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Observations and Modelling on Crater Shape Evolution with Latitude in Terra Cimmeria, Mars – Implications for Climate.

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We have used topographic data from the High Resolution Stereo Camera (HRSC) in the Terra Cimmeria region on Mars running from latitudes 25 to 50°S to investigate if there are latitudinal trends in crater shape, which could be attributed to climate. We used crater survey GT57633 [1] as a basis for our extended crater map in this region. For the 433 craters we delineated north-, south-, east- and west-facing zones. Within each zone we calculated the curvature of the crater wall, its mean slope and its maximum slope. We compared results from our 30 and 90 m HRSC elevation models, derived from stereo photogrammetry [e.g. 2] to those from the Mars Orbiter Laser Altimeter (MOLA) gridded data at ~400m resolution.

We found that the curvature of the crater walls becomes more 'U' shaped, or flat-bottomed rather than smoothly bowl-shaped towards the pole. This is more marked for pole-facing slopes. This trend is almost undetectable from the MOLA data. This could be related to the greater infilling of craters at mid-latitudes, possibly associated with 'viscous flow features' [3].

The MOLA profile data (which trend N-S) have already revealed that steep slopes become less common towards the poles [4] which is attributed to the presence of a volatile-rich 'mantling' material [5].We also observe that steeper maximum slopes are found towards the equator in both the MOLA gridded and HRSC data, in all slope orientations. This trend is clearer in the HRSC data and stronger for pole-facing slopes. The steeper pole-facing slopes could be due to the presence of km-scale gullies, which are found at mid-latitudes predominantly on pole-facing slopes [6]. We note that the maximum slopes measured in HRSC data (mean 0.26) are much higher than those in MOLA data (mean 0.07). The mean crater wall slope shows a similar latitudinal trend to the maximum slope, but pole-facing slopes are not different from the general population.

We find that HRSC data is better for regional studies of topography, because trends are clearer, slopes are more faithfully reproduced, due to higher resolution and the HRSC data can be used to study slopes of any orientation, because there is no N-S bias. We will map km-scale gullies, concentric crater fill and viscous flow features, which are climate-related features, to assess their influence on our observed trends in crater form. We will also utilize landscape evolution models [e.g. 7] to evaluate the effects of different slope processes (e.g. creep, rockfall, gullying) on crater form.

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