Nucleosynthetic Sr–Nd correlation in bulk chondrites: Evidence for nebular thermal processing and transportation of refractory dusts in the early Solar System

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Sr isotope compositions in meteorites reflect multiple contibutions of distinct nucleosynthetic processes occurred in diverse stellar environments. Previous studies found variabilities in $^{84}Sr/^{86}Sr$ ratios among different classes of carbonaceous and non-carbonaceous meteorites [1,2], yet the presolar phases responsible for the observed variations are still uncertain. The $^{84}Sr/^{86}Sr$ ratios of meteorites vary depending on the involvement of multiple components originated from the main-*s*, weak-*s*, *r*, and *p*-processes. Therefore, coupling of Sr isotopic data with the other isotope systems obtained from single meteorite aliquots is important to investigate the origin of Sr isotopic heterogeneity.

In this study, we revisited high precision Sr isotope analysis of bulk chondrites coupled with a robust sample digestion technique that confirmed complete dissolution of presolar grains [2]. Furthermore, we coupled Sr isotope anomalies in chondrites with Nd isotope anomalies newly measured and reported in [3] that were obtained from the same meteorite aliquots.

We investigated two terrestrial basalts, four enstatite chondrites, five ordinary chondrites, and ten carbonaceous chondrites. All types of chondrites including the enstatite chondrites exhibited positive isotope anomalies in $\mu^{84}Sr$ compared with the terrestrial basalts. The terrestrial basalts, enstatite chondrites, ordinary chondrites, and CAI-subtracted carbonaceous chondrites were plotted on the *s*-process mixing line in the $\mu^{84}Sr$ versus $\mu^{148,150}Nd$ diagrams. This linear correlation would be caused not only by nebular thermal processing inducing heterogeneous distribution of *s*-nuclides, but also by the incorporation of CAIs and the other refractory dusts into carbonaceous chondrites formation region.

References: [1] Moynier, F. et al. *ApJ*, **758**, 45, 2012. [2] Yokoyama, T. et al. *EPSL*, **416**, 46, 2015. [3] Fukai, R. and Yokoyama, T. *EPSL*, **474**, 206, 2017.