Report as of FY2007 for 2005ID51B: "A Reconnaissance Study of Arsenic Distribution in the Shallow Aquifer of the Treasure Valley: Year 2"

Publications

- Conference Proceedings:
  - Donato, M.M., K.W. Neely, B. Hoffman, S. Benner, 2005. Geochemical Processes And Mechanisms Of Arsenic Contamination In Southwestern Idaho GroundWater,in Proceedings Geological Society Of America Annual Meeting, October16-19, Salt Lake City.
- Other Publications:
  - Busbee, M., Benner, S., Hoffman, B., Cosgrove, D. 2006. Controls and mechanisms governing geogenic arsenic mobilization in the Treasure Valley shallow aquifer, Southwestern Idaho. Eos Trans.AGU 87(52),Fall Meeting.

Report Follows

A Reconnaissance Study of Arsenic Distribution in the Shallow Aquifer of the Treasure Valley

Project Summary

Perhaps the greatest emerging threat to water quality in Idaho is naturally occurring elevated arsenic in our groundwater-based drinking water supplies. In the most populated region of the state, the Treasure Valley, more than 40% of all tested drinking water wells exceed the new arsenic standard. The distribution of arsenic in the groundwaters of southwest Idaho is complex and not well understood and the mechanism of release has not been identified. This project is examining existing hydrologic and geochemical datasets to better understand arsenic release mechanisms in a research effort coordinated with state agencies.

Our work is ongoing but we are able to make a number of important observations. There are clear spatial trends in the distribution of arsenic in the Treasure Valley Aquifer with dissolved arsenic concentrations primarily elevated in two areas within the Treasure Valley; the first is in Canyon County and extends from Lake Lowell north and west and the second is located in Ada County north of the Boise River (Figure 1).

We have also conducted a comprehensive assessment of the well log data to reconstruct the previously observed redoximorphic boundary for the entire Treasure Valley as a continuation of work started by Donato et al. (2004). The most notable trend in this geologic dataset is the close correlation between the redoximorphic transition and both land surface and groundwater elevation, suggesting that the boundary may be a post depositional feature reflecting the historical water table across the Treasure Valley.

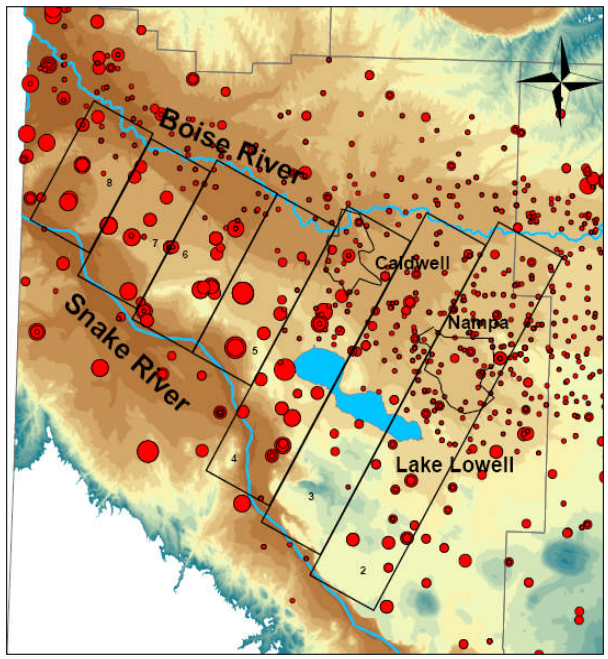

Figure 1. Treasure Valley arsenic concentrations. The size of the red circles increases with concentration.

Evaluation of existing chemical datasets in combination with grant collected samples, reveal a strong correlation between depth below the water table and arsenic concentrations with the majority of high arsenic wells sampling water from the upper 50 m of the aquifer (Figure 2). Furthermore, waters containing elevated arsenic concentrations are also oxic, not reducing, in nature. These observations suggest that elevated arsenic in the Treasure Valley is, at least in part, derived from sediments at or

near the water table and is supportive of a release mechanism *other than* reductive dissolution of iron oxides.

Sequential extractions conducted on near-surface sediments indicate the presence of significant amounts of easily mobilized arsenic. For example, the addition of deionized water to the sediments produces release of arsenic at concentrations of similar magnitude to those seen within the aquifer.

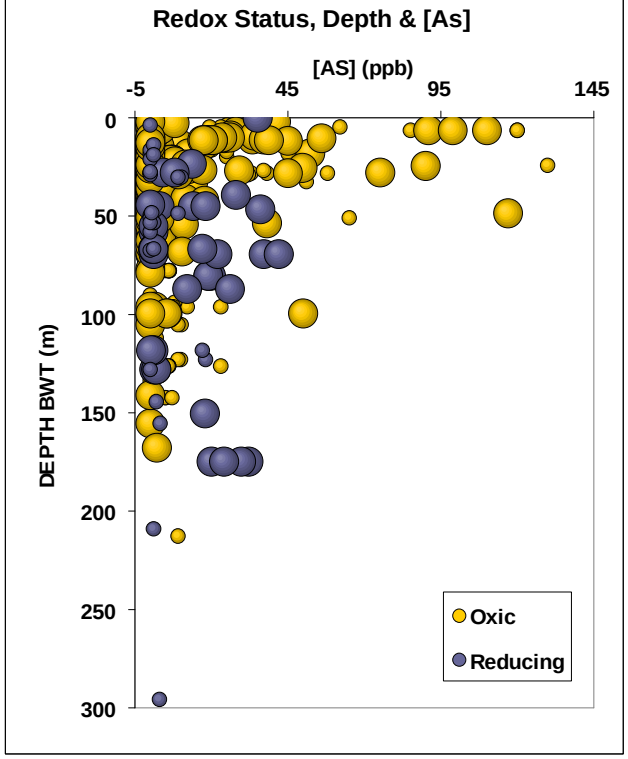

Figure 2. Arsenic concentration with depth below water table (BWT) and oxic vs. reducing conditions.

Collectively, these observations support a conceptual model of arsenic release whereby infiltrating irrigation waters are promoting flushing and/or desorption of arsenic from the unsaturated and near-water table sediments. Ongoing work is focusing on evaluating this conceptual model through further field and laboratory experiments and observations.

Publications Resulting from the Project

Donato, M. M., K. W. Neely, B. Hoffman, S. Benner, 2005.Geochemical Processes And Mechanisms Of Arsenic Contamination In Southwestern Idaho Ground Water, in Proceedings Geological Society Of America Annual Meeting, October 16-19, Salt Lake City.

Busbee, M., Benner, S., Hoffman, B., Cosgrove, D. 2006. Controls and mechanisms governing geogenic arsenic mobilization in the Treasure Valley shallow aquifer, Southwestern Idaho. *Eos Trans. AGU* 87(52), Fall Meeting.

Busbee, M., Benner, S., Hoffman, B., Cosgrove, D. 2006. Controls and Mechanisms Governing Geogenic Arsenic Mobilization in the Treasure Valley Shallow Aquifer, Southwestern Idaho. *Idaho Water Resources Research Symposium* Nov. 18-19, Boise Idaho.

Undergraduate and Graduate Student Researchers supported on the project

M.S. Graduate Student: Bernadette Hoffman
M.S. Graduate Student: Monty Busbee

Notable Achievements or Awards