New chemical separation technique of Nd for ^{146}Sm-^{142}Nd chronology

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The combination of ^{146}Sm-^{142}Nd (T1/2 = 6.8×107 yr [1]) and ^{147}Sm-^{143}Nd systems ($T^{1/2}$ = 1.06×10^{11} yr) has been widely used for the chronological study of meteorites and Hadean samples [2] [3]. To obtain precise and accurate Sm-Nd ages, high-yield and highly-pure Nd separation is indispensable prior to Nd isotope analysis. In this study, we developed a new chemical separation technique which enables to precisely determine the ^{142}Nd/^{144}Nd and ^{143}Nd/^{144}Nd ratios with TIMS, as well as the Sm/Nd ratios with ICP-MS for rock samples.

The performance of our method was evaluated using a basaltic standard, JB-3. The rock sample was dissolved by the mixture of concentrated acids ($HClO^4$, HF, and HNO^3). One-tenth of the solution was removed and mixed with ^{149}Sm- and ^{145}Nd-enriched spikes to determine Sm and Nd concentrations by ID-ICP-MS To avoid the isobaric interferences of molecular ions (e.g., ^{130}Ba16O, ^{133}Cs^{16}O), the spiked sample solution was passed through the TRU resin (Eichrom). The reproducibility of Sm/Nd ratio was 0.37 % (n =5).

The remainder of the sample solution (90%) was conditioned by 1M HCl and passed through a cation exchange resin (1:1 mixture of AG50WX8 and AG50WX12) to separate REEs from major elements. Next, Ce was removed from the rest of REEs by modifying the methods of [4], in which Ce^{3+} in the sample solution (10M HNO3) was oxidized into Ce^{4+} using $KBrO^3$ and passed through the LN resin (Eichrom). Finally, Nd was separated from Sm using the LN resin in HCl media. We achieved Ce/Nd = ~3×10^{-5} and Sm/Nd = ~4×10^{-5} with >91% Nd recovery.

The new chemical separation technique was applied for determining ^{146}Sm-^{142}Nd and ^{147}Sm-^{143}Nd ages of a basaltic eucrite, NWA 7188. The ^{146}Sm-^{142}Nd and ^{147}Sm-^{143}Nd mineral isochrons of NWA 7188 yielded ages of 4551±$^{11}_{13}$ Ma and 4141±310 Ma, respectively. The ^{146}Sm-^{142}Nd age is consistent with the metamorphic age of another basaltic eucrite, Agoult [5]. In contrast, the younger ^{147}Sm-^{143}Nd age was due to a secondary metamorphism on the parent body after the extinction of ^{146}Sm, which disturbed only the ^{147}Sm- ^{143}Nd systematics.

[1] Kinoshita et al. (2012) *Science* **335**, 1614-1617. [2] Boyet et al. (2010) *EPSL* **291**, 172-1812. [3] O'Neil et al. (2008) *Science* **321**, 1828-1831. [4] Tazoe et al. (2007) *JAAS* **22**, 616-622. [5] Iizuka et al. (2014) *EPSL* **409**, 182-192.