



2014 Minerals Yearbook

VERMICULITE [ADVANCE RELEASE]

VERMICULITE

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In 2014, U.S. production of vermiculite concentrate increased by about 10%, although reportable production remained at an estimated 100,000 metric tons (t) because of rounding to the nearest 100,000 t to avoid disclosing company proprietary data. (Percentages in this report were computed using unrounded data.) Worldwide vermiculite production was about 381,000 t in 2014, a 5% increase from that of 2013. Nearly 63,000 t of exfoliated vermiculite valued at \$51.7 million was sold or used in the United States in 2014, down slightly from 64,000 t in 2013. U.S. exports of vermiculite were estimated to be about 3,000 t, up from about 2,000 t in 2013, and imports were estimated to be 43,000 t, an increase of nearly 22% from that of 2013 and about equal to the average imports of the previous 5 years (tables 1, 3, 4).

Production

Vermiculite is a hydrated magnesium-aluminum-iron silicate. Raw vermiculite is similar in appearance to mica, contains water molecules within its internal structure, and ranges in color from black to various shades of brown to yellow. When vermiculite flakes are heated rapidly to a temperature of 900 °C or higher, the intermolecular water flashes into steam, and the flakes expand into accordion-like particles, which are gold or bronze in color. This expansion process is called exfoliation, and the resulting lightweight material is chemically inert, fire resistant, and odorless. Two U.S. producers accounted for all domestic crude vermiculite production. Virginia Vermiculite LLC mined and processed vermiculite concentrate at its operation in Louisa County, VA, and Specialty Vermiculite Corp. did the same at its operations at Enoree and Woodruff, SC. 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. Each producer responded to its respective surveys, but specific production data were withheld to avoid disclosing company proprietary data.

Vermiculite concentrate was shipped to 15 companies operating 18 plants in 11 States for conversion into expanded lightweight products (table 2). In 2014, 63,000 t of exfoliated vermiculite sold or used by producers was valued at about \$51.7 million with a 6% increase in average unit value (table 1). Of the 18 exfoliation plants, 8 responded to the annual canvass, representing nearly 60% of the estimated sold or used exfoliated vermiculite tonnages listed in tables 1 and 3. Production data for nonrespondents were estimated based upon previous years' reported production levels. States that produced exfoliated vermiculite were, in descending order of tonnage, New Jersey, South Carolina, Pennsylvania, Florida, Illinois, Massachusetts, Arizona, Arkansas, Texas, Ohio, and New Mexico.

Consumption

Vermiculite has a wide range of uses, particularly in the agricultural and construction industries, because of its attributes, including fire resistance, low thermal conductivity, high liquid-absorption capacity, inertness, and low density. In horticulture, vermiculite mixed with peat or other composted materials, such as pine bark, produces a soil-like material well suited as a growing medium for plants. To condition soil, vermiculite can improve the aeration of “sticky” soils (clay-rich) and the water-retention characteristics of sandy soils, reducing the likelihood of compaction, cracking, and crusting of the soil. These two uses accounted for about 46% of the exfoliated vermiculite sold or used in the United States in 2014 (table 3). Vermiculite also is used in the fertilizer and pesticide markets because of its ability to act as a bulking agent, carrier, and extender, while providing some potassium, magnesium, and minor elements to plants. Vermiculite can absorb liquids, such as fertilizers, herbicides, and insecticides, which can then be transported as free-flowing solids.

Other major uses of vermiculite include insulation products and lightweight aggregate applications, such as general building plasters and concrete products, for its lightweight and thermal insulation properties. Special plasters, including those used for fire protection and soundproofing, may use vermiculite combined with a binder, such as gypsum or portland cement, fillers, and other specialized additives. As insulation, exfoliated vermiculite, in some applications treated with a water repellent, is used to fill pores and cavities in hollow blockwork and masonry construction to enhance acoustic properties, 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. 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.

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, largely dependent on grade sizing, ranged from \$140 to \$575 per metric ton in 2014, virtually unchanged from 2013 prices that ranged from \$145 to \$565 per ton. The value of imports into the United States in 2014, mostly coarser grades

free on board (f.o.b.) barge Gulf Coast port, ranged from \$300 to \$1,040 per ton (Moeller, 2014, 2015). Coarser grained vermiculite with greater thermal expansion commands a higher price, but virtually none is produced in the United States.

