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VERMICULITE

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In 2011, the domestic vermiculite industry continued to recover from the economic recession of 2008–09 with a slight increase in vermiculite concentrate production, following a substantial increase in 2010 from that of 2009. Reportable domestic production of vermiculite concentrate in 2011 remained at an estimated 100,000 metric tons (t), which was rounded to the nearest 100,000 t to avoid disclosing company proprietary data. Worldwide vermiculite production was about 542,000 t in 2011, a slight decrease from that of 2010. About 70,000 t of exfoliated vermiculite was sold or used in the United States in 2011, down from 73,000 t in 2010. U.S. exports of vermiculite were estimated to be approximately 2,000 t, about the same as in 2010, and U.S. imports were estimated to be 53,000 t, 83% more than those of 2010 and slightly more than the average imports of the previous 5 years (tables 1, 3, and 4).

Legislation and Government Programs

In September, a Montana court approved a negotiated $43 million settlement for those affected by asbestos exposure from the former W.R. Grace & Co. vermiculite mine in Libby, MT, following several decades of investigation and a decade-long legal proceeding. Once the largest vermiculite mine in the world, the Libby Mine was closed in 1990. The vermiculite deposit in and around Libby contained asbestos. More than 70% of the vermiculite used domestically during more than eight decades, especially as home insulation, came from the Libby Mine. More than 1,300 people were expected to receive payouts from the settlement, the large majority of which were to receive between $22,000 and $61,000 each in exchange for releasing the State and various State agencies from future claims related to the Libby Mine (Berkowitz, 2011; Carswell, 2011).

Production

Vermiculite is a hydrated magnesium-aluminum-iron silicate; flakes of raw vermiculite concentrate are mica-like in appearance, contain water molecules within their internal structure, and range in color from black to various shades of brown to yellow. When the flakes are heated rapidly to a temperature of 900 °C or higher, the 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 Grace Specialty Vermiculite (subsidiary of W.R. Grace & Co.) 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. Production data for nonrespondents were estimated based upon previous years' reported production levels.

Vermiculite concentrate was shipped to exfoliating plants for conversion into the expanded lightweight products. The output of about 70,000 t of exfoliated vermiculite sold or used by producers was valued at $42.9 million in 2011. Although output was down slightly from 73,000 t in 2010, the average unit value increased in 2011 (table 1). Exfoliated vermiculite, from domestic and imported vermiculite concentrate, was produced by 15 companies operating 18 plants in 11 States (table 2). Of the 18 exfoliation plants, 11 responded to the annual canvass, representing 50% of the estimated sold or used exfoliated vermiculite tonnages listed in tables 1 and 3. States that produced exfoliated vermiculite were, in descending order of estimated output sold or used, New Jersey, South Carolina, Pennsylvania, Arizona, Florida, Massachusetts, Arkansas, Illinois, Ohio, New Mexico, and Texas.

Consumption

Vermiculite has a wide range of uses because of its various attributes including fire resistance, low thermal conductivity, high liquid absorption capacity, inertness, and low density (table 3). In lightweight aggregate applications, vermiculite is used in general building plasters and concrete products for its lightweight and good thermal insulation properties, alone or combined with other lightweight aggregates such as perlite. Special plasters include fire protection and soundproofing through 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). Vermiculite can absorb liquids, such as fertilizers, herbicides, and insecticides, which can then be transported as free-flowing solids.

As insulation, exfoliated vermiculite, sometimes treated with a water repellent, is used to fill pores and cavities in masonry construction and hollow blockwork 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 (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 and pesticide market because of its ability to act as a bulking agent, carrier, 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, largely dependent on grade sizing, ranged from $115 to $460 per metric ton in 2011, an increase from that of 2010 when prices ranged from $100 to $400 per ton. The value of imports into the United States, mostly coarser grades, f.o.b. (free on board) barge Gulf Coast port, substantially increased by mid-year 2011 to range from $440 to $900 per ton, up from $360 to $485 per ton in 2010 (Moeller, 2011; 2012). Whereas vermiculite prices rose worldwide, the largest price spikes were for vermiculite sourced from South Africa because of higher demand and a global shortage in coarse grades (Elliott, 2011a). 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 $610 per ton in 2011, an increase of 8% from about $564 per ton in 2010; 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 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 (United Business Media Global Trade, 2012). Total U.S. exports of vermiculite in 2011of about 2,300 t were shipped with the United Kingdom receiving 70%; Honduras, about 20%; and Latvia, about 3%, with 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 53,000 t, the majority of those coming from China with about 46%; South Africa, 35%; and Brazil, 14%. Concentrates of coarser particle size from higher yielding deposits, which have been increasingly less available in recent years, are imported mostly from China and South Africa.

