MARTIAN CRATER INTERIORS: RELATIONSHIPS WITH EJECTA, DIAMETER, LATITUDE, AND TERRAIN. T.L Bradley[1] and N.G. Barlow[2]. [1]Dept. of Geology, Univ. of Alberta, Edmonton, Canada T5A 2P6. [2]Lunar and Planetary Institue, 3303 NASA Road One, Houston, TX 77058.

Early analysis of the Mariner 9 and Viking images clearly demonstrated the diversity of ejecta and interior morphologies associated with martian impact craters. Further analyses led to the idea that some relationships may exist between interior morphology and terrain, latitude, and diameter (1, 2, 3). Despite early indications of trends, the databases used in these studies are generally insuffícent to draw firm conclusions because of their limitations in both crater numbers and areal extent. The database used for this study contains over 42,000 craters mapped from the Viking 1:2M photomosaics (4). All craters ≥8 km in diameter were classified by location, terrain unit, ejecta type, interior morphology, relationship to tectonic features, and degree of ellipticity. This data is archived in an RBASE 4000 computer data management system for ease of access to and manipulation of the data. The presence of such a complete database now enables the full investigation of possible relationships between crater characteristics.

Manipulation of the database entailed setting certain parameters and tallying the number of craters satisfying those conditions. Nine types of interior morphology were investigated (Table 1). The parameters considered in this study were terrain, diameter, latitude, and ejecta morphology. The resulting crater numbers were normalized to (1) the total number of craters satisfying the stated conditions (regardless of existence of any interior morphology), (2) the total number of craters displaying interior features and satisfying the specified parameters, and (3) the total number of craters with the particular interior morphology. The intersection and union of various crater characteristics were then graphed in the form of percentage bar-histograms. Histograms were chosen as the analytical tool because any relationships or trends existing in the data would be clearly displayed graphically. Approximately 1600 histograms were plotted for the 3819 craters displaying interior morphologies, the majority of which yielded little or no correlation between interior type and parameter(s). To those which showed some correlation, chi square statistical tests were applied and the results were found to be statistically viable.

The major results obtained from this study are: (1) Central peak craters were found to be distributed fairly evenly among all terrains and latitudes, therefore showing no presence of an underlying latitude or terrain control to their formation. However, most central peak craters display diverse or radial lineated ejecta and occur at diameters greater than 70 km. (2) Flat floor-deposits tend to occur on young terrains: 65% of all such craters lie within the sparsely cratered plains and mottled plains located in the northern hemisphere. (3) 63% of all peak rings occur on the older heavily cratered uplands and have a higher incidence at larger diameters (>120 km). (4) Flat floor-pristine craters dominate on younger terrains and between +30° and +60° (Table 2). (5) The numbers of both flat floor-deposits and flat floor-pristine craters decrease with increasing diameters. (6) 72% of all pancake ejecta craters show a flat floor-pristine morphology (Table 3). (7) Central pit morphology appears related to diameter of the primary crater: summit pits dominate at crater diameters up to 45 km, symmetric pits up to 65-km diameter, and asymmetric pits at larger crater diameters (confirming earlier findings of Awwiller and Croft (5)).

A complete analysis of martian cratering can now be done through the use of a recently developed global-wide database derived from Viking images. The relationships between crater interiors with diameter, terrain, latitude, and ejecta can be investigated thoroughly. It is through the careful analysis of such characteristics that regional variations in volatile content can be defined. The use of other related data, such as elevation and thickness of mantling material, will add additional insight into this study. The next step after the extensive statistical analysis is to look at the global picture with geological insight and determine the reasons for obtaining such results.

References: (1) Cintala, M.J. (1977). In Impact and Explosion Cratering, 575-591. (2) Wood, C.A., et al. (1978). Proc. Lunar Planet. Sci. Conf. 9th, 3691-3709. (3) Johansen, L.A. (1982). NASA TM 84211, 102-103. (4) Barlow, N.G. (1988). Submitted as NASA Contractor Report. (5) Awwiller, D. and S.K Croft (1986). Personal communication.

TABLE 1
INTERIOR MORPHOLOGY:
SY-symmetric pit
aP-asymmetric pit
sP-summit pit
Pk-central peak
PR-peak ring
FP-flat floor-pristine
FD-flat floor-deposits
Cx-complex

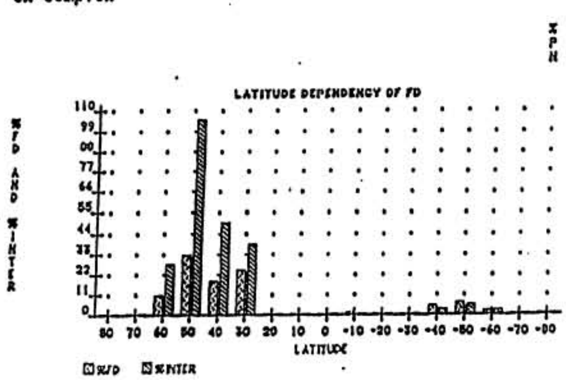

FIGURE 1

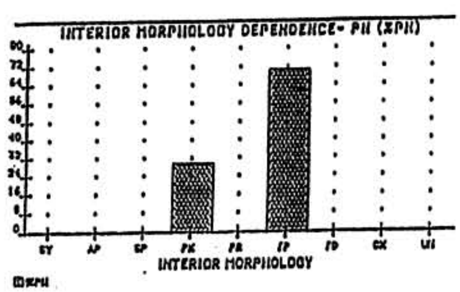

FIGURE 2