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CHEMISTRY AND MINERALOGY OF EARTH'S MANTLE

Mantle-derived guyanaite in a Cr-omphacitite xenolith from Moses Rock diatreme, Utah†

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ABSTRACT

Guyanaite, naturally occurring β-CrOOH, has been identified in a xenolith of Cr-rich omphacitite from the Moses Rock diatreme in the Navajo Volcanic Field of the southwestern United States. It occurs as the dominant phase in small clusters of accessory minerals, intergrown with kosmochlor-rich omphacite, zincian chromite, eskolaite, and carmichaelite. The assemblage is interpreted as the result of metasomatism of chromite-bearing serpentinite by slab-derived fluids during subduction of the Farallon Plate in Laramide time. At the time of entrainment of the xenolith, the rock was undergoing prograde metamorphism, with guyanaite dehydrating to eskolaite plus water. This reaction, and the coeval dehydration of the inferred accompanying host serpentinites (which would have been much more volumetrically significant), provided water for hydration of the subcontinental upper mantle, contributing to uplift of the Colorado Plateau. Recognition of guyanaite as a component of a subducted slab supports recent proposals, based on laboratory experiments, that high-pressure polymorphs of other common crustal oxy-hydroxide minerals such as boehmite and goethite (i.e., high-pressure δ-AlOOH and ε-FeOOH) can also transport and store water in the mantle.

Keywords: Guyanaite, mantle, xenolith, subduction, jade, kosmochlor, carmichaelite, Colorado Plateau