Chromium isotope constraints on the late Paleoproterozoic marine redox: Evidence from ~1.64 Ga carbonates of the greater McArthur Basin, Australia

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Understanding temporal changes in marine redox and their links to past atmospheric oxygen levels and biological evolution during the Proterozoic times is one of the primary research interests in earth system evolution studies and palaeobiology. The sedimentary record of marine carbonates and shales deposited in the greater McArthur Basin in Northern Territory (NT), Australia, provide such unique archives of Proterozoic seawater chemistry and coeval changes in the Earth's surface environments [1].

Here we present high-resolution Cr isotope records ($\delta^{53/52}$Cr) of the late Paleoproterozic carbonates (~1.64 Ga) sampled from two remote and correlative drill cores (Manbulloo and LV09001), which are about ~450 km apart, thus representing basin-wide records of paleoenviromental and redox conditions in the greater McArthur Basin. Acquired $\delta^{53/52}$Cr trends are complemented by independent paleo-redox proxy data, such as cerium anomalies (Ce/Ce*) and Zn/Fe ratios, and also traditional isotope tracers including $^{87}Sr/^{86}Sr$ and $\delta^{13}C$ proxies, which both showed correlated isotope trends between the studied cores (paleo-sites) with values that are consistent with predominantly marine settings.

Importantly, $\delta^{53/52}$Cr and Cr concetration data from the Manbulloo core also revealed a systematic and statistically significant anti-correlation between these two variables, which we interpret as evidence for a partial-reduction of oxidised Cr(VI) species to Cr(III) in local seawater, causing the observed coupling between Cr isotopes and concentrations recorded in carbonate archives. This paleo-redox interpretation is also supported by HyLogger spectral data [2] that show an increasing abundance of hematite, and thus oxidised Fe(III), associated with positively fractionated $\delta^{53/52}$Cr. We will discuss plausible processes and mechanisms responsible for this late Paleoproterozoic oxidation event.

[1] Cox *et al.* 2019, *Nature Scientific Reports* 9 (No. 5200)
[2] Smith B. 2019, HyLogger Data Package 0074, NTGS