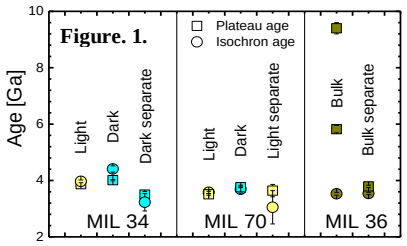
^{40}Ar/^{39}Ar AGES FOR LUNAR METEORITES MIL 090034, MIL 090036, AND MIL 090070 AND EXCESS ^{40}Ar IN MIL 090036. J. Park[1,2,3], L.E. Nyquist[4], G.F. Herzog[1], B.D. Turrin[5], F.N. Lindsay[1], J.S. Delaney[1], C.C. Swisher III[5], C.-Y. Shih[6], A. Yamaguchi[7], N. Shirai[8], M. Ebihara[8] and K. Nagao[9]. [1]Chem. & Chem. Biol., Rutgers U., Piscataway, NJ 08854. E-mail: *jp975@rci.rutgers.edu* [2]Lunar Planet. Inst., Houston, TX 77058. [3]Kingsborough Comm. Coll., Brooklyn, NY 11235. [4]XI/NASA/JSC, Houston, TX 77058. [5]Earth Planet. Sci., Rutgers U., Piscataway, NJ 08854. [6]JE-23, ESCG/Jacobs Sverdrup, Houston, TX 77258, USA, [7]Natl. Inst. Polar Research, Tokyo 190-8518, Japan, [8]Tokyo Metropolitan U., Hachioji, 192-0372, Japan, [9]Korea Polar Research Inst., Incheon 406-840, Korea.

Introduction: Lunar anorthositic regolith breccias Miller Range 090034 (MIL34), 090036 (MIL36), and 090070 (MIL70) provide information about the history of the lunar highlands. We previously reported ^{40}Ar/^{39}Ar ages and relative CRE ages for anorthite separates [1]. Here we extend this work to bulk samples of the light anorthite-rich, and the dark impact-melt-rich lithologies [2] of the paired stones MIL 34 and 70, and to bulk samples of MIL36. The primary goal was to understand lunar impact events at the time these breccias formed.

Experimental Methods: ~ 10 mg samples from the Light and the Dark lithologies in MIL34 and MIL70 and ~1 mg of two bulk chips in MIL36 were irradiated for ~80 hours at the USGS TRIGA reactor. Ar isotopes were measured mass spectrometrically [3,4].

Results and discussion: ^{40}Ar/^{39}Ar plateau and isochron ages are shown in Figure 1. The apparent ages of the Dark lithologies of MIL34 and MIL70 are generally older than both those of the light lithology and of the anorthite separates. We attribute these older ages and the two strikingly old apparent ages of bulk MIL36, resp., to (a) preferential retention of ^{40}Ar by glass or impact melt components (MIL34&70), and (b) re-implanted "lunar atmosphere" ^{40}Ar (MIL 36) [5,6]. Mounting evidence suggests that melted phases may retain ^{40}Ar during impact events because longer diffusion path lengths are generated in the resultant glass [7-9]. Our preferred Ar/Ar ages are 3500±110 Ma (MIL34 anorthite), 3520±30 Ma (MIL70 Light), 3540±40 Ma (MIL36-chip1, isochron age).



Conclusion: Young ages of ~3500-3540 Ma for each breccia probably date the time of breccia assembly. Other ages in the range ~3640-3940 Ma probably reflect the presence of older clastic material. The regolith breccia MIL36 contains excess ^{40}Ar implanted from the lunar atmosphere [5,6]. Previously determined CRE ages suggest pairing of MIL34 and MIL 70.

References: [1] Park J. et al. 2013. Abstract #2576. 44th *LPSC*. [2] Yamaguchi A. et al. 2013. Abstract#2539. 77th Goldschmidt Conference. [3] Turrin B.D. et al. 2010. *G^3* 11,Q0AA09,doi: 10.1029/2009GC003013. [4] Lindsay F.N. et al. 2014. *GCA* 129, 96-110. [5] Manka R. H. and Michel F. *C.*1970. *Science* 169, 278-280. [6] McKay D. S. et al. 1986. Proceedings of 16th Lunar & Planetary Science. D277-D303. [7] Bogard D.D. et al. 1985. *GCA* 49, 941-946. [8] Lindsay F.N. et al. 2015. *EPSL* 413, 208-213.[9] McConville P. et al. 1988. *GCA* 52, 2487-2499.