# EVIDENCE FOR P-PROCESS $^{180}$W HETEROGENEITY IN THE EARLY SOLAR SYSTEM

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**Introduction:** For most elements, in particular for r- and s-process isotopes, the abundances of non-radiogenic isotopes appear to be fairly homogeneous in the early solar system. This is likely to reflect efficient homogenisation of materials in the protoplanetary disk. However, a notably small number of elements are reported to display distinct anomalies, interpreted as being nucleosynthetic [e.g. 1,2]. Due to their low abundances, only few studies so far have measured heavy p-process isotopes [e.g. 3]. The low abundances of these neutron deficient nuclides reflect their particular formation conditions, most likely in Ne/O layers during Type II supernovae [e.g. 4]. Here we present high-precision measurements of the heavy p-process nuclide $^{180}$W in iron meteorites from different groups.

**Samples and analytical techniques:** Samples investigated for this initial study were several groups of magmatic and non-magmatic iron meteorites. Metal from a reduced terrestrial basalt (Dzheltul`skii massive) was also examined. Separation of W was performed by anion exchange using AG 1x8 resin, following a modified elution procedure from [5]. Isotope compositions were measured using the Neptune multicollector ICP-MS at Universität Bonn that is equipped with high sensitivity $10^{12}$ Ohm amplifiers for measuring $^{180}$W and the $^{180}$Hf interference monitor. For multiple measurements of AMES W standard solutions we obtained external reproducibilities of ca. ±80 ppm (2σ r.s.d.) for ca. 200ng of W. Ratios of $^{178}$Hf/$^{183}$W of the meteorite samples were typically below $10^{-5}$, an order of magnitude lower than required for accurate $^{180}$Hf interference corrections.

**Results and Discussion:** For most samples, except the terrestrial metal, clearly resolvable positive anomalies in $\varepsilon^{180}$W from the terrestrial standard value were measured. Notably, significant and systematic abundance variations exist between different groups of iron meteorites, ranging to values as high as +4 to +7 ε-units for magmatic iron meteorites. Conversely, non-magmatic IAB iron meteorites display the smallest $\varepsilon^{180}$W anomalies of ~ +1 ε-unit that are barely resolvable from the terrestrial value. This systematic suggest inefficient mixing of $^{180}$W in the earliest stages of the solar system, at least in the inner solar system region, where iron meteorites are thought to have formed [6]. Our first data appear to indicate that the increasing homogenization of the early solar system is mirrored by increasingly lower $^{180}$W anomalies in younger iron meteorite groups, suggesting mixing-timescales in the order of several million years. Cosmogenic effects due to burnout of $^{180}$W ($\sigma_{th}$=22.6±1.7 barn [7]) would shift the measured anomalies to the terrestrial value (and below) and were observed for the meteorites with the longest exposure ages.

**References:** [1] Andreasen R. and Sharma M. (2006) Science 314, 806-809; [2] Trinquier A. et al. (2007) ApJ 655, 1179-1185; [3] Fehr M.A. et al. (2005) 69, 5099-51112; [4] Woosley S.E. and Howard W.M. (1978) ApJS, 36, 285; [5] Horan M.F. et al. (1998) GCA 62, 545-554; [6] Bottke W.F. et al. (2006) Nature 439, 821-824; [7] Kang et al. (2007) PhR C 76.