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Selenium and Chromium Redox at Pond/Sediment Interfaces



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# SELENIUM AND CHROMIUM REDOX AT POND/SEDIMENT INTERFACES

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Direct measurements on the transport and transformations of redox-sensitive trace elements such as selenium and chromium in the environment are important for understanding factors controlling elemental cycles in natural and contaminated systems. Sediments directly underlying water bodies are important interfaces between aquatic and benthic environments, in which sharp gradients in redox potentials and changes in oxidation states of many elements typically occur. By combined use of the x-ray fluorescence microprobe and micro-XANES spectroscopy, quantitative concentration and oxidation state maps of a wide range of elements in this highly heterogeneous sediment boundary region can be obtained. Our experiments on reactive transport of Se have quantified diffusion and reduction of Se(VI), ponded over oxidizing versus reducing sediments, and helped explain the fate of Se-contaminated agricultural drainage waters discharged into wetlands and evaporation ponds. Wide variations in reduction rates are reflected in growth of localized zones (about 1 mm in size) of much higher Se(0). The micro-XANES profiles combined with a reactive transport model provided local Se reduction rates. Experiments on Cr(VI) transport and reduction to Cr(III) in sediments have also been conducted. Similar features, including measurements of localized zones on much higher reduction rates, were observed.