Photostable β-As_4S_4 produced at low temperature in culture by a novel bacterial isolate from the Alvord Hydrothermal Basin, Oregon

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The Alvord Basin in southeast Oregon contains numerous hydrothermal features never before characterized for their microbiology. Of these, Yellow Pot (61 ºC, pH 7.1, [As] 1-4 mg L^{-1}) was selected for intensive study because of an unusual flocculent precipitate, outgassing and mixing, a thick sediment layer, and occasional well-developed microbial mats. One goal was to identify microorganisms involved in arsenic cycling. Culturing techniques employed hydrothermal waters amended with yeast extract (0.05%) and 2 mM cysteine acting as a reductant. Inoculation and initial incubation was performed at the site. Several new strains of thermophilic bacteria have been discovered using this approach, including a novel *Caloramator*-like bacterium (designated YeAs-1) capable of reducing arsenic in culture.

As-sulfide precipitates form rapidly at 60 ºC once As-containing growth medium is inoculated with YeAs-1. The precipitates appear as a bright yellow flocculant material. FT-Raman spectra of precipitates formed in cultures not exposed to light and prosessed under 725 nm illumination indicate they are β-As_4S_4, typically only stable at temperatures above 260 ºC. Realgar and its β-polymorph are photosensitive, transforming to pararealgar upon exposure to sunlight or artificial light. Wavelengths <550 nm induce rapid transformation (Muniz-Miranda *et al.*, 1996). Following 24 h exposure to ultra violet light, very little phototransformation of the YeAs-1-formed β-As_4S_4 was observed spectroscopically. Difference spectra indicat formation of pararealgar, but even after 14 days exposure to sunlight, approximately equal mixture of both the β-phase and pararealgar is observed. Thus, the precipitates formed by YeAs-1 are conferred atypical photo- and thermal stability by some, as yet, uninvestigated mechanism.

Reference

Muniz-Miranda M., Sbrana G., Bonazzi P., Menchetti S. and Pratesi G. (1996) *Spectrochim. Acta A* **52**, 1391-1401

Stable carbon isotope fractionation during anaerobic microbial reduction of metals

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Experiments have been conducted using the Fe (III) reducing bacterium *Shewanella Putrefaciens (200R),* to understand stable carbon isotope fractionation during dissimilatory Fe (III) reduction. Ferric citrate and sodium lactate ($\delta^{13}C$, -25‰) were used as electron acceptor and donor respectively. Sodium bicarbonate ($\delta^{13}C$, -3‰) or potassium phosphate was used as buffering agent. δ^{13} C of the head gas suggested that bicarbonate not only enhanced iron reduction but also was a source of carbon in the reduction process (Figure 1). During the course of the experiments, consistent production of DIC in all the control samples was observed (Figure 2), very likely produced abiotically. The $\delta^{13}C$ of this DIC had a range of -30 to -38‰. These are the initial results of an ongoing research involving different metals, microbial species, electron donors and acceptors.

Figure 1: $\delta^{13}C$ of head gas

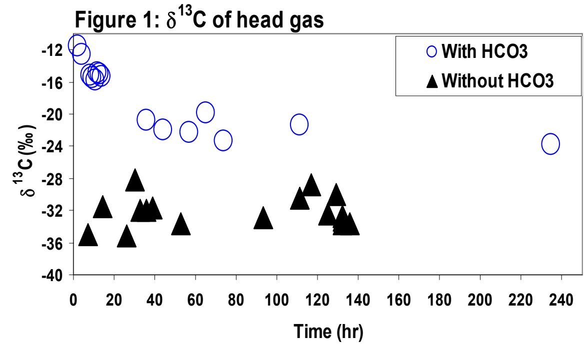

Figure 2: DIC from control samples