MAPPING LOW ELEVATION MOUNDS IN UTOPIA PLANITIA, MARS. M. Baranowska[1], A. Losiak[2], W. Włodarski[1*], [1]Institute of Geology, Faculty of Geographical and Geological Sciences, Adam Mickiewicz University in Poznań, ***mbaranowska8126@gmail.com**, [2]Institute of Geological Sciences, Polish Academy of Sciences.

Introduction: Utopia Planitia is one of the major depressions in the Northern Plains of Mars. It is filled with fluvial/lacustrine and periglacial sediments. The surface is covered by fine-grained dust material mixed with ice called Latitude Dependent Mantle [1]. Many different geomorphologic features like channels, polygons, thumbprint terrain or buried impact craters are presented in this area [2]. There are also large-scale tectonic structures within Utopia region; and the basin is boarded by regions with known volcanic activity in the past, from the west by Arabia Terra [3] and from the east by Elysium Planitia [4].

Some authors pointed out a number of structures of unknown origin around Utopia Planitia and suggested that they might have been formed by endogenic processes [5]. Numerous cone fields distributed across Utopia Planitia (especially in the southern section) are interpreted to be related to volcanic [6] or hydrovolcanic processes [7].

In this study, we examine distribution and properties of previously undescribed type of features - Low Elevation Mounds (LEMs). LEMs are hills elevated up to a couple tens of meters above the surroundings, with diameters of up to few kilometers and characterized by a low inclination slopes (Fig. 1). Some of them have a fracture along the longer axis.

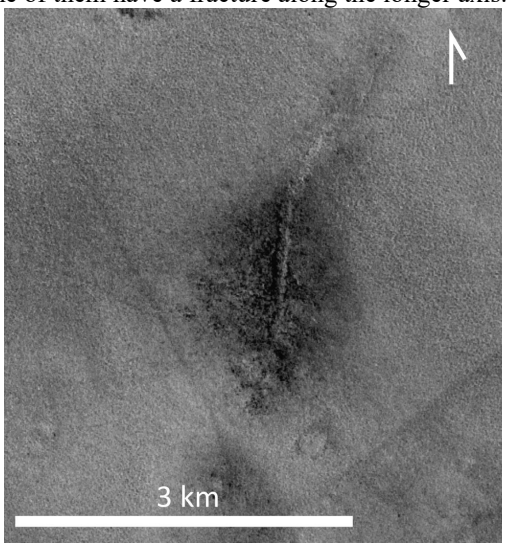

Fig. 1 Example of Low Elevation Mound (LEM) with a fracture at the summit of the mound.

Study area: The research area is in NW part of Utopia Planitia at 64º - 67º N; 82º- 91º E. It is 225 by 143 km, and it covers 32 175 km^2.

Stratigraphically the surface of the study area is mainly a Late Hesperian lowland unit with fluvial/lacustrine/marine sediments. The unit was modified by aeolian processes, and a recent periglaciation cycles. A small section in the south of our study region is a Middle Amazonian lowland, periglacial unit, covered with hummocky texture and field of knobs [8]. There are 2 tectonic ridges in NW and SE of the area, with NE/SW orientation [8].

Mapping process: Mapping is based on CTX Images, which were analyzed in JMars programme [9]. LEMs were recognized and mapped based on CTX images and then their elevation was determined based on individual MOLA shoots. We have not used MEX HRSC Blended DEM Global 200m v2 (or other similar DEM [10]), because the mounds are too small to be recognizable in such dataset (Fig.2). In 10 cases we were not able to find MOLA shoots crossing through the mound. Further detailed analysis was done in QGIS programme.

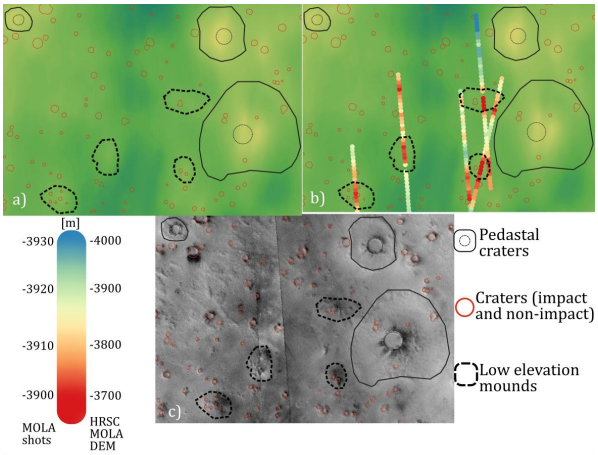

Fig. 2 Mars MGS MOLA - MEX HRSC Blended DEM Global 200m v2 with comparison to MOLA shots measurements and CTX Images a) Mars MGS MOLA - MEX HRSC Blended DEM Global 200m v2 with marked structures. b) Relevant MOLA shots for outlined low elevation mounds. c) CTX Images with marked structures.

