TERRAIN-CONFORMING LIGHT-TONED MANTLES IN THE HELLAS BASIN REGION, MARS.

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Introduction: There is substantial evidence for widespread deposition of a terrain-conforming, post-Noachian light-toned deposit. We give two areas as examples: Majuro Crater, and along a fluvial system draining the NE Hellas basin slope.

Observations and Inferences: Our initial study is focused on Majuro Crater, which is a latest Noachian to Hesperian 44-km diameter crater with well expressed ejecta. The crater features large alluvial fans which post-date deposition of the light-toned deposits. Glacial modification of the crater rim post-dates both the light-toned deposits and the alluvial fan deposits. Three locations of light-toned deposits have been examined: (a) a thick, partly eroded deposit on the central crater floor; (b terrain-conforming, partly eroded light-toned deposits on inner crater rim; and (c) light toned deposits on Majuro ejecta north of the crater rim. All exposures are bright in nocturnal THEMIS IR.

The light-toned deposits in Majuro Crater weather into meter-scale blocks. The deposits are commonly massive to coarsely layered. A spectral signature of phyllosilicates has been detected by CRISM in these deposits [*1*]. Where the light-toned deposits are relatively massive, wind erosion locally scours the deposit surface into decameter-scale cuspate flutes, indicating the susceptibility of the deposits to erosion by saltating grains. These features suggest the deposit contains a substantial component of silt-to-clay grain sizes. Thick light-toned deposits on the crater floor are partially mantled from the north by alluvial fan deposits and have been removed by deflation in the southeastern crater floor, leaving a steep scarp.

Other light-toned exposures are located on the interior NE rim of Majuro Crater, which is covered by CTX stereo coverage. This rim had been eroded into broad ~ 2 km wide knobs and valleys prior to deposition of terrain-conforming light-toned deposits. These deposits subsequently were partly eroded by aeolian deflation, creating erosional windows into the underlying crater rim deposits. The light-toned deposits are inferred to be exposed at or shallowly below the surface, except where they are clearly removed by erosion, exposing underlying dark-toned crater rim materials. Alluvial fan deposits are superimposed on the light-toned deposit along valley axes. We also infer that the light-toned deposits were emplaced prior to later glacial modification of the crater rim. Majuro's ejecta is mantled with light-toned deposits, which in turn is locally covered with darker deposits. We conclude for this study locality that light-toned deposits formed a terrain-conforming deposit over Majuro crater and its ejecta. This deposit was likely deposited by airfall, and occurred after erosional sculpting of the interior rim of Majuro crater and prior to alluvial fan deposits and glacial modification.

A second study area is on the east slopes of Hellas basin along one of the Navua Valles drainage lines leading towards Hellas (Fig. 1) [*2*]. The deposits in this area lie between the relatively modern drainage and mountainous slopes to the north. The main light-toned deposits here underlie a dissected terrace and drape over that terrace. To the south they dip beneath the younger fluvial deposits. The light-toned deposits are mantled by a thinner dark-tone deposit except where exposed by aeolian erosion. Where aeolian erosion is greatest, often on steep slopes of the terrace, windows expose material beneath the light-toned deposits. Some scarps in the light-toned deposits expose well-defined layering. A NW-SE trending valley has been eroded through the terrace deposits. Along the valley axis an inverted, meandering channel is floored by light-toned deposits, with a thin central cap of darker material (Fig. 1, red arrows). On the SW side of the inverted channel aeolian erosion has scoured 100 m below the inverted channel (Fig. 1, blue line). On the NE side of the inverted channel a sloping ramp of light-toned deposits connects the inverted channel to light-toned deposits capping the higher terrace some 400 m higher (Fig. 1, green line). Topographic profiles from a HRSC DTM illustrate the terrain-conforming nature of the light-toned layers (Fig. 2). Light blue indicates light-toned deposits at or below the surface. Grey indicates where deposits are inferred to be eroded. Brown indicates caps of darker-toned deposits. The blue line shows an inverted meandering channel, and green the axis of another valley (also shown by arrows in profiles).

Conclusions: One or more light-toned deposits were deposited conformably over a partially eroded terrain within the eastern Hellas Basin region, probably during the Hesperian. Airfall deposition from dust storm or volcanic ashfall is the most likely mechanism. Light-toned deposits are widespread on the martian highlands [*3*]. It is uncertain how many depositional events and depositional mechanisms these deposits represent, or whether they are regional or global in extent. In either case, where found they constitute an important stratigraphic marker [*4*].

The light-toned deposits discussed here are not exclusive of other depositional mechanisms. Deposits at Terby crater are nearly level, suggesting deposition at the margins of a deep Hellas lake [*5, 6*]. Elsewhere such deposits show rhythmic bedding, indicating long-term deposition governed by quasi-periodic climate change [*7*].

