II) MARTIAN IMPACT CRATERS, EJECTA BLANKETS, AND RELATED MORPHOLOGIC FEATURES: Preliminary Results From Computer Digital Inventory Using Arc/Info and Arcview

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It has been widely proposed that water and/or ice (permafrost) were present in the Martian subsurface in ancient times (1-3). It has further been argued that such subsurface conditions may be reflected in the morphologies of impact craters and their ejecta blankets, i.e., flowlike features (1-5). To address this issue, we have constructed an inventory in Arc/Info and Arcview formats that contains multiparameter digital information on over 4300 minimally eroded Martian impact craters, their ejecta blankets, and their related impact-generated surface features. Our intention is to use these data to explore the potential range of Martian impact site conditions thought possible for different impact-generated morphologies. The basic objective is to provide quantitative information that can help in interpretations of both Martian crustal history and of Martian impact cratering processes. Our companion abstract in these Conference Proceedings describes the content of the inventory and processing paths (6).

In order to examine the applicability of such inventory data, we have selected an area on west-central Mars (Figure 1) and completed preliminary testing of three cratering parameters using our Arc/Info and Arcview format. The three parameters, rim crest, central peaks, and ejecta blankets, were plotted as a function of latitude, longitude, and topography on MC10 and MC11 (Figures 2-4). We superimposed the USGS 1:2M digital topographic map on the test area and constructed three topographic profiles (7.5,15,22.5 degrees N.latitude). These transects extend from east (0 degrees longitude) to west (90 degrees longitude). The locations of each of the three parameters were then summed and plotted as histograms on the figures. The summation bins on the plots are spaced in 10 degree increments in longitude and 10 degree increments in latitude. The terrain is highest on the west side (Lunae Planum) of the test area, descends across the central part of the area (Xanthe Terra), and rises to the east (towards Arabia Terra). The terrain is youngest to the west and oldest to the east. We are now in the process of reviewing the results of the preliminary comparisons plotted in Figures 2-4.

Preliminary review of these initial plots indicate several points. For example, the limited number of 10km-diameter and larger craters in the western part of the test area on Figure 2 is consistent with the younger-aged terrain shown on the USGS digital geologic map of Mars. In addition, the abundance of craters between 45-55 degrees longitude and 0-20 degrees latitude is higher than the surrounding area because this terrain is also of older age. Comparisons between Figures 2 and 3-4 show a substantial number of craters without central peaks and ejecta blankets in the same region mentioned above. These preliminary observations require further examination. In Figure 3, there is a relatively smooth increase in the occurrence of central peaks from west to east, but no specific correlations seem apparent between the occurrences of peaks and terrain elevations. The same is true with respect to the ejecta blankets plotted in Figure 4. As expected for this area, the preliminary data reduction did not shown any prominent correlations between the parameters chosen here and the topography, terrain elevations, or previously inferred water and/or ice sites. This is consistent with numerous other studies (1-5). However, it is reasonable to expect correlations may become more apparent as we test areas north and south towards the colder polar regions (4). With the preliminary testing of our GIS software and format nearly completed, we plan to expand our studies to other regions on Mars.

References:(1) Carr, M.H., et. al., 1977, JGR, 28, 4055-4066; (2) Schultz, P.H., 1992, JGR, 11, 11, 623-11662; (3) Strom, R., et. al., 1992, in Mars, Kieffer, H., et. al., eds., 383-424; (4) Boyce, J.M., and Roddy, D.J., 1997, LPSC XXIX; (5) Carr, M.H., 1996, Water on Mars, 180p.; (6) Roddy, D.J., et. al., 1998, this Conference, LPSC XXIX.

