ABRADED PYROCLASTIC LINEAR PALEODUNES IN SYRIA AND DAEDALIA PLANA, MARS. K.D. Runyon[1] (kirby.runyon@jhuapl.edu), C.E. Viviano[1], Kim Seelos[1], M. Day[2]. [1]Johns Hopkins APL, Laurel, MD, USA [2]UCLA Dept. of Earth, Planetary, and Space Sciences, Los Angeles, CA, USA.

Introduction: Aeolian processes have dominated Mars' geologic activity throughout the Amazonian, and measurements of aeolian ripple and dune migration have been commonly reported since 2012 [e.g., Bridges et al., 2012; Banks et al., 2018]. Aeolian sand transport is a prerequisite of wind-driven abrasion, and, in addition to depositional aeolian bedforms, Mars also features erosional aeolian landscapes. Here, we highlight our recent publication's [Runyon et al., 2021] interpretation of light-toned barchan and transverse dune-like ridges on Mars that bear evidence for ongoing abrasion and highlight the interplay between modern aeolian deposition and erosion.

Geologic Context: The light-toned ridges appear in Syria and Daedalia plana, broadly located between Arsia Mons and the western extents of Valles Marineris. Numerous volcanic vents and flows have been mapped in this region [Witbeck, 1991; Tanaka, 2014].

Geologic Description of the Light-Toned Unit, Figure 1 (next page):

Geomorphology: The two common ridge morphologies are transverse ridges that are roughly triangular in cross section and buttes that are triangular in planform (termed "deltoids") and point in the interpreted downwind direction. At meter scale, both ridges and deltoids show fluted, faceted, and scalloped surfaces, interpreted as evidence of aeolian abrasion. North-facing (interpreted as upwind) slopes show light/dark alternating bands, taken as further evidence of abrasion, which has exposed crest-parallel stratification.

Mapping: Across both Syria and Daedalia planum, lava flows embay craters, smoothing their topography. Distal lava flow lobes are also common. The ridge-forming light-toned unit superposes these lower lava flows. Other occurrences of the light-toned unit manifest as caprock, commonly rimming craters and superposing the crater ejecta. Deltoids occur around the interpreted upwind periphery of the field of ridges, reminiscent of the arrangement of barchan dunes along the upwind periphery of transverse and barchanoid dune fields.

Composition: Extracted CRISM hyperspectral I/F data of the light-toned unit reveals a spectral signature consistent with global Martian dust and with nanophase Fe-oxides. CRISM mapping data shows this dust-like signature is present amidst the surrounding relatively dust-free volcanic plains, suggesting this is the primary signature of the light-toned ridges themselves (our preferred hypothesis), or that they somehow preferentially accumulate dust compared to surrounding materials.

Proposed Formation History and Conclusion: As shown in Fig. 2, we integrate our results into the following proposed history. *First*, lava flowed extensively over the terrain, embaying craters and muting the underlying topography. *Second*, pyroclastic eruptions deposited light-toned volcanic ash on the lava plains. *Third*, transverse bedforms formed in the high volume of volcaniclastic sediment, forming barchan dunes on the periphery where sediment was more scarce and transverse dunes in the deposit interiors where sediment was more plentiful. *Fourth*, the bedforms became lithified, either cemented in place by salts (particularly Cl and S [Bridges et al., 2010; Clark, 1982; Rieder et al., 1997]; or possibly sintered into an ignimbrite immediately following the bedforms' deposition and formation as the deposit outgassed [e.g., de Silva and Bailey, 2017]. *Fifth* and finally, low volumes of wind-blown sediment over time eroded the light-toned unit to its present morphology of bedforms with an abraded texture, preserving a record of both aeolian deposition and erosion into proto-yardangs.

In summary, we interpret the light-toned deposit, and in particular the ridges and deltoids, to be indurated paleodunes with a volcaniclastic origin that have been eroded into modern proto-yardangs sitting atop earlier lava flows in Syria and Daedalia plana. The present work will inform ongoing work on yardangs in the enigmatically low-dust Olympus Maculae [Runyon et al., 2019].

