AGU FALL MEETING
San Francisco | 12–16 December 2016

H42G-07: Hydrologically Controlled Arsenic Release in Deltaic Wetlands and Coastal Riparian Zones (Invited)

Thursday, 15 December 2016
11:50 - 12:05
Moscone West - 3014

Wetland and riparian zone hydrology exerts critical controls on the biogeochemical cycling of metal contaminants including arsenic. The role of wetlands in driving geogenic arsenic release to groundwater has been debated in the deltas of South and Southeast Asia where the largest impacted human population resides. In addition, groundwater in coastal areas worldwide, such as those in South and Southeast Asia and the Mid-Atlantic of the U.S., is at risk to largely unexplored biogeochemical and hydrologic impacts of projected sea level rise. First, we present data from fresh-sediment incubations, in situ model sediment incubations and a controlled field experiment with manipulated wetland hydrology and organic carbon inputs in the minimally disturbed upper Mekong Delta. Here we show that arsenic release is limited to near-surface sediments of permanently saturated wetlands where both organic carbon and arsenic-bearing solids are sufficiently reactive for microbial oxidation of organic carbon and reduction of arsenic-bearing iron oxides. In contrast, within the deeper aquifer or seasonally saturated sediments, reductive dissolution of iron oxides is observed only when either more reactive exogenous forms of iron oxides or organic carbon are added, revealing a potential thermodynamic restriction to microbial metabolism. Second, in order to assess the potential impacts of sea level rise on arsenic release to groundwater, we determined the changes in arsenic speciation and partitioning in sediment collected from an anthropogenically contaminated coastal riparian zone under controlled Eh regimes in both seawater and freshwater systems. Here we show greater arsenic release under anoxic/suboxic conditions in the freshwater system than in the seawater system, potentially due to high salinity induced microbial inhibition. Collectively, our work shows that shifting hydrologic conditions in deltaic wetlands and tidally influenced zones impacts the extent of arsenic release to groundwater. Land and water management decisions that increase the duration of wetland inundation may promote arsenic release to groundwater.

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