TERRAIN SOFTENING REVISITED: PHOTOGEOLOGICAL CONSIDERATIONS.

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Terrain softening is a term attributed to pervasive degradation of surface features at locations poleward of 30° N or S latitude (1). The volatile-rich interpretation of terrain softening has significant implications for the global distribution of ground ice on Mars. However, if non-volatile processes can also produce the surface degradation then great care must be exercised in using terrain softening to map ground ice distribution. Photogeologic analysis of high resolution Viking images of the northern mid-latitudes on Mars indicate that aeolian depositional and erosional processes contribute to the degradation of surface features and must be considered when making an interpretation of terrain softening. Theoretical constraints related to terrain softening are presented in a separate abstract (2).

Spatial resolution profoundly infuences the geomorphic interpretations that can be made from the Viking imaging data (3). The availability of high resolution images of Mars is limited; approximately 2900 frames have usable clarity and have a spatial resolution of < 20 m/pixel (4). Even if no overlap occurred between adjacent frames these images would cover < 1% of the martian surface. It is important that investigators examine the same type of feature when discussing alternative hypotheses for the surface history. Here we focus on concentric crater fill, one form of terrain softening (1).

Concentric crater fill is interpreted to result from centripital movement of material from the crater rim into the crater interior (1). Fig. 1 shows a portion of Utopia Planitia where craters with concentric fill have been reported (5). Fig. 2 provides a high resolution view of the crater fill. The sharp break in slope between the crater rim and deposits both inside and outside of the crater is not easily reconcilable with a slow downslope creep of material. The lineations on the deposits within the crater provide no clear evidence of centripital movement. The distinct ridge and groove topography may result from erosion of layered deposits that collected within the crater. Figs. 3-6 provide evidence of extensive layered deposits on the northern lowlands. Erosional stripping of aeolian sediments (6) is offered here as an alternative hypothesis to a volatile-related origin for concentric crater fill. Additional evidence supporting both hypotheses needs to be presented to the scientific community for critical evalutation.

REFERENCES: (1) Squyres, S., and M.H. Carr, Science 231, 249-252, 1986. (2) Clifford, S.M., and J.R. Zimbelman, LPS XIX (this volume), 1988. (3) Zimbelman, J.R., Icarus 71, 257-267, 1987. (4) Zimbelman, J.R., LPS XIX (this volume), 1988. (5) Squyres, S.W., JGR 84, 8087-8096, 1979. (6) Williams, S.W., and J.R. Zimbelman, LPS XIX (this volume), 1988.

FIGURE CAPTIONS: Figure 1. Concentric crater fill in Utopia Planitia (after Fig. 6 of ref. 5). The box indicates the location of Figure 2. 10B70, 97 m/pixel, 42°N, 272°W. Figure 2. Concentric crater fill. 425B07, 16 m/pixel. Figure 3. Utopia Planitia (near Fig. 1). The fresh ejecta appears to overlie the dark plains. The boxes indicate the locations of Figs. 4 (top) and 5 (bottom). 10B42, 89 m/pixel, 45°N, 270°W. Figure 4. Contact between the plains and crater ejecta. The dashed line indicates the margin of the bright crater ejecta. The plains consist of layered deposits that have been exposed by erosion. 466B85, 10 m/pixel. Figure 5. The crater rim is very subdued but there is a sharp break in slope between the rim and the materials inside and outside of the crater. The material within the crater appears to have undergone significant erosion, with layers (arrow) exposed. 466B82, 10 m/pixel. Figure 6. The irregularly shaped feature inside the crater may be the erosional remnant of an extensive sheet of material. The subdued crater at right indicates that much of the surface is still mantled, probably by a depositional episode that postdates the remnant preserved within the crater. 521B83, 18 m/pixel, 59.7°N, 105.8°W.


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