

Neodymium nucleosynthetic anomalies in chondrites, the end of the story?

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While the discrepancy between the Earth and chondrites for the ¹⁴²Nd systematics has been well-documented since 2005 [1], understanding its origin has proven to be more complicated. The identification of small variations in nucleosynthetic processes (rapid or slow) within Nd isotopes has been advocated for this difference [2,3], and after correction of those nucleosynthetic excess or deficit, the Earth has a chondritic composition in ¹⁴²Nd. Amongst chondrites, enstatite chondrites (EC) are particularly interesting as they share many isotope characteristics with Earth, even though their composition in major elements cannot be reconciled with the bulk composition of the Earth.

Here we combine forty (mainly) Antarctic enstatite and ordinary chondrites for high-precision multi-static Nd measurements to further investigate this issue. No systematic variation has been observed between groups or petrological types. As previously observed, ordinary chondrites (OC) are statistically different from Earth in $\mu^{145}\text{Nd}$ and $\mu^{148}\text{Nd}$, while EC are indistinguishable from terrestrial values for those isotopes. Analytical error on $\mu^{150}\text{Nd}$ precludes firm interpretation. On the other hand, both EC and OC share a similar $\mu^{142}\text{Nd}$ value of -15 ± 5 and -15 ± 12 respectively. Reconciling a discrepancy in ¹⁴⁵Nd and ¹⁴⁸Nd between OC and Earth-EC on one side, with a discrepancy in ¹⁴²Nd between EC-OC and Earth on the other side, cannot solely be related to s-process nucleosynthetic anomaly. Preliminary Lu-Hf data on the same samples indicate a petrological type effect on the Lu/Hf ratio, not entirely correlated to ¹⁷⁶Hf/¹⁷⁷Hf, possibly related to metamorphism [4]. On the other hand, $\mu^{178}\text{Hf}$ and $\mu^{180}\text{Hf}$, mainly related to s-process, do not show any deviation compared to terrestrial values. A careful use of ¹⁴⁸Nd and ¹⁵⁰Nd values is advocated here, especially in traditional analytical schemes.

[1] Boyet and Carlson (2005), *Science* 309, 576-581; [2] Bouvier and Boyet (2016), *Nature* 357, 399-402; [3] Burkhardt et al., (2016), *Nature* 537, 394-398; [4] Debaille et al., (2017), *EPSL* 473, 52-61.