

Stable Isotope Hydrology of Arsenic Contaminated Groundwater Aquifers of West Bengal, India: Implications to Genesis and Mobilization of Arsenic

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Arsenic contamination in groundwater has now become a serious threat to the people of West Bengal in India and Bangladesh and considered the biggest natural mass poisoning of the century. At present more than 3000 villages of 9 districts of West Bengal are affected. More than 43 million people are suffering and the total arsenic affected area covers 38865 sq. km. These figures show the severity of this environmental problem in India. Identifying the source and understanding the processes of arsenic mobilization through water are, therefore, most important for any arsenic mitigation plan.

Debate exists as to whether arsenic mobilization by reduction of FeOOH is driven by utilization of recent carbon inflow into the groundwater as a consequence of increased irrigation over the entire Bengal Basin or by degradation of Holocene peat layer deposited in Bengal basin. Most research have so far focused on arsenic and elemental geochemistry of water without understanding the aquifer dynamics and geological conditions. It is important to note that just studying the elemental chemistry (including arsenic) is not sufficient to resolve the major issues noted above. Stable isotopic ratios of oxygen ($^{18}\text{O}/^{16}\text{O}$), hydrogen (D/H) and carbon ($^{13}\text{C}/^{12}\text{C}$ in dissolved inorganic carbon; termed DIC) in groundwater are the potential tools to assess the validity of these model as they respond differently to rainfall, evapo-transpiration, recharge, ground-water flow, and extent of water-rock interaction. Compared to voluminous isotope data generated in Bangladesh groundwater (through work of International atomic Energy Agency or IAEA, British Geological Survey etc.), in West Bengal virtually no isotope data are yet available. Even in Bangladesh, discrepancies exist between observed isotope data and the carbon flow model. The problem requires analyses of oxygen & hydrogen isotopes of aquifers at various depths, surface water bodies and critical evaluation of recharge rate of these aquifers.

A program of studying temporal and spatial isotope geochemical variation in arsenic contaminated aquifers have recently been initiated. Preliminary data (of installed piezometers, surface water bodies etc.) indicate interesting observations regarding recharge sources of these aquifers. Coupled with elemental geochemistry it will hopefully be possible to distinguish between the two alternatives noted above regarding the driver for arsenic release. The talk will focus on present status of arsenic contamination in Bengal basin and the isotope hydrological approaches taken to resolve the problem.