The average unit value of U.S. exfoliated vermiculite sold or used by producers, using actual and estimated data, was about \$823 per ton in 2014, a nearly 6% increase from \$779 per ton in 2013; this was a composite value of exfoliated vermiculite produced from domestic 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 category “vermiculite, perlite, and chlorite, unexpanded” under Harmonized Tariff Schedule of the United States code 2530.10.0000. Trade data in this report are from PIERS, a U.S. trade database compiled by the Journal of Commerce (JOC Group Inc., 2015). Estimated U.S. exports of vermiculite in 2014 were 3,100 t, with the United Kingdom receiving 50%; Australia, 26%; Honduras and Russia, 6% each; France 4%; and the remainder to several other countries. Total U.S. imports of vermiculite—crude, concentrate, and exfoliated—(excluding any material from Canada and Mexico) were estimated to be about 43,000 t, the majority coming from Brazil, 47%; China, 25%; South Africa, 24%; and Zimbabwe, 3%. Concentrates of coarser-than-medium particle size from high-yielding deposits, which have been increasingly less available in recent years, were imported mostly from China and South Africa.

World Review

Global vermiculite production increased by 5% in 2014 to about 381,000 t (table 4), mainly owing to an increase in production from the world’s leading producer, Palabora Mining Co. Ltd. [a subsidiary of Palabora Copper (Pty) Ltd.] in South Africa (Palabora Mining Co. Ltd., 2014a, b). Data from China and Russia, which may have been producers of significant quantities of vermiculite, were unavailable. Although mines and prospects in Brazil, Peru, and South Africa had the capability to increase the production of medium to coarse grades, expected production increases in 2014, especially of coarser grades, did not materialize. In Europe, demand was sluggish mostly owing to a continued lack of growth in the region’s construction industry. Coarser and more expensive grades, increasingly in higher demand in recent years, continued to be in short supply (Palabora Mining Co. Ltd., 2013, p. 51).

Brazil.—With reserves estimated to be 1.2 million metric tons (Mt) of vermiculite ore, Brasil Minérios Ltd. had an estimated production capacity of nearly 80,000 metric tons per year (t/yr) of vermiculite at its largest mine, the São Luís De Montes Belos Mine near Goiania in central Brazil. Brasil Minérios reported production of 40,000 cubic meters (an estimated 4,000 t) of expanded vermiculite in 2013. Production data for 2014 were not available, but the company reported a maximum capacity of 100,000 t/yr of vermiculite concentrate from its mines and industrial plants. Its main plant was in Sao Luis (Brasil Minérios Ltd., 2015). In 2014, Brasil Minérios exported about 20,000 t of

vermiculite to the United States, a nearly 13% increase from that of 2013 (JOC Group Inc., 2015). About 60% of its vermiculite products were exported, 50% of which were coarser grades and 50% finer grades, with sales in North America (50%), Europe (35%), and Asia (15%) (Elliott, 2012b; Moeller, 2015; Torrisi and Patel, 2014).

Near Brasilia in Catalao, Goias State, Brasil Minérios owned the mining rights to vermiculite deposits containing estimated vermiculite ore reserves of 2 Mt (Elliott, 2011a). The company planned to begin production at the Catalão Mine by 2016, bringing Brasil Minérios’ total production capacity to 200,000 t/yr in 2016 (Elliott, 2012b; Torrisi and Patel, 2014). Brasil Minérios expected to meet Brazil’s domestic demand for vermiculite for 50 years, as well as export. Brasil Minérios has two exfoliation plants—one in Sanclerlândia, Goias State, and another in Cosmopolis, Sao Paulo State—with combined installed capacity of 15,000 cubic meters per month (Brasil Minérios Ltd., 2013).

Bulgaria.—Wolff & Müller Minerals Bulgaria OOD, a German-Bulgarian joint-venture company, mined vermiculite ore from its Belitza opencast mine and further developed the nearby Verona vermiculite deposit in southwestern Bulgaria near the capital of Sofia. The company processed the crude vermiculite ore into a concentrate in superfine- and micron-sized products and increased production capacity to 20,000 t/yr (Moeller, 2014; Wolff & Müller Minerals Bulgaria OOD, 2015).

China.—Xinjiang Yuli Xinlong Vermiculite Co., Ltd., produced vermiculite at its Xinlong Mine in the Bazhou area of Xinjiang Province. The Xinlong Mine, the top-producing vermiculite mine in China, had a capacity of 120,000 t/yr of vermiculite concentrate and 30,000 cubic meters per year of exfoliated vermiculite. The company’s leading product was a flake vermiculite concentrate ranging in size from 0.3 millimeter to 8.0 millimeters. The company exported most of its products, typically to developed countries and regions such as Europe, Hong Kong, Japan, the Republic of Korea, Taiwan, and the United States, but also sold domestically (Xinjiang Yuli Xinlong Vermiculite Co., Ltd., 2014).

South Africa.—In 2014, South Africa was the world’s leading producer and exporter of vermiculite, accounting for about 38% of estimated world production, excluding China and Russia (table 4). From 2000 through 2013, on average, 88% of the vermiculite produced in South Africa was exported (Directorate Mineral Economics, 2015, p. 18).

