

DISTRIBUTION OF DUNES IN IUS CHASMA, MARS. O. Kromuszczyńska* and K. T. Dębniak**, Planetary Geology Lab, Institute of Geological Sciences, Polish Academy of Sciences, Research Centre in Wrocław, Podwale 75, 50-449 Wrocław, Poland (*okromuszczyńska@twarda.pan.pl; **krzysztof.debniak@twarda.pan.pl)

Introduction: Ius Chasma is one of twelve units composing Valles Marineris - the largest trough complex in Solar System. Valles Marineris is located in the equatorial area of Mars, its origin is related to magmato-tectonic activity in Tharsis province. It covers the area of 764 000 km², all twelve troughs spreads for 6400 km, and their depth exceed 10 km [1]. Ius Chasma is an elongated trough in the western part of Valles Marineris. It is a tectonic-controlled depression of length of ~850 km, width up to 120 km, and depth locally exceeding 8 km. Ius Chasma is composed of two parallel E-W trending valleys which are separated by Gerion Montes - internal ridge of ~5 km high and up to 26 km wide. At present all the magmatic and tectonic processes are absent on Mars for about 3 Gy. Currently, the predominant processes are to mass wasting and eolian activity. Cartographic approach to eolian features enable to retrieve information about wind processes and regimes. This work presents the distribution of sand dunes in Ius Chasma.

Data and methods: The cartographic work in Ius Chasma was conducted on the base of CTX dataset. 100 CTX images with original spatial resolution of 6 m/pxl were used to create 3 mosaiks (western, central and eastern) with Integrated Software for Imagers and Spectrometers (ISIS). The resolution of mosaicks were decreased to 12 m/pxl due to limited capabilities of processing heavy files in ArcGIS, which were used to perform the mapping procedure [2].

Sand dunes in Valles Marineris: Dunes fields are abundant in Valles Marineris. In fact, this equatorial trough system contains around 44% of all non-polar large dune areas studied on Mars. The major dune fields occupy an area of ~22 000 km² displaying variety of morphologies, compositions, thermophysical properties, and associated landforms. There are three potential sand sources inside Valles Marineris: Interior Layered Deposits, walls of spur-and-gully morphology, and landslide deposits, and at least two strong candidates for an extra-trough sand sources, in Aurorae Chaos and on the plateau north of eastern Valles Marineris [3]. Substantial dune fields have been recognized in [3,4] in seven troughs (Ius, Melas, Coprates, Capri, Ganges, Hebes, and Juventae Chasmata), whereas significant dune areas in Ophir, Candor, and Echus Chasmata have not been observed in these studies (Fig. 1a).

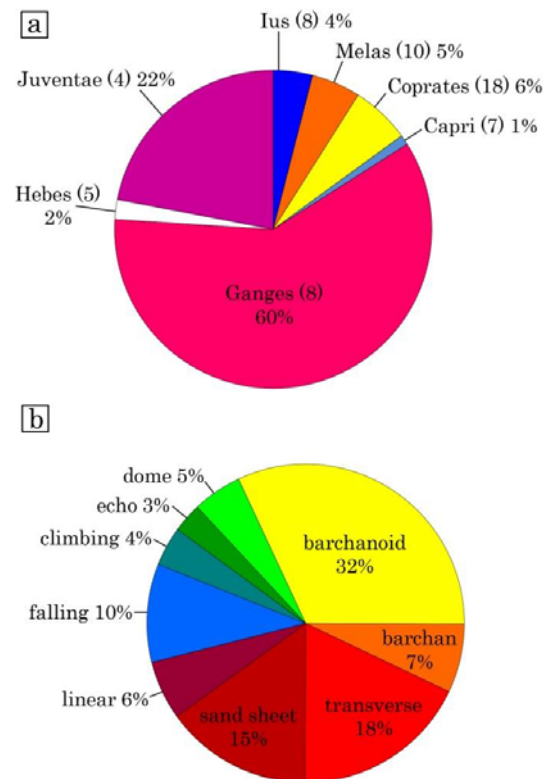


Fig. 1. Dune fields in Valles Marineris: (a) geographic-areal distribution with percentages and numbers of dune fields in chasmata, (b) morphologic distribution; on the basis of [3].

The most frequent dune field surface area is ~125 km², whereas the mean dune field surface area equals ~400 km². It is the result of the fact, that four vast ergs (>1000 km²) constitute the majority of dune area (~80%) in Valles Marineris. The most common dune morphology in the trough system barchanoid (~32%), followed by transverse (18%), sand sheet (15%), and climbing or falling dunes (14%). Other dune types (i.e. barchans, linear, dome, and echo dunes) are far less frequent (Fig. 1b). They are present in specific settings: barchan and dome dunes are located on the dune 500 field edges, whereas echo dunes have been recognized in chaotic terrains in eastern chasmata [3].

