The controversy on the bulk Sm/Nd of the Moon

A.D. BRANDON

NASA-Johnson Space Center, Houston, USA (alan.d.brandon@nasa.gov)

Recent $^{142}Nd/^{144}Nd$ data with precisions of ±3 to 7 ppm (2σ) on chondrites and planetary materials provide a refined tracking of the fractionation between Sm and Nd during early differentiation in terrestrial planets and small bodies, and may record differences in the bulk Sm/Nd and nucleosynthetic components that make up these materials. An emerging observation is that the present-day $^{142}Nd/^{144}Nd$ average for bulk chondrites is approximately 20 ppm lower than samples derived from Earth's convecting mantle. This may result from differences is the bulk Sm/Nd between chondrites and Earth, or mean that material in Earth with a lower Sm/Nd formed early in its differentiation history and has remained at least in part, isolated from convection to present. In the latter case, this missing reservoir may balance the Earth to have a bulk Sm/Nd of average chondrites.

Because the Moon likely accreted from melt and vapor ejected during a cataclysmic collision between Proto-Earth and a Mars-sized impactor very early in solar system history, it provides clues to the bulk composition of the Earth. To date, two different labs, DTM-CIW [1], and NASA-JSC [2], have measured Moon rocks for high-precision $^{142}Nd/^{144}Nd$. The DTM group reported that their data showed that the bulk Moon likely had a bulk Sm/Nd similar to the present-day Earth's convecting mantle, while the JSC group interpreted their data to reflect a bulk Sm/Nd for the Moon that is similar to average chondrites. Both interpretations in part depend on corrections to Nd isotopes resulting from neutron fluence. When the DTM data are broken into two suites, one measured in static mode, the other measured in multidynamic mode, and these are compared to the JSC data measured in static mode, and nuetron fluence corrections are made in accordance with the JSC approach, two of the datasets are identical - the JSC static and DTM multidynamic, while the DTM static data remain distinct. The two identical datasets yield a bulk Sm/Nd for the Moon that is indistinguishable from average chondrites, with all of the implications such an interpretation entails. New cups were installed on the JSC Triton in February, 2008. Multidynamic measurements for Nd isotopes on the same Moon rocks will be presented that will address this important controversy.

[1] Boyet, M. & Carlson, R. (2007) *Earth Planet. Sci. Lett.* **262**, 505-516. [2] Rankenburg, K., Brandon, A.D. & Neal, C.R. (2006) *Science* **312**, 1369-1372.

Lithium isotopes provide new insights into oceanic hydrothermal systems

C. BRANT*, L.A. COOGAN AND K. GILLIS

School of Earth and Ocean Science, University of Victoria, Canada (*correspondence: lithiumocean@gmail.com)

The large difference in the Lithium isotopic ratio of mid ocean ridge basalt (~4‰) and seawater (~32‰) makes Li isotopes attractive tracers of fluid rock interaction in oceanic crust. Li can provide new constraints on both high and low temperature hydrothermal processes, however the global data set is still very limited. Samples from Hess Deep, a tectonic window, exposing ~1Ma *in situ* oceanic crust, were analysed. Lavas are petrographically fresh with only minor alteration to clay minerals. Comparison of the Li/Y ratio of Hess Deep lavas to fresh glass from the EPR reveals the lavas to have been leached, having a decreased Li concentration and isotopically slightly enriched (~5 to 7 ‰). The dikes at Hess Deep are variably altered with chlorite or amphibole as the dominant secondary phases. The dikes have lost even more Li than the lavas, and most samples are isotopically enriched (~6 to 10 ‰). The isotopic enrichment can be explained by the interaction of seawater and basalt, with the final isotopic ratio lying in between the two end members. The leaching of Li from both the lavas and dikes is indicative of ubiquitous early high temperature (>150 °C) hydrothermal reactions in which Li is removed from the crust. During low temperature alteration off-axis, the growth of clay minerals which take up Li from seawater, increases the Li concentration of lavas, masking the early leaching revealed at Hess Deep. Greater extents of axial high-temperature hydrothermal circulation explains the greater Li depletion in the sheeted dike complex.