

Hf-Nd isotope decoupling in Early Precambrian seawater

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Banded Iron Formations (BIFs) are Precambrian marine chemical sediments that are archives of the trace element and isotope compositions of ancient seawater. Here we report Hf and Nd isotope data of pure chert and magnetite layers from the ca. 2.7 Ga Temagami BIF (Superior Province, Canada), determined by isotope dilution techniques and MC-ICPMS. Sample aliquots were also analysed for trace element systematics by quadrupole ICP-MS.

Shale-normalised REY patterns of the BIFs are similar to those of modern seawater and other pure Archean seawater precipitates. Enrichment of HREE compared to LREE, positive La and Gd anomalies, and super-chondritic Y/Ho ratios indicate a purely seawater-derived REY composition. Lacking Ce anomalies and strong positive Eu anomalies reveal anoxic conditions (with respect to Ce⁴⁺/Ce³⁺) and REY input into seawater via high-T hydrothermal fluids. Non-chondritic Zr/Hf ratios indicate minor influence of detrital aluminosilicates and a seawater origin of Hf. Samarium-Nd and Lu-Hf isochron ages are within error of the published depositional age of the ~2.7 Ga Temagami IF. Initial $\epsilon\text{Nd}_{2.7\text{Ga}}$ values range from +0.2 to +3.0, but six of the nine samples cluster around +1. In contrast, initial $\epsilon\text{Hf}_{2.7\text{Ga}}$ values point towards heterogeneous, strongly radiogenic compositions (+6.7 to +24.1). In the $\epsilon\text{Hf}-\epsilon\text{Nd}$ diagram, the Temagami BIFs lie well above the 'terrestrial array' and exhibit significantly different $\epsilon\text{Hf}-\epsilon\text{Nd}$ values than Temagami shale and hinterland tholeiites and adakites which tapped the Abitibi mantle [1]. Therefore, Temagami seawater Hf was even more radiogenic than ambient mantle, suggesting that selective weathering processes (including the zircon effect) already operated in the Neoproterozoic, leading to the decoupling of the Hf-Nd isotope systematics, that is well known from modern seawater [2] and Cenozoic FeMn precipitates [3]. This suggests that by 2.7 Ga ago, a significant fraction of evolved continental crust was exposed above sealevel and subject to terrestrial weathering.

[1] Polat & Münker (2004) *Chem. Geol.* **213**, 403-429. [2] Stichel *et al.* (2012) *GCA* **94**, 22-37. [3] Albarède *et al.* (1998) *Geophys. Res. Lett.* **25**, 3895-3898.

Zn isotope fractionation in pristine larch forest developed on permafrost-dominated soils in Central Siberia

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Towards a better understanding of Zn transport and storage in the tree-soil-mineral-river system, stable Zn isotope fractionation was studied in main biogeochemical compartments of a pristine larch forest of Central Siberia developed over continuous permafrost basaltic rock lithology.

It appears that Zn isotopes are not fractionated within the soils compared to the basaltic rocks. By contrast Zn isotope fractionation is observed between plants (larch) and soil and within the plant itself. Among the different habitats of the region receiving different amount of solar radiation and nutrients (South- and North-facing slope, peat bog) we observe systematic habitat-specific differences of Zn isotopic composition between whole plant and soil. As there is no apparently different physiological behavior of Zn within the same species within the different habitats we suggest the key role of Zn speciation in the soil solution to explain these differences. We observe a change of Zn isotopic composition in the larch needles within the course of the growing period suggesting a change in the nutrients source. Although the isotopic measurements do not allow distinguishing between mineral and organic source of Zn in natural waters, it can be concluded that, within the climate evolution and the increase of the thickness of thaw layer in peat bog environments, the global value of $\delta^{66}\text{Zn}$ in Siberian larch forest will increase.