

**POTENTIAL LIFE HABITAT AT THE EASTERN FLANK OF THE OLYMPUS MONS AS SEEN IN MEX HRSC AND MGS MOC IMAGES OF MARS.** A. T. Basilevsky<sup>1,2</sup>, S. Werner<sup>2</sup>, G. Neukum<sup>2</sup>, S. van Gasselt<sup>2</sup>, J.W. Head<sup>3</sup>, and B. A. Ivanov<sup>4</sup>, <sup>1</sup>Vernadsky Institute, RAS, Kosygin Str., 19, 119991, Moscow, Russia, atbas@geokhi.ru; <sup>2</sup>Institut fuer Geologische Wissenschaften, Freie Universitat Berlin, D-12249, Berlin, Germany; <sup>3</sup>Department of Geological Sciences, Brown University, Providence, R.I. 02912, USA; <sup>4</sup>Institute of Dynamics of Geospheres, RAS, 119334, Moscow, Russia.

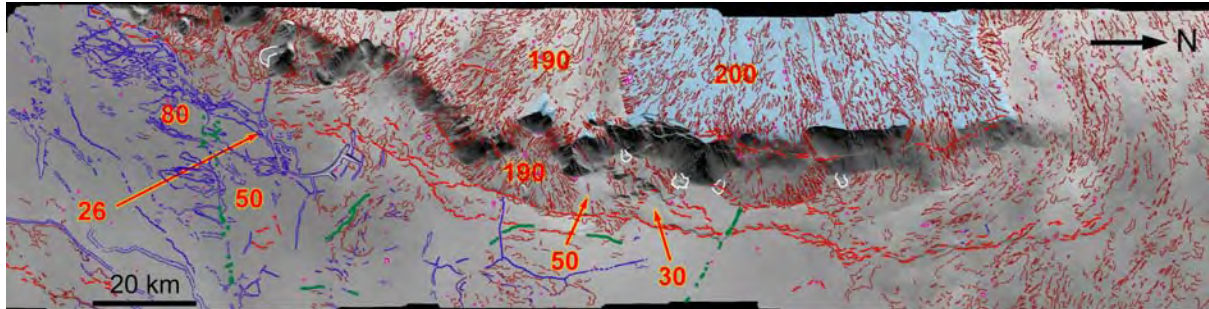


Figure 1. Geomorphic map of the Olympus eastern flank. Mesa material is shown in blue, dark red lines show lava flows, red – wrinkle ridges, violet – channels, green – dike extrusions, white – landslides?, red-and-yellow numbers – crater ages.

**Introduction:** This work is based on the photogeologic analysis of the High Resolution Stereo Camera (HRSC) images of the eastern flank of Olympus Mons volcano and adjacent lowland plains taken at orbit 1089 (Fig.1). The MGS MOC images were also used. This study continues our analysis of the western flank of volcano [1-2]. First results on the eastern flank have been presented in [3-6].

**Observations:** The study area includes eastern flank of Olympus Mons volcano and adjacent lowland plains. Lava flows cover the volcano slopes (except some steep scarps) and descend to the plains. In contrast to several small mesas in the western flank of Olympus Mons, only one relatively large mesa-like feature (covered by lavas, Fig.2) and a few small steep-sloped hills (all marked in blue in Fig.1) are observed here. Layers in their slopes are rarely seen most likely because of a dust mantle, whose presence is suggested from observation of down-slope trending dark streaks [e.g., 7].

Figure 2. HRSC image of the SE edge of the eastern flank mesa. Dark-red shows lava flows.

At the foot of the steep slopes of the volcano eastern flank there are observed five features (white contours in Fig.1), which have morphologic similarities with terrestrial landslides and/or rock glaciers.

The lowland plains neighboring volcano typically have a smooth surface with locally seen lava flows. In their southern part of the plains, a few networks of channels starting from the steep-sloped troughs are visible (violet lines in Fig.1). They were

first described by [8]. The channels intersect, anastomose and form networks; the largest network is about 10 km wide and 60 km long. The morphology of these networks, including presence of streamlined islands and terraces (Fig. 3), resembles that of the Martian outflow channels, which were previously interpreted as formed by the catastrophic release of subsurface water [e.g., 9].

Figure 3. Fragment of the channel network. Arrows show terraces, red dotted line – area of crater counts (see also Fig. 5).

Recently, this interpretation has been challenged by suggestion that highly fluid lavas could have cut the channels [e.g., 10]. Our observations show that some segments of the channels, usually close to the source troughs, have levees and sometimes are fringed with lava flows, while other segments have no levees and their slopes are terraced [11]. Probably these two varieties of the channels were predominantly carved by lavas and water correspondingly.

On the lowland plains, locally on the volcano slope and at the edge of the Olympus summit plateau, wrinkle ridges are observed (red lines in Fig.1), which are usually interpreted as the result of compressional deformation [e.g., 12].

