Mare Smythii is a circular basin that is similar to Mare Crisium, Mare Serenitatis, and Mare Imbrium in many respects, yet it also exhibits a number of distinctive characteristics. The margin between the mare surface and surrounding highlands is quite irregular which is attributed to the old age of the Smythii basin. Although most of the circular maria are filled with lavas only the northeastern one third and a small area in west-central Mare Smythii contain large exposures of such smooth material (Fig. 1). Mare ridges, which are common in all of the other circular maria are restricted to these portions of Mare Smythii. Gravity data derived from Apollo 15 and 16 subsatellite observations (1) suggest that the mascon in Mare Smythii is asymmetrical with the greatest portion of the mass of the fill (presumably high density lavas) being concentrated in the northeastern part of the basin. The remainder of the surface varies from undulatory to hummocky and has a higher albedo than the more typical planar mare surface in the western and northeastern parts. The planar mare material fills embayments along its contact with the hummocky surface, contains far fewer large craters and appears to be noticeably less battered. These relationships suggest a greater age for the hummocky surface.

Several small exposures of planar mare material are present in the floors of large craters on the hummocky surface. In addition, the floors of several other large craters and some hummocky inter crater areas are covered by a smooth dark mantle (Fig. 1) similar in appearance to soils found at the Apollo 17 landing site (2). The crater Swasey in southeastern Mare Smythii contains a chain of small craters which are composed of this material and lie along a fracture. The distribution of this dark mantle and its resemblance to the surface at the Apollo 17 landing site suggest that it is of pyroclastic origin.

The ring structures in Mare Smythii are similar to impact craters that have been modified by volcanism and tectonism and which can be observed along the margins of the other circular maria, where the lava fill is relatively thin (3,4). Mobilization of the crust during volcanism has resulted in isostatic uplift of the crater floors to form central uplifts. In many cases subsequent flooding of the lowest portions of the crater floor which surrounds the central uplift results in the formation of a moat, causing the crater to exhibit a multi-ringed appearance. These modified craters exhibit circular and nearly complete rims and, in many cases, relict central peaks which indicate an impact origin. The absence of similar modified craters in the centers of the other circular maria is attributed to destruction by repeated episodes of flooding and erosion by mare lavas. Their distribution in Mare Smythii extends to near the center of the
Fig. 1: Geologic sketch map of Mare Smythii showing major structural elements and stratigraphic units of the Smythii basin.
MARE SMYTHII
Brennan, W.J.

basin which, unlike the other circular maria, is not an area of thick lava fill. None of the modified craters is located in those portions of Mare Smythii which have a large gravity anomaly.

The evolution of Mare Smythii probably began with the formation of the basin by a large impact event followed by intense meteorite bombardment which caused the irregularities in its ejecta rim and formed the many large craters adjacent to it. Much of the ejecta from these subsequent impacts was emplaced in the basin to partially fill it with material lower in density than basaltic lava and to produce an undulatory to hummocky surface much like the low relief, hilly terrain observed in some parts of the highlands (5). This sequence of events is likely the result of the relatively old age of the Smythii basin and the time interval between basin formation and the onset of volcanism. Volcanism in the basin resulted in the filling of the lowest areas with successive lava flows and the formation of mare ridges as in the other circular maria. In the southern portion, which was partly filled by older ejecta, volcanism resulted in only local eruption of thin lavas and blankets of pyroclastic material. Mobilization of the crust during volcanism resulted in the modification of impact craters superimposed on the older ejecta fill.

The evolution of Mare Smythii has resulted from the same processes which have affected the other circular maria. The differences between it and the other circular maria can be readily accounted for by its older age and a longer interval of time between basin formation and lava flooding.

REFERENCES