

# VERMICULITE

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There are few producers of crude vermiculite worldwide, and only a handful of countries 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 formed 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>, while 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, vermiculite makes an excellent insulating material both at ambient and elevated temperatures.

## **Production**

The two dominant world producers are South Africa and the US, although South Africa is the main supplier to international trade because much of the US supply is used domestically and supplemented by imports. Production statistics for the US are withheld to prevent disclosure of confidential data and production figures for some other countries such as Russia, and China are not to high levels of certainty. Estimates of total world production can be a matter of speculation. For 2001, estimates ranged from about 425,000 t to 470,000 t. In 2002, it has been equally difficult to estimate production, with conflicting information showing significantly reduced consumption and imports in the US but significantly increased production in South Africa from the low levels of 2001. As such, it is estimated that production is probably of the order of 450-470,000 t in 2002. Zimbabwe production capacity has grown and there is a new producer in Uganda. China is particularly difficult to estimate precisely but production has certainly grown to a level where it is now one of the largest producers, possibly close to overtaking the US as the second-largest producer. Other significant producers are Brazil and Australia.

Palabora reported increased sales levels for 2002 of 190,000 t, a small increase over the 186,000 t sold in 2001, although production levels for 2000 were reported as 160,300 t and obviously some sales were made from stock held. Although actual production figures for 2002 were not released at the time of writing it was stated that production had significantly increased in 2002 as a result of improved plant recoveries, and it is likely that production levels were close to actual sales. The other producer in South Africa, Natkruit Mine, north of Pietersburg, is relatively small, and annual production is estimated at about 6,000 t.

Official US production figures are not published but industry estimates that consumption has fallen from around 240,000 t in 2000 to 200,000 t in 2001 and to only 140,000 t in 2002. A significant portion of the decline has been attributed to lower imports but, if imports and exports reported by the US Geological Survey (USGS) are removed from those figures, the production of vermiculite in the US is indicated as 186,000 t in 2000, 142,000 t in 2001 and only 97,000 t in 2002. This may actually be an underestimate of production from the two producers, W.R.Grace, from its mines in the Enoree district of South Carolina, and Virginia Vermiculite from its mines in the Boswells Tavern and Green Springs districts of Virginia. Although actual figures are not available, it has been indicated that production is higher than this rather low estimate.

By contrast, production in China has been rising to a level of around 100,000 t, much of which is exported. However, it is believed that exports to the US, which had become quite large, declined significantly in 2002, and production may actually have declined slightly in 2002. Production is from a number of relatively small operations, mainly in Xinjiang and Hebei Provinces. There is significant further potential for growth depending on market demand and, should there be further developments, it would not be surprising if overseas companies became involved in joint ventures to produce vermiculite.

In Zimbabwe, production capacity at Samrec's Shawa mine is now 40,000 t following its expansion in 2001. It has been indicated that the company is currently producing at close to that level, but it is estimated that production in 2002 was still building up to full capacity following the increase from its previous capacity of 18,000 t/y, and that output last year was about 30,000 t. The company is owned by Imerys of France. Much of the product is exported to markets in Europe, with perhaps 30% destined for other markets such as Asia and the Middle East. CMMP of France is the sales agent. There have also been some reports of limited sales into the US market. The other vermiculite producer in Zimbabwe, Dinidza Vermiculite, owned by Anpac, mines a different part of the same carbonatite complex as Shawa, but on a smaller scale.

Imerys increased its involvement in the vermiculite market further in 2002, with the acquisition of Vermiculite Industries, Australia's only producer. Production is about 12,000 t/y from its operations near Alice Springs but the company also has interests in other deposits, notably the Hillview deposit 650 km west of Sydney, and there would be opportunities for Imerys to increase production should markets be identified.

Production in Brazil has been estimated at 23,000 t by the USGS, although there are indications that this may be an underestimate and actual production levels may be around 30,000 t. The main producer is Mamore Mineracao e Metalurgica. There are some smaller producers and a number of companies involved with vermiculite expansion. Much of the material is used domestically, increasingly in the horticultural and agricultural industries, although it is also used in the local construction industry. Mamore is also developing some limited export markets.

In the CIS, Russian production is estimated to be around 25,000 t/y, although it is difficult to get accurate production levels. There have been investigations into development of further deposits that could add 50,000 t/y of production capacity, although no developments were reported in 2002. Likewise, there has been no news of further development of the Tebinbuliak deposit in Uzbekistan, which was being investigated as a potential new vermiculite source, mainly for domestic markets, currently supplied out of Russia.

Production began at a new operation in Uganda during 2002 and in early 2003 the first long-term contract was announced, although details have not been released. Canmin Resources, a subsidiary of Canadian company IBI Resources has built a 40,000 t/y capacity plant at Mbale. Only about 1,000 t was produced in 2002 as the company started up and began to develop export markets. However, Canmin expects to produce 15,000-20,000 t of material in 2003. One agreement that has been announced is for Stansbury Holdings of the US to import large flake Ugandan material for exfoliation at its plant in Los Banos, California, run by a subsidiary of International Vermiculite.

