KARST-LIKE LANDFORMS IN THE LIGHT TONED DEPOSITS (LTDs) WITHIN NOCTIS LABYRINTHUS, MARS. D. Baioni[1] and M. Tramontana[1], [1]Planetary Geology Research Group, Dipartimento di Scienze Pure e Applicate Università degli Studi di Urbino "Carlo Bo", Campus Scientifico "E.Mattei" località Crocicchia, 61029 Urbino, Italy, davide.baioni@uniurb.it.

Introduction: Noctis Labyrinthus, is located on the eastern edge of the Tharsis Plateau in the equatorial region of Mars, and consists of a network of intersecting valleys that merge and coalesce with pit chains and larger troughs. In this area several studies showed the presence of units that were identified and classified as light toned deposits (LTDs) with spectral signatures of sulfates and phyllosilicates sulfate [1,2]. In this study we focused our analysis on the LTDs located within a trought that is centered at 6.8° S, 261.1°E and is approximately 50 x 60 km in dimension with a depth of about 5 km below the surrounding plateau. Here, in the southern part of the trought floor, LTDs that display clear spectral signature of gypsum have been discovered through the anaysis of CRISM data [3]. Through the analysis of the MRO HiRISE images we studied in great detail the LTDs surfaces. In particular, we investigated the landforms that we interpreted as karst-like landforms, studying the possible processes involved in their formation and shaping.

Karst-like landforms: On the LTDs surface closed rimless depressions surrounded entirely by unbroken plains can be observed. These depressions are either rounded-shaped (Fig.1) or elliptical-elongate shaped (Fig.2), and range in length from 70 m to up of 1500 m, while Widths are generally between 50 and up of 300 m. The depressions display both simmetrycal and asymmetrical walls, and concave-up or flat floor geometry. These landforms display similarities with the terrestrial sinkholes that commonly develop in all kinds of evaporite terrains in arid or cold regions on Earth. Moreover, they strongly resembled the evaporite sinkholes described in other regions of Mars [4].

Discussion and conclusions: The depressions that can be observed in the LTDs surfaces lack evidence of wind action and erosional features associated with the evolution of impact craters. In fact, the analysis carried out suggests that they were not built or shaped by wind erosion, or impact craters heavily eroded or reworked by geomorphic processes. Thus these morphologic features, might be interpreted as karst landforms of polygenetic origin. The water necessary to shape and build these forms probably has been provided by the melting of ice or snow, that can be formed during periods of ice-snow-rich deposition from the atmosphere that may occur as the result of changes in the obliquity of Mars [5]. The melting of ice probably should have occurred gradually rather than rapidly, and had to persist long enough to shape the landforms observed. The depressions appear well preserved and do not seem reworked or modified, even by wind erosion. The freshness of these landforms and the absence of landforms with wind-related modifications might suggest a young erosional age.

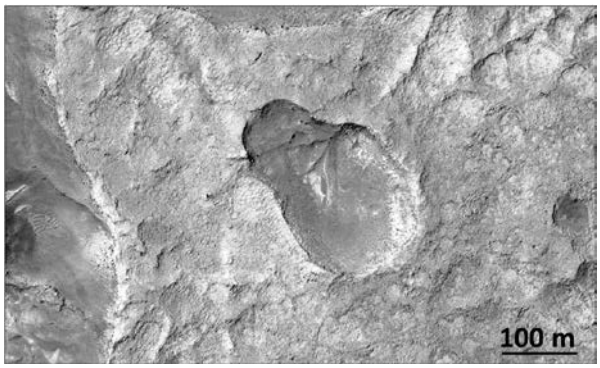

Figure 1: Rounded-shaped depression located on the LTDs (Images HiRISE PSP_007101_1730).

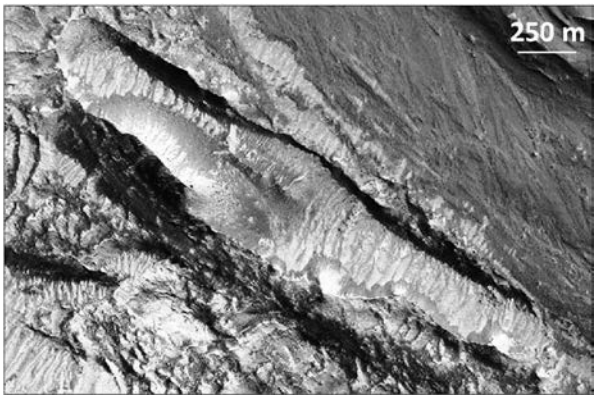

Figure 2: Elongate depression located on the LTDs (Images HiRISE PSP_ 016120_1730).

References: [1] Weitz C. et al. (2011) Geology, 39, 899-902. [2] Thollot P. et al. (2012) Journal of Geophysical Research, 117, E00J06. [3] Weitz C. et al. (2013) Planetary and Space Science, 87, 130-145. [4] Baioni D. et al. (2009) Acta Carsologica, 38/1, 9-18. [5] Laskar J. (2004) Icarus, 170, 343-364.