Iron along the GEOTRACES South Atlantic transect GA10

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Particles are fundamental to the biogeochemical cycling of both major- and micro-nutrients in the marine environment, including the essential micronutrient iron (Fe). While the dissolved form of Fe (dFe) is considered the most biologically available, the oceanic inventory of Fe is dominated by particle inputs. A labile fraction of particulate Fe (pFe) is either directly or indirectly available to phytoplankton. In addition to remineralisation processes, scavenging and dissolution interactions between this labile fraction and dFe may in fact govern the distribution of dFe in the ocean. Hence, particles are integral to cycling and maintaining Fe availability, and it is therefore crucial to understand the sources and distribution pathways of both Fe phases. Here we present data from the UK GEOTRACES South Atlantic transect from South Africa to Uruguay. Inputs of dFe (~2 nM) and pFe (~20 nM) were observed along both the Argentine and South African margins, though the largest inputs of pFe (~290 nM) were observed in bottom waters. In open ocean surface waters, where low dFe (<0.1 nM) were observed, correlations with labile-pFe (R^2=0.6113) indicate exchanges with particles could suplement Fe availability. Raised dFe (~0.75 nM) was observed around the mid-Atlantic ridge, though increases in pFe were not similarly evident.

Unique isotopic (δ^{56}Fe) signatures were also used to identify and inform sources of dFe. Near crustal dFe was associated with Antarctic Bottom Water, indicative of a non-reductive sediment source to these waters, coincedent with high pFe in benthic nepheloid layers. Light δ^{56}Fe signatures at both margins are indicative of dFe inputs from reductive margin sediments, and associated with Antarctic Intermediate Water. A distinct light δ^{56}Fe signature was also associated with hydromthermal input near the mid-atlantic ridge. Our findings are consistent with the emerging role particles are playing in dFe cycling, and combination with δ^{56}Fe data allows us to constrain Fe sources in this region.