



Abnormally high night temperatures in pit craters and collapsed sinuous rilles on Arsia Mons' flanks. Interpretations in terms of subsurface air circulation along slopes.

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Seven deep pit craters (or skyholes) had been recently discovered North of Arsia Mons (7°S, 240°E) or near the volcano (Cushing et al., 1997). The THEMIS instrument onboard Mars Odyssey imaged these pit craters in the visible and infrared channels with the THEMIS-VIS and THEMIS-IR subsystems. We first report on the finding of about 75 new pit craters in the South of Arsia Mons, near the volcano from THEMIS and HRSC images. These pit craters can be detected from nighttime THEMIS images by their thermal signal. They are systematically warmer than the surrounding at night (Cushing et al., 1997). All pit craters are in average 7K warmer than the background. We also discovered collapsed sinuous rilles which present the same thermal pattern.

To try to explain this thermal behaviour, thermal, geologic and geometric characteristics of these pit craters and collapsed sinuous rilles were documented in detail. Geologic and geometric effects, by the specific pit craters shape, do not show any influence on this pattern. The temperature difference is always observed whatever the season and is only present on pit craters and some collapsed sinuous rilles. We propose that the heat detected at night results from the advection of the geothermal heat in a subsurface CO₂ circulation system, in the porous media of the volcano flank.

This circulation system may consist of cold air entering at the base of the volcano flanks, flowing up the slope while being warmed by the martian geothermal flow. The atmospheric air will exit warmer along the flanks of the pit craters and of the collapsed sinuous rilles. Simple subsurface air flow models show similar temperature excess inside the pit craters and collapsed sinuous rilles considering a geothermal flow of 30 mW/m² along the flanks of Arsia Mons. This might give an indirect measurement of the martian geothermal flow.

References :

Cushing et al., 2007, THEMIS observes possible cave skylights on Mars
Geophysical Research Letters, 34