



FIGURE 10. Electronmicrograph of a grade of vermiculite for use on lawns.



FIGURE 11. Electronmicrograph of common household grade of plaster of Paris.

bodies in this group and that in a non-malignant control group. They did find a significant increase in asbestos bodies in mesothelioma cases as compared with the control group.

A supportive approach in establishing the meaning of the presence of these pulmonary fibers and their associated ferruginous bodies is to define the nature and source of the more common respirable fibers and, through laboratory research, the biological response to these different fibers.

Identification of Fibrous Materials

The lack of analytical techniques sufficiently sensitive to identify individual fibers in the lower micron and sub-micron diameter range has been a major problem in the past in studying the health effects of inhaled fibers. More precise analytical techniques and equipment have increased considerably the poten-

tial for the identification of these fibers.

The electron microprobe is especially useful in identifying major elements of individual fibers of up to one micron in diameter. These elements may be individually focused on an oscilloscope, and the resulting fiber image photographed to provide permanent records of the analyses.¹⁶

A second technique employs a laser microprobe in conjunction with a time-of-flight mass spectrometer. The laser beam is focused on a 6- to 8-micron spot containing the fiber. The laser vaporizes the constituents of the materials in the spot, and an elemental analysis is made with the mass spectrometer.¹⁷ The laser assembly may also be mounted on the optical bench of an emission spectrograph and used as a source of energy to vaporize elements for spectrographic analysis.¹⁸

Techniques are now available for removing organic material from a sample without altering the inorganic compounds. In a commercial instrument available for low-temperature dry ashing, incineration proceeds in an oxygen atmosphere at a pressure of 1 to 2 mm of Hg. A radio frequency source produces excited monatomic oxygen for the oxidative process.¹⁹

Improvements have also been made in optical and electron microscopy for studying the morphology of sub-micron fibers in greater detail.

Nature and Source of Fibrous Materials

Respirable fibers may be mineral, vegetable, or animal in origin and may come from both natural and synthetic sources. There are well over a hundred different natural minerals with some degree of fibrous structure. They are of widely contrasting chemical composition and may exist as ores of commercial value or may be disseminated generally in the earth, in fossil and other fuels, and in other commercial minerals. Examples of minerals with some degree of fibrous-like structure are shown in Table I.

Respirable fibers of vegetable origin may be from both live and dead plant tissues and include plant hairs, fragments of leaves, stalk, bark, flowering parts, ash from burning vegetation, and the like. Both silica and silicates, as well as other mineral constituents, may be