SELENOGRAPHIC DISTRIBUTION OF APPARENT CRATER DEPTHS.

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The transition from simple to complex crater morphologies within the 10-20 km diameter range on the moon is adequately documented (1-4). The correlation of diameter and depth for complex craters (>15 km in diam.) is less well defined than that of smaller, simple craters (4,5); hence, craters of equal diameter exhibit a wide range of depths. This disparity becomes more evident when apparent crater depth is used. This study is designed to examine the apparent depth of complex lunar craters as a function of diameter and selenographic distribution. If apparent depth is a function of crater diameter, then the frequencies of crater depth and diameter should be similar and the distribution of apparent depths on the lunar surface should be random. On the other hand, if crater depth is controlled by surface or subsurface characteristics of the target material, then apparent crater depths should show some correlation with lunar terrain and little or no correlation to crater diameter.

In this preliminary study, approximately 165 young, complex craters were identified in regions of LTO and LAC topographic coverage. Data collected for each crater include the location (selenographic latitude and longitude), surface characteristics, crater diameter, mean elevation of the surface, and apparent crater depth (surface elevation minus mean elevation of the crater floor). Depth and diameter frequency plots were compared for similar trends. Apparent depths were plotted on a lunar base map and analyzed for significant trends in selenographic distribution.

Apparent crater depths, which range from 0.2 to 3.7 km, exhibit little correlation to crater diameter. Craters exhibit a typical decreasing frequency at larger diameters, but apparent crater depth exhibits a more nearly gaussian distribution. The average apparent depth within the region of Apollo photographic coverage (95 craters) is 1.8 km. If divided into mare and highland subgroups, the mean apparent depth of mare craters is 1.4 km, and the mean apparent depth of highland craters is 2.2 km. A contour map of apparent crater depths (Fig. 1) exhibits sufficient organization to suggest that crater depths are correlated to selenographic locations. In general, regions of shallow crater depths (<1.5 km) are associated with basin interiors. Greater depths are associated with highland terrains. The deepest craters (>2.5 km) occur in the topographically highest regions, such as basin rims or farside terra.

Low apparent depths are found within the Imbrium, Serenitatis, Tranquillitatis, Crisium, and Smythii basins. High apparent depths are associated with the South Central Highlands;

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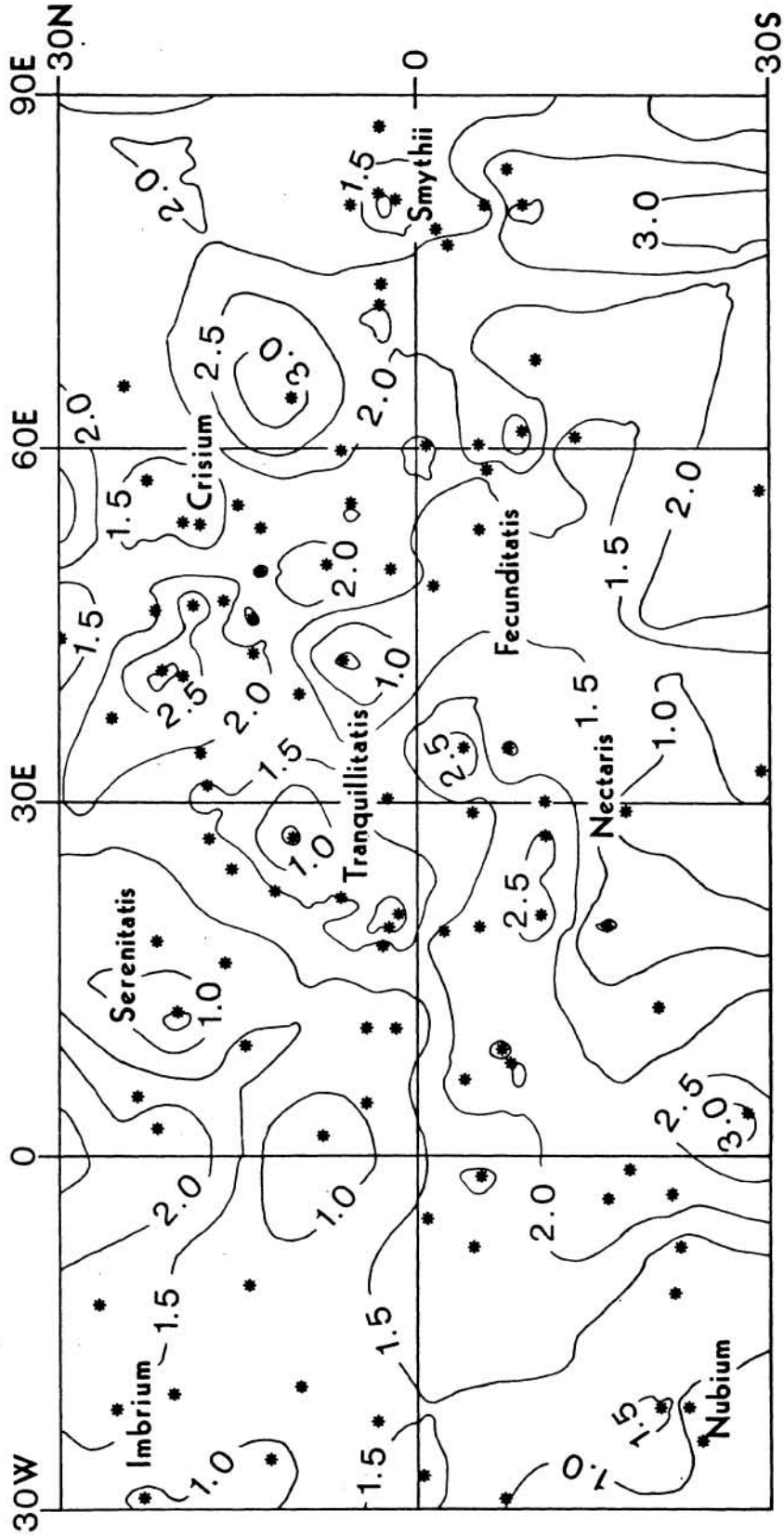

Figure 1. Apparent depths of lunar craters. Low apparent depths occur in regions of basins and low-lying terrain. Greater apparent depths occur on highlands and basin rims. Contour interval is 0.5 km.

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the Imbrium, Serenitatis, and Crisium basin rims; and interbasinal highlands. Neither the Fecunditatis and Nectaris basins nor the highlands north and east of Smythii and south of Nectaris are well defined due to a lack of topographic data. Data from LTO coverage east of the Smythii basin (beyond 90°E) indicates apparent crater depths of the farside highlands are consistently high with a maximum measured value of 3.7 km.

The mechanics of the transition from simple to complex craters remain a point of controversy. Crater depths exhibit a strong correlation with terrain characteristics and little relationship to crater diameter. The results of this study tend to support a model of crater excavation in which properties of the target material are a controlling factor in crater morphology. The mean apparent depth of complex craters is within the range of estimates for the average thickness of the lunar megaregolith (6-9). If the formation of a flat crater floor is controlled by a change in properties of the target material at depth (8-11), then the crater morphology provides a means of mapping the lateral variations in depth to that discontinuity. The distribution of craters large enough to reach the discontinuity is sufficient to provide reasonable estimates of regional thickness trends; however, the spacing is large and many important local variations are unsampled. Additionally, some apparently aberrant craters (young, with large diameter, but shallow--such as Taruntius) which would normally be assigned to an alternate mode of origin or significant post-impact modification, may not require special explanations. For the most part, such craters fall within the range of crater depths consistent with their surroundings.

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