Deglacial deep water circulation and end member Nd isotope changes in the subpolar North Atlantic

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Neodymium (Nd) isotopes have become a valuable proxy for the reconstruction of past water mass provenance and mixing. Accurate interpretation of Nd isotope palaeo records, however, requires a precise knowledge of the Nd isotope signatures of the water mass end members. North Atlantic Deep Water (NADW) is the major water mass ventilating the deep Atlantic Ocean today. However, whether the Nd isotope composition of NADW and its glacial counterpart remained constant or how much it varied during glacial cycles is actively debated. The subpolar North Atlantic is both the source region of NADW, as well as an area of very dynamic water mass mixing, which responded sensitively to climatic changes such as enhanced freshwater input and surface water temperatures. Furthermore, it is a region with highly variable weathering inputs in terms of Nd isotope compositions.

Aiming to provide improved (de-)glacial end member compositions, we reconstructed the deep water Nd isotope composition from several sites across the deep subpolar North Atlantic during the transition from the last glacial to the Holocene. Our results suggest that water mass exchange between the deep eastern and western basins was limited during the Last Glacial Maximum, possibly due to the weakened admixture of overflow waters from the Nordic Seas. Vigorous exchange between the two basins was established during the mid Holocene, evident through homogenised Nd isotope signatures across the two basins. Moreover, the Nd isotope composition of the deep boundary currents evolved towards more radiogenic isotope signatures in both basins during the mid to late Holocene.

This continued transition from undariogenic to radiogenic deep boundary currents during the Holocene provides evidence for changes in the Nd isotope compositions of NADW end members. It could thus be the cause for simultaneous changes observed further south in the deep West Atlantic at the Bermuda Rise.