PRELIMINARY GEOLOGIC MAP OF THE MC-16 NW QUADRANGLE, MARS: SUBDIVISIONS OF THE LOWER AND MIDDLE MEMBERS OF THE MEDUSAE FOSSAE FORMATION. S.P. Scheidt[1] and J. R. Zimbelman[1], [1]CEPS/NASM MRC 315, Smithsonian Institution, Washington, D.C. 20013-7012, (scheidts@si.edu)

Introduction: The Medusae Fossae Formation (MFF) covers an extensive portion of the MC 16-NW quadrangle of Mars [1,2,3], which is currently being mapped at a scale of 1:2,000,000 as part of the NASA PGG grant NNX07AP42G [4]. Since the global mapping of the MFF units using the Viking orbiter data [1,2], new higher resolution image data are being used to more accurately refine the global MFF boundaries and also guide the more detailed mapping of subunits.

Background: All three major global units of the MFF are found in the MC 16-NW quadrangle, which is east of Apollinaris Patera and south of Nicholson crater. Broadly described here, the upper member (Amu) comprise smoother, flat, rolling plains, the middle member (Amm) is more rugged and eroded, and the lower member (Amu) is smooth to rough and highly eroded [2]. Substantial variations exist within each unit, and mapping efforts to date have shown that that the MFF units are considerably more complex than is represented by the three global units [e.g., 5]. Several hypotheses have been published reguarding their formation [summarized in 5], but the hypotheses receiving the most attention lately are the emplacement of differentially weathered ignimbrites [3,7] as well as massive accumlations of variable indurated aeolian materials [e.g. 1,8,9,10]. New and old terrestrial analogs are providing new insights. For example, welded and non-welded zones were observed in terrestrial ignimbrites in the southwestern U.S., whereby these observations suggest that the varied degrees of induraction results in the differential weathering of the ignimbrites [11].

Methodology: Mapping is accomplished primarily by the photogeologic interpration of Thermal Emission Imaging System (THEMIS) infrared (IR) day-time temperature mosaic [12] and Mars Orbital Laser Altimeter (MOLA) topographic data to identify stratigraphic and structural relationships of the material units in the central MFF on the Martian surface. The newest version of the THEMIS day-time temperature mosaic (100 m/pixel) provides sufficient detail on the textural variations allowing subdivision of MFF units, where the enigmatic nature of the MFF is further reduced using ultra-high spatial resolution image data from the Mars Reconnaissance Orbiter (MRO) Context Camera (CTX) and the High Resolution Imaging Science Experiment (HiRISE). Where available, spectral data sets are leveraged to determine composition. Mapping is accomplished using the integration of several data sets in JMARS [13] and ArcGIS. Quality of the final map product will be ensured by a rigorous review process supervised by the U.S. Geological Survey (USGS). This mapping is carried out in tandem with the mapping of the MC 23-NW quadrangle so that the globally mapped units can be compared acoss quadrangles and have the potential to be consistent if genetically related.

Results to date: A survey of the MC 16-NW quadrangle reveals a variety of surface features that were mapped in and among the MFF, including craters, sinuous ridges, fluvial channels and aeolian features. Yardangs have varied orientations, spacing and width to height ratios. We verified that the newest version (2009) of the THEMIS IR day-time temperature mosaic [12] data aligns with MOLA topography better than previous data.

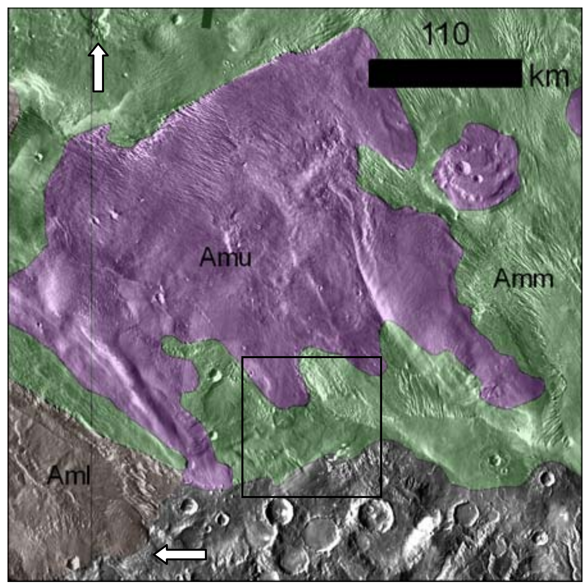

Figure 1. Portion of the MC 16-NW quad containing all three globally mapped MFF members. THEMIS IR day-time temperature background shows variations in surface texture.

