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VERMICULITE

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In 2010, the domestic vermiculite industry showed signs of recovery from the economic recession that started in late 2008 with a substantial increase in vermiculite concentrate production compared with that of 2009, although reportable production of vermiculite concentrate in 2010 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 increased to approximately 540,000 t in 2010, up about 5% from that of 2009. About 73,000 t of exfoliated vermiculite was sold or used in the United States in 2010, up from 69,000 t in 2009. U.S. exports of vermiculite were estimated to be approximately 2,000 t, down from about 3,000 t in 2009, and U.S. imports were estimated to be 29,000 t, 26% less than those of 2009.

Legislation and Government Programs

As a result of an estimated 400 deaths and more than 1,700 people treated for sicknesses attributed to asbestos-related diseases in the town of Libby, MT, and the surrounding region, research regarding vermiculite contaminated with amphibole continued in this area, the locality of what was once the largest vermiculite mine in the world (Hart and others, 2009; Brown, 2011; Frasca, 2011). Studies on the Libby vermiculite mine, which closed in 1990, continued in 2010 leading to a proposed settlement in October. The State of Montana was in the final stages of negotiating a $43 million settlement with those affected. More than 1,100 claimants with asbestos-related diseases would get a portion of the settlement in exchange for releasing the State and various State agencies from future claims related to the former vermiculate mine in Libby. For the settlement to be final, court approval was required, which was not achieved by yearend. A ruling on the settlement was expected in 2011 (Hintze, 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, 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 of vermiculite concentrate, Virginia Vermiculite LLC with two operations—one near Woodruff, SC, and one in Louisa County, VA—and W.R. Grace & Co. from its operation at Enoree, SC, produced an estimated 100,000 t of vermiculite in 2010. 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 73,000 t of exfoliated vermiculite sold or used by producers was valued at $41.2 million in 2010, up from $33.6 million in 2009 (table 1). Exfoliated vermiculite, produced from domestic and imported vermiculite concentrate, was produced by 14 companies operating 17 plants in 10 States (table 2). Of the 17 exfoliation plants, 9 responded to the annual canvass, representing 57% 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, South Carolina, New Jersey, Pennsylvania, Florida, Arizona, 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, 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/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, 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 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 $564 per ton in 2010, up by 16% from about $487 per ton in 2009; 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, 2011). Total U.S. imports of vermiculite in 2010—crude, concentrate, and exfoliated—(excluding any material from Canada and Mexico) were estimated to be about 29,000 t, the majority of those coming from South Africa, about 67%; Brazil, 14%; and China, 12%. Total U.S. exports of about 2,000 t were shipped to the United Kingdom, 66%; Israel and Latvia, about 7% each; and Honduras, about 6%, with the remainder to several other countries.

World Review

Brazil.—In 2010, Brazil Minerios Ltda. produced 35,000 t of vermiculite at its Sao Luis De Montes Belos Mine near Goiania in central Brazil. With estimated reserves of 1.2 million metric tons (Mt) of vermiculite ore, Brasil Mineros planned increases in production capacity to 55,000 metric tons per year (t/yr) of vermiculite in 2011 and to 80,000 t/yr by 2013 (Elliott, 2011c).

China.—As part of group restructuring, Imerys (Paris, France) achieved a portion of its cost savings during the year, by significantly reducing production and temporarily withdrawing from vermiculite activities at the company's Xinlong Mine in the Xinjiang Province, along with taking a depreciation of mining rights at the operation (Imerys, 2011, p. 5). Imerys was the world's second-ranked supplier of vermiculite, with production also from deposits mainly in Australia and Zimbabwe.

South Africa.—In 2010, South Africa was the world's leading producer and exporter of crude vermiculite, accounting for about 198,000 t, or 37%, of an estimated world production of 540,000 t (table 4). From 2000–09, on average, 89% of the crude vermiculite produced in South Africa was exported (Directorate Mineral Economics, 2011). From its mine in Limpopo Province, Palabora Mining Co. Ltd. (a member of Rio Tinto plc) managed the world's largest vermiculite reserves. Palabora Mining reported 196,000 t of vermiculite production in 2010 (Palabora Mining Co. Ltd., 2011). Palabora Mining was finding it increasingly challenging to produce sufficient quantities of coarse-grained grades from its diminishing resources to help meet substantially increasing world demand (Elliott, 2011c).

