Low-level detection of Libby amphiboles in attic insulation

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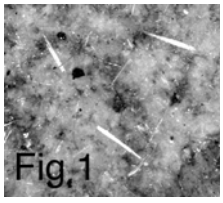
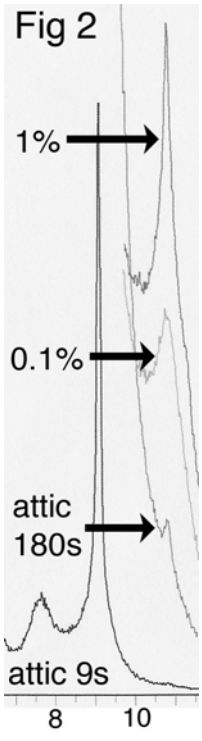
Since health concerns surrounding the amphibole asbestos content of attic insulation manufactured from vermiculite ore produced from a now-closed mine near Libby, Montana emerged in 1999, researchers have been seeking methods to detect and quantify its amphibole content. Currently we are working on two separate methods: 1) concentration of amphiboles and 2) powder X-ray diffraction (XRD).

For the concentration method, 0.25 g of sample was placed in boiling 12M HCl for 1 hr and then boiling 4M NaOH for 1 hr. Fig 1 (field of view 1 x 1 mm) shows amphiboles, and other residual material, left after this process. For the eleven samples treated with this method, 88 to 99 wt % of mineral matter was dissolved. All four Libby samples contained amphiboles, but the sample in Fig 1 showed the greatest concentration. No amphiboles were observed in the seven other vermiculite products with a non-Libby source.



For the XRD method, long count times were used over the (110) peak for 2 g micronized samples placed in a back-fill XRD mount. Fig 2 shows four scans. The one labeled "attic 9s" is a 9s count time for the attic sample we found to contain the most amphibole (Fig 1). The other three scans are all 180s count times (over a shorter scan range) at 0.02° steps, one being the attic sample, but at a greater counting time. The other two are from an amphibole-free expanded vermiculite (based on our concentration and XRD methods) to which we added 0.1 and 1 wt % of Libby amphibole. Based on these scans, our high concentration sample (shown in Fig 1) contains less than 0.1 wt % amphibole. These two methods used in conjunction can first show if amphiboles occur in a sample and then, if so, in what amounts.



Re-evaluation and re-classification of erionite group minerals

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Erionite has been shown to be an agent responsible for malignant mesothelioma and it is one of the most carcinogenic minerals in the world. Often the erionite specimens were incompletely or incorrectly characterized. Animal and cell experiments with erionite should only be performed with the minerals that have passed the quantitative characterization, both balance error (E%) and Mg-content tests, and the type of erionite (-Ca, -Na, -K) must be identified properly.

Large numbers of erionite deposits have been reported from many countries. Erionite from Beach Creek and Durkee, Oregon, USA; British Columbia, Canada; Faedo, Vicenza, Montresta, Nuoro, and Montecchio Maggiore, Italy; Shourdo, Georgia; Jindivick and Phillip Island, Australia passed the E% and Mg-content tests and re-classified as erionite-Ca. Erionite from Crooked Creek, Oregon, Cady Mountains, California, and Durkee, Oregon, USA; Dunseverik, N. Ireland; Montecchio, Maggiore, Italy; Lake Natron, Tanzania; Phillip Island, Australia; Campbell Glacier and Mt. Adamson, Antarctica passed the E% and Mg-content tests and re-classified as erionite-Na. Selected samples of erionite from Cappadocian region of Turkey passed the E% and Mg-content tests and re-classified as erionite-Na (Tuzkoy village) and erionite-K (Karain and Sarihidir villages).

However, some published erionite data from Italy were re-calculated as erionite-Ca and erionite-Na. Two sets of data from Phillip Island, Australia were re-calculated as both erionite-Ca and erionite-Na. Data from Durkee, Oregon, USA by three different authors were re-calculated as erionite-Ca, erionite-Na, and erionite-K. Mg contents of erionite-Ca from Agate Beach, Oregon, USA; Araules, Ht Loire, France; Maze, Niigata, Japan; and Mg contents of erionite-K from Jersey Valley, Nevada, USA; and Karain, Turkey were higher than 0.8. Thus, these samples did not meet the requirements.