
The crater size-frequency distributions of 48 near and farside upland plains areas and basin ejecta blankets were studied to determine the chronology of upland units. The plains sampled include areas that have been mapped as Imbrian plains, Pre-Imbrian plains, Nectarian plains, and Undivided plains (1,2). The basin ejecta deposits sampled are from the four youngest large basins (3,4): Orientale, Imbrium, Humboldtianum, and Nectaris. Primary impact craters larger than ~800 m were counted in each sample area. Also, because of the limited size of most sample areas few craters larger than 7 km were counted.

K (the number of craters > 1 m in dia./10^6 km^2) and C_s [steady-state size of Moore (5), Trask (6), which is equivalent to the equilibrium diameter of Gault (7)] have been determined for each area from the size-frequency data. Theoretical values for K for each area were determined by extrapolation of the size-frequency data to a diameter of 1.0 meters. This was done by extending a -3 slope curve from the error bars to a predicted number of craters > 1 m. Values for C_s were also determined for each area using an iterative algorithm of Cramer's rule to find the theoretical intersection diameter of the crater production curve and the Trask steady-state curve.

Histograms of C_s and K, and weighted histograms of C_s and K for the upland plains and basin ejecta blankets that were sampled are shown in Figures 1 thru 4. The weighting function is the percent of the sum of all areas counted (the percentages smaller than one are rounded to one and the percentages greater than one are rounded to the nearest half percent). The histograms show four modes of plains ages and each mode corresponds closely to the relative age (also determined by crater frequency distributions) of the ejecta blanket surrounding one of the four basins - Orientale, Imbrium, Humboldtianum, or Nectaris.

Our data are in general agreement with those of Boyce, Dial and Soderblom (8) which show a correlation between the ages of basins and the ages of plains. However, our data is in disagreement with relative ages determined on the basis of stratigraphy and albedo (1,2). For example, some plains mapped as Nectarian are younger than those mapped as pre-Imbrian plains and visa-versa. This apparent discrepancy between ages based on photogeologic mapping and those based on crater distributions can, in part, be resolved if the crater population has been modified or destroyed on older plains during the time of production of younger plains. This is consistent with earlier hypothesis that large impact events (basin-forming size) result in the modification or resurfacing of plains moonwide. Resurfacing or modification of plains can occur in two ways: by blanketing an old surface with new material or by reconfiguring the old surface (9).

Additionally, since the four large basins that correspond in age to the four plains units are > 600 km in diameter, the critical diameter of a basin whose formation can result in resurfacing of plains moonwide is > 600 km. Our study does not indicate a mechanism for resurfacing of plains. However, mechanisms involving seismic shaking (10) and ejecta deposition and/or erosion (11,12) have been proposed.
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In summary our data suggest that the crater distribution on uplands plains have been modified by the formation of large (> 600 km) impact basins. The data do not point to the specific mechanism for modification and resurfacing of the plains. However, any model for such a mechanism is constrained by the observation that some older plains surfaces are preserved after the formation of younger surfaces and that the production of new surfaces is in some manner tied to the formation of large impact basins.

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Figure 2. Histogram of K (average error bars) of upland plains units and basin ejecta

Figure 3. Histogram of weighted Cs (average error bars) of upland plains units and basin ejecta

Figure 4. Histogram of weighted K (average error bars) of upland plains units and basin ejecta

*Size-frequency data of ejecta for: a) Orientale basin, b) Imbrium basin, Humboldtianum basin, d) Nectaris basin.

°Weighting function: \[ f = \frac{\text{sample area}}{\text{total area}} \times 100 \]