Serenitatis and Humorum. The variable levels of fill are due in part to different states of degradation of the basin topography due both to impact modification and possible viscous relaxation (Solomon and Head, 1981). An additional cause of variation, however, is the different level of development of the ring structure both within and between impact basins (see maps in Solomon and Head, 1980). This initial variation is manifested as poorly developed or discontinuous rings (as in the outer ring of Nectaris) and undeveloped ring topography (as in the outer ring of Crisium). For example, the lack of development of a megaterrace in Crisium comparable to the one in Orientale enhanced the topography of the second ring and confined flooding largely to the region within that ring. Thus, for the mascon basins, the geometry of mare fill is a function of initial development of basin structure as well as extent of flooding.

The Orientale basin example provides a model for the geometry of lava fill of lunar basins and a framework for the study of style of lava filling, loading of the lithosphere, deformation of mare surfaces, and the relationship of impact basins to ensuing stages of volcanism. A major variable is the initial state of basin topography and ring development. No basin (even Orientale) is exactly like the Orientale topographic model. Comparison of the Orientale model and stages of development of mare flooding in other basins relative to their structure will provide a better understanding of the significance of this variable. In addition there may be variations between basins relative to the level of thermal stresses associated with basin formation (Bratt *et al.*, 1981) which may influence initial topography.

In summary, the application of the Orientale basin model to other basins should be done carefully, considering the following factors which might cause *overestimates* (different initial basin geometries in early lunar history caused by different target characteristics or variations in isostatic readjustments; degradation and infilling by impact processes) or *underestimates* (loading of the lithosphere by early basin fill, and subsidence of the basin floor).

4.2. SEQUENCE OF BASIN FILL

The Orientale model of basin flooding assumes that flooding begins at the lowest point in the basin and proceeds topographically upwards until flooding is complete. Studies of mare deposites in the partly flooded Orientale basin (Greeley, 1976; Gaddis and Head, 1981) show them to be concentrated as a large patch on the lowest part of the basin floor and also as small arcuate lakes along the base of the scarps defining the outer Rook and Cordillera rings. The fact that these latter lakes occur several kilometers above the basin floor mare deposit indicates that the modelling procedure is a simplification: in Orientale multiple vents exist at different elevations within the basin.

Other basins, however, provide clues to the nature of early volcanic fill more extensive than that found in Orientale. Stratigraphic studies of the deeply flooded maria Serenitatis (Howard *et al.*, 1973) and Crisium (Head *et al.*, 1978) show that the oldest deposits are exposed around the outermost edge of the maria deposits. Stratigraphic relationships and material excavated by impact craters confirm the presence of this early fill in the central maria, underlying thinner, younger deposits.