AR-AR AGE OF SHERGOTTITE DHOFAR 378: FORMATION OR EARLY SHOCK EVENT?

J. Park[1] and D. D. Bogard[1], [1]ARES code KR, NASA Johnson Space Center, Houston TX 77058. jisun.park1@jsc.nasa.gov

Introduction: Martian shergottite Dhofar 378 (Dho378) is from Oman, weighs 15 g, and possesses a black fusion crust [1]. The plagioclase in other shergottites has been converted to maskelenite by shock, but Dho378 experienced even more intense shock heating, estimated at 55-75 GPa [2]. Dho378 plagioclase (~43 modal %) melted, partially flowed and vesiculated, and then partially recrystallized [3]. Here we report ^{39}Ar-^{40}Ar dating of K-enriched phases of Dho378. We suggest that the determined age may date the intense shock heating event this meteorite experienced, but not the later impact that initiated the CRE age.

Ar-Ar Results: The ^{39}Ar-^{40}Ar data for 16 stepwise temperature extractions of mixed mesostasis plus plagioclase show the following major characteristics. Changes in the K/Ca ratio and in the differential rate of ^{39}Ar release with extraction temperature suggest three distinct, but overlapping Ar diffusion domains: <13%, 13-45%, and >45% cumulative ^{39}Ar release:. The youngest Ar-Ar age, ~162-165 Myr is observed at ~28-40% ^{39}Ar release, which we attribute primarily to the mesostasis. Extractions releasing >45% ^{39}Ar, probably from plagioclase, suggest older Ar-Ar ages and indicate release of trapped martian ^{40}Ar. An isochron plot for 8 extractions, releasing 3-45% of the ^{39}Ar and corrected for $^{36}Ar_{cos}$ using directly measured $^{36}Ar_{cos}$, gives an Ar-Ar age of 143±4 Myr (where the ± ignores the uncertainty in applying a correction for $^{36}Ar_{cos}$). Applying a correction assuming only one-half of the measured $^{36}Ar_{cos}$ gives an age of 159 ±2 Myr. Correcting for cos-^{36}Ar using the minimum measured ^{36}Ar/^{37}Ar ratio gives a minimum possible age of 138±5 Myr. All of these ages are within combined uncertainties of the Sm-Nd age of 157 ±24 Myr [4]. The trapped ^{40}Ar/^{36}Ar ratio obtained from the isochron is largely defined by the highest [K] data.

Conclusion: We suggest that the ~143 Myr Ar-Ar age determined from the Dho378 isochron may not date the impact that ejected the meteorite into space ~3 Myr ago, but a much earlier impact at ~143 Myr. The relationship between the similar Ar-Ar and Sm-Nd ages is not clear. Diffusion data for ^{39}Ar examined in thermal models for post-shock cooling of Dho378 indicate that total loss of ^{40}Ar from the low-temperature phase but only partial loss of trapped ^{40}Ar from the high-T phase are consistent with inferred cooling rates. For the Ar-Ar isochron not to have been reset ~3 Myr ago would seemingly require: 1) the mesostasis was not heated above ~500ºC, in spite of the observation that plagioclase was melted; or 2) K-rich phases heated to melting cooled so rapidly, on the order of seconds, such that ^{40}Ar diffusive loss did not occur; or 3) the Ar-Ar age dates only feldspar and not mesostasis., in spite of high (~1) K/Ca ratios observed.

Acknowledgements: We thank H. Takeda for supplying the Dho378 sample, C-Y Shih for separating the plagioclase analyzed, D. Garrison for lab support, and T. Mikouchi, G. McKay, L. Nyquist, and F. Hörz for helpful discussions.

References: [1] Russell S. S. et al. 2002. *Meteoritics & Planetary Science* 37 (suppl.):A157-A184. [2] Ikeda et al. 2006.

Antarctic Meteorite Research, 19, (in press). [3] Mikouchi T. and McKay G. 2003. #1920. *36th Lunar & Planetary Science Conference.* [4] Nyquist et al. 2006, *Antarctic Meteorites* xxx.