Seawater chemistry in the aftermath of the extrusion of the Early Paleoproterozoic Ongeluk LIP, Transvaal Supergroup, South Africa

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The GHEX-97 drillcore intersecting the top of the Paleoproterozoic Ongeluk Formation and the overlying marine chemical sediments of the Mn oxide-rich Hotazel Formation, Transvaal Supergroup, South Africa, is a unique archive of geochemical changes of seawater chemistry between the extrusion of the Ongeluk LIP and the first large-scale Mn oxide precipitation event in Earth history.

Shale-normalized REY patterns of all pure GHEX chemical sediments show typical seawater characteristics: depletion of LREY relative to HREY is accompanied by positive La_{SN} anomalies and super-chondritic Y/Ho ratios. The redox-sensitive REY (Ce and Eu), however, reveal a remarkable chemical evolution of seawater chemistry. While large positive Eu_{SN} anomalies are ubiquitous in the chert, jasper and BIF layers deposited immediately after the emplacement of the Ongeluk lava, they disappear within a 10 mm section of the core, well-below the lowermost Mn-rich sediment layer of the Hotazel Formation. This indicates that the seawater REY budget was subject to a rather quick transition from being dominated by a high-temperature (>250°C) hydrothermal component carrying a positive Eu_{SN} anomaly to being controlled by low-temperature-derived dissolved REY. Considering that the latter closely resembles the REY_{SN} distribution in the Rooinekke chemical sediments [1] deposited before the Ongeluk lava, the high-temperature hydrothermal activity resulting in positive Eu_{SN} anomalies appears to be confined to this volcanic episode. The depositional environment remained anoxic during this transition, as suggested by the lack of any Ce_{SN} anomaly. However, the lower Mn oxide horizon (Mn-1) of the Hotazel Formation is the first to show negative Ce_{SN} anomalies, indicating oxic conditions in seawater (resulting in Mn oxide deposition) as well as on the landmass that was the source area of the REY (resulting in negative Ce_{SN} anomalies in seawater).

[1] Schier et al. (2018). *Precam. Res.* 315, 92-102.