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A Sedimentary Source of Rare Earth Elements in the North Atlantic

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The Rare Earth Elements (REEs) are powerful geochemical tracers of environmental processes. However, ambiguities in the oceanic budgets of the REEs hamper their application. Evidence suggests a sediment pore water benthic flux is the major source of REEs to the ocean, with extrapolated estimates of this flux being equivalent in magnitude to that "missing" from modern budgets. Existing pore water REE data are available from only a few locations globally with no representative dataset from the North Atlantic, limiting our ability to constrain flux estimates and understand their impacts in both the modern and past oceans. Here, we present pore water data from the N. Atlantic east coast margin, Labrador Sea, Irminger Sea, and Greenland Sea. We discuss the implications of these new data in terms of the mechanisms driving the benthic source fluxes, and in terms of the broader marine budget of REEs.

Our 8 sites (with water depths 1400 m to 4900 m) represent a range of sediment compositions, grain size variations and include to various degrees, ice rafted debris (IRD). All sites sampled have elevated pore water REE concentrations with 3 of our sites having a clear subsurface maximum in the first 5 cm ranging from 100-2400 pmol cm^{-2} yr^{-1} at each site. These pore water concentrations relative to the overlying bottom water (average bottom water 21 pM ± 6) indicate a ubiquitous benthic flux. The greatest efflux is observed from sediments in the Irminger Sea (~135 pmol Nd $cm^{-2}yr^{-1}$). Lower, but consistent, fluxes are observed at various deep-sea sites along the N. Atlantic margin (US east coast ~2 pmol cm^{-2} yr^{-1}). Early analyses indicate that the averaged magnitude of our western north Atlantic margin fluxes (~11 pmol Nd $cm^{-2}yr^{-1}$) is comparable to those observed in the slope sites of the North Pacific (Oregon margin [1]), Tasman Sea, and are generally greater than abyssal sites of the central Pacific.

[1] Abbott, A. N., Haley, B. A., McManus, J., & Reimers, C. E. (2015). *Geochimica et Cosmochimica Acta*, *154*, 186–200.