

Modelling of metal ions sorption to various oxy-hydroxides colloids.

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The solid water interface plays a major role in the geochemical cycle of metal ions in soils and aquatic systems. Aquatic interfacial processes are also important in water treatment technology. The major question is the distribution of the metal ions between the aqueous phase and the solid surface.

Together with the organic matter, the metal oxides (Fe, Mn) are an important pool of the colloidal material encountered in soils, rivers or groundwaters. The colloidal material plays a major role for the speciation and the fate of trace metal pollutants and large number of studies have been devoted to their characterization.

For organic colloids, models with an extended data base are available to understand and predict their interactions with metal ions in complex geochemical environments [1,2]. Similarly, mechanistic insights are needed to understand the reactivity of the mineral colloid surfaces.

Model based on the surface complexation theory have been successful in describing the metal ions sorption to oxy-hydroxides. But the individual models used up to now all invoke different assumptions leading to little practical usefulness. A unified description for hydrous ferric oxides was proposed in the past by Dzombak and Morel [3].

Here, we will report a similar effort for the CD-MUSIC approach [4] for Cu, Pb, Zn, Cd binding to hydrous ferric oxides, goethite and hydrous manganese oxide. We will show that based on the data obtained for goethite it is possible to predict the behaviour of the metal ions when they interact with the hydrous ferric oxides. When surface species are taken from recently published spectroscopic (XAS) data, both salt and pH effects are taken into account.

References

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Nd in sedimentary planktic foraminifera located in a phase that records the Nd isotopic composition of surface seawater

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The Nd isotopic composition of ancient seawater is a potentially powerful tracer of ocean circulation and of varying inputs to the oceans from the continents. A number of recent contributions have led to conflicting conclusions about the suitability of forams as a substrate for studies of ancient seawater. Vance et al. (2000) (see also Scrivner et al. this volume) have shown that Holocene planktonic foraminifera record the Nd isotopic composition of surface seawater. In contrast, Pomies et al. (2000) demonstrate very clearly that foraminifera collected from within the water column have Nd concentrations that are a factor of about 30 lower than sedimentary forams. We have conducted cleaning experiments aimed at reconciling these two apparently conflicting observations.

Recently, it has been demonstrated (Haley and Kinkhammer 2002) that cleaning using DTPA removes substantial amounts of REE from foraminiferal calcite. Our experiments with this technique confirm this finding in that 80-95% of the Nd contained in our sedimentary foraminifera is removed by DTPA-cleaning. However, Nd isotopic analysis of the leachates from this cleaning demonstrates that the Nd removed is also identical to surface seawater. At present we cannot resolve between the possibilities that: (a) Nd in the sedimentary forams is contained in a phase such as barite that is rich in Nd and is removed by DTPA cleaning; (b) DTPA is merely a good complexing agent that effectively solubilizes Nd re-adsorbed onto foram surfaces after the reductive cleaning. The key point, however, is that Nd obtained from sedimentary planktic foraminifera resides in a phase whose Nd is derived from surface seawater, suggesting that Nd in forams can indeed be safely used to record the isotopic composition of Nd in ancient seawater.

References

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