

## VERMICULITE

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**T**here are few producers of crude vermiculite worldwide, and only a handful of countries are recorded as producing significant quantities. Production and markets tend to be dominated by producers in South Africa and the US, with smaller quantities produced in Brazil, Zimbabwe, Australia, Uganda, China and Russia. Crude vermiculite is almost always exfoliated before use. This involves heating the material rapidly to a temperature above 870°C. At this point water molecules, which form layers within the internal structure of vermiculite, boil, and the steam forces the layers apart in an 'accordion-like' expansion. Individual flakes may expand up to 30 times their original size, although average expansion in commercial grades will be less than that. Crude vermiculite tends to have a loose bulk density of 640-960 kg/m<sup>3</sup>, and exfoliated vermiculite has a loose bulk density in the range 52-192 kg/m<sup>3</sup>, depending on the grade and quality of the raw material. As a low-density material filled with air voids, it makes an excellent insulating material both at ambient and elevated temperatures.

### **Production**

Total world production of vermiculite can be difficult to estimate accurately. The United States Geological Survey (USGS) included an estimated figure for production in the US for 2003 but this was listed as an estimate, and production levels in some other countries, including China and Russia, can be very difficult to determine reliably. The largest producer by far is still South Africa, with production in the US considerably lower but still possibly retaining second place. Production in China may be of the same order of magnitude as that in the US now, although some estimates put output much lower. After significant falls in US production, there seemed to be some stabilisation of the situation in 2004.

The USGS reported world production of 480,000 t in 2003 although much of this is estimated, including US production. The USGS estimated South African production at 220,000 t, an increase of 10,000 t over the previous year, but indications from South Africa are that sales actually declined. Palabora Mining Co, the largest producer in the world by far, reported sales of 176,495 t in 2003 compared with 189,948 t in 2002. There was some other production in the country but it is believed that total output was only of the order of 6,000 t. Chinese production of vermiculite might actually be as high as 100,000 t now, but it is difficult to get accurate statistics. There are exports being made from China and their low cost are regarded by Palabora as one of the main threats to its international markets. Booming construction levels in China may actually mean that local consumption, which is often even more difficult to estimate, has increased beyond even the levels estimated.

South Africa still remains the dominant supplier to world markets, with virtually all of the production coming from Palabora. The company noted that slower

economic activity in its main markets in the US, Europe and Southeast Asia continued throughout 2003. Construction activity in many of these markets seems to be increasing, but there are considerable variations in this. In fact, there was strength in many European construction markets, with some exceptions. There is also the factor that overall demand in the US has been declining because of perceived environmental concerns. The company did, however, point out that local demand had increased. The average price obtained for the vermiculite was R1.429 compared with R1,911 in 2002, but all of that difference is accounted for by variation in the exchange rate of the South African rand against the US dollar. The price achieved in dollar terms, based on average exchange rates, was US\$189/t compared with US\$181/t the previous year, essentially representing little or no change in the price structure. There may be some improvement in sales during 2004 as there was a delay in offtake of grades of Rewormed Screen Undersize and Dry Dust Mesh to Mitsubishi in Japan, and sales of these grades could add to the total in 2004.

The US market seems to be little changed in 2003 and into 2004. It is estimated that consumption is of the order of 140,000 t and that local production in 2003 was perhaps slightly higher than estimates for the previous year, at just over 100,000 t. Imports continued to fall, to only 48,000 t, still mainly from South Africa, although Chinese imports remained a strong contender in the market. Exports are estimated to have remained stable at around the 10,000 t mark, although the US has never been viewed as a large exporter of vermiculite, consuming much of its own production and supplementing this with imports, traditionally from South Africa. The two current US producers are W R Grace, with mines in the Enoree district of South Carolina, and Virginia Vermiculite, with mines in the Virginia. US consumption of vermiculite still suffers from the perception of environmental problems. This has resulted in many of the horticultural users replacing vermiculite in their formulations. There has been considerable press coverage and campaigns by consumer protection groups and others concerning the presence of asbestos in vermiculite. The industry has had a difficult time convincing consumers that although there may have been asbestos present in some vermiculite (and specifically vermiculite from a mine in Montana that closed many years ago) production from existing producing mines does not have the same problem. The bad publicity and the continuing perception that vermiculite can pose a health hazard may have a long-lasting effect on the US market.

Chinese production as mentioned is very difficult to track. There are some larger producers, but potentially also a large number of relatively small suppliers. Two, Xinjiang Yuli Xinlong Vermiculite and Hebei Metals and Minerals Import Export Corp, are members of the Vermiculite Association and are involved with exports from China on a significant scale. In general, products are at the low end of the price range and competitive with at least some of the grades offered by Palabora. Exports to the US, alone, are now probably in the range of 10,000-20,000 t/y. Other exports are aimed largely at the Far East market, but it is believed that, with the surge in construction activity in China itself, local demand and hence production may actually be

running at high levels, and that production may actually be higher than even the most optimistic estimates. To date, no outside companies are known to have investigated opening up operations in China or to have entered joint ventures with local producers. However, should Chinese vermiculite increase significantly, overseas investment may be attracted.

