DELTAIC DEPOSITS INDICATIVE OF A PALEO-COASTLINE AT AEOLIS DORSA, MARS.
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Introduction: Previous studies of Mars have suggested a large standing body of water in the planet's Northern Hemisphere [1-6]. Similarly, recent studies of base-level controlled incised valleys [1] and deltaic deposits [2] indicate that Aeolis Dorsa is likely home to a paleo-coastline. Here we present detailed observations of a topographically-inverted fluvial deposit located in the southeastern part of Aeolis Dorsa (6.2° S 154.4° E) with the goal of further testing these hypotheses.

Methods: We mapped the sedimentary stratigraphy of the studied deposit using images from the Context Camera (CTX) in combination with CTX stereo-derived digital elevations models (DEMs). CTX DEMs were produced using the NASA Ames Stereo Pipeline [7-9], and were tied to point shot data from the Mars Orbiter Laser Altimeter (MOLA) [10] to correct for any error in the regional slope. Mapping and measurements were done with ESRI's ArcGIS software.

Observations: We identify eight sets of topographically-inverted branching deposits that we interpret as fluvial in origin (Figure 1B). Unique sets are identified by: (1) a common main feeding channel branch, and/or (2) common stratigraphic position based on elevation. In general, the channel deposits are oriented north-south and truncate at a systematic position towards the south. The sets of topographically-inverted fluvial deposits are observed to (1) stack atop one another and (2) terminate against each other (Figure 2A and 2B). The green deposit is positioned on top of both the dark-blue and orange deposit. The yellow deposit terminates against the dark-blue deposit. The red deposit terminates against the yellow and light-blue deposits. The light-blue deposit is also stacked on top of the pink deposit.

Interpretations: We interpret this topographically-inverted fluvial sedimentary deposit as the exhumed remnants of a large delta deposit with multiple deltaic lobes. The termination of these fluvial deposits south of the study area implies that this is either the most upstream (i.e., tributary) or downstream (i.e., distributary) end of a large fluvial system. The preservation of stacked deposits indicates this region was highly depositional, and more likely distributary or deltaic, rather than an upstream tributary catchment, which would be expected to be net-erosional. A similar logic has been applied to nearby valley-filling deposits [1]. In addition, morphological similarities to other deltaic deposits in this region [2], such as the inverted topography, the branching geometry of channels, and the lobe stacking, support this interpretation. The southward branching of the lobes coupled with the east-west orientation of the group is indicative of an approximately east-west oriented coastline ~55 kilometers long at this location.

Based on the cross-cutting and stacking relationships, we have interpreted relative ages for each of the lobes (Figure 1). The oldest lobes are colored red, pink and brown, followed by yellow, orange and light-blue, then dark-blue, and finally green. Those lobes put at the same stratigraphic level do not have a clear stratigraphic relationship, and so relative ages between these lobes can not be determined. We suggest that the number of lobes preserved in this deposit record a dynamic history of upstream river avulsion, and likely required a long-lived standing body of water.

Conclusion: The studied topographically-inverted branching fluvial deposits has been interpreted as deltaic in origin, with multiple preserved lobes. Qualitative similarities elsewhere at Aeolis Dorsa support this interpretation, as do the indications that this region was highly depositional rather than erosional. Our work is consistent with previous conclusions about the presence of a paleo-coastline at Aeolis Dorsa [1,2], and is indicative of a long-lived standing body of water.

Future work includes extraction of channel slope, deposit thickness, and strike and dip of exposed layers. We will test for whether there is evidence of variations in thickness along the channel, and for steeply dipping foresets.

References: [1] Cardenas B. T. and Mohrig D. (2015) *LPSC 46*, 2797. [2] DiBiase R. A. et al. (2013) *JGR: Planets, 118*, 1285-1302. [3] DiAchille G. and Hynek B. M. (2010) *Nature Geoscience, 3*, 459-463. [4] Head J. W. et al. (1999) *Science, 286*, 2,134-2,137. . [5] Parker T. J. et al. (1989) *Icarus, 82*, 111-145. [6] Perron J. T. et al. (2007) *Nature, 447*, 840-843. [7] Beyer, R., et al. (2014), *LPSC 45*, #2902. [8] Broxton, M., L. Edwards (2008), *LPSC 39*, #2419. [9] Moratto, Z., et al. (2010), *LPSC 41*, #2364. [10] Smith, D. et al. (2001), *JGR, 106*, 23,689–23,722. 840-843.

