

Microbial reduction of ferrous arsenate: Arsenic mobility in reduced tailing environments

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Introduction

Following the onset of reducing conditions in arsenic rich tailing impoundments, arsenate may be remobilized during the Fe(III) to Fe(II) transformations of Fe oxides, as well as iron arsenates [1-3] e.g. scorodite, by dissimilatory iron-reducing bacterium (DIRB). This study will assess the stability of reduced iron arsenate phases using synthetic ferrous arsenate as an analogue for natural symplectite in the presence of the model As-respiring bacterium *Shewanella sp.* strain ANA-3.

Results and Discussion

During the experiment progressive nucleation of a reduced arsenite phase within the microbial biomass was observed (Fig. 1). Preliminary results suggest the remobilization of As(III) in solution via microbial reduction. This has important implications for As transport in reduced sediments. The mechanism along with solid phase characterization will be discussed.

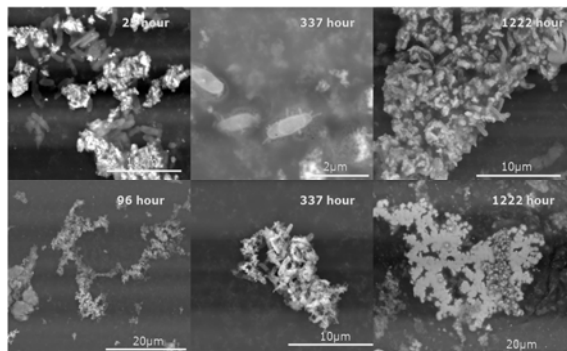


Figure 1: Secondary mineralization associated with biomass.

- [1] Cummings *et al.* (1999) *Environ.Sci.Technol* **33**, 723-729.
- [2] Papassioppi *et al.* (2002) *Water, Air, Soil Poll.* **3**, 81-90.
- [3] Weisener *et al.* (2007) *pers. comm.*

Jarosite reactivity and trace metal geochemistry in acid sulfate soils

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Jarosite ($\text{KFe}_3(\text{SO}_4)_2(\text{OH})_6$) is commonly found in acid sulfate soil environments and may represent a significant store of acidity at these sites. A natural sample of jarosite was sourced from an acid sulfate soils site near Kempsey NSW, Australia. The sample was analysed for major and trace element composition, and then experiments were conducted to determine jarosite dissolution rate, and the flux of acid, salts and trace metals from jarosite under conditions relevant to flooded acid sulfate soils environments.

Jarosite dissolution experiments were conducted in batch reactors in solutions of water, dilute HCl and H_2SO_4 (pH 3 and 4) and 1 mM oxalic acid (pH 3). Jarosite dissolution rates based on either K^+ or SO_4^{2-} release to solution were similar in the inorganic experiments, ranging from 0.25 – 1.1 μmol jarosite/g/day. Rates were slightly faster in experiments run at pH 4 than the corresponding experiments run at pH 3, similarly, jarosite reaction rates were greater in HCl than in H_2SO_4 at the same pH. Jarosite dissolution rates were 10 fold greater in oxalic acid than in the inorganic solutions. The reaction was nonstoichiometric, Fe concentrations were limited by the solubility of FeOOH phases.

Analysis of the solid phase by laser ablation ICP-MS showed that the jarosite was enriched in P, V, Cr, Sr, Rb, Sr, Ba, As, Pb, and the LREE compared to the surrounding clay matrix. However, the behaviour of these trace elements was generally non-stoichiometric in the dissolution experiments. Elements that substitute for Fe were retained in the solid phase whereas elements such as Rb and Sr that substitute for K were preferentially released to solution. The REE also substitute for K but their behaviour is more complex. The LREE are strongly enriched in the jarosite solid phase, however, in the dissolution experiments, there is a MREE enrichment, similar to what was observed in the porewater at the site, indicating that jarosite is a major factor controlling trace element geochemistry in acid sulfate soils.