GLOBAL GEOLOGIC MAPPING OF GANYMEDE LIGHT AND DARK MATERIAL AT 1:15M. G. Wesley Patterson[1], James W. Head[1], Geoffrey C. Collins[2], Robert T. Pappalardo[3], Louise M. Prockter[4], and Baerbel K. Lucchitta[5], [1]Department of Geological Sciences, Brown University, Providence, RI, 02912 (Gerald_Patterson@brown.edu), [2]Wheaton College, Norton, MA, 02766, [3]LASP, University of Colorado, Boulder, CO, 80309, [4]Applied Physics Laboratory, Laurel, MD, 20723, [5]USGS, Flagstaff, AZ, 86001.

Introduction: The Galilean satellites represent a series of bodies that all formed from the same proto-Jovian nebula but are distinctly different in their physical properties, surface geology, and thermal evolution [1-4]. The explanation for many of these disparate characteristics is likely related to the radially varying conditions of the nebula during the earliest period of their formation [5-6]. However, an explanation for the differences in the geological evolution of Ganymede and Callisto, given their similar size, density, and bulk composition, remain one of the most fundamental questions in comparative planetology [6, 7]. Understanding the global distribution of geologic units on Ganymede in space and time can offer constraints on our ideas of how and why this icy satellite evolved to its present state.

The Voyager mission provided important information about the nature of the surface of Ganymede at moderate resolution and these data were used to produce a series of geologic maps covering the imaged surface at the 1:5M scale [e.g., 8-10]. The Galileo mission has provided a host of new data (high-resolution monochromatic, color, and stereo imagery, polarimetry, near-infrared spectral imagery, etc.) and we are compiling a global geologic map of Ganymede (at the 1:15M scale) that will represent the most recent understanding of the satellite on the basis of this data. This contribution builds on important previous accomplishments in the study of Ganymede [11-15] and here we summarize our progress toward the completion of this global mapping project.

Unit definitions: The first task we undertook in developing a global geologic map of Ganymede was to reassess the units identified at Voyager resolution using Galileo resolution data [16, 17]. The result of this reassessment was a revised Description of Map Units (DOMU) in which the units have been divided into five terrain types: 1) light, 2) dark, 3) reticulate, 4) palimpsest, and 5) crater material.

Light material: This material has been subdivided into four units: grooved, subdued, irregular, and undivided. The *grooved unit* (**lg**) is arranged in domains characterized by parallel, roughly evenly spaced grooves and ridges oriented in a single dominant direction. The *subdued unit* (**ls**) is similar to the grooved unit but appears smooth or finely grooved at Galileo and/or Voyager resolution except where secondary craters and crater chains are superposed. The *irregular unit* (**li**) is similar to the subdued unit but contains isolated grooves with no preferred orientation. The *undivided unit* (**l**) represents all materials of sufficiently low resolution for which morphological properties and/or age relationships cannot be determined.

Dark material: This material has been subdivided into four units: cratered, lineated, irregular, and undivided. The *cratered unit* (**dc**) represents large areas of low albedo material with moderate to high crater density commonly occurring as polygons bounded by bright units. The *lineated unit* (**dl**) is similar in character to the bright grooved unit but with lower albedo and depressions tending to be more sinuous and shallower. The *dark irregular unit* (**di**) is characterized by isolated grooves with no preferred orientation similar to the *light irregular unit* but having an albedo characteristic of dark materials. The *undivided unit* (**d**) represents all materials of sufficiently low resolution that their material properties cannot be determined. This also may include irregularly shaped large patches and small slivers of low albedo material interspersed within light terrain of indistinct morphology or areas too small to be identified by morphologic criteria other than albedo.

Reticulate material (**r**)*:* This terrain consists of a single unit. It is often associated with and surrounded by bright grooved, bright subdued, and/or dark lineated units but can be distinguished from them by its variable albedo and presence of grooves with two dominant directions (typically orthogonal to each other).

Palimpsest material: This material consists of two units: palimpsests and palimpsest interior plains. The *palimpsest unit* (**p**) is characterized by flat, generally circular to elliptical structures occurring predominately (but not exclusively) on dark terrain units. These structures lack rims but can have internal, concentric ridges. The *palimpsest interior plains unit* (**pi**) is characterized by smooth, circular to subcircular patches of high albedo material commonly found at or near the center of palimpsests.

Crater material: This terrain consists of seven units: bright craters, partly degraded craters, degraded craters, secondary craters, dark crater material, basin rugged material, and basin smooth material. The first three units separate craters into a stratigraphic sequence ($\mathbf{c_1}$, $\mathbf{c_2}$, and $\mathbf{c_3}$ from oldest to youngest respectively) based on degradation state, which we feel can be more clearly determined than for palimpsests. The *secondary crater unit* (**cs**) is characterized by fields of uniform, small pits surrounding large bright craters, partly degraded craters, and some palimpsests. *Dark crater material* (**cd**) appears to be predominately associated with bright craters and forms dark patches on their floors or rims. The *basin rugged material* (**br**) and *basin smooth material* (**bs**) units are used to define the prominent Gilgamesh basin.

