Lithogeochemical and sulfur isotope indicators of environment of formation and genesis of the Moss hyper-enriched black shale showing, Yukon

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The Moss Ni-Mo-Zn-Pt-Pd-Re-Au hyper-enriched black shale (HEBS) showing is located the western Richardson Mountains and is one of several in northern Yukon. The mineralization consists of a thin (1-3 cm), stratiform, semi-massive sulfide horizon that occurs at the stratigraphic contact between the Road River Group and Canol Formation. We evaluate the ambient paleoenvironmental conditions using several robust lithogeochemical proxies. Prior to HEBS formation, clastic sedimentation predominated, whereas chemical sedimentation prevailed during and immediately after HEBS formation. Rare earth element-Y data indicate that the water column was (weakly) oxygenated ($Ce/Ce^*_{SN} < 1$), that there was no hydrothermal venting ($Eu/Eu^*_{SN} \approx 1$), and that there was a significant seawater influence on the sedimentary environment ($Y/Ho > 28$) for the entire deposition interval. High (>10) authigenic Mo/U ratios indicate that seawater-sourced ferromanganese oxyhydroxide particles precipitated in the water column and were shuttled to (and sedimented on) the seafloor. The particles dissolved within the reducing, organic matter-rich sediments and precipitated as sulfides. Negative $\delta^{34}S$ values (-19.3 to -23‰) of the HEBS sulfides indicate that the sulfur originated by microbial reduction of seawater sulfate.

Collectively, these data signify a basinal environment that experienced varying degrees of restriction and stratification, but fresh (i.e., unfractionated) marine waters delivered metals, metalloids, and sulfur [1]. Such a geological setting is considered critical for the formation and preservation of HEBS mineralization.

[1] Gadd et al. 2019, Geological Survey of Canada Open File 8549, p. 163-178.