

Surface passivation does not impede biotransformation of Fe oxides by *Shewanella oneidensis*

K. EUSTERHUES^{1*}, M.W. FRIEDRICH², J. THIEME³,
J. PRIETZEL⁴, T. KELLER¹, G. GRUNDMANN⁴,
M. SALOMÉ⁵ AND K.U. TOTSCHÉ¹

¹Friedrich-Schiller-Universität Jena, Germany

(*correspondence: karin.eusterhues@uni-jena.de)

(t.keller@uni-jena.de, kai.totsche@uni-jena.de)

²Universität Bremen, Germany

(michael.friedrich@mpi-marburg.mpg.de)

³Georg August Universität Göttingen, Germany

(jthieme@gwdg.de)

⁴Technische Universität München, Germany

(prietzel@wzw.tum.de, g.grundmann@tum.de)

⁵European Synchrotron Radiation Facility, Grenoble, France

(salome@esrf.fr)

At later stages of microbial reduction experiments reduction rates are often observed to drop, even when Fe(III) sources are not depleted and reducing conditions prevail. This study investigates, whether surface passivation, i.e. the formation of Fe(II)-rich coatings on the original Fe(III) particles, might be a limiting factor in dissimilatory Fe reduction.

We performed incubation experiments with *Shewanella oneidensis* using lactate as the carbon source and (i) goethite, (ii) poorly crystalline goethite, (iii) a mixture of goethite and ricefield soil material as electron acceptors. Solids were examined by XRD, Fe-XANES and XPS to determine extent, arrangement, and mineralogy of newly formed Fe(II) minerals. XRD was able to identify vivianite after incubation of both types of goethite. Fe-XANES suggests that metavivianite and Fe(II)-lactate were formed as well.

To investigate the spatial Fe(II) distribution we collected maps at different energies (pre-edge: 7110eV; high energy: 7200 eV; whiteline Fe(II): 7127.5 eV, whiteline Fe(III): 7131.5eV) and maps of XANES spectra across individual particles. While many finegrained Fe(III) particles survived incubation, we observed that most of the larger particles (5-100µm) have been completely transformed to or newly formed as Fe(II) phases. Within the spatial resolution of ~1µm XANES spectra and major element distribution of all investigated bio-reduced Fe(II) particles did not differ between core and rim. By XPS, we detected a still significant contribution of Fe(III) in the topmost nanometers of the surface of all incubated samples. We conclude that surface passivation did not occur at the given experimental conditions.

Isotope domain mapping of ⁸⁷Sr/⁸⁶Sr biosphere variation, UK

J.A. EVANS¹, J. MONTGOMERY²,
AND G. WILDMAN³

¹NIGL, British Geological Survey, Keyworth, Notts, NG12 5GG, UK (je@bgs.ac.uk)

²Division of Archaeological, Geographical and Environmental Sciences, School of Life Sciences, University of Bradford, Bradford, BD7 1DP, UK (jmontgomery@bradford.ac.uk)

³British Geological Survey, Keyworth, Notts., NG12 5GG, UK (gwildman@bgs.ac.uk)

The potential of ⁸⁷Sr/⁸⁶Sr isotope composition to the tracking and origin of material, whether it is humans, animals, water or wine can only be fully realised if high-quality reference data sets are available against which to compare the unknowns. This is currently not the case. Despite the rapid increase in ⁸⁷Sr/⁸⁶Sr-based provenance studies of biosphere materials there are no well documented maps available. Most researchers resort to generating reference maps from a variety of geological datasets and the analysis of sparse 'environmental' samples. A major reason for this lack of reference material is the investment needed to undertake systematic sampling and analysis over large areas. A further problem is associated with choice of proxy material, as organisms differ in their habitat and exploitation of resources. In this paper various approaches to isotope biosphere sampling are considered, some of the problems are assessed, the precision required for the study of human populations is discussed and a first attempt is made to condense all of the available information into an 'isotope package' map. The study details work undertaken on the Island of Skye, Scotland where the complexity of geological and isotope data is reduced into five main ⁸⁷Sr/⁸⁶Sr packages, and goes on to considered the approach to producing a biosphere map for the UK.