Tungsten and molybdenum in hydrothermal fluids of the Izu-Bonin Arc and the Okinawa Trough

Y. SOHRIN[1], K. KISHIDA[1], K. OKAMURA[1] AND J. ISHIBASHI[2]

[1] Institute for Chemical Research, Kyoto University, Uji, Kyoto 611-0011, Japan (sohrin@scl.kyoto-u.ac.jp)
[2] Department of Earth and Planetary Sciences, Faculty of Science, Kyushu University, Hakozaki, Fukuoka 812-8581, Japan (ishi@geo.kyushu-u.ac.jp)

Deep-sea hydrothermal systems are believed to be an important source or removal mechanism of elements in the ocean. However, most of trace elements in hydrothermal fluids have not been determined yet due to difficulties with sampling and analysis. Here we report that we succeeded in determining W in the hydrothermal fluids for the first time.

Sample solutions were collected from the Suiyo Seamount (28°34'N, 140°39'E) in the Izu-Bonin Arc and the Hatoma Knoll (24°51'N, 123°50'E) and the No. 4 Yonaguni Knoll (24°50'N, 122°42'E) in the Okinawa Trough. These hydrothermal systems are related to arc-backarc magmatism. The samples were filtered with 0.2 μm Nuclepore filters and acidified to pH 1-2 with hydrochloric acid for storage. Tungsten was extracted from the samples using a column of 8-hydroxyquinoline immobilized on fluorinated metal alkoxide glass (MAF-8HQ) and determined by ICP-MS (Sohrin et al., 1998).

The concentrations of W increased linearly with a decrease in those of Mg. Endmember concentrations of W in high-temperature fluids (310-240°C) were 14.7 nmol/kg at the Suiyo Seamount and 124 nmol/kg at the Hatoma Knoll. The concentration of W at the Yonaguni Knoll was significantly higher than at the Hatoma Knoll. Such a difference was not observed for other constituents. The concentrations of W in the hydrothermal fluids were 3-4 orders of magnitude above an ambient level in seawater (Sohrin et al., 1999). These results suggest that hydrothermal systems are critical sources of W to the ocean. In contrast, Mo, which belongs to the same Group 6 as W, decreased in the hydrothermal solutions to one hundredth of the concentration in seawater. The decrease seems to be caused by precipitation of Mo-rich sulfides.

References

Sohrin Y. et al., (1998), *Anal. Chim. Acta* **363**, 11-19.
Sohrin Y., Matsui M. and Nakayama E., (1999), *Geochim. Cosmochim. Acta* **63**, 3457-3466.

The GTS-HPF experiment: reaction-induced permeability changes

J. M. SOLER[1] AND U. K. MÄDER[2]

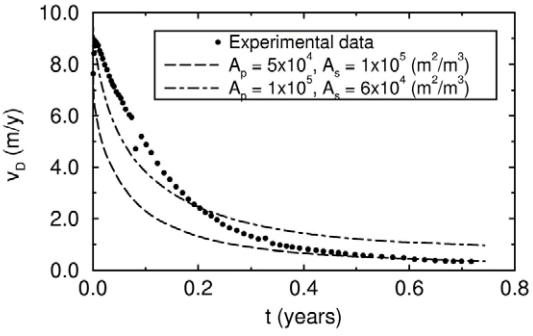
[1] Institute of Earth Sciences "Jaume Almera" (CSIC), Barcelona, Spain (jsoler@ija.csic.es)
[2] University of Bern, Switzerland (urs@mpi.unibe.ch)

The HPF experiment at the Grimsel Test Site

One of the objectives of the GTS-HPF experiment (Hyperalkaline Plume in Fractured Rock) is to study the alteration of the Grimsel granodiorite due to the circulation of high-pH solutions derived from the degradation of cement. A K-Na-Ca-rich high-pH solution is currently being injected into a fracture. An extraction borehole is located about one meter away from the injection borehole. A small-scale laboratory version of the experiment (1D column experiment) was performed at the University of Bern.

The results of one- and two-dimensional scoping calculations suggested that the precipitation of secondary minerals (CSH and CASH phases, zeolites) would cause the progressive sealing of the fracture and reduction of fluid flow. These phenomena are currently being observed in the in situ experiment at Grimsel. Also, the results of the small-scale laboratory experiment (constant hydraulic gradient) show a significant reduction of permeability with time (Fig. 1). However, the amount of mineralogical alteration is only minor. Reactive transport simulations have been performed using a modified version of GIMRT (Steefel and Yabusaki, 1996). Fluid flow is updated during the course of the simulations according to Kozeny´s equation. A reasonable match between experimental data and model calculations (Fig. 1) is only obtained if mineral surface areas about two orders of magnitude smaller than those measured by BET (fault gouge) are used. The reduction of permeability is controlled by the newly-created surface area (secondary minerals), since changes in porosity are only minor.

Figure 1: Darcy velocity vs. time. Experimental data (dots) and results from two model calculations (lines). Surface areas for primary (A_p) and secondary minerals (A_s) are also shown.



References

Steefel C.I. and Yabusaki S.B. (1996) *PNL*-11166, Pacific Northwest Laboratory, Richland, WA, USA.