I) MARTIAN IMPACT CRATERS, EJECTA BLANKETS, AND RELATED MORPHOLOGIC FEATURES: Computer Digital Inventory in Arc/Info and Arcview Format

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The surface of Mars exhibits a wide variety of impact crater and ejecta-blanket morphologies that have been the subject of considerable debate (1-3). It is commonly thought that many of these landforms are directly influenced by specific rheological properties of the Martian rocks at the time of impact (1-4). For example, ejecta blankets with flowlike surface features are interpreted to have been influenced by water and/or ice (permafrost) that lowered the strength of the target rocks at the time of impact (5,6). Formation of large central peaks also may have been influenced by low-strength target material during impact (7). Such unique aspects in Martian impact cratering processes have prompted a number of research studies, including the assemblage of several digitally based crater and ejecta inventories (8). These inventories basically address impact craters as a function of location and geology. Generally, their goal is to provide interpretations of Martian crustal conditions as a function of geologic time. We have constructed one of these inventories in a special format that contains multiparameter digital information on minimally eroded Martian impact craters, their ejecta blankets, and related impact-generated surface features. Our intention is to use these data to explore a range of impact site conditions thought possible for different impact-generated morphologies. The basic objective is to provide information for interpretations of both Martian crustal history and of Martian impact cratering processes.

Our inventory has been assembled in a computer digital format to permit: (a) multiparameter interactive comparisons of impact cratering, topographic, and geologic data, (b) statistical analyses of these comparisons, (c) studies of impact cratering processes, and (d) construction of a digital data base of basic crater and ejecta blanket spatial parameters. Figure 1 shows the area, mainly all of western Mars, included in our work. In addition, we have digitized the USGS global geologic map of Mars and are using the USGS 1:2M global topographic map of Mars in our data correlations.

To date, we have electronically digitized over 4300 Martian craters and their related physical parameters. All features were interpreted on the Viking medium resolution 1:2 million-scale mosaic images on file at the U.S. Geological Survey in Flagstaff, Arizona. The data have been recently converted from an earlier USGS digitizer format to a current Arc/Info software format (8). This information is being managed using Arcview software which permits a variety of graphic correlations and analytical manipulations. The crater data utilized in our digital format currently include 48 site parameters, of which only a few apply to any given crater site (Table 1). The basic criteria for inclusion of a crater in the inventory is that it have one or more of the following characteristics: minimally degraded crater that is larger than about 10 km in diameter, ejecta blanket (complete or partial), central peak(s), central pit(s) in central peak(s), secondary ejecta field(s), pedestal / rampart features, multirings, or an unusual morphologic feature (see Table 1). Inventory data were also collected on a limited number of older more eroded crater sites, especially where one or more of the above characteristics could be identified. An example of the parameters recorded for a typical minimally eroded crater, on the order of 10 km in diameter, include at least a crater number (identifier), latitude / longitude, and a digitized trace of the rim crest. Where present, digitized traces were made of terraces on crater walls, of the base of crater walls, of the base of central peaks(s), of central pit(s), of the path of ejecta chains, and of other features with areal distributions amenable to digitization. Nondigitized parameters recorded in the inventory include features, such as flat floors, hummocky flat floors, ballistic ejecta, and others (Table 1).

Analysis of this data base is now in progress; see our companion abstract for this Conference (9). Our first objective is to determine if systematic correlations and distributions of different crater types exist as a function of latitude, longitude, elevation, topographic setting, inferred geologic target materials, structural setting, and geologic setting . A second objective will be to use the digital data to calculate and compare crater and ejecta blanket parameters that have spatial dimensions, such as maximum and minimum diameters, areas of rim crests, crater floor areas, areas of bases of central peaks on crater floor, depths of apparent craters, thicknesses of ejecta blankets, volumes of apparent craters and ejecta blankets, and other dimensional parameters. Our objective here is to determine if comparisons of quantitative crater dimensions will yield additional insight into Martian cratering and crustal issues. In addition, we hope to merge our data base with the extensive Mars crater inventory of N. Barlow (10; personal comm., 1997) to extend coverage to all of Mars. Our data base is available to other researchers and we encourage cooperation.

