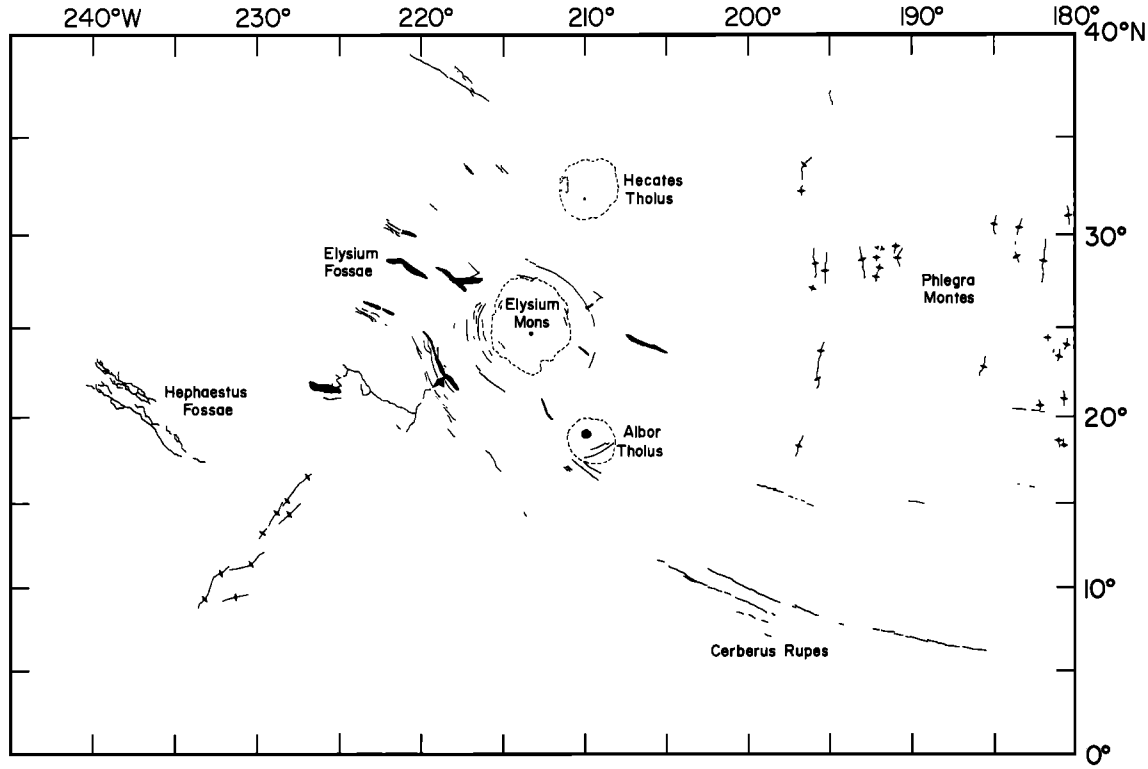

Fig. 1. Sketch map of the Elysium region, showing major volcanic constructs and tectonic features. Light lines indicate graben and narrow linear features; darker areas denote wide depressions and volcanic calderas; notched lines indicate ridges; and dashed lines outline the edges of the volcanoes. Identification of each feature was made using U.S. Geological Survey controlled photomosaics (Elysium quadrangle and portions of Amenthes and Cebrenia quadrangles) and selected Viking orbiter photographs. The approximate boundaries of Elysium Planitia, which generally coincides with the Elysium topographic rise, are 0°–40°N, 180°–260°W.

6.1-mbar reference equipotential surface [*Batson et al.*, 1979]. On top of this rise sit the three volcanoes Elysium Mons, Hecates Tholus, and Albor Tholus. The volcanic and tectonic characteristics of the region have been discussed by *Scott and Allingham* [1976], *Malin* [1977], and *Mouginis-Mark et al.* [1984].

On the basis of crater density, volcanic activity in the Elysium region ceased prior to the time of most recent activity in the Tharsis region. The plains of Elysium are more densely cratered than their Tharsis counterparts [*Neukum and Wise*, 1976; *Malin*, 1977]. *Plescia and Saunders* [1979] found that the surface of Elysium Mons has fewer craters greater than 1–1.5 km in diameter per unit area than the surfaces of Hecates Tholus and Albor Tholus. Elysium Mons is also the source of the youngest major lava flows in the region [*Mouginis-Mark et al.*, 1984]. The time of last major volcanic activity in the Elysium region is poorly constrained; the surfaces of the three volcanoes are estimated to have average ages of at least 1 b.y. according to diverse models of the Martian cratering flux [*Plescia and Saunders*, 1979], but isolated younger eruptions have also been postulated [*Mouginis-Mark et al.*, 1982].

A broad positive free air gravity anomaly is associated with the Elysium region. The anomaly is nearly centered over Elysium Mons but is much broader than the volcano itself [*Sjogren*, 1979]. Gravity models suggest that the topography of Elysium is isostatically compensated at wavelengths of 1000–2000 km [*Janle and Ropers*, 1983]. The fact that the topographic rise and gravity anomaly have persisted for so long after the cessation of volcanic activity suggests that a principally thermal mechanism for the origin of the present broad topographic rise of Elysium is unlikely [*Solomon and Head*, 1982].

A number of physiographic features in the Elysium region either are of tectonic origin or have likely been influenced by tectonic stress during their formation (Figure 1). An extensive set of concentric fractures and graben encircle Elysium Mons at distances of approximately 150–350 km from the volcano center. Some of these faults, particularly those to the west of the volcano (Figure 2), are quite fresh and sharply defined and apparently postdate the most recent volcanic units that they cut. Others appear to have been partially buried by subsequent volcanic deposits (Figure 2, lower center). On the basis of photogeologic mapping, *Mouginis-Mark et al.* [1984] conclude that most of the circumferential fracturing occurred after formation of the intermediate stage volcanic unit (the compound plains) but before the end of late stage effusive flank activity on Elysium Mons. No comparable graben surround the other two volcanoes, but these constructs have been partially buried by extensive lava flows from the vicinity of Elysium Mons [*Mouginis-Mark et al.*, 1984], so that any evidence for early episodes of fracturing around Hecates Tholus and Albor Tholus could have been obscured.

A number of linear depressions of probable extensional origin display a predominantly northwest-southeast trend. Some of these features are sufficiently narrow so that they show no discernible floor in Viking orbiter photographs (Figure 3), while others have flat floors and widths up to 15 km (Figure 4). In the first category are the Elysium Fossae (Figure 1) and a number of fault systems, including He-