Hydrothermal Iron Budget at the Mid-Atlantic Ridge: Diving inside the TAG Neutrally Buoyant Plume

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Hydrothermal vents situated at mid-ocean ridges are considered a significant source of trace elements (TEs) into the deep ocean inventory [1]. Recent work at the fast-spreading East Pacific Rise observed basin scale transport of TEs, supported by dissolved–particulate exchange [2]. To expand on currently limited knowledge of the impact of slow-spreading ridges, the HERMINE (GEOTRACES GPrA07) cruise took place around the TAG vent site (26° 8′ N, 44° 50′ W) on the Mid-Atlantic Ridge. Sampling near the vent site (5 stations in the first 2 km) to 75 km away followed the neutrally buoyant plume (NBP) direction based on L-ADCP data, giving high resolution characterisation of TEs within the plume.

Here we present the concentrations of dissolved and particulate iron and manganese (dFe, pFe, dMn and pMn) along the TAG NBP. We observed an exponential decrease in dMn and dFe concentrations as the plume spreads along its main dispersion vector. Concurrently, the dFe/pFe ratio does not remain constant. We show that the 99% loss in the first 30 km of dFe is caused by dilution and precipitation. Aggregation of dFe to pFe predominates in the first 2 km (239 - 8047 nmol m^{-3} d^{-1}). Disaggregation dominates between 2 and 30 km from the vent site (4 - 14 nmol m^{-3} d^{-1}), supporting the reversible exchange hypothesis [2]. Based on these results, we present a box model to better understand the size fractionation that takes place inside the first 30 km of the TAG NBP.

[1] Tagliabue et al. (2010) *Nat. Geosci.* **3**, 252–256. [2] Fitzsimmons et al., (2017) *Nat. Geosci.* **10**, 195–20.