POSSIBLE EVIDENCES OF ICE DINAMICS IN THE PUTATIVE GLACIERS AT THE LOWER NW FLANK OF HECATES THOLUS VOLCANO, MARS. J.D. Centeno[1] and M.A. de Pablo[2,3], [1]Departamento de Geodinámica. Universidad Complutense de Madrid. 28040 Madrid. Spain. [2]Departamento de Geología. Universidad de Alcalá. 28871 Madrid, Spain. (miguelangel.depablo@uah.es). [3]International Research School of Planetary Sciences. Università d'Annunzio. 65124 Pescara, Italy.

Introduction: NW flank of Hecates Tholus (31.6ºN, 150ºE), at the Elysium volcanic rise (Fig. 1), shows different features marking the existence of a possible glacier covered by dust and aeolian sediments, as proposed by different authors [1][2][3][4], by the analysis of MOC, THEMIS ad HRSC images. Most of them are similar to those described in other glaciers of Mars [5][6][7][8][9]. Nowadays, the very high resolution HiRISE images provide the opportunity to study those features in detail in order to understand the geological and geomorphological evolution of this volcano and glaciers.

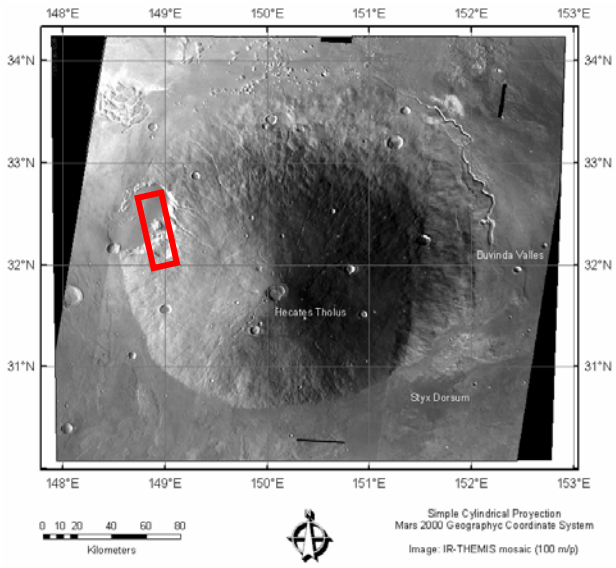

Fig. 1: Location map of the HiRISE (PSP_001527_2125) footprint here described (red box) in Hecates Tholus

Observations: Only few HiRISE images covering this area of Mars are available. However, one of them (PSP_001527_2125), covering the lower NW flank of the volcano (Fig. 1), reveals a wide variety of geomorphological features similar to those tipical of terrestrial glaciers, confirming the observations done by different researches [1][2][3]. However, we focus our attention in a particular feature and its spatial distribution: crevasses. Most of them are located in the glacial valleys, but also in the gently sloped surface forming the bottom of the depressions at this flank of the volcano, giving evidence of recent or present ice and ice flow. In adition, some crevasses are located in the edge between the hills and valleys slopes and the putative glacier, not in the cirques. Althought, they could be interpreted to be bergschrunds (Fig. 2, A-D), In adition, some crevasses are located between the valley slopes and the putative glacier, and could be interpreted to be bergschrunds (Fig. 2, A-D). They leave a wide gap between the ice and the nearest slope free of ice. This is normal in terrestrial bergschrunds, but their (1) extensive distribution in the study area, and (2) width range, seems to indicate present or very recent glacial flow.

Interpretation and discussion: These observations are clear evidence of active or very recent flow in the glacier. With the gravitational processes showed in the slopes [4] and without recent flow, bergschrunds and crevasses would be destroyed shortly. The mass balance gradient is the engine of glacial flow in most glaciers. This balance gradient can be achieve by differences in melting, sublimation, and. compactation All of them are under the regional conditions (a general slope toward de NW) and local topography (depressions producing a centripetal flow and a ring of bergschrunds).

Moreover, we observed abundant periglacial features in the study area what could be also related to all those processes implying ice-melting: gullies and gelifluxion depostis at the base of the steeped slopes (Fig. 2, E-G). Althought gullies could be only related, for example, to insolation [10] or groundwater flow [11], the very abundant gelifluxion deposits (Fig. 2, F) could indicate ice and permafrost melting. Melting could be related to high geothermal flux, but both gullies and gelifluxion deposits are mainly located at south-facing slopes. In that case, the most feasible condition to trigger both processes should be the isolation.

However, the presence of rought and not dust- or sediments-covered north-facing slopes, made us still to thing on geothermal flux. Last eruption could has been as recent as 100.000 yr [3], and may be remains some geothermal activity what could cause the local ice-melting and the consequent ice-mass movement. This working hypothesis is in agreement to other similar processes described in this volcano. For example, melting of an ice-cap lotated on the summit of the volcano has been proposed as the origin of some channels located in its flanks [12].

Conclusions: Assuming the existence of buried ice under a thin laker of dust and aeolian sediments, like many other glaciers described on Mars, the glaciers located in the lower NW flank of Hecates Tholus volcano, could be indicative of (1) downslope glacier flow; (2) ice compactation; (3) ice melting due to (a) climate warming and/or (b) geothermal activity at this volcano; and/or (4) high sublimation rate. All those processes have important implications on the geological and geomorphological evolution of this volcano and region, but also in the local and global climate. The objective of the research that we are carrying out is to check all these hypothesis as well as to search for similar features in other glaciers on Mars.

