

GEOMORPHOLOGICAL MAP OF THE LOWER NW FLANK OF HECATES THOLUS VOLCANO, MARS. M.A. de Pablo^{1,2,3} and J.D. Centeno³, ¹Departamento de Geología. Universidad de Alcalá. 28871 Madrid, Spain. (miguelangel.depablo@uah.es). ²International Research School of Planetary Sciences. Università d'Annunzio. 65124 Pescara, Italy. ³Departamento de Geodinámica. Universidad Complutense de Madrid. 28040 Madrid. Spain.

Introduction: The most important volcanoes of Mars shows possible glacial features on their NW flanks [1][2][3][4]. Hecates Tholus, 31.6°N, 150°E (Fig. 1), at the Elysium volcanic rise, shows glacial features that have been recently mapped [5][6][7]. The age of this volcano ranges between 3,800 and 100,000 yr [5][8][9]. The glacial activity in its NW flank is mainly related to a double elliptical depression with an origin not yet explained [5][9][10].

We conducted a geomorphological study of the high resolution HiRISE, MOC and CTX images in order to recognize possible glacial and periglacial features in the lower NW flank of Hecates Tholus volcano [11][12], targeted to confirm the glacial origin of different materials and features observed in the area by other authors [5]. The analysis returned a wide variety of glacial and periglacial features marking an important role of ice on the landscape sculpting of this area [11][12] (Figure 1). Then, we made a 1:100,000 in scale geomorphological map (by the use of a GIS software tool) of this region, in order to locate and to deduce the origin of all those features, their cross-cut relationships, spatial distribution, etc. We based our cartography on the analysis of two CTX images (B04_011324_2128; B06_011957_2127), as well as on a HRSC Digital elevation model (H1262_0000).

Results: The available HiRISE and CTX images reveal the existence of different glacial features (Fig. 2) in all the area and an important modification on the original morphology of this flank of the volcano due to these glacial processes. The most important glacial features observed in the area are the potential glacial tongues marked by possible lateral, central and frontal moraines. These glacial tongues flow from the scarps that characterize this depression in the NW flank of Hecates Tholus. Some of the tongues seem to flow through narrow channels, but most of them seems to start at the head of the scarps and to flow through the main depression. Once there, they are very similar to piedmont type of glaciers on the Earth. In the front of these glaciers, at the edge of the depression of the volcano flank, we observed glacial features related to the erosion of the bedrock by glaciers (e.g., roches moutonnées and flutes), what is a clear marker of glacier retreat at least at the distal part of the glacial complex. This observation, together with the existence of fluvial features on the front of the putative glacier tongues talk about a possible warming event during the last stage of the geological history of this area, such as we previously indicate [12].

Our future works about this area will be focused on the study of the geological history, its climate implications and to analyze radar data (MARSIS data) in order to test if (under the limit of the data resolution) is it possible to deduce the existence of ice under the surface of this area. We will prepare more detailed geomorphological maps of selected sites.

References: [1] Head and Marchant, (2003) *Geology* 31, 641–644. [2] Shean et al., (2005) *JGR*, doi:10.1029/2004.[3] Milkovich et al., (2006) *Icarus*, 181, 388-407. [4] Shean et al., (2007) *JGR*, doi: 2006JE002761. [5] Hauber et al., (2005) *Nature*, 434, 356-361. [6] de Pablo (2006), *36th COSPAR Scientific Assembly*. Abstract #293. [7] de Pablo (2009) *PhD Thesis*, URJC. 500 pages. [8] Tanaka (1986) *JGR* 91, 139-158. [9] Neukum et al., (2004). *Nature*, 432, 971-979. [10] de Pablo et al., (2007) *Geogaceta*, 42, 3-6. [11] de Pablo and Centeno (2011) *LPSC*, 42. Abstract #1030. [12] Centeno and de Pablo (2011). *LPSC*, 42. Abstract #1031.

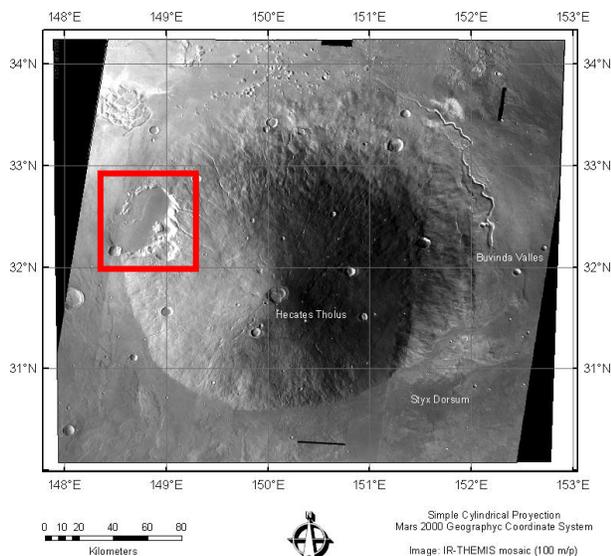


Fig. 1: Location map of the study area (red box) in the NW flank of Hecates Tholus volcano.