Palabora Mining reported increased production in 2014 from its mine in Limpopo Province. In development activities, the company was extending its mining area beyond the current daily operations to increase overall production from the ore body to 150,000 t/yr by the end of 2015 (Palabora Mining Co., Ltd., 2014; Torrisi and Patel, 2014, p. 57; Industrial Minerals, 2015). Palabora Mining continued to face increased competition in the global vermiculite market, including competition from the South American producers, but it regained some of its market share lost in the past few years with a 5% increase in sales in 2013, in part through competitive pricing (Palabora Mining Co., Ltd., 2014, p. 12, 38). Because of grade constraints and lower recovery rates from the vermiculite ore body, the vermiculite

product has continued to shift toward fine and superfine grades, there being a limited capability to produce sufficient quantities of coarse grades to meet increasing demand (Palabora Mining Co. Ltd., 2013, p. 4, 51, and 149). Based on the company's latest exploration of nearby properties, Palabora determined that it could double annual vermiculite production and exceed the previous expected mine life of 24 years (Elliott, 2011b, 2012a; Torrisi and Patel, 2014).

Palabora Mining marketed its vermiculite products through the company's Singapore office to its three international subsidiaries in Europe, North America (Palabora America Ltd. Vermiculite Division in Kennesaw, GA), and Australia (Palabora Mining Co., Ltd., 2014, p. 38).

Uganda.—The Namekara Mine, a vermiculite project in the Manafwa district of eastern Uganda, remained on care-and-maintenance status through the end of February, in part owing to oversupply and sluggish market conditions in Europe, its largest market. At that time, Gulf Industrials Ltd. (Sydney, New South Wales, Australia) announced that it had entered into a Deed of Settlement and Release with its lenders, Richmond Partners Master Ltd. and Jonah Capital Ltd., giving the lenders full ownership of the Namekara vermiculite operations including the mining lease, exploration licenses, and other assets and liabilities associated with the project (Gulf Industrials Ltd., 2014). The Namekara deposit has about 55 Mt of inferred resources—including significant quantities of coarse and medium grades of about 20% and 30%, respectively—with sufficient resources to operate for more than 50 years at previously announced rates of production (Elliott, 2012b; Gulf Industrials Ltd., 2011, p. 10, 17).

Zimbabwe.—Samrec Vermiculite (Pvt.) Ltd., a subsidiary of Imerys SA, conducted intermittent mining operations at the Shawa Mine, in Shawa until September when the mine reported a resumption of ongoing active mining operations. In accordance with the country's Indigenisation and Economic Empowerment Act (IEEA), Imerys agreed with the Government of Zimbabwe to an ownership plan in which it pared down its 100% interest in Samrec to 49%, the remaining 51% going to local entities (Source, The, 2014a). The Act limits foreign investment with a majority of the interests required to be under local control. Samrec operated the Shawa Mine, in the village of Buhera near the township of Dorowa, about 300 kilometers southeast of the capital of Harare. The Shawa Mine, a surface mining operation with ore to a depth of 40 meters, had an expected mine life of more than 30 years in one of the largest vermiculite deposits in the world. In the fourth quarter of 2014, the company reported the resumption of production at the rate of 40,000 t/yr. The ore, which included a significant portion of large flake vermiculite, was processed into concentrates, the majority of which was exported to Europe, Japan, and Taiwan (Lismore-Scott, 2014; Source, The, 2014b).

On a smaller scale, Zimbabwe-based Wickbury Investments (Pvt) Ltd. mined vermiculite in Buhera for transport to its beneficiation facilities in the capital city of Harare. The company invested \$1 million in improving its extraction and beneficiation facilities to produce exfoliated vermiculite for the domestic market. Wickbury marketed its product mainly to

Zimbabwe's farming industry to slow the leaching of fertilizers from soil after excessive rainfall while also promoting the mineral's slow release of fertilizer to the soils. In drier areas, farmers would benefit from the mineral's ability to swell and store water, increase soil aeration, and transport and store nutrients, in both instances improving the long-term fertility of soils (Dickson, 2015).

Outlook

Exploration and development of vermiculite deposits containing medium, large, and premium (coarser) grades (mostly in China and South Africa) are likely to continue to be driven by the increasing demand for these larger grades. During the next several years, operations in Brazil and the United States are expected to help maintain regional and global supplies of fine, superfine, and micron grades. Although affected by political instability in recent years, continued production from the Shawa Mine in Zimbabwe may provide some of the needed supplies of coarser grades in the market.

Although increased demand and tight supplies for coarser grades of vermiculite continued globally, prices for vermiculite are expected for the most part to be unchanged through 2015.

