Crater Populations on the Uranian Satellites; S.K. Croft, Lunar and Planetary Laboratory, University of Arizona, Tucson, Arizona 85721

Two independent sets of crater counts on the Uranian satellites (1,2) have been published. Unfortunately, there are substantial variations between the data sets which cast considerable uncertainty on the accuracy of the counts and on the geologic interpretations based on them. In an effort to reduce the uncertainty, a third independent set of crater counts were carried out on Miranda, Umbriel and Oberon. The results are presented here in figure 1 (the Titania curve is taken from ref. 1, the Ariel curve in ref. 1 was originally done by this author).

In short, the new crater counts agree within the uncertainties with the results of ref. 1, and tell the same story. As may be seen from the figure, the oldest surface in the system is Miranda's cratered terrain (curve MC), Umbriel (U) and Oberon (O) are next with densities about $\frac{1}{3}$ of Miranda's, then Titania (T), Ariel (A) and the resurfaced coronae on Miranda (MR) as the youngest. In addition, younger surfaces have progressively steeper slopes indicating a progressive decrease of large objects with time. As pointed out by (1), these populations are not found in either the Jovian or the Saturnian system, which implies that they are internal to the Uranian system. The progressive loss of large objects in the system is consistent with a collisionally evolving group of impactors. Craters from external sources (comets, etc.) must be present, but their signature is apparently "lost in the noise." It was recognized early on (3) that Titania had been totally resurfaced in spite of its heavily cratered appearance. The crater densities on Umbriel and Oberon compared to Miranda presented here substantiate the conclusion of (1) that these two satellites are also totally resurfaced in spite of their primitive appearance. This evidence of total resurfacing followed by re-establishment of a primitive appearance suggests that the apparent absence of resurfacing on other somewhat anomalously primitive appearing satellites, particularly Callisto and Rhea, needs to be reconsidered.

Detailed crater counts largely paralleling the counts of (2) were carried out on discreet areas on Miranda, both in the cratered terrain and on the coronae, with substantially different results: a) crater densities were found to be systematically lower than (2)'s counts by factors of 1.5 to 2, b) no significant leading-trailing asymmetry was found, and c) while the coronae are younger than the cratered terrain, Arden (AR) and Inverness (I) were found to be about the same age (see figure 2), whereas Elsinore (E), with about $\frac{1}{2}$ the crater density of the other two coronae, is the youngest surface on Miranda. In addition, the craters on the cratered terrain could be divided into "fresh" (CF) and "mantled" (CM) craters (fig. 3) separated by the stratigraphic mantling event recognized by (4). The fresh crater population on the cratered terrain is seen in fig. 2 to have the same shape curve as all three coronae and about the same density as Arden and Inverness. Thus the resurfacing in Arden and Inverness occurred very shortly after the mantling event. The smaller crater density of Elsinore is not considered to be evidence of a leading-trailing asymmetry since the change in fresh crater density across the boundary between Elsinore and the cratered terrain is quite sharp whereas no change is apparent across the neighboring Inverness-cratered terrain boundary (fig. 4). Only two anomalies were found in the otherwise uniform population on the cratered terrain. First, the mantled crater population thins and disappears as one approaches the edge of Arden (curve CNA in fig.

3), whereas the fresh population of largely small craters is uniform over the whole area. This is interpreted as evidence of a thickening mantling layer of ejecta around the Arden impact structure (4). The other anomaly is an approximately 30% lower density in 1-2 km diameter craters in Silicia Regio (larger craters have normal densities). This is thought to be observational loss due to shadowing and piece-wise highly oblique viewing angle of the surface in this topographically rugged and partially shadowed terrain and not a real effect. Finally, the fresh crater curve on Miranda appears somewhat flatter (fig. 1) than on Titania and Ariel, though the overlap in diameter between the three data sets is poor. Thus Miranda's fresh craters may be due in part to another distinct population which is speculated to be re-accreted fragments from the Arden impact. **References** 1. Strom, R.G. (1987) *Icarus* **70**, 517. 2. Plescia, J.B. (1987) *LPSXVIII*, p. 784-789. 3. Smith, B.A. *et al.* (1986) *Science* **233**, 43. 4. Croft, S.K. (1987) *LPSXVIII*, p. 209, and *Icarus*, submitted.

