CHANNEL NETWORK SOUTH-EAST OF OLYMPUS MONS, MARS, AS SEEN IN MEX HRSC IMAGES: MORPHOLOGY, DEPTHS, AREA AND VOLUME. N. V. Pupysheva[1,2], A. T. Basilevsky[2], B. A. Ivanov[3], G. Neukum[4], S. Werner[4], and S. van Gasselt[4], [1]Department of Geography, Moscow State University, Moscow pypisheva@mail.ru; [2]Vernadsky Institute, RAS, Moscow, 119991, Russia; [3]Institute of Dynamics of Geospheres, RAS, 119334 Moscow, Russia. [4]Institut fuer Geologische Wissenschaften, Freie Universitaet Berlin, 12249 Berlin, Germany.

Introduction: SE of Olympus Mons volcano there is a channel network first identified in Viking Orbiter images and interpreted as recently carved by water released from the depth although non-fluvial (lava channels) origin was not excluded [1]. We revisited this area through analysis of recently acquired images taken by Mars Express HRSC [2] and MGS MOC cameras [3] and MOLA profiles [4]. First results of this new stage of the study are given in [5, 6] and in the companion abstract [7].

Description and analysis: The network is in the lowland plains neighboring the SE scarp of volcano, mostly within 85 x 50 km area although some its components extend beyond it (Figure 1). Most part of the network seems to have a common source: arcuate graben with extensions. The source is in the northern part of the area at the altitudes about 800 m above the reference level. The network mostly extends to SW along the 10 m/km topography gradient down to 0 m altitude. Channels composing the network are mostly interconnected, often being braided and intercrossed with numerous islands. Channels are typically to 250-350 m wide although in some places channels widen up to 1,7-2,5 km. Some channels and their segments (mostly in the middle / lower parts of the network) are arcuate and sinuous while others are rectilinear (Figure 1).

Islands are different in sizes, from 150 x 400 m to 1.8 to 3.7 km. They typically form chains following along the channel bank. Often the larger island is accompanied by a few of smaller ones. Streamlined islands are rather common so direction of current is easily determined.

Some channels have levees, most of them, not (Figures 1, 2). Channels with levees are observed in the areas neighboring the volcano scarp foot and in the SE part of the study area. Some channels have terraces (Figure 1, 2), mostly two, but up to 6 terraces are locally seen. Channel floors are typically flat, their transverse provile is mostly U-shaped, sometimes V-shaped. In the western part of the study area channels are locally wrinkle-ridged and upthrusted [see 5, 6, 7] . In the central part of the study area and in the adjacent areas are seen chains of hills hundred meters across and linear ridges, which are probably surface expressions of the magma dike extrusions [6, 7, 8, 9].

Channels morphometry: On the HRSC image we have measured the area occupied by the channels (~273 km^2). Using MOLA profiles the channel depths were measured: from 8 to 40 m with average value = 24 m, that is close to estimates by [1] in the upper part of the network. (Figure 1, 3). This allowed to calculate the volume eroded from the network: ~6.4 km^3, if to use for calculation the average depth, and 7.3 km^3, if to calculate the volume separately for relatively deep (30-40 m) and relatively shallow (<30 м) segments of the network. This leads to estimate of volume of the channel carving liquid. If erosion efficiency was 40%, the volume would be ~18 km^3. If erosion efficiency was 10%, the volume would be ~73 km^3.

Discussion. The morphology of the studied network, including presence of streamlined islands and terraces, resembles that of the Martian outflow channels, traditionally interpreted as formed by catastrophic release of subsurface water [e.g., 10]. However, recently, this interpretation has been challenged by the suggestion that highly fluid lavas could have cut the channels [e.g., 11]. We think that both water and lava could cut the channels: channels with levees, especially close to the source graben, could be cut mostly by lavas, while channels with terraces, by water. The lava massive release seemed to be natural in this volcanic region, while water could be mobilized by lava (magma) extrusions and/or by tectonic compression. Absence of collapse pits and chaoses suggests that water was released from large depth.

