# Zeolite Diagenesis Below Pahute Mesa, Nevada Test Site

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**Abstract:** The Tertiary silicic volcanic rocks in the Silent Canyon Caldera beneath Pahute Mesa, of the Department of Energy's Nevada Test Site have been divided into three vertical mineralogical zones that vary in thickness and transgress stratigraphic boundaries. Zonal contacts are generally sharp. Zone 1, the uppermost zone, includes unaltered or incipiently altered rhyolitic glass. Zone 2 is characterized by a predominance of clinoptilolite and subordinate amounts of smectite, cristobalite, and mordenite. Zone 3 is a complex mineral assemblage that includes analcime, quartz, calcite, authigenic K-feldspar and albite, kaolinite, chlorite, and mixed-layer illite/smectite. The mixed-layer clay shows an increase in ordering and a decrease in expandability with depth.

Shortly after deposition and after shallow burial, hydration of relatively impermeable, highly porous vitric rocks resulted in the rapid formation of the Zone 2 assemblage (except mordenite). This stage of alteration resulted in a net porosity loss and negligible mass transfer. Continued burial and rise in temperature led to a dehydration stage in which the Zone 2 assemblage was replaced by the Zone 3 minerals. The dehydration stage resulted in a porosity increase and an increase in permeability of several orders of magnitude. This process, like the earlier reactions, also conserved mass. Precipitation of mordenite followed the formation of this zonal configuration. The diagenetic zones below Pahute Mesa were caused by: (1) changing pore-water chemistry in an essentially closed hydrologic system; (2) disequilibrium or kinetic precipitation of metastable phases; and (3) a higher thermal gradient than that now present.

**Key Words:** Analcime • Clinoptilolite • Closed hydrologic system • Diagenesis • K-feldspar • Mordenite • Zeolite

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