COSMIC-RAY EXPOSURE HISTORIES OF PALLASITES

L. Huber[1], D.L. Cook[2,3], G.F. Herzog[2], M. Cosarinsky[1], I. Leya[1]. [1]University of Bern, Space Research & Planetary Sciences, Switzerland. E-mail: liliane.huber@space.unibe.ch [2]Rutgers University, Piscataway, NJ, USA, [3]University of Oxford, Oxford, UK.

Introduction: Pallasites are stony-iron meteorites that are considered to have originated in the core-mantle boundary of differentiated parent bodies [e.g., 1]. Noble gases in pallasites are interesting for several reasons: *First*, solar noble gases have been found in some samples of Brenham olivines [2,3]. How the solar gases survived melting and differentiation remains unknown. *Second*, few studies on cosmic-ray exposure (CRE) ages of pallasites incorporate modern production rates and/or proper shielding corrections. The few studies performed so far indicate that the CRE ages for pallasites are comparable to the CRE ages for mesosiderites [e.g., 4]. *Third*, pallasites can help to validate model calculations of cosmogenic production rates. Reliable model calculations exist for iron meteorites [5] and ordinary and carbonaceous chondrites [6]. By using data from pallasites together with those from mesosiderites [e.g., 7] we can test the model predictions for a high-iron matrix.

Samples: We measured the activities of the cosmogenic radionuclides ^{10}Be and ^{36}Cl as well as the concentrations and isotopic compositions of He, Ne, and Ar in metal separates of the pallasites Admire, Ahumada, Albin, Brenham, Eagle Station, Esquel, Finmarken, Glorieta Mountain, Huckitta, Imilac, Krasnojarsk, Molong, South Bend, and Springwater.

Results: The noble gas blanks, which are crucial for the study of metal samples, are low (i.e., less than a few percent for ^{3,4}He, ^{21,22}Ne, and ^{36,38}Ar). The Ne and Ar data are almost purely cosmogenic, with ^{36}Ar/^{38}Ar ratios as low as 0.60. Only very minor corrections (4% at most, normally less than 1%) are necessary for trapped gases and/or impurities. The measured ^{38}Ar concentrations range from 0.3×10^{-8} to 9×10^{-8} cm^{3}STP/g. There was no indication of trapped solar gases in the iron phase or the measured olivines. The ^{10}Be and ^{36}Cl activities range from ≈ 0.1-4.3 dpm/kg and 0.1-18.8 dpm/kg, respectively.

The cosmogenic nuclides systematics obtained here for pallasites are very similar to the cosmogenic nuclide systematics for iron meteorites. The cosmic-ray exposure ages, which have been obtained using three different approaches, range from a few million years (Krasnojarsk) up to about 1 billion years (Eagle Station) with a cluster around 150Ma. Some of the ages, in particular Eagle Station disagree with literature data obtained using the K-Ar system [8]. At the conference we will present detailed results and discuss their implications.

References: [1] Mittlefehldt D.W., McCoy T.J., Goodrich C.A., Kracher A. 1998 *Planetary Materials. Rev. in Mineralogy 36.* [2] Mathew K.W. and Begemann F. 1997. *Journal of Geophysical Research 102*:11015–11026. [3] Nagao K. and Miura Y.N. 1994 *Meteoritics & Planetary Science* 29 (Abstract). [4] Herzog G.F. 2003 *Treatise on Geochemistry 1:347-380*. [5] Ammon K., Masarik J., and Leya I. 2009. *Meteoritics & Planetary Science 44:485-503* [6] Leya I. and Masarik J. 2009 *Meteoritics & Planetary Science* 7:1061-1086 [7] Albrecht et al., 2000. *Meteoritics & Planetary Science* 35:975. [8] Megrue G.H. 1968. *Journal of Geophysical Research* 73:2027-2033.