ORIGIN AND RELATIVE AGE OF LUNAR AND MERCURIAN INTERCRATER PLAINS,
The most widespread terrain type on Mercury is level to gently rolling plains covered by a high density of superposed small craters in the size range 5-10 km. These plains occur between and around clusters of large craters comprising more heavily cratered terrain and have been termed "intercrater plains" (1). The high density of superposed small craters has been interpreted as secondaries from craters and basins of the more heavily cratered terrain which suggests that the intercrater plains are older than most of the heavily cratered terrain and may be the oldest exposed unit on Mercury. If this interpretation is correct then the intercrater plains may be an ancient primordial surface possibly similar to the hypothesized lunar "magma ocean". However, Malin (2) has recognized degraded craters and basins within the heavily cratered terrain which appear to be embayed by intercrater plains suggesting that at least some intercrater plains post-date the later portions of heavy bombardment by large objects. If this is the case then the intercrater plains may represent an early volcanic episode (2), or possibly basin ejecta (3).

On the moon, a similar type of terrain occurs southwest of the Nectaris basin and is termed the "Pre-Imbrium Pitted Plains" (1 and 4). However, this lunar highlands plains unit has a much more restricted distribution than mercurian intercrater plains. Prior to the Apollo 16 mission which returned impact breccias from a Cayley-type plains deposit, the pitted plains were interpreted as a pre-mare highland volcanic deposit (4). Many investigators now regard this unit to be basin-related ejecta deposits (5). Under this interpretation the deposits' relatively close proximity to the Nectaris basin makes that basin the most likely source.

Since the morphology and stratigraphic relationships of lunar pitted plains and mercurian intercrater plains are so similar, their comparison should provide insight into their origin and relative age. Most previous studies have concentrated on their morphology, stratigraphic relationships, and areal distribution. In this study the crater diameter/density distributions associated with lunar and mercurian highland plains are compared in order to determine the relative age and possible origin of these plains. Only craters in the size range 7-100 km are considered.

Counts of craters ≥7 km in diameter were compiled for areas in a strip of lunar highlands extending from the equator to about 70° S latitude and from the central meridian to about 20-30° E longitude. This strip was further divided into blocks consisting of (1) the Albategnius area about 1 to 2 basin radii from the Imbrium basin rim and containing rather large tracts of Cayley material, (2) the Werner area which is rather heavily cratered, and (3) the Cuvier and Manzinus areas containing fairly large tracts of pitted plains. In addition, crater counts were performed in the Clavius region (one of the most heavily cratered regions in the frontside highlands) and in an annular segment adjacent to and south of the Nectaris basin. The annular segment encompasses an area equivalent to the continuous ejecta blanket of a basin this size. Figure 1 is a diameter/density plot of craters in the Albategnius, Werner, Cuvier, and Clavius areas and Figure 2 is a similar plot of the Man-
LUNAR AND MERCURIAN INTERCRATER PLAINS

Strom, R. G.

The crater density (P) is the percent of the area covered by craters of a given diameter. On this type of plot, a traditional -2 distribution function on a diameter/frequency plot is a horizontal line, while a -1 distribution is a straight line sloping down to the left at an angle of 45°. This type of plot shows variations in the distribution function much more readily than conventional diameter/frequency plots. Figures 1 and 2 show that the areas containing tracts of pitted plains (Cuvier and Manzinus areas) have a significant deficiency of craters < 40 km diameter relative to the more heavily cratered areas (Werner and Clavius). This suggests that the pitted plains have obliterated many of the craters < 40 km diameter and are therefore younger than much of the heavily cratered terrain. The lunar highlands one basin radius from Imbrium (Albategnus area) show a diameter/density distribution similar to that of the pitted plains. However, contrary to the heavily cratered areas lacking plains units (Clavius and Werner areas) where the density of the more degraded craters (Classes 4 and 5) is significantly less than the fresher craters (Class 3), the Albategnus area shows the density of the more degraded craters is greater than the fresher craters. This indicates that the effect of basin ejecta (Cayley fm.) at one basin radius is to alter the fresher craters (Classes 1-3) to more degraded ones (Classes 4 and 5).

Regions of pitted plains (Manzinus and Cuvier areas), on the other hand, display an abundance of fresher craters (Class 3) and a marked paucity of the more degraded types (Classes 4 and 5). This suggests that the mode of emplacement of pitted plains was different from that of the Cayley plains of the Albategnus area. Further, Figure 3 shows that the crater density and population index of the annular segment within one basin radius of Nectaris (Nectaris "Ejecta Blanket") are essentially the same as those of the Clavius area. This indicates that the Nectaris continuous ejecta blanket has been cratered to the same extent as the Clavius region, and that the emplacement of the pitted plains, which caused the loss of craters < 40 km diameter, cannot be the result of basin ejecta deposition related to the Nectaris impact. Therefore, the pitted plains probably represent a pre-mare epoch of highland volcanism. Also shown in Figure 3 is the diameter/density distribution of pre-mare craters south of the equator in Oceanus Procellarum and Mare Nubium. The shape of the pre-mare curve and the Manzinus curve are the same, which shows that crater obliteration by volcanic flooding can produce a diameter/density distribution similar to that observed in the pitted plains (Manzinus area).

Figure 4 is a comparison of the crater diameter/density distribution for the lunar Clavius and Manzinus areas, and the south polar region of Mercury (H-15 Quad). The south polar region of Mercury, like many other areas of the planet, contains large tracts of intercrater plains similar to the lunar pitted plains. The slopes of the Mercury curves are steeper than the heavily cratered Clavius area but are similar to the Manzinus area containing pitted plains. This suggests that the mercurian intercrater plains have obliterated craters in a manner similar to that of the lunar pitted plains and were therefore emplaced during the period of heavy bombardment. Furthermore, the curve for the fresher mercurian craters (Curve 1, Figure 4) is shallower than that for more degraded craters (Curve 2, Figure 4), again indicating that the intercrater plains have obliterated some of the original crater population with
LUNAR AND MERCURIAN INTERCRATER PLAINS

Strom, R. G.

The turn-up of the mercurian curves at diameters <15 km is the result of the high density of superposed small craters (secondaries) on the intercrater plains.

Therefore, the similarity in the diameter/density distribution between areas containing intercrater plains on Mercury and pitted plains on the moon suggests that both the mercurian intercrater plains and the lunar pitted plains represent a highland volcanic episode which took place during the period of intense bombardment on each body. The more widespread distribution of intercrater plains on Mercury than on the moon may be the result of the greater early expansion (more open fracture) of Mercury during formation of its large core than in the case of the moon.