World Review

Demand for vermiculite continued to increase globally in 2011, especially for the coarser grades, which were increasingly in shorter supply in recent years. Prices began to rise in mid-2011 because of increased demand. New operations ramping up production in Brazil and Uganda were expected to help reduce global supply shortages, mostly medium to smaller grades from Brazil and significant percentages of medium to premium coarse grades from Uganda (Elliott, 2012b).

Brazil.—In 2011, Brasil Minérios Ltd. produced nearly 70,000 t of vermiculite at its São Luís De Montes Belos Mine near Goiânia in central Brazil. Minérios exported 60% of its product; 40% of the company's exports went to North America. By upgrading its processing technologies, the company increased production by 20% and produced an exceptionally clean product at reduced costs. With estimated reserves of 1.2 million metric tons (Mt) of vermiculite ore, the company planned to increase production capacity to 100,000 metric tons per year (t/yr) of vermiculite in 2012 (Elliott, 2011c–d; 2012b).

Near Brasília in Catalão, Goiás State, Brasil Minérios owned the mining rights to huge vermiculite deposits, consisting of an estimated vermiculite ore reserve of 2 Mt (Elliott, 2011c). The company planned to begin production at the Catalão Mine and reach production capacity of 20,000 t/yr by 2013 and 100,000 t/yr in 2016, bringing Brasil Minérios' total production capacity, including the São Luís Mine, to 200,000 t/yr in 2016 (Elliott, 2011d; 2012a, b).

China.—Late in 2011, Imerys' (Paris, France) Xinlong Vermiculite Co. Ltd. resumed operations at the company's Xinlong Mine (Xinjiang Province) following the curtailment of vermiculite mining during 2010 as part of an Imerys group restructuring (Elliott, 2012b). Xinjiang Weili Xinlong Vermiculite Co. produced about 80,000 t of vermiculite in 2011 and was expected to increase production to at least 100,000 t in 2012 (Elliott, 2011e).

South Africa.—In 2011, South Africa was the world's leading producer and exporter of vermiculite, accounting for about 31% of estimated world production of 542,000 t (table 4). From 2000–10, on average, 88% of the vermiculite produced in South Africa was exported (Directorate Mineral Economics, 2012).

From its mine in Limpopo Province, Palabora Mining Co. Ltd. (a member of Rio Tinto plc) managed the world's leading developed vermiculite reserves. Palabora Mining reported 165,000 t of vermiculite production in 2011, 16% less than that of 2010, owing to wet weather in the first and fourth quarters, reduced ore feed grades, and various safety improvements (Palabora Mining Co. Ltd., 2012, p. 2, 39). Production of all grades of vermiculite—large, medium, and small—at Palabora's South African deposit have decreased, and the production of sufficient quantities of coarse-grained grades to meet the substantially increasing world demand was becoming increasingly challenging for the company (Elliott, 2011d). Palabora began a project on nearby properties, which could as much as double its annual vermiculite production. With the inclusion of Palabora's newly identified reserves, the mine may significantly exceed its current expected

24-year mine life, based on recent average production of about 200,000 t/yr (Elliott, 2012a).

Uganda.—Gulf Industrials Ltd. (Sydney, Australia) continued to increase production at the East African Namekara vermiculite deposit, as part of the company's larger East African Vermiculite Project (EAVP) in eastern Uganda. The EAVP has about 55 Mt of inferred resources, including significant quantities of coarse and medium grades of about 30% each. In part owing to a newly installed drier system, the company increased production capacity from 4,000 t/yr of raw vermiculite concentrate in 2010 to about 18,000 t/yr in 2011 and anticipated reaching the company's nameplate production capacity of 30,000 t/yr during 2012 (Elliott, 2011b).

Gulf Industrials also planned to increase production capacity to 80,000 t/yr at Namekara by adding a 50,000-t/yr plant by 2014. Gulf Industrials was working to improve transportation and related infrastructure, negotiating a mining agreement with Government of Uganda, and stabilizing its supply of electricity. All of Namekara's product was transported by truck in 2011, but the company was planning to integrate road transport with that of rail. The Rift Valley Railways Consortium was working to manage and upgrade the railways of Kenya and Uganda (Elliott, 2012b). The Namekara deposit has sufficient resources for more than 50 years at planned rates of production. Dupres Minerals Ltd. was under contract to market and distribute Namekara's vermiculite through 2034 (Proactive Investors Australia, 2010; Gulf Industrials Ltd., 2011, p. 2–4).

Outlook

While increased demand and tight supplies for coarser grades of vermiculite continued globally, and new and expanding operations continued ramping up production, prices were expected to stabilize somewhat in 2012. However, some forecasts were mixed, citing the potential for decreasing prices owing to oversupply of the smaller grades. Price spikes like those of mid-2011 were not expected. In the first half of 2011, prices for imports into the United States increased by 20% to as much as 80%. Prices for exfoliated vermiculite are likely to continue to be affected by the volatility of natural gas costs (Elliott, 2012b). Vermiculite production was expected to continue to increase worldwide in 2012, in large part because of expanding production from the major mining operations in Brazil and Uganda and significant increases in production from China.

