



2005 Minerals Yearbook

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 2004. Worldwide vermiculite production increased to 527,000 t in 2005. U.S. exports were an estimated 5,000 t. U.S. imports were about 91,000 t, an increase of 31% from those of 2004. The average unit value of U.S. exfoliated vermiculite sold or used by producers increased by 5% compared with that of 2004.

Vermiculite is a hydrated magnesium-aluminum-iron silicate, with a generalized formula of $(\text{Mg}, \text{Fe}^{+2}, \text{Al})_3(\text{Al}, \text{Si})_4\text{O}_{10}(\text{OH})_2 \cdot 4\text{H}_2\text{O}$ (Fleischer and Mandarino, 1991, p. 211). Deposits of vermiculite are generally associated with ultramafic rocks rich in magnesium silicate minerals. Vermiculite is a secondary mineral formed primarily by the alteration of mica and less commonly by alteration of amphibole, chlorite, olivine, pyroxene, or other clay minerals. 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° 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 upon expansion to gold or bronze. This expansion process is 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).

Production

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 using employment data and/or adjusted production 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 2005, using actual and estimated data, was about 85,000 t, which was produced from both domestic and imported vermiculite concentrate (table 1). Exfoliated vermiculite was produced by 13 companies operating 17 plants in 10 States (table 2). Of the 17 exfoliation plants, 8 responded to the annual canvass, representing 61% 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 and estimated production levels. States that produced exfoliated vermiculite were, in descending order of estimated output sold or used, South Carolina, New Jersey, Pennsylvania, Arizona, Arkansas, Florida, Illinois, Massachusetts, Ohio, and New Mexico.

In November, Normiska Corp. of Canada acquired The Schundler Co. of Metuchen, NJ, a major expander of vermiculite and perlite supplying the eastern United States. Normiska is a horticultural company that also supplies composted pine bark, sphagnum peat moss, and mulches of varying specifications (Normiska Corp., undated^{§1}).

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-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 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).

¹References that include a section mark (§) are found in the Internet References Cited section.

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. According to Moeller (2006) prices for U.S. vermiculite concentrate, ex-plant, ranged from \$95 to \$190 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 \$410 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 2005 (excluding Canada and Mexico) were about 90,900 t (Commonwealth Business Media, Inc., 2005§). South Africa supplied 53% of the tonnage, and China, 46%.

Outlook

Prices for U.S. vermiculite concentrate may increase in 2006 because of increased energy and transportation costs. Worldwide production capacity continues to outpace consumption, which could limit price increases in the future (Moeller, 2006). New

products for waste treatment and disposal may create new markets for vermiculite. Research could be performed to find uses of both vermiculite concentrate and exfoliated vermiculite in organic and inorganic chemical treatment, toxic waste treatment, and other uses (Hindman, 2006).

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.

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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 Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.
- Vermiculite Association, The.

TABLE 1
SALIENT VERMICULITE STATISTICS¹

(Thousand metric tons and thousand dollars unless otherwise specified)

| | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|--------|--------|--------|------------------|--------|
| United States: | | | | | |
| Production: ² | | | | | |
| Concentrate ^c | 110 | 100 | 110 | 100 ³ | 100 |
| Exfoliated: ^c | | | | | |
| Quantity | 140 | 115 | 95 | 90 | 85 |
| Value ^e | 48,000 | 44,900 | 34,800 | 35,400 | 35,100 |
| Average value ^{e,4} dollars per metric ton | 340 | 390 | 370 | 390 | 410 |
| Exports ^e | 7 | 10 | 15 | 10 | 5 |
| Imports for consumption ⁵ | 65 | 56 | 37 | 69 ^e | 91 |
| World, production ⁶ | 431 | 498 | 491 | 516 ^r | 527 |

^cEstimated. ^rRevised.

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

²Sold or used by producers.

³Dickson, Ted, 2006, Vermiculite, countries and commodities reports, accessed March 17, 2006, via URL <http://www.mining-journal.com>.

⁴Based on rounded data.

⁵Source: Commonwealth Business Media, Inc., 2005.

⁶Excludes production by countries for which data were not available.

TABLE 2
ACTIVE VERMICULITE EXFOLIATION PLANTS IN THE UNITED STATES IN 2005

| 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, Inc. | Jefferson | Arkansas. |
| Do. | La Salle | Illinois. |
| Thermal Ceramics Inc. | Macoupin | Do. |
| Thermo-O-Rock East, Inc. | Washington | Pennsylvania. |
| Thermo-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 USE¹

(Metric tons)

| | 2004 | 2005 |
|--------------------------|--------|--------|
| Aggregates ² | 24,300 | 22,300 |
| Insulation ³ | W | W |
| Agricultural: | | |
| Horticultural | 22,200 | 24,600 |
| Soil conditioning | 22,800 | W |
| Fertilizer carrier | W | W |
| Total | W | W |
| Other ⁴ | 9,830 | 12,500 |
| Grand total ⁵ | 90,000 | 85,000 |

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

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

²Includes concrete, plaster, and premixes (acoustic insulation, fireproofing, and texturizing uses).

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

⁴Includes various industrial and other uses not specified.

⁵Rounded to two significant digits because of estimated data.

TABLE 4
VERMICULITE: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

| Country | 2001 | 2002 | 2003 | 2004 | 2005 ^c |
|---|---------|-----------------|-----------------|----------------------|------------------------|
| Argentina | 1,110 | 1,105 | 1,124 | 1,293 ^r | 1,300 |
| Australia ^c | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 |
| Brazil, concentrate | 21,464 | 22,577 | 26,055 | 28,700 ^r | 30,000 ^{p,3} |
| China ^c | 70,000 | 80,000 | 90,000 | 100,000 | 100,000 |
| Egypt ^c | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 |
| India ^c | 4,300 | 4,300 | 4,400 | 4,400 | 4,500 |
| Japan ^c | 6,400 | 6,200 | 6,200 | 6,000 | 6,000 |
| Malawi | 1 | -- ^r | -- ^r | -- ^r | -- ³ |
| Russia ^c | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 |
| South Africa | 156,632 | 210,297 | 182,802 | 196,893 ^r | 209,801 ^{p,3} |
| Uganda | 220 | 664 | 1,724 | 2,688 ^r | 3,100 ³ |
| United States, concentrate, sold and used by producers ^c | 110,000 | 100,000 | 110,000 | 100,000 ⁴ | 100,000 |
| Zimbabwe | 11,632 | 23,803 | 20,016 | 27,150 | 23,045 ^{p,3} |
| Total | 431,000 | 498,000 | 491,000 | 516,000 ^r | 527,000 |

^cEstimated. ^pPreliminary. ^rRevised. -- Zero.

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

²Excludes 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, 2006.

³Reported figure.

⁴Dickson, Ted, 2006, Vermiculite, countries and commodities reports, accessed March 17, 2006, via URL <http://www.mining-journal.com>.