

Upwelling of distinct rare earth element signal in the South Pacific

**KATHARINA PAHNKE¹, MAREIKE GUTENSOHN^{1,2} AND
HENNING WALTEMATHE¹**

¹Carl von Ossietzky Universität Oldenburg

²Swedish Metabolomics Centre, Umeå University

The differential behavior of earth elements (REE) across their series make them useful tracers for biogeochemical processes in the ocean. While their distribution in the water column shows clear indications of vertical controls such as surface and bottom inputs and particle scavenging, lateral transport by water masses also plays role. Here we present new dissolved REE data from the South Pacific across the Southern Ocean frontal system and combine them with existing data from the South Pacific to explore the transfer of deep REE signals to the upper Southern Ocean.

The South Pacific dissolved REE show exceptionally high heavy over light shale-normalized REE ratios (HREE/LREE of up to 8) in the interior of the ocean (intermediate and deep waters) that correlate with dissolved LREE, but not with HREE, suggesting preferential LREE scavenging in the low to southern high latitude Pacific rather than preferential HREE release. The high HREE/LREE ratio shoals with neutral density surfaces towards the south across the South Pacific frontal system, highlighting the significance of isopycnal mixing in transporting this signal to the upper Southern Ocean. Moreover, the HREE/LREE ratio shows a clear gradient between PDW/UCDW and LCDW, thus allowing differentiation between these deep water masses in the Southern Ocean that is difficult e.g., with radiogenic neodymium isotope ratios that are widely used as water mass tracer. We conclude, that the dissolved shale-normalized HREE/LREE ratio is particularly useful in tracing the lateral transport of water masses in the Southern Ocean.