GEOLOGY OF GALILEO REGIO, GANYMEDE. R. Casacchia, IAS - Reparto di Planetologia, Rome, Italy, and R. Strom, Lunar and Planetary Lab., University of Arizona, Tucson, AZ 85721

Galileo Regio is the largest area of heavily cratered terrain on Ganymede. It is a circular region characterized by a relatively high crater density, systems of furrows, and a relatively low albedo. Galileo Regio is bounded by younger grooved terrain which has formed at the expensive of the older heavily cratered terrain. A geologic map of the region has been compiled from Voyager 2 high resolution (~2Km/line pair) pictures and a rectified photomosaic of the area. The map covers an area of about $5X10^7 Km^2$.

Four geomorphologic units are recognized on the basis of albedo, degree of roughness, and the geometrical pattern of the terrain:

1. Crater materials - rough crater deposits consisting of ejecta and/or interior crater materials. This unit is subdivided into four catagories based on the degree of crater degradation: fresh, degraded, and two classes of palimpsests.
2. Rough terrain - irregular surfaces with a high density of small craters ($<$ 8Km dia.) and valley-like structures perpendicular to large furrows. This unit is the oldest terrain and occurs predominately in the northern part of Galileo Regio.
3. Smooth terrain - flat, smooth surfaces with a low density of small craters and an apparently lower albedo than the Rough terrain. It appears to be at a lower elevation than the Rough terrain. The Smooth terrain occurs preferentially adjacent to furrows and predominates near the southern boundary of Galileo Regio.
4. Reticulate terrain - rough surfaces with a well-defined polygonal structure of intersecting ridges and valleys. This terrain is primarily located at the southern boundary of Galileo Regio and may be transitional between it and the adjacent younger grooved terrain.

The tectonic framework of Galileo Regio (Fig. 1) primarily consists of two systems of discontinuous furrows characterized by smooth-floored valleys about 10Km wide between parallel ridges. One system of furrows has a generally arcuate trend on a regional scale and predates all observed craters including the most degraded palimpsests. These furrows have an average spacing of about 50Km. The other system consists of several widely spaced furrows which transect the arcuate furrows at various angles and therefore post-dates them. Like the arcuate furrows, however, they predate all craters including palimpsests. These two furrow systems appear to be the oldest major structural features on Ganymede and formed contemporaneously with or very shortly after the Rough terrain, but before the vast majority of craters.

The shape of the size/frequency distribution of craters greater than about 7Km diameter, including palimpsests, is virtually identical to that of Callisto, but the crater density is a factor of seven less (See Strom and Casacchia, these abstracts). This indicates that Galileo Regio and probably other heavily cratered regions are

considerably younger than the surface of Callisto. Apparently Galileo Regio formed, i.e., became rigid enough to register impacts, relatively late in Ganymede's history. Since the systems of furrows pre-date the craters, they probably formed at about the same time as the Rough terrain and may be due, at least in part, to the solidification process which formed the Rough terrain.

The smooth terrain appears to span a range of ages from shortly after the formation of arcuate furrows up to the emplacement of the grooved terrain. The Reticulate terrain also appears to have formed sometime during Smooth terrain formation. Both of these terrains predominately occur near the southern border of Galileo Regio, and the smooth terrain is preferentially located adjacent to furrows. This suggests that both terrains may have formed in response to the initial development of the adjacent Grooved terrain, and that the Smooth terrain may have been emplaced along structural weaknesses associated with the furrows.

Two major results of this study are:

1. Ganymede's outer layers were thermally active on a global scale early in its history. Either Ganymede experienced a relatively short period of global resurfacing when the cummulative cratering flux had fallen by at least a factor of seven relative to Callisto, or the outer layers were warm (melted?) shortly after Ganymede's formation and remained too thermally active to record craters until the cummulative cratering rate had fallen appreciably.

2. At least the furrows on Galileo Regio were formed at about the same time as the crust became rigid enough to record impacts, and may have been a consequence of crustal solidification rather than a separate tectonic event.

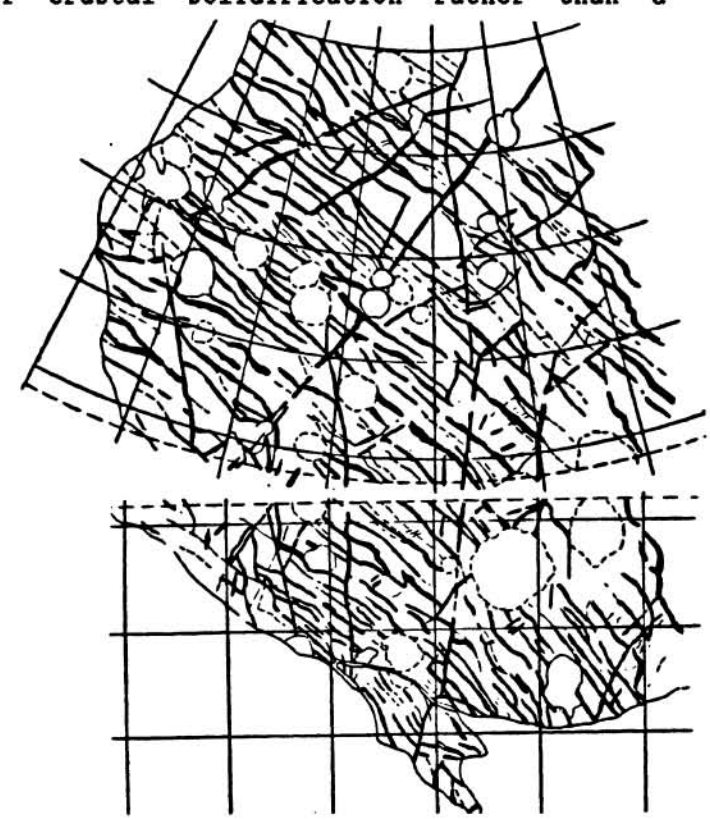

Fig. 1
Tectonic Map

furrow
palimpsest
fresh craters