A renewed search for extant ^{126}Sn: Te isotopics of Allende CAIs obtained by HG-ICPMS

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The first solids that formed in our Solar System, calcium–aluminum-rich inclusions (CAIs), provide abundant evidence for the presence of short-lived radionuclides at their time of formation. However, most of these radionuclides can be produced by different processes in different settings, and therefore do not necessitate injection by a nearby supernova. In contrast, ^{126}Sn (which decays to ^{126}Te with a half-life of ≈235,000 years) is produced exclusively by *r*-process nucleosynthesis in supernovae [1] [2]; thus, evidence of extant ^{126}Sn in early Solar System materials would provide unequivocal evidence for supernova injection into the forming Solar System. Such evidence of ^{126}Sn would be derived from an excess of its daughter product, ^{126}Te, relative to chondritic abundance. In this work, we investigate the Te isotopics of Allende CAIs using a novel method of measurement that achieves considerably higher precision than previous studies.

Instrumental sensitivity for elements that readily form a hydride, such as Te, can be significantly increased by introducing the sample as a hydride gas to the ICPMS [3]. By coupling a CETAC HGX-200TM to a Neptune MC-ICPMS at ASU, we have increased the useful ion yield of Te by 8× and our overall precision by more than 30× when compared with measurement of Te isotopes using traditional solution MC-ICPMS. We report external reproducibilities (2SD) of ±35 ppm (^{122}Te/^{128}Te), ±29 ppm (^{124}Te/^{128}Te), ±10 ppm (^{126}Te/^{128}Te), and ±14 ppm (^{130}Te/^{128}Te) while consuming <10 ng Te per analysis.

The measurement of 11 Allende CAIs spanning a large range of ^{124}Sn/^{128}Te ratios (0.4 to 10.0) has revealed no resolved isotopic variation from terrestrial standards. This result indicates that either: 1) there was no input of *r*-process material within a few Ma prior to CAI formation, or, more likely, 2) there was no live ^{126}Sn present at the time of the alteration event that equilibrated Te isotopes in Allende CAIs. Further study of unaltered CAIs is required to differentiate between these two possibilities.

[1] Qian et al. (1998) *ApJ*, **506**, 868. [2] Fehr et al. (2009) *MAPS*, **44**, 971. [3] Forrest et al. (2009) *Geostand. Geoanal. Res.*, **33**, 261.