In some places, wrinkle ridges border the arch-like terraces at the foot of the volcano slope. In one of such places we see the channel crossing a terrace

(Fig.4). Here streamlined islands suggest that the direction of the channel forming flow was uphill suggesting that the wrinkle-ridged terrace formed as the result of tectonic compression and uplift subsequent to channel incision.

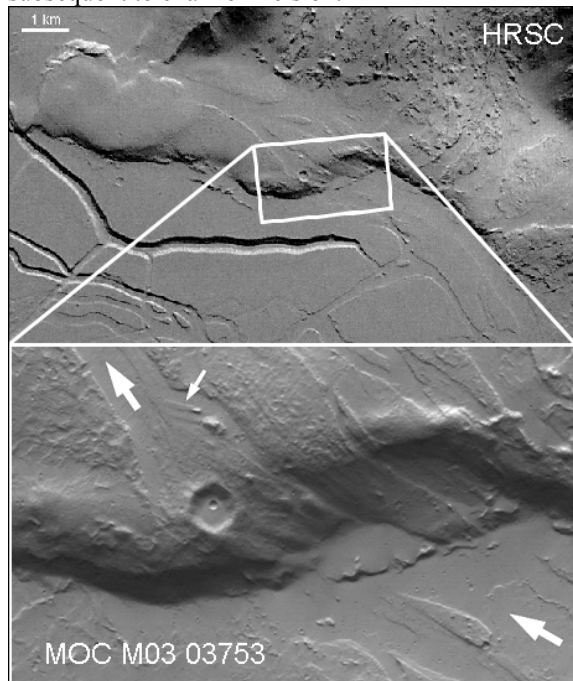


Figure 4. The channel appearing to climb the tectonic terrace. A streamlined island is indicated by the small arrow, and flow direction by the large arrows.

In the HRSC and MOC images of the lowland plains, ridges that are significantly more rectilinear than normal wrinkle ridges are observed. Sometimes they merge into linear chains of dome-like hills obviously superposed on the channels (Fig.5). These ridges and chains of hills are morphologically similar to those observed in other areas of Mars and interpreted as volcanic ridges and cones above the dikes [13, 14].

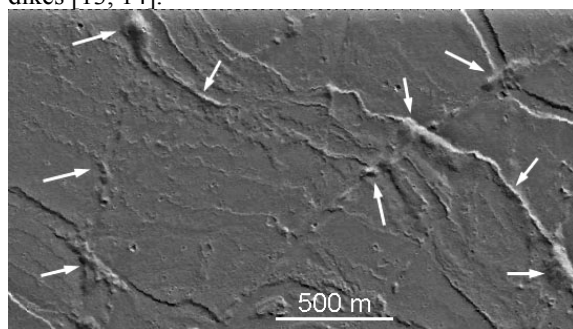


Figure 5. Extrusions of lavas (arrows) superposed on channels. Fragment of MOC M22-01909.

**Crater counts.** They showed that lavas covering the eastern flank of the volcano are 190-200 Myr old, the surface age of the plains neighboring the eastern flank is between 30 and 80 Myr old, and at least one of the channel networks formed ~26 Myr ago (Figures 3 and 6).

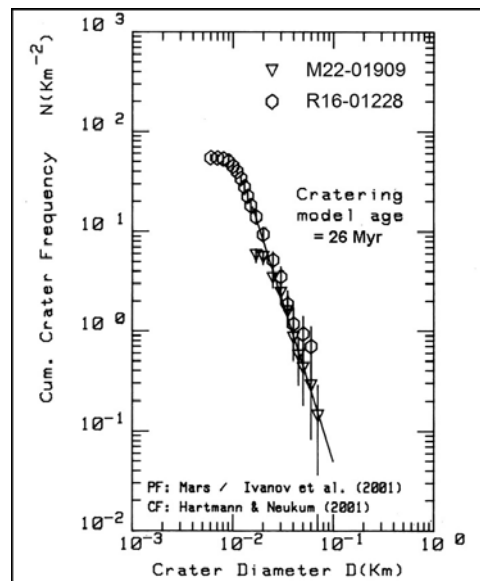


Figure 6. Plot of crater counts in the channel floor (see area of crater counts in Fig.3).

**Discussion and conclusion.** The eastern flank of Olympus Mons, like its western flank, is not only an accumulation of lavas but contains layered deposits probably deposited from the atmosphere. At the foot of the eastern scarp were found a few landforms resembling rock glaciers and/or landslides. In the neighboring plains there are observed trough and channel networks carved by water and/or lava. Here are also seen tectonic compressional landforms as well as volcanic ridges and chains of cones (tracing dike emplacement), all postdating the channels. Such valley networks and wrinkle ridges are typical for Hesperian time [9, 12]. Here they are very young (<26 Myr) being probably the effects of the latest stages of the Olympus Mons volcanism and topographic load. The extremely long duration of the Olympus Mons volcanic activity (since 3.9 Gyr until very recent [1, 15]), that implies correspondingly long hydrothermal activity, makes this area to be interesting as potential Martian life habitat.

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