COMPARISON OF NORTHERN HEMISPHERE MARTIAN CRATER DATA BETWEEN CRATER DATABASES. N. G. Barlow, Dept. Physics and Astronomy, Northern Arizona University, Flagstaff, AZ 86011-6010 Nadine.Barlow@nau.edu.

Introduction: The first edition of the *Catalog of Large Martian Impact Craters* ("Catalog 1.0") was compiled in the 1980's from the Viking 1:2M photomosaics and has been used in a number of studies investigating crater morphology and size-frequency distribution analysis [e.g., 1-5]. The Catalog is currently in revision ("Catalog 2.0") utilizing data primarily from Mars Odyssey (ODY) Thermal Emission Imaging System (THEMIS) visible and daytime IR images. Catalog 2.0 is currently complete for MC quads 01 through the northern part of 21 (~65%). Here we report on comparisons of the data between Catalogs 1.0 and 2.0 for the northern hemisphere of Mars. A similar analysis with the Robbins database [6] is ongoing.

Catalog Data: Differences in the data compiled between the two Catalogs include:

- Catalog 1.0 crater measurements were obtained by digitizing off the Viking photomosaics. Catalog 2.0 crater measurements are obtained using a 2-point rim-to-rim technique in an ArcView program specifically developed for this project by Trent Hare (USGS).
- Coordinate system in Catalog 2.0 is based on the Mars 2.1 Control Network [7], leading to changes in the latitude/longitude of the crater centers relative to Catalog 1.0. In addition, east longitude system is used in Catalog 2.0 whereas west longitude was used in Catalog 1.0.
- Crater preservation was very generic in Catalog 1.0 (fresh, somewhat degraded, degraded). Catalog 2.0 uses a 0.0 ("ghost") to 7.0 (very fresh) numeric system to define crater preservation [8].
- Catalog 1.0 only included classifications for ejecta and interior morphologies if both were present. Catalog 2.0 uncouples these classifications from each other (Tables 1, 3).
- Ejecta classifications in Catalog 2.0 follow the recommendations from the Mars Crater Consortium [9].
- Catalog 2.0 contains information about ejecta mobility and lobateness of layered ejecta deposits, which was not included in Catalog 1.0.

Results: Number, Size, and Shape: Catalog 2.0 contains 14,224 craters ≥5-km-diameter, compared to 12,920 in Catalog 1.0. The increased number is largely due to better resolution allowing identification of highly degraded craters and improved diameter measurements. Northern hemisphere craters (not including large basins or buried craters only detectable using MOLA or radar [10, 11]) range in diameter from our cut-off of 5.0 km to 591.6 km. Of the 12,749 craters occurring in both Catalog 1.0 and 2.0, 69% have diameters within 10% of each other and 83% have diameters within 15% of each other. Distribution of craters in the northern hemisphere is consistent with previous crater size-frequency distribution analyses [e.g., 1].

Most craters in the northern hemisphere are circular in planform, with only 456 craters in Catalog 2.0 being classified as elliptical based on elongated shape and/or asymmetric ejecta blanket. Only 213 of these elliptical craters have a minor diameter that is less than 80% of the major diameter. The azimuth orientation of the major axis was investigated as a function of crater preservational state and terrain age. The highest concentration is oriented between 80°-100° azimuth (~parallel to the present-day equator) regardless of preservation state or underlying terrain unit, consistent with impacting objects crossing Mars' orbit with inclinations within ~25°-35° of the ecliptic plane. Smaller peaks have orientation angles of 30°-50° and 120°-150° but these cannot be easily reconciled with expected obliquity excursions or polar wander. This analysis suggests that the use of elliptical crater orientation is not a reliable technique for determining the orientation of the Martian poles over time.

Results: Ejecta Morphologies: Catalog 2.0 has 5835 craters with a classifiable ejecta morphology compared to 4198 in Catalog 1.0. Although some ejecta classifications have changed between Catalogs 1.0 and 2.0 due to improved image resolution (Table 1), the overall geographic distribution of the single layer ejecta (SLE), double layer ejecta (DLE), and multiple layer ejecta (MLE) craters has not radically changed from Viking data analysis: SLE are seen throughout the northern hemisphere, DLE are concentrated in the 30°N-60°N region, and MLE are most common in the 0°-30°N zone [3]. Table 2 summarizes the median diameter, median ejecta mobility (EM) ratio (ratio of maximum ejecta extent to crater radius), and median lobateness (Γ) (measure of ejecta sinuosity; Γ = 1.0 indicates a circular ejecta planform and higher values indicate greater sinuosity) for the layered ejecta morphologies in the northern hemisphere.

