



# 2009 Minerals Yearbook

## VERMICULITE

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Production of vermiculite concentrate in the United States was an estimated 100,000 metric tons (t) in 2009. Worldwide vermiculite production was approximately 505,000 t in 2009, a slight decrease from that of 2008. U.S. exports in 2009 were estimated to be approximately 3,000 t, a decrease of 40% from those of 2008. U.S. imports of vermiculite were an estimated 39,000 t, 47% less than those of 2008. The average unit value of U.S. exfoliated vermiculite sold or used by producers was estimated to be \$487 per metric ton, about the same as that of 2008.

## 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.

Two U.S. producers of vermiculite concentrate, Virginia Vermiculite LLC with two operations (near Woodruff, SC, and in Louisa County, VA) and W.R. Grace & Co. from its operation at Enoree, SC, produced an estimated 100,000 t of vermiculite in 2009. 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 production data reports from prior years. Data are rounded to one significant figure to avoid disclosing proprietary company information.

Vermiculite concentrate was shipped to exfoliating plants for conversion into lightweight material. Output of exfoliated vermiculite sold or used in 2009, using reported and estimated data, was about 69,000 t, 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, 8 responded to the annual canvass, representing 47% 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, Pennsylvania, New Jersey, Arizona, Florida, Massachusetts, Illinois, New Mexico, Ohio, and Arkansas.

## Consumption

Vermiculite has a wide range of uses that take advantage of its various attributes of fire resistance, reliable 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, fillers, and specialized additives (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-base 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 plants. As a soil conditioner, exfoliated vermiculite can improve the aeration of "sticky" soils (containing clay) and the water retention 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).

## Prices

Published prices for vermiculite serve only as a general guide because of variations in application, quantity, source, and other factors. U.S. domestic prices for vermiculite concentrate, ex-plant, ranged from \$95 to \$400 per metric ton, largely dependent on grade sizing. The average value of imports into the United States, f.o.b. (free on board) barge Gulf Coast port, ranged from \$210 to \$460 per ton (Moeller, 2010). Coarser grained vermiculite with greater thermal expansion commands a higher price, but no deposits within the United States yield this type of vermiculite, so a stable import market persists for this product.

The average unit value of U.S. exfoliated vermiculite sold or used by producers, using actual and estimated data, was about \$487 per ton; this 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. Total U.S. imports of vermiculite in 2009 (excluding any material from Canada and Mexico) were estimated to be about 39,000 t.

## World Review

The Palabora Mining Co. (a member of Rio Tinto plc) manages the largest known vermiculite reserves in the world in South Africa. Approximately 94% of Palabora’s mined vermiculite is exported, which accounts for an estimated 38% of the world’s average annual total vermiculite production of about 200,000 t (Palabora Mining Co., 2010).

Imerys (Paris, France) was the world’s second-ranked supplier of vermiculite in 2008, with production from deposits in Alice Springs, Northern Territory, Australia; Korla, China; and Shawa, Zimbabwe (Imerys, 2010, p. 9, 26).

## Outlook

As a result of nearly 300 deaths attributed to asbestos-related diseases in the vicinity of Libby, MT, research regarding vermiculite contaminated with amphibole continues in this area, the locality of what was once the largest vermiculite mine in the world (Whitehouse and others, 2008; Hart and others, 2009). Studies on the Libby vermiculite mine, which closed in 1990, will likely continue for the foreseeable future.

Owing to the energy-intensive process associated with the exfoliation of vermiculite, natural gas prices, which remained stable in 2009, typically dictate price fluctuations for exfoliated vermiculite. In the event of an increase in natural gas prices,

the cost for exfoliated vermiculite would probably likewise increase.

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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.
- Whitehouse, A.C., Black, C.B., Heppe, M.S., Ruckdeschel, John, and Leven, S.M., 2008, Environmental exposure to Libby asbestos and mesotheliomas: *American Journal of Industrial Medicine*, v. 51, no. 11, p. 877–880.

## GENERAL SOURCES OF INFORMATION

### U.S. Geological Survey Publications

- Lightweight Aggregates. Ch. in *United States Mineral Resources*, Professional Paper 820, 1973.
- 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.
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TABLE 1  
SALIENT VERMICULITE STATISTICS<sup>1</sup>

(Thousand metric tons and thousand dollars unless otherwise specified)

	2005	2006	2007	2008	2009
United States:					
Production, concentrate <sup>2</sup>	100	100 <sup>3</sup>	100 <sup>3</sup>	100 <sup>3</sup>	100 <sup>3</sup>
Exfoliated: <sup>c</sup>					
Quantity	85	90	85	82	69
Value <sup>e</sup>	35,100	36,500	36,500	40,100	33,600
Average value <sup>4</sup> dollars per metric ton	410 <sup>5</sup>	406	429	489	487
Exports <sup>e</sup>	5	5	5	5	3
Imports for consumption <sup>6</sup>	91	65 <sup>e</sup>	51	73	39
World, production	521	513	502 <sup>r</sup>	517 <sup>r</sup>	500 <sup>e</sup>

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

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

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

<sup>3</sup>Rounded to one significant digit.

<sup>4</sup>Based on rounded data.

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

<sup>6</sup>Source: UBM Global Trade, a division of United Business Media Ltd., 2010.

TABLE 2  
ACTIVE VERMICULITE EXFOLIATION PLANTS IN THE UNITED STATES IN 2009

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.	LaSalle	Illinois.
Thermal Ceramics Inc.	Macoupin	Do.
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.	Laurens	South Carolina.
Do. Ditto.		

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

(Metric tons)

	2008	2009
Aggregates <sup>2</sup>	29,500	24,300
Insulation <sup>3</sup>	5,850	5,860
Agricultural:		
Horticultural	21,500	14,900
Soil conditioning	W	W
Fertilizer carrier	W	W
Total	W	W
Other <sup>4</sup>	W	W
Grand total <sup>5</sup>	82,000	69,000

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	2005	2006	2007	2008	2009 <sup>e</sup>
Argentina	1,403	1,585	1,726	1,813 <sup>r</sup>	1,800
Australia <sup>e</sup>	12,000	13,000	13,000	13,000	12,000
Brazil, concentrate	24,191	19,279	18,952	20,089 <sup>r</sup>	20,100
China <sup>e</sup>	100,000	110,000	110,000	120,000	120,000
Egypt <sup>e</sup>	12,000	12,000	5,770 <sup>r,3</sup>	7,560 <sup>r,3</sup>	8,000
India <sup>e</sup>	4,500	4,600	4,700	4,800	4,900
Japan <sup>e</sup>	6,000	6,000	6,000	6,000	6,000
Russia <sup>e</sup>	25,000	25,000	25,000	25,000	25,000
South Africa	209,801	197,765	198,526	199,764	193,334 <sup>3</sup>
Uganda	2,574	3,512	3,500 <sup>e</sup>	3,500 <sup>e</sup>	3,600
United States, concentrate, sold and used by producers <sup>e</sup>	100,000	100,000 <sup>4</sup>	100,000 <sup>4</sup>	100,000 <sup>4</sup>	100,000 <sup>4</sup>
Zimbabwe	23,045	20,000	15,000	15,000 <sup>e</sup>	10,000
Total	521,000	513,000	502,000 <sup>r</sup>	517,000 <sup>r</sup>	500,000

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

<sup>1</sup>World totals 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 13, 2010.

<sup>3</sup>Reported figure.

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