Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.12639

Comparing dissolved rare earth element distributions in the US GEOTRACES GA03 (North Atlantic zonal) and GP15 (Pacific meridional) transects.

ALAN M. SHILLER

University of Southern Mississippi

Presenting Author: alan.shiller@usm.edu

Rare earth elements (REEs) show slight systematic changes in geochemical behavior across the series, resulting in greater particle-reactivity of the light REEs (LREE) relative to the heavies (HREE). Furthermore, while most REEs are in the +III oxidation state, Ce and Eu can be in other oxidation states leading to distinct characteristics of those elements. As part of the US GEOTRACES effort, we determined dissolved REEs and Y at 32 stations across the North Atlantic and an additional 35 stations in the Pacific.

Among our observations: LREEs show preferential removal in the upper water column of the northern Central Mode Waters of both oceans showing low La/Yb ratios in conjunction with waters showing other tracer evidence of dust input (Ga) and nitrogen fixation (N*), thus suggesting a biological connection. Bottom waters in both oceans show increases in REE concentrations and LREE/HREE ratios. Water mass deconvolutions suggest that these deep REE increases cannot be accounted for by simple mixing and require an additional source, presumably from the sediments.

In the Atlantic, other features of note include an increase in LREEs in the strong oxygen minimum zone off Mauritania, consistent with an association of REE cycling with the redox cycles of Fe and Mn. Also along the eastern margin, but below the oxygen minimum, a small but distinct increase in the cerium and europium anomalies is observed, consistent with terrigenous input. In hydrothermally influenced waters along the mid-Atlantic Ridge, there are increases in Ce/Ce*, Eu/Eu*, and Y/Ho but a decrease in Nd/Yb and in REE concentrations. Surface water distributions are more consistent with elements influenced by margin inputs than with atmospheric input.

For the Pacific, only Ce shows a clear influence of the margin. In intermediate waters, Ce and the Ce anomaly (Ce/Ce*) show a broad plume centered around 1000 m and extending south from the Alaskan margin in waters with $O2 < 25$ µM. Likewise, there are slight increases in Ce and Ce/Ce* at ~300 m in low O2 waters at 10°N and 3°S, probably reflective of the distal ends of the East Pacific OMZs.