrate, although Stansbury reportedly was seeking to increase this by a significant amount. Intended sales would include horticultural markets in the western United States. The company reported that vermiculite concentrate of 90% purity was priced at up to \$165 per ton f.o.b. mine. Working capital and equipment for the project were provided by the joint-venture partner, Nevada Vermiculite LLC. Rehabilitation of the Elk Gulch Mine and mill required the recommissioning of the beneficiation mill, developing a mine plan, and establishing a loading facility for vermiculite concentrate onto rail cars and trucks (North American Minerals News, 1999b).

Stansbury was also negotiating to acquire a vermiculite exfoliation plant from Pacific Vermiculite LLC at Los Banos, CA. Although current capacity was 5,000 t of vermiculite concentrate per year, Stansbury anticipated doubling the plant's capacity if market conditions justify it (North American Minerals News, 1999a).

Hines Horticulture, Inc., acquired Strong Lite, Inc., in August 1999, with plants in Pine Bluff, AR, and Seneca, IL. Strong Lite is a producer and marketer of horticultural growing mixes using composted bark. Strong Lite also was selling expanded vermiculite and perlite that are used in growing mixes. Hines' Sun Gro business was currently the largest North American producer and marketer of sphagnum peat moss and growing mixes. Customers for these products included greenhouse growers, nursery growers, and golf course developers (AOL News, August 2, 1999, Hines Horticulture acquires Strong Lite; Sun Gro expands..., press release, accessed August 24, 1999, via URL <http://www.AOLNews@aol.com> by J.R. Hindman).

Environment

In late 1999, the U.S. Environmental Protection Agency (EPA) sent a team to Libby, MT, to assess conditions and collect information on effects resulting from asbestos presence in the vermiculite mine near Libby. The mine was shut down in 1990. EPA's first priority was to determine if there was current risk to public health in Libby and, if so, to take necessary actions to reduce or eliminate these risks. EPA was working closely with local, State, and other Federal agencies (U.S. Environmental Protection Agency, Libby asbestos response—background, accessed July 24, 2000, at URL <http://www.epa.gov/region08/superfund/sites/lbybkgd.html>).

Consumption

Vermiculite-containing plasters can be made with either gypsum or portland cement. Some advantages of vermiculite plasters over conventional types of plasters are lighter weight, improved workability, very good fire resistance, and reduced thermal conductivity.

In fire protection, vermiculite-board products include factory-made boards and panels and premixed coatings that can be applied by mechanical spray or by hand; an example is hydrocarbon storage vessels fireproofed with vermiculite cement.

In horticulture, vermiculite particles aid aeration, improve moisture retention, and promote the steady release of added fertilizers and are commonly used in combination with other materials such as peat. Vermiculite can also be used as a carrier and extender for fertilizers, pesticides, and herbicides (Mandoval, Ltd., Vermiculite—Applications, accessed July 26, 2000, at URL <http://www.palabora.com/>).

In refractory products, vermiculite is normally bonded with alumina cements, fire clays, and silicates to produce castable high-alumina concretes, high-alumina bonded bricks, slabs and special shapes, and silicate bonded insulating shapes and molded products (Russell, 1999).

Prices

Published prices (Industrial Minerals, 1999) serve as a general guide only; prices for raw U.S. vermiculite concentrate, bulk, ex-plant were about \$143 to \$220 per metric ton, depending on particle size. For imported South African crude vermiculite, bulk, f.o.b. barge, Gulf Coast, prices ranged from \$187 to \$243 per ton.

The average value of \$315 per ton in 1999 for sold-or-used vermiculite (table 2) was a composite that included U.S. and imported vermiculite and was based largely on estimated data.

Foreign Trade

Trade data for vermiculite concentrate are not collected as a separate category by the U.S. Census Bureau, but are included under a basket category with tariff code number 2530.10.0000, titled “vermiculite, perlite, and chlorite, unexpanded.” According to Moeller (2000), U.S. exports of vermiculite concentrate in 1999 were about 7,000 t. Total U.S. imports of vermiculite in 1999 were about 71,000 t (PIERS (Port Import/Export Reporting Service, a division of The Journal of Commerce), data printout, 2000). South Africa was the main supplier; China supplied 22% of the material.

