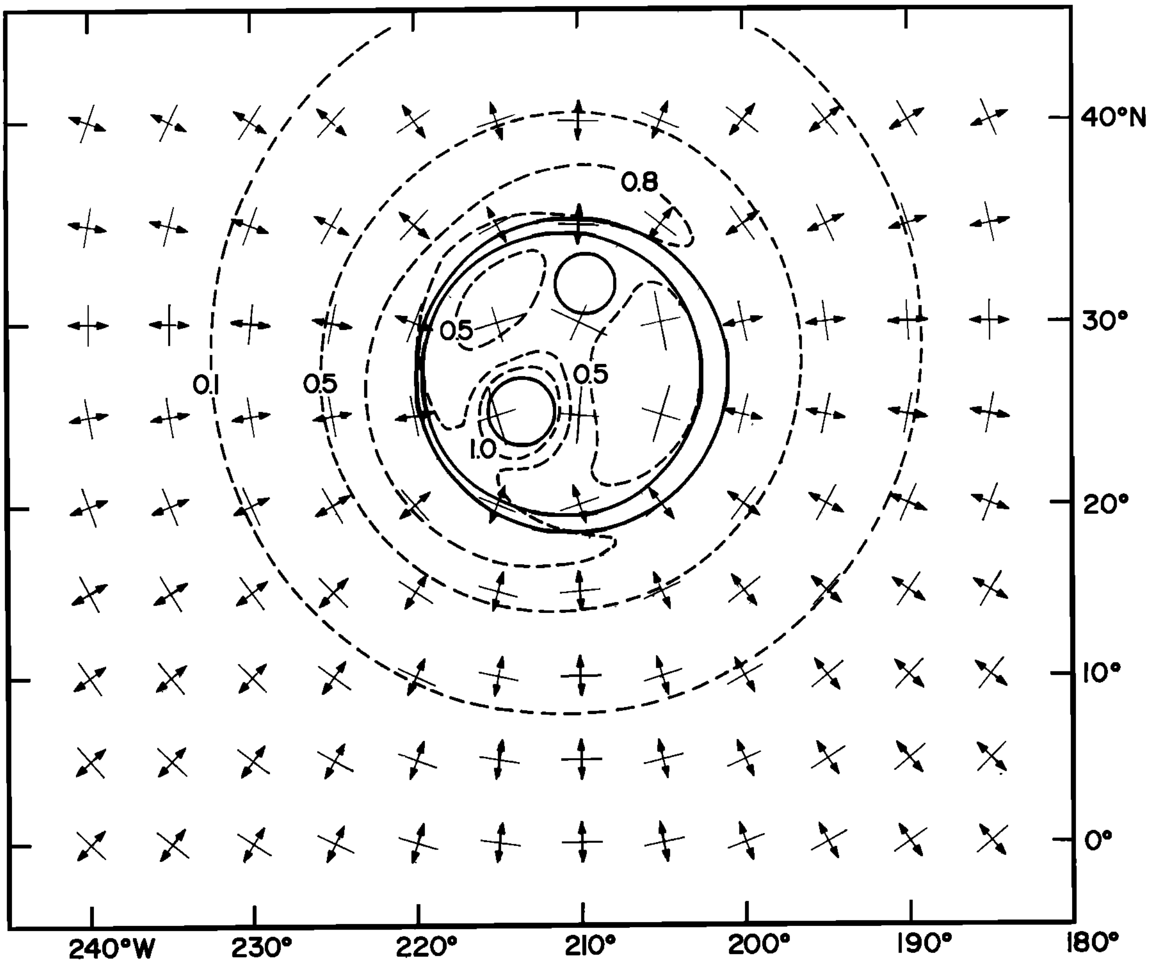

Fig. 8. Principal horizontal stress orientations and maximum stress differences at the surface of the lithosphere for a load model consisting of Elysium Mons, Hecates Tholus, and a regional load of Elysium Planitia basalts approximately 900 km in horizontal extent (load JR1 in Table 1). Crosses indicate directions of horizontal principal stresses, with arrowheads denoting extension; where both horizontal principal stresses are of the same sign, the one of larger magnitude is indicated. Dashed contours of the maximum stress difference $\Delta\sigma = \sigma_1 - \sigma_3$ (in kilobars) are also shown. The magnitudes of the loads are based on the gravity models of *Janle and Ropers* [1983]. The thickness of the elastic lithosphere is taken to be 100 km. Young's modulus and Poisson's ratio are assumed to be 10^{12} dyn/cm^2 and 0.25, respectively. Circles represent disk loads, with only the largest disk shown for the individual volcanoes and with the largest and smallest disks shown for the regional load.

Janle and Ropers [1983], except that the excess mass for Elysium Mons is the slightly larger value assumed by *Comer et al.* [1985]. A separate load might also have been considered for Albor Tholus, but we did not do so because of its small size; its volume is less than that of Elysium Mons by nearly a factor of 20 [*Blasius and Cutts*, 1981]. The Elysium Planitia loads are based on topographic relief and correspond to the disc loads TD1–3 and TD6–7 of *Janle and Ropers* [1983]. Cylindrical discs, however, are poor approximations to the areal load distribution for loads of horizontal dimension at least comparable to the local flexural length. We therefore represented each load by a stack of cylinders approximating a cone for individual volcanoes and a truncated cone (or beveled disc) for larger volcanic units. In all of these representations the total excess mass is preserved.

The stress field for one such regional load model is shown in Figure 8. The model includes loads for Elysium Mons and Hecates Tholus and a load (JR1 in Table 1) equivalent to about a 1.5-km-thick basalt unit over central Elysium Planitia. This model corresponds to the least compensated of the three-disc gravity models of *Janle and Ropers* [1983]. For this as well as other load models (Table 1), stress fields were calculated for a range of assumed values for the thickness of the elastic lithosphere.

All models with the thickness of the elastic lithosphere less than about 150 km predict stress fields with large stress differences ($\Delta\sigma = \sigma_1 - \sigma_3$, where σ_1 and σ_3 are the greatest and least compressive principal stresses, respectively) and with the greatest extensional and compressive principal stresses oriented horizontally and approximately radial and circumferential, respectively, to the center of mass of the total load (a point between Elysium Mons and Hecates Tholus). Such stress fields would give rise predominantly to strike-slip faulting, though in the presence of an additional stress field, graben circumferential to the Elysium rise or compressive features approximately radial to the rise might also be produced. The simple model of Figure 8 fails to predict concentric graben around Elysium Mons at the distances observed because the stress field in the vicinity of the shield is dominated by the compressive stress field of the regional Elysium Planitia load.