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Behaviour of dissolved Neodymium Concentrations and Isotopes in the deep South Pacific Ocean

HENNING WALTEMATHE[1], TORBEN STRUVE[2], TIMOTHY FERDELMAN[3] AND KATHARINA PAHNKE[2]

[1]Institute for Chemistry and Biology of the Marine Environment (ICBM)

[2]Institute for Chemistry and Biology of the Marine Environment (ICBM), University of Oldenburg, Germany

[3]Max Planck Insitute for Marine Microbiology, Bremen, Germany

Presenting Author: henning.waltemathe@uni-oldenburg.de

The dissolved neodymium (Nd) isotopic composition (expressed as ε_{Nd}) of seawater is often used as geochemical tracer for water masses in the ocean. However, this application is hampered by additional sources of Nd and isotope exchange at ocean boundaries and suspended particles of hydrothermal and lithogenic origin [1,2], that are not yet fully constrained. The subtropical South Pacific gyre is an ideal region to test the influence of hydrothermal activity on dissolved Nd concentrations ([Nd]) and ε_{Nd} due to the near absence of vertical particle transport in this remote and oligotrophic area. Here, we present seawater [Nd] and ε_{Nd} from a deep-water (>1500m water depth) E-W transect across the oligotrophic South Pacific gyre (R/V Sonne cruise SO245, GEOTRACES process study GPpr09). Dissolved [Nd] and ε_{Nd} from 8 stations range from 10.76 to 31.1 pmol/kg and ε_{Nd} = -3.9 to -8.5, respectively. Neodymium concentrations show a consistent pattern with downward increasing [Nd] at all stations, but slightly lower [Nd] in the East compared to similar water depths (≥3000 m) in the West Pacific. Stations west of the East Pacific Rise (EPR) at depths >3500 m show the lowest ε_{Nd} values (ε_{Nd} = -7.5 to -8.5) and more radiogenic ε_{Nd} values of ~ -4 to ~ -6 are found at water depths above 3500 m and east of the EPR.

Optimum Multiparameter Analysis of water mass proportions reveals that the ε_{Nd} values at >1500 m water depth can be explained to a large extent by mixing of deep water masses from the Southern Ocean and the North Pacific. In contrast, [Nd] in the deep East Pacific (1500-3000 m water depth) shows a deficit relative to theoretical, conservative [Nd], suggesting enhanced scavenging of Nd by hydrothermal particles from the EPR. In summary, our data show a mainly conservative behaviour of ε_{Nd} in the deep South Pacific, but pronounced modification of [Nd] by hydrothermal activity.

[1] Abbot et al. (2015), *Geochim. Cosmochim. Acta* **154**, 186-200. [2] Stichel et al. (2018), *Front. Mar. Sci.* **5:96**.