Outlook

Using data in table 1, an estimate of U.S. apparent consumption (calculated as production plus imports minus exports) was about 240,000 tons per year in 1999. A relatively small portion of this was used in the unexpanded state, but actual data are not available. Horticultural and related uses have been the largest U.S. end-use category of vermiculite in recent years. Alternative and competing products to vermiculite in this category include bark, peat, and perlite. One active market for vermiculite has been in the friction-lining industry (such as brake and clutch linings) as an alternative to asbestos. A fairly new market area for vermiculite has been in liquid vermiculite dispersions for use in flexible films for packaging, gaskets, and other uses (Russell, 1999). According to Roskill Information Services, Ltd. (1999), North America and Western Europe account for about 80% of world vermiculite consumption; European consumption is expected to increase to about 150,000 tons per year by 2001.

References Cited

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GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

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Lightweight aggregates. Ch. in United States Mineral Resources, Professional Paper 820, 1973.

Other

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

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The Vermiculite Association (www.vermiculite.org).

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

TABLE 1
SALIENT VERMICULITE STATISTICS 1/

(Thousand metric tons and thousand dollars)

	1995	1996	1997	1998	1999
United States:					
Sold and used by producers:					
Concentrate	171	W	W	W	175 e/
Exfoliated	130	135	155 e/	170 e/	175 e/
Value	\$39,400	\$45,300	\$49,400 e/	\$53,300 e/	\$55,300 e/
Average value 2/	\$306	\$334	\$318 e/	\$313 e/	\$315 e/
Exports to Canada	6 e/	8 e/	9 r/ e/	11 e/	7 e/
Imports for consumption	30 e/	48	67	68	71
World, production 3/	486 r/	280 r/ 4/	301 r/ 4/	327 r/ 4/	534 e/

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

1/ Data are rounded to no more than three significant digits.

2/ Based on unrounded data.

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

4/ Excludes U.S. data.

TABLE 2
ACTIVE VERMICULITE EXFOLIATION PLANTS IN THE UNITED STATES IN 1999

Company	County	State
J.P. Austin Associates, Inc.	Beaver	Pennsylvania.
P.V.P. Industries	Trumbull	Ohio.
Palmetto Vermiculite Co., Inc.	Spartanburg	South Carolina.
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.
Sun Gro Horticulture, Inc.	Jefferson	Arkansas.
Do.	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.
W.R. Grace & Co., Construction Products Div.	Maricopa	Arizona.
Do.	Broward	Florida.
Do.	Greenville	South Carolina.

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

(Metric tons, unless otherwise specified)

	1998 e/	1999 e/
Aggregates:		
Concrete	20,700	21,400
Plaster	4,770	4,600
Premixes 2/	4,980	2,340
Total	30,500	28,300
Insulation:		
Loose-fill	W	W
Block	W	W
Other 3/	2,010	1,710
Total	W	W
Agricultural:		
Horticultural	20,900	27,200
Soil conditioning	43,300	39,600
Fertilizer carrier	W	W
Total	W	W
Other 4/	6,420	6,290
Grand total	170,000	175,000

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

1/ Data rounded to no more than 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.

TABLE 4
VERMICULITE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1995	1996	1997	1998	1999 e/
Argentina	44	40 e/	822 r/	100 r/ e/	100
Australia e/	2,500	2,500	5,000	10,000	12,000
Brazil	18,806	21,999	23,000	24,300 r/	24,000
China	NA	NA	NA	NA	40,000
Egypt	483	447	447 r/	12,376 r/	12,000
India	1,696	2,405	4,405 r/	4,080 r/	4,000
Japan e/	15,000	15,000	15,000	15,000	15,000
Kenya	457	734	1,418 r/	353 r/	350
Mexico	225	350	295	--	100
Russia e/	40,000	30,000	25,000	25,000	25,000
South Africa	221,748	196,000 r/	211,001	221,300 r/	212,000
United States, sold and used by producers 3/	171,000	W	W	W	175,000
Zimbabwe	13,742	10,249	14,841	14,804	14,000
Total	486,000 r/	280,000 r/	301,000 r/	327,000 r/	534,000

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

1/ World totals, U.S. data, and estimated data are rounded to no more than 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 21, 2000.

3/ Concentrate.