Experimental and Numerical Modeling Analysis of Arsenic-Sulfide Precipitation in Groundwater Environments

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PURPOSE OF STUDY

Sulfate reduction may be a simple, effective method for removing arsenic from contaminated groundwater. In low temperature groundwater, arsenic would precipitate to form orpiment or mackinawite. However, much is unknown about arsenic-sulfide precipitation, such as how effective either mineral is at removing arsenic and how arsenic is incorporated into iron sulfide. The researchers will investigate how arsenic-sulfide precipitation works and whether mackinawite is more effective than orpiment.

STUDY UNDERWAY

- The researchers will perform four semi-continuous flow bioreactor experiments to test arsenic behavior in different systems containing iron- and sulfate-reducing microbial activity, sulfate-reducing activity, iron-reducing activity, and no microbial activity.
- Periodically, headspace gases will be analyzed and solid-phases samples for sequential extraction analysis and high-resolution transmission electron microscopy will be collected.
- The results of the analyses will be used to create a reactive-transport model of arsenic biogeochemistry.

BENEFITS

- This study will determine the role of iron and sulfate-reducing microorganisms in arsenic precipitation with sulfide.
- It will establish the effectiveness of arsenic removal by mackinawite and orpiment.

Matthew Kirk is a graduate student in Earth and Planetary Sciences at UNM and will complete his Ph.D. around May 2008. He grew up in Bartonville, Illinois, which is just outside of Peoria. Matthew has a B.S. in geology from Bradley University and an M.S. in geology from the University of Illinois.