Comparison between seawater and archive Nd isotope compositions using multi-scatter plots: A new global data compilation

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Neodymium isotopic ratios (ε_{Nd}) have been used as a tracer of water mass and continental inputs to the ocean. To further evaluate the faithfulness of this tracer and better constrain areas strongly affected by local/regional continental inputs, we have updated a global seawater ε_{Nd} database (Lacan et al., 2012) and combined it with present-day water mass tracers including temperature, salinity, concentration of silica, phosphate, nitrate and oxygen of WOA09, $\delta^{13}C$ values of dissolved inorganic carbon (Schmittner et al., 2013), and natural seawater ^{14}C values of GLODAP database (Key et al., 2004). In addition, we compiled ε_{Nd} data of sedimentary oxyhydroxide coatings, foraminiferal tests, deep-sea corals and fish teeth/debris from the Holocene period (≤10ka).

For water masses at water depth ≥ 1500m, multi-scatter plots between seawater ε_{Nd} values and other water mass tracers present clear correlations, attesting that a primary control of seawater ε_{Nd} values is large-scale deep water mixing. Noticeable exceptions are found in the northern northwest Atlantic where local/regional sources have highly contrasted Nd isotopic signatures. At 600-1500m water depths, the correlations become loose and virtually disappear for 0-200m. The surface seawater Nd concentration tends to be higher at stations within 1,000 km from the continents, reflecting contribution from local sources. Archive ε_{Nd} data generally agree with seawater values expected from the multi-scatter plots. However, the relationships are more scattered, in particular for oxyhydroxide coatings. In spite of these complications, both seawater and archive ε_{Nd} values clearly show latitudinal gradients at water depths ≥ 600m in the Atlantic and Pacific, confirming the usefulness of Nd isotopes to distinguish northern and southern source intermediate and deep water masses.

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