

Geology and mineralogy of Tithonium Chasma, Mars

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We investigate the western parts of Tithonium Chasma on Mars, a part of the Valles Marineris trough system. The study area is characterized by a diversity of landforms and spectral contrast in the visible wavelengths, as seen by the High Resolution Stereo Camera (HRSC). Bright interior layered deposits (ILD) dominate the geomorphology of the floor of Tithonium Chasma. They are strongly eroded into flutes and yardangs and show almost no impact craters at their surface, attesting to an easily erodible rock material, recent exposure, and an efficient erosion process. The largest ILD covers an area of about 350 km² and reaches a maximum height of >2000 m (volume ~350 km³). Its flank slopes display slope angles of up to 40° and more, indicating that it consists of consolidated material. While it is impossible to identify layering at the scale of HRSC images (10-20 m/pixel), MOC images show very fine and uniform layering at meter scales. A lack of boulders at the base of these quite steep slopes might indicate fine-grained material. Other interesting features on the trough floors are landslides, which in some places could alternatively be interpreted as remnants of glaciers or rock glaciers, and several elongated depressions, which might represent volcanic vents due to their association with tectonic fracture systems. Spectra taken with the OMEGA spectrometer provide evidence for sulfate minerals associated with bright ILD on the floor of Tithonium Chasma. We present a GIS-based photogeological map, based on both image and topographic information provided by HRSC data. We discuss the spatial associations of landforms and try to reconstruct the local stratigraphy, in order to get a better view on the evolution of the Valles Marineris system.