Dunes in Ius Chasma: Eolian features within Ius Chasma are the most common of recently active landforms. They are either erosional features (periodic bedrock ridges), or depositional features (large black dunes, sand covers, and “regular” dune fields). Periodic bedrock ridges (*Pbr*) appear as megarripple

forms and dune-like features which are in fact ridges carved in cohesive substrate by wind. In CTX image resolution, it is mostly impossible to distinguish whether a ripple-like landform is a regular dune or an erosional ridge. Two examples of *Pbr* unit are presented in the map; one is an authors' assumption (centered at 7°12'S, 83°19'W), and one is based on literature (centered at 7°43'S, 80°33'W) [5].

Dark-toned dune fields (*Bd*) are the most stunning eolian features in Ius Chasma. There are four large black dune fields located in the southern Ius graben, each covering an area ranging from 141 to 321 km². The material source for the westernmost dune field (centered at 7°36'S, 83°59'W) might be floor unit deposits of possible lacustrine origin, whereas easternmost dune field has originated in escapes of fallen deposits associated with easternmost sapping channels. Potential sand sources for other dune fields are difficult to define. Six smaller *Bd* areas are present in central and eastern Ius Chasma regions. All dune fields cover a cumulative area of 1119 km². In addition, westernmost dune field is bordered on three extensive sand covers to the south. They are composed of brighter-toned sediments and display small to medium-sized ripples on the surface. Each cover is ~10 km wide and they all occupy an area of 124 km².

The most common eolian features in Ius Chasma are "regular" dune fields. There are 10 352 individual fields, covering together an area of 4753 km² (Fig. 2). The largest dune fields display areas of almost 270 km², whereas the least extensive are as small as 1800 m². Dune fields are present especially on landslide deposits, floor units, within valleys of sapping channels, and within western glacial landforms. The main corridor of dunes spans along the south-facing wall of Geryon Montes for over 180 km. Glacial features in the western chasma are the place, where over 1585 dune fields are present what implies that glacial landforms are a highly productive source of friable particles. Dunes within landslides are widespread in central and distal parts of deposits, but do not occur near landslide scars. Dune slip faces in open-space areas are oriented along the W-E direction, which has implication for the prevailing wind regime in Ius Chasma. Other localities strongly affected by local topography (i.e. within landslides) display individual wind trends.

References: [1] Gourronc M. et al. (2014) *Geomorphology*, 204, 235-255. [2] Dębniak K. T. et al. (2016) *J. Maps*, submitted. [3] Chojnacki M. et al. (2014) *Icarus*, 232, 187-219. [4] Chojnacki M. et al. (2014) *Icarus*, 230, 96-142. [5] Montgomery D. R. et al. (2012) *J. Geophys. Res.* 117, 12.

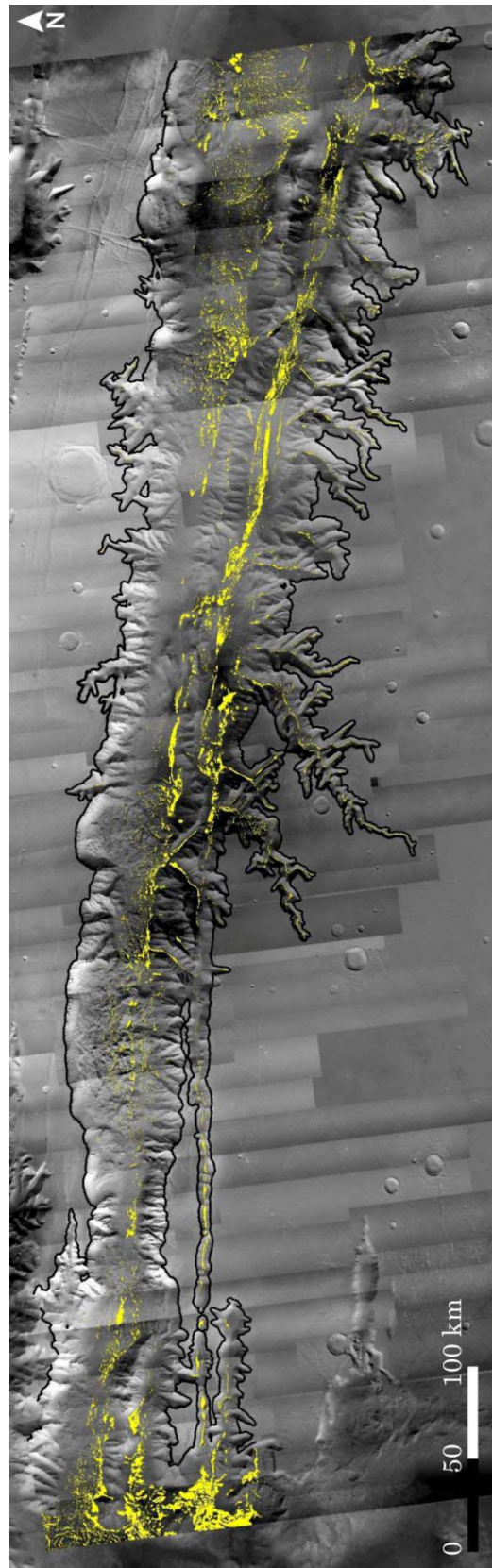


Fig. 20. 10 352 dune fields in Ius Chasma; CTX image mosaic prepared in ISIS software.