Isotope fractionation by biomethylation of inorganic Se species

KATHRIN SCHILLING[1], THOMAS M. JOHNSON[2] AND WOLFGANG WILCKE[3]

[1]Geographic Institute, Johannes Gutenberg University Mainz, 55099 Mainz, Germany

[2]Environmental Isotope Geochemistry Group, Department of Geology, University of Illinois at Urbana-Champaign, 245 Natural History Building, 1301 W. Green St., Urbana, IL 61801

[3]Geographic Institute, University of Berne, Hallerstr. 12, 3012 Berne, Switzerland

Biomethylation of Se is an effective mechanism to detoxify Se-contaminated environments and is an important part of the global Se cycle. Biomethylation tends to fractionates stable Se isotopes in response to biogeochemical conditions and type of Se source compound.

Our objective was to study the effect of the type of inorganic Se species (i.e. Se (IV) or Se (VI)) on the stable Se isotope fractionation during methylation by the fungus *Alternaria alternata*. The fungus was cultivated with 5 mg kg^{-1} as $NaSeO_4$ or $NaSeO_3$ for 11-15 days. All Se isotope measurements were carried out with MC-ICP-MS. Se isotopes were significantly fractionated during the methylation of Se (VI) ($\delta^{82/76}$Se of methylselenide = -3.97 to -3.25‰) compared to the initial $\delta^{82/76}$Se of Se (VI) of -0.69± 0.1‰. We suggest that Se (VI) was metabolized by following the assimilatory sulfate reduction pathway. If Se (IV) was supplied as Se source the methylselenides ($\delta^{82/76}$Se = -1.44 to -0.16‰) were less depleted in ^{76}Se compared to the Se (IV) source (-0.20± 0.1‰). We assume that two parallel detoxification steps occurred, one process resulted in Se (0) which accumulated in the fungus (56 to 64% of the supplied Se) and the other produced methylselenides (33 to 40%). In a further study, we will determine whether a similar Se isotope fractionation occurs for Se (IV) if the incubation time is reduced to 3-5 days.

Uptake of metals and metal-bearing particulates by silica-rich coatings

M. SCHINDLER, N. MANTHA AND J. DUROCHER

Department of Earth Sciences, Laurentian University, Sudbury, ON, Canada (mschindler@laurentian.ca, nm_mantha@laurentian.ca, jl_durocher@laurentain.ca)

Hydrous-silica coatings were identified on the surface of a granite outcrop in contact with acidic pond water at the Copper Cliff mine-tailings area in the Greater City of Sudbury, Ontario [1]. These coatings were found to have higher average concentrations of Cr, Mn, Co, Ni, Cu, Zn and Pb than Fe-hydroxide coatings precipitated from the tailings pond water. As a consequence, we systematically examined Si-rich coatings on siliceous minerals and rocks in mine tailings and in close proximity to former smelters and roast yards of the Sudbury area. Si-rich coatings on minerals and rocks in mine tailings form from weathering of the siliceous material by acidic pore- and pond waters and contain high metal concentration at their interface to overlying Fe-rich coatings. Si-rich coatings in close proximity to local smelters and roast-yards are the results of the intensive weathering of the underlying rock by sulfuric-acid precipitations during past smelter and roast beds operations (1888 -1975). These black-coloured Si-rich coatings contain a high number of nano- to micrometer-size smelter particulate and secondary Fe-sulfate minerals such as jarosite (Fig. 1). These results indicate that freshly-formed amorphous silica-gel type coatings on the surface of weathered siliceous rocks and minerals have profound abilities to trap dissolved metals from pore waters and metal-bearing particulates from the atmosphere (see also [2]).

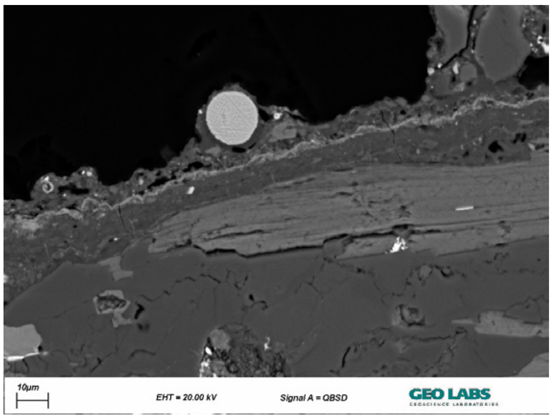

Figure 1: Spherical smelter particulate trapped in an amorphous silica coating on the surface of a granitic rock.

[1] Schindler *et al.* (2009) *Environmental Science & Technology* **43**, 8775. [2] Perry *et al.* (2006) *Geology* **34**, **7**, 537.