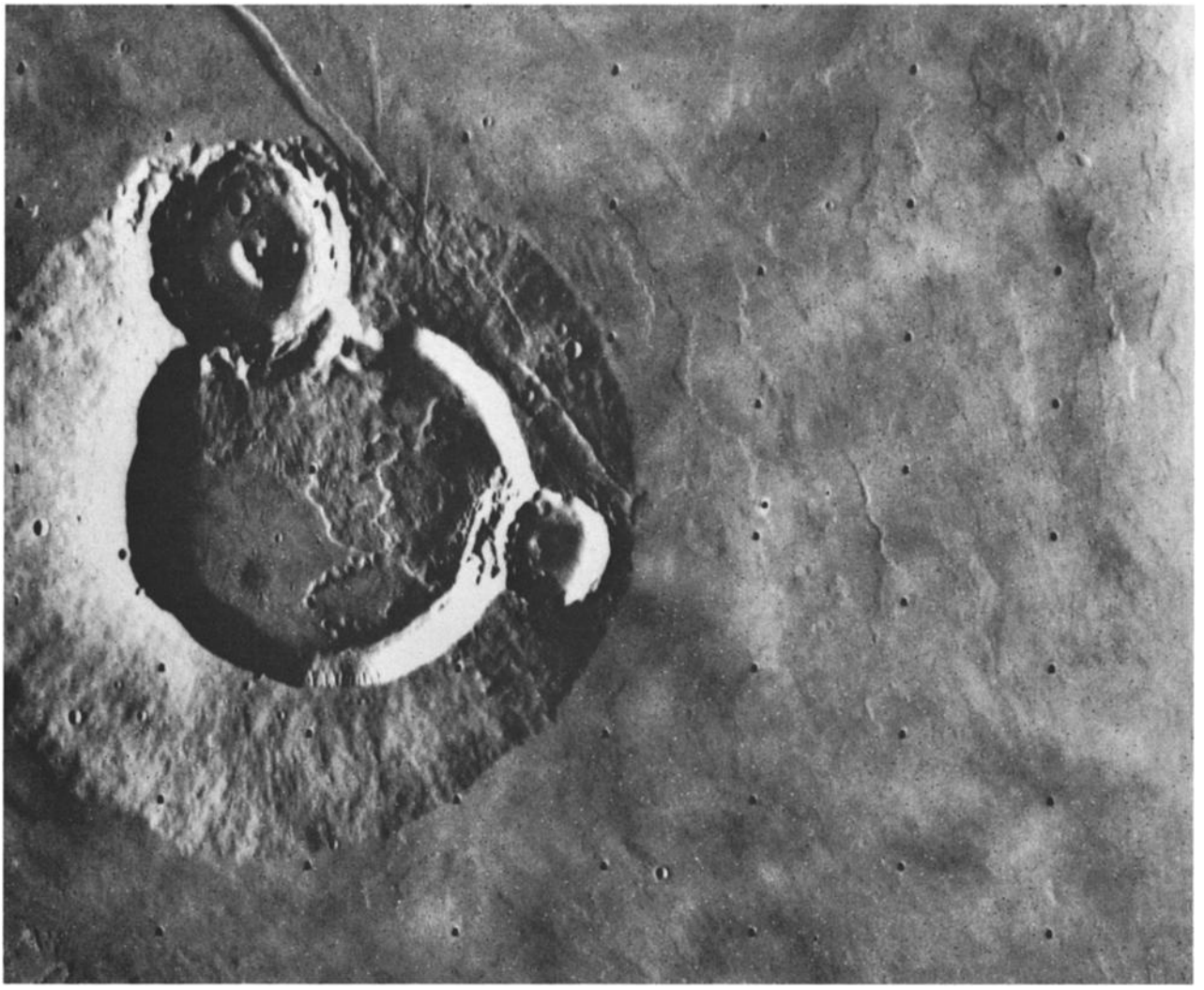

Fig. 2*b*

plains on the eastern flank of the Tharsis rise. The total thickness of volcanic plains material postdating the time of heavy impact bombardment in the central portions of the Tharsis province has been estimated by simple extrapolation from these results; *Plescia and Saunders* [1980] and *De Hon* [1981] estimate that this thickness does not exceed 2 to 5 km. The thickness of volcanic plains units may be estimated independently from the dimensions of partially buried volcanic constructs (Figure 2). A number of the minor paterae of the Tharsis region have been interpreted as partially buried shield volcanoes [*Plescia and Saunders*, 1979*b*; *Greeley and Spudis*, 1981; *Blasius and Cutts*, 1981]. *Pike and Clow* [1981] have estimated that if the visible dimensions of each patera are extrapolated to yield a buried edifice with dimensions similar to those of the Martian montes, then the depths of burial of these paterae are 10–15 km. Pike and Clow, however, rejected these values in favor of the hypothesis that the unburied paterae are smaller than the montes.

Tectonic history. The Tharsis region is the site of the greatest density of large-scale tectonic features on Mars (Figure 1). A great many prominent graben and smaller-scale linear rilles and extensional faults radiate outward from central Tharsis (Figure 3), including the great Valles Marineris canyon system. These features are the product of horizontal extensional stresses that were of largest magnitude in directions generally concentric to the Tharsis topographic rise [*Carr*, 1974; *Blasius et al.*, 1977]. Wrinkle ridges similar to lunar mare ridges also occur in the Tharsis area [*Lucchitta and Klockenbrink*, 1981; *Saunders et al.*, 1981], notably on the ridged plains on the eastern flank of the Tharsis topographic rise (Figure 4). Mare ridges have generally been interpreted as tectonic features resulting from horizontal compressive stresses [*Howard and Muehlberger*, 1973; *Muehlberger*, 1974; *Lucchitta*, 1976, 1977; *Sharpton and Head*, 1981]. The orientations of ridges on the Tharsis ridged plains are generally concentric to the center of the topographic rise [*Wise et al.*, 1979*a*]. Thus the stress field at the time of ridge formation was characterized by horizontal compression, with the greatest compressive stress oriented radially with respect to Tharsis.

At least four major episodes of large-scale extensional faulting in the Tharsis area have been identified on the basis of preserved tectonic features. These tectonic episodes may partially overlap in time and are all closely associated with contemporaneous or nearly contemporaneous volcanic activity. The earliest tectonic episode produced a set of linear faults oriented radially with respect to a center near 40°S, 90°W, in the Thaumasia region [*Frey*, 1979; *Wise et al.*,