P-4278

Lake Magadi sediments: Deciphering primary and diagenetic features

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Abstract

Lake Magadi, Kenya, a saline-alkaline lake located in the East African Rift valley, is known for its siliceous sediments including unique varieties of chert, magadiite, and abundant zeolites. Core drilling at Lake Magadi in 2014, as part of the Hominin Sites and Paleolakes Drilling Project (HSPDP), has provided the materials for detailed study of chert and other siliceous sediments. Two cores, 137.3 and 197.9 m in depth, drilled to trachyte bedrock, dated at 1.08 Ma, present an opportunity to interpret siliceous minerals in the context of evolving Magadi Basin paleoenvironments over the past one million years.

Cores contain terrigenous muds to sand-sized grains with abundant feldspars (albite, sanidine, and anorthoclase) eroded from surrounding trachyte bedrock. Finely laminated chemogenic layers of magadiite and chert derived from siliceous gel also occur in the cores. Magadiite is a hydrous sodium-silicate which forms distinctive 20 µm lepispheres. Biogenic-rich layers contain pollen and plant fragments; volcanogenic layers have abundant pumice fragments. Many of these deposits are overprinted by early diagenesis in the saline-alkaline environment. X-ray diffraction (XRD)of Lake Magadi sediments reveals a suite of zeolites including, analcime, erionite, philipsite, and [T6]clinoptilolite. Scanning electron microscopy (SEM) shows diagenetic formation of zeolites, including the replacement of pumice by Na-erionite, growth of erionite in pore spaces between sediments, and replacement of feldspars by erionite. XRD analysis of pure siliceous laminae with quartz and magadiite indicates partial conversion of magadiite to quartz (chert) with an intermediate quartz phase, moganite. Understanding the magadiite to chert timing is crucial for Uranium-Thorium radiometric dating.

Fluctuating silicate mineralogy can yield important paleolimnological data which can improve the overall paleoenvironmental interpretation of the Magadi Basin.