**CRATER DENSITIES, SURFACE AGES AND EVOLUTION OF GANYMEDE'S BRIGHT TERRAIN.** S. Seddio[1] and P. Schenk[2], [1]University of Rochester Dept. of Earth and Environmental Sciences and Dept. of Physics and Astronomy (sseddio@mail.rochester.edu), [2]Lunar and Planetary Institute (schenk@lpi.usra.edu).

**Introduction:** At present, surface ages of bodies in the outer solar system are determined only from crater densities. A major issue is whether the source of the projectiles that formed these craters is primarily asteroids or comets [1]. We may be able to distinguish these populations by detailed examination and comparison of the cratering records in the inner and outer Solar System. In this report, we offer a fresh look at these issues.

The *Galileo* mission has provided significant increases in resolution for selected regions of Ganymede. We compare our new Ganymede data to previous counts for Callisto [2], to determine whether both satellites have experienced similar cratering histories, and to the Moon, which serves as a reference standard for the inner solar system.

**Methods:** Crater counts were made from new controlled global image mosaics of Ganymede produced by P. Schenk. Craters were counted and measured directly from the mosaics by taking two approximately perpendicular diameters of each crater and averaging the two. The data was carefully examined to verify that redundant or missing craters were accounted for. Two types of counts were performed. Global quadrangle mapping of Ganymede allowed us to count large areas down to 10 km diameter. Selected high-resolution mosaics allowed craters down to 200 m in diameter to be counted.

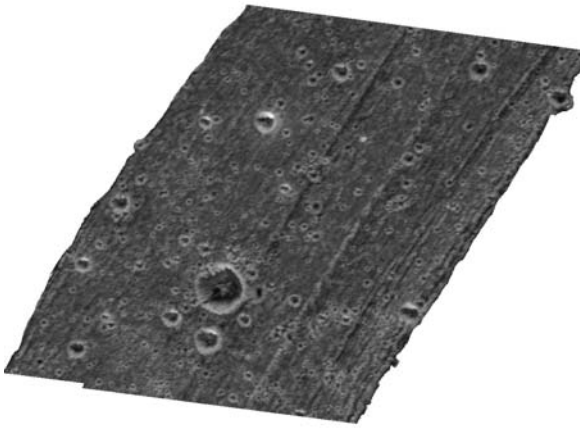

**Figure 1.** Portion of *Galileo* mosaic of Arbela Sulcus of Ganymede (0.035km/pixel). Region is located near 15°S, 347°W°.

On Ganymede, the bright terrain is relatively young and less densely cratered than dark terrain, and most craters are not significantly eroded. Thus bright terrain provides a robust record of the most recent cratering population during the past few Gyr. Regions that were observed under adverse high solar incidence illumination and regions obviously dominated by secondary cratering fields were avoided. Another problem that arises when counting on Ganymede is that crater density changes as a function of radial distance from the apex which is approximately 4 times as heavily cratered as the antapex, 180° away. This effect is well understood [3] and can be corrected. The quantity of high-resolution images was limited by the failures of one of *Galileo's* antennae.

**Results:** All data is presented in standard cumulative crater size frequency plots (Fig. 2) and in R-plots (Fig. 3). The cumulative plots display absolute crater densities, and the R-plots, which are in essence "normalized differential plots where the D-3 power-law" trend is divided out [1].

Our Ganymede data has an inverted "W" shaped size distribution (Figs. 2, 3). The Ganymede crater population, which has a low R-value near 5-10 km diameter, does vaguely resemble the lunar distribution, but there is no evidence of a very steep very small crater population, nor of a spike in large basin production (which on the Moon may be related to the Late Heavy Bombardment and not be preserved on Ganymede due to relaxation or degradation in ancient terrains). Overall, our Ganymede data is somewhat similar to the lunar data but not definitively so. Collisional evolutionary processes may produce broadly similar size-frequency distributions in both asteroidal and cometary populations, such that any similarities may not be diagnostic.

