

# Geomorphological architecture of the banded terrain at the NW of Hellas basin, Mars.

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## Abstract

We use geologic mapping techniques and morphometric analysis to characterize the geomorphic architecture of the banded terrain in NW Hellas basin, Mars. The banded terrain is composed of smooth ribbons or bands of material located in the deepest part of Hellas basin. The morphometric analysis reveals that the banded terrain is localized on slopes that average  $\sim 7^\circ$ . Furthermore, individual ribbons vary in length from 4.5 to 10 km. The bands are separated by narrow inter-band depressions that are approximately 65 meters wide and 10 meters deep. Crater-size frequency analysis yields a young Amazonian age for the terrain ( $\sim 1.3$  Gyr), which is indicative of either a young emplacement age or low crater-retention properties for the banded deposits.

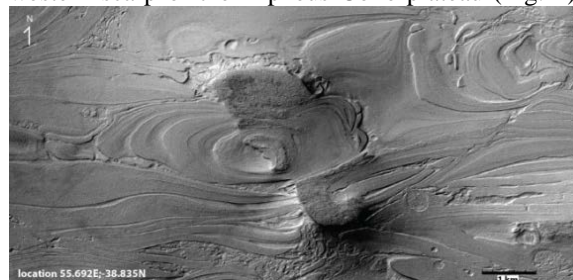
## 1. Introduction

Hellas Basin, which is centered at  $67.8^\circ\text{E}$ ;  $40.8^\circ\text{S}$ , contains the lowest elevations on Mars with a maximum depth of  $\sim 7.5$  km, in relation to the reference datum, and contains many geologic units [1]. Distinct markers related to fluvial, glacial and volcanic flows have been mapped in the basin [2, 3 and 4]. The NW part of the basin is covered largely by a unit, which shows flow features and is unofficially called “Banded Terrain” [5, 6] (Fig. 1). The aim of this study is to characterize the particular flow structures of the banded terrain using high resolution (meter-scale) mapping and morphometric analysis. To this end, we use images from the Mars Reconnaissance Orbiter Context Imager (CTX, resolution 6m/px) and the High Resolution Imaging Science Experiment (HiRISE, 25–50 cm/px) to map the various geomorphological features related to, and associated with, the banded terrain.

## 2. Mapping and morphometric results

**Mapping results:** The banded terrain is localized in a region ( $37\text{--}42^\circ\text{S}$ ;  $51\text{--}58^\circ\text{E}$ ) [5, 6] close to the north-

western scarp of the Alpheus Colle plateau (Fig. 2).



**Fig 1.** Example of banded terrains in the NW Hellas basin (CTX image). Image ID: P17\_007636\_1414.

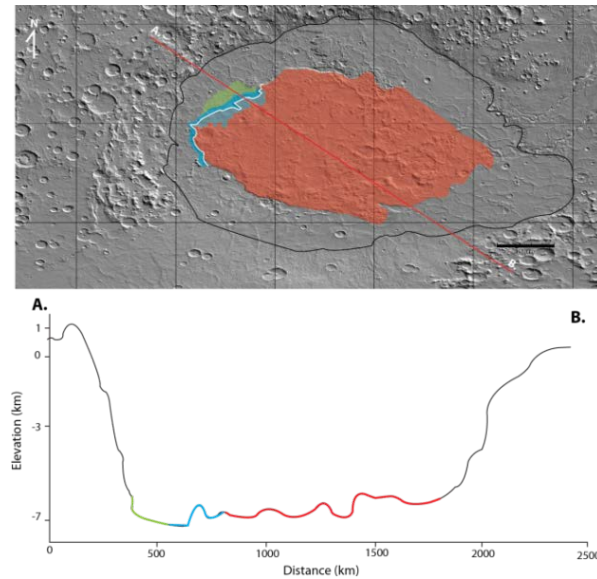
These terrains display an alternation of small reliefs (ribbons) and depressions (inter-ribbons) with variable dips and strikes for the beds (Figs. 1 and 3A). Some bands have an elliptic shape with an E-W trend in their orientation, which is generally perpendicular to the main slope. Others are defined by smooth, curved and streamline ribbons with a length of approximately 4.5 to 10 km (Figs. 1 and 3A). This banded terrain has distinct source regions. Indeed, the ribbons or inter-ribbons start at a high topographic point. In some locations, an overlapping of ribbons is observed which can be the result of different flow directions or multiple flowing episodes. Farther to the NW is the honeycomb terrain, which is characterized by concentric, polygonal shapes resembling cells or honeycombs [2, 6]. In some of these “cells”, features similar to the banded terrain are observed. Interestingly, few ribbons of the banded terrain appear to be more elliptical from the scarp to their contact with the honeycomb terrain.

Our determination of banded terrain ages by crater counting yields an average age of 1.3 Gyr (late Amazonian), which indicates a young age emplacement for the bands or low crater-retention properties.

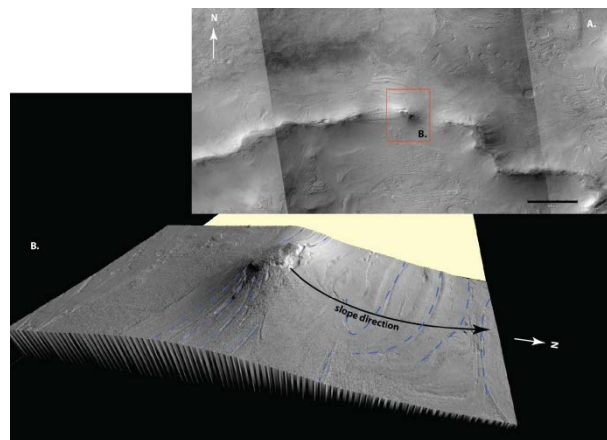
### Morphometric analysis:

**Slope profiles and calculation of the inter-bands' depth:** the slope angles vary from  $4^\circ$  to  $13^\circ$  in the banded terrain area with an average of  $7^\circ$ .

Measurements of lengths of shadows yield an average depth of 10 m for the inter-bands.



**Fig 2.** Upper: MOLA shaded relief map of Hellas basin with the units of interest in color for clarity. Colored units are: the central plateau (red), the banded terrain (blue), the Honeycomb terrain (green), the scarp outline of the central plateau (white line), the basin's rim (black line). Lower: a NW-SE topographic profile whose outline is shown in the upper panel. The profile is colored in some sections to match those of the units described in the map.



**Fig 3.** 3D view showing slope effect on the flow features' emplacement. Upper Image ID: P17\_007636\_1414. Lower image ID (3d view): PSP\_007781\_1410.

### 3. Future work

We plan to use also CTX- and HIRISE-derived DTMs to calculate the volume corresponding to the inter-ribbon depressions, and to compare the results with those obtained with the depth inter-bands' calculation method. The relief can also be used in future works to characterize the material of the ground.

In addition, we intend to use thermal infrared data to characterize the thermal inertia of the banded terrain which could yield important clues regarding its composition or physical properties.

### Acknowledgements

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