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Neodymium Isotope Ratios in Sedimentary Organic Matter

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Total sedimentary organic matter (SOM) represents a continuum between continental and marine organic matter inputs. Identifying the marine component of SOM may be useful in the development of a neodymium (Nd) isotope ratio proxy for surface water. Organic matter produced in the photic zone likely incorporates the Nd isotope ratio signature of the uppermost water column. Extracting marine SOM-Nd from ocean core sediments may therefore represent Nd isotope ratios that were present in surface water at the time of deposition. Following the ground-breaking work of Freslon et al. (2014), we performed oxidative leaching (H_2O_2) of the decarbonated, <63-um fraction of coretop sediments across sites in the Pacific Ocean to extract total SOM-Nd. After Nd is separated and purified, Nd isotope ratios are measured by multi-collector ICPMS. In order to interpret what causes the variability of the SOM-Nd isotope ratios, we compare our results to: 1) the bulk carbon/nitrogen and $\delta^{13}C$ ratios to estimate the approximate fractions of marine versus continental SOM in the sediments, 2) modern surface water Nd isotope ratios to ground-truth the potential as a surface water proxy, 3) authigenic Nd isotope signatures to verify that our SOM-Nd signal is unique and can be differentiated from bottom water, and 4) lithogenic Nd isotope ratios in the detrital component of the sediment which should mimic the continental organic matter input.

We chose two regions to investigate: the Eastern Equatorial Pacific (EEP) where detrital fluxes from the continent are very low and the Northwest Pacific (NWP) where the opposite is true. Our results from EEP sediments indicate Nd isotope ratios in SOM-Nd that are very similar to surface waters, and distinct from either bottom water or detrital signatures. NWP sediments have coretop SOM-Nd isotope ratios that are also usually distinct from detrital and bottom water Nd isotope ratios, but the extent of similarities with surface water are difficult to discern. To broadly apply this proxy, we attempt to deconvolve the total SOM-Nd into its continental and marine components with bulk and other organic geochemistry measurements, as well as isotope mixing models.

Freslon et al. (2014) *Geochim. Cosmochim. Acta* 140, 177-198.