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AMAZONIAN THERMOKARST WITHIN A TROUGH OF NOCTIS LABYRINTHUS, MARS

ABSTRACT: BAIONI D., TRAMONTANA M. & MURANA A., *Amazonian thermokarst within a trough of Noctis Labyrinthus, Mars.* (IT ISSN 0391-9839, 2017).

This paper describes the possible ice-related landforms observed on the floor of a trough located in the western part of Noctis Labyrinthus, centred at -6.8° S, 98.9° W, in the equatorial region of Mars.

A morphological survey of the study area and of the landforms was investigated through an integrated analysis of Mars Reconnaissance Orbiter (MRO) High Resolution Imaging Science Experiment (HiRISE) and Context Camera (CTX) data.

The analysis highlighted the presence of landforms interpreted as being due to thermokarst processes, resembling similarly ice-related landforms found both in the cold-climate non-glacial regions of Earth and in other areas of Mars.

These landforms, which are attributed to melting processes of ground ice, suggest significant climatic changes and climatic conditions differing from those existing now. Moreover, they appear to display young erosional age, suggesting that they are probably of Amazonian age.

KEY WORDS: Thermokarst, Noctis Labyrinthus, climate changes, Amazonian, Mars

INTRODUCTION

Mars is currently a hyperarid, hypothermal desert and its largest reservoirs of surficial water ice are located at the poles (Bibring & *alii*, 2004). However, general atmospheric circulation models suggest that ice migrates directly to the near-equatorial regions during periods of higher obliquity (Levrard & *alii*, 2004; Chamberlain & Boynton, 2007).

In particular, climate models have shown that near-equatorial glaciation could be induced episodically as Mars reaches high obliquities (Forget & *alii*, 2006; Head & *alii*, 2003, 2006).

Studies based on the Mars Global Surveyor and Mars Odyssey data have identified both stratigraphical evidence of glaciation and periglaciation (Soare & Osinski, 2009; Soare & *alii*, 2012) and a landscape assemblage consistent with periglacial activity (Soare & *alii*, 2008) in non-polar regions of Mars.

Analysis of the most recently acquired high-resolution satellite images provided evidence for the possible presence of ice in the planet's tropical and equatorial regions (Megè & Bourgeois, 2011; Shean, 2010), and features attributed to present or previous permafrost or ground-ice-related processes at low latitudes and/or equatorial areas of the planet have been identified (Balme & Gallangher, 2009; Megè & Bourgeois, 2011; Warner & *alii*, 2010).

Canyon troughs, as well as impact craters, are useful targets for the identification of periglacial features because their interiors function as cold traps, shielding volatile elements from the ablative effects of insolation or wind and preserving icy bodies that would otherwise be removed in an open plain (Levy & *alii*, 2009; Shean, 2010).

Noctis Labyrinthus (denoted as NL hereafter) (fig. 1) is an intricate system of Late Hesperian and early Amazonian linear troughs and rounded pits connecting the Tharsis volcanic rise and western Valles Marineris (Tanaka & *alii*, 2014; Rodriguez & *alii*, 2016). We focused our study on a trough located in the western part of NL (fig. 1A and 1B), centred at -6.8° S, 98.9° W, approximately 60 × 50 km in size and with a depth of 5 km below the adjacent plateau (Weitz & *alii*, 2013). The north-western part of the trough floor (fig. 1C and 1C1) is characterized by chaotic terrain (Weitz & *alii*, 2013), where the widespread presence of shallow depression morphologies that display different shapes and sizes, whose origin is still unknown, can be observed.

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