The Banded Terrain in the NW Region of Hellas Basin

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1. Introduction

Hellas Basin on Mars exhibits a wide range of different types of terrain with significantly different ages [3]. There is considerable evidence for ancient fluvial activity [7,1] and it has been suggested that lakes (possibly ice-covered) may have persisted into the early Amazonian period [9]. The NW region of the basin contains the lowest elevation terrain on Mars and it might be expected that any water present locally would flow to this area from the surroundings. A geological map encompassing this region has been presented in [8].

Large areas in the NW region of Hellas Basin (37-42S, 51-58E) are covered with “banded terrain”. An example is shown in Figure 1. The dearth of impact craters indicates a young crater retention age, due to recent emplacement of the units and/or active processes that erase craters. It is characterized by long, often thin, adjacent ribbons up to several kilometers long which change orientation and warp, often in response to local topography. The aim of this study is to establish whether the terrain is in some way related to water and/or ice by reviewing the available images of the region in order to place constraints on the formation mechanism(s).

The area covered by banded terrain is large. Observations from the HiRISE camera [5,6] on Mars Reconnaissance Orbiter (MRO) therefore only cover a small fraction but at spatial scales near 50 cm/px. The Context Imager (CTX) on MRO [4] is being used to produce almost complete coverage of the region at 5 m/px and the data allow a fairly complete assessment of the distribution of banded terrain.

2. Notable Features of Banded Terrain

Large Scale Distribution: In Figure 2, the positions of HiRISE images are shown superimposed on a MOLA contour map for the study area. Filled diamonds indicate images where banded terrain was found. Note how the terrain is in the vicinity of the large crater at 41S, 53E and along the scarp running SW-NE which is up to 1000 m in height. (A more detailed mapping based on CTX data will be presented at the meeting.)

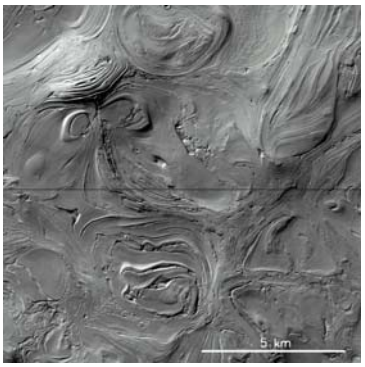

Figure 1 Section of CTX image P19_008559_1408_XN_39S306W showing examples of "banded terrain". North is approximately up.

Small Scale Distribution: Banded terrain can cover large areas (Figure 1) but there are occasionally isolated deposits covering only a small area (e.g. 2-5 km^2) surrounded by older terrain indicating local production.

Appearance: The banded terrain in some areas is highly contorted and there is evidence of cross-cutting and even total disruption of bands by interaction with other bands, indicating flow.

Multiple episodes: There are several examples of where material has been put down in layers and although we have yet to explore stereo reconstruction of these sites, the brightness distribution suggests that layering is associated with topography indicating strength of the material composing the layers.

Sources: In many places, the starting points of individual bands can be identified. Although these may not necessarily be sources, the visual appearance gives the impression that older terrain forming local topographic highs started to "flow" thereby producing the bands (Figure 3). The material flowing from the topographic high then covered lower lying older terrain but was not fluid enough to spread out over a wide area. Together with the observations of isolated areas and the lack of obvious caldera(s), it is difficult to envisage a volcanic origin for these features and we currently tend towards a mechanism involving ice.

Other features in vicinity or superposed: Although rare, scalloped terrain is evident in the study area. This has also been seen in the nearby Peneus-Amphitrites Paterae region [2]. There is also evidence in HiRISE data of polygonal depressions superposed on some bands. These observations point to the possibility of near-surface ground ice. To the NW, more obvious polygonal terrain is evident but it appears likely that these are indurated dunes.

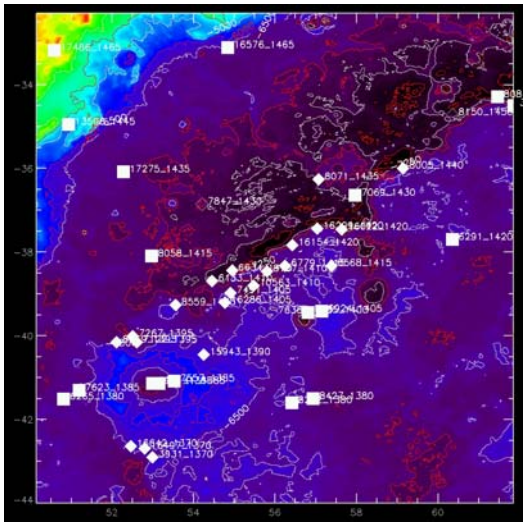

Figure 2 MOLA map of the NW region of Hellas Basin. Contours are superimposed to give the height scale. Filled diamonds show the positions where HiRISE images contain evidence of banded terrain. Filled squares indicate where no banded terrain was seen. Open diamonds are ambiguous (e.g. possibly degraded banding).

The presentation will illustrate the above features with additional examples and suggest possible interpretations including exploring the idea that these features are a consequence of the flow of ice-laden material.

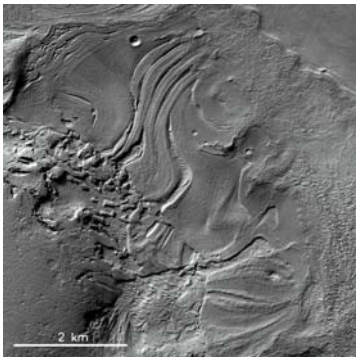

Figure 3 Section of CTX image P19_008559_1408_XN_39S306W showing a banded unit superimposed upon a substrate.

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