



# Utah Geological Association

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June UGA Luncheon Meeting

June 14, 2010

## ***The Fluvial Recharge Model for Arsenic Contamination of Groundwater in South Asia***

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The widespread contamination of groundwater by As in the floodplain of the Ganges River (Bangladesh, West Bengal, Terai region of Nepal) has been well-documented over the past decade. The dominant paradigm for elevated groundwater As in south Asia is the reductive-dissolution model, according to which, in the strongly reducing conditions of the thick sedimentary package of the Indo-Gangetic Plain, As is released from adsorption sites on Fe oxyhydroxides after dissolution of the Fe oxyhydroxides by micro-organisms. An alternative model is the fluvial recharge model, according to which, elevated groundwater As results from losing streams with elevated As, which is a consequence of rapid erosion. This study found that nine out of 27 wells in Kathmandu Valley, a tectonic valley in



the upper reaches of the Ganges River system, had As levels exceeding the Nepal Interim Standard, which is five times the WHO Standard. In Kathmandu Valley, surface water As was statistically indistinguishable from groundwater As, which supports the fluvial recharge model. There was no correlation between As and Fe and between As and Mn (indicative of reducing conditions), which is inconsistent with the reductive-dissolution model. A longitudinal profile down a major tributary of the Ganges River showed elevated dissolved As upstream of the Indo-Gangetic Plain and undetectable dissolved As within the Indo-Gangetic Plain. It is suggested that (1) the decrease in the advected velocity of the large As oxyanion allows it to adsorb onto suspended clay in the Indo-Gangetic Plain, and (2) the reductive-dissolution model might apply in the Indo-Gangetic Plain while the fluvial recharge model applies in the tectonic valleys upstream of the Indo-Gangetic Plain. The important implication of the fluvial recharge model is that it may not be possible to address the problem of As contamination of groundwater in the tectonic valleys without addressing the problem of deforestation.

*Steven Emerman with Nepali colleague Tara Bhattarai*

**Biography:** Steven Emerman has been Associate Professor in the Department of Earth Science at Utah Valley University since 2008. He has B.S. in Mathematics from Ohio State University, M.A. in Geophysics from Princeton University and Ph.D. in Geophysics from Cornell University. Dr. Emerman lived in southern Africa from 1986-89, where he taught at the University of Botswana, University of Zimbabwe and Eduardo Mondlane University (Mozambique), and served in the military underground of the African National Congress. He was a Fulbright Professor at Tribhuvan University in Nepal in 2003 and is a frequent visitor to Nepal. Dr. Emerman's main field areas are Nepal, Mexico and Mali with interests in (1) arsenic and heavy metals in surface water and groundwater, and (2) groundwater exploration and development in volcanic terrains.

\*\*\*\*\* **LUNCHEON LOCATION** \*\*\*\*\*

The June luncheon meeting will be at 12:00 noon, **Monday June 14th**, 2010, at the Utah Department of Natural Resources, 1594 West North Temple. *Enter on south side.*

**Please make your reservations (537-3300) no later than 4:00 p.m. on Thursday June 10th.**

Click to make reservations for the Luncheon Meeting by sending email to [reservations@utahgeology.org](mailto:reservations@utahgeology.org).

Lunch at 12:00 noon. Meeting begins at 12:30. Cost: \$10.00 w/ reservations; \$5.00 for students. Cash or Checks only please.