1978). Similarly, if the ejecta is of mare composition only, then the crater depth may give a minimum estimate of lava thickness. Uncertainty about the processes involved in crater cavity formation and modification (Settle and Head, 1979) make exact thickness estimates difficult. For example, extensive central uplift (Grieve *et al.*, 1977; Grieve, 1980) in craters not actually penetrating through the maria can expose material in the central peaks that originally lay well below the maximum depth of excavation. The assumption that the crater had actually penetrated through the lava deposit would lead to an underestimate of lava thickness.

1.3. STRATIGRAPHY

(Figure 2d). Stratigraphic techniques and regional topography can be used to estimate lava thicknesses, particularly at the edge of lava deposits, where topography and onlap relationships are clear (Head, 1974a).

1.4. GEOPHYSICAL TECHNIQUES

(Figure 2a). Surface geophysical techniques include the traverse gravimeter, which estimated a lava thickness of 1 km at the Apollo 17 site (Talwani *et al.*, 1973), and active seismic experiments, which estimated a thickness of ~ 1.4 km at the Apollo 17 site (Cooper *et al.*, 1974). Gravity anomalies in mascon basins can be converted to lava volumes and thicknesses (Solomon and Head, 1979, 1980). Similar techniques can be applied to the irregular maria (Thurber and Solomon, 1978). These latter techniques provide lower bounds for the thickness of lunar mare basalt fill of 3 km in mascon maria and 0.5–1.5 in irregular maria (Thurber and Solomon, 1978).

Although these approaches have provided significant advances in the understanding of the emplacement of the lunar maria (DeHon and Waskom, 1976), there are still basic uncertainties concerning thicknesses and volumes in many areas. The major difficulty in establishing thicknesses and volumes in flooded areas is reconstructing the sub-volcanic topography. Greeley and Womer (1980) and Womer and Greeley (1981) have simulated lava flooding of a basin using scale models in the laboratory. The approach taken here, however, is to start with *known* topography characteristic of early planetary crusts, and to artificially flood it with lava, keeping track of the evolving thickness, volume, surface area covered, and map pattern. Upon completion of flooding (no sub-volcanic topography exposed), data are available on maximum and average lava thicknesses, total volume, and the relationship of area covered (or exposed) to lava thickness and volume. In addition, a series of maps is available to show patterns of exposed sub-volcanic topography at various stages of filling. Since the volume and thickness of lavas associated with each map pattern is known, these maps can be used to estimate the same parameters for flooded planetary areas that show comparable map patterns. A range of unflooded terrain typical of early planetary crusts is being investigated (highland cratered terrain; basin interiors; basin margins; large craters; upland plains). This paper reports on the results of experiments in several areas of lunar basin interiors and margins.

The procedure is as follows: Lunar Topographic Orthophotomaps (1:250 000), Lunar