In some earlier papers we discussed the cratering record of the Jovian satellites in comparison with the cratering record of the inner solar system (1,2). Recently, Strom and Casacchia (3) have pointed out that a) there is a great similarity of the shapes of the crater size distributions of one of the oldest terrains of Ganymede, Galileo Regio, and those formed on Callisto, and b) the overall crater density is about a factor of seven lower than that on Callisto. Argument a) is in accordance with our former findings (2); argument b) is in gross contradiction to our findings (1,2). This has led us to reexamine the cratering record of Ganymede in making precise measurements on rectified images which has not been undertaken by other workers yet.

The geological units where cratering data were obtained are: 1) Cratered terrain and Galileo Regio (for definition of terrain types see Smith et al. (4)); 2) Grooved terrain; 3) Transitional terrain; 4) Osiris; 5) Gilgamesh. Data for Galileo Regio and cratered terrain are shown in Fig. 1 in comparison with the lunar highland curve (from (5)). The oldest terrains of Ganymede appear a factor of about 4 less cratered than the oldest lunar highlands, in accordance with our former findings. The shape of the Ganymede relative crater frequency appears to coincide with the lunar curve shifted a factor of about 1.5 to the left in diameter direction (and downward to take out the frequency difference) as indicated by the dashed curve in Fig. 1.

Fig. 2 shows a comparison of Galileo Regio cratered terrain data with data for the ancient crust of Callisto. They nearly coincide and thus are not different by a factor of 7 as maintained by (3).

In Fig. 3 we present cumulative crater frequency data for Galileo Regio, grooved terrain and transitional terrain. (Transitional terrain is a heterogeneous area in which it is possible to recognize both grooved terrain and cratered terrain, but where those two terrain types cannot be clearly separated). The distributions appear similar, with some deviations at the smallest sizes and which can be attributed to superposition and resolution problems (the Galileo Regio data).

Fig. 4 displays a comparison of our data for one specific cratered terrain area, for Osiris, and Gilgamesh. Again, the shapes of the distributions are very similar.

Taking the whole span in crater frequency between Galileo Regio cratered terrain and Gilgamesh, we arrive at a factor of about 8 difference. Gilgamesh is the youngest basin on Ganymede. For the Moon, such a comparison (5) would lead to a factor of about 14, almost a factor of 2 larger than for Ganymede. In a lunar-like cratering chronology of the Jovian system, as proposed by (6), and taking the youngest basins for “marking the horizon” of the end of the early heavy bombardment (7), this would mean that the oldest visible crust of Ganymede is ca. 100 m.y. younger than the oldest visible crust of the Moon. In a scenario, where the cratering record of Ganymede was produced by objects in jovicentric orbits as proposed by (2), no such simple argument can be made, however.

In conclusion, we have found:

(i) There is no marked difference between the crater frequencies of the oldest terrains of Ganymede and Callisto (factor < 2), contrary to (3).
(ii) The crater size distributions on all terrain types, from oldest to youngest are very similar. This is interpreted as an indication that the underlying body distributions did not change, contrary to interpretations by (4).

(iii) There is a clear similarity in shapes of the crater size distributions of Ganymede and Callisto, in accordance with our former findings (1,2) and with (3).

(iv) The solidification of the oldest visible parts of the crusts of Ganymede and Callisto seems to have happened at not too different times, as can be judged from the almost identical crater frequencies.