

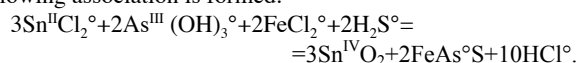
## REE behavior during the formation of Sn-W deposits

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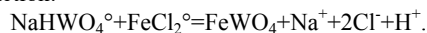
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REE behaviour was considered for two Sn-W deposits, Svetloe and Iul'tin (Chukotka, Russia). Both deposits take place within the Iul'tin ore district. The isotopic composition of oxygen and hydrogen allowed to conclude that meteoric waters were probable source of hydrothermal fluids in these deposits [1]. REE content in fluorites may be used as an indicator to determine the nature and the evolution of fluids [2]. Regularities of REE spectra changes indicate the presence of two generations of fluorite. REE concentrations in the hydrothermal solutions in equilibrium with fluorites were obtained by conversion of two generations of fluorite into fluids using the distribution coefficients of mineral / fluid [2]. For the first fluorite generation the fluid is magmatic one, for the second fluorite generation the fluid is exogenous. Mixing these two fluids leads to the deposition of ore. The deposition of cassiterite and arsenopyrite occurs when acidic magmatic fluid carrying the ore elements mixed with alkaline meteoric water. As a result pH increases and the following association is formed:



The wolframite deposition occurs under the following reaction:



The composition of wolframite changes in the vertical section of Iul'tin deposit from 47% to 64% mol% FeWO<sub>4</sub>. For Svetloe deposit it is shown that wolframite is depleted of iron (from 39 to 5 mol% FeWO<sub>4</sub>) under the joint deposition of wolframite and arsenopyrite.

[1] Sushchevskaya T. *et al.* (2000) *Geochem. Int.* **38**, Suppl. 2, P. 123. [2] Raimbault L. (1985) *Bull. Mineral* **108**, P.737.

## Methylotrophy in Yellowstone National Park hot springs

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Autotrophic microorganisms in hot springs, like their mesophilic counterparts in other aquatic ecosystems, likely play a major role in supplying reduced organic C to these systems [1]. However, hot springs are surface expressions of geologic activity that releases compounds that may serve equally well as sources of C, such methane (CH<sub>4</sub>). Indeed, CH<sub>4</sub> assimilation pathways may be less energetically expensive in terms of ATP and reductant than the Calvin Cycle or alternative pathways for CO<sub>2</sub> fixation [2]. Thermodynamic calculations also show that microbes capable of aerobic CH<sub>4</sub> oxidation can thrive in hydrothermal ecosystems due to the amount of energy released from its catabolism [3]. Several recent studies have isolated CH<sub>4</sub>-oxidizers from geothermal environments [4].

The goal of this study was to investigate whether methylotrophs (utilizers of reduced C<sub>1</sub> compounds) were present and active in various thermal features in Yellowstone National Park. To accomplish this objective, we incubated hot spring sediments and microbial mats in microcosms amended with stable-isotope labeled and unlabeled methanol (CH<sub>3</sub>OH) overnight at *in situ* temperatures. We found evidence for methylotrophy in the sediments of slightly acidic hot springs (pH 6.0) based on <sup>13</sup>C enrichment of CO<sub>2</sub> and bulk sediment. To complement our isotopic data, we extracted DNA from hot spring sediments and retrieved functional genes encoding key enzymes in aerobic CH<sub>4</sub> and CH<sub>3</sub>OH oxidation. Sequencing of these genes suggests that a complex methylotrophic community may be present in the hot spring, as clones grouped with gammaproteobacterial obligate methanotrophs and betaproteobacterial obligate methylotrophs.

[1] Azam & Malfatti (2007) *Nature* **5**, 782–791. [2] Berg (2011) *Appl. Environ. Microbiol.* **77**, 1925–1936. [3] Shock *et al.* (2010) *Geochim. Cosmochim. Ac.* **17**, 4005–4043. [4] Trotsenko *et al.* (2009) *Microbiol.* **78**, 387–401.