Iron speciation and high solubility in Alaskan glacial dust

ANDREW W. SCHROTH[1], JOHN CRUSIUS[2], EDWARD R. SHOLKOVITZ[3] AND BENJAMIN C. BOSTICK[4]

[1]US Geological Survey 384 Woods Hole Road, Woods Hole MA, 02543 (aschroth@usgs.gov)
[2]US Geological Survey 384 Woods Hole Road, Woods Hole MA, 02543 (jcrusius@usgs.gov)
[3]Woods Hole Oceanographic Institution, 266 Woods Hole Road, Woods Hole, MA 02543 (esholkovitz@whoi.edu)
[4]Dept of Earth Sciences, Dartmouth College, Hanover, NH, 03755 (ben.bostick@dartmouth.edu)

A primary source of bioavailable iron (Fe) to Fe-limited waters of the open ocean is associated with particulates, often sourced from desert-derived dust storms. However, portions of these Fe-limited regions of the ocean are in the high latitudes, proximal to coasts that are strongly influenced by glacial weathering and associated sediment fluxes. In these waters, glacial dust storms could be an important intermittent source of relatively soluble Fe for phytoplankton. Here, we quantify the solubility of Fe in size-fractionated glacial flour from catchments of different bedrock Fe composition within the Copper River watershed, AK, and African dust, using leaching experiments following Sedwick *et al.* [1]. We analyze the speciation and mineralogy of Fe in these sediments by X-ray absorption spectroscopy and X-ray diffraction. We demonstrate that glacial flour differs substantially in solubility based on catchment geology, and in all cases releases more Fe relative to African dust during our experiments. Iron speciation also varies by catchment bedrock composition and dust source. While African dust is dominated by secondary ferric Fe phases, significant fractions of Fe in glacial flour are associated with reduced Fe in primary minerals. Relatively soluble primary mineral phases in glacial sediment may result in its higher solubility relative to African dust. These data provide a link between the speciation of Fe in these sediments and their relative solubility in marine systems. Our study emphasizes the potential importance of glacially-derived dust fluxes to the biogeochemical cycling of Fe in marine waters that are limited by this micronutrient and also adjacent to coasts influenced by glacial weathering processes.

[1] Sedwick *et al.* (2007) *Geochem. Geophys. Geosyst.* **8**, 10.

Organic matter degradation in Lake Baikal – A sediment trap study

CARSTEN J. SCHUBERT[1]*, JUTTA NIGGEMANN[2], BENTE AA. LOMSTEIN[2] AND MICHAEL STURM[3]

[1]Eawag, Seestrasse 79, CH-6047 Kastanienbaum, Switzerland (*correspondence: carsten.schubert@eawag.ch)
[2]Department of Biological Sciences, Section for Microbiology, University of Aarhus, Ny Munkegade, Building 1540, DK-8000 Aarhus C, Denmark (jutta.niggemann@biology.au.dk)
[3]Eawag, Überlandstrasse 133, CH-8600 Dübendorf, Switzerland

Lake Baikal offers a unique opportunity to study water column processes in a freshwater system with conditions similar to oceanic systems, e. g. great water depth and oxygenated water column. Investigations on sediment trap material provide information on the early stages of organic matter degradation in the water column.

Sediment trap material from 18 different water depths has been analysed for bulk organic matter parameters, including organic carbon and nitrogen isotopic compositions, chlorin concentrations, and Chlorin Indices [1]. Detailed studies focused on the concentration and composition of amino acids and fatty acids.

The extent of organic matter degradation in the water column of Lake Baikal is reflected in the fluxes of total organic carbon, chlorins, amino acids, and fatty acids at different water depths. In line with earlier studies in marine systems, the labile compounds represented by chlorins, amino acids, and fatty acids, were preferentially degraded over bulk organic carbon. A wide range of diagenetic indicators has been applied to assess the diagenetic stage of the sediment trap material, including the pigment based Chlorin Index, different amino acid based indicators, and the Fatty Acid Index [2]. All indicators showed consistent trends, indicating that the diagenetic stage of the sediment trap material increased with increasing water depth.

This study of sediment trap material from Lake Baikal provided interesting insights in organic matter degradation in this unique aquatic system. It showed the applicability of different diagenetic indicators for studies of freshwater systems and at early stages of organic matter degradation.

[1] Schubert *et al.* (2005) *Geochem. Geophys. Geosyst.* **6**, Q03005, doi,10.1029/2004GC000837. [2] Niggemann & Schubert (2006) *Org. Geochem.* **37**, 626-647.