

East Antarctic neodymium supply to the Indian sector of the Southern Ocean and its dispersal into the open Southern Ocean

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The East Antarctic continental margin remains an understudied yet climatically highly relevant and dynamic region of the Southern Ocean. Over the past decades, Antarctica featured rising air and ocean temperatures, retreating sea ice around the continent, freshening in surface and deep waters, and decreasing rates of Antarctic Bottom Water formation. In some East Antarctic regions such as near the Denman Glacier, marine-based ice shelves have increasingly been exposed to subglacial melting induced by upwelled Circumpolar Deep Water onto the East Antarctic continental shelf.

Water masses in the Southern Ocean have traditionally been characterized by hydrographic parameters (e.g. potential temperature, salinity, neutral density, oxygen). However, Neodymium isotopes (eNd) make an excellent isotopic tracer of the dynamical interaction of the Southern Ocean (SO) and the East Antarctic Ice Sheet. East Antarctic continental shelf waters carry a characteristically unradiogenic (low) eNd, while Antarctic Circumpolar Current-derived water masses are distinctly more radiogenic (higher eNd). These Nd isotopic boundary conditions allow semi-quantitative mixing calculations for individual water masses given that each water mass carries a distinctive eNd source signature.

An extensive set of seawater samples obtained during scientific expeditions EASI-1 and EASI-2 onboard RV Polarstern now resolves (1) the Nd isotopic gradients in all key water depths reaching from the southeastern Weddell Sea (8°W) to Cape Darnley (66°E), and (2) identifies highly under-observed water mass mixing processes within the Antarctic Slope Current originating from admixture of modified Circumpolar Deep Water (mCDW). The eNd of Cape Darnley Bottom Water, a regional

variety of AABW, can be traced from the formation area of its precursor water masses in northwestern Prydz Bay to the open Southern Ocean. The upwelling of mCDW onto the East Antarctic shelf in the Shackleton Ice Shelf and Denman Glacier area is also clearly resolvable by the eNd distribution. A water column transect extending from the Denman Glacier front (66°S) to 45°S along the 100°E meridian provides a first detailed insight into the latitudinal eNd gradients in the Indian Ocean. Finally, the presence of a remnant NADW eNd signature within lower CDW along this transect is striking.