Tracing surface iron using isotopic signatures from the UK South Atlantic GEOTRACES GA10 Section

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Iron (Fe), an essential nutrient for nitrogen fixation and photosynthesis, is found in minute concentrations in many parts of the surface oceans. In order to better understand the role of Fe as a nutrient, we require a detailed understanding of the oceanic sources and sinks. Fe isotope ratios (δ^{56}Fe) can provide insight into this, because different sources (sediments, atmospheric dust, hydrothermal vents) may have distinct δ^{56}Fe signatures. For example, reductive release of Fe from sediments has an isotopically light δ^{56}Fe signature of -1.8 to -3.5‰, measured both within porewaters and in the water column near sediments [1-3]. However, particle-exchange, physical mixing and precipation of Fe during transition from low to highly-oxygenated surface waters may complicate this picture [4]. GEOTRACES transects do show that sources may be quantified in the oceans [5], only if the Fe source signatures and fractionation processes are well understood.

Here, we present a high-resolution dissolved δ^{56}Fe surface transect of the south Atlantic Ocean, from the 2011 UK 40°S GEOTRACES GA10 cruise. In the open ocean, dissolved Fe concentrations are low (0.027 – 0.1 nmol kg^{-1}) with relatively high δ^{56}Fe (+0.5 to +1‰), which we associate with biological uptake. Near the margins, Fe concenrations are higher, with one sample reaching 0.8 nmol kg^{-1}. We use this surface data, along with shelf and slope water column δ^{56}Fe data to a) better contrain the isotopic signature of Fe released from sediments to provide insight into its long range transport, and b) link surface Fe enrichments to sediment-derived Fe on both margins.

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