Our Ganymede size distribution (Fig. 3) has a very different shape from that reported for Callisto [2]. There are three possible explanations for this. Higher projectile velocity at Ganymede could shift crater diameters to large values, but it is highly unlikely that the shift would be an order of magnitude. There could also be a change in population due to the greater age of Callisto's surface. This would require that the ancient projectile populations be quite different than today. Another possibility is that erosional processes on Callisto's surface have altered the preserved crater population [4]. Detailed comparison of ancient terrains on Ganymede and Callisto should be undertaken to elucidate these questions.

**References:** [1] Zahnle, K., P. Schenk, H. Levison, and L. Dones. (2003) *Icarus*, *163*, 263-289. [2] Schenk, P., C. Chapman, K. Zahnle, and J. Moore. (2004) *Jupiter*. 427-456. [3] Zahnle, K., P. Schenk, S. Sobieszczyk, L. Dones. (2001). *Icarus, 153,* 111-129. [4] Moore, J., and 11others. (2004) *Jupiter*, 397-426.

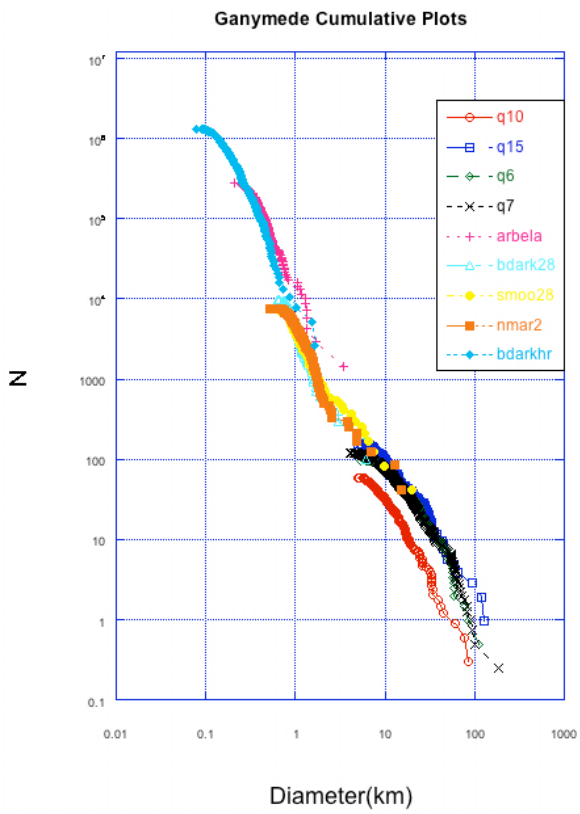


**Figure 2.** Cumulative size frequency distribution for crater on Ganymede. Curves represent different counting areas, selected from medium and high resolution Galileo mosaics.

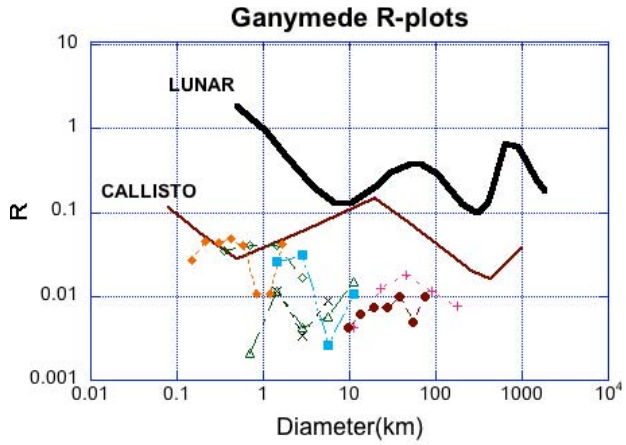


**Figure 3.** R-Plot comparing Ganymede bright terrain data to Callisto and the Moon. Curves represent different counting areas, selected from medium and high resolution Galileo mosaics.