EXPOSURE AGES OF IAB IRONS: IMPLICATIONS FOR THE FORMATION AND COLLISIONAL HISTORY OF THE IAB PARENT BODY.

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Introduction: Following a study to unravel the formation history of the IAB parent body by Ar-Ar thermochronology [1], we now investigate its later collisional history and try to answer the question about potential irradiation of IAB silicates prior to their mixing with liquid metal. We therefore determined ^{3}He, ^{21}Ne, and ^{38}Ar exposure ages for the metal phases and silicate inclusions of Caddo County, Landes, and Ocotillo using a new set of model calculations, which are consistent for iron and stony meteorites [2] and thus allow a direct comparison of metal and silicate ages.

Methods: We analyzed He, Ne, and Ar in metal samples and olivine separates from adjacent silicate inclusions. The chemical compositions of the samples were determined by SEM and electron microprobe. We calculated for all samples endmember exposure ages assuming irradiation in a pure iron meteorite matrix on the one hand and in ordinary chondrite matrix on the other. The IAB bulk chemistry and thus the "true" exposure ages lie in between those endmembers. Minimum preatmospheric radii were estimated using the recovered weights of the meteorites and measured ^{4}He/^{21}Ne in metal samples. These radii are at least ~20 cm for Caddo and Landes, and at least ~30 cm for Ocotillo.

Results and Discussion: Exposure ages determined from ^{3}He, ^{21}Ne and ^{38}Ar in metal agree excellently and are ~2 Ma for Caddo County, ~200 Ma for Landes, and ~600 Ma for Ocotillo. Substantial production rate variations due to variations in shielding are only expected for Ocotillo.

He-3 exposure ages for Caddo County olivines are slightly higher than the metal ages, while metal and olivine ^{21}Ne ages are in good agreement. In contrast, ^{3}He and ^{21}Ne exposure ages for Landes and Ocotillo olivines are significantly lower than the respective metal ages. Thus, loss of cosmogenic He and Ne from olivine is probably an issue for these samples. Ar-38 exposure ages for olivines from all three meteorites are significantly higher than the respective metal ages. This is attributed to contamination of the olivine separates used for noble gas analysis with clinopyroxene adding a significant amount of Ca to the samples. However, also uncertainties in the ^{38}Ar production rates from Ca cannot be excluded.

Conclusions and Outlook: (1) Consistent ^{3}He, ^{21}Ne, and ^{38}Ar exposure ages were obtained for IAB metal. (2) Most exposure ages determined for IAB silicates suffer from noble gas loss and/ or the fact that sample chemistry and noble gas analyses are - unlike for cosmogenic radionuclides – not determined on the same aliquot. (3) The three investigated meteorites have very different exposure ages and thus were ejected from the IAB parent body in different collisional events. The last of these collisions must have occurred only few Ma ago. (4) Due to the extremely low exposure age of Caddo County, a significant preirradiation of its silicates compared to the metal phase should easily be detectable, but can be excluded based on our data.

We anticipate to present noble gas exposure ages for several further IAB irons at the conference.

References: [1] Vogel N. and Renne P.R. 2008. *Geochimica et Cosmochimica Acta* 72: 1231-1255. [2] Ammon K. and Leya I. 2008. *Meteoritics and Planetary Science*: in press.