CONTINUING TO CHARACTERIZE THE HISTORY OF A DIVERSE INVERTED LANDSCAPE: MAPPING OF THE AEOLIS DORSA REGION, MARS.
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Introduction: This abstract summarizes our second year of work on a 1:500k map of the Aeolis Dorsa (AD) region [1]. Located within the western Medusae Fossae Formation (MFF), this region (Fig. 1) lies just north of Mars' highland-lowland boundary (HLB), southeast of the young Cerberus plains lavas and ~800 kilometers east of Gale Crater. It contains a long history of fluvial, aeolian, sedimentological, tectonic, and collapse events, recorded in substantial and complex stratigraphic layering that has been locally and regionally deformed. The funded mapping effort covers landforms resulting from these varied and interleaved processes [1], and we report our progress on mapping each category of landforms.

Fluvial landforms: The AD fluvial history is recorded in an areally extensive, morphologically varied, and stratigraphically stacked population of fluvial features. Most of these fluvial features are inverted, although smaller, negative-relief sinuous, fluviatile troughs also exist, particularly within the spotty dark mantling unit. Our previous and on-going work in this region [2-4] has focused on identification and mapping of the inverted fluvial features. This work in mapping inverted features is complete [4]. Previous work has provided paleodischarge estimates for these inverted features [3], but we are re-examining the techniques commonly used to make such estimates [5]. Upon completion of this re-examination, we will estimate and provide new paleodischarge values for the inverted fluvial features. We also plan to map the smaller negative-relief troughs and estimate paleodischarges.

While this mapping has used visible wavelength data to examine surface morphologies, we have also used the mosaic of nighttime infrared data [6] to identify a near-surface / surficial fluvial unit [7]. This unit appears more widespread than the surficial inverted fluvial deposits and so suggests more extensive fluvial deposition. In our mapping to date, this unit appears to lie subjacent to the inverted surficial deposits and therefore to precede them in time, although a gradation between the surficial and near-suface deposits may be possible in some areas. This relative stratigraphic relationship of the surficial fluvial units and the near-surface helps us to address some of the outstanding questions from our first-year Planetar Mappers Meeting abstract [1] concerning the timing and conditions of fluvial feature formation and how these fluvial features fit into the larger history of water on Mars [7]. We plan to finalize the mapping of this thermally detected fluvial unit by this fall and provide our interpretations of its timing relative to the inverted fluvial deposits.

Aeolian landforms: Aeolian deposition and abrasional landforms are pervasive in the AD region, as in the larger MFF. From early in the history of Mars exploration, aeolian abrasion was evident in the form of yardangs [e.g., 8]. Aeolian deposition is apparent in the form of large dark dunes, which cluster in specific locations [9]. Our initial mapping of dune and sandsheet landforms [shown in 9] suggests that dark sand is more prevalent than is apparent from surface albedo. This mapping coincides with a separate project beginning this year to investigate the source(s) of sand in the wMFF [9].

Local-scale tectonic landforms: The AD mapping region exhibits tectonic landforms at a range of size scales. The HLB crosses the very southern margin of the map area, just south of a kilometer-deep trough. The rectilinear troughs and mesas associated with this deep depression suggest an extensional tectonic origin, although collapse mechanisms are also possible.

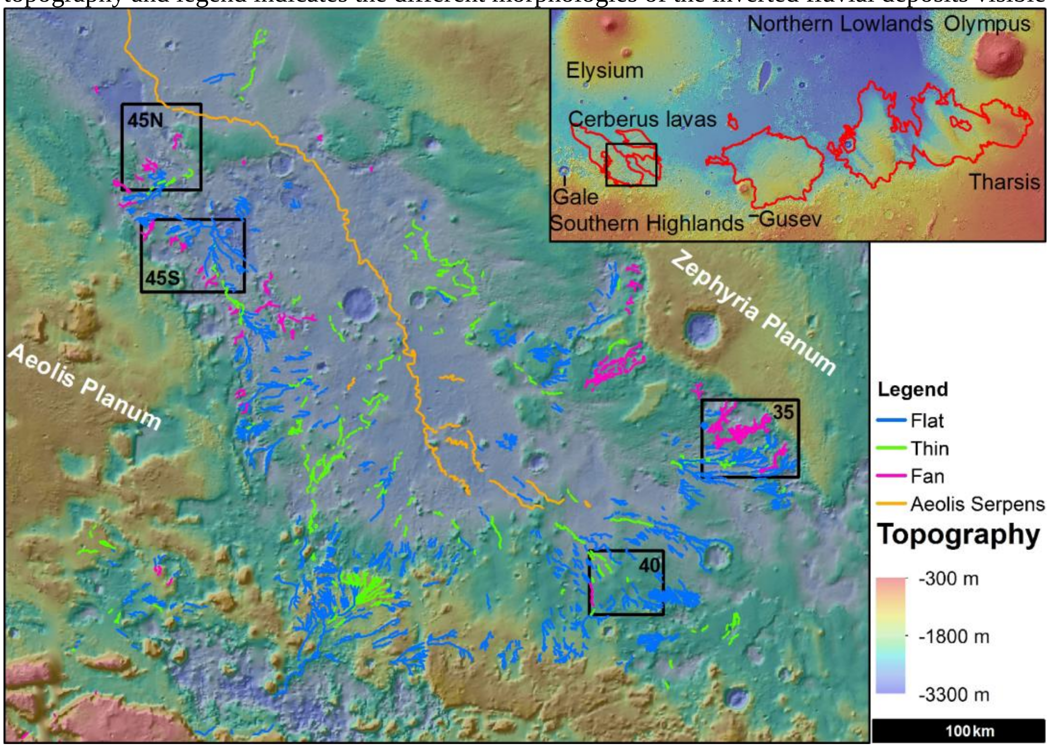
At small size scales, wrinkle ridges suggest the opposite tectonic strain, namely, localized contraction [10]. Our preliminary mapping [shown in 10] shows a scattered distribution of these landforms, suggesting repeated distributed episodes of contraction. This work will be another focus of our Year 3 activities.

