A New Lunar Fragmental Breccia Meteorite Northwest Africa 15368

D. Dickens 1 , R.G. Mayne 2 , and J. Gross 3 , 1 CCMS, Colorado Center for Meteoritic Studies, Loveland, CO 80538 (d.dickens@meteoritic.org), 2 Monnig Meteorite Collection, Texas Christian University, 2950 W. Bowie St. Fort Worth, TX 76109, 3 Department of Earth and Planetary Sciences, Rutgers University, 610 Taylor Road, Piscataway, NJ 08854-8066

Importance of Lunar Meteorites: The Apollo, Luna, Chang'e 5, and upcoming Artemis mission return material have provided, and will continue to provide, a pristine sample pool from the lunar surface that will serve as invaluable ground truths for researchers for many years to come. However, these return samples are inherently very limited in the locations they represent[1], and may not be representative of the Moon as a whole. For example, the Apollo samples are thought to come from an anomalously KREEP-enriched terrane[2]. These mission return samples can often also be difficult for researchers to obtain. Lunar meteorites, therefore, continue to offer an important and relatively easy to obtain resource of lunar material representing a broad range of sampling areas from the lunar crust at varying depths including regolith, inferred by the size, age, and distribution of craters on the lunar surface[3]. Over the past half century many different types of lunar meteorites have been recovered and classified. Most of these lunar meteorites are fragmental breccias and were found in the dry deserts of North Africa, including NWA 15368. A recent uptick in lunar meteorite classifications originating from this area is providing increased opportunity for researchers to access lunar material from areas of the lunar surface not sampled by return missions.

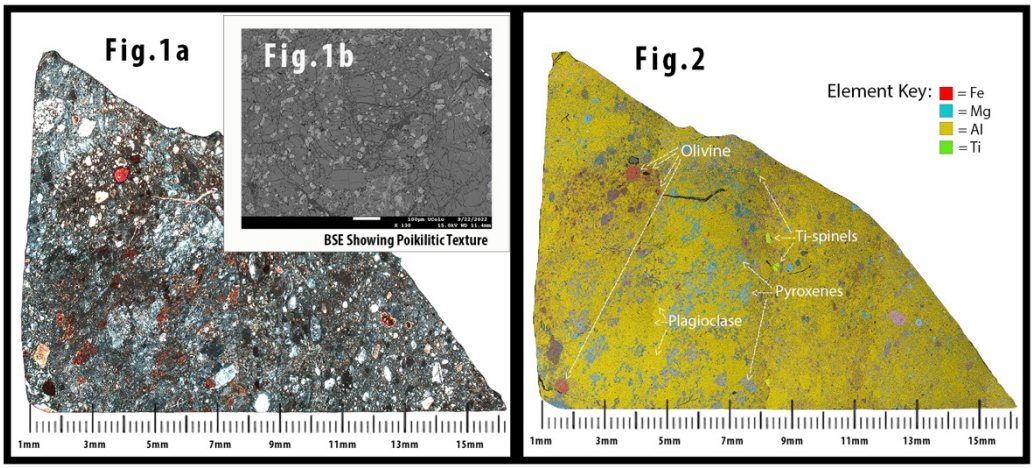

Figure 1a. Microcrograph in XPL, credit R.G. Mayne, TCU. Figure 1b. Backscatter image at x130 showing poikilitic texture with olivine chadacrysts embedded in plagioclase oikocrysts, credit D. Dickens, CCMS. Figure 2. Elemental X-ray map for Fe, Mg, Al, and Ti with inferred mineral labels, x-ray map credits R.G. Mayne, TCU.

Methods: Two 25mm polished epoxy probe mounts and several 25mm polished round thin sections were produced from the center of an ~800g end piece cut from the original ~17,840g mass. Chemistry of all major mineral phases were analyzed at the University of Colorado Boulder's Electron Microprobe Laboratory using the JEOL JXA-82300 EPMA ca. at 0.2-0.7 µm. X-ray maps were created using the Hitachi TM4000 tabletop scanning electron microscope (SEM) at TCU. PPL and PPX micrographs were captured using an Olympus BX-51petrographic microscope at TCU.

Description: Here, we describe Northwest Africa (NWA) 15368, a newly discovered lunar polymict fragmental breccia. NWA 15368 is represented by a single sand ablated ~17,840g mass displaying regmaglypts and melt vesicles visible on the exterior of the meteorite. It contains a diverse petrology consisting of a variety of lithic subhedral and rounded mafic igneous fragments set in a groundmass composed predominantly of anorthite[4]. Fragment and clast sizes range from <0.1 mm to >6 mm and are primarily comprised of plagioclase (An 95.9±3.1 Ab 2.9±0.7 Or 1.2±3.3), low-Ca pyroxene (Fs 20.7±0.1 ,Wo 4.0±0.1), pigeonite (Fs 30.1±5.2 ,Wo 9.5±3.7), augite (Fs 16.9±1.1 Wo 36.5±2.8), and olivine (Fa 38.0±2.6).Minor phases include kamacite and ilmenite. This meteorite is shocked with ubiquitous impact melt textures present. It may be more accurately petrographically classified as a polymict fragmental regolith melt breccia [5]. Examination of BSE images from polished mounts and optical examination of thin sections show areas displaying a poikilitic texture with stained and altered olivine often found as subhedral and spheroidal chadacrysts isolated by larger unaltered feldspar oikocrysts. An amorphous phase fills interstitial spaces between feldspar grains further encapsulating and isolating olivine chadacrysts.

References: [1] Sutton, et al, 1971, *Proceedings of the Lunar Science Conference*, vol. 2, p.17 [2] Jolliff, et all, 2000, *Journal of Geophysical Research, Planets* Vol.105, is.E2, p.4197-4216 [3] Wu, et al 2022, Volume 49, Issue 20 *Geophysical Research Letters*. [4] *Meteoritical Bulletin* 111, 2022. [5] Stöffler, et al, 1980, *Proc. Conf. Lunar Highlands Crust*, p. 5-70.