Biogeochemical cycling of chromium and chromium isotopes in the sub-tropical North Atlantic Ocean

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Due to the redox-sensitivity of chromium (Cr) isotopes and the potential of marine sediments to record past variations in the Cr isotopic composition of seawater (and hence a record of seawater oxygenation), it is vital to understand the modern-day distribution of Cr and its isotopes in seawater. However, the processes that regulate the behaviour of Cr isotopes in the modern ocean are not well understood, and the effects of biological activity, benthic processes and hydrothermal inputs on Cr distributions, in addition to levels of dissolved oxygen, need to be quantified.

Here we present results of the analysis of dissolved Cr concentrations and dissolved Cr isotope ($\delta^{53}Cr$) distributions in seawater samples collected from a transect across the sub-tropical North Atlantic (GEOTRACES $GA_{pr}08$ cruise). Concentrations of dissolved Cr ranged between 1.84 and 2.63 nM, and $\delta^{53}Cr$ values varied from 1.06 to 1.42‰. Subsurface waters were depleted in Cr, and enriched in heavy Cr isotopes, relative to deeper waters. Lowest Cr concentrations and highest $\delta^{53}Cr$ values coincided with lowest dissolved iron concentrations [1]. Our data suggest that removal of Cr in the euphotic zone is primarily controlled by particle scavenging, rather than biological uptake. The net Cr isotope fractionation factor derived for these Cr isotope data is $\varepsilon \approx -0.79$‰, consistent with the global Cr and $\delta^{53}Cr$ relationship [2].

[1] Kunde et al. (2019) GBC, 33. [2] Scheiderich et al. (2015) EPSL, 423, 87-97.