References: (1) Carr, M.H., et. al., 1977, JGR, 28, 4055-4066; (2) Schultz, P.H., 1992, JGR, 11, 11623-11662: (3) Strom, R., et. al., 1992, in Mars, Kieffer, H., et. al., eds., 383-424; (4) Melosh, H.J., 1989, Impact Cratering, Oxford Press; (5) Boyce, J.M., and Roddy, D.J., 1997, LPSC XXIX; (6) Carr, M.H., 1996, Water on Mars, 180p.; (7) Roddy, D.J., 1977, Impact & Explosion Cratering, 1301p.; (8) Hare, T.M., et. al., 1997, LPSC XXVIII.; (9) Roddy, D.J., et. al., 1998, this Conference, LPSC XXIX.; (10) Horner, V.M. and Barlow, N.G., 1988, LPSC, XIX, 505-506.

Figure 1. Area of Mars completed for impact-crater inventory (cross-hatch)

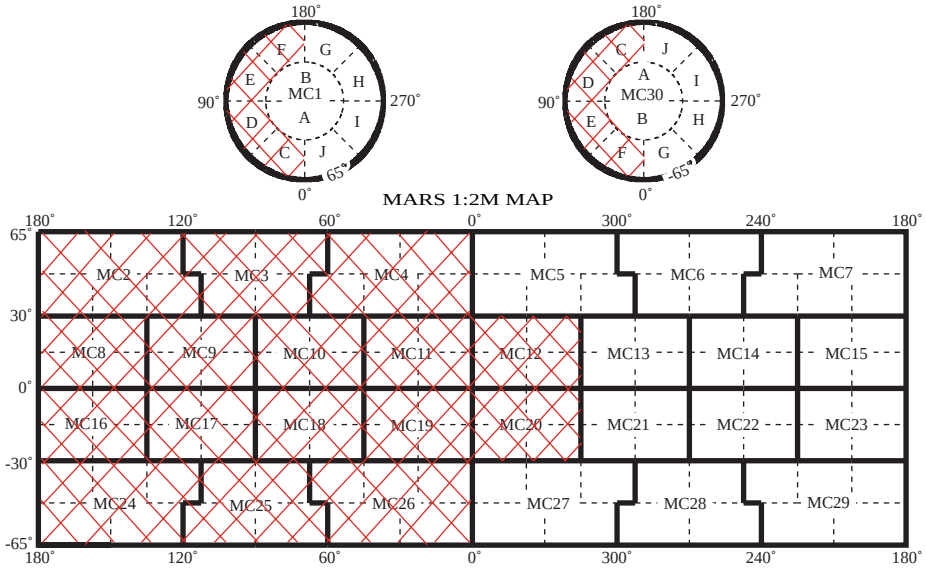

Table 1. Crater-Site Morphological Parameters

CODE	DESCRIPTION	CODE	DESCRIPTION
0	Rim Crest	25	Partial Central Ring
1	Terrace	35	Radiate, Grooved Ejecta
2	Crater Rim Interaction	36	(Unused)
3	Diameter Of central peak(s)	37	(Unused)
4	(Unused)	38	Superimposed Linear Feature
5	Ejecta (Outer)	39	Uncertain
6	CP1	40	Morphologically Fresh Crater
7	CP2	41	Tectonically Destroyed Fresh Morphology (Partly)
8	CP3	42	Levee Ejecta
9	>3 CPS	43	Ghost Crater
10	CP W Central Pit	44	Badly Degraded Crater
11	Flat Floored	45	(Unused)
12	Hummocky Flat Floored	46	(Unused)
13	Ridge On Floor	47	Morph Fresh W/O Complete Ejecta
14	Diameter Of Flat Floor	48	Ballistic Ejecta
15	Partial Rim Crest	49	Pedestal Crater
16	Ejecta Flow Line	50	Impact Or Volcanic?
17	Hummocky Ejecta	51	Rampart Crater
18	Central Pit	52	Mult Rampart Flows
19	2 Deg Impact Chain	53	Scalloped Rim
20	Double Ejecta (Inner)	54	Fractured Floor
21	2 Deg Impact Cluster	55	Bilateral-symmetric Crater
22	Diam Central Pits	56	Chaotic Material
23	Bowl Shaped	57	Mantled Crater
24	Central Ring	58	Dark Albedo On Crater Floor