Authigenesis of Trioctahedral Smectite in Magnesium-Rich Carbonate Speleothems in Carlsbad Cavern and Other Caves of the Guadalupe Mountains, New Mexico

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Abstract: Trioctahedral smectite is a constituent of Mg-rich carbonate crusts and moonmilks (pasty deposits) in caves of the Guadalupe Mountains of southeastern New Mexico. Energy dispersive X-ray microanalysis of individual crystallites and their aggregates along with the X-ray diffraction analysis indicates that the smectite is probably stevensite. Saponite is likely present in some samples also. The smectite is intimately associated with dolomite crusts and huntite moonmilks in Carlsbad Cavern, Lechuguilla Cave, and other dolostone caves. Clay particles appear as fibers and films, with aggregates comprising decimicron-sized filamentous masses that envelop crystals of dolomite, huntite, and magnesite. The occurrence of smectite is related to the genesis of the Mg-rich carbonate minerals. In water films, progressive evaporation and carbon dioxide loss results in the sequential precipitation of Mg-rich calcite, aragonite, dolomite, huntite, and magnesite. This sequence of carbonate precipitation removes Ca and greatly increases the Mg/Ca ratio in the solutions. Silica is commonly available probably because of high pH conditions, and consequently, smectite forms in the Mg-rich alkaline environment. Along with the Mg-rich carbonate minerals, opal, quartz, and uranyl vanadates may precipitate with the smectite.

Key Words: Authigenesis • Carlsbad Cavern • Caves • Dolomite • Huntite • Moonmilk • Stevensite • Trioctahedral Smectite

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