Potential lacustrine landforms: In our first year abstract [1], we pointed out potential lacustrine landforms, perhaps fed by groundwater. For example, large craters in the central (lower) portion of the map area exhibit marginal terracing suggestive of shoreline deposits. Lacustrine features were not proposed for mapping, but their identification would substantially add to our understanding of the history of water in this region. We will map and investigate these features at the end of Year 3 and in Year 4.

Summary: The primary focus of the proposed maping work – namely, inverted fluvial deposits – is complete, and the mapping of the near-subsurface fluvial units is targeted for completion this fall. Mapping of aeolian and tectonic landforms is beginning in Year 3, with investigations into potential lacustrine feagtures slated for Years 3 and 4. These disparate landforms indicate the rich history to be discovered in the AD region.

References: [1] Burr D. M. and Jacobsen R. E. (2015) *Planet. Mappers Meet.*, Honolulu, HI. [2] Burr D. M. et al. (2009) *Icarus*, 200, 52-76. [3] Burr D. M. et al. (2010) *JGR* 115, E07011. [4] Jacobsen R. E. and Burr D. M., *Geosphere*, in review. [5] Jacobsen R. E. and Burr D. M. (2015) *GSA Fall Meet.*, Abs. 190-9. [6] Fergason R. L. et al. (2006) *JGR*, *111*, E12004. [7] Burr et al. (2016) *LPS XXXIII*, Abstract #1392. [8] Ward (1997) *JGR*, *84*, B14, 8147-8166. [9] Boyd A. S. and Burr D. M. (2016) this meeting. [10] Borden R. M. and Burr D. M. (2016) this meeting. [11] Scott D. H. and Tanaka K. L. (1986) U.S.G.S, IMAP 1802-A. [12] Greely R. and Guest J. E,, (1987) U.S.G.S., IMAP 1802-B. [13] Harrison S. K. et al. (2010) *Icarus*, *209*, 2, 405–415.

Figure 1: Context (inset upper right) and mapping area for the AD region (from [4]). The MFF is outlined in red [11, 12], but smaller deposits appear throughout the region (e.g., [13]). The background is colorized shaded relief topography and legend indicates the different morphologies of the inverted fluvial deposits visible on the surface.



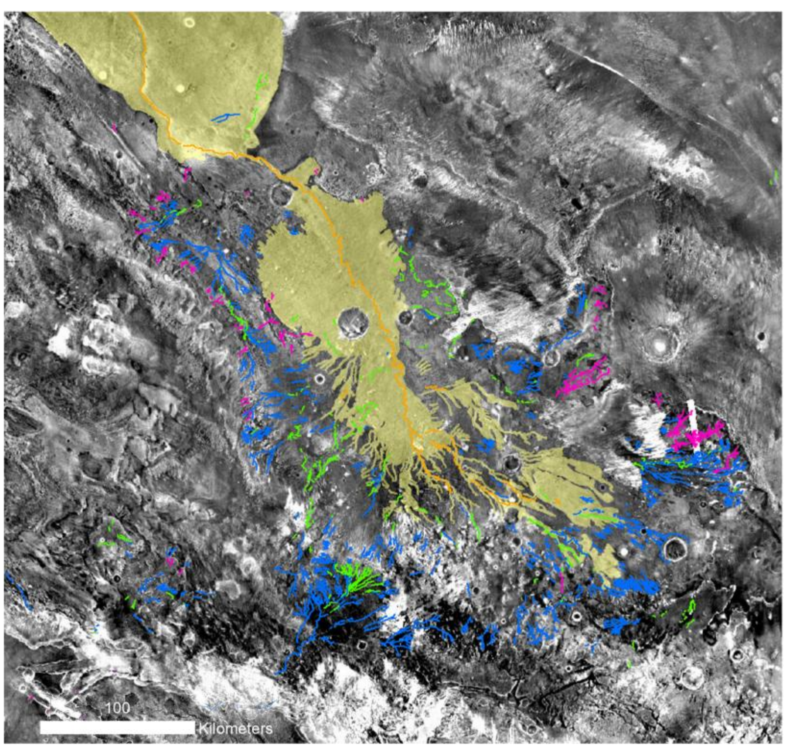


Figure 2. Nighttime infrared data of the map area as in Figure 1, showing our our mapping of the thermally detected near-surface fluvial unit. For comparison, the inverted fluvial features are also shown with color-coding as in Figure 1.