

Distribution of dissolved Fe and Mn in the Atlantic-Arctic transition zone

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The high latitude North Atlantic, and specifically the Greenland-Iceland Norwegian-Sea region, is an important thermohaline circulation hub, notably for North Atlantic Deep Water (NADW)^[1]. The region exhibits a complex circulation and is subject to various terrestrial inputs and the resuspension of sediments as the forming deep water flows over shallow sills. These processes influence the region's trace element concentration and distribution.

Iron (Fe) and manganese (Mn) are often thought to share common sources and sinks in the ocean. However, Fe and Mn also have completely different reactivities and speciation, which can lead to a decoupling of their distributions^[2]. The Greenland-Iceland Norwegian-Sea region is an ideal region to study the distributions of both elements to determine the influence of different sources and processes. Moreover, the resulting concentrations represent the preformed concentrations in NADW, which plays a crucial role in trace metal cycles throughout the Atlantic Ocean.

Our preliminary results show that the distribution of dissolved Fe and Mn in the region are indeed decoupled. Dissolved Fe exhibits a typical nutrient-type profile, while Mn concentrations, although also depleted at the surface, show a subsurface maximum. The observations suggest biological uptake in surface waters, and imply that there is potential for co-limitation of Fe and Mn, as observed in the Southern Ocean^[3]. Near Greenland, elevated Mn and high Fe/N ratios suggest surface input of Fe and Mn from Greenland.

At depth, dissolved Fe concentrations near Iceland were relatively high without a concurrent signal for Mn, implying input of Fe from a deep-water source that does not effectively contribute Mn. Between Greenland and Iceland, the homogeneous Fe and nitrate concentrations imply that significant physical mixing occurs in this region, while dissolved Mn does not show a similar pattern. Overall, our observations highlight the differential effects of external sources and internal cycling processes on the distribution and concentration of trace metals in a relatively small geographic area.

1. Dickson, B., et al., Arctic-Subarctic Fluxes. Springer Netherlands: Dordrecht. p. 443-474.
2. van Manen, M., et al., Marine Chemistry, 2022. **246**: p. 104161.
3. Wu, M., et al., Nature Communications, 2019. **10**(1): p. 3582.