Ga isotopes in terrestrial and meteoritical samples

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Gallium is abnormally enriched in the mantle compared to other moderately siderophile elements and its abundance follow the volatile depletion trend [1]. Therefore it is usually assumed there must be little or no Ga in the core (e.g. [2]). Experimental data suggest that some Ga could indeed have partitioned into the core [3] and therefore the origin of this over-abundance of Ga in the silicate Earth is still puzzling.

Samples were analyzed using a Thermo-Fisher Neptune Plus multi-collector inductively-coupled-plasma mass-spectrometer (MC-ICP-MS). We developed an ion-exchange chromatography protocol to extract and purify 100% of the Ga. This leads to reliable δ^{71}Ga (^{71}Ga/^{69}Ga permil deviation from a standard) analysis with a precision around 0.06‰ (2SE). We measured various terrestrial samples (OIB, basalts, granite, marine sediment, andesite), 2 carbonaceous chondrites (Allende (CV) and Murchison (CM)), 4 ordinary chondrites, and 2 enstatite chondrites.

Terrestrial samples have a narrow range of isotopic composition with statistically similar values (average δ^{71}Ga = 0.01 ‰, 2SE = 0.05, n = 14 Ga isotopic standard used here is a in-house solution). The chondrite average (carbonaceous, ordinary, enstatite) δ^{71}Ga = -0.27‰ (2SE = 0.14, n = 3) is isotopically lighter than the Earth.

There is a clear difference between the Ga isotope composition of chondrites and of the terrestrial samples. If the Earth was formed from chondritic material, then the bulk Earth should have the same composition as the chondritic average. Several mechanisms that could explain this difference will be investigated: Ga isotope fractionation during mantle-core formation and evaporation. Although our results are preliminary, isotopic fraction during metal/silicate partitioning seem to be the most likely processes. However, a combination of both processes is also possible.

[1] McDonough W. F. 2001. In *Earthquake Thermodynamics and Phase Transformation in the Earth's Interior*. p. 16. [2] McDonough W. F. 2003. In *Treatise on Geochemistry*. p. 559. [3] Blanchard I. *et al*. 2012. Abstract #V51B-2777, *45th American Geophysical Union Conference*.