

Chromium isotope heterogeneity on a modern carbonate platform: Implications for an emerging paleo-redox proxy

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The chromium isotope system is emerging as a useful monitor for changes in redox conditions in the Earth's ancient oceans and atmosphere. Marine carbonate rocks are increasingly utilized in this role as they are relatively common in the sedimentary record and have been shown under laboratory conditions to be capable of recording the Cr isotope composition of precipitating fluids under some conditions [1]. We investigate the heterogeneity of $\delta^{53}\text{Cr}$ values on a modern marine carbonate platform in the context of carbonate sediment genesis, mineralogy, and the influence of burial and early lithification. We present new $\delta^{53}\text{Cr}$ data from the upper 200 m of ODP Leg 166 site 1003 drill core [2] taken from the western margin of the Great Bahama Bank (GBB) and modern carbonate sediments accumulating on the GBB platform-top. Shallow-water surface sediments record a tight range of heavy $\delta^{53}\text{Cr}$ values from +0.70‰ to +0.96‰ while drill core samples record a relatively large range of $\delta^{53}\text{Cr}$ values from (+0.44‰ to +0.90‰). This down-core $\delta^{53}\text{Cr}$ variability occurs alongside changing sediment composition and mineralogy that are related to variations in relative sea-level across the platform and the degree of lithification. This implies a different set of redox processes influences $\delta^{53}\text{Cr}$ values in well ventilated, shallow, bank-top sediments compared to mixtures of platform and pelagic material at depth. As the GBB represents a reasonable modern analogue for many Phanerozoic and Precambrian carbonate successions, the preliminary framework presented here may have significant implications for the interpretation of vertical $\delta^{53}\text{Cr}$ profiles in paleo-redox studies.

[1] Rodler *et al.* (2015) *Geochimica et Cosmochimica Acta* 164, 221-235

[2] Swart *et al.* *Proceedings of the Ocean Drilling Program, Scientific Results* 166, 91-8