References: [1] Hauber et al., (2005) *Nature*, 434. 356-361. [2] de Pablo (2006), *36th COSPAR Scientific Assembly*. Abstract #293. [8] Tanaka (1986) *JGR* 91. 139-158. [3] Neukum et al., (2004).Nature, 432. 971-979. [4] de Pablo and Centeno (2011) *LPSC*, 42, 1030. [5] Head and Marchant, (2003) *Geology* 31, 641–644. [6] Shean et al., (2005) *JGR*, doi:10.1029/2004.[7] Milkovich et al., (2006) *Icarus*, 181, 388-407. [8] Shean et al., (2007) *JGR*, doi: 2006JE002761. [9] Head et al., (2010) *Earth & Planet. Sci. Let.*, 294. 306-320. [10] Malin and Edgett, (2000). *Science*, 288. 2330-2335. [11] Marquez et al., (2005). *Icarus*, 179. 398-414. [12] Fasset and Head (2006). *Planet & Space Sci*., 54. 370-378.

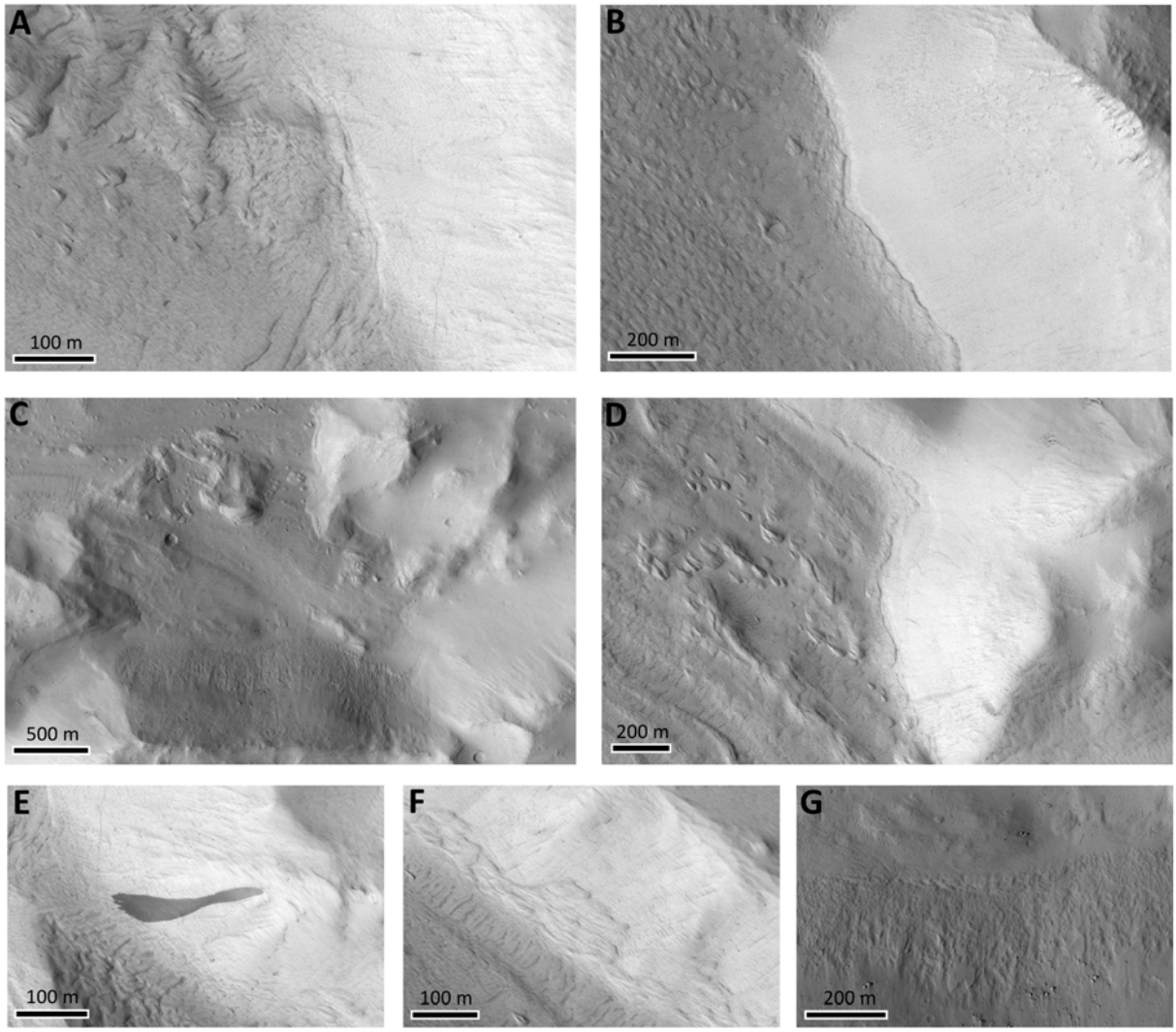

Fig. 2 : Examples from HiRISE image (PSP_001527_2125) showing fractures, crevasses, and bergschrunds (frames A to D), as well as possible markers of periglacial (and partial melting of ice and permafrost) processes (images E to F).