Manganese precipitation and the removal of zinc from No Cash Creek, Keno Hills, Yukon, Canada

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No Cash Creek is a natural stream that receives water from the 500-level adit of the historic No Cash Mine (1948 to 1988). The adit discharge water and stream sediments contain elevated concentrations of Mn, Fe and Zn which decrease rapidly downstream in cascading (aerated) and additionally in a quiescent peat bog environment.

Optical microscopy showed that there were coatings around lithic grains and plant fragments in stream sediments within 600 m of the adit. EMP BSE images and element mapping of the lithic coatings show concentric bands rich in Mn and Zn (Fig. 1).

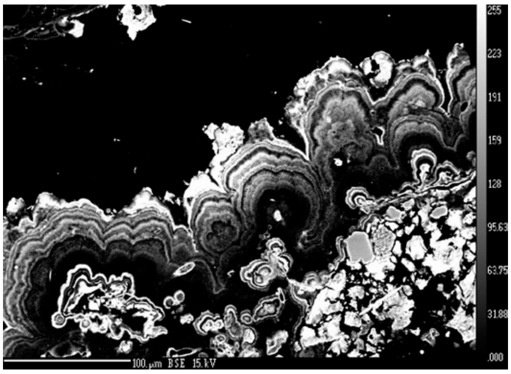

Figure 1: Mn-rich coating on a lithic grain

Initial data show that the average concentration of Mn and Zn varies within one sample with type of mineral substrate from 23 wt. % Mn and 6 wt. % Zn around pyrite to 9 wt. % Mn and 4 wt. % Zn around sphalerite. Mafic lithic fragments also have higher Mn and Zn than silicic grains. There is also considerable variation across one coating (Fig.1) from 30 to 12 wt. % Mn and 8 to 4 wt. % Zn although the Mn:Zn ratio remained constant at 3.1 (st. dev. 0.5).

Coatings around wood contain predominantly Fe with <30 wt. % Fe and <3 wt. % Zn. There is no apparent relationship between the concentration of Fe and Zn.

In conclusion, the major process removing Zn from the water of No Cash Creek is coprecipitation with or absorption on Mn-rich coatings around lithic grains.

Hotspot: The Snake River geothermal drilling project

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The Snake River Plain (Idaho, USA) represents the track of deep-seated mantle hotspot that has thinned the lithosphere and fueled the intrusion of up to 10 km of hot basaltic magma into the lower and middle crust. The heat from these intrusions, and from rhyolites formed by the basalt, drives the high heat flow and high geothermal gradients observed in deep drill holes from throughout the Snake River Plain [1-3]. Heat flow in the SRP tends to be high along the margins of the plain (80-100 mW/m^2-s) and low in shallow drill holes along the axis of the plain (20-30 mW/m^2-s). However, deep drill holes (>1 km) along the axias of the plain are characterized by high heat flows and high geothermal gradients below about 500 m depth [2]. This discrepancy is caused by the Snake River aquifer – a massive aquifer system that extends under the plain. Thermal gradients through the aquifer are static until the base of the aquifer is reached, then rise quickly at deeper levels in the crust. Below the aquifer along the axis of the plain, heat flow values are comparable to heat flow values along the margins of the plain or higher (75-110 mW/m^2-s [2]). Bottom hole temperatures for wells along the margins of the plain near Twin Falls are typically around 30-60°C at 400-600 m depth [4] and as high as 120°C at 2800 m depth in the axial region of the plain [2].

The Snake River Geothermal Drilling Project is jointly funded by the US Department of Energy (DOE) and by International Continental Drilling Program (ICDP). Our goal is to evaluate geothermal potential in three settings: (1) the high sub-aquifer geothermal gradient associated with the intrusion of mafic magmas and the release of crustal fluids from the associated wall rocks, (2) the valley-margin settings where surface heat flow may be driven by the up-flow of hot fluids along buried caldera ring-fault complexes, and (3) in the western SRP graben. Drilling is currently in progress.

[1] Blackwell (1978) *Geol Soc Am Memoir* **152**. [2] Blackwell (1989) *Tectonophysics* **164**, 323–34. [3] Lewis & Young (1989) USGS *Water-Resources Investigations Report* **88**–4152. [4] Baker & Castelin (1990) Idaho Dept. Water Resources, *Water Information Bulletin* No. **30**, Part 16.