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Impacts of the main sources and geochemical processes on the distribution of Ra isotopes in the Southeast Atlantic Ocean

LUCIA HELENA VIEIRA[1,2], AARON JOSEPH BECK[2], MARK JAMES HOPWOOD[2], JAN SCHOLTEN[3] AND ERIC P. ACHTERBERG[2]

[1]Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research

[2]GEOMAR Helmholtz Centre for Ocean Research Kiel

[3]Christian-Albrecht University Kiel

Presenting Author: lucia.lhv@gmail.com

The southeast Atlantic Ocean features an important eastern boundary region influenced by the discharge the world's second largest river, and the Benguela Upwelling system and its associated oxygen minimum zone (OMZ). This study is part of the GEOTRACES international program (section GA08) and aimed to use Ra isotopes (^{226}Ra, ^{228}Ra, ^{224}Ra, and ^{223}Ra) to investigate several key ocean boundary processes in the South Atlantic Ocean, including Ra supply by the shelf, abyssal and slope sediments, the influence of the Congo River, the Angola-Benguela front (ABF), and the wind-driven coastal upwelling.

The Congo River plume dominates the Ra isotope distributions in surface waters of the Congo-Angola region (3° S). Their elevated ^{228}Ra and ^{226}Ra activities in its extensive surface plume reached up to 1000 km from the river mouth. A shelf ^{228}Ra plume in the upper 300 m were observed in the Benguela region (29° S). The enhanced ^{228}Ra activities that extends >1000 km from the African continental margin is unrelated to riverine sources, and may indicate that Ra is derived from shelf and slope sediments and laterally transported along isopycnal surfaces.

The ^{228}Ra /^{226}Ra ratios are useful tracers when comparing water bodies. As such, the ABF is noticeable in the ^{228}Ra/^{226}Ra distributions. In addition, increased Ra isotopes, Si and Fe (II) concentrations were observed in the OMZ of the Benguela region indicating inputs from additional Ra sources, such as the reducing shelf sediments as a result of silica dissolution, and/or the presence of submarine groundwater discharge (SGD) along the Namibian shelf. Rainfall episodes in the Namibian hinterland may lead to a subterranean aquifer recharge and its subsequent discharge as SGD into the Namibian coast. Previous studies suggested that such process may be related to the nearshore hydrogen sulfide (H_2S) eruptions observed off Namibia [1,2].

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