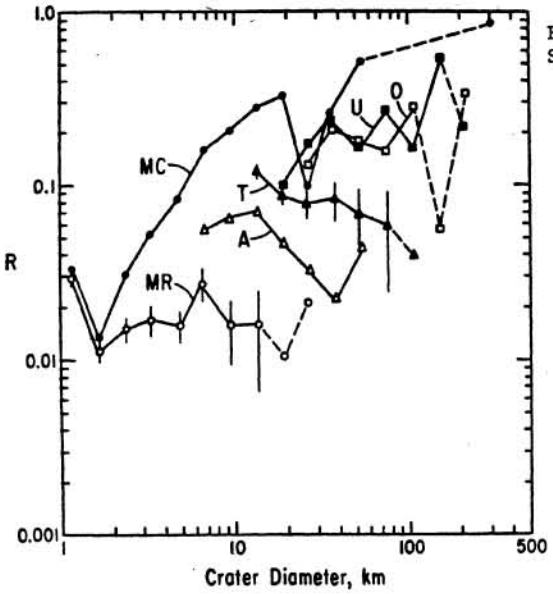

Figure 1. Five Satellite Summary

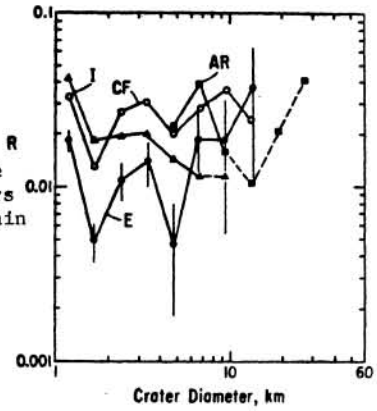

Figure 2. Coronae plus Fresh Craters on Cratered Terrain

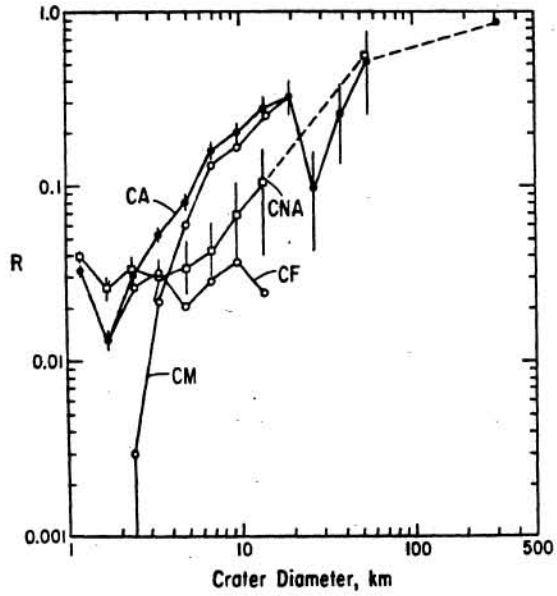

Figure 3. Miranda Cratered Terrain, Fresh and Mantled

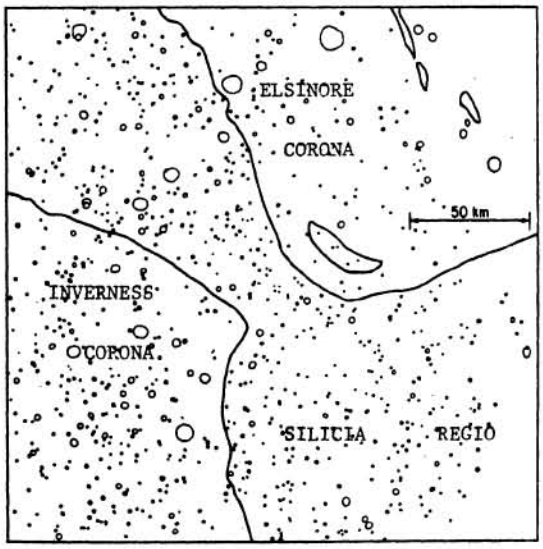

Figure 4. Sketch Map of Fresh Craters on FDS #26846.29