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Analysis of an evaporitic dome in eastern Tithonium Chasma (Mars): the result of diapirism processes?

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The Tithonium Chasma (TC) is the northern trench of the western troughs of Valles Marineris (Mars). In the easternmost part of the canyon system a mountain displaying dome shape morphology is located. The mineralogical characteristics of the dome have been indicated by the OMEGA image spectrometer data that mapped it as a sulphate deposit (OMEGA data orbit 531_3). Studies on the spectral characteristic absorptions for the hydrated magnesium sulphates carried out on the deposits within the Tithonium Chasma, showed the mineralogical components displayed by the dome in detail. According to these results the dome shows clear signatures of kieserite (Mg SO4.H2O), an evaporitic mineral also found on the Earth. Further studies carried out on the characteristics and the genesis of Kieserite both on Mars and on the Earth showed that the dome can not be constituted entirely by kieserite alone but probably it might be constituted also by the same salts that on the Earth alter to kieserite, such as, carnallite, kainite and halite.
In this work we investigated in great detail the surface features of the dome located in the eastern part of TC, with the aim to try to determine its nature and origin. The morphological features of the dome have been investigated through the integrate analysis of HiRISE, HRSC, MOC and THEMIS data, while the morphometric characteristics have been measured on a topographic map (50 m contours lines) built using HRSC and MOLA data.
The observation of the dome surface highlights features created by fluvio-erosional and solutional processes. The dome appears to be characterized by deep gully morphology displaying a radial system that develops from the margins of the summit plateau. The solutional surface is characterized by landforms typical of the karst morphology such as, karren, dolines and collapse dolines. Depositional forms displaying periglacial rock glacier features can be seen at the foot of the slopes, while they seem to be lacking along the dome flanks. The observation made also highlights the presence of layers outcropping on the surface of the dome. The layers display both laterally and vertically continuity apparently without facies variations. The dome seems to be formed of different materials (minerals, grain-size) with different properties. The analysis performed show that the landforms observed clearly indicate the presence of solutional processes that seem to have worked in a selective way. These landforms indicate the presence of liquid water, probably caused by the melting of ice in a periglacial environment, or permafrost rich soil, suggesting that either the material is ice-rich or was so at one time.
Deposits similar to that one located in the eastern TC are found almost in all chasmata of Valles Marineris system and are well known as interior layered deposits(ILD). To explain the origin and formation mechanisms of the ILD several hypotheses have been formulated in previous studies.
The results carried out in this study allow us to suppose that any of the previous hypotheses to explain its origin is fitting with the evidences found. In our opinion the data observed show evidences that allow us to suppose that the dome located in the eastern part of TC might represents the result of diapirism processes.