Deglacial deep water export and Nd isotope changes in the Nordic Seas

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The Nordic Seas host one of the major global deep water production areas and are thus crucial for the evolution of the connection between atmosphere and deep ocean. Recently formed deep water masses enter the North Atlantic as overflow currents and form the lower parts of North Atlantic Deep Water (NADW). While it has been found that this deep water production was weakened during glacial times, the exact onset of deep and strong overflows and their export to the Central Atlantic Ocean during the last deglaciation is still poorly constrained.

Here we investigate the evolution of deep water radiogenic neodymium (Nd) isotope signatures in the Norwegian and Iceland Seas, and in the flow paths of overflow waters across the subpolar North Atlantic from the Last Glacial to today. We show that the deep Nordic Sea's water masses were, much unlike today, deeply unradiogenic during the Last Glacial, with Nd isotope signatures (ε_{Nd}) reaching values between -12 and -16. We infer that this was either caused by increased weathering inputs from unradiogenic glaciated source areas around the Nordic Seas and/or reduced contributions of Icelandic material to the Nordic Basins. The Nordic Sea's water masses became more radiogenic during the late deglaciation. However, modern values between -8 and -10 were only reached in the mid to late Holocene. This transition from less to more radiogenic signatures can be traced in authigenic sediment fractions throughout the deep subpolar and even subtropical North Atlantic and can explain the largest part of a recently described unradiogenic anomaly in deep Atlantic Nd isotope signatures during the early Holocene [1]. Such a close connection of deep water Nd isotopes evidences a rapid deepening and/or strengthening of overflow waters between 10 and 8 ka, as well as the simultaneous displacement of southern sourced water across the deep North Atlantic.

The unradiogenic deep waters of the glacial Nordic Seas are thus a prime example for a marked end member change due to different weathering regimes under varying climate conditions, with a profound impact on our interpretation of past seawater Nd isotope compositions of the Atlantic Ocean.

[1] Howe et al. (2016), Geology 44: 831-834.