

## **Stimulated migration of arsenic and uranium by reductive transformation of iron**

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Arsenic and uranium are redox active toxins that can have severe impacts on environmental quality and human health. One of the principal phases controlling dissolved concentrations and transport of both elements within aerobic environments is Fe (hydr)oxides. As a consequence, reductive transformation of Fe will have pronounced influences on the partitioning of these toxins. A transition from aerobic to anaerobic conditions appears to be the major means by which As is displaced from solids. Reductive transformation, inclusive of dissolution and recrystallization, invokes a displacement of As(III) and As(V). However, desorption and transport of As(V) is transitory whereas As(III) undergoes prolonged and pronounced desorption. Moreover, desorption of As(III) occurs independent of iron reduction. Thus, although As(III) has a greater binding capacity on iron (hydr)oxides than As(V), surface complexes of the reduced species, arsenite, are appreciably more labile than for the oxidized counterpart. Contrasting the behaviour of arsenic, uranium undergoes minimal gross transport under anaerobic conditions owing to reductive precipitation of uraninite (UO<sub>2</sub>) by dissimilatory bacterial reduction. Although gross transport is not observed, uranium does undergo a micro-scale redistribution within physically heterogeneous systems, migrating to points of microbial activity. Using constructed reaction cells having a distribution of advective and diffusive pore-domains, in combination with micro- X-ray fluorescence and absorption spectroscopies, we reveal the repartitioning of uranium during a transition from an aerobic to anaerobic state.