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Limited exchange of neodymium isotopes with the NE Atlantic continental margin

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Neodymium isotopes (expressed as εNd) have been widely used to trace water masses in the ocean. One major limitation of εNd has been shown near land masses, where weathering input and exchange processes often overprint the conservative seawater signal. Reconstruction of paleoceanographic environments is therefore restricted to open ocean conditions. To better understand the shelf-seawater exchange of εNd and rare earth elements (REE), process studies along and across shelf regions are of vital importance. The NERC Shelf-Sea-Biogeochemistry program provided the opportunity to carry out a GEOTRACES process study to improve the understanding of the role of the well oxygenated NE Atlantic Margin Shelf in the iron (Fe), REE and carbon cycle. Seawater Nd and REE were collected as auxiliary geochemical tracers to provide information about the provenances of Fe and water masses. We here present the first highly resolved dataset of seawater εNd and REE from a well-oxygenated continental shelf. Our results show clearly separated signals from the Bay of Biscay (εNd ≈ -12) and the Celtic Sea (εNd ≈ -9) with limited mixing of Atlantic water onto the shelf. The elemental concentrations of particulate and dissolved Nd suggest scavenging at the mixing interface, from which particles are transported down the shelf edge. These particles have only limited influence on seawater εNd in the Bay of Biscay as indicated by comparison of filtered and unfiltered samples. Our findings show that Nd isotopes can be used to trace mixing of water masses in well-oxygenated shelf environments such as the NE Atlantic Shelf.