Imerys of France is now a significant player in world markets through its ownership of both Samrec, with its vermiculite mine at Shawa in Zimbabwe, and Australian Vermiculite Industries (AVI), with an operation near Alice Springs. The Zimbabwe operation is thought to be producing at close to its capacity level of 40,000 t/y and production from Australia is around 12,000 t/y. Material from Zimbabwe is mainly shipped to Europe where it is marketed by CMMP, a trading and processing company based in France, although there are also perhaps 10,000 -15,000 t/y shipped elsewhere, mainly to Asian markets. Asia is also the largest market for exports of vermiculite from AVI but as it is the only producer in Australia it also serves the domestic market.

Brazilian production in 2003 has been estimated at 23,000 t by the USGS but the previous year's production was revised downwards from the same level, to 22,000 t. Nevertheless, this may be an underestimation. Brazil Minerios is a relatively new producer and has plans to enter the North American market in the next 2-3 years. Its current production is of the order of 10,000 t/y of vermiculite concentrate from operations in Goias State, some of which is expanded in its own plants for local markets.

Uganda is a new addition to the ranks of vermiculite producers. IBI Resources, through its Ugandan subsidiary, Canmin Resources, has developed a 40,000 t capacity deposit at Mbale, known as the Namekara project. However, initial capacity on a single shift is 15,000 t with an increase to 25,000 t/y possible by adding a second shift. Only a small amount of additional capital expenditure would be needed to increase the output to the 40,000 t/y level. The company has been developing contracts for export sales and has reached an agreement with a company for local sales and sales to countries in the region. Some customers apparently had problems using horizontal kilns for exfoliating the material, which has thin flakes. As a result of this, the company has developed a vertical exfoliation unit, which it has used for in-house processing and for the domestic Ugandan market. It has now sold one of these machines to a customer in Europe, with delivery scheduled for the fourth quarter of 2004 and production expected later in the year, potentially increasing off take of product from Uganda. IBI is also in discussions with other customers for this exfoliator and related vermiculite supply contracts.

In February 2004, IBI took an option on a vermiculite property in Nevada, US. Considerable exploration work had already been carried out on the project, which is being assessed by the company to determine what further work is required to bring the project to a development decision stage. A new company, North American Vermiculite, has been formed by IBI to operate the project. The option lasts until December 2005.

Russia is a long-standing producer of vermiculite. Traditionally, production was for domestic markets including markets in what are now independent countries that were once part of the Soviet Union. There have been no further developments announced of investigations into vermiculite deposits in Uzbekistan or in some other potential deposits in Russia itself. Current production is estimated to be of the order of 25,000 t/y.

In Canada, some further progress has been made at the vermiculite operations of Regis Resources at Cavendish Township, Ontario. After some apparent teething problems with its mill Regis is now in production and sample shipments have been made to the US, including some being expanded for Regis by W R Grace. The material is very light in colour, almost white and may find some niche markets because of its colour.

### **Markets**

The market for vermiculite is heavily tied to its uses in construction and horticultural/agricultural applications. Markets can vary considerable from region to region. In virtually all cases, vermiculite is exfoliated before use and the exfoliation process takes place close to the market as the large volume increase associated with the process makes it uneconomical to transport the exfoliated material long distances. Although there are few producers of raw vermiculite, there are large numbers of often relatively small companies involved with exfoliation.

In Europe, the market is considered to be mature, although in many countries the market is relatively strong because of high levels of construction. In general, however, the market for vermiculite is relatively stable. European demand has not been hit badly by the same sort of asbestos fears that the North American market has experienced. US product from Montana that did have a problem with asbestos content was never a factor in the European market, and the sources of vermiculite used in Europe have not been linked with asbestos contents. There are occasionally some concerns expressed by certain groups but so far there has been no significant problems in Europe concerning an association of asbestos with vermiculite.

The US market seems to have stabilised somewhat in 2003 after significant falls that resulted in total consumption possibly as low as 140,000 t. However, it would appear that there were still some declines and this could continue at a rate of perhaps 2% per year, mainly due to reduced usage in potting soils, but also due to some industrial consumers moving overseas. There is the perception that vermiculite is associated with asbestos and that perception will be difficult to overcome, certainly in the short term. Despite extensive work by current producers to show that their products do not have the same asbestos problems as those from Libby, Montana, the perception is still prevalent in the minds of consumers and in press reports. Vermiculite has already been removed from potting soil mixes and agricultural products. This is in contrast to Europe where there may actually be some potential growth in this market due to environmental objections to the use of peat-based composts. The use of vermiculite loose fill insulation is also suffering in the US from the same asbestos concerns. The market appears to be stabilising

but it may be a long time before markets can overcome the perceived association with asbestos and for markets to recover significantly.

### **Prices**

There has been no change in published prices for vermiculite during the year, although increasing freight rates may result in higher delivered prices. Prices listed in Industrial Minerals were US\$160-200/t for South African material fob Rotterdam and US\$130-200 per short ton (equivalent to US\$144-221/t) bulk ex-works for US material. Palabora had an average sales price of US\$189.02 when converted from rand at the average rand/US\$ exchange rate. This compares with an average realised price of US\$181.31/t in the previous year. It is difficult to get an accurate indication of price trends from this as the most significant factor has been fluctuations in the rand/US\$ exchange rate. There is also a wide range of grades of vermiculite sold and this is reflected in the range of quoted prices, and a change in the relative proportions of the different grades can influence the average price. No significant changes in pricing other than those caused by exchange rate or freight costs are expected and, if anything, there is continuing downward price pressures in some markets, where cheaper grades are being offered from China.