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**Title: The Role of Competitive Adsorption of Suspended Sediments in Determining Partitioning and Colloidal Stability**

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### **Objectives/Hypothesis**

The overall objective of this study was a better understanding of the dynamics of competitive adsorption of metal ions on particles. To accomplish this, the study focused on surface studies of competitive adsorption/precipitation of lead, cadmium and zinc ions on particles. The specific objectives of the work were to; (1) investigate competitive adsorption of metals on colloids, (2) investigate changes in colloidal stability, and (3) study transport properties of Zn on sediments in different aquatic environments. Phenomena of particular interest are: (a) Metal surface equilibria (b) Particle aggregate equilibria, and c) Adsorption desorption processes.

### **Approach**

The analytical techniques utilized were; X-ray Photoelectron Spectroscopy (XPS) and Ion Scattering Spectroscopy (ISS). Both chemical speciation and quantitative information were provided by XPS. The application of natural sediments from known particle size distribution in place of novel synthesized particles has been accepted as more realistic in understanding adsorption and transport phenomena. Solution analyses and mass balance determinations were carried out by atomic absorption spectrometry (flame and graphite).

### **Results**

A tremendous amount of interest is being placed on the adsorption of cations by sediments (hydrated oxides etc.), Because of their role in controlling the transport and fate of trace metals in the environment. Consequently, there is a need for more information at moderate and environmentally realistic concentrations i.e.,  $<10^{-6}$  M. The reversibility of adsorption under different environmental conditions warrants serious scrutiny as the fate of adsorbed ions seem to depend heavily on this process. The rate at which divalent cation adsorption becomes significant varies with the particular cation and the solid involved, the solid: solution ratio, the specific surface area of the solid, the total cation concentration, and the concentration of interacting species. It is therefore necessary to study the problem in terms of the sediment properties (type, size distribution, etc.). X-ray photoelectron spectroscopy proves to be a good probe for investigating the adsorption of metal ions on sediments. The effect of surface carbon concentrations should be more strongly considered. These results, although preliminary, do present some interesting observations and may in the end offer some insight as to the fate of metal ions in different environments.

**Supplemental Keywords**

Metal ions, metal transport, and fate

**Publications and Presentations**

McWhinney, H. and M. Weisner, "The Role of Competitive Adsorption on Suspended Sediments in Determining Partitioning and Colloid Stability", Final Project Submitted to the South and Southwest Hazardous Substance Research Center, June 1997.

**For Further Information**

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