Sr and Ba nucleosynthetic anomalies in meteorites

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A common feature of all terrestrial planets and most meteorites is their significant depletion in volatile and moderately volatile elements compared to the solar composition. Several hypotheses have been proposed to account for this depletion. Volatile loss can occur through partial condensation of the nebular material due to removal of the vapor phase prior to further cooling of the protoplanetary disk. Alternatively, volatile elements were lost due to evaporation by heating of the solids. A third possibility is that large impacts could lead to loss of a vapor phase containing moderately volatile elements. Volatile depletion induces elemental fractionation with refractory elements and in this study we aim at coupling the radioactive chronometers ^{87}Rb-^{87}Sr and ^{135}Cs-^{135}Ba to determine the timescale of volatile depletion.

In this study, we developed a new protocol for high-precision isotopic measurements of Sr, and Ba by thermal ionization mass spectrometry. Our method allows the separation and purification of both elements from the same aliquot. Repeated measurements of the Sr isotopic standard NBS987 yield ^{87}Sr/^{86}Sr = 0.710246 ± 4 ppm (2 SD) in multidynamic mode. For Ba we achieved a precision of 85 ppm for the low abundance p-process ^{130}Ba and ^{132}Ba in static mode, and 9 ppm for ^{135}Ba in multidynamic mode on a standard solution, within the range of published data [1].

Previous studies reported a ~-23 ppm deviation in ^{84}Sr for terrestrial samples relative to the standard [2] [3]. Our measurements of terrestrial samples are identical to the NBS987 standard within error, in agreement with [4]. Preliminary results show that ordinary chondrites do not show any nucleosynthetic anomaly in ε^{84}Sr. More measurements will be carried out to search for anomalies in other objets from the early solar system.

[1] Bermingham et al., 2014, *GCA*, **133**, 463. [2] Moynier et al., 2012, *ApJ.*, **758**, 45. [3] Paton et al., 2013, *ApJ Lett*, **763**, 40. [4] Hans et al., 2013, *EPSL*, **374**, 204.