

Preliminary observations on the provenance of industrial vermiculites by powder X-ray diffraction.

Industrial vermiculite is widely used as a packing and insulation material. Upwards of 10 million homes in the United States may contain vermiculite insulation originating from Libby, Montana. Libby vermiculite is known to contain traces amounts of amphibole asbestos. Differentiating Libby vermiculite from vermiculite from other sources is important for possible future remediation. In this preliminary study, samples of unexpanded (i.e. ore) and expanded (i.e. the industrial product Zonolite) vermiculite from Libby, and expanded vermiculite from seven commercial sources were analyzed by powder X-ray diffraction. For all samples, the powder diffraction patterns display peaks at 10, 12, and 14 angstroms indicating the presence of biotite, hydrobiotite, and vermiculite respectively. A broad peak at 24 angstroms was observed and indicates a mixed layer of vermiculite and hydrobiotite. X-ray diffraction patterns for the (unexpanded) Libby ore and the expanded vermiculite (i.e. Zonolite) are nearly identical. Diffraction patterns for the seven commercial samples were also nearly identical. However, comparison of diffraction patterns between both Libby samples and the seven commercial reveals distinct differences in 10-, 12-, and 14-angstrom peaks between the Libby and the commercial samples. In the commercial samples the 12-angstrom peak is significantly more intense relative to the 10- and 14-angstrom peaks. For the both Libby samples the peak intensities are essentially reversed with the 10- and 14-angstrom peaks having a greater, equal intensity relative to the 12-angstrom peak. Although further work is required, these preliminary data suggest that powder X-ray diffraction may provide an efficient way to distinguish the provenance of industrial vermiculite samples.