THE CRATERING RECORD OF GALILEO REGIO, GANYMEDE. R.G. Strom, Lunar and Planetary Lab., Univ. of Arizona, Tucson, AZ 85721 and R. Casacchia, IAS-Reparto di Planetologia, Rome, Italy

Galileo Regio and other similar regions are relatively heavily cratered areas representing the oldest surfaces on Ganymede. The craters have a range in morphologies from sharp-rimmed, fresh-appearing to palimpsests with very subdued rims surrounded by a circular bright region. In conjunction with the geological mapping of the region (1), the craters were subdivided into five morphological classes: fresh (Class 1), degraded (Class 2), central pit palimpsests (Class 3), palimpsests (Class 4), and very subdued craters with barely discernable rims (Class 5). Although these classes are primarily based on the state of preservation of crater structures, they are not comparable to crater degradational classes on the terrestrial planets because their morphologies are different. Over 4000 craters with diameters larger than 7km were measured on an area of about $5X10^7 km^2$. The diameter of palimpsests was considered to be the central smooth area or the subdued rim because it probably more closely represents the excavation crater. These diameters range from about 30 to 95km. Central pit palimpsests are bright craters with a central pit surrounded by an extremely low rim and appear to be transitional between degraded craters and palimpsests.

Figure 1 is the crater size/density distribution for all crater classes on Galileo Regio compared to those on Callisto, and the lunar highlands and maria from Strom, et al. (2). Two striking aspects of the Galileo Regio curve are apparent: (A) the shape of the curve is virtually identical to that of Callisto, and (B) the overall crater density is about a factor of seven lower than that on Callisto. The lower crater density must mean that Galileo Regio began recording the observed crater population at a later time than Callisto, in agreement with previous results by Strom, et al. (2). Either a large-scale (probably global) diameter-independent resurfacing event took place early in Ganymede's history, or more likely Ganymede developed a rigid crust capable of retaining craters later than Callisto. Thermal history models (3) suggest that this latter case may have occurred 4×10^8 yrs later on Ganymede than Callisto. If so, then the cummulative impact flux fell by at least a factor of seven in 4×10^8 yrs. If the impacting objects originated external to the Jovian system, then the impact rate at Ganymede would be about twice that at Callisto. In this case, the cummulative impact flux would have fallen by a factor of about 14 in 4×10^8 yrs.

The shape of the Jovian crater curves is vastly different from those of the Moon and terrestrial planets. It is characterized by a great paucity of craters larger than about 40km and a different distribution function at diameters less than 40km relative to the Moon. The paucity of large craters has been attributed to a loss of craters by viscous relaxation in ice, but does not explain the different distribution function at smaller diameters. Various studies (2, 4, and 5) have shown that crater obliteration by viscous relaxation on Callisto was not an important process and that the observed crater population is most likely the production population representing a different population of impacting objects. The fact that the Calileo

Regio curve is identical to that of Callisto strongly supports this conclusion. The oldest surfaces on Ganymede have been much more thermally active over a longer period of time than Callisto as indicated by the much lower crater density and more abundant palimpsests on Galileo Regio. This should lead to much more crater obliteration on Ganymede if viscous relaxation were an important obliterative process, and result in a greater paucity of large craters than on Callisto. This is not the case. Furthermore, the shape of the curve for the freshest craters on Galileo Regio is essentially the same as that for all craters (Fig. 2). These observations strongly suggest that crater obliteration has not significantly altered the production population, and that the crater morphologies, e.g., palimpsests, are largely the result of the impact process in a more thermally active crust than Callisto, in agreement with Croft (6). This suggests that the population of impacting bodies in the Jovian system was significantly different from that responsible for the period of heavy bombardment in the inner Solar System.

References

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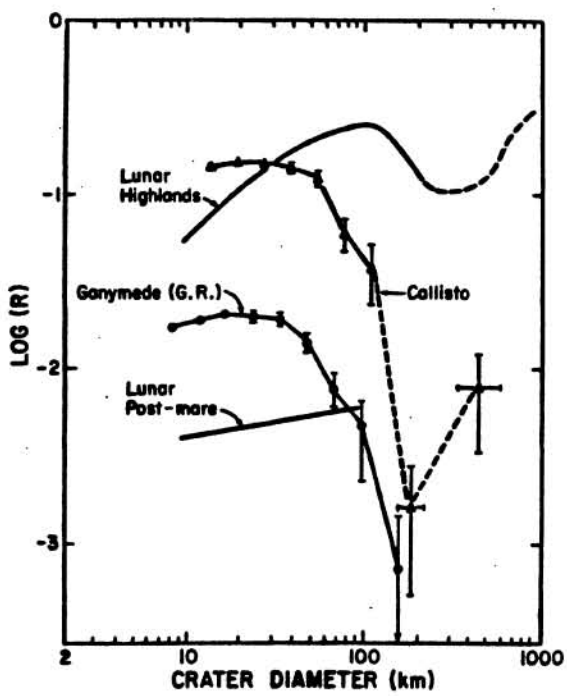

FIG. 1

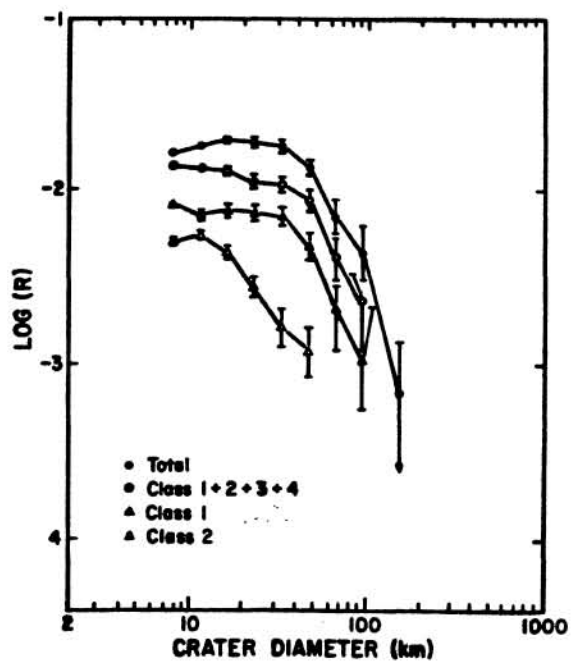

FIG. 2