PALLADIUM-SILVER CHRONOMETRY OF IIA IRON METEORITES

M. Schönbächler[1], R.W. Carlson[2] and K.J. Theis[1]. [1]School of Earth, Atmospheric and Environmental Sciences, University of Manchester, Oxford Road, Manchester M13 9PL, UK. (m.schonbachler@manchester.ac.uk). [2]Department of Terrestrial Magnetism, Carnegie Institution of Washington, Washington, DC 20015, USA.

Introduction: The IIAB iron meteorites display distinct fractionation patterns in various element concentrations and are thus generally believed to have formed as a result of fractional crystallization from a metallic liquid that coalesced as an asteroidal core. Pt-Re-Os systematics date the crystallization of the IIAB metal phase to 4546 ± 46 Ma [1]. The extinct ^{107}Pd-^{107}Ag decay system is another chronometer that can provide further and potentially more precise constraints on the timing of core crystallization due to the relatively short half-life of 6.5 million years. The chronometer has already been successfully applied to iron meteorites. For example, an internal metal isochron determined by TIMS for the IVA iron meteorite Gibeon yielded an initial ^{107}Pd/^{108}Pd ratio of 2.5 x 10^{-5} [2]. Using the initial ^{107}Pd/^{108}Pd ratio of the solar system obtained from carbonaceous chondrites, a Pd-Ag age of 8.5 (+3.2/-4.6) Ma after solar system formation can be obtained [3]. In this study, we apply the Pd-Ag chronometer to IIA iron meteorites in order to further constrain the crystallization history of these meteorites.

Analytical techniques: The Ag isotope compositions of four IIA iron meteorite samples (Negrillos, Murphy, Coahuila and North Chile) were measured by MC-ICPMS. The low Ag content (ppb level) of these samples required the processing of relatively large sample amounts (up to 18 g). The Pd/Ag ratios were obtained by isotope dilution on the same sample aliquot.

Results: All analyzed IIA iron meteorites (except North Chile) show a linear correlation between Ag isotope compositions and Pd/Ag ratios. The Pd-Ag data point for the IIA iron Coahuila reported by [2] also falls on this correlation line, which has a slope that corresponds to an initial ^{107}Pd/^{108}Pd of 2.28 (±0.39) x 10^{-5}. This yields an age of 8.9 (+4.7/-5.9) Ma after solar system formation, indicating the time when IIA metal reached closure temperature for the Pd-Ag system. Notably, the two North Chile data points available so far (determined in this study for Filomena and by [2] for Tocopilla) plot below the correlation line defined by the other IIA irons. This indicates that North Chile is either (i) a few million years younger than the other analyzed IIA samples or (ii) has disturbed Pd-Ag systematics.

References: [1] Cook D. L et al. 2004. *Geochimica et Cosmochimica Acta* 68: 1413–1431. [2] Chen J. H. and Wasserburg G. J. 1996. in Earth Processes: Reading the Isotopic Code, Geophysics Monograph ’95, pp. 1-20. [3] Schönbächler M. et al. 2008. *Geochimica et Cosmochimica Acta, 72,* 5330-5341.