LUNAR METEORITES MILLER RANGE 090034, 090070 AND 090075: COMPOSITION AND PAIRING.

D. J. P. Martin[1] and K. H. Joy[1]. [1]School of Earth, Atmospheric and Environmental Sciences, University of Manchester, M13 9PL UK. E-mail: dayl.martin@student.manchester.ac.uk

Introduction: MIL 090034 (MIL34), 090070 (MIL70) and 090075 (MIL75) are feldspathic lunar meteorites. They were found in close proximity in the Miller Range of mountains during the 2009 ANSMET expedition. It has been previously proposed that they are launch grouped stones [1,2]. Here we test this hypothesis using mineral chemistry comparisons, and investigate what they reveal about the lunar highlands. We compare our data to Apollo samples and other feldspathic lunar meteorites to investigate precursor parent rock types [3].

Samples: MIL34, MIL70 and MIL75 are feldspathic regolith breccias with similar appearances at the hand specimen scale [4]. They are composed of pale white clast-rich impact-melt breccia clasts consolidated by darker coloured glass and vein networks. Small igneous clasts are present in MIL34 and MIL75 that have interlocking crystals and a significant proportion of mafic material. Fragments of spinels, silica and troilite were also found in the samples alongside olivine, pyroxene and plagioclase fragments. The spinels are situated within the impact melt breccia clasts of MIL75 and silica fragments are found only within MIL34. In contrast, olivine, pyroxene and plagioclase can be found throughout each of the samples within all clast types, glassy matrix areas and melt veins.

One thick-section of each meteorite was studied using optical microscopy, environmental SEM and EPMA to obtain images, photomontages and chemical data. Clast and mineral average compositions were obtained and compared.

Results and Discussion: Plagioclase An# averages at 95-96% for each sample and mafic mineral Mg# varies between 55% and 65% for most values (the exceptions being igneous clasts that have mafic phases with higher Mg# values – up to 92). The similarities in sample collection location, composition (clast, mineral, and melt-vein) and texture support the hypothesis that they are paired [1,2].

MIL34, MIL70 and MIL75 mineral fragment and bulk glass compositions are similar to ferroan anorthosite (FAN) samples [5]. Only the igneous lithic clasts represent other rock types (Mg-suite). Around 20% of other lunar meteorites also contain FAN-type clasts [3]. Gross et al., suggest that this coverage is consistent with the Imbrium eject blanket [6] and, given the similarity of these samples with Apollo ferroan anorthosites, it is possible that MIL34, MIL70 and MIL75 originated from a small crater within similar nearside highlands crust.

References: [1] Zeigler R. A. et al. Abstract #2377. 43rd Lunar and Planetary Science Conference. [2] Korotev R. et al. Abstract #1999. 42nd Lunar and Planetary Science Conference. [3] Gross J. et al. 2014. *Earth and Planetary Science Letters* 388:318-328. [4] Korotev R. 2013. http://meteorites.wustl.edu/lunar/moon_meteori tes.htm [5] Wieczorek M. A. et al. 2006. *Journal of Geophysical Research* 105:20417-20430. [6] Spudis P. D. et al. 2011. *Journal of Geophysical Research* 116:E00H03.