
Detection of Trace Amounts of Erionite Using X-ray Powder Diffraction: Erionite in Tuffs of Yucca Mountain, Nevada, and Central Turkey

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Abstract: Recent data in the biological literature suggest that the natural zeolite erionite may be more tumorigenic than asbestos minerals. Because of its potential biological importance, a technique has been developed to facilitate detection of erionite in tuffaceous rocks to a lower limit of detection (LLD) between 100 and 500 ppm. The method involves the use of automated X-ray powder diffraction instrumentation with long count times, as much as 360 s/step. The presence of interfering phases, such as smectite or clinoptilolite, raises the LLD. Ethylene glycol solvation of smectite improves the LLD, and profile fitting with clinoptilolite-bearing mixtures improves quantification. Application of these methods to tufts from central Turkey allowed improved detection and more accurate quantification compared with previous scanning electron microscope examinations. Use of these methods with tufts from Yucca Mountain, Nevada, the potential site for the nation's first high-level radioactive waste repository, showed that erionite occurs sporadically. Erionite is found only in the altered zone directly above the lower vitrophyre of the Topopah Spring Member. This altered zone is anomalous in that it contains a variety of zeolites that are either rare or absent in other Yucca Mountain tuffs. It appears that erionite is restricted to fractures and must have formed under unusual and variable conditions in the altered zone.

Key Words: Clinoptilolite • Detection limits • Erionite • Profile refinement • X-ray powder diffraction • Zeolitic tuffs

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