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Oceanographic variability in the Weddell Sea across the last deglacial: Insights from isotope geochemistry and sedimentology

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By examining the past physical behavior of the Weddell Sea from a paleoceanographic standpoint, we can gain a better understanding of the mechanisms governing water mass transformation and carbon cycling in the Southern Ocean and how they change over time. Here, we investigate three sediment cores originating from the Powell Basin in the northwestern Weddell Sea (2627 m), the continental slope of Dronning Maud Land (1776 m), and the calving front of the Ronne Ice Shelf (497 m) respectively. These cores present the opportunity to observe paleoceanographic changes in continental shelf, slope, and deep open-ocean environments across the last deglacial. We find evidence for significant changes in ocean circulation and sediment provenance across this interval, indicative of a dynamic oceanographic response to the changing climate.

To investigate this, we used reductive leaching and subsequent total digestion to determine the lead (Pb) and neodymium (Nd) isotope compositions of the detrital and authigenic phases. These are strengthened by Rock-Eval analyses and sedimentological observations to provide further insight to paleoenvironmental changes across the embayment. We highlight novel results from the modern calving front, where the core preserves a complete transition from sub-glacial till to open ocean conditions across the last deglacial. This core offers a unique opportunity to explore how chemical weathering of ice-bound detritus in the marine environment affects the lead and neodymium radioisotope composition in a real world setting, with implications for the application of these isotopes as water mass tracers and sedimentary provenance identification.