CRATER DATABASES FOR MERCURY, THE MOON, MARS, GANYMEDE AND CERES—A STATUS REPORT. N. G. Barlow, Dept. Physics and Astronomy, Northern Arizona University, Flagstaff, AZ 86011-6010. Nadine.Barlow@nau.edu.

Introduction: Databases of impact craters on different solar system bodies are utilized in numerous studies to investigate age relationships, geologic and climate histories, impactor populations across the solar system, and general comparisons between different objects. As part of several large-scale studies of ejecta and interior morphologies of impact craters, my research group has been compiling global crater databases for craters generally ≥5-km-diameter on Mercury, the Moon, Mars, Ganymede, and Ceres. All of these datasets are nearing completion and complement/enhance existing crater catalogs produced by others. Here I describe the current status of each database.

Mercury Crater Database: The MESSENGER Mercury Dual Imaging System (MDIS) global mosaic (250 m/pixel resolution) [1] was used to identify and classify all craters ≥5-km-diameter [2]. JMars [3] was used to measure crater diameters using the three-point setup. The resulting catalog contains 21,099 craters. The catalog includes latitude and longitude of the crater center and the crater diameter. Craters with central peaks included measurement of the basal diameter of the peak and computation of the ratio of the peak diameter to crater diameter (D_{pk}/D_c). Peak ring basins, proto-basins, and central pit craters included measurement of the diameter of the ring or pit and computation of the resulting ring or pit diameter to crater diameter ratio (D_r/D_c or D_p/D_c). To date, only central peak, peak ring, proto-basin, and central pit features have been classified. Classification of ejecta morphology, other interior features, underlying geologic unit, and preservational state remain to be completed.

Lunar Crater Database: The Lunar Reconnaissance Orbiter (LRO) Wide Angle Camera (WAC) global mosaic (100 m/pixel) [4] was used with JMars to measure the diameters of 30,123 lunar craters ≥5-km-diameter. Latitude, longitude, and diameter of all craters are cataloged. Classification of ejecta and interior morphologies, underlying geologic unit, and preservational state are approximately 40% complete. As with Mercury, diameters of central peaks, peak rings, proto-basins, and central pits will be measured and the corresponding D_{pk}/D_c, D_r/D_c, and D_p/D_c values will be computed.

Martian Crater Database: The Mars Odyssey Thermal Emission Imaging Spectrometer (THEMIS) daytime infrared global mosaic (100 m/pixel) is being used to identify all craters ≥5-km-diameter on Mars. Measurements are made using an ArcGIS program specifically designed for this project by Trent Hare of the USGS. THEMIS daytime IR and visible (VIS; 18 m/px) [5] data are used to classify ejecta and interior morphologies and assign a numeric value (0.0 to 7.0) characterizing the crater's preservation state [6]. Note that we are using the best quality images for this analysis, not the THEMIS daytime IR global mosaic which has inconsistent image quality. The catalog currently contains location, diameter, ejecta, and interior information on 26,073 craters ≥5-km-diameter across the entire northern hemisphere, in the 0°-30°S zone between longitudes 0°-135°E and 180°-360°E (i.e., covering the Viking quadrangles MC01-22), and in the 0°-15°S 135°E-180° region (covering Viking subquadrangles MC23NW and MC23NE). We estimate the database is approximately 65% complete. We have compared diameter measurements and ejecta and preservation classifications between this database and the Robbins and Hynek catalog [7] for a test area (25°-75°N, 0°-180°E)—while diameters are generally within 10% of each other, there is considerable discrepancy between ejecta classifications (disagree on 60%) and preservation classification between the two datasets [8].

Ganymede Crater Database: The Ganymede crater database was compiled from the global mosaic using the best images from the Galileo Solid State Imager and Voyager Imaging Science Subsystem (ISS) (400 to 20 m/pixel) [9]. The database containes 5441 craters ≥5-km-diameter in the ±60° latitude range [10]. Crater location, diameter, ejecta morphology, interior morphology, and general albedo (bright, dark, intermediate) are included in the catalog. Central pit diameters and D_p/D_c ratios also are included, along with central peak diameters and D_{pk}/D_c values. The data are undergoing a final check and geologic units are being added.

Ceres Crater Database: As noted in [11], we are compiling a database of craters ≥1-km-diameter for Ceres. The database currently contains size, location, ejecta/interior morphology, central peak and central pit diameters, D_{pk}/D_c and D_p/D_c information, and depth measurements for approximately 19,000 craters in the southern hemisphere of Ceres. We anticipate completion of the database with northern hemisphere crater data by the end of calendar year 2017.

Distribution and Archiving Plans: Current versions of the crater databases are available to planetary researchers upon request to the author. Upon completion of the databases, Excel and ArcGIS shapefile versions will be archived through the USGS's PDS Annex [12], Northern Arizona University's Institutional Repository, and the author's website.

Comparison Studies: The compilation of crater databases is driven by science questions that can be addressed through statistical analysis of crater distributions and characteristics. The use of crater size-frequency distribution analyses to determine model ages of planetary surfaces is a prime example of the value in compiling crater databases. The primary scientific impetus for the creation of the crater databases described above is an effort to use crater morphologic and morphometric information to investigate crustal characteristics between different solar system bodies. Examples of this include (1) comparison of layered ejecta morphologies on Mars, Ganymede, and Europa to investigate the relative roles of subsurface versus atmospheric volatiles in the production of these morphologies [13], (2) analysis of central pit craters across the solar system to investigate target strength and the role of subsurface volatiles, uplift, and collapse in central pit formation [14, 15], and (3) using central peak craters to constrain variations in crustal strength among different solar system bodies [11, 14]. Results from the crater analysis often support but sometimes contradict findings from studies using other information, leading to further investigations of the range of planetary environments in which craters form.

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