DARK-RAY CRATERS ON GANYMEDE. James Conca, California Institute of Technology, Pasadena, California, 91125.

The surface of Ganymede as revealed by Voyager contains many ray craters. A significant number have dark rays. The criteria for assigning a crater to this category is the presence of a low-albedo deposit with distinct dark rays surrounding the central crater. Within the Voyager coverage only forty-three dark-ray craters (DRCs) can be identified on Ganymede down to the limit of resolution. The distribution, ejecta morphology, and ray pattern of DRCs show no variation or correlation with terrain type. However, distribution and albedo of DRCs with respect to latitude and longitude is non-uniform. No DRCs were observed above +60° latitude and only four are seen above +40° (where the polar shroud becomes evident). Figure 1 shows the position of each DRC on Ganymede. Being in synchronous orbit around Jupiter, Ganymede has constantly leading and trailing points, called the apex and antapex, respectively (Figure 1). A plot of the number of DRCs per 10^6 km^2 as a function of distance from the apex is given in Figure 2. It can be seen from Figure 2 that the number of DRCs increases with increasing distance from the apex. Even within the poor resolution coverage of areas between 120° and 180° from the apex the number of DRCs continues to increase, strongly indicating that DRCs are concentrated on the trailing hemisphere. Also, the albedo decreases and the areal extent of the low-albedo deposits surrounding DRCs increases with increasing distance from the apex. From observations of DRCs, and their proximity to bright-ray craters (and the similar depths of excavation), it is suggested that on Ganymede the low-albedo deposits may not be due to substrate characteristics but to characteristics of the impacting projectile. If this is the case, then together with the fact that DRCs make up less than 1% of all ray craters on Ganymede, this suggests that a rare component of the impacting population is involved in the formation of DRCs on Ganymede.

On icy bodies the ejecta from an impact will be a mixture of ice and projectile contamination. If there is ablation of H_2O from the surface of the ejecta, then whatever contamination that is non-ice will concentrate as a surface lag deposit with the contaminant to ice ratio increasing through time. The effect of the layer on the visible albedo will depend on the ablation rate, projectile material, and amount of contaminant. The process for ablation of H_2O from Ganymede's surface that best explains the antapical distribution of DRCs is sputtering of H_2O by charged particles. This process varies with longitude on Ganymede because Jupiter's magnetic field is corotating with the planet at Ganymede's orbit 176 km per second faster than Ganymede in the same direction. Therefore, charged particles within the magnetosphere are impinging on the trailing hemisphere to a much greater degree than on the leading hemisphere. Using the sputtering relationships developed by Haff, 1980, the area covered by projectile contamination as a result of sputtering a dirty-ice ejecta blanket on Ganymede is a function of the average particle diameter, D, the initial contaminant concentration, n_m (fractional atomic number concentration), the charged particle flux in Ganymede's vicinity (Belcher, et al., 1980) and the relative sputtering efficiencies of ice and silicate materials (Brown, et al., 1980). Figure 3 shows the fraction of the surface area covered by contaminant as a function of time using different values of D and n_m. The surface coverage reaches a steady state coverage in time T, after which the coverage and relative sputtering efficiencies between ice and contaminant is in equilibrium. Thus sputtering an ejecta blanket with D = 10 microns and n_m = 0.0056 will result in 85% of the surface of the ejecta blanket being covered by projectile contamination in 1.75 x 10^6 years after impact (Figure 3, function 7). T is directly proportional to D, and inversely proportional to n_m. If projectile characteristics are important in the formation of DRCs on Ganymede, then the velocity of the impact and composition of the projectile material must be in a range so as to result in an appropriate D and n_m to cause a visible albedo change when sputtered.

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