

LETTER: ACTINIDES IN GEOLOGY, ENERGY, AND THE ENVIRONMENT†

Thermally induced transformation of vorlanite to “protovorlanite”: Restoration of cation ordering in self-irradiated CaUO_4

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ABSTRACT

Vorlanite, cubic CaUO_4 heated at temperatures above 750 °C, transforms irreversibly into rhombohedral CaUO_4 , proving that the latter crystallized as a precursor of vorlanite in high-temperature skarns. Vorlanite most probably originated due to pseudomorphic transformation of rhombohedral CaUO_4 , caused by disordering of cations and uranyl-bonds that resulted from α -decay events of uranium. The ease of the transition from rhombohedral CaUO_4 to vorlanite and the fast reversal transition during heating can be explained by the similarity of both structures. Formation of vorlanite prevents CaUO_4 from undergoing metamictization.

Keywords: Vorlanite, rhombohedral CaUO_4 , radiation damage, phase transformation, Raman spectroscopy