



# 2006 Minerals Yearbook

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## VERMICULITE

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Production of vermiculite concentrate in the United States was an estimated 100,000 metric tons (t), about the same as in 2005. Worldwide vermiculite production was about 520,000 t in 2006, similar to that of 2005. U.S. exports were estimated to be about 5,000 t, and U.S. imports were an estimated 65,000 t, 29% less than in 2005. The average unit value of U.S. exfoliated vermiculite sold or used by producers was estimated to be \$406 per metric ton, slightly less than that of 2005.

## Production

Flakes of processed 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° C or higher, the water flashes into steam, and the flakes expand into accordion-like particles. This expansion process is called exfoliation, and the resulting lightweight material is chemically inert, fire resistant, and odorless.

Domestic production (sold or used) data for vermiculite were collected by the U.S. Geological Survey (USGS) from two voluntary canvasses—one for mine-mill (concentrator) operations and the other for exfoliation plants. Production data for nonrespondents were estimated based on employment data and production data reports from prior years. The two U.S. producers of vermiculite concentrate were Virginia Vermiculite Ltd. with two operations (near Woodruff, SC, and in Louisa County, VA) and W.R. Grace & Co. from its operation at Enoree, SC.

Vermiculite concentrate was shipped to exfoliating plants for conversion into lightweight material. Output of exfoliated vermiculite sold or used in 2006, using actual and estimated data, was about 90,000 t, which was produced from both domestic and imported vermiculite concentrate (table 1). Exfoliated vermiculite was produced by 13 companies operating 17 plants in 11 States (table 2). Of the 17 exfoliation plants, 11 responded to the annual canvass, representing 72% of the estimated sold or used exfoliated vermiculite tonnages listed in tables 1 and 3. Data for the remaining operations were estimated from previous years' reported production levels. States that produced exfoliated vermiculite were, in descending order of estimated output sold or used, South Carolina, New Jersey, Pennsylvania, Arizona, Florida, Arkansas, Michigan, Massachusetts, Illinois, Ohio, and New Mexico.

In April 2006, Ontario, Canada-based IBI Corp. and its wholly owned subsidiary North American Vermiculite Inc., signed an agreement with Rio Tinto America Industrial Minerals Inc. granting Rio Tinto an option to acquire 100% interest in the Mica Peak/Gold Butte vermiculite property in Nevada. The option was open until April 1, 2008. The Mica Peak deposit is

about 80 kilometers east of Las Vegas, NV (Industrial Minerals, 2006).

## Consumption

Vermiculite has a wide range of uses that take advantage of its various attributes of fire resistance, good insulation, high liquid absorption capacity, inertness, and low density (table 3). Vermiculite is used in general building plasters, either in its own formulations or combined with other lightweight aggregates such as perlite. Special plasters include fire protection and acoustic products in which vermiculite is combined with a binder, such as gypsum or portland cement, and fillers and rheological aids (Roskill Information Services Ltd., 2004, p. 103).

Exfoliated vermiculite, sometimes treated with a water repellent, is used to fill pores and cavities in masonry construction and hollow blockwork to enhance acoustic, fire rating, and insulation performance. Finer grades of exfoliated vermiculite, combined with potassium or sodium silicate, are used to produce insulation shapes. The ability of vermiculite-based insulation shapes to resist attack by molten aluminum makes them especially useful as secondary insulation in the aluminum production process (Roskill Information Services Ltd., 2004, p. 112).

In horticulture, exfoliated vermiculite improves soil aeration and moisture retention. When vermiculite is mixed with peat or other composted materials, such as pine bark, the resulting product provides a good growing medium for plant propagation (increasing the number of plants). As a soil conditioner, exfoliated vermiculite can improve the aeration of "sticky" soils (containing clay) and the water-holding characteristics of sandy soils. This allows for easier watering and reduces the likelihood of compaction, cracking, and crusting of the soil. Vermiculite is used in the fertilizer/pesticide market because of its ability to act as a carrier, bulking agent, and extender (Roskill Information Services Ltd., 2004, p. 108-109).

