Response of the Cr isotope proxy to Ocean Anoxic Event 2

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Cr stable isotopes record mass dependent fractionations that reflect changes in chromium oxidation state. Ellis et al. [1] showed that reduction of soluble Cr(VI) to Cr(III) during sedimentation is accompanied by a large isotope fractionation effect of 3.5‰, with light isotopes enriched in the produced Cr(III), thus leaving the residual pool of Cr(VI) enriched in the heavy isotopes. Extrapolation of these results to the oceanic Cr reservoir, where Cr(VI) is the thermodynamically favoured species under oxidizing conditions, leads to the hypothesis that drawdown of Cr(VI) in seawater during episodes of widespread anoxia should correlate with positive shifts in δ^{53}Cr values in marine sedimentary successions, if the fractionation factor and the various Cr input fluxes remained constant.

To test this hypothesis, we used a MC-TIMS method to measure δ^{53}Cr values recorded in pelagic carbonate deposited in the Western Interior Seaway during Cretaceous Ocean Anoxic Event 2 (OAE 2). Our results show that the onset of ocean anoxia correlates with a decrease in sedimentary δ^{53}Cr values, which is opposite to the model prediction. The discrepancy may be reconciled if the light Cr sedimentation flux, driving seawater to higher δ^{53}Cr values during periods of increased ocean anoxia, were more than offset by a corresponding increase in the input flux of isotopically light Cr to the oceans. Indeed, anomalously high trace metal abundances reported in carbonate sediment deposited during OAE 2 (e.g., Cr, Co, Ni) have been interpreted to reflect elevated inputs from submarine eruption of the Caribbean large igneous province [2], which we propose sharply increased the influx of isotopically light Cr(III) to the oceans.

[1] Ellis *et al Science*, **295**, 2060. [2] Snow and Duncan, *Paleoceanography* **20**, 3005.