PARAMETERS AFFECTING FORMATION OF MARTIAN IMPACT CRATER EJECTA MORPHOLOGY. N. G. Barlow, Lunar and Planetary Institute, 3303 NASA Road One, Houston, TX 77058.

Mariner 9 and Viking images of Mars revealed the existence of a previously unobserved type of crater ejecta morphology, referred to as rampart ejecta. This type of ejecta morphology is characterized by one or more lobes of material which have been emplaced by flow across the surface (1). However, Viking images revealed a larger diversity of ejecta morphologies existing across the martian surface. Several different types of ejecta structures are identifiable and a number of studies have attempted to correlate these various morphologies with changes in parameters such as diameter, terrain type, and latitude (2, 3, 4). The results of these analyses have often been contradictory, primarily due to the limited areal extents of the studies.

Recently I have submitted a catalog of martian impact craters to NASA for publication and distribution to the Regional Planetary Image Facilities (5). This catalog consists of information relevant to 42,283 martian impact craters mapped from the Viking 1:2M photomosaic series and distributed across the entire martian surface. Each entry contains information on the crater's location, size, preservational state, ejecta and interior characteristics, and degree of ellipticity (if applicable). The catalog is complete for craters ≥8-km diameter, of which 25,826 craters or 61% of all catalog entries meet this criteria. 3819 of these 25,826 craters are associated with one of seven types of ejecta morphology. These seven types (after the classification scheme described in (2)) are single lobe rampart, double lobe rampart, multiple lobe rampart, radial lineated, diverse, pancake, and unclassifiable.

Using the information in this catalog a new study has been undertaken to determine which physical parameters affect ejecta morphology formation. This study differs from the previous analyses by including all craters ≥8-km diameter across the entire surface of Mars, by using a finer distinction of terrain units and their relative ages determined from relative plots (6), and by considering the relationships of various combinations of parameters and particular ejecta morphologies. The method used in this analysis consists of three steps: (1) Deciding which parameter (such as diameter, latitude, or terrain type) or combination of parameters are to considered and determining the number of craters with a particular ejecta morphology which satisfy the stated condition(s); (2) Comparing the value obtained in step 1 with (a) the total number of craters showing the same ejecta morphology across the planet, (b) the total number of craters with any ejecta morphology satisfying the same parameter(s), and (c) the total number of craters which satisfy the stated parameter(s), regardless of whether they show an ejecta morphology; (3) Tabulation and display of the percentage values obtained in step 2 by means of histograms and display of the distribution of the craters with a particular ejecta morphology using computer generated maps. Chi square tests have been used to guarantee that the results are statistically different from random.

Some preliminary results from this analysis are as follows: (1) Single lobe rampart craters dominate among ejecta craters at diameters ≤20 km and are distributed among all terrain units equally. 77% of all craters with a pristine flat floor are associated with single lobe ejecta. (2) Single lobe and multiple lobe craters predominate at diameters ≤30 km. (3) 62% of all double lobe craters are located on the post heavy bombardment aged terrains between +35° and +65° latitude. 51% of all craters displaying a flat floor-deposits interior structure are associated with double lobe ejecta morphology. (4) All pancake craters in this study are less than 15 km in diameter and 60% were <10 km. 71% of all pancake craters display a pristine flat floor interior structure. (5) All craters >70-km diameter display radial lineated, diverse, or unclassifiable ejecta blankets.

The results thus far suggest that crater diameter plays the major role in the formation of a particular ejecta morphology. However, the transition between single, double, and multiple lobe rampart morphologies is not a simple diameter progression. Latitude appears to be more important for the formation of double lobe craters than is diameter. Obviously the formation of a particular ejecta morphology depends on the complex interaction of numerous physical parameters, some of which (such as impact velocity and density of atmosphere at the time of impact) are impossible to include in the present analysis. However, this study is being extended to include the potential effects of elevation and strata thickness in an attempt to at least narrow the range of parameters which appear to affect ejecta morphology formation.

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