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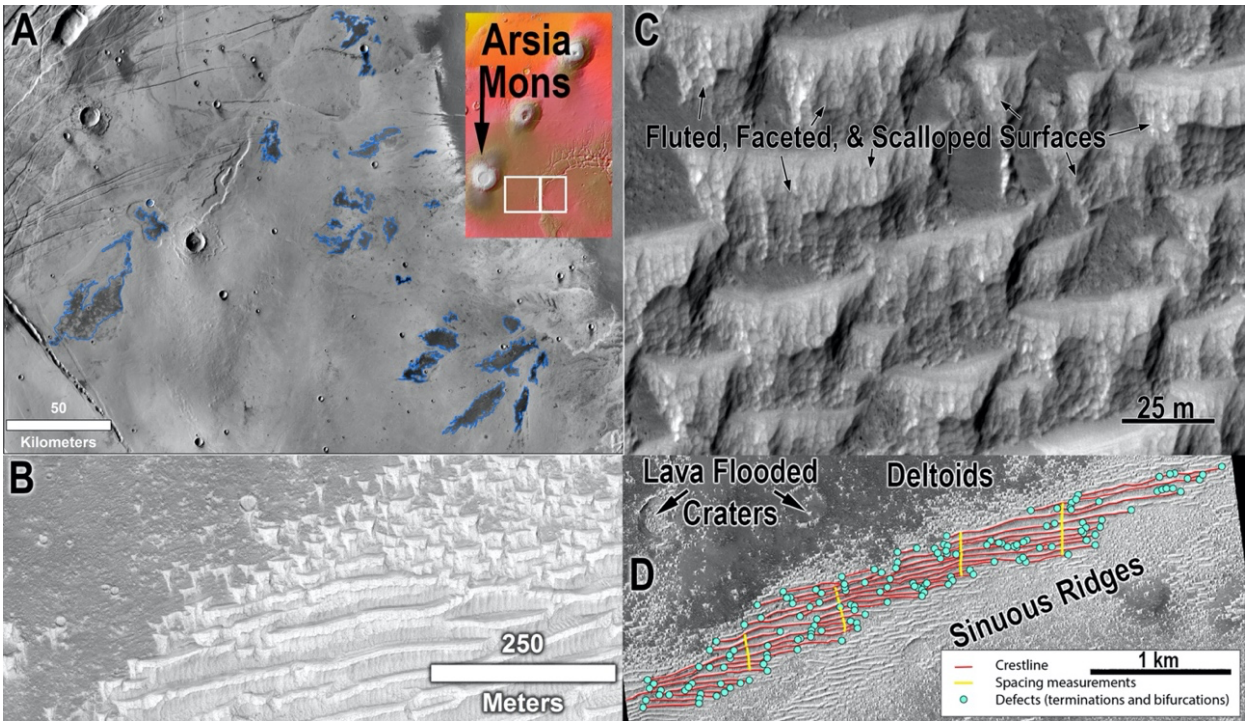

Figure 1. A) Mapping (blue outlines) of ridge-bearing light-toned unit in Syria Planum (Daedalia Planum not shown; THEMIS basemap). B) Deltoids and ridges of the light-toned unit atop interpreted lower lava flows (HiRISE ESP_061693_1670). C) Zoom in on Deltoid and ridge abrasion morphology (fluted, faceted and scalloped surfaces; HiRISE 56629_1670). D) Mapping of defects (crestline terminations and bifurcations); lava-flooded craters (HiRISE ESP_032880_1670). THEMIS and HiRISE credit: NASA. Modified from Runyon et al. (2021).

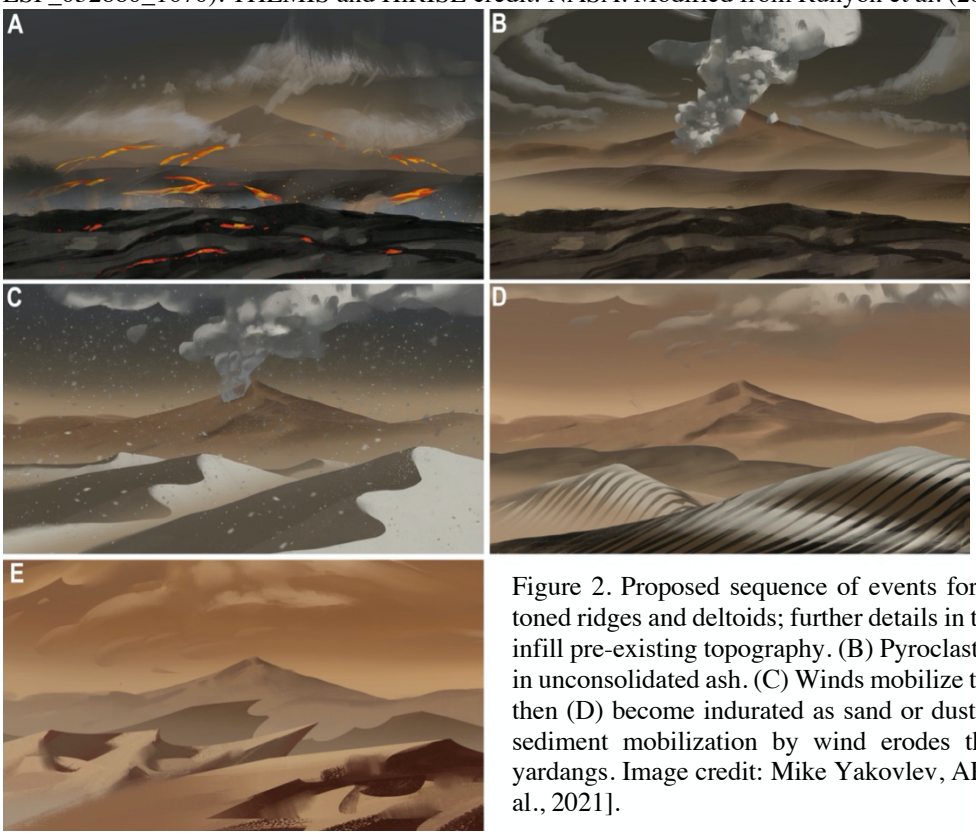

Figure 2. Proposed sequence of events for the formation of the light toned ridges and deltoids; further details in text. (A) Basaltic lava flows infill pre-existing topography. (B) Pyroclastic eruptions coat the region in unconsolidated ash. (C) Winds mobilize the ash into bedforms which then (D) become indurated as sand or duststone. (E) Deflation and/or sediment mobilization by wind erodes the lithified bedforms into yardangs. Image credit: Mike Yakovlev, APL. Taken from [Runyon et al., 2021].