Chromium in the Black Sea

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Variations of chromium (Cr) concentrations and isotope compositions in sedimentary rocks are widely applied to reconstruct past redox conditions, and specifically, to the rise of oxygen during the Precambrian. More recently, a variety of redox-independent processes affecting Cr concentrations and isotope compositions have been identified in modern seawater and sediments, challenging the interpretation of Cr isotope compositions as a redox tracer. The conditions in the Black Sea range from oxic to anoxic/euxinic and serve as a natural laboratory to study the behaviour of Cr across a pronounced redox boundary.

Chromium concentrations in the Black Sea are lowest (0.7 nM) at ~100m, the same depth where dissolved oxygen reaches concentrations lower than the detection limit (1-2 µM), but ~70m above the maximum in dissolved iron concentrations. Below that depth, Cr concentrations increase again to reach maximum values of 2.4 nM at 500m depth. Overall, Cr concentrations below 250 m (~2.26 ± 0.06 nM) do not show significant changes. The elevated deep water Cr concentration in the Black Sea shows similarities to the typical open ocean nutrient type Cr profile [1]. However, the isotope compostions of the deep water dissolved Cr is shifted to significantly heavier values ($\delta^{53/52}$Cr ~1.8 ‰) compared to North Atlantic deep water ($\delta^{53/52}$Cr ~1-1.2 ‰ [1,2]). Further, we have observed a distinct trend of increasing dissolved $\delta^{53/52}$Cr values towards the sediment-water interface. This trend suggests isotope fractionation during Cr uptake into the sediments, rather than in the water column, similar to what has been observed for dissolved $\delta^{235/238}$U in the Black Sea. We will compare water column data with sediment data to get a better understanding how Cr isotope compositions in the sedimentary archive are related to water column processes in an anoxic basin.

[1] Scheidereich *et al.*, (2015), EPSL **423**, 87–97
[2] Goring-Harford et al (2018), GCA 236: 41-59