# A comparison of arsenic retardation in reduced Holocene sediment and oxidized Pleistocene sediment

M.R.H. MOZUMDER[1*], B.C. BOSTICK[1], M.A. ISLAM[2],
I. CHOUDHURY[2], K.M. AHMED[2], T. ELLIS[1],
B. MAILLOUX[3], AND A. VAN GEEN[1]

[1]Lamont-Doherty Earth Observatory of Columbia University, NY 10964, USA (*mozumder@ldeo.columbia.edu)
[2]University of Dhaka, Dhaka-1000, Bangladesh
[3]Barnard College, New York, NY-10027, USA

The distribution of As in S/SE Asian groundwater is spatially highly variable. Remediation efforts to reduce human exposure exploit this variability by encouraging the reliance on the subset of low-As wells. This field study conducted under controlled conditions with both reduced (grey) and oxidized (orange) aquifer sands places new constraints on the extent to which adsorption delays As transport relative to groundwater flow. We conducted a field column experiment to examine the sorption characteristics of As under anoxic condition with freshly collected sediment cores (7.5 cm long, 1.6 cm dia.) from Araihazar, Bangladesh. A total of 14 cores (8 gray sand, 5 orange sand, 1 pure sand control) were eluted with unaltered groundwater pumped directly from a 20 m deep well elevated in dissolved As (320 μg/L, >90% as arsenite) and dissolved Fe (7 mg/L) concentrations over a span of 3 weeks at porewater velocities of 2-3 cm/hr and 7-9 cm/hr. Effluent As in both the gray and orange fast sand columns reached 50% of the input concentration within 50 PV (pore volumes). However, the slow column effluents reached 50% of input As levels within 30 PV for the gray sand and within 50 PV for the orange sand. The apparent distribution coefficient for gray sand increased (from 3 to 6 L/kg) with increasing pore-water velocity suggesting sorption-related nonequilibrium [1]. Unlike orange sand, the gray sand column effluents also contained a high initial As concentration. In addition, after breakthrough, both As and Fe effluent concentrations in gray sand exceeded the input level, possibly because of particularly elevated levels of phosphate and/or dissolved organic carbon in the inflow. The results are modeled by reversible kinetic reactions with irreversible sink/source [2].

[1] Brusseau, et al. (1989) Water Resour. Res., 25 (9). [2] Selim et al. (1990). Modeling the transport of heavy metals in soils, U.S. Army Corps of Engineers, CRREL, Monograph 90-2.