NORTHWEST AFRICA 8159: AN ~2.3 BILLION YEAR OLD MARTIAN OLIVINE-BEARING AUGITE BASALT

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Introduction: Based on petrology, mineralogy, and bulk composition, the new NWA 8159 martian meteorite is distinct from all known samples from Mars [1]. In particular, the augite compositional trends are unique, but most similar to those of nakhite intercumulus [2]. Whether NWA 8159 represents a new lithology or is related to a known meteorite group remains to be determined. Sr and Nd isotopic analyses will allow comparison of source characteristics with SNC and other new ungrouped meteorites (e.g., NWA 7635 [3,4]). Here we report initial Rb-Sr and Sm-Nd isotopic results for NWA 8159 with the objective to determine its formation age and to potentially identify similarities and potential source affinities with other martian rocks.

Sampling and Analytical Procedures: To limit the effects of desert weathering, a ~1.35 g cube was extracted from the center of NWA 8159, a fined-grained ~150 g stone from Morocco. The material was processed according to existing JSC procedures. The fine-grained nature, zoned pyroxene, and shock melt veins of NWA 8159 [1] made clean separation difficult. Nevertheless, WR, concentrated mineral separations, and nearly pure plagioclase and pyroxene splits were recovered, all of which have varing amounts of impurities. Various acid concentrations (1N to 6N HCl) were explored for leaching each split to reduce the effects of contamination due to terrestrial weathering and martian impact events. Rb-Sr and Sm-Nd isotopes were measured with a ThermoFinnigan Triton TIMS using methods established recently by the CICG group at JSC. Results reflect leaching trials that have been performed on the WR and main mineral fraction. Additional separations, including the purest plagioclase and pyroxene separates, remain to be measured. These splits will likely provide the most leverage in terms of age precision, and can now be processed following procedural refinements specific to getting the best data out of NWA 8159.

Results and Discussion: Several trends are found among the Rb-Sr and Sm-Nd data. All of the acid leachates imply that NWA 8159 has experienced isotopic and/or elemental exchange events complicating interpretation of potential isochrons. When Rb-Sr data are plotted the residual separates appear slightly disturbed (all data plot along an apparent mixing line, with the residual data largely found at one end). On the other hand, the Sm-Nd systematics appear to be more robust. When all Sm-Nd data are plotted, the residual data define a best fit line consistent with an age of ~2.3±0.5 Ga (95% conf., n=4, MSWD=53) that is clearly discernable from the trends defined by the leachates and other martian meteorite ages (cf. [3]). We interpret the analyses of the residual material to define the formation age of NWA 8159, while the leachates reflect mixing with materials from the surface of Mars incorporated into the rock by impact.

References: [1] Agee C.B. et al. 2014. Abstract #2036. 45th LPSC., [2] Herd C.D.K. et al. 2423. Abstract #1423. 45th LPSC. [3] Righter et al. 2014. Abstract #2550. 45th LPSC., [4] Andreasen R. et al 2014 Abstract #2865 45th LPSC.