Discussion: The improved THEMIS accuracy gives confidence to the observations that the MFF deposits extends beyond the previously mapped global boundaries of the MFF (Fig. 1). For example, the Aml extends further south, and new stratigraphic subdivisions can be made between Aml and Amm at the edges of MFF units. Further subdivision of the MFF deposits, especially in Amm, is based on the working hypothesis that erosional textures, mostly due to yardangs [14], indicate genetically different geologic materials (Figure 2).

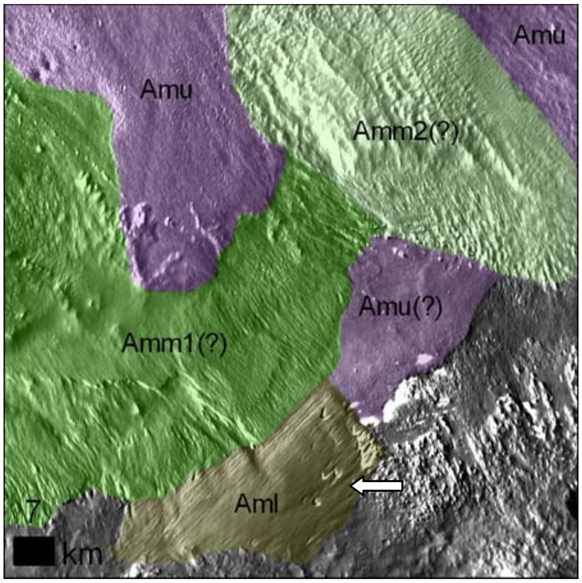

Figure 2. In this example, MFF units have been further subdivided based on the contacts between variable surface textures that are the result of differential weathering. This figure is from the inset box of Figure 1 above. The white arrow indicated aeolian scour features (see Fig. 3) found elsewhere in the Aml unit.

In the example shown, Amu shows a generally smooth texture with relatively few yardangs and is distinguished from other units based on scarps bordering Amm. Amm2 below appears to have a different texture (interferring NW striking yardangs and NE striking ridges) than Amm1 (NE striking yardangs). South of Amm1 is a previously unmapped area of Aml, which is a smoothly eroded surface with crescent-shaped aeolian scour features (Figure 3) also present in other units of Aml. Some areas of Amm are as heavily eroded as Aml, such as in an example of an inverted detritic fluvial drainage pattern (Figure 4). It is hypothesized that this feature may have been formed similarly to sinous ridges (SRs) in the western MFF [see 15]. Mapping of the MC 16-NW quadrangle will continue using the THEMIS day-time IR temperature mosaic, and will hopefully lead to distinctions between ignimbrite emplacement, aeolian deposition and aeolian erosion surfaces.

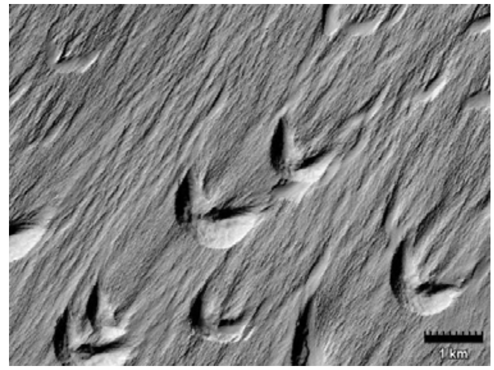

Figure 3. Aeolian scour features observed by HiRISE.

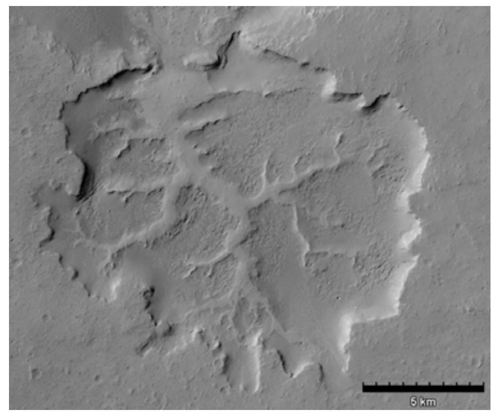

Figure 4. This dentritic fluvial drainage pattern is shown here by CTX. The inverted topography was not clear in the THEMIS day-time IR temperature mosaic used for mapping. This feature indicates heavy erosion that may possibly place this unit in the Aml member.

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