A CATALOG OF IMPACT CRATERS ON GANYMEDE.

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Introduction: Previous crater catalogs for Ganymede were based on Voyager analysis but Galileo data provides improved resolutions in the areas where it covered the moon and also helped fill in regions not imaged or imaged poorly by Voyager. Voyager and Galileo images combine to reveal the diversity of impact craters on this icy Jovian satellite. Previous studies cataloged the interior morphologies of these craters primarily as central peak, central pit, and central dome [1]. It was shown that craters with central peaks were the most abundant of the interior morphology on all terrains followed by the central dome craters and then the central pit craters. The results also showed no strong correlation between the morphology and geologic unit [1].

Studies of ejecta morphologies associated with Ganymede craters show that some are surrounded by layered ejecta morphologies, displaying both single layer and double layer ejecta structures [2-4]. Similar morphologies surrounding martian impact craters are commonly attributed to the role of subsurface ice [5-7]. We are studying the similarities and differences between the layered ejecta morphologies on Ganymede and Mars in order to constrain the role of target volatiles on layered ejecta formation. However, this report will focus on the current status of our study of interior morphologies found in Ganymede craters.

Methodology: Data sources used in this project are the Voyager and Galileo imagery from the PDS system and the geologic and shaded relief maps from the US Geological Survey (USGS). We also use the USGS GIS maps of Ganymede available through PIGWAD. Diameters are measured and coordinates of crater center are obtained through use of the Ganymede PIGWAD GIS maps.

When completed, this catalog will include all craters 3 km in diameter and larger across Ganymede. Crater rim diameters are measured along four different directions and averaged over these four measurements. The catalog also includes interior and ejecta morphologies, geologic unit, and a generalized preservational scale (0 through 3, with 0 very degraded and 3 a pristine, very fresh crater). The geologic units are obtained from the USGS geologic maps.

Current Status of Catalog: At present the catalog contains 1200 craters of which 465 craters display interior morphologies. Our current study region covers the regions with longitude ranging from -180° to -115° and 0° to 91.8° and latitude ranging from +85.6° to -29.7° and +86.7° to -32.2° (Fig 1). The diameter range of the craters included thus far is from 5 km to 85 km. Craters with diameter less than 5 km have not yet been included in the catalog.

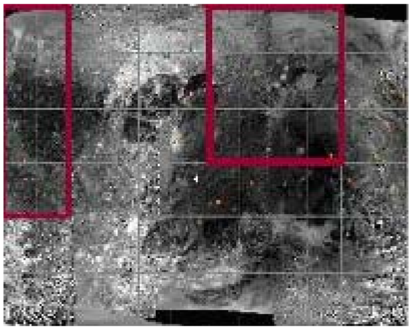

Figure 1: Current coverage of Ganymede crater morphologies are indicated by the red bounded areas.

Interior Morphologies: The most common interior morphologies are central peaks, central pits, and central domes, but other morphologies are also noted, such as pitted domes and anomalous domes. Central peak craters are the most common interior morphologies. 23% of craters with interior morphologies are central peak craters. 8% of all interior morphologies are central pits and 7.8% of all craters with an interior morphology are central dome craters.

Central Peaks: Central peak craters are characterized by a relatively flat floor with a raised central complex [1] (Fig. 2). They are abundant in all regions cataloged thus far. The peak is believed to form immediately following crater formation as the target material, behaving as a Bingham fluid, freezes upon rebound [7]. Central peaks on Ganymede are similar in morphology to central peaks in impact craters on other planetary surfaces.

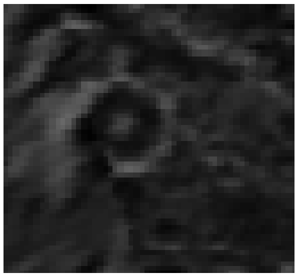

Figure 2: Low resolution example of a central peak crater, located at longitude -116.28° and latitude +27°. Crater is 15 km in diameter.

Central Pits: Central pit craters are characterized by a depression centered in the floor of the crater (Fig. 3). On Ganymede, most of the floors are updomed in a concave fashion and the pit lies atop this uplift. This updoming is likely the result of relaxation and rebound of the icy target material [8]. Several formation models have been proposed for central pit craters on Ganymede, including vaporization of the icy target during crater formation and escape of the resulting gases [9-11], collapse of a central peak in the weak icy crust [12], and excavation into an underlying liquid layer [13, 14]. Detailed studies of central pit craters on Ganymede [15] and Mars [16, 17] are helping to constrain these possible formation models.

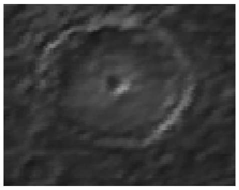

Figure 3: Example of a central pit crater, located at longitude -138.9° and latitude +31.9°. Crater is 63 km in diameter.

Central domes: Central dome craters are characterized by a flat floor with a raised central complex often surrounded by a moat (Fig. 4). The uplifted floor is generally believed to form by relaxation and rebound of ice-rich material underlying the transient crater cavity [8].

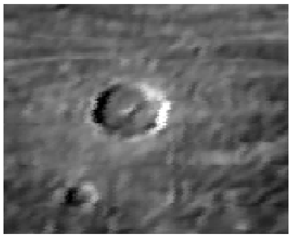

Figure 4: Example of a central dome crater, located at longitude +36.5° and latitude +37°. Crater has a diameter of 38 km.

Discussion and Future Work: Our preliminary analysis indicates that central peak, central pit, and central dome craters occur over all of the regions thus far studied. There is no obvious relationship between interior structure and latitude, longitude, terrain albedo, or geologic unit. Thus the local environment does not appear to be a significant contributor to the formation of specific interior morphologies.

Much work remains to be done, including expansion of the crater catalog to regions not yet covered, incorporation of craters down to 3 km diameter, and classification of ejecta and other interior morphologies. Upon completion of the catalog, we will conduct more detailed studies looking at potential correlations of the interior and ejecta morphologies with location, geologic unit, terrain albedo, crater diameter, etc. The final catalog will be deposited with the PDS and USGS PIGWAD for use by the planetary community.

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