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Jarosite formation in Permian-Triassic strata at Xiakou (South China): Implications for jarosite precipitation from H_2S upwelling on Mars

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Abstract

The source of sulfuric acid and associated aqueous alteration of ancient martian sedimentary rocks remain under debate in the context of divergent models of jarosite formation. Here, we report the formation of sulfates, including jarosite in K-bentonites within shallow-water facies of the Permian-Triassic (P-T) transition at Xiakou in South China. In these strata, jarosite is dispersed in the clay matrix or forms aggregates in pore spaces, has a euhedral morphology, and coexists with variably ^{34}S-depleted paragenetic gypsum and bassanite ($\delta^{34}S$ = –37.23‰ to +3.20‰ VCDT). Subaqueous alteration of volcanic tuffs concurrently with oxidation of upwelled, biogenically sourced H_2S is the process of jarosite formation in the Xiakou K-bentonites. This mechanism of jarosite precipitation and stability over geological time challenges the long-held view of acidic, water-limited conditions leading to iron(III) sulfate precipitation and would be consistent with possible microbial or nanobial life on early Mars.

Keywords: Tuff, K-bentonite, smectite, jarosite, sulfates, microbial reduction