

TUNGSTEN ISOTOPIC COMPOSITIONS IN PRESOLAR SILICON CARBIDE GRAINS.

J. N. Avila¹, T. R. Ireland¹, P. Holden¹, F. Gyngard², V. Bennett¹, S. Amari², E. Zinner². ¹Research School of Earth Sciences and Planetary Science Institute, The Australian National University, Canberra ACT 0200, Australia. ²Laboratory for Space Sciences and Physics Department, Washington University, St. Louis, MO 63130, USA. Corresponding author: janaina.avila@anu.edu.au

Introduction: The *s*-process nucleosynthesis in the Hf-Ta-W-Re-Os path has received considerable attention lately. New neutron capture cross sections for ^{174,176,177,178,179,180,182}Hf, ¹⁸⁵W and ^{186,187,188}Os have been reported [1-4], and small anomalies in W and Os isotopes have been observed in primitive meteorites [5-7]. However, as suggested by [2; 3], model calculations for *s*-processes nucleosynthesis appear to underestimate ¹⁸²W and overestimate ¹⁸⁶Os, and this may have implications for the ¹⁸²Hf-¹⁸²W and ¹⁸⁷Re-¹⁸⁷Os chronometers. Tungsten isotopes are particularly important because they are affected by several branching points (¹⁸²Ta, ^{181,182}Hf, and ¹⁸⁵W), which also affect Re and Os isotopes. Here we report, for the first time, W isotopic measurements in presolar SiC grains in order to provide additional constraints on *s*-process nucleosynthesis.

Experimental: ^{182,183,184,186}W and ¹⁸⁰Hf were measured with SHRIMP RG at ANU in an aggregate of presolar SiC grains (KJB fraction) extracted from the Murchison meteorite [8]. Tungsten isotopes were measured as WO⁺ ions, which have a higher yield than the atomic species (WO⁺/W⁺ ~ 3). An O⁻ primary ion beam of 5 nA was focused to sputter an area of 20 μm in diameter. SHRIMP RG was operated at a mass resolving power of m/Δm= 5000 (at 1% peak). At this level, isobaric interferences were well resolved from the WO⁺ species. NIST silicate glasses and synthetic SiC were used to monitor instrumental mass fractionation and isobaric interferences.

Results and Discussion: The W isotopic compositions are anomalous in comparison to those observed in normal solar system materials. The SiC grains appear to be enriched in ¹⁸²W and ¹⁸⁴W relative to ¹⁸³W, as expected for *s*-process nucleosynthesis in AGB stars [e.g. 5]. However, an unexpected enrichment in ¹⁸⁶W is observed. The low ¹⁸⁰Hf/¹⁸³W ratios determined here imply a low contribution from radiogenic ¹⁸²W after SiC condensation, otherwise the ¹⁸²W excesses would be even higher. The observed enrichment in ¹⁸⁶W requires the activation of the ¹⁸⁵W branching point during AGB thermal pulses, when marginal activation of the ²²Ne(α ,n)²⁵Mg source produces neutron densities as high as N_n= 5 x 10⁹ neutrons cm⁻³ [9], bypassing ¹⁸⁶Os. This result is in disagreement with ⁹⁶Zr depletions in SiC grains that indicate that the ²²Ne(α ,n)²⁵Mg source was weak in their parent stars.

Production and destruction of W isotopes by cosmic rays still need to be investigated, especially for samples, such as presolar grains, exposed for a long time to galactic cosmic radiation.

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