TABLE 1. Estimates of Moho Relief, Apparent Volume of Mantle Uplift, Basin Volume, and Ejecta Volume for Major Basins on the Lunar Nearside

Basin	Radius, km	Moho Relief, km	Ambient Crustal Thickness, km	V_u, 10^6 km^3	V_b, 10^6 km^3	V_e, 10^6 km^3
Orientale	310	66	85	6	0.7	7
Serenitatis	305	30	60	8	1	9
Crisium	225	31	55	6	1	7
Humorum	205	27	60	3	0.5	4
Nectaris	300	28	60	4	0.7	5
Smythii	300	33	65	4	0.6	5
Nubium	340	10	60	2	0.3	2
Fecunditatis	345	14	60	2	0.2	2
Tranquillitatis	340	12	60	2	0.2	2

Basins are listed in order of increasing age [*Wilhelms*, 1981]. The indicated radius corresponds to the second ring [*Head*, 1977; *Wilhelms*, 1981].

beneath each basin. These quantities are listed in Table 1, in order of increasing basin age [*Wilhelms*, 1981].

Table 1 and Figure 10 suggest a general decrease in the apparent volume of uplifted mantle with increasing basin age. The Moho beneath the central mare units of Orientale (Figure 10*a*) is raised by 66 km relative to the ambient depth of about 80 km. Serenitatis (Figure 10*b*), a basin about the same diameter as Orientale and of somewhat greater age, is surrounded by crust with an average thickness of 55 km; mantle relief beneath Serenitatis is 30 km, but the uplifted volume is broader and thus somewhat larger (7.5×10^6 km^3 versus 6.0×10^6 km^3) than that beneath Orientale. The volume of apparent mantle uplift beneath Orientale is also more uncertain, however, because of poor data coverage over the western portion of the basin. The difference in the magnitude of Moho relief between the two basins nonetheless exceeds the sum of the errors in these two quantities (Figure 9). The oldest basin examined is Tranquillitatis (Figure 10*i*). Though slightly larger in diameter than the nearby Serenitatis basin, Moho relief beneath Tranquillitatis is only 12 km, also a significant difference in relation to the errors shown in Figure 9. We interpret the decrease in the apparent mantle uplift with increasing basin age (Table 1 and Figure 10) to be the result of an age dependence of the basin formation or modification processes. We consider the implications of this inference in a later section.

Figure 7 shows a generally thinner crust over the central nearside of the moon than near the limb regions, a result also noted in several earlier studies of lunar crustal structure [e.g., *Kaula et al.*, 1974]. This large region of thinner crust coincides approximately with the location of the ancient Procellarum basin [*Whitaker*, 1981], a 3200-km-diameter structure centered near 26°N and 15°W. This coincidence suggests that some record of mantle uplift during basin formation is still apparent even for the largest and one of the oldest of the preserved nearside basins [*Wilhelms*, 1981].

The thicknesses of mare basalt, shown in map view in Figure 8, are deserving of several comments. The inversion procedure preserved the constraint of premare isostasy within all major basins for the complete set of iterations. Equivalently, the Bouguer gravity anomaly over these basins is sufficiently large so as to require both an elevated Moho and more than 250 m of high density mare basalt. Basalt thicknesses beneath the centers of the irregular mare basins (Nubium, Fecunditatis, and Tranquillitatis) range from 0.5 to 1.3 km, while the younger circular mare basins (Orientale, Serenitatis, Crisium, Humorum, Nectaris, and Smythii) contain as much as 3.5–4.5 km of basalt fill within the central depression region. That these thicknesses in the central portions of the circular basins are greater by up to 2 km than the values derived by *Thurber and Solomon* [1978] under a similar set of assumptions can be attributed to the improved accuracy of the topographic data used here and to the method adopted to evaluate the gravitational potential due to anomalous mass (equation (3)). It should be noted, however, that the region of thickest mare fill in each of the Orientale and Smythii basins constitutes only a single block in the model depicted in Figure 8. In some irregular mare regions (e.g., Oceanus Procellarum) the constraint of premare isostasy was relaxed during the inversion because the basalt thickness within one or more blocks dropped below the 250-m limit after an iteration. For such regions, either the surficial mare basalt unit is very thin or the crust is somewhat thicker than would be predicted from complete isostatic compensation of premare relief.

As noted earlier, the mare basalt thicknesses depicted in Figure 8 should probably be regarded only as lower bounds on the actual thicknesses within the central regions of most basins [*Thurber and Solomon*, 1978]. If the lunar lithosphere maintained finite strength during the formation of at least the younger basins, then the premare basin would have had incompletely compensated relief and a greater thickness of mare basalt would be required to match the Bouguer gravity field. Further, some portion of the mare basalt load in the mascon maria has likely been compensated by lithospheric flexure [e.g., *Solomon and Head*, 1979, 1980], which also would lead to mare units somewhat thicker and Moho relief somewhat less than indicated by the structural model presented here. It is interesting to note that mare thicknesses estimated by *DeHon and Waskom* [1976] and *DeHon* [1978] from rim heights of craters buried or partially buried by mare deposits are generally comparable to the values in Figure 8 for many mare regions. This similarity between the two determinations is probably coincidental, however, because the rim height technique tends to underestimate mare thickness by as much as a factor of 2 [*Head*, 1982].

It is also possible that the mare basalt thicknesses shown in Figure 8 for some regions may be overestimates because of a significant contribution to the gravity field from subsurface intrusions of high-density mare basaltic material. The thickness of mare basalt within the central block of the Orientale