

MINERALS IN THE HUMAN BODY

Crystal chemical and structural modifications of erionite fibers leached with simulated lung fluids‡

PAOLO BALLIRANO^{1,2,*} AND GEORGIA CAMETTI^{1,†}

¹Dipartimento di Scienze della Terra, Sapienza Università di Roma, Piazzale A. Moro 5, I-00185 Roma, Italy

²Laboratorio Rettorale Fibre e Particolato Inorganico, Sapienza Università di Roma, Piazzale A. Moro 5, I-00185 Roma, Italy

ABSTRACT

Inhalation of erionite has been proven to be the cause of the extended epidemic of malignant mesothelioma occurring in Central Anatolia, Turkey, and of cases of lung diseases in the U.S.A. Its carcinogenicity is three orders of magnitude greater than that of regulated asbestos. Here we report the results of the investigation of the structural and crystal chemical modifications occurring in erionite leached with artificial lysosomal fluid (ALF) and Gamble's solution. ALF leaching produces a migration of Na⁺ ions from Ca1 to Ca2 extraframework cationic site, without the occurrence of any significant modification of the chemical composition of the fibers. In contrast, leaching with Gamble's solution induces a complex ionic-exchange process resulting in a temporary partial replacement of Na⁺ by Ca²⁺, coming from the fluid, which is fixed at a third Ca3 cationic site. Subsequently, the exchange process reverses. In fact, Ca²⁺ is removed from Ca3 and Na⁺ migrates back to Ca1, the structure being indistinguishable from the starting, unleached material. Such processes seem to be accompanied by a progressive amorphization of fibers. Present data could provide valuable background for a more detailed comprehension of the morphostructural/biological activity relationships inducing pathogenicity.

Keywords: Erionite-Na, malignant mesothelioma (MM), simulated lung fluids SLFs, leaching, Rietveld method