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LAYERED DEPOSITS OF THE EASTERN VALLES MARINERIS AND CHAOTIC TERRAINS ON MARS

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Light-toned and layered deposits (LDs) are present throughout the whole Valles Marineris and adjacent chaotic terrains. They are supposed to be of sedimentary [1,2,3] or volcanic origin [4]. Using high-resolution image and elevation data, we study their morphology, elevation, thickness, layer geometry, and consolidation in order to ascertain how they formed.

LDs show differing morphologies. There are light-toned mounds with a flat top and steep slopes, flow-like structures where light-toned material flows around the chaotic-terrain material as well as terrace-like structures and razorblade-shaped morphologies that show massive cap rocks at their top and layering in lower parts. Often, there is a diffuse contact between LDs and chaotic terrain due to dust coverage. Many of the LDs exhibit yardangs, suggesting weakly consolidated and fine-grained material shaped by wind erosion. Wind activity is also indicated by dunes that occur in depressions (e.g., fractures) that are cut into the LD surfaces. Debris fans and a general lack of boulders at their base may indicate loose to partly consolidated sedimentary material. This is also confirmed by TES-derived thermal-inertia values of ~ 300 SI indicating rock materials [7].

Elevation data show that LDs are located in depressions at different elevations but far beneath the surrounding plateau rims (1000-4000 m in the chasmata, 200-1500 m in the chaotic terrains). LDs are superimposed on chaotic-terrain material and are therefore younger. Strike and dip measurements point towards sub-horizontal layering (in the range of < 10°) and NS- to NNE-SSW-strike for Iani Chaos. LD thicknesses vary in the range of 200-4000 m, assuming ILDs have horizontal to sub-horizontal stratification (Fig. 1.1, 1.2).

When looking at higher-resolution MOC images, deposits show varying surfaces (rough, fractured, grooved, cap rock). Different surfaces textures may be due to differences in consolidation and/or wind erosion; the mineralogical composition is however comparable. LDs are closely connected to sulphate- [5] and hematite rich materials [6]. A topographic trend is observed as some LDs show surfaces that are restricted to chaotic terrains and other to chasmata.

References:

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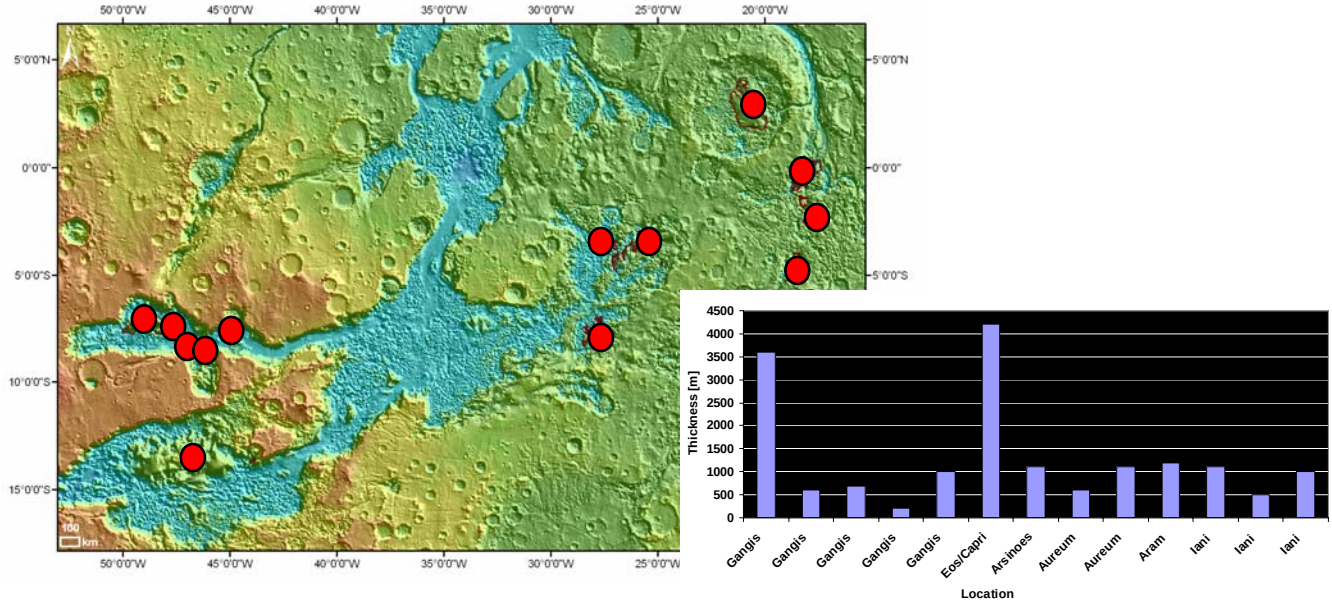

Fig. 1.1: MOLA-map showing the locations of LDs in the research area (red circles).
Fig. 1.2: LD thicknesses from west to east (sub-horizontal layering assumed).