Precise Mo isotopic analysis on Pacific and Antarctic seawater

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In Mo isotopic geochemistry, Mo isotopic ratio data for the seawater is very important as a standard reference value. However, mainly due to analytical difficulty in precise isotopic ratio measurement, only few data have been reported for the seawater samples [1, 2]. Moreover, the reported isotopic ratio data varied significantly, and probably was possessed with low reliability. To over come this, we have developed a new preconcentration technique using a chelating resin TSK-8HQ column for the precise isotopic ratio measurement with a MC-ICP-MS (Nu Plasma 500). The mass-discrimination effect was externally corrected by an exponential law using the $^{88}Sr/^{86}Sr$ ratio. In order to evaluate the small changes in the resulting Mo isotopic ratio data, the sample-standard bracketing technique was employed. Combination of the new chemical preconcentration technique and the correction techniques enabled us to obtain accurate and precise Mo isotopic ratio data for the seawater.

We applied the proposed method to seawater samples collected from 5 sampling stations in the Pacific Ocean that ranged from subarctic to subtropical regions. They included samples of four water masses: the Pacific Deep Water, North Pacific Intermediate Water, Western North Pacific Central Water and Pacific Subarctic Water. The salinity normalized (S = 35) mean Mo concentration (n = 108, excluding 5 outlier) was 10.4 ± 0.5 ppb (2 s.d.). The mean $\delta^{98/95}Mo$ (n = 107, excluding 2 outlier) was 2.47 ± 0.09 (2 s.d.), demonstrating that the Mo concentrations and isotopic compositions were uniform among different water masses, depths and sampling stations. Although the observation of Mo isotopic fractionation through active biological nitrogen fixation could be expected at subtropical area, we did not find significant change in Mo concentrations and isotopic compositions in seawater by the biological activity. We are going to analyze seawater samples from the Antarctic Ocean, and report the Mo isotopic data obtained as well.

[1] Barling *et al.* (2001) *EPSL* **193**, 447-457. [2] Siebert *et al.* (2003) *EPSL* **211**, 159-171.

Serpentinized olivine-rich gabbros near the Kairei Hydrothermal Field, Central Indian Ridge: A key to understanding the unique chemistry of the vent fluid

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The Kairei Hydrothermal Field (KHF) on the first segment of the Central Indian Ridge is known to be characterized by an unusually high concentration of H_2 in the vent fluids [1]. Recently, much attention has been payed to the KHF, because the H_2-rich hydrothermal fluids are known to host a hydrogen-based hyperthermophilic subsurface lithoautotrophic microbial ecosystem, which is considered to be a likely modern proxy for the early Earth ecosystems prior to photosynthesis [2]. Despite the increasing interest in the fluid chemistry and associated biota of the KHF, however, the cause of the unique chemistry of the hydrothermal fluids is still unclear [3].

Here, we report the discovery of serpentinized olivine-rich gabbros from a small ocean core complexe (OCC) at 15 km east of the KHF. Dives with the manned submersible *Shinkai 6500* recovered plagioclase-dunite, troctolite, and olivine gabbro samples from the OCC. Although these rocks are not typical mantle peridotite which is well known as a host of H_2-rich hydrothermal vent fluids, all the samples have been subjected to serpentinization to various extents. Microscopic observation revealed that the olivines in the samples were replaced by serpentine + magnetite, indicating the generation of H_2 by the serpentinization reaction. The results of the geological and petrological investigations suggest that the hydrothermal serpentinization of the olivine-rich gabbros is responsible for the unusually high concentration of H_2 in the Kairei hydrothermal fluids driving the occurrence of the unique microbial ecosystem.

[1] Van Dover *et al.* (2001). [2] Takai *et al.* (2006). [3] Gallant & Von Damm (2006).