Protracted core formation in protoplanets inferred from Hf-W chronometry of iron meteorites

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Dating core segregation in the parent bodies of iron meteorites using ^{182}Hf-^{182}W chronometry is critical for understanding the processes of protoplanet accretion and differentiation in the solar protoplanetary disk. We report 5-20 parts-per-million (ppm) variations in relative ^{182}W abundances between five different magmatic iron meteorite groups, corresponding to core formation ages of ~0.7-2 Myr after formation of Ca-Al-rich inclusions (CAI). The ^{182}W variations are inversely correlated with the inferred S concentrations of the parental metal melts of the iron meteorites, indicating that the differences in core formation ages reflect variations in the average melting temperatures of metal, which are controlled by their S contents [1]. We conclude that core formation in protoplanets most likely was a protracted process involving two main metal segregation steps that were separated in temperature by several hundred degrees [2], and as shown here, also distinct in time by ~1 Myr. Regardless of differences in the time of core formation, the parent bodies of the IIAB, IIIAB and IVA irons, and probably also those of the IID and IVB irons, seem to have accreted in a narrow time interval between ~0.2-0.7 Myr after CAI formation.

[1] Fei, Y et al. (1997) *Science 275,* 1621-1623. [2] Kracher, A. & Wasson J.T. (1982) *Geochim. Cosmochim. Acta. 46,* 2419-2426.