Other uses include refractory-insulation gunning and castable mixes and vermiculite dispersions. Finer grades of exfoliated vermiculite are used to partially replace asbestos in brake linings, primarily for the automotive market (Roskill Information Services Ltd., 2004, p. 112-113).

The apparent increase in exfoliated vermiculite use in aggregates in 2006 (table 3) may be the result of better data collection and handling and may not necessarily reflect market conditions. For the end use categories of 'horticultural' and 'soil conditioning', there may be uncertainty in the exact meaning of these terms, and this may be reflected in the consumption figures (table 3).

Although vermiculite and perlite have different properties, they compete with each other in such markets as horticulture, lightweight aggregates, and thermal insulation (King, 2006).

### Prices

Published prices for vermiculite serve only as a general guide because of variations in application, quantity, source, and other factors. According to Moeller (2007), prices for U.S. vermiculite concentrate, ex-plant, ranged from \$95 to \$180 per metric ton, depending on sized grades.

The average unit value of U.S. exfoliated vermiculite sold or used by producers, using actual and estimated data, was about \$406 per ton, which was a composite value that included exfoliated vermiculite produced from both U.S. and imported concentrate (table 1).

### Foreign Trade

Trade data for vermiculite concentrate are not collected as a separate category by the U.S. Census Bureau but are included within the basket category “vermiculite, perlite, and chlorite, unexpanded” under Harmonized Tariff Schedule of the United States, code 2530.10.0000. According to the Journal of Commerce Port Import/Export Reporting Service, total U.S. imports of vermiculite in 2006 (excluding any material from Canada and Mexico) were about 65,000 t. China supplied 69% of the tonnage, and South Africa, 30% (Commonwealth Business Media, Inc., 2007).

### Outlook

Increasing market applications for vermiculite include coatings and binders (chemically delaminated vermiculites that form high tensile strength films); finely ground vermiculite (as a functional filler in coatings, construction materials, and in friction brake applications); and in pollution control applications (Moeller, 2007).

Vermiculite production in China reportedly was increasing, with total production capacity of more than 150,000 metric tons per year. Further plant expansion was being planned for 2007. Approximately 80% of Chinese production was being exported, mostly to Asia and North America, but the domestic market also was growing. Worldwide vermiculite production capacity was continuing to outpace consumption, with coarser-size products in limited supply (Moeller, 2007).

### References Cited

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- Roskill Information Services Ltd., 2004, The economics of vermiculite (8th ed.): London, United Kingdom, Roskill Information Services Ltd., 126 p. plus appendix.

### GENERAL SOURCES OF INFORMATION

#### U.S. Geological Survey Publications

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

#### Other

- Vermiculite. Ch. in Industrial Minerals and Rocks (7th ed.), Society for Mining, Metallurgy, and Exploration, Inc., 2006.
- Vermiculite. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.
- Vermiculite Association, The.

TABLE 1  
SALIENT VERMICULITE STATISTICS<sup>1</sup>

(Thousand metric tons and thousand dollars unless otherwise specified)

	2002	2003	2004	2005	2006
United States:					
Production: <sup>2</sup>					
Concentrate <sup>e</sup>	100	110	100 <sup>3</sup>	100	100 <sup>4</sup>
Exfoliated: <sup>c</sup>					
Quantity	115	95	90	85	90
Value <sup>e</sup>	44,900	34,800	35,400	35,100	36,500
Average value <sup>e,5</sup> dollars per metric ton	390	370	390	410	406
Exports <sup>c</sup>	10	15	10	5	5
Imports for consumption <sup>6</sup>	56	37	69 <sup>e</sup>	91	65 <sup>e</sup>
World, production <sup>7</sup>	498	491	513 <sup>r</sup>	521 <sup>r</sup>	520

<sup>e</sup>Estimated. <sup>r</sup>Revised.

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

<sup>2</sup>Sold or used by producers.

<sup>3</sup>Dickson, Ted, 2006, Vermiculite, Countries and Commodities Reports, accessed March 17, 2006, via URL <http://www.mining-journal.com>.

<sup>4</sup>Rounded to one significant digit.

<sup>5</sup>Based on rounded data.

