GEOC: Division of Geochemistry

109 - Influence of sea level rise on arsenic mobility in coastal soils

View Session Detail

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Abstract: Sea level rise (SLR) is occurring worldwide as a result of a changing climate. Projections estimate that the global mean sea level will rise 0.8m by 2100 compared to 1990 levels. The Mid-Atlantic coast of the US is experiencing SLR rates higher than elsewhere in the world due to the synergistic impact of coastal subsidence and SLR. Historic and current industrial activities along coasts have created a legacy of contamination in surrounding soil and groundwater. As sea levels rise, a new problem is introduced: how will impending SLR impact low-lying coastal contaminated sites? Delaware is the lowest lying state in the U.S., with a history of industrial activities and contamination making Delaware an ideal location to investigate SLR impacts on contaminated coastal sites. Arsenic is a carcinogenic toxin commonly found in many coastal communities, and stands to undergo changes in mobility and toxicity due to SLR. Soil samples were collected from an industrial site heavily contaminated with arsenic (13,000 mg kg^{-1}) in South Wilmington, DE, adjacent to a tidal river. The soil was reacted with river and sea waters in automated biogeochemical microcosm reactors (MC) at defined reductive potential (Eh) levels ranging from -300 mV to +300 mV. Field Eh probes were deployed where the soils were collected to validate the range of Eh used in the MC. Slurry samples were collected after 72h of equilibration at each defined Eh level and the solid and liquid phases were preserved for analysis under an inert atmosphere. Aqueous samples were analyzed for total metal content, metal speciation, and other important redox markers by standard methods. Solid samples were analyzed by synchrotron-based XAS and XRF to determine speciation and elemental associations of As. Reducing conditions led to increased As mobilization with both river and sea water. Under the most reducing conditions there was more As in solution for the river water treatments than sea water. Solid phase results suggest that this may be caused by the precipitation of As sulfide or Fe sulfide mineral phases when Eh of sea water systems reaches below 0 mV. This study provides important information on the impact of sea level rise on the cycling, mobility, and speciation of redox sensitive heavy metals in contaminated soils.