Influence of As(V) on Fe(II)-catalyzed Fe Oxide Recrystallization

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Fe(II)-catalyzed recrystallization of Fe oxides can enable trace element release from and incorporation into Fe oxides [1]. As(V) was observed to incorporate into magnetite during the reductive transformation of lepidocrocite [2] and ferrihydrite [3] to magnetite, but was not observed to incorporate into goethite and hematite in the presence of Fe(II) [4]. As(V) was also observed to decrease the rate and extent of Fe(II)-catalyzed transformation of ferrihydrite to more crystalline iron oxides [5]. Here we investigate the potential for As(V) incorporation during Fe oxide recrystallization and the effect of As(V) on Fe(II)-catalyzed recrystallization of goethite, magnetite, and ferrihydrite.

We measured isotope mixing between aqueous Fe(II) and magnetite, goethite, and ferrihydrite in the presence of As(V) by reacting isotopically "normal" Fe oxides with ^{57}Fe-enriched aqueous Fe(II). We observed increasing inhibition of isotope mixing with increasing concentrations of adsorbed As(V) above 100 μM. Low levels of As(V) coprecipitation (As:Fe mole ratios of 0.0005-0.0155) had little influence on the extent of isotope mixing in goethite or magnetite. XAS and chemical extraction data suggest that adsorbed As(V) may be incorporated during reaction with goethite when aqueous Fe(II) is present, and with magnetite when aqueous Fe(II) is present or absent. Our results show that adsorbed As(V) can inhibit Fe(II)-catalyzed Fe oxide recrystallization and that Fe oxide recrystallization may enable As(V) uptake in the environment.

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