Natural organic matter in Mekong Delta sediments: implications for As release and mobility

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Arsenic (As) groundwater contamination is an important environmental issue throughout deltaic regions of Southeast Asia. The sources and sinks of As in the sediments overlying contaminated aquifers are under debate. Peat layers have been proposed as effective sinks for As under reducing conditions due to the thiol binding of As(III) to natural organic matter (NOM) and the formation of As sulfides [1]. We performed experiments to characterize the composition of the porewater in equilibrium with the sediments as well as leaching experiments designed to accelerate contaminant release processes. The results show that peat, obtained from sediments in the Mekong Delta in Vietnam, deposited ~ 7,600 years ago in paleo-mangrove environments, can become a source of As under reducing conditions. In this peat, As is associated with NOM and arsenian pyrite. Thus, microbial reductive dissolution of As-bearing Fe(III) (oxyhydr)oxides, the most commonly accepted model for As release, cannot be a major mechanism here. Our results suggest that As is released equally from the NOM-thiol bound As and arsenian pyrite, and that these processes may be microbially mediated. Furthermore, peat contributes with humic-like dissolved OM (DOM) to the DOM pool of the reducing porewater. This organic humic-like material may promote the formation of As-humic DOM dissolved or colloidal complexes that may maintain As in solution, enhancing its mobility [2]. Overall, this study shows the potential for peat layers derived from paleo-mangroves in deltaic environments to release As accumulated during deposition and/or diagenesis.

[1] Langner, P. et al. (2011). *Nat. Geosci*. 5(1), 66–73.

[2] Mladenov, N. et al. (2015). *ES&T*. 454, 505-508.