GEOCHEMICAL CONTROL OF MICROBIAL ARSENITE OXIDATION[1]

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Abstract. My lab is studying microbial arsenite [As(III)] oxidation in an effort to better understand how and why microorganisms interact with this toxic metalloid. By doing so, we hope to generate information that will allow for better prediction of arsenic fate and transport in the environment. Much of our effort has focused on microbial populations in an acid-sulfate-chloride geothermal spring in Yellowstone National Park. We study this spring as an anologue to acid rock drainage environments, combining biogeochemical measurements, phylogenetic analysis, and pure culture experiments to model *in situ* As(III)-H_2S-microbe interactions. Significant As(III) oxidation occurs in this spring, but only in specific zones in the outflow channel where H_2S is depleted. As(III)-oxidizing *Hydrogenobaculum* and *Acidicaldus* isolates were used to directly demonstrate that H_2S inhibits As(III) oxidation. In addition, spring-side *ex situ* experiments found that the microorganisms in the spring mats appear enzymatically equipped to oxidize As(III), but are inhibited from doing so if appreciable dissolved H_2S is present ($\geq$ 5-10 M H_2S). Preliminary quantitaqtive PCR data also suggest that H_2S constrains the distribution of an As(III) chemolithoautotroph. H_2S appears to act as a reversible, uncompetitive enzymatic inhibitor; an example of a geochemical control of microbial metabolism.

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