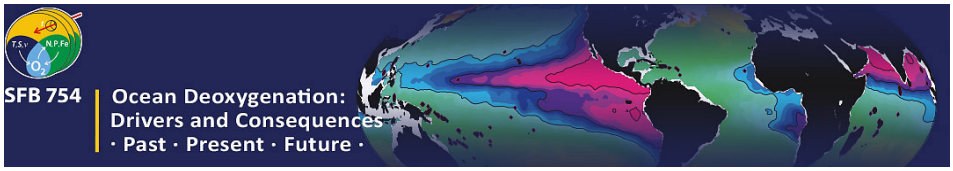

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Reconstructing Antarctic Bottom Water formation since the Last Interglacial Period

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The formation of Antarctic Bottom Water (AABW) around the Antarctic margin ventilates the deep ocean and contributes to the global overturning circulation system. Oceanographic observations in recent decades have revealed an accelerated warming and freshening of AABW, which suggest that significant changes in the southern limb of the global circulation system are likely, in response to increased warming and freshwater input from Antarctic ice melt. Paleoclimate records proximal to the source regions of AABW formation remain scarce, but far-field records and modelling studies suggest a reduction in AABW and reduced oxygenation of bottom waters during past climate warming.

We used sediment archives from the Adelie Land margin of East Antarctica, which today makes up a quarter of the total global AABW inventory, to reconstruct bottom water oxygenation since the Last Interglacial Period (LIG). Dense Shelf Water, a precursor water mass to AABW, forms on the continental shelf as a result of intense sea ice formation in polynyas associated with Mertz and Ninnis Glaciers, and along the coast of Commonwealth Bay. As Dense Shelf Water flows via canyons down the continental slope into the abyssal ocean, it mixes with lower oxygen Circumpolar Deep Water to form AABW. The concentration of redox sensitive metals in surface sediments from the Adelie Land shelf record the well ventilated shelf waters based on high excess manganese concentrations and little to no excess uranium. Preliminary results from along the continental slope (2600 m), show high excess manganese concentrations recorded during peak warm conditions of the LIG and Holocene, while glacial periods show zero excess manganese or uranium concentrations. These data suggest continued export of well oxygenated bottom waters from the Adelie Land margin during the LIG and imply an Antarctic icescape along the continental shelf that was comparable to Holocene conditions. Further work will decipher the broader paleoenvironmental implications at these sites proximal bottom water formation region since the LIG.

Position

Postdoc

Affiliation

University of Tasmania

Email Address

Taryn.Noble@utas.edu.au

Are you a SFB 754 / Future Ocean member?

No

Primary author(s) : Dr NOBLE, Taryn (University of Tasmania)

Co-author(s) : Dr BOSTOCK, Helen (NIWA); Ms CREAC'H, Layla (University of Tasmania); Dr CHASE, Zanna (University of Tasmania)

Presenter(s) : Dr NOBLE, Taryn (University of Tasmania)

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