EGU23-17352, updated on 21 Feb 2024
https://doi.org/10.5194/egusphere-egu23-17352
EGU General Assembly 2023

Tracing ocean circulation using neodymium isotopes – promises and limitations

Katharina Pahnke, Torben Struve, Mika Sutorius, Henning Waltemathe, and Martin Zander
Institute for Chemistry and Biology of the Marine Environment (ICBM), University of Oldenburg, Oldenburg, Germany

Neodymium (Nd) isotopes have been applied for decades now to trace ocean circulation both in the present and past oceans. Their tracer utility stems from the characteristic Nd isotope signature of different rocks and their imprint on seawater as well as the biological inactivity of Nd and its appropriate residence time in the ocean, allowing for the determination of water mass provenance and flow paths. However, the application of this tracer, especially for the reconstruction of past ocean circulation changes, has been challenged based on uncertainties e. g. in the magnitude of the benthic flux of Nd to deep waters, Nd isotope exchange and input at ocean margins, and diagenetic alterations of the original bottom water Nd isotope signature in sediments.

Based on recent studies of dissolved Nd isotope distributions in surface to deep waters we show the power of Nd isotopes for tracing the provenance of currents and water masses particularly within restricted geographic regions. Using additional trace metal and isotope data from marine sediments analyzed alongside authigenic Nd isotopes, we explore the validity and limits of Nd isotopes as tracer of past ocean circulation changes.