With supplies of finer grades far exceeding coarse grades, producers will continue to look for more ways to use finer grades in existing products, such as insulation, brake pads, and fireproofing, and to develop product lines for new uses, such as micron-sized grades of vermiculite to absorb mine water or to replace zeolite in ion-exchange columns. Innovative approaches to existing technologies, such as Brazil Minérios Ltd.'s unique hybrid wash screen–dry winnower hold promise for high quality, cost-effective improvements in processing vermiculite concentrate using conventional technologies (Elliott, 2012b).

The International Monetary Fund expected the global economy to increase by about 3.5% in 2012 and 3.9% in 2013, with advanced economies continuing to improve slower than emerging and developing economies (International Monetary Fund, 2012). Continued growth in the global economy, particularly in the economies of emerging and developing countries and in regions where the construction industry is recovering, may lead to increased use of vermiculite in the construction industries of these economies in 2012–13.

Owing to the energy-intensive process associated with the exfoliation of vermiculite in traditional blast furnaces, changes to natural gas prices typically lead to price fluctuations for exfoliated vermiculite. Use of a new microwave technology for processing vermiculite could substantially reduce the energy needed to exfoliate crude vermiculite concentrate as compared with conventional furnaces and, in time, potentially alter the way that vermiculite is exfoliated worldwide Moeller, 2012). The process produced a more consistent heating of all the vermiculite flakes, which increases the proportion that is exfoliated successfully. Up to 8% of vermiculite is not fully exfoliated in traditional blast furnace processing; that portion is difficult to use in end products and incurs costs for waste disposal (Elliott, 2011a).

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TABLE 1
SALIENT VERMICULITE STATISTICS[1]

(Thousand metric tons and thousand dollars unless otherwise specified)

		2007	2008	2009	2010	2011
United States:						
Production, concentrate[e, 2, 3]		100	100	100	100	100
Exfoliated:[e]						
Quantity		85	82	69	73	70
Value[e]		36,500	40,100	33,600	41,200	42,900
Average value[e, 4]	dollars per metric ton	429	489	487	564	609
Exports[e, 5]		5	5	3	2	2
Imports for consumption[e, 5]		51	73	39	29	53
World, production		510	537 [r]	533 [r]	544 [r]	542 [e]

[e]Estimated. [r]Revised.
[1]Data are rounded to no more than three significant digits unless otherwise specified.
[2]Sold or used by producers.
[3]Rounded to the nearest 100,000 metric tons to avoid disclosing company proprietary data.
[4]Based on rounded data.
[5]Source: United Business Media Global Trade (a division of United Business Media Ltd.), 2012.

TABLE 2
ACTIVE VERMICULITE EXFOLIATION PLANTS IN THE UNITED STATES IN 2011

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.
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 USE[1]

(Metric tons)

	2010	2011
Aggregates[2]	14,300	11,700
Insulation[3]	5,560	3,200
Agricultural:		
Horticultural	17,400	18,600
Soil conditioning	11,000	11,300
Fertilizer carrier	W	W
Total	W	W
Other[4]	W	W
Grand total[5]	73,000	70,000

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

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

[4]Includes various industrial and other uses not specified.

[5]Rounded to two significant digits because of estimated data.

TABLE 4
VERMICULITE: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country	2007	2008	2009	2010	2011[e]
Argentina	1,726	1,813	2,150	2,000 [e]	2,000
Australia[e]	13,000	13,000	12,000	13,000	13,000
Brazil, concentrate	18,952	32,503 [r]	50,438 [r]	49,976 [r]	50,000 [p]
Bulgaria	--	--	--	3,000 [e]	3,000
China[e]	110,000	120,000	120,000	120,000	120,000
Egypt[e]	5,770 [3]	7,560 [3]	4,500 [r]	-- [r]	5,000
India	9,639	11,742	12,000 [e]	12,000 [r, e]	13,000
Japan[e]	6,000	6,000	6,000	6,000	6,000
Russia[e]	25,000	25,000	25,000	25,000	25,000
South Africa	198,526	199,764	193,334	199,285 [r]	170,000
Uganda[e]	3,500	3,500	3,600	3,500	20,000
United States, concentrate, sold and used by producers[e, 4]	100,000	100,000	100,000	100,000	100,000
Zimbabwe	17,395	16,123	3,211	10,000 [r, e]	15,000
Total	510,000	537,000 [r]	533,000 [r]	544,000 [r]	542,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]World totals 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 June 11, 2012.

[3]Reported figure.

[4]Rounded to avoid disclosing company proprietary data.