DISTRIBUTION OF LAYERED OUTCROPS IN THE MEDUSAE FOSSAE FORMATION, MARS S. Y. Khan[1] and K. W. Lewis[1], [1]Johns Hopkins University, 3400 N. Charles St., Baltimore, MD 21218 (syked@jhu.edu)

Introduction: The Medusae Fossae Formation (MFF) is an extensive, fine-grained layered deposit straddling the crustal dichotomy boundary on Mars [*1, 2*]. Past studies suggest the MFF was formed by either volcanic, sedimentary, or paleopolar processes [3-8], but its origin remains a source of debate and further efforts to understand the underlying structure of the unit are stymied by dust cover and aeolian modification. Fortunately, increased high-resolution coverage of the MFF is enabling more detailed quantitative study of kilometer- and meter-scale layering present throughout the formation.

Since different processes can generate diagnostic thinning trends (e.g., distal thinning of volcanic ash deposits) [9], measuring layer thicknesses across the MFF may help constrain its origin. This work aims to survey the full extent of the MFF for layers visible in HiRISE imagery in order to evaluate regional stratigraphic relationships.

Data and Methods: We analyzed 638 images from the High Resolution Imaging Science Experiment (HiRISE) to locate layered deposits within the MFF. The boundary of the MFF was defined by the AHtu and Htu units from [1]. Based on the presence, extent, and abundance of layers, each image was classified on a scale of high to low layer visibility. Layer visibility counts are summarized in Table 1. We used Context Camera (CTX) images to identify any additional layered deposits not captured by HiRISE.

Results: Layers are primarily located in the yardang-rich southern border of Lucus Planum, and the river networked regions of Aeolis Planum and Zephyria Planum (Figure 2). High visibility layered deposits are most common south of 0.50 °S, particularly in the AHtu unit. While Eumenides Dorsum and Gordii Dorsum were mostly devoid of layers, some low visibility layered deposits were present in the northernmost extent of both lobes, consistent with previous observations by [10].

The most expansive occurrences of high visibility layering in Lucus, Aeolis, and Zephyria Planum are characterized by contour-like bedding patterns (Figure 1b, 1c), referred to as onion skin topography by [10] and quasi-concentric bedding in [11]. These deposits generally consist of meter- to decameter-scale layering.

Aeolian reworking of the MFF has in some cases served to expose layers as well. Caprocks, cliff faces,

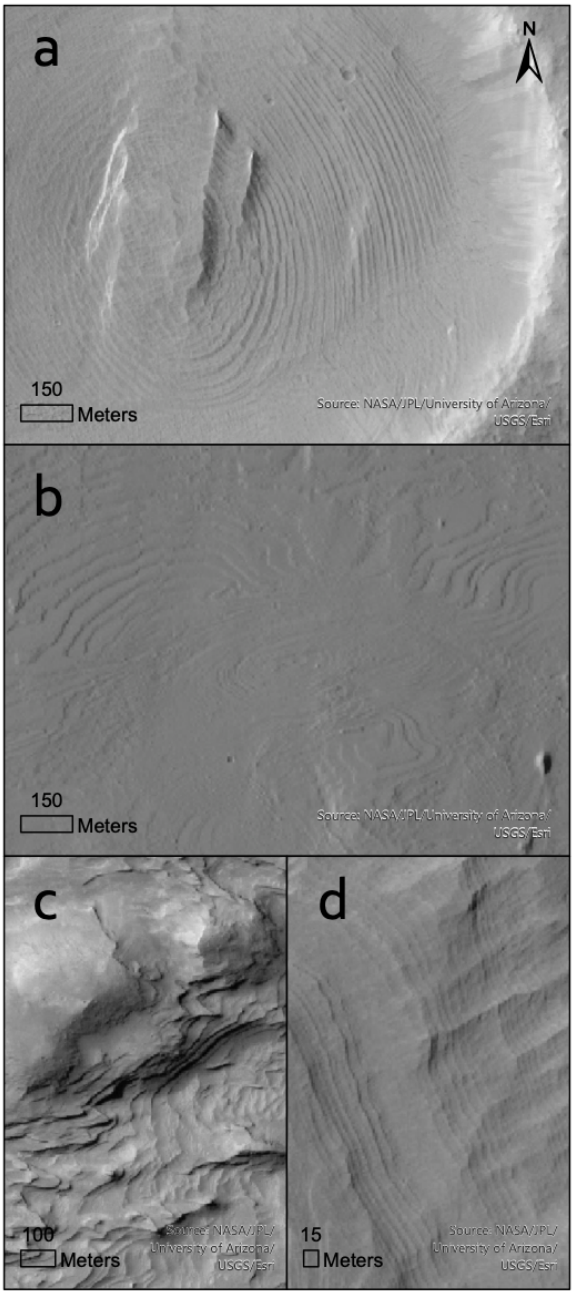

Figure 1. Layering in the Medusae Fossae Formation. (a) Unnamed crater with potential rhythmic layering near Eumenides Dorsum, ESP_026025_1920, (b) Potential rhythmic layering in Lucus Planum, ESP_028650_1695, (c) Layering in Aeolis Planum, ESP_052123_1765, (d) Meter-scale layered deposits in Gale crater, PSP_008002_1750.

