

Comparison of arsenic concentrations in simultaneously-collected groundwater and aquifer particles from Bangladesh, India, Vietnam, and Nepal

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Abstract: One of the reasons the processes resulting in As release to groundwater in southern Asia remain poorly understood is the high degree of spatial variability of physical and chemical properties in shallow aquifers. In an attempt to overcome this difficulty, a simple device that collects groundwater and sediment as a slurry from precisely the same interval was developed in Bangladesh. Recently published results from Bangladesh and India relying on the needle-sampler are augmented here with new data from 37 intervals of grey aquifer material of likely Holocene age in Vietnam and Nepal. A total of 145 samples of filtered groundwater ranging in depth from 3 to 36 m that were analyzed for As (1-1000 $\mu\text{g/L}$), Fe (0.01-40 mg/L), Mn (0.2-4 mg/L) and S (0.04-14 mg/L) are compared. The P-extractable (0.01-36 mg/kg) and HCl-extractable As (0.04-36 mg/kg) content of the particulate phase was determined in the same suite of samples, in addition to Fe(II)/Fe ratios (0.2-1.0) in the acid-leachable fraction of the particulate phase. Needle-sampler data from Bangladesh indicated a relationship between dissolved As in groundwater and P-extractable As in the particulate phase that was interpreted as an indication of adsorptive equilibrium, under sufficiently reducing conditions, across 3 orders of magnitude in concentrations according to a distribution coefficient of 4 mL/g. The more recent observations from India, Vietnam and Nepal show groundwater As concentrations that are often an order of magnitude lower at a given level of P-extractable As compared to Bangladesh, even if only the subset of particularly reducing intervals characterized by leachable Fe(II)/Fe > 0.5 and dissolved Fe > 0.2 mg/L are considered. Without attempting to explain why As appears to be particularly mobile in reducing aquifers of Bangladesh compared to the other regions, the consequences of increasing the distribution coefficient for As between the particulate and dissolved phase to 40 mL/g for the flushing of shallow aquifers of their initial As content are explored. ?? 2008 Elsevier Ltd. All rights reserved.

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concentrations; Orders of magnitudes; Physical and chemical properties; Ranging; Reducing conditions; Shallow aquifers; Spatial variabilities; Vietnam; Groundwater resources; adsorption; aquifer; arsenic; comparative study; concentration (composition); groundwater; water depth; Asia; Bangladesh; Eurasia; India; Nepal; South Asia; Southeast Asia; Viet Nam

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