The relationship of ε_{Nd} among authigenic phases, bottom water, pore water and detrital sediments

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Understanding the distribution of neodymium isotopic compositions of seawater (ε_{Nd}) is challenging as the oceanic budget of Nd remains poorly constrained. Recently a "bottom-up" perspective of Nd cycle in the ocean has been proposed in which benthic flux supplies Nd to bottom water while potentially modifying its ε_{Nd} [1,2]. Here, we use chemical extraction methods to study the role of authigenic Nd-bearing phases in the diagenetic and oceanic cycle of Nd to better understand how the ε_{Nd} of bottom water, pore water, authigenic phases and detrital sediments are related in early diagenesis. Using coretop sediments from the Gulf of Alaska (GOA), We develop a leaching method to extract authigenic ε_{Nd}. Detailed evaluation of the sources of leachate Nd using major and trace element geochemistry, $^{87}Sr/^{86}Sr$-ε_{Nd} isotope systematics and results from leaching volcanic ash samples suggest that authigenic Fe-Mn oxyhydroxide is the dominant phase extracted during leaching and that contamination from volcanic and other detrital sources to leachate Nd is insignificant (<1%). However, coretop ε_{Nd} is consistently more radiogenic than bottom water. We infer that authigenic phases record pore water ε_{Nd}, which diverge from bottom water ε_{Nd} because of the diagenetic contribution of reactive and radiogenic sedimentary materials to the formation of authigenic phases during early diagenesis. In our conceptual model we suggest that the interaction between authigenic phase and pore water in the early diagenetic zone supports the benthic flux of Nd, and the residence time of bottom water and the distribution of the reactivity of sedimentary components are the key factors controlling the relationship of ε_{Nd} among bottom water, pore water, authigenic phases and detrital sediments. We further show that the observations of deep water ε_{Nd} in the Pacific is consistent with this model. Our results provide a new framework of investigating the oceanic cycle of Nd and the application of authigenic ε_{Nd} in paleoceanography.

[1] Abbott et al. (2015a) *GCA* **154**, 186–200. [2] Abbott et al. (2015b) *Geology* **43**, 1035.