Uganda.—Gulf Industrials Ltd. (Sidney, Australia) continued development of and 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, considered to be one of the world's largest deposits, has about 55 Mt of inferred resources, including significant quantities of coarse grades of vermiculite. The company planned to increase production capacity from 4,000 t/yr of raw vermiculite concentrate in 2010 to 18,000 t/yr with the installation of a new drier system in 2011 and to 80,000 t/yr during 2012 (Elliott, 2011b). The Namekara deposit has sufficient resources for more than 50 years at planned rates of production. The company secured a 25-year sales contract for all production with Dupres Minerals Ltd., which will market and distribute the product (Proactive Investors Australia, 2010; Gulf Industrials Ltd., 2011, p. 2–4).

Outlook

With increased demand globally and a tightening of supply, especially in coarser grades, prices were expected to rise, possibly significantly, in 2011. Vermiculite production was expected to continue to increase worldwide in 2011 reflecting a continued slow recovery from the global economic recession. The ramping up of production from major mining operations in Brazil and Uganda was expected to contribute to increased production in 2012. The Imerys Xinlong Mine in China was expected to reopen in late 2011 or early 2012.

International Monetary Fund (IMF) forecasts of global economic growth for 2011 and 2012 were mostly unchanged from those completed in early 2010. The world economy was expected to grow at about 4.5% per year in each year, with offsetting changes across various economies—advanced economies increasing at about 2.5% and emerging and developing economies at about 6.5%. Growth in the global economy may result in increased activity in vermiculite markets in 2011–12. Because of anticipated increases in construction activity and a continued recovery from the global economic recession, North American vermiculite markets could increase

by 2% to 3%, while those in Europe and Asia may increase by 3% and 5% or more, respectively (International Monetary Fund, 2011).

Owing to the energy-intensive process associated with the exfoliation of vermiculite in traditional blast furnaces, natural gas prices typically dictate price fluctuations for exfoliated vermiculite. Prices, which remained stable in 2009, rose slightly in 2010. In the event of increased natural gas prices, the cost for exfoliated vermiculite would probably increase likewise.
A new microwave technology under development held promise to significantly reduce the energy needed for processing crude vermiculite, and, by producing a more consistent heating process on all the vermiculite flakes, to increase 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 utilize 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)

		2006	2007	2008	2009	2010
United States:						
Production, concentrate[e, 2, 3]		100	100	100	100	100
Exfoliated:[e]						
Quantity		90	85	82	69	73
Value[e]		36,500	36,500	40,100	33,600	41,200
Average value[e, 4]	dollars per metric ton	406	429	489	487	564
Exports[e]		5	5	5	3	2
Imports for consumption[5]		65 [e]	51	73	39	29
World, production		512 [r]	510 [r]	525 [r]	509 [r]	536 [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., 2010.

TABLE 2
ACTIVE VERMICULITE EXFOLIATION PLANTS IN THE UNITED STATES IN 2010

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[1]

(Metric tons)

	2009	2010
Aggregates[2]	24,300	14,300
Insulation[3]	5,860	5,560
Agricultural:		
Horticultural	14,900	17,400
Soil conditioning	W	11,000
Fertilizer carrier	W	W
Total	W	W
Other[4]	W	W
Grand total[5]	69,000	73,000

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	2006	2007	2008	2009	2010[e]
Argentina	1,585	1,726	1,813	2,150 [r]	2,000
Australia[e]	13,000	13,000	13,000	12,000	13,000
Brazil, concentrate	19,279	18,952	20,089	20,100	35,000
Bulgaria	--	--	--	--	3,000
China[e]	110,000	110,000	120,000	120,000	120,000
Egypt[e]	12,000	5,770 [3]	7,560 [3]	12,000 [r]	12,000
India	10,539 [r]	9,639 [r]	11,742 [r]	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	197,765	198,526	199,764	193,334	198,005 [3]
Uganda[e]	3,512 [3]	3,500	3,500	3,600	3,500
United States, concentrate, sold and used by producers[e, 4]	100,000	100,000	100,000	100,000	100,000
Zimbabwe	13,421 [r]	17,395 [r]	16,123 [r]	3,211 [r]	5,000
Total	512,000 [r]	510,000 [r]	525,000 [r]	509,000 [r]	536,000

[e]Estimated. [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 July 13, 2011.

[3]Reported figure.

[4]Rounded to avoid disclosing company proprietary data.