

A possible mud volcano field in Chryse Planitia, Mars

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Abstract

Chryse Planitia on Mars where hypothesized large quantities of sediments were delivered by cataclysmic flooding or debris flows related to the development of the gigantic circum-Chryse outflow channel system (e.g., [1]) may fit a condition of mud volcano formation [2]. Possible mud volcanoes have been already reported in parts of Chryse Planitia [3][4]. Here, we describe a newly identified small field of landforms that resemble mud volcanoes on Earth [5]. The morphological characteristics of the landforms are compared with mud volcanoes widely distributed in Azerbaijan. These landforms, if indeed linked with mud volcanism, may provide important clues for understanding processes of gases such as CO₂ and CH₄ on Mars.

1. Introduction

The field is located in relatively flat outwash plains of Tiu and Ares Valles where a series of streamlined hills occur among topographically low areas (Fig. 1).

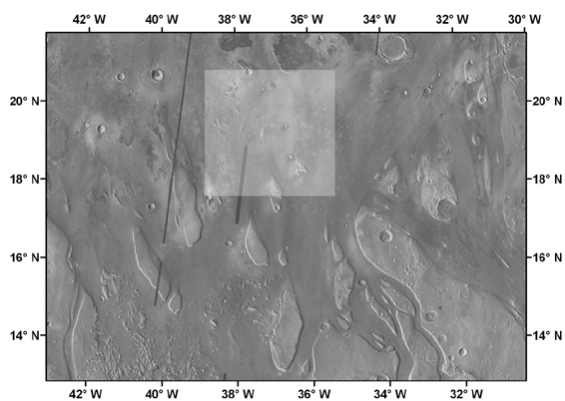


Figure 1: Location (box) of the study area in Chryse Planitia, Mars. MOLA map.

2. Morphological characteristics

A large flow feature with branching lobes dominates the central part of the field, which comprises three types of landforms: cones (Fig. 2), shield-like features (Fig. 3), and mounds (Fig. 4).



Figure 2: Cone morphology with a flow-like feature emanating from a breached rim. THEMIS VIS image.

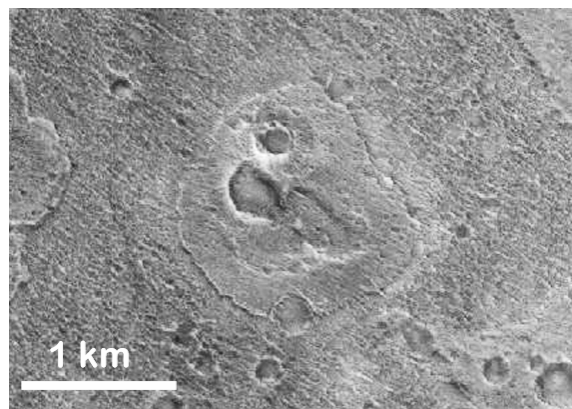


Figure 3: Shield-like feature morphology with central craters. CTX image.

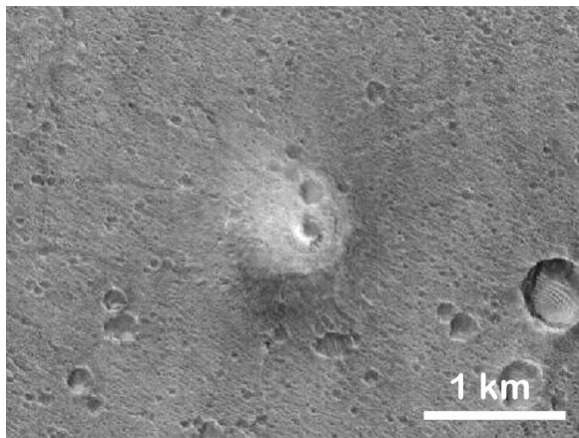


Figure 4: Mound morphology with summit pits. CTX image.

Conical edifices with summit craters are up to over 1 km wide, and occasionally flow-like features emanate from a breached rim (**Fig 2**). Shield-like features are up to over 1 km in diameter. They appear to have height-diameter ratios much lower with respect to those of the cones, and they are characterized by single or multiple central craters (**Fig. 3**). Round mounds are up to several hundreds meters wide, occurring isolated (**Fig. 4**) or in a group. Their margins are gradual to the surrounding materials. Some display pit- or knob-like features on their summits.

3. Mud volcanoes in Azerbaijan

Mud volcanoes are prevalent in several geological settings on Earth (e.g., [6]). Their morphology varies widely [2]. Azerbaijan is one of the best places for observing mud volcano morphology.



Figure 5: Cone-shaped mud volcano with extruding mud flows. Photo by Ronnie Gallagher.



Figure 6: Shield-like mud volcano with multiple eruption centers. Photo by Ronnie Gallagher.



Figure 7: Round mound-shaped mud volcanoes with eruption pits. Photo by Ronnie Gallagher.

Although large mud volcanoes (> hundreds of meters wide) exist in Azerbaijan, we focused our study on relatively small edifices (< tens of meters wide). Large and likely old mud volcanoes seem to be intensively modified by erosional processes, making it difficult for proper comparison. We find mud volcanoes of widely variable shapes resembling the landforms in our study area on Mars (**Figs. 5, 6, 7**).

References

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