

LIGHT-TONED LAYERED DEPOSITS OF CHAOTIC TERRAINS ON MARS

M. Sowe¹, E. Hauber¹, R. Jaumann^{1,2}, and G. Neukum²

¹Institute of Planetary Research, German Aerospace Center (DLR), Berlin, Germany, ²Department of Earth Sciences, Institute of Geological Sciences, Planetary Sciences and Remote Sensing, Free University Berlin, Berlin, Germany. mariam.sowe@dlr.de

Introduction Light-toned and layered deposits (LDs) are mainly exposed in craters, chasmata, and chaotic terrains. Whether they are of sedimentary or volcanic origin is still under debate [1,2,3,4]. This study concerns with LDs in some of the chaotic terrains (Fig. 1). There we look at their morphology, elevation, thickness, layer geometry, and consolidation using high-resolution image and elevation data to characterize LDs in order to ascertain which formation hypotheses are possible.

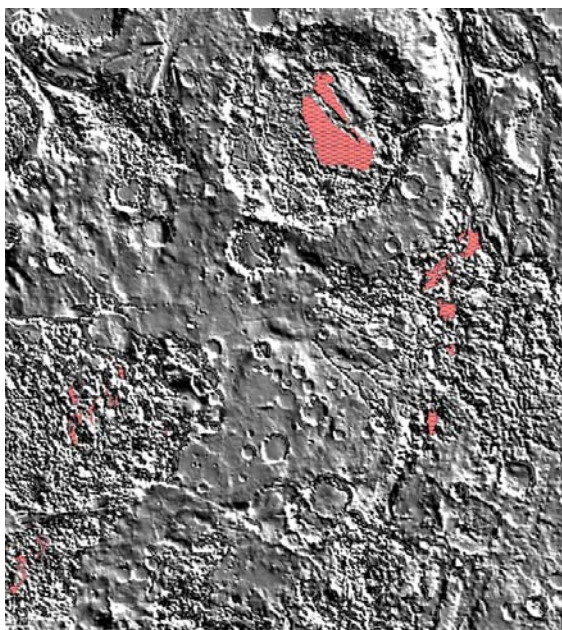


Fig. 1: MOLA map showing the study area including LDs in Aureum, Arsinoes, Aram, and Iani Chaos. The -2100 m contour, which is the maximum elevation of LDs in that region, is marked.

Results LDs differ from their surroundings by their lighter colour and their layering as well as their morphology differs. LDs are mostly isolated light-toned mounds. There are flow-like structures where light-toned material encloses chaotic material (Fig. 2a, b) as well as appearances. Some LDs show massive cap rock at their top and layering in lower parts. The surfaces often show strong evidence for wind erosion (yardangs) and fractures. Debris fans are observed on many LD slopes. The contact between LDs and chaotic terrain is often covered by dust. Wind

activity is also indicated by dunes concentrated in depressions (e.g., fractures) on the LD surfaces. TES-derived nighttime thermal inertia (TI) confirms that the material is more consolidated than its surroundings [5] (Fig. 3a, b).

LDs are mainly located in depressions at different elevations beneath the surrounding plateau rims. Their elevations range from -4000 m to -2000 m. They are stratigraphically exposed on chaotic terrain (Fig. 2a, b), the source regions of the outflow channels, and are therefore younger. Assuming horizontal stratification LD thicknesses vary in the range of 500-1200 m (Fig. 3). When looking at higher-resolution MOC images, deposits show varying surfaces (rough, fractured, grooved, cap rock).

Different surfaces textures of LDs have a comparable elevation and mineralogical composition comparable. Differences in consolidation, erosion and/or age might explain these features. LDs are closely connected to sulphate- [6,7] and hematite rich materials [8] that indicate an aquatic environment.

In Iani Chaos an LD is composed of several layers that could be differentiated [9]. These layers have nearly horizontal layering. There different thicknesses have been measured. The dip direction within the LD changes as in the western part the layers dip westwards and in the eastern part eastwards. Measuring the thicknesses, we tried to find similarities supposing that isolated patches of layers are correlated within Iani Chaos. We do find some similar thicknesses in the western part that correlate to layers in the eastern part. We try to find out whether these layers are texturally consistent. Using TES-TI at nighttime, we see no differences in layering concerning the thermophysical properties due to the limits of spatial resolution. The THEMIS-brightness temperature of different layers at nighttime only shows minor differences.

Therefore higher resolution images (HIRISE) would be useful to have a closer look at the surface and layering to get more information of the surface texture.

