

Mechanistic insights into U(VI) reduction and the associated uranium isotopic fractionation

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Oxidized uranium (hexavalent, U(VI)) is present in surface waters, both naturally, in areas with a granitic bedrock and as a result of contamination from mining or nuclear fuel processing. In anoxic soils and sediments, uranium can accumulate through reductive processes, forming natural hotspots or engineered accumulations.

Looking through the sedimentary rock record, one can consider the accumulation of U as an indication of local anoxic conditions and the associated isotopic fractionation may reveal more detail about the depositional environment. A thorough understanding of the mechanism of U(VI) reduction and the attendant isotopic fractionation is necessary in order to interpret the geological record and to optimize U remediation strategies.

Here, we present recent development in laboratory-based investigations of the reduction of U(VI) by microorganisms as well as by minerals along with advances in constraining the associated isotopic fractionation. The work presented will span mechanistic understanding of microbial and abiotic U reduction and the current understanding of U isotopic fractionation.