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# Potential Solubility and Sorption Controls on Arsenic in the Presence of Elevated Dissolved Iron

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Geogenic arsenic (As) pollution of aquifers is a severe problem worldwide. In systems containing high concentrations of dissolved Fe and As, formation of specific low-solubility Fe-As(V) solids is thermodynamically favourable. However, the rates of formation of such solids are poorly understood. Also, arsenic sorption to prevalent Fe-containing minerals could be a competing process. The objective of this study was to identify the extent and rate of the most dominant As(V) uptake mechanism in the presence of Fe under approximate in-situ conditions. Batch experiments to systematically probe interaction between Fe and As were performed with initial As(V) concentration of 3 μM (224 μg $L^{-1}$) and initial Fe(II) concentrations of 5 – 500 μM in a variety of matrices. Time-dependent sampling for dissolved Fe and As showed that in systems with initial dissolved Fe(II) ≥ 70 μM, total dissolved As decreased to below 10 $\mu g L^{-1}$ (WHO drinking water guideline) within 2 h (Fig. 1). Speciation analyses by IC-ICP-MS and spectrophotometry showed no conversion of As(V) to As(III), whereas almost all Fe(II) was oxidised to Fe(III). Thermodynamic calculations consistent with an updated database for 80 μM initial Fe(II) indicated that conditions were at saturation with respect to the Fe(III)-As(V) solids scorodite, parascorodite, and ferric orthoarsenate, consistent with $FeAsO_4{\cdot}xH_2O_{(s)}$ stoichiometry. Observed Fe(III)/As(V) molar uptake ratios supported the formation of a 1:1 Fe(III)-As(V) solid. However, a definitive evidence for their precipitation could not be found. Instead, solid phase characterization on the precipitate showed formation of lepidocrocite which may have facilitated high As(V) uptake through surface precipitation or sorption. These results from macroscopic geochemical analyses would be combined with XPS and TEM-SAED investigations on solid specimens to identify the exact mechanism for As uptake. These findings could potentially aid in developing remediation strategies for As-contaminated water.

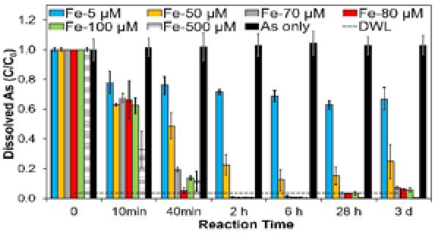

**Figure 1**. Dissolved As at different reaction times.