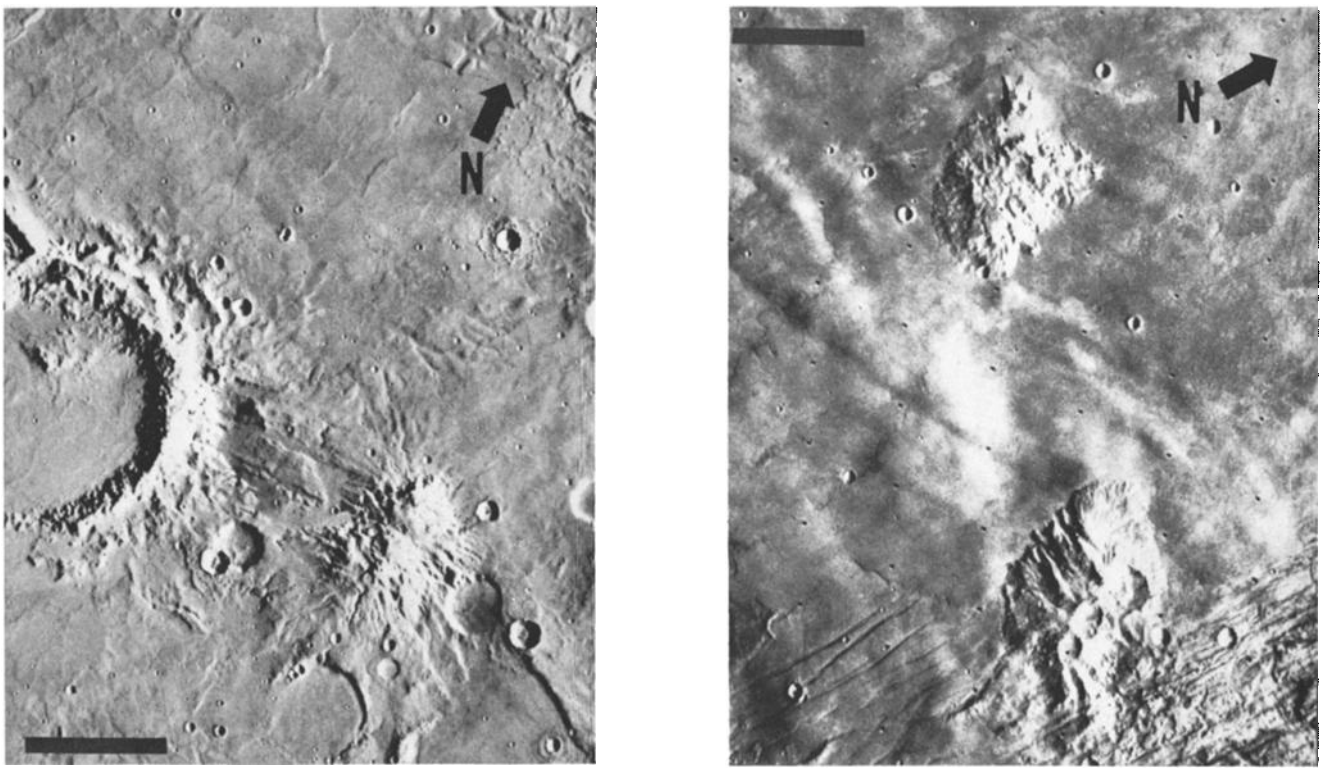

Fig. 18. (*a*) Heavily furrowed massifs protruding above smooth plains south of Valles Marineris. Massifs may indicate outer fourth ring of large impact basin centered on Syria Planum. Viking frame 610A24 centered at 61°W, 20°S. (*b*) Isolated massifs 800 km southwest of the center of Syria Planum that help define the second ring of a possible impact basin. Bar scale in both frames correspond to 50 km. Viking frame 56A47 centered at 111°W, 25°S.

massifs and the patches of cratered terrain typically are heavily dissected by sinuous channels or furrows and by a complex network of graben that was mapped in detail by *Plescia and Saunders* [1979].

Figure 19 shows a sketch map of prominent massifs, high-relief terrain, and concentric scarps. These features form broken concentric rings around Syria Planum. The innermost ring is identified by Noctis Labyrinthus and only a few high-standing massifs. The second ring is primarily comprised of isolated massifs and may be reflected by the sector graben of Arsia Mons and Pavonis Mons. The third ring contains numerous isolated massifs and a very well defined scarp that exhibits more than 1-km relief [*Roth et al.*, 1979]. The outermost ring approximately corresponds to the limit of extensive lava filling to the south and southwest. Other possible correlations for the outer ring include the widening of Valles Marineris and parallel canyons of Ophir Chasma (74°W, 4°S) and Hebes Chasma (79°W, 1°S), and the elongate extension of Tharsis Tholus (112°W, 19°N).

The concentric pattern of massifs and structural features is proposed to represent remnants of an impact basin approximately 1400 km in diameter (third ring). The broken pattern of massifs and the somewhat poorly defined concentric arrangement is in contrast with smaller and more clearly defined multiring basins on the moon and Mars. However, the large Argyre Basin (900 km in diameter; 45°W, 50°S) exhibits the same ill-defined concentric pattern of isolated massifs in a zone between 400 and 900 km from the center of the basin. A prominent scarp forms the outer boundary for the most prominent massifs in a manner similar to the scarp identified around Noctis Labyrinthus near 80°W, 15°S.

The proposed Tharsis impact basin has been extensively modified by volcanic modification that resulted in the widely recognized [e.g., *Mutch et al.*, 1976] regional uplift, radial tension fractures, and large effusions of lava. In contrast to the evolution of Argyre and Hellas, volcanism in this region nearly destroyed the basin remnants. *Masson* [1979] independently suggested that a more recent stage of igneous activity around Syria Planum resulted in geothermal activity that contributed to the formation of Noctis Labyrinthus. We further propose that this activity was controlled by deep-seated faults related to the Tharsis impact basin.

CONCLUDING REMARKS

The ancient cratered uplands of Mars clearly reveal the influence of impact cratering on the early martian crust. As on the moon, some of these craters are proposed to have provided zones of weakness that localized igneous activity. This suggestion is consistent with the following observations:

1. Modification style is generally similar to volcanically modified lunar craters.
2. Crater modification is commonly restricted to the crater interior; consequently, modification was localized by the impact structure.
3. Modification affects only certain craters in a given region; thus the modifying process was selective and not simply the result of crater relief.
4. Modification affects a wide range of crater sizes from