Banded Terrain and Associated Geology at the NW of Hellas Basin, Mars. M. R. El Maarry[1], N. Thomas[1], A. Pommerol[1]. [1]Physikalisches Institut, Universität Bern, Switzerland, (corresponding author's email: Mohamed.elmaarry@space.unibe.ch).

Introduction: Hellas Basin on Mars exhibits a wide range of different types of terrain with significantly different ages [1]. There is considerable evidence for ancient fluvial activity [2,3] and it has been suggested that lakes (possibly ice-covered) may have persisted into the early Amazonian period [4]. 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 [5]. Large areas in the NW region of Hellas Basin (37-42S, 51-58E) are covered with "banded terrain" (Fig. 1). The dearth of impact craters indicates a young crater retention age, because of 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 gain more understanding on the possible formation pathways of these terrains and whether they are linked to liquid water, ice activity, or other processes such as salt-diapering [6] through a combination of mapping, morphometric analysis, and transport modeling. The area covered by banded terrain is large. Observations from the HiRISE camera [7] on Mars Reconnaissance Orbiter (MRO) therefore only cover a small fraction but at spatial scales near 50 cm/px. As such, the Context Imager (CTX) on MRO [8] was used for the mapping part due to its almost complete coverage of the region at 6 m/px.

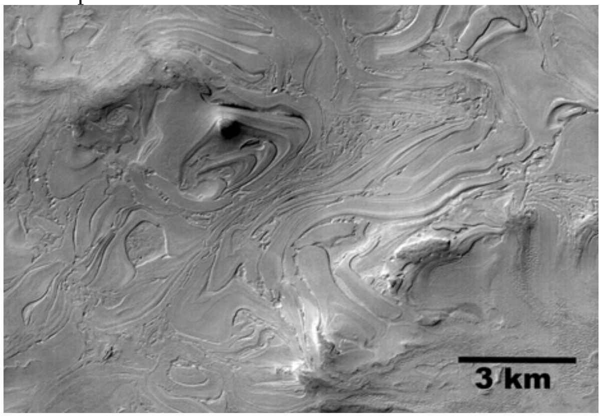


Fig. 1. A typical example of banded terrain NW of Hellas Basin as seen by the CTX camera. Image ID: P15_006845_1392.

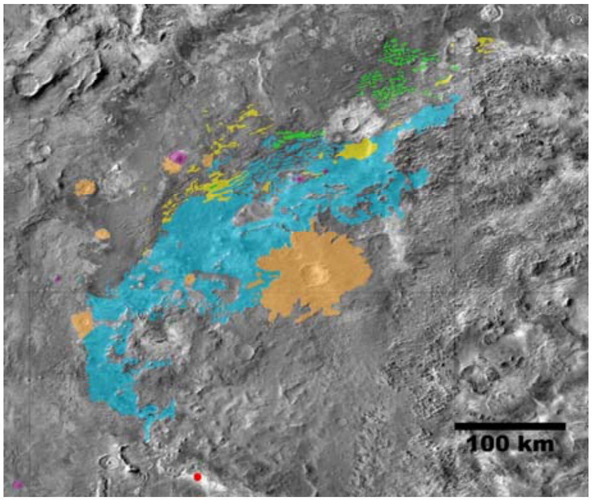


Fig. 2. Colorized mapping of various units in NW Hellas including (in order of relative age starting with the youngest) banded terrain (blue), honey-comb terrain (green), and reticulate terrain (yellow). Also included are fresh-looking impact craters (orange), and large mounds (purple) which are generally young but show a complex relation with the banded terrain suggesting a syngenetic formation in many cases. The red dot near the bottom shows the location of the putative remnants of pack-ice (fig. 3f).

Mapping Results: Fig. 2 shows the results of mapping the banded terrain in NW Hellas along with associated terrains and interesting geomorphological units that could be both spatially and temporally linked to the formation of the banded terrain. We will only summarize here the highlights of our mapping.

Cracking at variable scales: Cracking is visible at various scales (Fig. 3a,b,c) ranging from a few meters to hundreds of meters in spacing. While small polygonal cracks can easily be attributed to thermal contraction processes acting on an ice-rich substrate, recent studies [9] have shown that this is an unlikely mechanism in the case of larger cracking patterns making desiccation a more plausible mechanism. This highlights the potential role of liquid water in shaping these terrains. Cracks are seen within the banded terrain as well as neighboring units. In addition, the so-called reticulate terrain [2,5] may in fact be an inverted terrain of old polygonal cracks that have been filled with material more resilient to weathering (Fig. 3c).

Honey-comb terrain: consists of "mega-cells" that can be a few kilometers wide (Fig. 3d). Our mapping shows that this terrain is commonly associated with the banded terrain which sometimes appears to cover or in-fill the older “cells” in many locations.

Other Features: Include numerous large (km-sized) mounds scattered throughout the region as well as a single site that shows putative pack-ice remnants. Some of the mounds display summit pits and evidence of flowing material. These features further highlight the complex history of the region rendering it worthy of detailed analysis.