Table 1: Comparison of Numbers of Craters with Ejecta Morphologies in Catalogs 1.0 and 2.0

Catalog 1.0	Number	Catalog 2.0	Number
SL	3356	SLE	3181
DL	227	DLE	1113
ML	205	MLE	1094
Radial	66	SLERd	32
Diverse	71	Diverse	139
Pancake	11	SLEP	224
Amorphous	262	Pedestal	52

Table 2: Characteristics of Layered Ejecta Morphologies

Morphology	Median D	Median EM	Median Γ
SLE	7.2	1.4	1.15
DLE	7.5		
Inner		1.5	1.11
Outer		3.1	1.15
MLE	14.9	2.4	1.2

The non-layered "radial" ejecta morphology is only seen around 32 craters in the northern hemisphere, with most at diameters > 25 km (median D = 47.9 km). Craters displaying both a layered ejecta morphology and chains of secondary craters are termed "diverse". The 139 diverse ejecta craters in the northern hemisphere have a median diameter of 21.0 km and 73% of them have a MLE morphology for the layered deposit.

Results: Interior Morphologies: Table 3 shows the comparison of craters classified with interior morphologies between Catalogs 1.0 and 2.0. Catalog 2.0 allows up to two interior morphology classifications, thus the total number of interior morphologies (7669) exceeds the number of northern hemisphere craters classified with an interior morphology (6972).

Table 3: Comparison of Numbers of Craters with Interior Morphologies in Catalogs 1.0 and 2.0

Catalog 1.0	Number	Catalog 2.0	Number
Pk	750	Pk	1013
PR	11	PR	9
FD	115	FD	5173
FF	6	FF	43
FP	270	Ct	105
Complex	14	WT	427
Pits	338	Pits	898

Approximately 74% of all northern hemisphere craters with an interior morphology contain some type of floor deposit (FD), which includes eolian, fluvial, and periglacial materials. Craters displaying flat floors (FF, 0.6%), fractured/chaotic textures (Ct; 1.5%), wall terraces (WT; 6.1%) (Fig. 1), and central peaks (Pk; 15%) (Fig. 2) are concentrated in the highlands. Peak ring craters (PR) are rare in the northern hemisphere but have much larger median diameters compared to Pk craters (53.2 km vs 10.9 km). Central pit craters comprise about 13% of all craters with an interior morphology: 60% of the central pit craters are floor pits, found on both highlands and plains, while 40% are summit pits which are concentrated in the highlands.

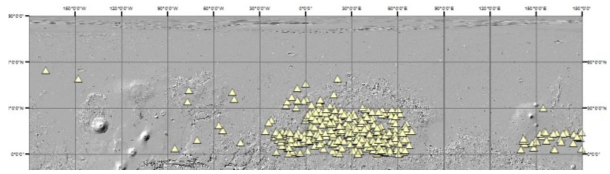

Figure 1: Distribution of craters with wall terraces.

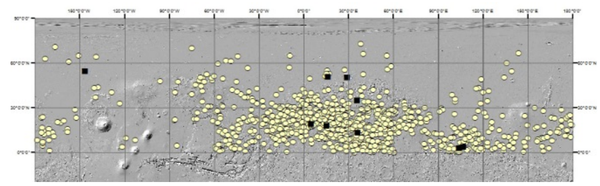

Figure 2: Distribution of craters with central peaks (yellow) and peak rings (black).

Conclusions: This comparative analysis reveals the following:

- Craters are easier to identify and classify with the new higher-resolution data.
- The orientations of elliptical craters are consistent with impactors arriving along trajectories within ~25°-35° of the ecliptic. A few concentrations at higher orientation angles cannot be easily reconciled with proposed obliquity changes or polar wander and are likely just from random inclinations of impacting objects.
- Although higher resolution images have improved the ability to precisely classify ejecta morphologies, the overall geographic and diameter trends are obvious in any data set with resolutions on the order of 100 m/pixel.
- Strength of the target material is an important consideration in the distribution of craters with interior morphologies such as wall terraces, central peaks, and summit pis.

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