<sup>6</sup>Source: Commonwealth Business Media, Inc., 2006.

<sup>7</sup>Excludes production by countries for which data were not available.

TABLE 2  
ACTIVE VERMICULITE EXFOLIATION PLANTS IN THE UNITED STATES IN 2006

Company	County	State
Isolatek International, Inc.	Sussex	New Jersey.
J.P. Austin Associates, Inc.	Beaver	Pennsylvania.
Palmetto Vermiculite Co., Inc.	Spartanburg	South Carolina.
P.V.P. Industries, Inc.	Trumbull	Ohio.
Schundler Co., The	Middlesex	New Jersey.
Southwest Vermiculite Co., Inc.	Bernalillo	New Mexico.
Sun Gro Horticulture Canada Ltd.	Jefferson	Arkansas.
Do.	Branch	Michigan.
Thermal Ceramics Inc.	Macoupin	Illinois.
Therm-O-Rock East, Inc.	Washington	Pennsylvania.
Therm-O-Rock West, Inc.	Maricopa	Arizona.
Verlite Co.	Hillsborough	Florida.
Vermiculite Industrial Corp.	Allegheny	Pennsylvania.
Whittemore Co., Inc.	Essex	Massachusetts.
W.R. Grace & Co.	Maricopa	Arizona.
Do.	Broward	Florida.
Do.	Greenville	South Carolina.

TABLE 3  
ESTIMATED EXFOLIATED VERMICULITE SOLD OR  
USED IN THE UNITED STATES, BY END USE<sup>1</sup>

(Metric tons)

	2005	2006
Aggregates <sup>2</sup>	22,300	30,600
Insulation <sup>3</sup>	W	6,800
Agricultural:		
Horticultural	24,600	24,100
Soil conditioning	W	W
Fertilizer carrier	W	W
Total	W	W
Other <sup>4</sup>	12,500	W
Grand total <sup>5</sup>	84,600 <sup>r</sup>	89,600

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data; included in "Grand total."

<sup>1</sup>Data rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes concrete, plaster, and premixes (acoustic insulation, fireproofing, and texturizing uses).

<sup>3</sup>Includes loose-fill, block, and other (high-temperature and packing insulation and sealants).

<sup>4</sup>Includes various industrial and other uses not specified.

<sup>5</sup>Rounded to two significant digits because of estimated data.

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

(Metric tons)

Country	2002	2003	2004	2005	2006
Argentina	1,105	1,124	1,293	1,403 <sup>r</sup>	1,500 <sup>c</sup>
Australia <sup>c</sup>	12,000	12,000	12,000	12,000	13,000
Brazil, concentrate	22,577	26,055	25,103 <sup>r</sup>	24,191 <sup>r</sup>	25,000 <sup>p</sup>
China <sup>c</sup>	80,000	90,000	100,000	100,000	110,000
Egypt <sup>c</sup>	12,000	12,000	12,000	12,000	12,000
India <sup>c</sup>	4,300	4,400	4,400	4,500	4,600
Japan <sup>c</sup>	6,200	6,200	6,000	6,000	6,000
Russia <sup>c</sup>	25,000	25,000	25,000	25,000	25,000
South Africa	210,297	182,802	196,893	209,801	197,765
Uganda	664	1,724	2,688	3,100	3,000 <sup>c</sup>
United States, concentrate, sold and used by producers <sup>c</sup>	100,000	110,000	100,000 <sup>3</sup>	100,000	100,000 <sup>4</sup>
Zimbabwe	23,803	20,016	27,150	23,045	20,000 <sup>c</sup>
Total	498,000	491,000	513,000 <sup>r</sup>	521,000 <sup>r</sup>	520,000 <sup>5</sup>

<sup>c</sup>Estimated. <sup>p</sup>Preliminary. <sup>r</sup>Revised.

<sup>1</sup>World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>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 17, 2007.

<sup>3</sup>Dickson, Ted, 2006, Vermiculite, Countries and Commodities Reports, accessed March 17, 2006, via URL <http://www.mining-journal.com>.

<sup>4</sup>Rounded to one significant digit.

<sup>5</sup>Rounded to two significant digits.