GEOLOGIC STRUCTURE OF THE EASTERN MARE BASINS;
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An isopach map of the basalts in the eastern mare basins (30°N to 30°S; 0° to 100°E) is constructed from measurements of the exposed external rim heights of partially buried craters (1,2). The data, which are sufficiently scattered to yield gross thickness variations, are restricted to thin maria with less than 1500-2000 m of mare basalts. In deeper mare basins, complete burial results in the total obscuration of craters. Hence, it is impossible to measure the thickness of materials in the deep parts of Mare Serenitatis, Mare Nectaris, Mare Crisium, or central Mare Fecunditatis. Mare Nectaris and central Mare Fecunditatis are shown with modeled thicknesses. The composite isopach map (Fig. 1) is assembled from those basins which have sufficient topographic data for analysis. The total area of mare surface studied is approximately 1.4 X 10^6 km^2. The average thickness of basalt, exclusive of the deep circular basins, is between 200 and 400 m.

The multiring mascon basins are filled with mare basalts to various levels. The data for Mare Serenitatis and Mare Crisium are limited to a few scattered buried craters along the margins of the basins. Both basins have deeply flooded central interiors and extensively flooded shelves. A trough within eastern Serenitatis basin is formed by lowlying terrain between the first and second raised rings of the basin. In contrast to the deep flooding of the Serenitatis and Crisium basins, only the innermost basin of Mare Nectaris is filled; and thin basalts incompletely flood a small portion of the Smythii basin floor.

Shallow maria occupy lowlying terrain of various origins which are flooded as a consequence of their low elevation (4,5). The limited thickness of basalt is evident by the number of prebasalt craters observed within the basins. Sinus Amoris (northeast extension from Mare Tranquillitatis) occupies a trough concentric to Mare Serenitatis. Mare Spumans and Mare Undarum occupy a trough concentric to Mare Crisium. The Tranquillitatis basin is a composite structure of overlapping troughs and depressions adjacent to nearby circular basins. The Fecunditatis basin is a composite structure with a moderately deep central basin and adjacent terrain modified by the formation of the Nectaris and Crisium basins. Some ancient circular mare basins may have formed in Tranquillitatis (Lamont and eastern Tranquillitatis) or Fecunditatis at a time of nearly complete isostatic recovery.
Correlations between surface topography, basalt thickness, and basin floor configuration are apparent in all basins. Some correlations observed are:

1. Positive gravity anomalies occur over areas thicker than 1000 m (Mare Smythii is an exception).
2. Mare ridges are typically located in regions of pronounced thickness changes (e.g. change from shelf to inner basin).
3. Surface topography is commonly depressed in the region of thick mare basalts.
4. Arcuate rilles are generally confined to areas where mare basalts are thin (less than 500 m), and they tend to be subparallel to the zones of equal thickness.

The isopach map and its correlations have important implications for basin structure and lunar processes. Some implications are:

1. The total volume of mare basalts generated during late Imbrian to early Eratosthenian times are less than previous estimates. Therefore, the smaller volume of basalts requires less heat output for this late stage volcanism. Also, the gravity differential observed in the basins is not entirely due to surface basalts (5).
2. The structure of irregular basins is largely controlled by nearby circular mare basins.

References

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Figure 1. Isopach map of the eastern mare basalts. Isopach interval is 250 m.

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