Nucleosynthetic neodymium isotope anomalies in bulk chondrites

RYOTA FUKAI[1] AND TETSUYA YOKOYAMA[1]

[1] Department of Earth and Planetary Sciences, Tokyo Institute of Technology, Japan (fukai.r.aa@m.titech.ac.jp)

High precision Nd isotope analyses in meteorites have been the center of interest in recent cosmochemistry community. One of the most remarkable results of high precision Nd isotope analysis is that chondrites possess $^{142}Nd/^{144}Nd$ ratios ~20 ppm lower than those in terrestrial rocks [1]. The anomaly was interpreted to be caused by the Sm-Nd fractionation via early differentiation of the terrestrial mantle. On the other hand, variations in stable Nd isotopes (e.g., $^{148,150}Nd/^{144}Nd$) have been documented in chondrites [2]. However, the existence of Nd isotope anomalies in bulk aliquots of chondrites remains unclear unless high precision Nd isotope data with complete sample digestion become available. In this study, we revisit high precision Nd isotope analysis of chondrites by applying a new sample digestion technique and an improved dynamic multicollection method using TIMS.

We measured one enstatite chondrite (EH6), eight ordinary chondrites (H, L, LL), five carbonaceous chondrites (CV3, CR2, CO3, C2-ung.) and one rumuruti chondrite (R4). The ordinary chondrites show uniform isotope anomalies for $\mu^{142}Nd$ (–12 ± 5 ppm), $\mu^{148}Nd$ (10 ± 8 ppm) and $\mu^{150}Nd$ (20 ± 12 ppm). Although the $\mu^{142}Nd$ values for ordinary chondrites obtained in this study are generally consistent with those of previous studies, positive anomalies in $\mu^{148}Nd$ and $\mu^{150}Nd$ were not recognized in previous studies. In contrast to ordinary chondrites, five carbonaceous chondrites show variable Nd isotope anomalies exceeding analytical uncertainties.

The data points for ordinary chondrites and a rumuruti chondrite are generally plotted on a mixing line between the terrestrial composition and the putative *s*-process end-member composition. This means that the isotope anomalies in ordinary chondrites are induced by the heterogeneous distribution of *s*-process nuclides in early Solar System. By contrast, most of the data for the carbonaceous and an enstatite chondrite deviate from the mixing line. We consider that the offset from the mixing line is caused by the heterogeneous distribution of *p*-nuclides in the early Solar System.

References: [1] Boyet and Carlson (2005) *Science*, *309*, 576. [2] Carlson et al. (2007) *Science*, *316*, 1175.