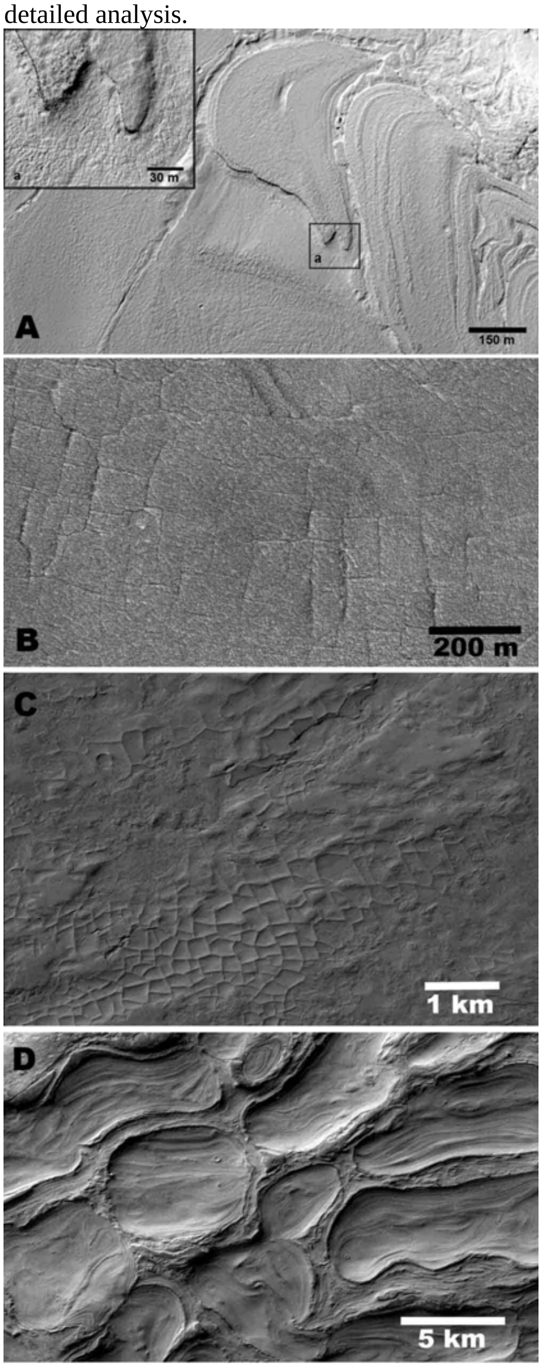
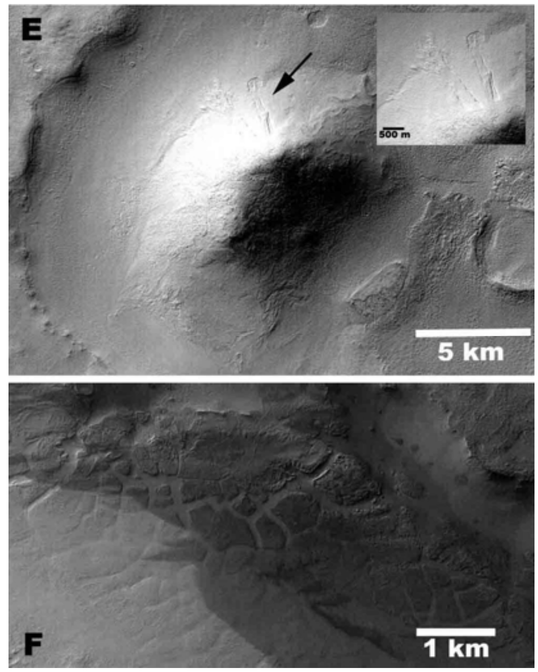


Fig. 3. High resolution images of banded terrain and associated terrains/units. (A) HiRISE image of banded terrain with HiRISE in the inbox (a) for associated terrain displaying



HiRISE in the inbox (a) for associated terrain displaying cracking similar in magnitude to that of thermal contraction cracks although desiccation cannot be discounted. (B) HiRISE image of rectilinear troughs commonly associated with banded terrain. Notice the larger spacing between the troughs. (C) Terrain described as reticulate in previous investigations. The terrain displays erosive behavior with rectilinear ridges that can be an inverted terrain displaying older and more resilient crack fillings. The overall magnitude, orientation, and erosive behavior argue against them being fossilized dunes. (D) Terrain described as honey-comb in previous investigations. This terrain may be indicative of intense tectonic activity in the region. (E) Large (5-6 km wide) mound in NW Hellas. Note the flow feature near the summit (arrowed). (F) Potential pack-ice remnants that hint at an extensive glacial activity in the region. Image ID: (A) PSP_007491_1405, (B) ESP_020255_1430, (C) B19_017143_1646, (D) P17_007781_1414, (E) P13_006265_1389, (F) P20_008849_1334.

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