References: [1] Mangold, N. *et al.*, (2012), *PSS* **72**, 18-30; [2] Hargitai, H. I. *et al.*, (2017), *Icarus* **294**, 172-200; [3]. Malin, M. C., Edgett, K. S., (2000), *Sci.* **290**, 1927-37; [4] Mangold, N. *et al.*, (2010), *Icarus* **207**, 265-76; [5] Wilson, S. A. *et al.*, (2007), *JGR Pl.* **112**, E08009; [6] Wilson, S. A. *et al.*, in *Lakes on Mars,* N. A. Cabrol, Ed. (Elsevier, 2010), Ch. 7, 195-222; [7] Lewis, K. W. *et al.*, (2008), *Science* **322**, 1532-35.

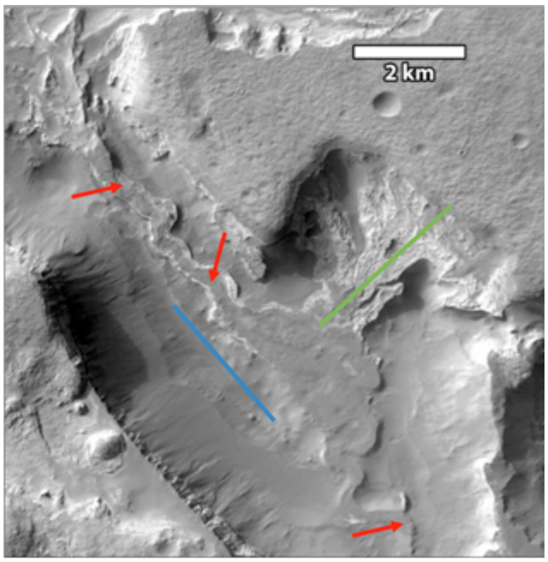

Fig 1. Study area on the east slopes of Hellas basin along a drainage line leading towards Hellas. A NW-SE trending valley has been eroded through the terrace deposits. Along the valley axis an inverted, meandering channel is floored by light-toned deposits, with a thin central cap of darker material (red arrows). On the SW side of the inverted channel aeolian erosion has eroded about 100 m below the inverted channel (blue line). On the NE side of the inverted channel a sloping ramp of light-toned deposits connects the inverted channel to light-toned deposits capping the higher terrace some 400 m higher (green line).

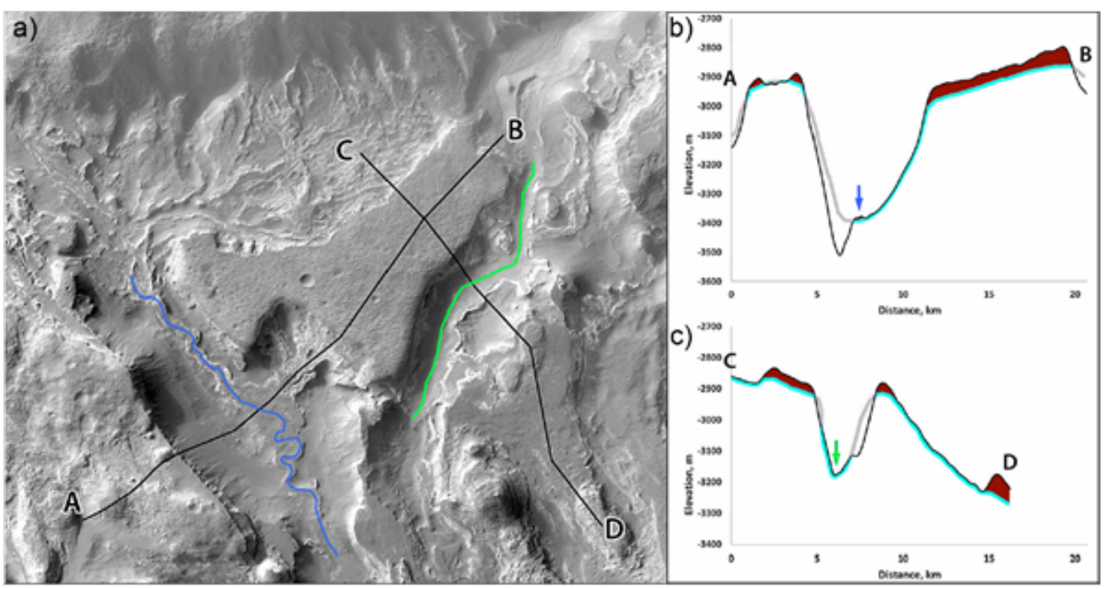

Fig. 2. Topographic profiles from a HRSC DTM illustrate the terrain-conforming nature of the light-toned layers. Light blue indicates light-toned deposits at or below the surface. Grey indicates where deposits are inferred to be eroded. Brown indicates caps of darker-toned deposits. Blue line shows inverted meandering channel, and green the axis of another valley (also shown by arrows in profiles).