Geophysical Research Abstracts, Vol. 8, 07754, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07754

Pristine, degraded and cratered morphologies of southern hemisphere gullies on Mars: Possible indications for a climate change

D. Reiss (1), R. Jaumann (1) and G. Neukum (2)

(1) Institute of Planetary Research, German Aerospace Center (DLR), Berlin, Germany (dennis.reiss@dlr.de), (2) Institute for Geosciences, Freie Universitaet Berlin, Germany.

We mapped individual gullies in the southern hemisphere using Mars Orbiter Camera (MOC) images and classified them into pristine, degraded and cratered gully morphologies. Then we compared the latitudinal distribution, orientation of the three age classes (pristine = young to cratered = old) to constrain possible clues for their formation process and time. 30372 MOC-NA images (sub-phases AB-R02) in the latitude range between 0° and 90°S were analyzed. 1363 (∼4.5 %) images which show gully features were found. Individual gullies on these images were then mapped in respect to their geographic position and orientation. Duplicated gullies were excluded. In total, 16156 individual gullies were found and classified. Clear characteristics of pristine gullies are the superposition on geologically young surface features such as dunes. Additionally, all gullies showing no obvious degradation and no superposition of impact craters have been classified as pristine. Gullies which show signs of erosion or infilling of the channels were classified as degraded. When one of the gully features (alcove, channel or apron) is superposed by impact craters the gullies were classified as cratered. Gullies occur only in mid- and high latitudes between 27°S - 83°S. No gullies were found in equatorial regions. The latitudinal distribution of the three classes is different. Pristine gullies occur over the whole latitude range between 27°S - 83°S, whereas the degraded gullies occur between 28°S - 60°S and the cratered gullies between 30°S - 52°S. The most obvious differences can be observed in the latitude dependant orientation of the three classes. Figure 4 shows the orientation of the pristine, degraded and cratered gullies in ∼10 degree steps. From ∼30°S to 40°S the gullies of all three classes are located on pole facing slopes. An abrupt change occurs from ∼40°S. While the pristine gullies are still located on pole facing slopes,

the degraded (from 40°S to 60°S) and cratered gullies (from 40°S to 52°S) are located on equator facing slopes. The pristine gullies in high latitudes show a different orientation to the mid latitude ones. The high latitude pristine gullies between 60°S to 75°S are located on both equator as well as pole facing slopes. Between 75°S to 83°S they occur on equator facing slopes. The limited distribution of gullies to mid and high latitudes from our analysis is consistent with previous studies. However, degraded and cratered gullies occur only in mid latitudes. It is noteworthy that gullies, if they are younger, extend to higher latitudes: cratered gullies extend only to 52°S, degraded to 60°S and pristine up to 83°S. The orientation of the pristine gullies in mid latitudes is strongly limited to pole facing slopes which indicates a climatic control by deposition and melting of volatiles on sheltered slopes (cold traps) for their formation. The orientation of high latitude pristine gullies on all slope directions is consistent with the recent distribution and availability of volatiles in polar regions. The pole facing orientation of old and young gullies between 30°S - 40°S may indicate equal climatic conditions for their formation. The orientation of the degraded and cratered gullies southward of 40°S resembles the orientation of high latitude pristine gullies, if degraded and cratered gullies on pole facing slopes have been reshaped by pristine gullies. This may indicate a regression of ice from the mid latitudes to the south polar region, and therefore a climate change.