

Deadly Erionite

People shudder at the thought of inhaling serpentine asbestos, but the possible perils of this pale in comparison to the risk of inhaling fibers of the zeolite mineral named erionite. This mineral is considered so hazardous that the EPA requires any one who intends to manufacture, import or process any article containing erionite to notify the E.P.A. 90 days in advance. This gives the EPA a chance to review, limit or prohibit that activity. What is it about erionite that warrants such notoriety?

Erionite ($\text{NaK}_2\text{MgCa}_{1.5}\text{Al}_8\text{Si}_{28}\text{O}_{72} \cdot 28\text{H}_2\text{O}$) was first described by A.S. Eakle in 1898. It was found as white woolly fibrous masses in cavities in rhyolite lava from near Durkee, Baker County, Oregon. It was soon found at other localities in Nevada, Wyoming, California and abroad in similar occurrences. Erionite turns out to be most common, but hardest to recognize, as microscopic fibers in volcanic ash altered by weathering and ground water.

The recognition of the toxicity of erionite sprang from a study done in the 1970's by the Turkish government which wished to identify and treat various respiratory diseases in rural areas in Turkey. The study uncovered a high incidence of a rare malignant mesothelioma in lung tissues of people in certain small villages in the Cappadocia area in Turkey's central mountainous region. In one small village the disease accounted for 43% of the deaths during the period of study. Comparing this to a 9.7% rate of death from this disease among asbestos insulation installers shows how anomalous this condition was. An intensive study was undertaken to determine the cause of the high incidence of this disease.

The areas around the affected towns were rich in altered volcanic ash, which was soft and easy to work. Some homes were actually carved out of the ash beds. In other places, blocks of ash were used as building stone or in stucco pastes and whitewash. Ash-laden mud flowed down the streets during heavy rains, hardening later to be stirred up as dust by foot or animal traffic. All this ash contained substantial erionite fibers, mixed with clay and other minerals. Erionite fibers were found in biopsies of lungs of the afflicted people. Further studies showed erionite caused similar diseases in laboratory animals.

These findings came at a time when the relationship of serpentine asbestos to respiratory disease was becoming known. The evidence that a fibrous mineral other than serpentine was associated with malignant mesothelioma was of great importance. It led to a much more diligent and realistic testing of materials that could be used as substitutes for serpentine asbestos before this material could be used.

It is not clear why erionite is so toxic. Other fibrous zeolites tested - mordenite and various synthetic zeolites - have so far not shown erionite's toxicity. Whether the cause is erionite's shape, some aspect of its surface reactivity, its resistant to dissolution in fluids in the lung, or some combination of these, is not known.

Erionite bearing volcanic tuffs are found here and there in the American west (not in Wisconsin or Minnesota), fortunately in regions with low populations. Where found, it obviously should not be disturbed, quarried or mined. The very dust blowing off the outcrops is a long term hazard to residents. The world is an unexpectedly dangerous place, and it is to be hoped that other such mineralogical hazards are rapidly identified. Their discovery may allow physicians to make substantial headway in the treatment of certain diseases. Even more important, it may show us how to prevent them.

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References:

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