4.3.P10

Iron isotope fractionation by chemotrophic iron-oxidisers

E.M. LEIGHTON[1], T. ELLIOTT[1], C.J. HAWKESWORTH[1], R.J. PARKES[2] AND C. COATH[1]

[1] Department of Earth Sciences, University of Bristol, Bristol, BS8 1RJ, UK (emma.leighton@bristol.ac.uk; tim.elliott@bristol.ac.uk; c.j.hawkesworth@bristol.ac.uk; chris.coath@bristol.ac.uk)

[2] School of Earth, Ocean and Planetary Sciences, Cardiff University, Cardiff, CF10 3YE, UK (jparkes@earth.cf.ac.uk)

Knowledge of the isotopic behaviour of iron in natural and experimental systems has expanded considerably since initial work began in this field [1]. However, a greater understanding of the pathways and controls on Fe isotopic fractionation, produced from the abiological and biological transformations of Fe, is still needed to characterise the global Fe biogeochemical cycle in a manner comparable to that of the carbon isotope system.

Oxidation and reduction of Fe by direct or indirect microbial activity plays a large role in the global cycling of Fe. The discovery of chemotrophic microorganisms able to oxidise Fe anaerobically [2], increases the importance of Fe recycling via redox reactions in natural environments, as well as extending the diversity of Fe-utilising microbial metabolisms.

Fe isotopic fractionation by strains of the chemolithotrophic bacterium Thiobacillus denitrificans, has been investigated. Batch experiments have been done using different inoculum potentials, temperatures, and pO2 levels with Fe(II) as the only electron donor. Iron isotope compositions were determined by high-resolution, multiple collector, ICP-MS, with an external precision (1 σ) on δ56Fe and δ57Fe of $\pm$ 0.05 and 0.08 ‰, respectively. The analytical methods were similar to those in the literature [3]. Preliminary data shows a – 0.8 ‰ δ56Fe Fe isotopic fractionation between Fe(II) in solution and FeOOH precipitate. This isotopic shift between substrate and product can be attributed to biological oxidation as no abiotic Fe oxidation occurred in concomitant sterile controls. Experiments examining variable pO2 levels in both abiotic and biological systems provide a useful basis to examine how the isotopic signature of biological oxidation is modified by abiotic Fe(II) oxidation.

References

[1] Beard, B., Johnson, C. M., Cox, L., Sun, H., Nealson, K. H., and Aguilar, C. (1999) Science **285,** 1889-1898.

[2] Straub, K. L., Benz, M., Schink, B., and Widdel, F. (1996) Appl. Environ. Microbiol. **62(2),** 1458-1460.

[3] Weyer, S., and Schwieters, J. B. (2003) Int. J. Mass. Spectrom. **226,** 355-368.

4.3.P11

Interaction between an aerob bacterium and vermiculite: Effects on chemical, mineralogical and mechanical properties of vermiculite

B. MÜLLER

ETH Zürich, Zürich, Switzerland (barbara.mueller@igt.baug.ethz.ch)

This research work focusses on gaining insight into the changes in chemical, mineralogical and mechanical properties of the clay mineral vermiculite affected by microbial activity.

Determination of the major, minor and trace element content, water content, grain size, X-Ray diffraction pattern, intracristalline swelling with glycerine, layer charge, CEC, exchangeable cations, BET surface and rheology provided the necessary information about the differences between pure vermiculite, vermiculite suspensions containing the nutrient medium and vermiculite suspensions containing the nutrient medium and the bacterium *Pseudomonas fluorescens*.

We hypothesize that the aerobic bacterium *Pseudomonas fluorescens* causes changes in trace element composition (vermiculite in contact with the bacteria contained significantly less Zn and V, but the same amount of e. g. Fe and Cu, compared to vermiculite from bacteria free slurries after two weeks of experiment run time), grain size, aggregation of vermiculite grains as evidenced by smaller BET surfaces and enhanced viscosity of the bacteria containing slurries. Layer charge, intracristalline swelling and CEC were not affected by the microbial activity, nor did the bacteria account for the exchange of potassium against sodium in the vermiculite. The microbes inhibited the last process during the first stage of the experiments, however increasing run time favors this exchange as well.