Ocean-atmosphere redox conditions recorded by the 1.88 Ga Sokoman IF

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A temporary resurgence of massive iron formation (IF) deposition at ca. 1.88 Ga is an important junction in Earth's post-Great Oxidation Event history [1,2]. Occurrences of IF deposited at this time exhibit both small negative to large positive Ce anomalies, sub- and super-chondritic Y/Ho ratios, and variably sloped shale-normalized REE+Y patterns. Collectively, these features have been interpreted as evidence for Fe/Mn-(oxyhydr)oxide-driven element cycling across a redox-stratified ocean [3]. However, few studies of ca. 1.88 Ga IF have integrated REE+Y data with a full suite of other redox-sensitive elements (i.e., Cr, Mo, U, V, W) to further constrain the ocean-atmosphere redox architecture.

Here we present bulk-rock chemostratigraphic variations in REE+Y and redox-sensitive elements in the ca. 1.88 Ga Sokoman IF, Labrador Trough, Canada from two localities: Sheps Lake and Lac Ritchie. Similar to other coeval granular IF occurrences, the Sokoman IF shows: (1) negligible overprinting of REE+Y chemistry by insoluble element-rich detrital particles (ultra-low Al, Ti, Nb, Zr, etc.); (2) pervasively terrestrial over hydrothermal sources of soluble REE+Y (minimal Eu anomalies and positive La-Gd-Y anomalies); and (3) support for Fe/Mn-redox-stratified basin conditions with Fe-Mn-(oxyhydr)oxide shuttles resulting in both positive and negative Ce anomalies. Enrichment factors (EFs) of Cr, Mo, U, V, and W are generally low, consistent with their muted delivery under a low-O_2 post-GOE atmosphere [4]. Nevertheless, there is variable coupling between EFs that appears to signify either shifting redox conditions, variable proxy sensitivity under low-O_2 conditions, or minor element-specific detrital contamination. These results will be interpreted in the context of available data from other contemporaneous IF and deep-water equivalents to establish a more global perspective on ocean-atmosphere redox at ca. 1.88 Ga.

[1] Bekker *et al.* (2010) *Econ. Geol.* **105**, 467-508; [2] Konhauser *et al.* (2017) *Earth-Sci Rev.* **172**:140-177; [3] Planavsky *et al*. (2010) *GCA* **74**, 6387-6405; [4] Partin *et al.* (2013) *Chem. Geol.* **362**: 82-90