Investigating the isotopic signature and release of iron sourced from sediments to the UK South Atlantic GEOTRACES GA10 Section

SUMMERS, B.A.[1,*], HOMOKY, W.B.[2,3], MILLS, R.A.[3], JOHN, S.G.[4] & CONWAY, T.M.[1,5]

[1] College of Marine Science, University of South Florida, US
[2] Dept. Earth Sciences, University of Oxford, UK
[3] Ocean and Earth Science, University of Southampton, UK
[4] Dept. Earth Sciences, University of Southern California, US
[5] School of Geosciences, University of South Florida, US

[*] Corresponding author – brentsummers@mail.usf.edu

Iron (Fe) is an essential nutrient in the oceans, where it is needed for nitrogen fixation and photosynthesis by marine microorganisms. In order to better understand the role Fe plays as a micronutrient, we require a detailed understanding of the oceanic sources of Fe. Fe isotope ratios (δ^{56}Fe) may provide insight into this, because different sources (sediments, atmospheric dust and hydrothermal venting) may have distinct δ^{56}Fe signatures. Reductive release of Fe from sediments has perhaps the most striking δ^{56}Fe signature, with isotopically light values of -1.8 to -3.5‰ being measured both within porewaters and in the water column near sediments [1-3]. Furthermore, GEOTRACES ocean transects show that such sources may be traced and quantified in the oceans [4], provided suitable constraints on Fe source signatures and fractionation processes are available.

Here, we present new water column dissolved δ^{56}Fe data from several shallow stations on the South American margin (<1500 m; 36-37ºS), collected from the 2011 JC068 leg of the UK 40ºS GEOTRACES GA10 cruise. At these stations, dissolved Fe concentrations are high (0.6 – 3 nmol kg^{-1}), likely due to Fe release from shelf and slope sediments. We use these data, together with sediment porewater dissolved δ^{56}Fe profiles, to place constraints on the isotopic signature of Fe released from sediments in this region, and compare this to Fe from other margins. Our GA10 section dataset has water column Fe concentration anomalies (0.8-2 nmol kg^{-1}) that are coincident with light δ^{56}Fe signatures (down to -0.6‰) as far east as 40ºW, such that long range transport of sedimentary Fe in this region of the South Atlantic might be invoked as an explanation for these data.

[1] Severmann *et al*. 2006. *GCA*, 70(8), 2006-2022.
[2] Homoky *et al*. 2009. *Geology*, 751-754.
[3] John *et al*. 2012. GCA. 93, 14-29.
[4] Conway and John. *Nature*, 511 (7508), 212.