

Microbial oxidation of arsenite in geothermal waters

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The release of arsenic from natural sources is recognized as a worldwide problem affecting subsurface drinking water aquifers in many regions. The predominant forms of arsenic in aqueous environments are arsenate and arsenite, with arsenite being more toxic and more mobile than arsenate. A variety of microorganisms have been found to oxidize arsenite or reduce arsenate, yet the biogeochemical cycling of arsenic is not well understood, particularly in geothermal environments where arsenite is often a common constituent of geothermal fluids. Although several recent studies described As(III) oxidation in acidic geothermal springs [1, 2], none have described As(III) oxidation in neutral geothermal springs (pH range 6.5-8). Microbial arsenite oxidation was investigated in geothermal springs within the Alvord Basin, OR, USA. Arsenic concentrations within the hot springs ranged in concentration from 1-6 mg/L [3]. The water/sediment interface of outflow channels from several springs with a source temperature of 80-90°C were analyzed for changes in temperature and As(III) concentrations as a function of distance from the source. Several springs exhibited a decrease in As(III) within a few meters of the source and one spring was further studied because As(III) concentrations decreased within the first 250cm. Samples were collected and used for culture enrichments of As(III) oxidizers and As(V) reducers. Several As(III) oxidizing microorganisms were obtained in pure culture and further characterized. Samples were also collected for analysis of microbial populations using molecular methods to discern the prevalence of the isolated As(III) oxidizers within the zones exhibiting decreased As(III) concentrations.

References

- [1] Langner, H.W. et al. 2001. Environ. Sci. Technol. 35:3302-3309.
- [2] Jackson, C.R. et al. 2001. Environ. Microbiol. 3(8):532-542.
- [3] Koski, A.K. and S.A. Wood .2004. In Wanty, R.B. and Seal, R.R. III, eds., Water-Rock Interaction. Proceedings of the 11th Intl. Symp. on Water- Rock Interaction WRI-11, v. 1. Saratoga Springs, NY, A.A. Balkema, Leiden, the Netherlands, p. 149-152

Relationship between sediment and lavers isotope ratios ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) and recent decline of biological productivity in Ariake Sea, Japan

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Possible cause for the decline of biological productivity in Ariake Sea was investigated using $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ of a 50-cm long sediment core and harvested lavers. The overall analytical precision was $\pm 0.1\text{‰}$ for $\delta^{13}\text{C}$ values and less than $\pm 0.2\text{‰}$ for $\delta^{15}\text{N}$ values. The core sample was categorized in three parts from the top toward the deep.

- I. 1986-2002, $\delta^{15}\text{N}$ of sediment showed increasing tendency (0.03‰ per year), which was accompanied by decrease in laver production.
- II. 1970-1985, $\delta^{15}\text{N}$ of sediment was relatively constant at $6.8 \pm 0.1\text{‰}$.
- III. 1950-1970, $\delta^{15}\text{N}$ fluctuated significantly.

The above vertical change could be related to decadal change in number of dam construction that might interrupt terrestrial nitrogen input to the Ariake Sea. Nitrogen depression tendency was also indicated by temporary change in $\delta^{15}\text{N}$ of edible lavers (*nori*) during *in situ* cultivation period.

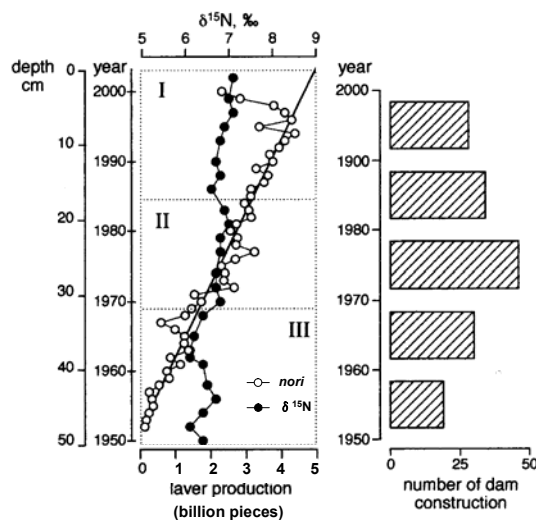


Figure 1 $\delta^{15}\text{N}$ of dated core sediment and annual *nori* production in Ariake Sea, and number of dam construction around Kyushu Island.