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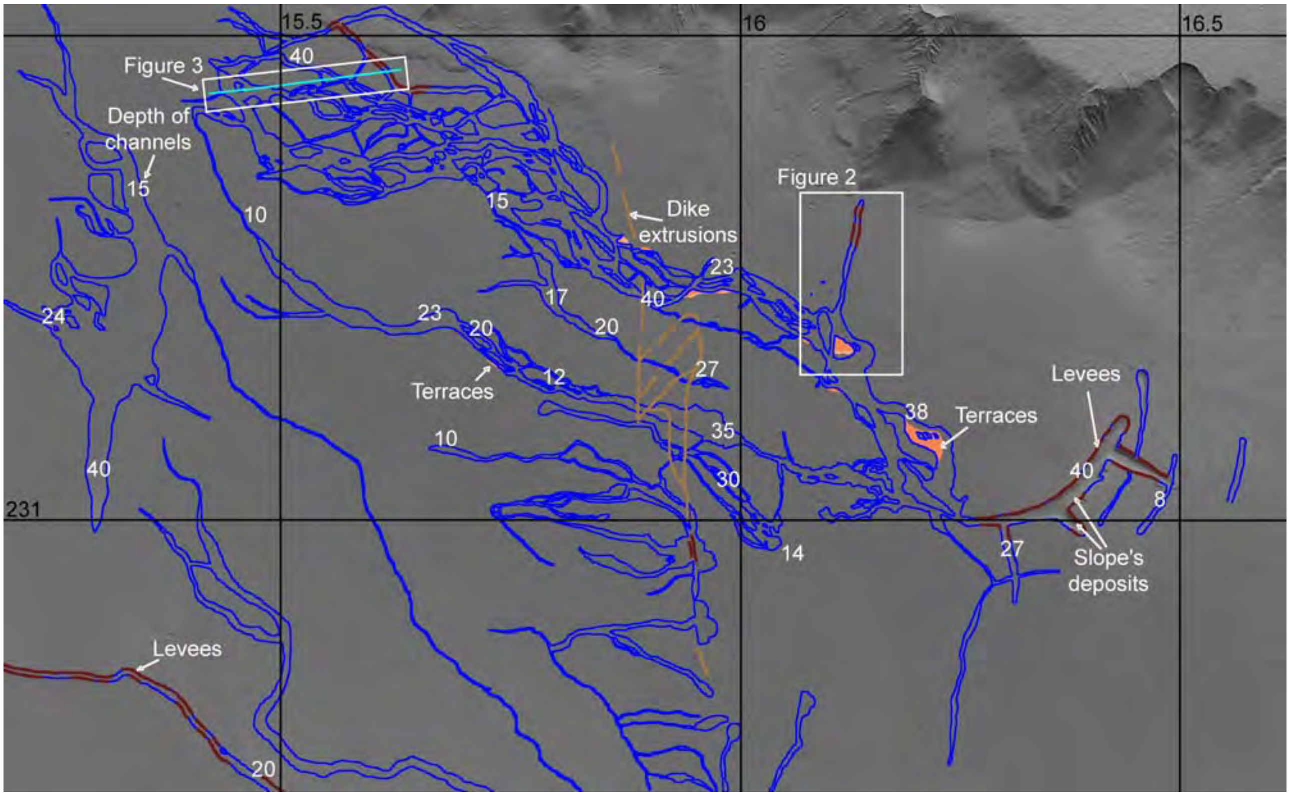

Figure 1. Geomorphic scheme of the study area based on analysis of HRSC images taken at Mars Express orbit 1089. White numbers desigmate channel depths measured from MOLA profiles.

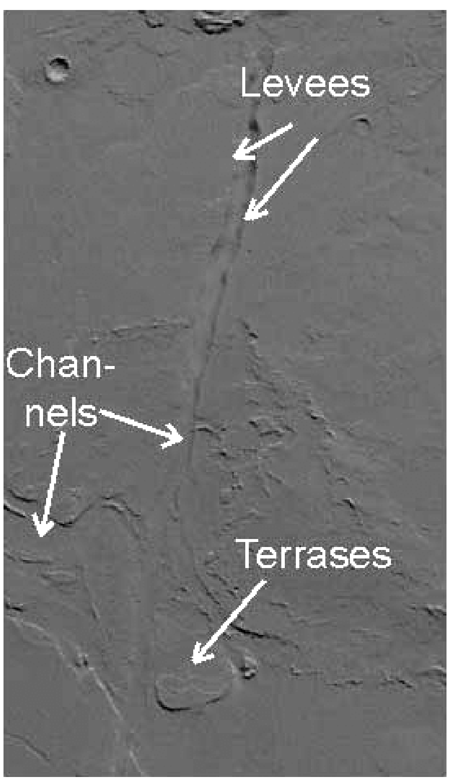

Figure 2. Details of channels' morphology.

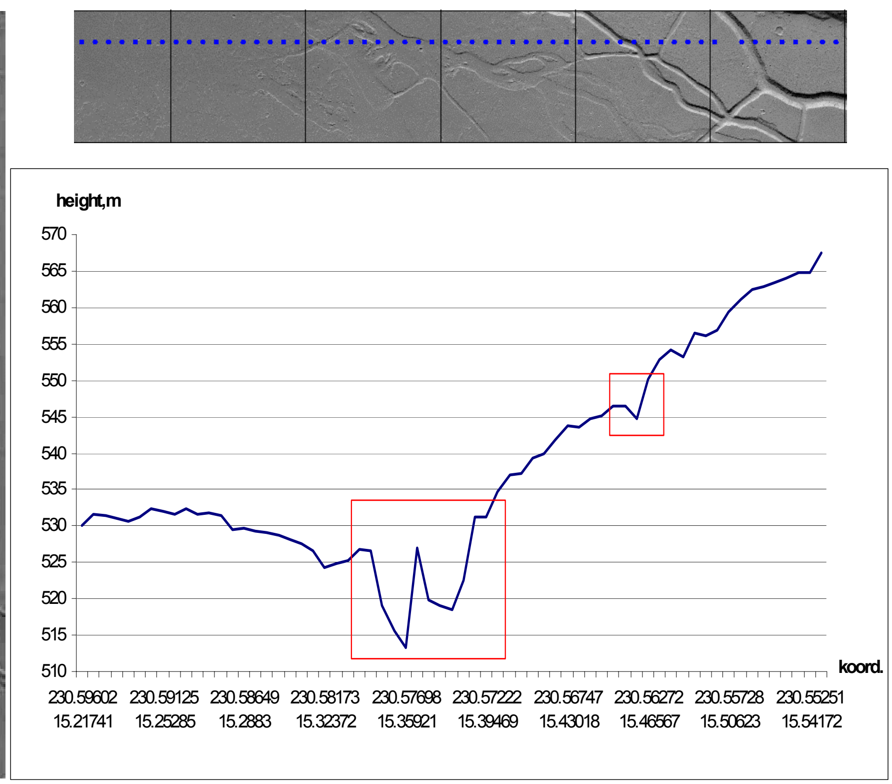

Figure 3. One of MOLA profiles through the channel network.