The Geochemistry & Microbiology behind Arsenic Cycling within riverbank Aquifers in Bangladesh

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Groundwater arsenic (As) contamination is an ongoing problem in the Ganges-Brahmaputra-Meghna Delta, Bangladesh. Geochemical changes are caused by river water movement into shallow aquifers and may play a major role in determining where arsenic contamination occurs, which is not fully explained by existing models. The variation in the Meghna River level from tidal fluctuations causes the groundwater flow direction in the immediate vicinity of the river (<10 m) to change regularly. We predict that frequent flow reversal creates a natural reactive barrier (NRB) of iron (Fe(III)) oxides in the shallow Meghna riverbank aquifer that adsorbs As during oxidizing conditions and releases reduced Fe(II) and As during reducing conditions. An east-west monitoring well transect perpendicular to the river was sampled in January 2016 for geochemical constituents. At this time of year the groundwater at this site generally flows towards the river (gaining conditions). Solid phase Fe and As were measured with a portable XRF to identify whether an NRB is present and its location in the shallow aquifer.

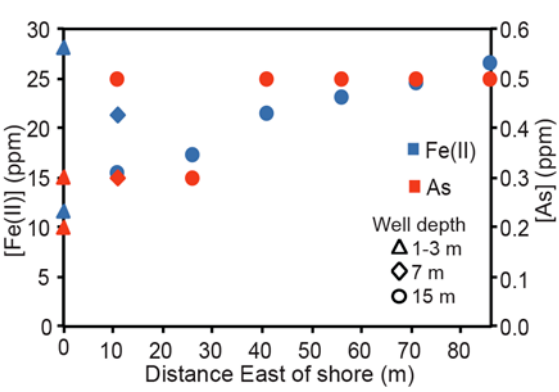

Figure 1. [As] &[Fe(II)] with distance from the river bank, sampled from the seepage face (1-3 m), 7 m, and 15 m wells.

A simultaneous spike in [Fe(II)] and decrease in [As] were observed in shallow wells 0-10 m from the river bank under anoxic conditions. XRF data shows high solid-phase Fe, As, and sulfur (S) at the same depth, which may indicate that As sulfide minerals are being precipitated, explaining the sequestration of As alongside active Fe(III) reduction.