Copper adsorption on natural schwertmannite and sulfate-rich goethite in AMD systems

J. WEBSTER-BROWN[1,2], P. SWEDLUND[1] AND V. LANE[2]

[1]Department of Chemistry, University of Auckland, New Zealand (*correspondence: j.webster@auckland.ac.nz)
[2]School of Geology, Geography and Environmental Science, University of Auckland, New Zealand

With the generation of surface complexation constants for the formation of ternary metal-sulfate-Fe oxide complexes on synthetic ferrihydrite and goethite [1, 2], our ability to accurately model metal uptake on sulfate-rich Fe oxides in AMD systems has improved. Metal adsorption edges for synthetic schwertmannite can now be modelled using surface complexation constants for the metal-sulfate-ferrihyrite ternary system [1], and parameters have been developed to model adsorption onto synthetic sulfate-rich goethite [2]. To determine if there are significant differences between the adsorption capability of natural and synthetic oxide surfaces, Cu adsorption edges and isotherms were determined on natural schwertmannite and sulfate-rich goethite collected from a former Pb-Zn mine near Te Aroha in New Zealand.
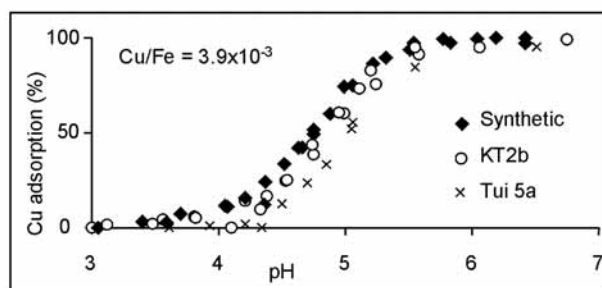

Figure 1: Cu adsorption edge for synthetic and natural (KT2b & Tui 5a) schwertmannite. The Cu/Fe mole ratio is shown.

Discussion of Results

The adsorption edges for the natural oxides were frequently close enough to those for synthetic analogues (e.g. KT2b in Fig. 1), that metal adsorption could be reliably modelled for the experimental conditions using existing surface complexation data. However, the adsorption capacities of the natural and synthetic analogues proved to be very different. Modelling metal adsorption on the natural oxides is therefore less reliable at higher Cu/Fe ratios.

[1] Swedlund et al. (2001) Appl. Geochem. 16, 503-511.
[2] Swedlund et al. (2008 in prep)

Controls of organic nitrogen accumulation in freshwater sediments

B. WEHRLI* AND S. SOBEK

Institute of Biogeochemistry and Pollutant Dynamics, ETH Zurich, Switzerland and Eawag, Swiss Federal Institute of Aquatic Science and Technology, Kastanienbaum, Switzerland (*correspondence: wehrli@eawag.ch)

The preservation of organic matter in marine sediments has been studied intensively [1], however, it is recognized to a far lesser extent that also lake sediments are globally significant sinks of organic matter. Unfortunately, the reported data from lakes are dispersed and often originate from single core measurements. Global estimates of organic nitrogen (ON) burial in lakes can be based on the review of Dean and Gorham [2] with an average ON burial rate of ~ 9 Tg ON yr^{-1} in lakes representing a significant loss term in the global nitrogen cycle.

Oxygen Exposure or Protective Sorption?

In our study we address the effects of two potential controls of organic matter burial in lake sediments - oxygen exposure time and protective sorption to mineral particles. A large sample of contrasting systems (Lakes Baikal, Kivu, Kinneret, Constance, Brienz, Zug, Lugano, Swedish boreal lakes) is analyzed for organic matter burial, oxygen exposure times using microelectrodes and sediment dating techniques, as well as for the available surface area of mineral particles. Previous analyses [3, 4] and new data are combined to compare burial efficiencies in these freswater systems to marine data [1].

Role of O₂ and Terrestrial Input

The results obtained so far indicate that protective sorption is of minor influence for the burial efficiency of organic nitrogen. O_2 exposure times from centuries in L. Baikal to weeks in some prealpine lakes clearly affect ON accumulation. Burial efficiencies approach 100% at short O_2 exposure times for sediments with a large fraction of terrestrial input. Systems with large autochthonous fractions closely follow the marine trend. The data help to extrapolate global ON sinks in aquatic systems.

[1] Hedges & Keil (1995) Marine Chemistry 49, 81-115.
[2] Dean & Gorham (1998) Geology 26, 535-538. [3] Muller et al. (2005) Global & Planetary Change 46, 101-124.
[4] Maerki et al. (2006) Limnology & Oceanography 51, 1342-1354.