Nucleosynthetic tin isotope variations in chondrites

M. FRIEBEL[1*], M. SCHÖNBÄCHLER[1], M.A. FEHR[1], E. R. TOTH[1]

[1]Institute of Geochemistry and Petrology, ETH Zürich, Switzerland (*correspondence: friebel@erdw.ethz.ch)

Nucleosynthetic isotope variations in bulk meteorites have been reported for various refractory elements including Zr and Mo [e.g. 1]. In contrast, studies of moderately volatile elements do not reveal such variations [e.g. 2]. A recent study [3], however, suggested that the moderately volatile element Zn exhibits small, but resolvable nucleosynthetic variations. With ten stable isotopes of different nucleosynthetic origin and a similar 50% condensation temperature to that of Zn (704 K and 726 K), Sn is an ideal candidate for investigating nucleosynthetic isotope heterogeneities, thereby providing constraints on solar nebula conditions.

In this study, bulk carbonaceous and enstatite chondrites, as well as acid leach fractions of Jbilet Winselwan (CM) were measured for their Sn isotope composition. Tin was purified using a two-stage ion chromatography. Its isotopic composition was analysed with a NU-Plasma II MC-ICP-MS coupled to DSN-100, allowing for static analysis of all Sn isotopes. The daily external reproducibility (2 sd) of a 200 ppb Sn standard solution (NIST 3161a) was typically ±11 ppm for $^{118}Sn/^{120}Sn$ and ±31 ppm for $^{124}Sn/^{120}Sn$. Bulk analyses of two CM (Murchison and Jbilet Winselwan) and one CR (GRA06100) chondrite exhibit small negative deviations from the terrestrial Sn standard in $^{124}Sn/^{120}Sn$. Leachates of Jbilet Winselwan revealed larger and better resolved positive offsets in $\varepsilon^{124}Sn$ for the first leach fractions, whereas the last leach step displays a negative $\varepsilon^{124}Sn$ value. Smaller variations are observed for other Sn isotopes, including ^{117}Sn and ^{122}Sn. The isotopic pattern of the last leach fraction (acid-resistant residue) resembles the modelled pattern of an s-process excess (similar to the pattern for the bulk CM chondrites), while the first leach step is consistent with an s-process deficit. This indicates the dissolution of an anomalous Sn carrier in the acid-resistant residue. It is reminiscent of similar patterns observed, e.g., for Zr isotopes in carbonaceous chondrites, which were at least partly attributed to refractory presolar silicon carbide (SiC) grains in the acid-resistant residue [1]. Tin is unlikely to be abundant in SiC grains, but could be present in sulphide inclusions [4]. The heterogeneous distribution of such an Sn carrier may explain the observed variations in $\varepsilon^{124}Sn$ between the different bulk chondrites.

[1] Schönbächler et al. (2005), *GCA* **69**, 5113 [2] Fehr et al. (2005) ***GCA*** 69, 5099 [3] Savage et al (2014) ***MAPS*** 49, A356 [4] Hynes et al. (2011) **LPSC** 42, A2332