

How Big Was It? The Former Extent of the Medusae Fossae Formation, Mars. I.T. Dunning¹, T.K.P. Gregg¹, and J.R. Zimbelman², ¹Department of Geology, 126 Cooke Hall, University at Buffalo, Buffalo, NY 14260-3050; iandunni@buffalo.edu; ²Smithsonian Institution, CEPS/NASM MRC 315, Washington, DC.

Introduction: The Medusae Fossae Formation (MFF), Mars, is an unconformable deposit [1- 6] that covers $\sim 2.1 \times 10^6 \text{ km}^2$ [7] of the Martian surface, stretching discontinuously over 5,000 km between 135°E – 235°E and 10°N – 10°S . The thicknesses of present-day MFF outcrops range from 10 – 10^3 m [7, 8]. MFF is characterized by internal layering and displays abundant yardangs. Terrestrial yardangs are common in ignimbrites, suggesting that the MFF is composed of similarly fine-grained and differentially indurated materials. Outliers of MFF around the continuous outcrops and yardangs are consistent with the interpretation that the MFF previously covered a larger area, but aeolian processes have eroded the MFF to its current extent. Here, we use high-resolution ($<25 \text{ m/pixel}$) visible images (primarily Context Camera [CTX] images [9]; Fig. 1) to search for and systematically map MFF outliers to constrain the MFF's previous extent, and from that, erosion rates on the Martian surface.

Methods: MFF outliers are mapped using CTX images. A $1^\circ \times 1^\circ$ grid is overlain onto Mars Orbiter Laser Altimeter (MOLA) [10] imagery and symbols are used in each gridbox to denote the presence or absence of MFF deposits. Three transects that are three gridboxes wide are currently being mapped – two N-S transects and one E-W transect – to gain a better sense of the extent of the MFF before more complete mapping is accomplished (Fig. 2).

MFF deposits are identified using characteristic features shown in Table 1 [11]. Characteristics are listed in Table 1 vertically in order of decreasing reliability (e.g., “yardangs” are a more reliable characteristic than “layered materials”). MFF deposits are confidently identified if they exhibit: 1 “excellent” characteristic; 2 “very

good” characteristics; 1 “very good” characteristic and 2 “good” characteristics; or ≥ 4 “good” characteristics. These characteristics appear to be unique to the MFF in comparison to all other features and formations observed on Mars.

Mapping started proximal to Eumenides Dorsum and progressed south until $\sim 14^\circ\text{S}$ (area of box shown in Figure 2), and at least 3 transects will be mapped. The extent of the MFF can be interpolated based on the simple assumption that it was once continuous, and thus the area between the main lobes and the outlier outcrops represents terrain once blanketed with MFF deposits. Rough erosion rates will then be calculated in terms of area.

Preliminary Results: Mapping completed as of this writing suggests that the MFF may once have been twice as expansive as currently mapped. We have located MFF deposits on the Southern Highlands as well [12].

Bennett and Bell [13] map and characterize unconformable, mounded deposits found in craters throughout the equatorial region of Mars. Using the criteria given in Table 1, we concur with Bennett and Bell [13] that deposits found in 2 of the impact craters (one at 5.5°N , 221.5°E ; another at 4.5°S , 222.5°E) are outliers of MFF.

References: [1] Scott, D.H. and Tanaka, K.L. (1982) *JGR*, 87, 1179-1190. [2] Francis, P.W. and Wood, C.A. (1982) *JGR*, 87, 9881-9889. [3] Scott, D.H. and Tanaka, K.L. (1986) *USGS Misc. Invest. Ser. Map I-1802-A*. [4] Greeley, R. and Guest, J.E. (1987) *USGS Misc. Invest. Ser. Map I-1802-B*. [5] Griffin, L. J. and Zimbelman, J. R. (2009) *LPSC XL*, Abstract #1196. [6] Tanaka, K.L. et al. (2014) *Planet. and*

Table 1. Characteristics used to identify the MFF.

