

Nd isotopic study on marine environment: past, present and future

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Neodymium (Nd) isotopic composition, $^{143}\text{Nd}/^{144}\text{Nd}$, is very useful for studying marine environment. This is based on the facts, 1) relatively short residence time of Nd in ocean compared with ocean circulation time, and 2) wide range of Nd isotopic composition of major Nd sources, i. e., rocks in the land area.

The earliest studies focused on marine chemical precipitates, such as ferromanganese nodules, to deduce the seawater Nd isotopic composition, as they show high rare earth element concentrations including Nd. Then, late 1970' s, Professor Jerry Wasserburg' s group of California Institute of Technology (CALTEC) succeeded in direct Nd isotopic determination of seawater (Piepgras et al., 1979). Through 1980' s, the CALTEC group did several important contributions on seawater Nd isotopic composition (Piepgras and Wasserburg, 1982, 1983, 1987; Stordal and Wasserburg, 1986). However, not until 2000' s, only a few research groups followed their approach, because of the analytical difficulties of measurement due to very low Nd concentration in seawater (normally 5 to 50 pmol/kg).

On the other hand, in the mid 1990' s, Professor Keith O' Nions and his co-works started to reconstruct the past ocean circulation pattern using time-series radiogenic isotopic composition records, such as Nd and Pb, of ferromanganese crusts (Burton et al., 1997; Ling et al., 1997). This approach has been extended to several marine sedimentary samples including foraminiferal tests and fish teeth (Vance and Burton, 1999; Thomas, 2004; Scher and Martin, 2006; Huang et al., 2014).

Since the start of the GEOTRACES program in 2006, number of seawater Nd isotopic composition data has been dramatically increasing because Nd isotopic composition was selected as a key parameter of the program. The Nd isotopic data sets may enable to compare the real Nd isotopic distribution in marine environment and the predicted one by using global circulation model.

In my talk, I will also discuss the future aspects of marine environmental Nd isotope geochemistry.

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