# Earth's higher-than-chondritic $^{142}$Nd is not due to early global silicate differentiation

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A fundamental assumption in Earth Sciences states that the isotopic composition and relative abundances of refractory elements in the bulk Earth are the same as in chondritic meteorites. This 'chondritic Earth' paradigm is the basis for using radiogenic isotope systems and partitioning studies to investigate the differentiation of planets into crust, mantle, and core.

The accessible silicate Earth exhibits a ~20 ppm excess in $^{142}$Nd compared to most chondrites analyzed so far [1, 2]. Thus, if the bulk Earth is characterized by chondritic Sm/Nd *and* $^{142}$Nd/$^{144}$Nd ratios, then this $^{142}$Nd difference must reflect $^{146}$Sm-decay and a higher-than-chondritic Sm/Nd in the accessible silicate Earth. Mass balance then requires the existence of a complementary reservoir characterized by a lower-than-chondritic Sm/Nd. This enriched reservoir must have been isolated from the accessible silicate Earth within the first 30 My of the solar system, either by sequestration to the deep Earth [1] or by loss to space through collisional erosion [3]. As to whether this reservoir existed and whether or not it has been lost from Earth has tremendous implications for our fundamental understanding of the Earth, not only for constraining the timescales of mantle differentiation and mantle mixing, but also for determining the Earth's bulk composition, heat content and structure [3, 4].

Here we show by high-precison Nd and Sm isotope measurements of a comprehensive set of chondrites that the $^{142}$Nd excess of the accessible Earth compared to chondrites results from Earth's accretion from precursor bodies enriched in Nd produced by the *s*-process of nucleosynthesis. After correction for this effect, the $^{142}$Nd/$^{144}$Nd of chondrites and the accessible Earth are indistinguishable to within ~5 parts per million. This obviates the need for a hidden reservoir or collisional erosion of early-formed crust, and implies a chondritic Sm/Nd ratio, bulk composition and heat budget for the present-day bulk Earth.

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