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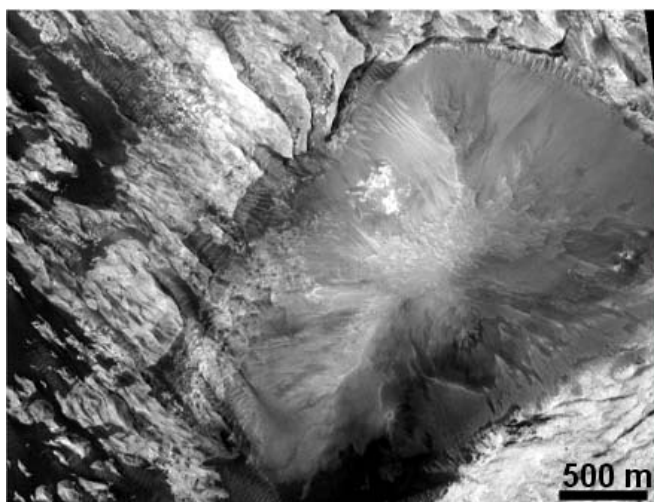


Fig. 2, b: MOC image (R1600246) with corresponding HRSC rgb-nadir composite (h0934) showing LD material enclosing a chaotic mound in Iani Chaos.

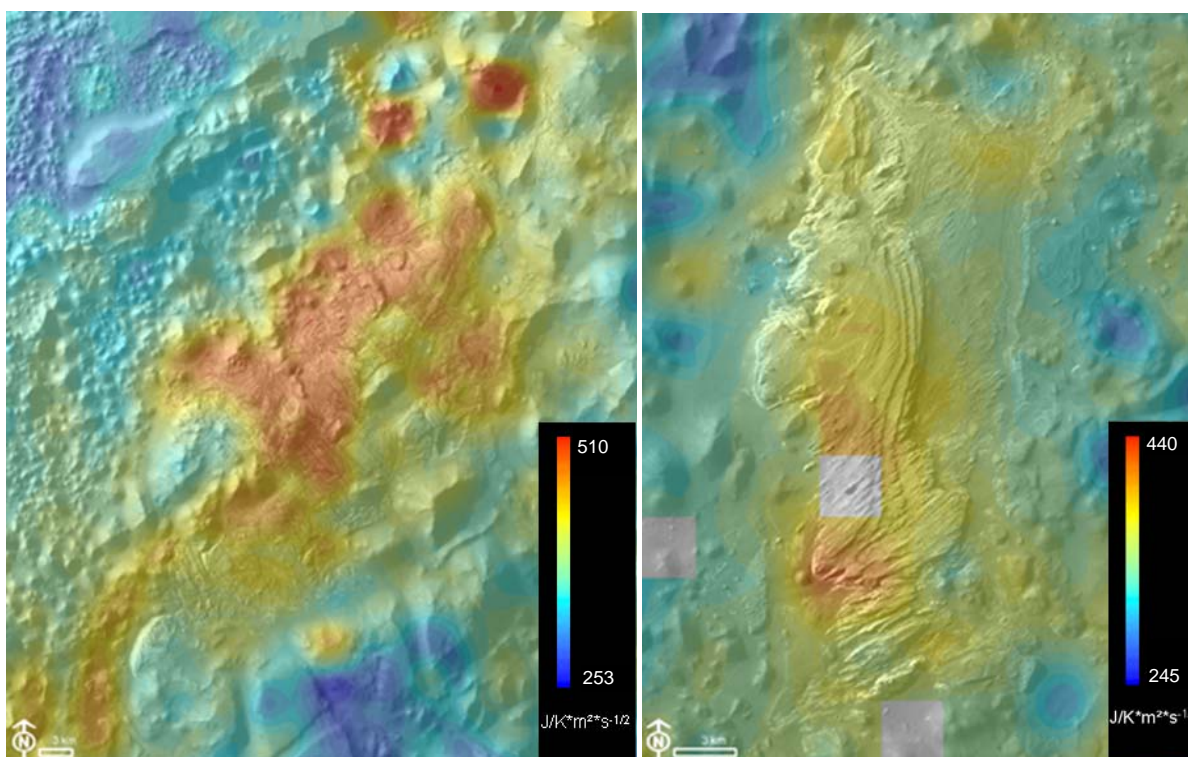
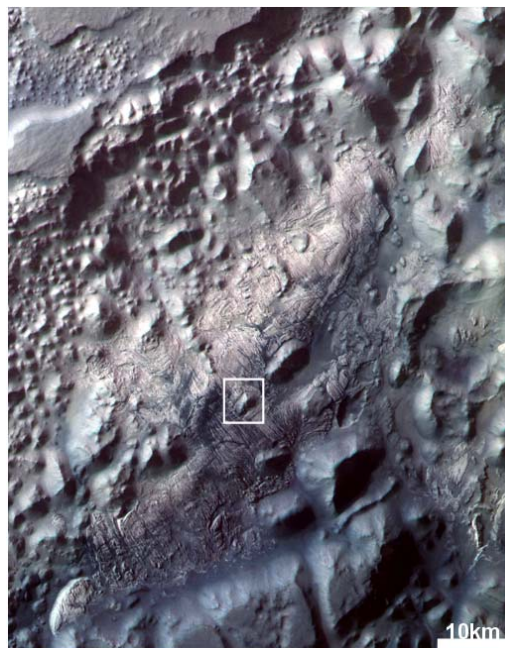


Fig. 3a, b: TES-TI of LDs in Iani Chaos. LDs have a higher TI (~460-510 SI, 410-440 SI).