

Supply of bio-essential trace metals to the continental shelf waters of East Antarctica

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Marine algae (phytoplankton) form the foundation of the Antarctic food web and take up atmospheric CO₂ during photosynthesis, impacting the global carbon cycle. In large parts of the Southern Ocean, availability of the trace metals iron and manganese is a key factor limiting the growth of phytoplankton. The distribution of these metals in seawater is strongly source-dependent, due to their low solubility, and potential sources supplying trace metals to the Southern Ocean are still poorly understood. Additionally, the most likely sources, comprising Antarctic continental shelf sediments, ice shelves and sea ice, are likely to be influenced by climatic warming-driven changes in circulation, ice shelf melt, sea ice cover or other factors. To date, the impact of such changes on the supply of trace metals, and subsequently Southern Ocean primary production and carbon uptake, remains uncertain.

To improve our understanding of trace metal supply and -cycling in the Southern Ocean, we collected seawater samples using the NIOZ trace-metal clean seawater sampler ('Titan') during the '23-'24 Polarstern expedition (EASI-2/PS140). In total, we sampled the entire water column at 47 stations in the Indian sector of the Southern Ocean and the East Antarctic continental shelf. On the shelf, we collected seawater near the stable Amery Ice Shelf in Prydz Bay, where new Dense Shelf Water is produced, and near the rapidly melting Shackleton Ice Shelf and in the vicinity of Denman Glacier, where warm ocean water intrudes on the continental shelf and subglacial melting is clearly evident. Here, I present the first results from this expedition, focusing on dissolved trace metal release from glacial melt, identified by $\delta^{18}\text{O}$, and sedimentary input from the Antarctic continental shelf.