STATUS REPORT ON THE "CATALOG OF LARGE MARTIAN IMPACT CRATERS", VERSION 2.0.

N. G. Barlow, Department of Physics and Astronomy, Northern Arizona University, NAU Box 6010, Flagstaff, AZ 86011-6010; Nadine.Barlow@nau.edu.

Introduction: The original *Catalog of Large Martian Impact Craters* (henceforth *Catalog 1.0*) was produced in the late 1980's using the Viking 1:2,000,000-scale photomosaics, with a resolution of ~100 m/pixel. *Catalog 1.0* has become one of the primary datasources for martian impact craters and has been used in numerous studies by researchers around the world. The *Catalog* is currently being revised using Mars Global Surveyor (MGS) and Mars Odyssey data. Old data are being updated and several new pieces of information are being included. The revision (henceforth *Catalog 2.0*) will be distributed in ASCII format via the Planetary Data System and in GIS format through the USGS's PIGWAD system.

Catalog Data: *Catalog 1.0* contained information on 42,283 craters ≥5-km-diameter across the entire martian surface [1, 2]. The information in this *Catalog* included the following: MC Subquadrangle, crater ID number, latitude and longitude of the crater center, crater diameter, terrain unit on which crater is superposed, general preservational classification, ejecta and interior morphologies (if applicable), diameter of minor axis if crater is elliptical, azimuthal angle of orientation if crater is elliptical, pit diameter if crater contains a central pit, and any comments (generally the crater name if one is assigned).

The *Catalog* is being revised using MGS Mars Orbiter Camera (MOC), MGS Mars Orbiter Laser Altimeter (MOLA), MGS Thermal Emission Spectrometer (TES), and Mars Odyssey Thermal Emission Imaging System (THEMIS) data. Measurements are done using an ArcView GIS program specifically designed for this project by Trent Hare (USGS-Flagstaff) and using applications available through ASU's JMars software package [3].

This revision is producing many changes to the original *Catalog* data. Craters are being added which were missed in *Catalog 1.0* due to resolution and image clarity issues (MOLA and THEMIS daytime IR reveal craters in regions where clouds or thick hazes prevented their detection in the visible-wavelength imagery from Viking). More precise measurements of crater diameters are finding that some of the smaller craters in *Catalog 1.0* are below the 5-km-diameter limit for the *Catalog*—these have been eliminated from *Catalog 2.0*. Many other revisions of crater information are being made due to the improved data from MGS and Odyssey, revealing many new insights into the distributions and characteristics of different crater types [4].

The columns in *Catalog 2.0* contain the following data:

MC Subquadrangle and Old ID: These two columns contain the original identification information for the crater from *Catalog 1.0*. This is primarily for cross-referencing purposes.

New ID: The MC subquadrangle nomenclature is seldom used today, so after discussions with the USGS and the Mars Crater Consortium it was decided that a new identification system was needed for the craters in *Catalog 2.0*. The new ID values consist of the (east) longitude and latitude values of the crater center to one decimal place. Thus, a crater at longitude 176.01°E, latitude 24.33°S has an ID value of 1760-243, while a crater at longitude 29.53°E, latitude 13.80°N has an ID value of 0295+138.

Latitude and Longitude: The latitude/longitude system for surface features on Mars has shifted since *Catalog 1.0* was produced due to redefinition of the geodetic grid using MOLA data [5, 6]. Latitudes and longitudes of all craters in *Catalog 2.0* (and their resulting new ID values) are based on MDIM 2.1. The east longitude system is used in *Catalog 2.0*, as opposed to the west longitude system which was in effect when *Catalog 1.0* was produced.

Diameter: The main diameter column provides the diameter of ~circular craters and the major axis diameter for elliptical craters. Values are in kilometers.

Minor Axis Diameter: This is the diameter, in kilometers, of the minor axis for elliptical craters.

Azimuthal Angle: The angle of orientation for the major axis of elliptical craters is given in this column. This angle is measured in degrees from north in a clockwise direction (i.e., from north through east to south to west), hence the name "azimuthal angle".

