SPRING DEFROSTING IN THE RUSSELL CRATER DUNE FIELD - RECENT SURFACE RUNOFF WITHIN THE LAST MARTIAN YEAR?

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Abstract: Rill erosion on a dune slope in the Russell Crater dune field was detected on a high resolution Mars Orbiter Camera (MOC)-NA image from the latest public release of MOC-data (October, 2001). The identified erosional morphology differs from previously observed gully erosion [1] elsewhere on Mars. We report here our morphological studies of the erosion features as well as seasonal observations (monitoring) of the dune field with MOC- wide angle (WA) and Thermal Emission Spectrometer (TES) data. The observation indicates that the extremely fresh appearing erosion is caused by recent surface runoff within the last Martian year.

Morphology: The erosion features were found in the high resolution MOC-NA image M1901170. They are located on a 350m high (MOLA-track ap16829) dune slope with a dip of about 8° (MOLA-track ap13426) in the Russell Crater dune field at 54.5°S and 347.3°W (Fig. 1). Additional erosion features occur on the same image at smaller dunes further to the south (Fig. 2). The erosion starts in small alcoves in a dendritic pattern at the dune crest and merges after a short distance in main channels, which have a parallel pattern following the slope topography. The individual main channels are approximately the same size from beginning to end. In contrast to all other observed gullies on Mars they run out and end abruptly on the dune base without a depositional apron. Most of them occur on poleward facing slopes. This is in accordance with the gullies observed by [2].

The morphological forms show strong affinity to rill erosion on Earth [2]. Rill erosion features 1) are fairly straight and furrowlike, with flaring sides, 2) generally start high on the hillslope, near its inflection point below the crest and 3) the channel at the bottom remains very narrow. The development of rills and gullies differs in their genesis. Rill erosion is solely bound to overland flow whereas gullies are formed by subsurface flow, with or without surface wash [2]. The morphology of the rills on dune slopes in Russell Crater indicates that overland flow is the major process responsible for their formation. However, the lack of an alluvial cone at the channel terminations and the proc-
The seasonal changes in frost cover on the Russell Crater dune field are similar to those observed at the Richardson Crater dune field (72.4°S, 180.0°W) [3] with slightly higher temperatures and albedos.

**Discussion:** The morphology of the rills indicates that overland flow probably causes the erosion. The MOC-image was acquired in mid autumn at Ls 50° and the very fresh appearing rills suggest that the erosion took place by a defrosting process between late winter and mid spring indicated by the TES-data. We favor an erosion process by liquid water: the rills are located in absolute elevations of ~200 m, and the retreat of the south polar cap leads to an increase of the atmospheric pressure in the southern spring [4, 5] which could allow liquid water to be stable in this region [6]. The lack of a depositional apron may be caused by compaction of the dust material with potentially simultaneous sublimation of the fluid.

Alternatively it is possible that the rills were formed by an unknown warming process of CO2-sublimation in late winter to early spring.

Further observations will be made to identify and understand seasonal erosion processes.

**References:**