High precision Sr isotope measurements for bulk chondrites with complete sample digestion

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High precision stable Sr isotope analyses on bulk meteorites have been conducted in some previous studies [1–3]. These studies found isotopic variations of $^{84}Sr/^{86}Sr$ ratios among three types of chondrites (enstatite, ordinary, and carbonaceous chondrites). However, the extent of Sr isotope heterogeneities across entire classes of chondrites remains unclear due to the limited number of Sr isotope data with sufficiently high precision. 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.

The reproducibilities for NIST 987 standard obtained by the dynamic multicollection method were 16 ppm for $^{84}Sr/^{86}Sr$ ratio (n = 7, 2SD), which are two times superior to those in previous studies [1–3]. We investigated four enstatite chondrites (EH and EL), seven ordinary chondrites (H, L, and LL), and four types of carbonaceous chondrites (CI, CM, CO, and CV). Three types of ordinary chondrites had generally uniform $\mu^{84}Sr$ values (= –12 ± 29 ppm; 2SD). By contrast, enstatite and carbonaceous chondrites showed variable Sr isotopic compositions depending on each subgroup. For instance, EL chondrites showed the lowest $\mu^{84}Sr$ values (= –30 ± 26 ppm) among all types of chondrites, while EH chondrites showed $\mu^{84}Sr$ values indistinguishable from ordinary chondrites (= –12 ± 36 ppm). On the other hand, a CI chondrite had a $\mu^{84}Sr$ value (= 14 ± 14 ppm) resolvable from those of CV chondrites that presented the highest $\mu^{84}Sr$ values (= 36 ± 21 ppm) among all types of chondrites. The observed global trend for the $\mu^{84}Sr$ value that range from –30 ppm for EL chondrites to 36 ppm for CVs have been induced most likely by the selective destruction of presolar grains via nebular thermal processing. Furthermore, existence of a local trend observed in carbonaceous chondrites on the $\mu^{84}Sr$-$\mu^{54}Cr$ diagram would reflect the additional processes that may have occurred in the outer Solar System before the accretion to each parent body for carbonaceous chondrites.

References: [1] Moynier, F. et al. (2012) *ApJ*, **758**, 45. [2] Paton, C. et al. (2013) *ApJL*, **763**, 40. [3] Yokoyama, T. et al. (2015) *EPSL*, **416**, 46.