CRATER DEGRADATION VARIATIONS IN THE MARTIAN CRATERED TERRAIN.

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Introduction. Various studies have indicated that different elements of impact crater morphology are influenced or controlled by characteristics of the target rocks. For example, fluidized ejecta and central pits of martian craters are generally interpreted in terms of subsurface volatiles[1,2], and the development of central peaks and wall terraces is related to target strength[3]. In this note I report crater observations in two regions of Mars which, although mapped as having similar characteristics, must have experienced differing periods and/or intensities of resurfacing and volatile emplacement/retention. This investigation differs from most previous martian crater morphology studies in that the degradational state of each crater is explicitly considered; thus, the focus is erosional history rather than primary morphological differences.

Method. Craters > 20 km in diameter were examined on the MC-16 and MC-19 quadrangles of Mars: 255 craters from MC-16 NW, SW and NE, and 162 craters from MC-19 SW and SE. An attempt was made to examine only Noachian age cratered plateau terrain (Nplc)[4], however, correlation of Viking photographs with the Mariner 9 geologic map proved difficult; hence Nplc and Nhc (Noachian hilly and cratered material) territory are probably both present. Young volcanic terrains were excluded.

Crater degradation was classed on a 1 to 5 scale following earlier studies[2,3]. Class 1 craters are fresh with continuous sharp rims. Class 2 craters show a small degree of degradation - the rims are slightly worn. Class 3s are quite worn with no rims sharpness left (the rims are often completely removed in spots). Class 4 craters are ruins, and class 5s are ghosts which are often hard to detect. For each crater the presence or absence of a central peak and/or depression was noted.

Crater Numbers. The number density of craters > 20 km in MC-19 is $73/10^6$ km^2 vs. $113/10^6$ km^2 in MC-16, thus the former region has experienced some sort of erosional event which removed older craters. Further evidence concerning the differing histories of the two areas is provided by examination of their crater degradation distributions (Fig. 1). Although the abundances of fresh craters (classes 1 and 2) are equal in the two quadrangles, far fewer strongly degraded craters (classes 4 and 5) have been detected in MC-19 than in MC-16. Indeed, the majority (60%) of craters in MC-19 are of an intermediate degradation state (class 3). These results agree with the crater density determinations in that MC-19 has a lower crater density and lacks old craters, however, the large percentage of class 3 craters is difficult to explain.

Central peaks and pits. The abundance of central peaks in fresh craters is influenced by the strength of the surface materials[3]. For example, central peaks are more common in craters formed on lunar mare basalts than in lunar highland craters, and a similar, but less pronounced effect was found for martian craters[2]. Although both MC-16 and MC-19 are similar cratered terrains the abundance of central peaks is substantially greater in class 1 and 2 craters in MC-16 than in MC-19 (Fig. 2) This result implies that the MC-16 substrate has greater strength than that of MC-19, an unexpected result considering the higher crater density (and hence likelihood of megaregolith development) in MC-19. Before this result is accepted, however, an examination of central pit distribution (Fig. 3) discloses a reversed relation - pits are considerably more frequent in MC-19 craters than in those of MC-16. This observation is interpreted to mean that subsurface volatiles, which transform peaks to pits[2], are more abundant in MC-19 than in MC-16. Thus, the combined peak plus pit distribution is nearly identical for the two regions.

Conclusions. Preliminary examination of craters in two cratered terrain regions

of Mars that are mapped as identical units reveal differences in history that might otherwise have remained undetected. The relatively low crater density and paucity of degraded craters in MC-19 implies that many older craters were completely removed by some erosional process that did not effect MC-16. The high abundance of central pits in MC-19 probably reflects concentrations of volatiles, another difference from MC-16. The lack of central peaks in MC-19 would imply a weaker substrate than MC-16 except for the apparent replacement of peaks by pits.

References.

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