Tracing the thermal state of the Archean mantle: Insights from coupled Eu-$\varepsilon Nd_{(t)}$ patterns of BIFs

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Banded Iron Formations (BIFs) are marine chemical sediments, and their occurrence is confined to the Precambrian. Pure BIFs, i.e., chemical sediments devoid of syn- and post-depositional alterations, may serve as reliable archives for ancient seawater. Here we present a compilation of own and published rare earth and yttrium (REY) as well as Sm-Nd isotope data of *pure* Precambrian marine chemical sediments, reflecting the compositional changes of ancient seawater through Early Earth´s history.

Chondrite-normalised Eu/Eu* ratios (subscript CN) of *pure* Precambrian marine chemical sediments closely follow their $\varepsilon Nd_{(t)}$ values and both reveal positive peaks, overlapping with abundant zircon age spectra published by [1]. Large positive Eu_{CN} anomalies and mantle-like $\varepsilon Nd_{(t)}$ values are observed in the *Eoarchean*, they decrease during the *Mesoarchean* until ~2.8 Ga, and display a conspicuous peak at ~2.7 Ga and decrease again until ~2.5 Ga. The combination of these two proxies suggests enhanced REY contributions to Archean seawater from the Earth´s mantle (affecting the $\varepsilon Nd_{(t)}$ values) via high-temperature (>250 °C), black smoker-like hydrothermal fluids (increasing the Eu_{CN}/Eu^*_{CN} ratios) that had mobilized REY from seafloor basalts. These results indicate a relationship between the thermal state of the Early mantle, magmatic activity and BIF deposition via high-temperature hydrothermal emanations into Archean seawater. Using geochemical tools, our study corroborates the work of [2], proposing a link between BIF deposition and mantle plume events. Coupled $\varepsilon Nd_{(t)}$ - Eu_{CN}/Eu^*_{CN} systematics of *pure* BIFs, therefore, provide a reliable tool to track the thermal state of the Early Earth´s mantle and identify episodes of intense magmatic activity, triggering high-temperature, hydrothermal venting to the ancient oceans.

[1] Condie & Aster (2010) *Precamb. Res.* **180**, 227-236.
[2] Isley & Abbott (1999) *J. Geophys. Res.* **104**, 15461-15477.