Seasonal Arsenic Accumulation in Stream Sediments at a Groundwater Discharge Zone

Seasonal changes in arsenic and iron accumulation rates were examined in the sediments of a brook that receives groundwater discharges of arsenic and reduced iron. Clean glass bead columns were deployed in sediments for known periods over the annual hydrologic cycle to monitor changes in arsenic and iron concentrations in bead coatings. The highest accumulation rates occurred during the dry summer period (July-October) when groundwater discharges were likely greatest at the sample locations. The intermediate flow period (October-March), with higher surface water: levels, was associated with losses of arsenic and iron from bead column coatings at depths below 2-6 cm. Batch incubations indicated iron releases from solids to be induced by biological reduction of iron (oxy)hydroxide solids. Congruent arsenic releases during incubation were limited by the high arsenic sorption capacity (0.536 mg(As)/mg(Fe)) of unreacted iron oxide solids. The flooded spring (March-June) with high surface water flows showed the lowest arsenic and iron accumulation rates in the sediments. Comparisons of accumulation rates across a shoreline transect were consistent with greater rates at regions exposed above surface water levels for longer times and greater losses at locations submerged below surface water. Iron (oxy)hydroxide solids in the shallowest sediments likely serve as a passive barrier to sorb arsenic released to pore water at depth by biological iron reduction.

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