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Hydrological fluctuations drive microbially-mediated oscillations in As concentration in Mekong Delta groundwater (Vietnam).

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Contamination of arsenic (As) in groundwaters is thought to affect more than 100 million people, including in the watersheds downstream from the Himalayas. The source of As is geogenic, coming from its association with minerals in aquifer sediments. The most widely accepted mobilization mechanism of As from the sediments to groundwater on the South and South-East regions of Asia is the microbially-mediated reductive dissolution of iron-(oxy)hydroxides.

Overall, the research conducted to date has shown high diversity of microbial metabolisms influencing As dynamics in groundwater systems, linking elemental cycles particularly those of nitrogen, carbon, sulfur, and iron. However, the dynamics of coupled elemental cycles resulting in the mobilization/immobilization of As under oscillating hydrological conditions are not well understood. To address this knowledge gap, a 5-well transect was drilled from the Bassac River to about 1 km inland in the Mekong Delta in Vietnam. Monthly hydrological and geochemical and quarterly microbiological sampling was carried out for one year to characterize seasonal changes at the site. Large geochemical changes were detected during the transition from the dry to the rainy season, correlating with the observed hydrological changes. In particular, Fe(II), As(III), and nitrate concentrations show large deviations across seasons, suggesting a role for nitrogen-dependent processes. We seek to leverage meta-omic tools to decipher the activity of the microbial community and provide mechanistic understanding of the observations as well as delineate the role of the electron donors present in the system in modulating As in the aquifer.