Neodymium isotopic composition of East Antarctic continental shelf and deep water

A. GRIFFITHS[1*], M. LAMBELET[1], T. VAN DE FLIERDT[1], M. REHKAMPER[1], K. C. CROCKET[2], R. ABELL[2], F. NITSCHE[3]

[1] Department of Earth Science and Engineering, Imperial College London, South Kensington Campus, London, SW7 2AZ (*correspondence: a.griffiths15@ic.ac.uk)
[2] SAMS, Scottish Marine Institute, Oban, Argyll, PA37 1QA
[3] Lamont-Doherty Earth Observatory of Columbia University, Route 9 W, Palisades, New York 10964, USA

Antarctic Bottom Water (AABW) plays a key role in the Earth's climate system by forming the lower limb of the Meridional Overturning Circulation and, thus, influencing large scale redistribution of heat, nutrients and carbon. The neodymium (Nd) isotopic composition of seawater has been used as palaeo-proxy to understand circulation changes in the AABW through time. The biogeochemical processes controlling Nd in seawater, however, remain underconstrained, and modern observations of Nd isotopes in the AABW are still scarse, and geographically limited to the West Antarctic realm.

To overcome this limitation, samples were collected for Nd isotope and Rare Earth Element (REE) analysis at nine stations off the coast of Wilkes Land (~120°E) in the Australian-Antarctic Basin.

The results show that the different water masses have the following Nd isotope characteristics: Antarctic Surface Water, $\varepsilon_{Nd} = -9.1 \pm 0.5$; Modified Circumpolar Deep Water (MCDW), $\varepsilon_{Nd} = -8.8. \pm 0.4$; Antarctic Bottom Water, $\varepsilon_{Nd} = -8.3 \pm 0.3$. MCDW values are within the range of published data for CDW in the Southern Ocean. This, coupled with no observable fractionation of REEs, suggests that boundary exhange processes do not modify the ε_{Nd} of MCDW on the continental slope and shelf. AABW observations confirm regional variability around Antactica: AABW off the Wilkes Land coast exhibits a distinct ε_{Nd} signiture in between published data of less radiogenic Atlantic sector AABW ($\varepsilon_{Nd} = -9.1 \pm 0.7$) and more radiogenic Pacific sector AABW ($\varepsilon_{Nd} = -7.4 \pm 0.9$). REE data suggest, however, that this regional ε_{Nd} signiture is not caused by local continental inputs, but instead reflect mixing of advected AABW with local MCDW.

Further studies from different regions around East Antarctica are required to further quantify how boundary exchange and local inputs effect deep and bottom water ε_{Nd} signatures.