Mapping strategy: Using the revised DOMU described herein, we are in the process of compiling the global geologic map. To accomplish this task we have 1) broadly mapped the boundaries of terrain types (e.g., dark material, craters, etc.) and superimposed structures (i.e. furrows) across the surface of Ganymede and 2) compiled detailed maps of geologic units (e.g., light grooved, dark cratered, palimpsest interior plains, etc.) in 60˚x 60˚ quadrangles. The assigned unit boundaries have been reviewed and modified as necessary within each quadrangle before proceeding to the next. The minimum dimension we have established for mapping a feature as a unit is 30 km (2 mm on the map). This map (Fig. 1) is being produced entirely in GIS format for analysis and combination with other datasets.

We have completed the detailed mapping of light and dark materials, craters, and furrows for the entire surface of Ganymede. The results for six quadrangles spanning from 30˚S to 30˚N and 180˚W to 180˚E are shown in Fig. 1. The units mapped cover all terrain types described except basin materials and span a wide range of resolutions and lighting conditions.

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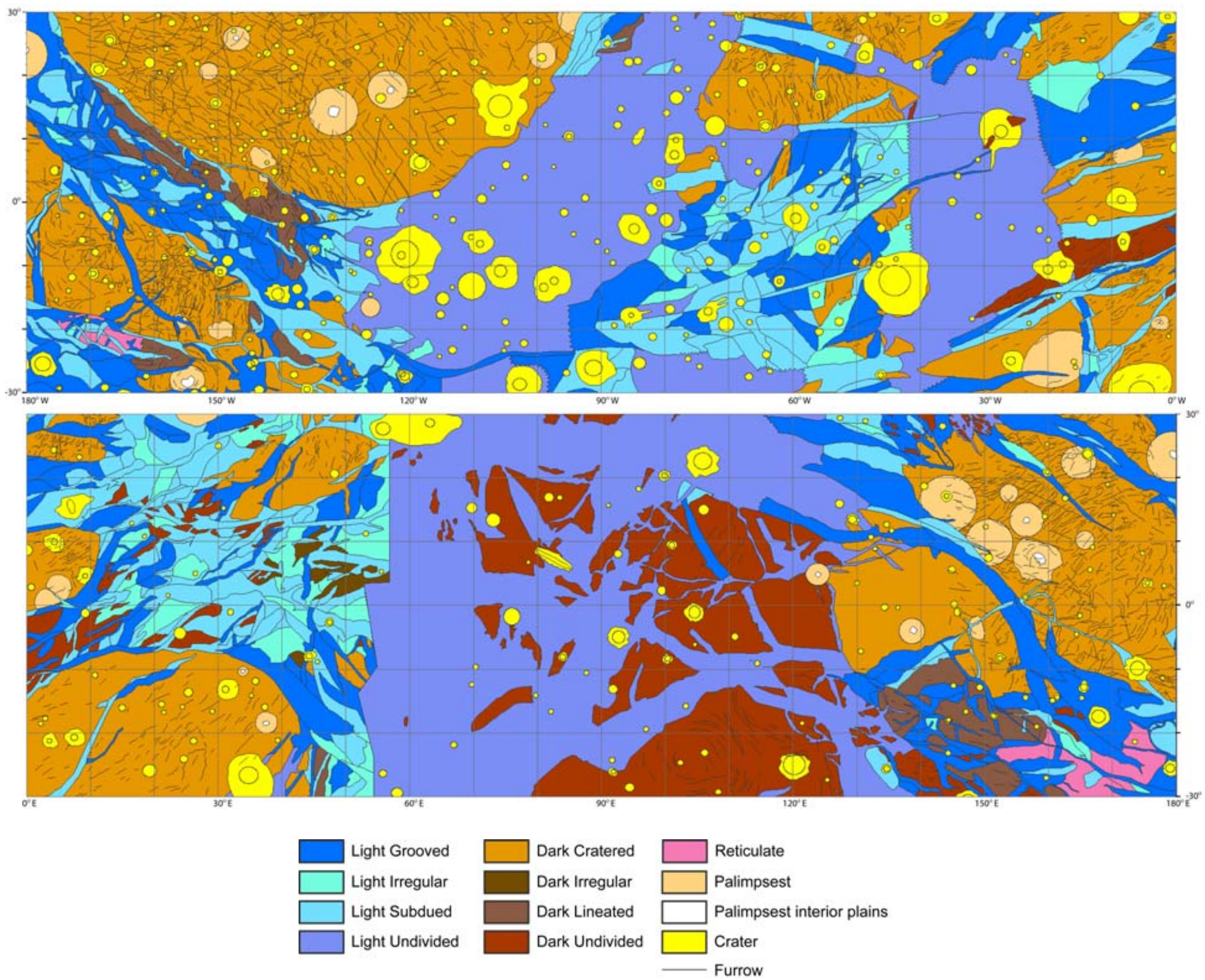

Fig. 1. Geologic map of Ganymede from -30° to 30° latitude and -180° to 180° longitude utilizing the revised DOMU presented here.