SPATIAL DISTRIBUTION AND MORPHOLOGY OF SECONDARY CRATERS. Peter J. Mouginis-Mark, 26913 Cook Road, Olmsted Twp., Ohio 44138.

The importance of the erosional effect of secondary impact craters on the Moon and Mercury is gaining increasing support in the photointerpretation of surface phenomena (1,2). Excavation of the pre-existing topography by secondary impacts and the areal distribution of tertiary ejecta will both modify the original surface morphology of a planet at considerable distances from the primary impact. Prior to a re-evaluation of lunar stratigraphy to include basin secondaries (3), it is pertinent to investigate the spatial distribution and morphology of kilometer-sized secondaries with respect to their distance from the parent crater.

The data base used here draws on measurements made using a "DMAC" digital mapping table of secondary craters around the lunar craters Aristarchus (40 km), Maunder (53 km), Aristoteles (87 km) and Copernicus (92 km) and five mercurian primaries (60 - 140 km). High resolution Orbiter IV photography was used for the lunar craters and close encounter frames from Encounters 1 and 3 of Mariner 10 for Mercury. Maximum crater diameter, crater depth (from shadow measurements), the orientation and length of the "V-Structure" limbs (4) and the distance from the parent crater were measured for the lunar examples. Crater diameter and distance from the primary were obtained for the mercurian secondaries. Several topographic maps were prepared of selected mercurian secondaries using photoclinometric techniques (5) in order to determine the crater depth and dune dimensions.

Several significant relationships are apparent from a preliminary analysis of over 5,000 secondary craters (5):

1. Secondaries NE and SE of Copernicus show a progressive increase in their depth/diameter ratio (D/d) with increasing range from the primary crater (Figure 1). For a total sample of 488 craters, at any given range, the values of D/d for different craters may vary by as much as 0.15. But, the mean value of D/d for all secondaries at a specific range increases

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from 0.09 at 1.1 crater radii (50 km) to 0.12 at 2.6 radii (120 km) and 0.17 at 3.7 radii (170 km).

2. The mean length of lunar "V-Structures" limbs is equal to the diameter of the secondary crater ± 0.5 km for craters between one and four kilometers diameter.

3. The orientation of over 3,250 V-Structure limbs around all four lunar craters combined show a good correlation with the proposed lunar grid (6). Peaks in the limb azimuthal distribution (greater than 200 limbs in a 10° sector) occurred between bearings 300-330°, 350-10° and 30-60°. Minima in the distribution (less than 100 limbs in a 10° sector) were observed to occur between bearings 270-290° and 70-90°. No obvious reason is evident to explain this distribution, although a limited range of illumination conditions may be a contributory factor.

4. The depths of mercurian secondaries obtained by photoclinometry gave approximate values of D/d = 0.08 to 0.1. Secondary "dunes" were also measured to be in excess of 250 meters higher than the local datum and up to 5 km in length.

5. Maximum areal density of secondary craters occurs at 1.4 to 1.5 crater radii from the rim crest of the primary for all five mercurian craters, with a maximum observed density of 30 secondaries per 300 km^2 for the crater Kuiper (63 km).

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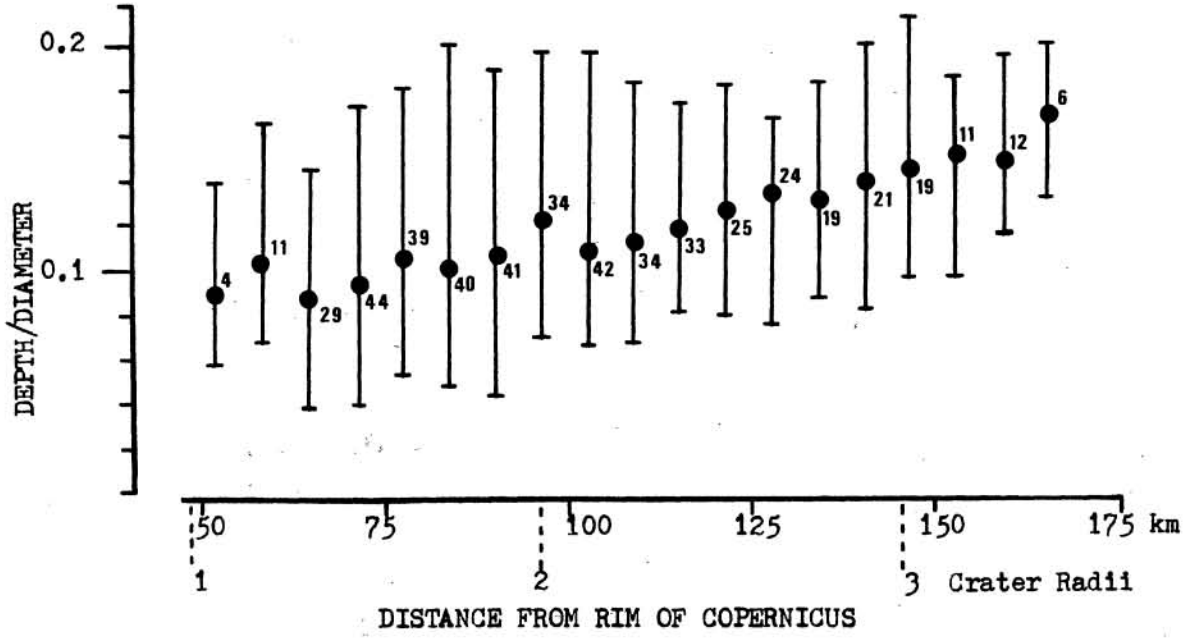

Figure 1. Variation of secondary crater depth/diameter ratios with distance from the rim of Copernicus. Mean values are given by dots, maximum and minimum values by the ends of the bars. Numbers refer to the size of each sample at that particular range.