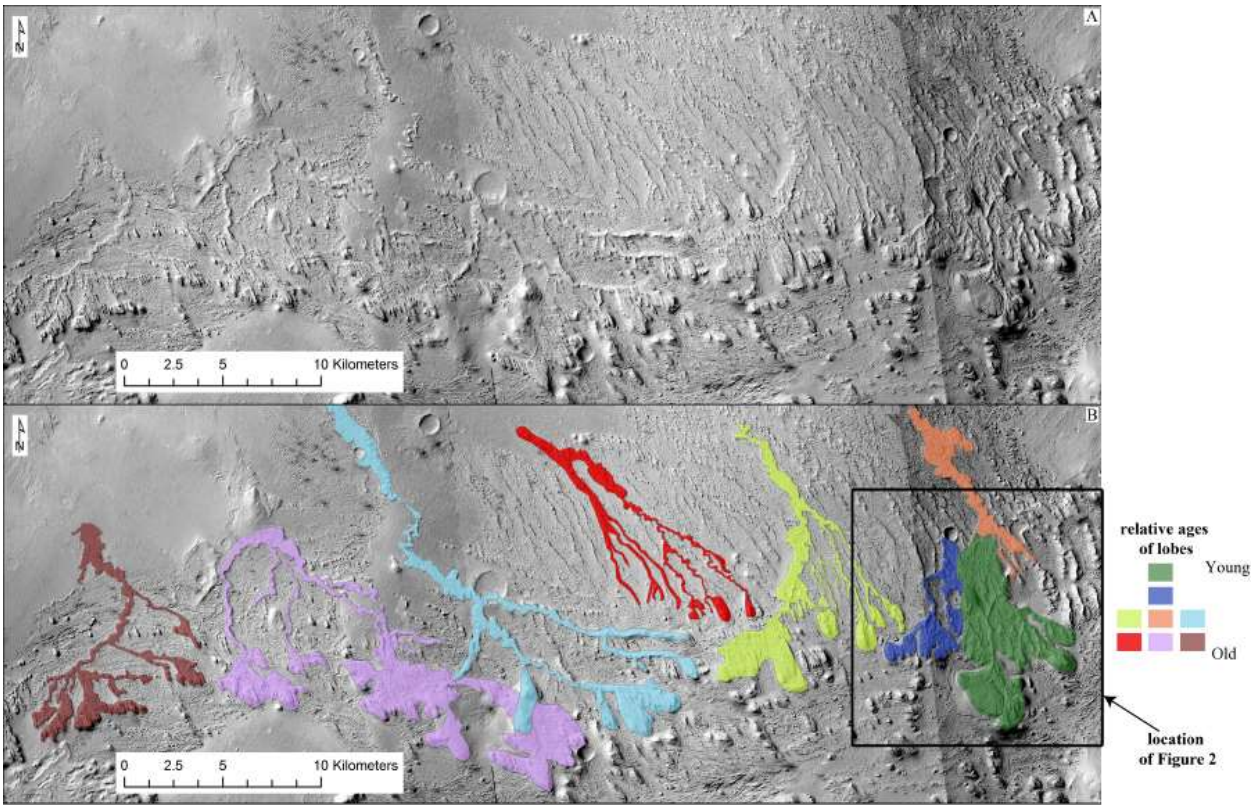

Figure 1: ***(A)*** *Branching fluvial deposits at southeast Aeolis Dorsa.* ***(B)*** *Same as A, with interpreted depositional lobes and their relative ages. Note the stacking and termination of some lobes against others. Image background is a mosaic of CTX images B17_016203_1744, B19_016981_1746, and B20_017548_1739.*

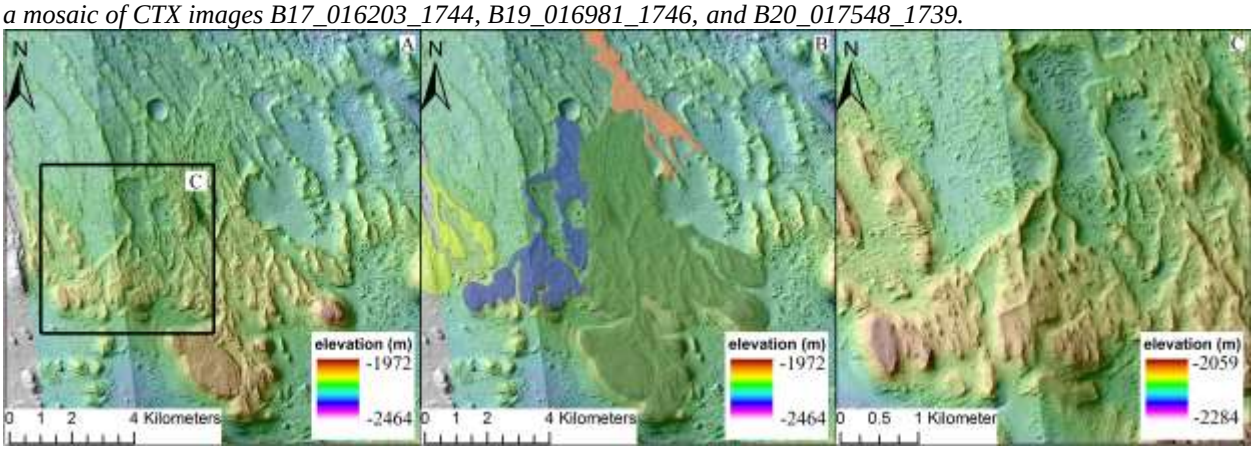

Figure 2: ***(A)*** *DEM of the eastern-most portion of the study area. Increases in elevation southward are indicative of the exposure of stratigraphically higher deposits rather than a northward slope. The inset marks the location of panel C.* ***(B)*** *Same as A, with lobes mapped.* ***(C)*** *Zoom in on the terminal end of the blue lobe (Fig. 1B). This figure demonstrates the branching nature, and the thickness of these deposits suggests this system was distributary rather than tributary.*