Changing solubility of aeolian iron in the Arctic from Greenland ice cores

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Aeolian deposition is an important source of iron (Fe) to the ocean. On a glacial-interglacial time scale, large changes in dust emissions and atmospheric transport, and hence iron, may have modulated primary production in the remote ocean. Because dust-iron is thought to be relatively insoluble (~1%) small changes in solubility resulting from changes in chemical weathering may potentially affect primary productivity. However little is known regarding the history of aeolian iron solubility.

Here we present two 200 yr Greenland ice core records of total/soluble Fe and non-sea-salt sulfur. We investigate changes in Fe solubility during well-known volcanic eruptions, the rise of anthropogenic sulfur emissions and biomass burning events.

Iron isotope fractionation during Fe(II) oxidation and precipitation of iron in acid mine drainage (Carnoulès Mine, France)

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Acid mine drainage (AMD) is produced upon oxidation of pyrite in mining residues. In these systems Fe plays a key role in water chemistry since the redox reactions involving Fe are an important energy source for chemolithotrophic bacteria such as *A. ferrooxidans*. AMD are thus ideal sites to study Fe isotope fractionation in natural waters. Few Fe isotopes data have been published to date in AMD or in similar Fe-rich waters. Recently, Herbert et al. (2008) published iron isotope data at the redox interface of a mine tailings stock. Experiments performed in AMD like water by Balci et al. (2006) demonstrated that iron isotope fractionation during the oxidation of $Fe(II)_{aq}$ into $Fe(III)_{aq}$ by *A. ferrooxidans* was controlled by non-biological equilibrium and kinetic factors.

Our study focused on iron isotope fractionation during the Fe(II) oxidation and the subsequent precipitation of iron minerals in acid mine drainage. Iron isotopes have been measured in a small stream receiving acid mine drainage from the Carnoulès mine tailings (Gard, France), characterized by acid pH (3-5), extremely high Fe(II) ($\approx$ 2g/l), SO_4^{2-} ($\approx$ 4 g/l) and As(III) (100 mg/l) concentrations and As-rich iron minerals (tooeleite, As-rich schwertmannite) that form in the streambed. Natural solid samples that precipitate in the acid stream exhibit positive δ^{56}Fe values whereas the water presents negative δ^{56}Fe values, leading to a fractionation of about 2-3 ‰ in agreement with the values that are expected for the oxidation of Fe(II) into Fe(III). Fractionation between water and solid tends to decrease along the stream flowpath. In laboratory experiments, different strains of *A. ferrooxidans* isolated from the field were cultivated in the AMD water. Iron isotopes were measured in the dissolved phase and in the successive minerals (tooeleite, schwertmannite, jarosite) that form through time, together with Fe speciation, cell growth, and the various physico-chemical parameters. Dissolved iron isotopic composition decreased from -0.6‰ down to -1.5‰ within the first 10 days of experiments corresponding to the precipitation of 25% of Fe during the bacterial growth period. δ^{56}Fe equilibrated around -0.5‰ after 40 days of experiments. Results of iron isotope measurements will be discussed according to kinetics of iron oxidation, nature of minerals formed and bacterial strains involved.