Results: We mapped 133 low elevation mounds within 32 km^2 study area (Fig.3). Low elevation mounds are hills with the longer axis diameters between 1 km to 7,3 km. They are mainly oriented 100º/280º. The height ranges from 5 to 65 m, but most mounds have height less than 30 m. Low elevation mounds have low slope, on average inclined 0,2º to 1,5º. Some mounds show linear alignment along NE/SW, which is consistent with the trend of the tectonic ridges present outside the area of study.

Morphologically, low elevation mounds can be distinguished into 3 types. 1) Fractured, with

significant fracture or fractures at the top of the mound. The fractures are observed on 33 mounds, and they have a width of 100-300 m and depth of approximately 2 m (in 4 cases where MOLA shots were crossing the LEM in a way allowing to make this determination). Although the majority of fractures consist of a single narrow line across the mound, 8 of them displays a more complex "branching" pattern. 2) Cratered, with summits covered with sub-circular or irregular features. 3) Smooth, characterized by a darker albedo, without any features on their surface.

Discussion: Low elevation mounds may be interpreted to be mud volcanoes or pingos.

Mud volcanoes: The low elevation mounds show a similar range of sizes to mud volcanoes [11, 12]. The summits of low elevation mounds are characterized by subcircular orifices, which are like those found on some of the martian mud volcanoes examples [12]. However, mud volcanoes on Mars usually have a caldera-like feature at the top and sometimes there is a flow-like features coming from the caldera [13]. Neither of those features were observed by us in the proximity of LEMs. Additionally, most of the times sediment that builds the mud volcanoes is different than the surroundings – in southern Utopia Planitia they are often of higher albedo [13], which is not the case for LEMs.

Pingos: Low elevation mounds have a significantly higher diameter than average martian pingos described in the past but are similar in terms of the fracture system at the mound top [14]. Pingos on Mars show a broad range of morphologies [15, 16]. Utopia Planitia is known for its abundance of pingo-like forms [16]. It could suggest that low elevation mounds LEMs are previously unrecognized type of pingo-like features. If true, this suggests more water-ice mobility at this site than previously thought.

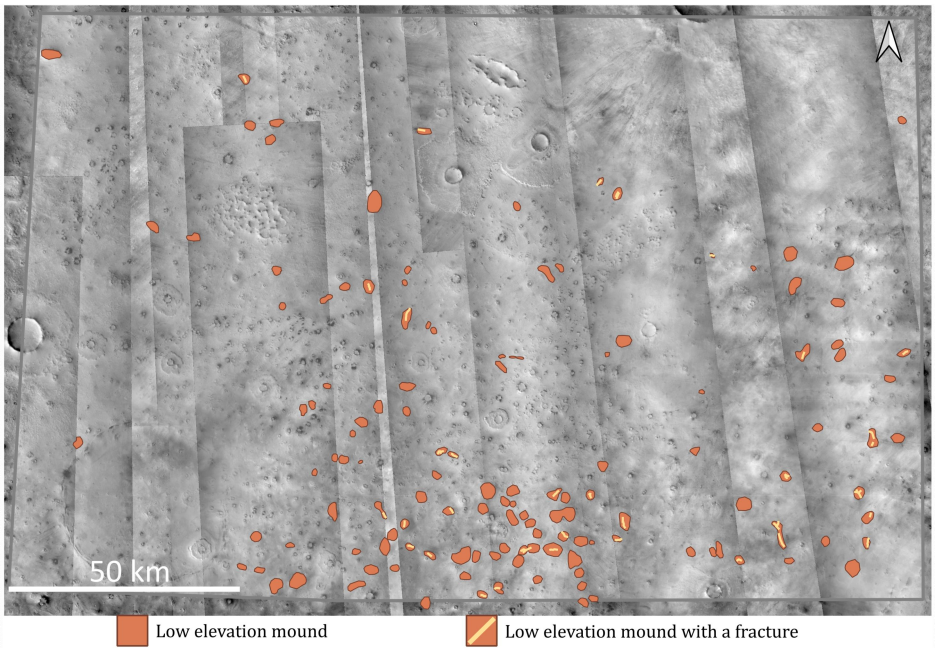

Fig. 3 The distribution of the Low Elevation Mounds (LEMs) with/without the fractures at the top. LEMs usually occur in groups and sometimes are aligned.

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