

## **Dissolved rare earth elements in the US GEOTRACES North Atlantic Section**

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The rare earth elements (REEs) are a unique chemical set wherein there are systematic changes in geochemical behavior across the series. 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. Thus, the geochemical properties of the REEs make them particularly useful tools for inquiring into various geochemical processes. As part of the US GEOTRACES effort, we determined dissolved REEs and Y at 32 stations across the North Atlantic during US cruises GT10 and GT11 along a meridional transect from Lisbon to the Cape Verde Islands and a zonal transect from Cape Cod to the Mauritanian coast. While profiles are similar to previous reports, features are observed at the interfaces indicative of various input and removal processes. In the strong oxygen minimum zone off Mauritania, there is an increase in the light REEs but not the heavies. Also along the eastern margin, below the oxygen minimum, a small but distinct increase in the cerium anomaly ( $Ce/Ce^*$ ) is observed. These observations are consistent with an association of REE cycling with the redox cycles of Fe and Mn. 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. We also take advantage of a previously published water mass analysis for the section to estimate that most of the deep water changes can be explained by conservative mixing of waters with different pre-formed REE concentrations. Finally, we examine recent evidence of methanotrophic requirements for light REEs and speculate on the oceanic role for this process.