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A pronounced Eu anomaly in dissolved seawater REE patterns close to the Mid-Atlantic Ridge

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The concentrations of Rare Earth Elements (REEs) in the ocean reflect riverine, aeolian and hydrothermal inputs as well as internal cycling, removals, and transport. The chemical behaviour of this set of elements is generally similar but with subtle, predictable variations, which allow us to separate entangled physicochemical processes. Hydrothermal fluids are enriched in REEs with respect to seawater, particularly in Eu, but due to efficient scavenging by plume particles, hydrothermal vents are considered a net sink for REEs in the ocean, and an unlikely influence on wider seawater REE patterns [1]. Elderfield et al., however, hypothesised that the Eu/Sm ratio might record hydrothermal input to seawater [2]; Europium anomaly (Eu/Eu*) could be used to similar effect [3]. Our ability to assess the impact of hydrothermalism on Atlantic REE distributions has long been hindered by a paucity of dissolved REE measurements near hydrothermal vent sites.

Here we present dissolved REE concentrations in deep water samples, collected from the GA13 transect at a number of vent sites along the Mid-Atlantic Ridge (MAR), and measured by Elemental Scientific seaFAST ICPMS.

We reveal strong excursions in Eu/Eu* at depths in the water column that are coincident with excursions in the plume tracers dissolved Mn and ^{3}He at TAG vent site. Plume Eu/Eu* excursions are also present 30 km from the main vent site, providing evidence that the strong Eu anomaly present in TAG hydrothermal fluids is not wholly removed from the dissolved fraction by plume scavenging processes, and may impact REE patterns farther afield. Eu anomalies will be discussed in the context of wider Atlantic observations and used to investigate the utility of Eu/Eu* as a record of hydrothermal input to seawater.

References:

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