The iron isotope signature of shallow pore waters spanning the depth of the south Atlantic Ocean

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Dissolved iron (Fe) entering the oceans may be traced and quantified if it has a distinct isotope composition; studies of dysoxic and highly reducing ocean margin sediments agree - the reductive dissolution of Fe is a major source of dissolved Fe to the oceans with a light isotopic signature (e.g. δ^{56}Fe = -1.82 to -3.45‰), but basin-wide evidence is sparse and dissimilar. Here we present the first pore water profiles of dissolved Fe isotope ratios spanning the entire depth of the South Atlantic Ocean (60 to 5144 m water depth), and from the East and West margins. Shallow samples from the oxic shelf, slope and deep-seafloor sediments of UK-GEOTRACES, reveal a distinctly heavy isotopic signature for dissolved Fe (δ^{56}Fe = 0.16±0.09‰, n = 8, relative to IRMM-014) that is overprinted by high-concentrations of light Fe isotopes emanating from underlying ferruginous zones of reductive dissolution. A further assessment of Fe partitioning between soluble and dissolved fractions shows Fe colloids dominate the pore water content in oxic zones. These findings indicate non-reductive sediment dissolution may impart a basin-scale influence on the oceanic Fe budget, its isotope composition and physico-chemical speciation.