Excellent	Very Good	Good
Superposed layered materials displaying different yardang orientations	Yardangs	Deposit mantling underlying terrain
	Crenulated margins	Consistent surface texture
	Layered materials	Geographic continuity with known MFF deposits
		Proximity to known MFF deposits
		Aligned topographic depressions, such as grooves or troughs, suggesting removal of material

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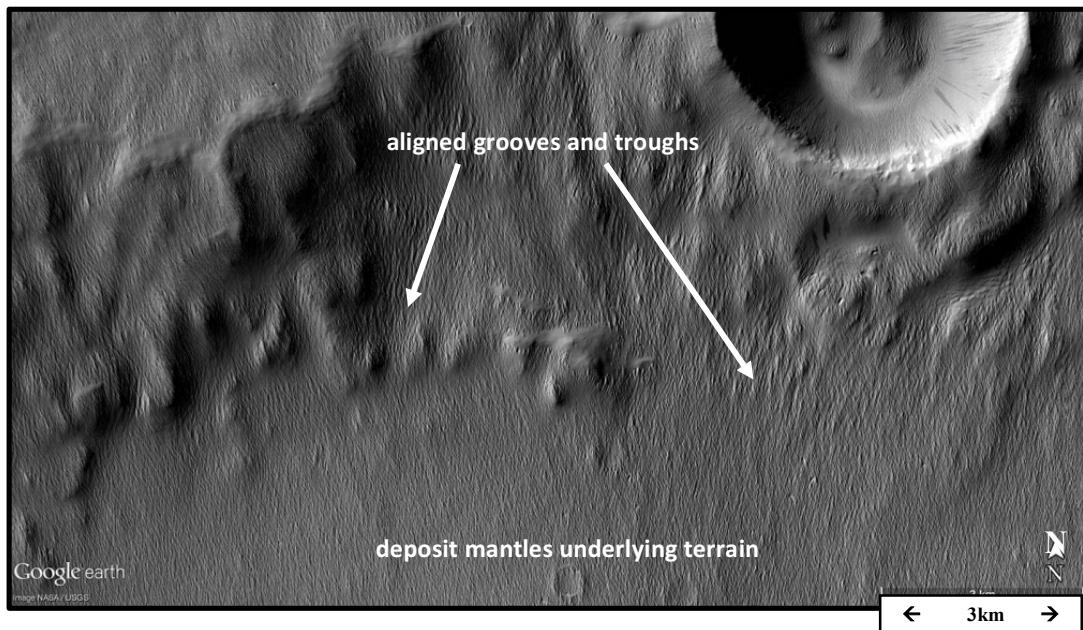


Figure 1. Typical expression of MFF outlier outcrops. Image centered at 11.5°S, 206.5°E. CTX image (courtesy of MSSS/JPL/NASA) rendered using Google Earth.

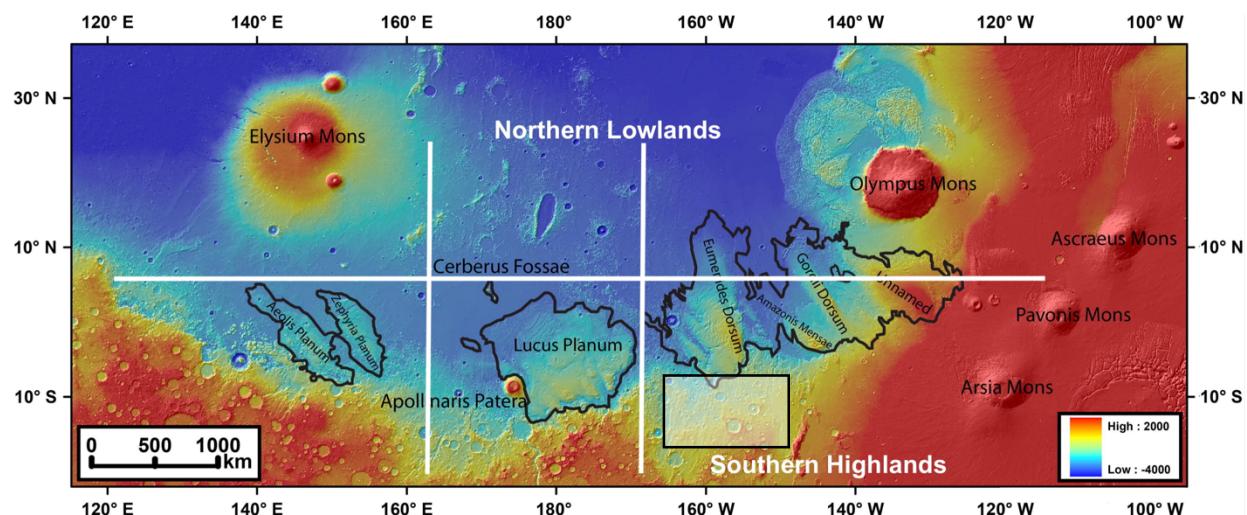


Figure 2. Location of previously mapped outcrops of MFF (modified from [14]) outlined in black on MOLA data. White lines show transects to be examined for MFF outliers. Pale box outlined in black shows where MFF outcrops have been identified using CTX images.