With supplies of finer grades far exceeding those of coarse grades, producers will continue to investigate more ways to increase the use of the finer grades in higher value markets and in existing products, such as a functional filler in coatings, fireproofing, friction brake applications, and insulation. To increase fire resistance in coatings and binders that form high-tensile-strength films, finer grades of vermiculite concentrate may be used as intumescents, the concentrate swelling (expanding) and promoting a less dense, passive barrier upon exposure to heat. Product lines may be developed for new uses, such as fine-sized to micron-sized grades of vermiculite to control air pollution and absorb water in mines, replace zeolite in ion-exchange columns, purify wastewater, or serve to contain or remove nuclear waste. Innovative approaches to existing technologies, such as Brazil Minérios' unique hybrid wash screen-dry winnow, hold promise for high-quality, cost-effective improvements in processing vermiculite concentrate using conventional technologies (Elliott, 2012a; Moeller, 2015).

The International Monetary Fund predicted that the global economy would increase by about 3.3% in 2015 and 3.8% in 2016. Growth was projected to be stronger in the advanced economies while remaining strong, but slowing somewhat, in the emerging markets and developing economies in 2015 compared with 2014. Growth in the United States was expected to increase to 2.5% in 2015 and 3.0% in 2016 from 2.4% in 2014, with a continuing solid recovery spurred by continued increasing employment, good business and financial conditions, lower fuel prices, and continued strengthening of the housing market (International Monetary Fund, 2015). Continued improvement in the global and U.S. economies may result in increased activity in vermiculite markets in 2015–16, especially in those regions where the construction industry is expanding.

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TABLE 1
SALIENT VERMICULITE STATISTICS¹

(Thousand metric tons and thousand dollars unless otherwise specified)

	2010	2011	2012	2013	2014	
United States:						
Production, concentrate ^{e,2,3}	100	100	100	100	100	
Exfoliated: ^e						
Quantity	67	62	59	64	63	
Value ^e	38,200	42,100	45,400	50,100	51,700	
Average value ^e	dollars per metric ton	571	673	766	779	823
Exports ^e	2	2	2	2	3	
Imports for consumption ⁴	29	53	57	36	43	
World, production	427 ^r	403 ^r	380 ^r	364 ^r	381 ^e	

^eEstimated. ^rRevised.

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

²Sold or used by producers.

³Rounded to the nearest 100,000 metric tons to avoid disclosing company proprietary data.

⁴Source: JOC Group Inc. (a division of IHS Inc.), 2015.

TABLE 2
ACTIVE VERMICULITE EXFOLIATION PLANTS IN THE UNITED STATES IN 2014

Company	County	State
Fireproofing Products, Inc.	Bernalillo	New Mexico.
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.
Specialty Vermiculite Corp.	Maricopa	Arizona.
Do.	Broward	Florida.
Do.	Laurens	South Carolina.
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.
Vermiculite Products Inc.	Harris	Texas.
Whittemore Co., Inc.	Essex	Massachusetts.
Do. Ditto.		

TABLE 3
ESTIMATED EXFOLIATED VERMICULITE SOLD OR
USED IN THE UNITED STATES, BY END USE¹

(Metric tons)

	2013	2014
Aggregates ²	9,870	9,290
Insulation ³	3,510	4,140
Agricultural:		
Horticultural	19,300	20,600
Soil conditioning	10,100	10,100
Fertilizer carrier	W	W
Total	W	W
Other ⁴	W	W
Grand total ⁵	64,000	63,000

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 ³	2010	2011	2012	2013	2014 ^e
Argentina	2,500	1,000	320	1,000 ^{e,r}	1,000
Brazil, concentrate	49,976	54,970 ^r	51,986	68,014 ^r	70,000
Bulgaria ^c	3,000	15,000	18,600	18,600	18,000
Egypt	-- ^r	1,865 ^r	3,000	3,000 ^e	3,000
India	17,342	12,454 ^r	8,315 ^r	9,554 ^r	10,000
Japan ^e	6,000	6,200	6,200	6,200	6,000
Kenya	395	515	457	460 ^e	400
Russia ^c	25,000	25,000	25,000	NA ^r	NA
South Africa	199,285	170,571	132,886	127,658	143,000 ⁴
Uganda	2,475	8,426	11,251	243	--
United States, concentrate, sold and used by producers ^{e,5}	100,000	100,000	100,000	100,000	100,000
Zimbabwe	21,012 ^r	7,228 ^r	21,625 ^r	28,808 ^r	30,000
Total	427,000 ^r	403,000 ^r	380,000 ^r	364,000 ^r	381,000

^cEstimated. ^rRevised. NA Not available. -- Zero.

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

²Includes data available through July 16, 2015.

³In addition to the countries listed, Australia and China produced vermiculite, but available information is inadequate for the formulation of reliable estimates.

⁴Reported figure.

⁵Rounded to one significant digit to avoid disclosing company proprietary data.