BA ISOTOPE ABUNDANCES IN BULK METEORITE SAMPLES

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Introduction: Primitive meteorites (whole-rock composition), and their individual constituents show significant variations in isotopic composition of many elements (e.g., Ca, Ti, Ba, Nd, Sm). The solar system formed from a mixture of debris from several nucleosynthetic sources. The range of isotopic variations in bulk samples constrains the dynamical mixing and processing of various dust sources in the solar nebula. A consequence of this variation at measurable levels would require us to construct individual isochrons for radiogenic systems for planetary bodies like Vesta and Earth with "common" or different initial ratios. Planetary evolution models based on the shifts in isotopic ratios due to radioactive decay are strongly dependent on the initial isotopic state and a ''bulk solar'' value that need to be carefully assessed. How do the Nd isotopic compositions of various meteorite samples reflect the composition of the bulk Earth? [e.g., 1-3].

We have developed and tested analytical procedures and techniques in our laboratory to isolate pure fractions of Ba, Nd and Sm from single aliquots of rock samples. We have measured Nd, and Ba isotopic composition in terrestrial rock standards USGS BCR-2 and synthetic mono-element standards such JNDi-1 and Ba-Std (Alfa Aesar). The Nd isotopic composition of JNdi and BCR-2 for ^{142}Nd agrees within ±12ppm external precision [4]. We have recently developed protocols for measurement of Ba isotopes (134, 135,136, 137 and 138) using Isoprobe-T TIMS in a 4 sequence multi-dynamic mode. We have used ^{134}Ba/^{136}Ba for mass fractionation correction. Initial measurements do not include ^{132}Ba (low abundance) because low mass detector L3 was equipped with 10^{10} resistor suitable for high signal strength (^{40}Ca). The results for ^{135}Ba/^{136}Ba, ^{137}Ba/^{136}Ba, and ^{138}Ba/^{136}Ba isotopic ratios have internal precision ($2\sigma_m$) of less than 8ppm. Single analysis of Ba isotopes from a whole-rock sample of non-cumulate eucrite Piplia Kalan gave us values for Ba isotopes which are indistinguishable from terrestrial standard. Our results suggest that on a planetary scale (eucrite parent body (EPB) and Earth) Ba isotopes do not r, s and p process variations. The lack of excess ^{135}Ba (due to decay of ^{135}Cs, half-life ~ 2.5Ma)) in Piplia Kalan suggests that eucrite parent body crystallized much after ^{135}Cs had decayed or the abundance of this radionuclide was insufficient for any measurable trace. Since Piplia Kalan records the presence of ^{26}Al (half-life ~0.7 Ma), a short-lived radionuclide with half-life at least 3 times less ^{135}Cs, it suggests that ^{135}Cs was not present in Piplia Kalan in insufficient abundance to result in ^{135}Ba excess. The reasons for this could be at least two fold: a) Deficit in this alkali element at the time of formation of PK because of geochemical and geothermal conditions favor the escape of Cs from the planet or sequestration of this Cs in a hidden reservoir in the planet not sampled so far. Our sample set includes Dhajala (3.8H chondrite), Murchison (CM) and Tagish Lake. Work on these samples is in progress.

References: [1] Carlson R. et al. 2007. *Science* 316: 1175 [2] Andreasan R. and Sharma M. 2007. *Astrophysical Journal* 665: 874 [4] Bermingham K.R. and Mezgar K. 2010. *Lunar Planetary Science* Abstract # 1735 [4] Ali A. and Srinivasan G. 2009. *Eos Trans. AGU, 90(22), Joint Assembly Supplement* Abstract # V31B-27.