A new decay constant for ^{184}Os and evidence for p-process heterogeneity of ^{180}W in iron meteorites

D. L. COOK[1*], T. SMITH[2], I. LEYA[2], C. HILTON[3], R. J. WALKER[3], AND M. SCHÖNBÄCHLER[1]

[1] Institute for Geochemistry and Petrology, ETH Zürich, Clausiusstrasse 25, 8092 Zürich, Switzerland (*correspondence: david.cook@erdw.ethz.ch)
[2] Space Science and Planetology, University of Bern, Sidlerstrasse 5, 3012 Bern, Switzerland
[3] Department of Geology, University of Maryland, 8000 Regents Dr., College Park, MD 20742

Introduction: Variations in ^{180}W occur in iron meteorites from a wide range of magmatic groups; however, their origin is debated. Excess ^{180}W has been ascribed to *p*-process heterogeneity in the nebula [1], radioactive decay of ^{184}Os [2], and spallogenic production from exposure to galactic cosmic rays (GCR) [3]. Five IIAB irons were chosen from different positions in the crystallization sequence [4] to determine the magnitude of the relative contributions to ^{180}W excesses from the various proposed sources.

Methods: Tungsten isotopes were measured by MC-ICPMS at ETH Zürich [5]. Noble gases were measured at the University of Bern [6]; cosmogenic radionuclide analyses were carried out at the DREAMS facility in Dresden [7]. Trace element concentrations were determined at the University of Maryland [8]. The model for GCR effects on W isotopes [3,9] was improved to include spallation effects from Pt and Ir.

Results and Discussion: CRE ages, based on ^{36}Cl-^{36}Ar, were used with trace element concentrations (Os, Re, Ir, Pt, W), measured ε^{180}W and ε^{182}W values, and our new GCR model to correct ε^{180}W values for effects from neutron capture and spallation reactions. The corrected values correlate with Os/W ratios and define a decay constant for ^{184}Os of $(2.22 \pm 1.10) \times 10^{-14}$ a^{-1}, a value smaller than previously suggested [2,3]. The isochron intercept ($\varepsilon^{180}W_i = 0.64 \pm 0.35$) differs significantly from the terrestrial value and provides the first cogent evidence for *p*-process variability in W isotopes in the early solar system.

References: [1] Schulz et al. (2013), *EPSL* **362**, 246-257. [2] Peters et al. (2014) *EPSL* **391**, 69-76. [3] Cook et al. (2014), *GCA* **140**, 160-176. [4] Wasson et al. (2007), *GCA* **71**, 760-781. [5] Cook & Schönbächler (2016), *JAAS*, 31, 1400-1405. [6] Ammon et al. (2011), *MAPS* **46**, 785-792. [7] Akhmadaliev et al. (2013), *Nucl. Instrum. Methods Phys. Res. B* **294**, 5-10. [8] Walker et al. (2008), *GCA* **72**, 2198-2216. [9] Leya & Masarik (2013), *MAPS* **48**, 665-685.