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The Neodymium isotopic composition in oxic pore waters from the Atlantic and Pacific: implications for the use of Nd isotopes as a past water mass proxy

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Neodymium (Nd) isotopes have been widely used as a proxy to reconstruct past ocean circulation. A variety of archives (e.g., Fe-Mn oxyhydroxides, phosphates) have been used to extract authigenic Nd isotopic signatures but in recent years it has been increasingly questioned which archives can be reliably used and under which environmental conditions primary seawater Nd isotopic signatures are altered by early diagenesis. Pore waters of marine sediments are *the* key environment in which early diagenetic exchange processes between seawater-derived Nd and terrigenous solid phases take place. Marine pore waters hence provide crucial information to understand Nd isotope and Rare Earth Element and Yttrium (REY) cycling between marine sediments and overlying bottom waters. Because of methodological challenges, pore-water Nd isotopic compositions have only been assessed in few places until now, thus only providing a non-representative view globally.

Here we present REY and ε_{Nd} data from oxic pore waters at ca. 4000-5500 m depth from the Northeast Atlantic and the Central Pacific. Neodymium concentrations range from 10-40 pM in the Northeast Atlantic (overlying seawater 12-26 pM) and from 43-79 pM in the Central Pacific (overlying seawater on average 45 pM). The depth profiles display a concentration peak in the upper ca. 2 cm, suggesting a benthic flux of REY. Shale normalized (SN) pore-water REY patterns show seawater characteristics including large negative Ce_{SN} anomalies, positive Y_{SN} anomalies and HREY enrichment. The HREY enrichment decreases with depth in the upper ca. 20 cm at both sites, revealing REY fractionation during interactions of the pore water and the solid phase. ε_{Nd} values of the pore waters range from -10.5 to -12.7 in the Northeast Atlantic and from -3.6 to -4.0 in the Central Pacific and are in the same range as near-bottom seawater values.

Our results show slight REY fractionation during early diagenesis and Nd isotopic composition in a similar range in the pore water and the overlying seawater potentially indicating no change of the Nd isotopic signature during early diagenesis at the studied sites. Comparison to the authigenic and detrital solid-phase Nd isotopic composition is, however, crucial to fully understand the early diagenetic processes.