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Bacterially enhanced dissolution of meta-autunite

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Abstract

The release of U from the mineral meta-autunite $\{Ca[(UO_2)(PO_2)](H_2O)_6\}$ was evaluated using spectroscopy, aqueous geochemistry, and electron microscopy in a minimal media with the dissimilatory metal-reducing bacterium *Shewanella putrefaciens* 200R. The onset of anaerobic conditions resulted in the rapid release of U and phosphate to solution followed by the reprecipitation of meta-autinite. Spectroscopy measurements (XANES) indicated that the U was not released via reduction during the bacterial incubations, but instead dissolution was promoted by uptake and immobilization of P by the bacterial cells. Our results suggest that U(VI) in "refractory" P mineral phases may be mobilized from U mill tailings and/or U disposal sites and that the nutrient status (P) of the geologic setting may be a predictor for the lability of U in these environments.

Keywords: Uranium, autunite, phosphate, *Shewanella putrefaciens*, weathering, XANES