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Dissolved Beryllium-10 in Southern Ocean water masses: a study assessing the sediment-water relationship

MATTHEW RICHARD JEROMSON[1], THOMAS J WILLIAMS[2], TARYN NOBLE[2], ZANNA CHASE[2], DAVID FINK[3], KRISTA SIMON[3], ASHLEY TOWNSEND[4], ALEXANDRA POST[5], KATHRYN GUNN[6] AND DUANNE WHITE[1]

[1]Australian Centre for Excellence in Antarctic Science, University of Canberra
[2]Australian Centre for Excellence in Antarctic Science, University of Tasmania
[3]Australian Nuclear Science and Technology Organisation
[4]Central Science Laboratory, University of Tasmania
[5]Geoscience Australia
[6]University of Southampton

Around Antarctica, meteoric beryllium-10 (^{10}Be) concetrations and ^{10}Be/^{9}Be ratios stored in iron and manganese oxide sediment phases are now often being used to trace and interpret changes in oceanographic conditions, such as meltwater input and circumpolar deep-water (CDW) upwelling. However, there are very few dissolved beryllium measurements from Southern Ocean waters. Understanding sea water signatures is critical to understanding the signatures locked into sediments – especially in application to past oceanographic change. This study reports measurements of Be in sediment and water samples collected from south of WA in 2023. The water samples captured multiple Southern Ocean water masses including: upper and lower CDW; Antarctic Intermediate Water; Subantarctic Mode Water; and surface waters. Extraction of dissolved ^{10}Be in the water column samples was carried out a by an initial Fe-coprecipitation step followed by ion-exchange chromatography and selective Be pH control. This chemistry protocol is also amenable to simultaneously purify Th and Nd isotopes. We found that ^{10}Be concentrations are depleted in surface waters and with increased proximity to WA, but concentrations then increase with increasing water column depth, a trend that is like signatures observed in the Atlantic sector of the Southern Ocean. With these beryllium water profile measurements, we aim to resolve three questions: 1) how do beryllium signatures vary across a transect running from near shore to deep water environments? 2) do we observe significant changes in beryllium signatures across different Southern Ocean water masses? And 3) Is there a relationship between water mass signature and beryllium signatures locked in the underlying sediments? In resolving these questions, we may provide further insights into how dissolved Be signatures are interacting with, and being deposited into seafloor sediments, improving potential understanding of how the proxy may be used as a tracer for various oceanographic processes in the Southern Ocean.