Figure 1. Western Mars (MC10 and MC11) with Digital Topographic Map

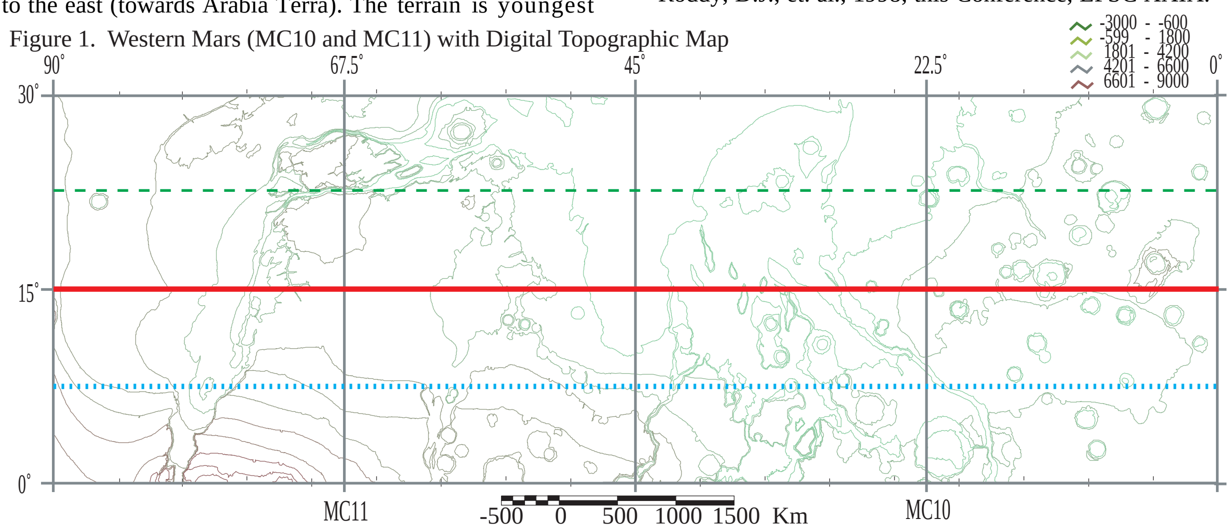

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Figure 2. Crater Rim Crest Histograms vs Latitude, Longitude, and Elevation

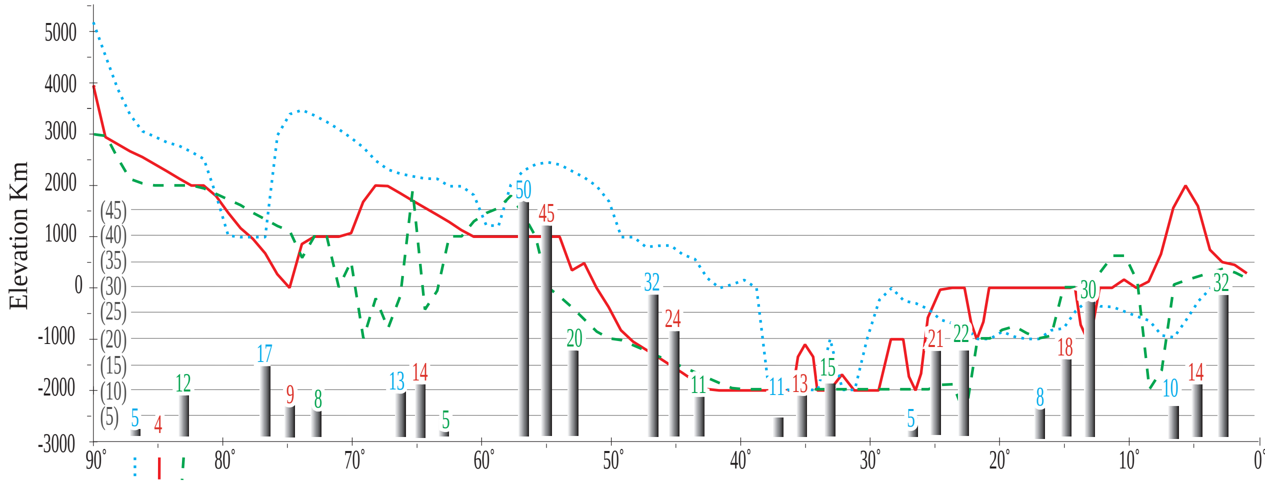

Figure 3. Central Peak Histograms vs Latitude, Longitude, and Elevation

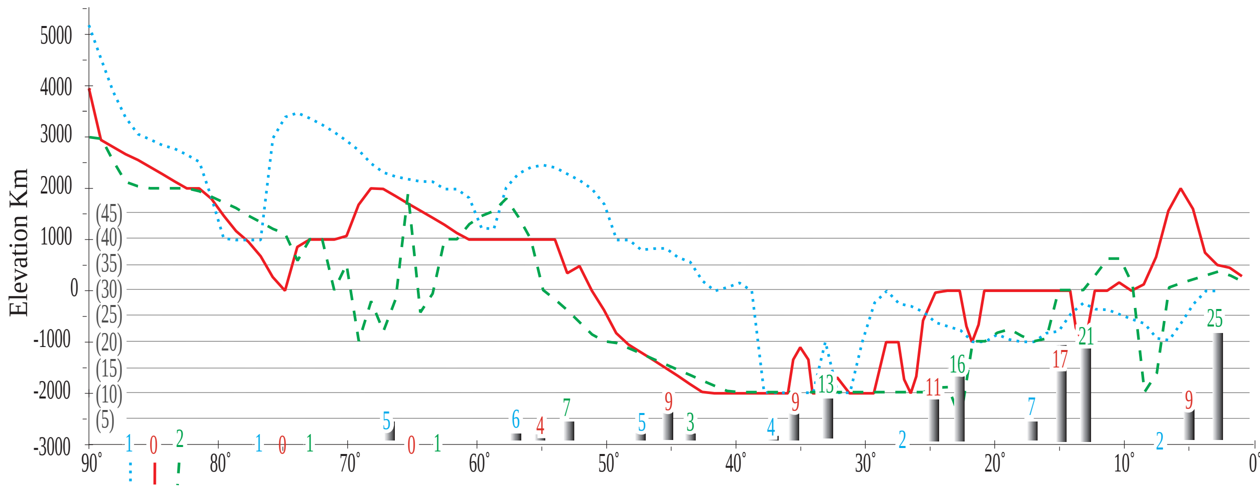

Figure 4. Ejecta Histograms vs Latitude, Longitude, and Elevation