In Canada, Regis Resources opened a new mine in Cavendish Township, Ontario, and completed construction of the mill, and limited quantities are now available to the market. Hedman Resources is also investigating the possibility of entering the vermiculite market and early in 2003 it acquired rights over land claims and equipment from Enviro Industrial Technologies, also in Ontario, including sales agreements. Hedman had already been investigating its own deposit at North Bay, Ontario.

### **Consumption**

There are contrasts in the consumption patterns for vermiculite from region to region. Virtually all vermiculite is exfoliated before use and, since there is such a large volume increase, this generally takes place close to the eventual point of use because of transport considerations. While there are only a few large producers of vermiculite, there are many companies involved with exfoliation of the product. The main uses for vermiculite are as an ultra light-weight aggregate in construction applications, as loose fill insulation and in horticultural and agricultural applications, where it can be used in applications such as fertiliser or pesticide carrier or in composts.

In general, the market in Europe is fairly mature and quite stable, and sales of vermiculite have proved to be fairly resilient despite economic cycles. There has been no real indication of any substantial downturn in European sales in 2002 or the start of 2003, despite relatively weak economies in a number of European countries influencing construction activity. In horticultural applications, there may be some potential for greater use of vermiculite as the environmental lobby against the use of peat-based composts gains ground. Imports into Europe come largely from South Africa, with growing amounts from Zimbabwe and even some from as far afield as Australia and China. The new products from Uganda have yet to make a significant impact on the European markets.

The US market, by contrast, has been falling, possibly to as low as 140,000 t in 2002. One of the main influences for the decline has been the perception that vermiculite is dangerous because of an asbestos content. It is fairly well established that there was an asbestos problem with vermiculite produced from the Libby operations in Montana but producers and importers of vermiculite have gone to great pains to show that their products are free from asbestos.

The main reason given for the decline in demand for vermiculite in the US was its removal from a number of horticultural and agricultural products, most notably Scotts Co, possibly the largest single, consuming company in the country. Scotts removed vermiculite from its fertiliser formulations where it was used as a carrier, a move that possibly accounted for half of the loss of demand in 2002. A subsidiary company also removed vermiculite from its potting soil mixes and at least one other company followed suit. Although it has been many years since vermiculite from Libby has been used, there were citations filed against Virginia Vermiculite from the MSHA claiming asbestos exposure levels, but these have since been rescinded after resampling and testing. However, with many scare stories in the press, there has been an increase in perception amongst consumers that vermiculite is dangerous because of asbestos content. Such perceptions are difficult to overcome. Government agencies seem to accept that the problems are not with vermiculite, as such, and are specific to vermiculite from Libby, but still monitor other sources closely. Moreover, public perception can be harder to overcome and this has much to do with Scotts' decision.

It would appear that markets for 2003 are now steady and, no doubt, both producers and importers are looking at ways to regain markets or develop new ones for the future. Some of the alternatives being used to replace vermiculite include perlite, lightweight clays, diatomite and polystyrene, depending on the application. Additionally, increased amounts of peat are used in some potting composts and it appears that the environmental objections to the use of peat in the US are not as strong as in Europe.

Asia is the other large market for vermiculite, with Japan and other countries traditionally being supplied from South Africa and, more recently, from China and Australia. It would appear that there is further room for expansion of its use in both construction and horticulture over the medium term to long term, with China potentially in a position to satisfy much of any increase in demand, both domestically and overseas.

Elsewhere in the world, markets are more limited, although there tend to be local markets developed around centres of production such as in South Africa, Zimbabwe, Brazil and perhaps in the new production centre in Uganda, where rose growers are reportedly making good use of locally-produced material.

### **Prices**

There have been no changes in list prices for vermiculite since the last *Mining Annual Review*, a situation that is not unusual for industrial minerals. Prices quoted in *Industrial Minerals* are US\$160-260/t for crude South African

vermiculite in bulk, fob Rotterdam. US prices are also unchanged at US\$130-200/short ton for crude material in bulk, ex-works. From Palabora's preliminary annual report summary, it would appear that there has been an increase in prices, with the average realised price rising from R1,571 to R1,911/t. However, the average exchange rate of the rand against the US dollar was R8.45 = US\$1 in 2001, compared with R10.54 = US\$1 in 2002. The difference is sufficient to account for all of the increase in the rand price. In dollar terms, using the average exchange rates, the price realised was US\$183.95/t in 2001 compared with US\$181.31/t in 2002.

The large range of prices for vermiculite reflects the range of grades available. Large-sized flakes generally command a premium price although the market for the largest flakes has tended to be quite limited in recent years.