The removal and redistribution of chromium in hydrothermal vent environments

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The chromium isotope composition of marine sediments is emerging as a powerful proxy for the reconstruction of redox changes in the ocean-atmosphere system. Robust application of the proxy requires detailed knowledge of chromium fluxes to the ocean. While riverine sources are thought to track the extent of oxidative weathering on the continents, the record of this weathering in marine chemical sediments may be obscured by hydrothermal Cr fluxes at mid–ocean ridges. Here we present both the chromium concentration and speciation of hydrothermal sediments from the East Pacific Rise. We find that reduced chromium (III) is associated with the metalliferous component of this sediment specifically iron (oxy)hydroxide phases. Additionally we find that chromium in the carbonate phase is not present above a concentration of 0.3 ppm, suggesting these biogenic carbonates include little Cr. The Cr:Fe ratio of the metalliferous component decreases below the sediment water interface implying diagenetic chromium redistribution. Enrichments of manganese in the top of the core suggest the presence of manganese oxides, which are known oxidants of Cr. We hypothesize that these manganese oxides induce oxidative remobilization of Cr from the surface sediments. Such redox driven chromium diagenesis has the capacity to influence the isotopic fingerprint of Cr near the vent locale. Combining our results with those of Feely et al., suggests that while iron oxides are an effective sink for Cr in the vicinity of hydrothermal vents, diagenesis and remobilization of Cr occurs in proximal sediments [1]. Determining the quantitative importance of these processes will help refine marine Cr budgets and isotope mass-balance models.

[1] Feely et al., (1996), *Geochemica et Cosmochimica Acta* **60**, 2297-2323