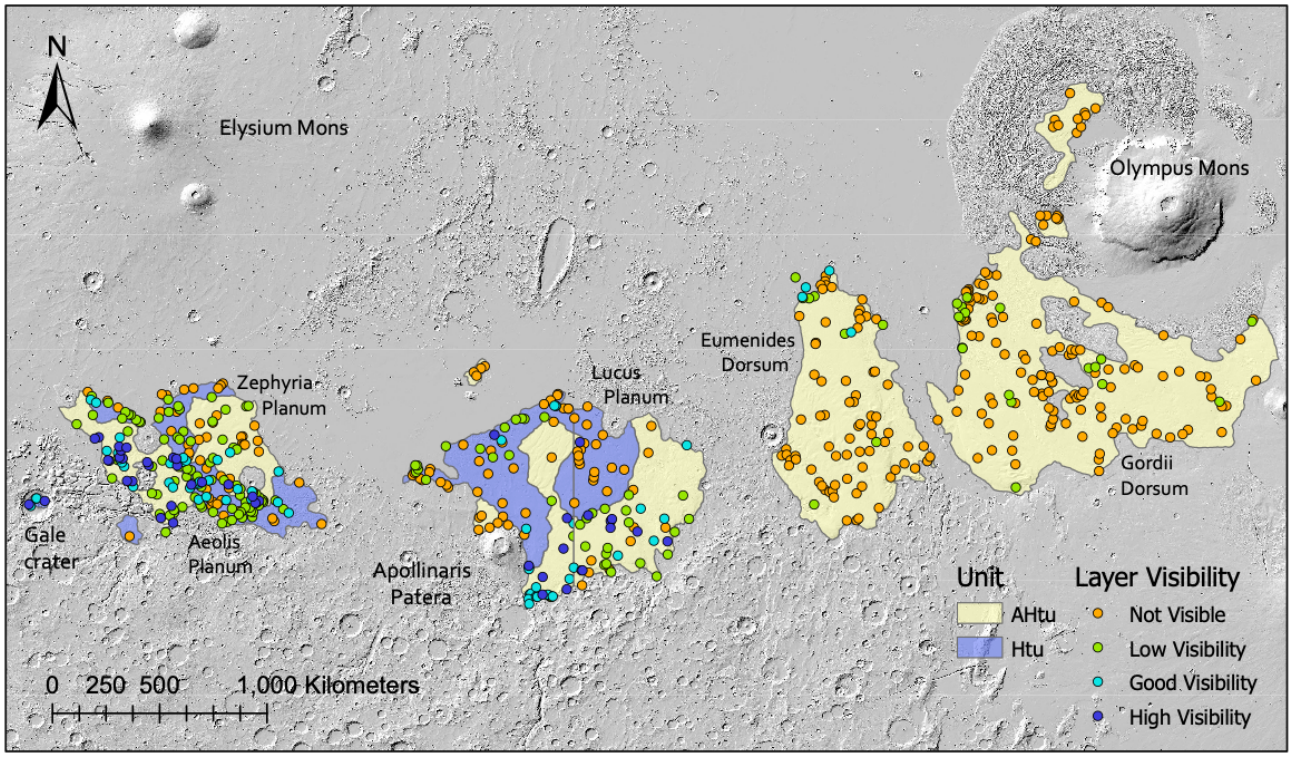

Figure 2. Occurrence and visibility of layers in the Medusae Fossae Formation. Each marker represents one HiRISE image.

and yardangs occasionally reveal thick layered sequences. These exposures constitute the majority of low visibility layered deposits.

Table 1. Layer visibility counts

Layer Visibility	# of Locations
High Visibility	43
Good Visibility	62
Low Visibility	151
Not Visible	322

Discussion: This work confirmed the distribution of layered deposits first described by [10] and revealed trends in layer exposure within and across lobes that may be primary depositional features of the MFF or caused by more recent aeolian erosion.

Layered deposits found within craters of the MFF – including Gale crater, the field site of the Mars Curiosity rover – may be used to introduce constraints on depositional ages and build a more comprehensive picture of the geologic history of Gale crater's enigmatic sedimentary mound, Mount Sharp. Two instances of rhythmic layering, potentially indicative of climate change by orbital cycling, are also located in craters near Eumenides Dorsum. The first, found within Bullseye crater, was identified by [12]. This survey revealed an additional site in a nearby crater to the north (Figure 1a), with a more continuous exposure of the stratigraphy. Rhythmic layering has also been identified in southern Lucus Planum (Figure 1b).

Stereo HiRISE images further enable us to map layer exposures in the MFF in three dimensions. Layer thicknesses and orientation measurements at good to high visibility locations, at the scale of the exposed layers, will allow us to uncover diagnostic structural and thickness trends and evaluate stratigraphic correlations across the MFF.

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