scrubbing and desliming operations the vermiculite is concentrated, dewatered, and dried in a dryer at a controlled temperature. The products are separated by standard screens and stored in bins or silos for later shipment.

A series of ponds is maintained for settling and confining all mill waste. Clarified water is pumped back to the mill in a closed system.

Processing

Vermiculite is used mostly in the expanded form, exfoliated by heating. The expanded material weighs from 4 to 8 lb per cu ft, depending on the size of the particle and method of furnacing. It is therefore uneconomical to ship the expanded material long distances. The unexpanded ore concentrate weighs from 50 to 60 lb per cu ft and can be shipped in bulk hopper cars at commodity rates and for long distances. The ore concentrate from the two mill locations is shipped to many expanding plants located throughout the United States and Canada.

Standard sizes are produced by the mills so that when the concentrate is shipped to the expanding plant and exfoliated it will be a finished product ready for the various market requirements. The standard commercial screen sizes for the concentrates are −3 + 10, −6 + 14, −8 + 28, −20 + 65, −50 mesh (Tyler standard screen sizes). When the bulk car of concentrate arrives at a plant it is unloaded by conveyors and bucket elevator into closed storage bins or silos. From storage it is fed at controlled rates into vertical furnaces that are fired by gas or oil. Depending on the type of furnace the flame temperature may vary from 2000° to 3500°F. Rapid expansion controlled by the time-temperature relationship is critical for minimum bulk density and good quality. After leaving the furnace the material is passed over a separator which cools the vermiculite and removes rock impurities. The expanded vermiculite is normally packaged in 3 or 4-cu-ft paper or plastic bags, but may also be shipped in bulk railroad cars. Most furnaces are equipped with bag collectors for dust control. A few use wet scrubbers. In addition to vermiculite itself, various products using expanded vermiculite as a base are manufactured at some of the plants.

Production

Although the mineral vermiculite has been known since 1824 it remained a curiosity until almost 100 years later. The first report of mining was in 1913 in the Turrett Mining District near Salida, Colo., where eight carloads were produced. However, it was not until the deposit at Libby, Mont., was developed in the 1920s that commercial production began. Production developed slowly until 1940, when 22,000 tons was produced in the United States. By 1950 the U.S. production had grown to 208,000 tons. In 1960 it was still at the 200,000-ton level, but by 1970 had reached 285,000 tons. In 1973, reported U.S. production was approximately 365,000 tons (Fulkerson, 1973).

Current production at the Palabora deposit is estimated at approximately 170,000 tons. Capital expansion plans for the major producers in the United States and the Republic of South Africa, when fulfilled, will have the effect of increasing production capacity by one-third.

Marketing and Uses

An estimated 80% of sales of expanded vermiculite goes for construction industry uses. Nonresidential building consumes about three-fourths of that figure, with the balance going to new work and renovation in residential buildings.

The remainder of nonconstruction applications occurs in the agricultural, horticultural, and industrial markets.

Primary construction uses include: (1) loose fill insulation for horizontal areas such as attics; (2) treated vermiculite granules for insulation of masonry walls; (3) lightweight aggregates combined with setting materials, such as gypsum, asbestos, or portland cement; (4) acoustical plaster formulations combining vermiculite with binders such as bentonite; and (5) rigid board or tile products employing vermiculite as a component.

Marketing of vermiculite is deceptively complex. Depending on the industry served, a variety of marketing tools are required.

Vermiculite producers achieve basic distribution of ore by setting up their own processing plants, by selling to licensees, or by a combination of the two.

Those products entailing specification by architects or engineers call for a sophisticated, technical, competent specification sales effort. Supporting technical data must be factual, informative, well-organized, and based on testing procedures set forth by such organizations as the Bureau of Standards, Underwriter's Laboratories, Inc., and the American Society for Testing and Materials.

The technical products offered to the building

industry must be applied by subcontractors versed in their usage. This frequently places a burden on the manufacturer to supply technical service and know-how in proper application. In some cases this has led to the designation of approved applicators with whom the manufacturer develops a special relationship centered on proper use of his materials.

Distribution methods vary according to end use of vermiculite products. Attic insulation is purchased by the homeowner who must be motivated to buy through advertising and sales promotion. The product must be available to the consumer through local lumber, building material, and home center outlets. The dealer must be encouraged to stock and promote attic insulation to prospects, and the distributor must be involved as the dealer's source for his requirements.

Masonry fill insulation requires a specification sales effort, and entails an additional distribution outlet, the concrete block producer, since it is sold as an adjunct to concrete block. The general contractor and masonry contractor need to be informed of the benefits and usage of the product, through technical data and advertising.

Lightweight vermiculite aggregates are used extensively in insulated roof deck systems on nonresidential buildings, such as schools, churches, warehouses, and hospitals. Special compounds with vermiculite aggregate as a key ingredient are widely employed to fireproof high-rise office structures.

In addition to the primary influences—architect, engineer, contractor, subcontractor, distributor, dealer—a number of other influences come into play in the marketing of vermiculite building products. These include building officials, insurance rating agencies, owners, roofing manufacturers and governmental agencies.

Manufacturers of fertilizers and agricultural chemicals for the home lawn and garden market rely on vermiculite as a carrier for active chemicals. As the carrier, vermiculite often comprises 90% or more of the composition in agricultural formulations.

Vermiculite is sold as a soil conditioner at retail through garden supply channels. It is also combined with other growth materials into potting soils or soil substitutes, for the professional grower or home gardener.

Industrial uses, though accounting for only a small percentage of total expanded vermiculite consumption, are many and varied. A partial list of uses would include:

Cryogenic insulation
Insulation of appliances, coolers, safes
Insulating component in prefabricated chimneys
Oil-less lubricant
Aggregate in refractory components
Slow cooling of steel
Cushioning material in packaging applications
Insulation of underground steam or hot water lines
Window display material
Grease or oil absorbent
Sound-deadening applications
Nuclear waste disposal

No single use of vermiculite will support a mining or processing investment. Seasonal factors, weather, competitive conditions, and the mix of grades emerging from the mill call for a diversified effort to achieve desirable results.

Economic Considerations

The average value of crude vermiculite in early 1975, f.o.b. milling plant, was $25.–38.00 per st. The value of crude vermiculite from South Africa, c.i.f. Atlantic ports, was $55.–70.00 per st.

No special taxes are imposed on the vermiculite industry. Producers are granted a depletion allowance of 14% on domestic and foreign production. There are no tariffs on imports of crude vermiculite. Imported processed vermiculite carries a tariff of 7½% ad valorum.

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