THE "CATALOG OF IMPACT CRATERS ON GANYMEDE". J. Katz-Wigmore and N. G. Barlow, Department of Physics and Astronomy, NAU Box 6010, Northern Arizona University, Flagstaff AZ 86011-6010; jik6@dana.ucc.nau.edu; Nadine.Barlow@nau.edu.

Introduction: Voyager imagery revealed the range of interior and ejecta morphologies associated with impact craters on Ganymede [1-3]. Much of these data have been surpassed in resolution by the Galileo Solid State Imager (SSI) and Near Infrared Mapping Spectrometer (NIMS) data [4], revealing impact craters in a level of detail not previously obtained by Voyager analysis.

This project utilizes Galileo SSI and NIMS data, together with Voyager data where Galileo information is not available, to produce a catalog of all craters ≥3-km-diameter on Ganymede. These data will be used to obtain a better understanding of the environmental influences contributing to the formation of particular morphological features associated with impact craters on Ganymede. Galileo's higher resolution imagery and compositional information (from NIMS) allow us to better characterize the interior and ejecta morphological features than was possible with Voyager imagery. These data permit us to identify distinguishing features which could relate to the environmental conditions under which these features were produced.

Crater Catalog: Data for this project include the Galileo SSI and NIMS data and Voyager imagery data, US Geological Survey geologic maps, and the controlled photomosaic map (1:15M scale) of Ganymede. We are currently in the process of producing the crater database, which is called the *Catalog of Impact Craters on Ganymede*. Galileo SSI imagery (with resolutions between 50 and 200 m/pixel) and Voyager imagery (with resolutions of >1-km/pixel) are being used to identify all impact craters ≥3-km-diameter and classify their ejecta and interior morphologies. The data are being obtained from the Planetary Data System and are being processed using the US Geological Survey image processing package ISIS (Integrated Software for Imagers and Spectrometers). Each crater entry includes the following information.

Location: Latitude and longitude of the crater center are being determined using the latest control net information.

Crater Diameter: Rim diameter is measured in three different directions and the results are averaged to produce an average diameter for the crater. In the case of elliptical craters, the diameters of both the major and minor axes are measured and the azimuthal angle of major axis orientation (measured clockwise from north) is determined.

Geologic Unit: The latest geologic maps for Ganymede are used to identify the geologic unit on which each crater is superposed.

Crater Classification: Following the nomenclature established by previous researchers [3, 5-7], each crater is assigned to one of the following classes: simple crater, complex crater, multiring basin, penepalimpsest, or palimpsest. Simple craters are bowl-shaped craters with no interior features and only small amounts of post-formation modification. Complex craters are larger craters with interior features such as central peaks or central pits. Multiring structures are associated with the largest craters, characterized by multiple rings radiating outward from the crater center. Palimpsests are approximately circular bright albedo spots which probably represent relaxed craters [8]. Penepalimpsests are transitional features between palimpsests and younger, morphologically sharper craters.

Interior Morphologic Features: All interior features are being noted and characterized [9]. These features include central peaks, central pits, and central domes. Central pit diameters are being measured and the central pit is classified as small-pit or large-pit, depending on the pit-to-crater diameter ratio (0.2 is the dividing point) [6, 7].

Ejecta Morphology: Pedestal ejecta morphologies are classified as single layer or double layer, depending on the number of ejecta pedestals which can be identified [10]. Craters with only secondary crater chains are classified as radial ejecta. Dark ray and bright ray craters also are noted.

Pedestal Ejecta Characteristics: Two major characteristics of the pedestal ejecta morphologies are being quantified—ejecta mobility ratio, which is a measure of ejecta fluidity at the time of emplacement, and lobateness, a measure of the ejecta sinuosity. The ejecta mobility ratio (EM) compares the extent of the ejecta as measured from the crater rim to the size of the parent crater [11, 12]:

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

Lobateness (Γ) is computed from the perimeter (P) and area (A) of the ejecta deposit [13]:

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

A circular ejecta blanket has Γ = 1; larger Γ values indicate greater ejecta sinuosity.

Preservation: A preservation classification system has been developed to provide information on the degradation state of each crater. Although patterned after

the Martian crater preservation system which uses a 0.0 (almost completely destroyed) to 7.0 (extremely fresh) scale [14], image resolution limits us to classifying Ganymede craters into a 0.0 to 4.0 system. Most palimpsests are 0.0 on this scale while extremely fresh craters are 4.0.

Data Analysis: This project consists of three tasks: (1) Production of a crater morphology catalog, (2) Analysis of possible environmental factors affecting formation of specific crater characteristics, and (3) Comparison of Ganymede pedestal and central pit craters with Martian analogs. We are currently working on the production of the crater catalog (Task 1). We have previously reported some of the preliminary results for the pedestal crater characteristics [10] and are reporting some initial results for the interior morphologies at this meeting [9]. Completion of the crater catalog will allow us to conduct a more detailed analysis of how environmental conditions affect the formation of these and other crater characteristics (Task 2).

The final task of this project will be to compare the characteristics of Ganymede craters to analogous features associated with Martian impact craters. Martian impact craters display a range of layered ejecta morphologies which may be analogous to the pedestal ejecta morphology seen around some craters on Ganymede [15]. Many Martian impact craters also display central pits [16], analogous to the central pits seen in some Ganymede craters. Qualitatively these features appear similar on the two bodies, but this study will provide the necessary quantitative comparisons to determine the degree of similarities and differences between craters on these two bodies. Preliminary analysis of sinuosity and ejecta extents of pedestal/single-layer ejecta show that such values are statistically different among the two bodies [10]. A more detailed analysis will allow us to provide constraints on the environmental conditions giving rise to these features on Ganymede and how factors such as the rock/ice ratio and surface temperature might affect the crater formation process on Mars and other bodies.

Catalog Format: Once all the craters ≥3-km-diameter on Ganymede have been cataloged, the resulting database will be ingested into ArcGIS format. ArcGIS is a Geographic Information System (GIS) program which facilitates the creation/overlay of various maps, comparison between different data sets, and querying of the data. Crater analysis tools being developed for the GIS Martian crater database should be applicable to the Ganymede crater catalog as well [17].

Archiving Plans: The *Catalog of Impact Craters on Ganymede* will be submitted to the Planetary Data System in ASCII format and to the USGS PIGWAD (Planetary Interactive GIS on the Web Analyzable Database) system in GIS format to enhance its usefulness to the planetary community.

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