Stratigraphic Unit: Rather than the generic terrain designations used in *Catalog 1.0* (e.g., "plains", "ridged plains", "intercrater plains"), *Catalog 2.0* uses the stratigraphic unit designations from the USGS geologic maps. References to the datasources are included.

Preservation Class: *Catalog 1.0* used a very generic classification system for crater preservation which had three major subdivision: fresh with ejecta blanket, crater with no ejecta blanket, and crater almost completely buried (i.e., a "ghost" crater). *Cata-*

log 2.0 uses a system which classifies the crater's preservational state on a 0.0 ("ghost crater") to 7.0 (pristine) scale. The value is computed by applying a numeric ranking to each of the following parameters: depth of crater and rim height relative to that of a fresh crater of equivalent size, preservational state of the ejecta blanket and any interior structures, and thermal inertia of ejecta blanket relative to the surrounding material [7].

Ejecta Morphology: MOC and THEMIS VIS and daytime IR imagery is being used to identify and revise the ejecta classifications. The ejecta nomenclature recommended by the Mars Crater Consortium is being used [8].

Interior Morphology: MOC and THEMIS imagery is also being used to identify and revise the interior morphologies expressed by impact craters. Up to three interior features can be included in *Catalog 2.0.*

Crater Depth and Rim Height: Using the MOLA profile routine available through JMars, we are determining the average depth and rim height for each crater.

Central Peak Height and Basal Diameter: Any craters displaying a central peak have the central peak height and basal diameter measured using the MOLA routines available in JMars.

Central Pit Diameter: Pit diameters are measured using the ArcView application for any craters displaying a central pit (some preliminary results are discussed in [9]).

Ejecta Extent, Perimeter, and Area: These three columns quantify the characteristics of the layered ejecta morphologies. Ejecta extent is the maximum distance of the ejecta blanket as measured from the crater rim. Ejecta perimeter is measured by tracing along the outer edge of each complete ejecta layer, and ejecta area is the area inside of this perimeter. These values are used in computing the ejecta mobility ratio and lobateness columns.

Distal Rampart Height: MOLA profiles are used to determine the average height of the ramparts found at the distant edges of the rampart ejecta morphologies.

Lobateness: Lobateness (Γ) is a measure of the ejecta sinuosity, computed from the ejecta perimeter (P) and area (A) [10]:

$$\Gamma = P/(4\pi A)^{1/2}$$

$\Gamma = 1$ indicates a circular ejecta planform; higher values indicate increasing amounts of sinuosity. Lobatness values are computed for the single layer ejecta pattern, the outermost complete layer of the multiple layer ejecta morphology, and for both the inner and outer ejecta layers of the double layer ejecta morphology.

Ejecta Mobility Ratio: Ejecta mobility ratio (EM) is a measure of the fluidity of the ejecta material during emplacement. It is computed from the ejecta extent and crater radius [11, 12]:

$$EM = (\text{ejecta extent})/(\text{crater radius})$$

As for the lobateness calculations, EM is computed for the single layer ejecta, the outermost complete layer of the multiple layer ejecta morphology, and for both the inner and outer layers of the double layer ejecta pattern.

Mineralogy: Up to three major mineralogic components of the surrounding material, as determined from TES and THEMIS, can be included.

Thermal Inertia: Thermal inertia of the surrounding material, as determined from TES [13], is included and used to help compute the preservational classification.

Comments: This column is reserved for additional information. It is primarily used to indicate the name of the crater if one has been assigned by the IAU.

Status of Catalog 2.0: As of January 2005, approximately 80% of the northern hemisphere of Mars and approximately 10% of the southern hemisphere has been completed. Our goal is to have a preliminary copy of *Catalog 2.0* submitted to USGS for incorporation on the Planetary Interactive GIS on the Web Analyzable Database (PIGWAD) (webgis.wr.usgs.gov) by the end of 2006. GIS-based tools to analyze the crater data are being developed and will be beta-tested by the Mars Crater Consortium prior to being placed on the USGS website for use by the planetary community.

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