# Soluble and colloidal iron phases along the U.S. GEOTRACES North Atlantic Transect: A new model of dissolved Fe size partitioning

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Understanding the size distribution of dissolved iron (Fe) in the ocean is important because different Fe species are expected to have different reactivities and thus potentially different labilities to biological uptake and scavenging. The size partitioning of dissolved Fe (dFe<0.2 $\mu$m) into soluble (sFe<0.02 $\mu$m) and colloidal (0.02 $\mu$m < cFe < 0.2 $\mu$m) species was investigated at 28 stations along the U.S. GEOTRACES North Atlantic Transect (NAT). Upper ocean dFe size partitioning was highly variable with depth: 79±6% of aerosol-derived surface dFe was maintained in the colloidal size fraction, while cFe disappeared completely at the deep chlorophyll maximum, a result of preferential cFe biological uptake and/or scavenging. In the subsurface ocean below, however, dFe was constantly partitioned ~50-50% into sFe and cFe phases, which we hypothesize results from a "steady state" of dFe exchange reactions during and immediately following remineralization. There were only two exceptions to this constant subsurface partitioning. First, cFe dominated (82-96%) at and downstream of the Mid-Atlantic Ridge hydrothermal system, and also along Line W between Woods Hole and Bermuda the dFe partitioning favored ~60-80% cFe, with the excess cFe presumably resulting from inorganic cFe inputs along the margin. Thus, in the North Atlantic Ocean, we propose a new model of dFe size partitioning where a "steady state" of dFe exchange reactions during and following remineralization re-partitions subsurface dFe into constantly fractionated sFe-cFe pools, while in the upper ocean, downstream of the Mid-Atlantic Ridge, and along Line W, sFe and cFe cycle independently because either not enough time has passed to reach a new dFe exchange steady state or one of the dFe phases is non-labile to dFe exchange.