Seepage Phenomena Originating from Dark Dune Spots at Southern and Northern Polar Region of Mars

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Abstract
Important direction in Martian surface investigations is to find recent activity and effect of water on the atmospheric and soil conditions. Our Mars Astrobiology Group (in Budapest Collegium, Institute for Advanced Studies) sponsored by ESA ECS-project No.98004 has realized analysis of slope streaks originated from Dark Dune Spots (DDS). As a result we interpret these streaks as near-surface seepages of liquid water below the ice cover at the Southern and Northern Polar Region of Mars.

Observations/Discussion
We observed 20-200 m sized low albedo streaks on defrosting polar dunes in the Southern and Northern hemisphere of Mars, based on MOC, HRSC and HiRISE images (Horváth et al. 2001, Gánti et al. 2003, Pócs et al. 2003, Horváth et al. 2009). These structures originate from dark dune spots, they can be described as elongated flow-like and sometimes branching streaks, and frequently has another spot-like structure at their end. Their whole appearance and the connection between their morphometric parameters suggest that some material is transported downward from the upper spot that accumulates at the bottom of the slope. Possible scenarios for the origin of such streaks, including dry avalanche, liquid CO_2, liquid H_2O and gas phase CO_2 models are presented (Horváth et al. 2009). Based on their morphology and the currently known surface conditions of Mars, no model interprets the streaks satisfactorily.

The best interpretation of the morphology and morphometric characteristics is given by the one implying liquid water. In this case the greatest problem is the maintenance of liquid phase. A hypothetical local greenhouse effect may play an important role in it, where solar radiation would penetrate through the surface frost cover and be absorbed on the dark dune surface, heating up the individual dune grains (Szatmáry et al. 2007).

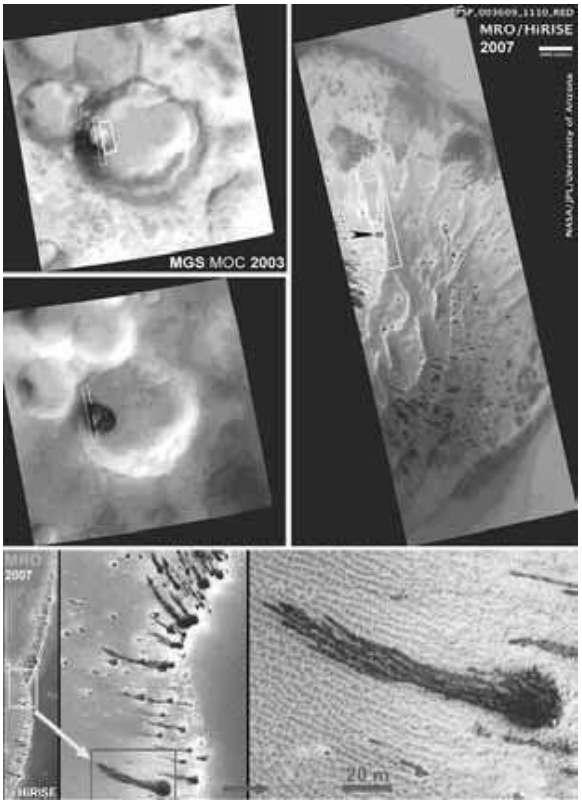

***Fig. 1** Unnamed 70 km diameter crater at 151°W, 69°S with dark dune field. Upper left image acquired at the middle of spring, middle left image at the middle of summer. Upper right image is MRO HiRISE 2007 spring summer image of the dune field with many DDS streaks. In the lower part magnified detaisl of a many-fingered DDS seepage are visible*

The latest HiRISE images (Fig. 1 and Fig. 2) also support the liquid flow scenario. We suggest that with better knowledge of sub-ice temperatures, due to extended polar solar insolation, and the heat insulator capacity of water vapour and water ice, models and measurements may show in the future that ephemeral water could appear and flow under the surface ice

layer on the dunes today (Möhlmann 2004, Szathmáry et al. 2007).

Synthesizing observations of MRO's HiRISE camera with TES temperature data and theoretical modeling, it seems to be possible that on the water ice covered southern polar dunes during springtime, seepage phenomena takes places with the help of interfacial water at subzero temperatures (Möhlmann 2008).

There are also good analogies for Martian seepages phenomena from the Antarctica Dry Valleys in the case of liquid water related structures, which resembling to Martian low latitude slope streaks (Head et al. 2007).

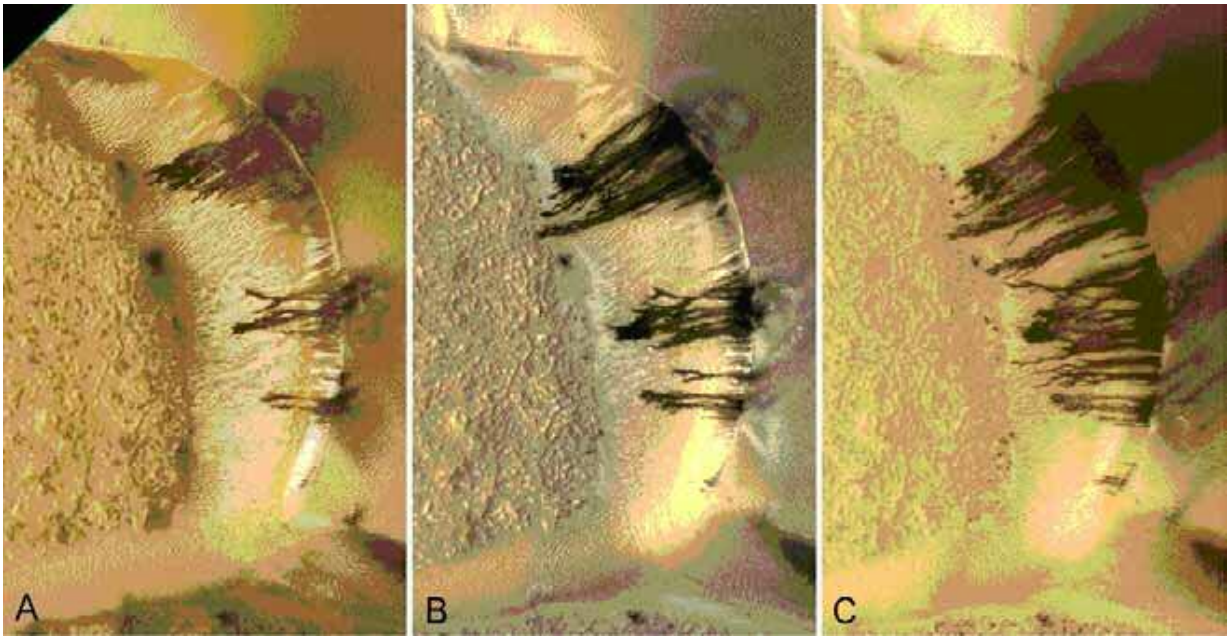

***Fig. 2.** Sequence of HiRISE false color images of slope streak development at the Northern Polar Region at 77N 300E, acquired from left to right A) Ls=38.6 (image no. 7468-2575), B) Ls=48.7 (7758-2575), C) Ls=53.7 (7903-2575) respectively. The images show 200 m wide terrains, and acquired with 22 and 12 day differences*

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