Zinc and Arsenic immobilization and magnetite formation upon reduction of maghemite by *Shewanella putrefaciens* ATCC 8071

C. CISMASU[1], G. ONA-NGUEMA[2], D. BONNIN[3],
N. MENGUY[2] AND G.E. BROWN JR.[1,4]

[1]Department of Geological & Environmental Sciences,
Stanford University, California 94305, USA
(cismasu@stanford.edu, gordon.brown@stanford.edu)
[2]Institut de Minéralogie et de Physique des Milieux Condensés
(IMPMC), UMR 7590, CNRS, Université Paris 6 & 7,
IPGP, Paris, France
(georges.ona-nguema@impmc.jussieu.fr,
nicolas.menguy@impmc.jussieu.fr)
[3]Laboratoire de Physique Quantique, Ecole Supérieure de
Physique et Chimie Industrielle, Paris, France
(dominique.bonnin@espci.fr)
[4]Stanford Synchrotron Radiation Laboratory, SLAC, MS 69,
Menlo Park, California 94025, USA

Bacterially mediated reduction of Fe(III)-(oxyhydr)oxides results in their dissolution and the possible formation of Fe(II)-bearing phases such as magnetite, green rusts, siderite, etc. These mineralogical transformations affect the mobility of surface-associated metal(loid)s, which may be released into solution, adsorbed, or incorporated into newly formed minerals. Maghemite (γ-Fe_2O_3) is a mineral found in certain types of soils and in calcines resulting from ore roasting. Little is known about the reduction of maghemite by Fe(III)-respiring bacteria, the impact of reductive dissolution on the release of associated contaminants, or the nature of biogenic Fe(II)-containing products. In this study, we incubated samples of pure maghemite and As(V)- and Zn-adsorbed maghemite with the Fe(III)-reducing bacterium, *Shewanella putrefaciens* strain ATCC 8071 in a batch system under anoxic conditions. We show that magnetite forms as a result of maghemite bioreduction and that the reduction rate of maghemite is influenced by pre-adsorbed As(V), whereas Zn has no such effect. Furthermore, during bioreduction, soluble Zn and As concentrations decrease significantly, possibly as a result of coprecipitation or adsorption reactions on the newly formed biogenic magnetite.

Changes to metal availability following the oxidation of acid sulfate soil materials

S.R. CLAFF[1], L.A. SULLIVAN[2] AND E.D. BURTON[3]

[1]Southern Cross GeoScience, Southern Cross University,
Lismore Australa
(*correspondence: salirian.claff@scu.edu.au)
[2]Southern Cross GeoScience, Southern Cross University,
Lismore Australa (leigh.sullivan@scu.edu.au)
[3]Southern Cross GeoScience, Southern Cross University,
Lismore Australa (ed.burton@scu.edu.au)

Practical Application of a Sequential Extraction Method Optimised for Acid Sulfate Soils

The oxidation of pyrite in acid sulfate soils can lead to the production of sulfuric acid, resulting in a number of negative environmental impacts. One such impact is the release of metals bound to previously stable minerals. The toxicity and mobility of a metal is linked to its geochemical form. Thus changes in the oxidation state of acid sulfate soil materials can release metals bound to the affected mineral phases. As such, total metal concentrations give little indication as to the bioavailability and potential toxicity of a metal. In acid sulfate soil materials the metals bound in the di-sulfidic (essentially pyritic) fraction are of particular importance. However current risk assessment and management of these soils deals with net acidity production only. Sequential extractions are one method of measuring the mobility metals at a given time, in a specific material, and of monitoring these changes in phase associations and subsequant changes in phase associations within a range of operationally defined fractions. Four unoxidised acid sulfate soil materials were collected and oxidised over a period of 90 days. Soils were sampled frequently during the oxidation process. For each sampling period, changes in sulfur distribution, and metal availability and release were measured. A new six-step sequential extraction method is applied. It has that has been optimised for use in assessing environmental risk posed by metals in acid sulfate soil materials.