Mo isotope evidence for distinct isotope reservoirs in the early Solar System

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Isotope anomalies in bulk meteorites have been thought to reflect complicated physicochemical histories in the early Solar System. Recently, carbonaceous chondrites was found to be discriminated from the other meteorites using the ε^{50}Ti–ε^{54}Cr and Δ^{17}O–ε^{54}Cr diagrams [1], suggesting the existence of isotopically distinct source materials which have differently accreted on individual meteorite parent bodies. Mo is one of the promising elements for understanding the source materials and the processes that occurred in the formation regions of meteorite parent bodies. Although previous studies on Mo isotope anomalies primarily focused on carbonaceous chondrites and iron meteorites [2], the paucity of data for the other types of meteorites hinders the full evaluation of the existence of the distinct reservoirs for Mo in the early Solar System. Here we determine Mo isotope anomalies in ordinary chondrites, rumuruti chondrites, and iron meteorites with high precision N-TMIS technique [3].

In the μ^{95}Mo–μ^{94}Mo diagram, Mo isotope data for O- and R-chondrites, and iron meteorites (excluding IVB) are plotted on the mixing line between the terrestrial component and the *s*-process endmember defined by a nucleosynthetic model [4]. By contrast, the data for carbonaceous chondrites [2] and IVB irons examined in this study are plotted on the mixing line between the terrestrial component and the data for presolar SiC. The distinctive trends for non-carbonaceous meteorites imply that multiple nucleosynthetic components other than presolar SiC have contributed to non-carbonaceous meteorites, and that the assemblage of presolar materials in the source materials for carbonaceous chondrites and non-carbonaceous meteorites are different from each other. This is most likely caused by the spatial difference of individual reservoirs, rather than the difference of their formation ages. One possible scenario is that thermal processing acted differently on the early Solar System materials dependent on the distance from the young sun and the oxidized conditions in each reservoir. Alternatively, injection of a nearby supernova and subsequent size sorting of grains containing nuclides synthesized by the *r*-process and *p*-process might have produced the distinctive trends.

[1] Warren, P. H. (2011) *EPSL*, **311**, 93. [2] Burkhardt C. et al. (2011) *EPSL*, **312**, 390. [3] Nagai and Yokoyama (2016) *JAAS*, in press. [4] Bisterzo et al.(2014) *ApJ*, **787**, 10.