the Hellas and Isidis basins. Combining the terms for loading with the terms for deformation circumvents this dependence and results in the dimensionless values for displacement and radial and azimuthal stress of

$$\omega^* = \frac{1}{(\rho g^*)}\left[d \cdot \mathrm{ber}' d \cdot \mathrm{ker}\, r - d \cdot \mathrm{bei}' d \cdot \mathrm{kei}\, r\right] \quad (1)$$

$$\sigma^*_\theta = \frac{E/R}{2\,(\rho g)^*}\left(\frac{d}{r}\right)^2 + \frac{d\,E/R}{(\rho g)^*}\,\frac{\mathrm{bei}' d \cdot \mathrm{kei}' r}{r} + \frac{d\,E/R}{(\rho g)^*} \cdot \frac{\mathrm{bei}' d \cdot \mathrm{ker}' r}{r} - \frac{6\,d\,L^2\,\mathrm{ber}' d}{T^2}\left(\mathrm{kei}\, r + \frac{1-\nu}{r}\,\mathrm{ker}' r\right) - \frac{6\,d\,L^2\,\mathrm{bei}' d}{T^2}\left(\mathrm{ker}\, r - \frac{1-\nu}{r}\,\mathrm{kei}' r\right) \quad (2)$$

$$\sigma^*_\theta = \frac{E\omega^*}{R} - \frac{E/R}{2(\rho g)^*}\left(\frac{d}{r}\right)^2 - \frac{d\,E/R}{r(\rho g)^*}\left(\mathrm{ber}' d \cdot \mathrm{kei}' r + \mathrm{bei}' d \cdot \mathrm{ker}' r\right) - \frac{6\,d\,L^2\,\mathrm{ber}' d}{T^2}\left(\nu \cdot \mathrm{kei}\, r - \frac{1-\nu}{r}\,\mathrm{ker}' r\right) - \frac{6\,d\,L^2\,\mathrm{bei}' d}{T^2}\left(\nu \cdot \mathrm{ker}\, r + \frac{1-\nu}{r}\,\mathrm{kei}' r\right) \quad (3)$$

where

$$(\rho g)^* = \frac{E\,T}{R^2} + \rho g \qquad L = \left(\frac{E\,T^3}{12(1-\nu)(\rho g)^*}\right)^{1/4}$$

The normalized displacement, radial stress, and azimuthal stress (ω^*, $\sigma_\phi{}^*$, $\sigma_\theta{}^*$, respectively) are thus functions of d the load diameter, r the radial distance from the basin center, and T the lithospheric thickness. R is the planetary radius to the midplane of the lithosphere, and the remaining constants are identified in Table 2 with their assigned values. Primes indicate function derivatives in these equations and bei, ber, kei, and ker denote Bessel–Kelvin functions of order zero.

These equations can be further simplified by relating the distance variables d and r to the lithospheric thickness such that deformation becomes a function of load diameter and lithospheric thickness. The factor used here for this purpose (α) is the flexural parameter defined by *Turcotte* [1979] as a measure of the horizontal extent of flexure:

$$\alpha = \left(\frac{E\,T^3}{3\,(1-\nu)\,\Delta\rho\,g}\right)^{1/4} \quad (4)$$

for $\Delta\rho$ = the difference in density between load and mantle. When position is thus referenced to the load edge in units of α, both the deflection and the stress distributions achieve a characteristic form independent of lithospheric thickness (Figure 11). In particular, the radial stress outside the load is extensional over a region extending some 4–5 α from the load edge, with a maximum 1 α from the load edge. Hoop stresses are compressional over this region and of lesser magnitude [*Solomon and Head*, 1979].

The stress distribution detailed above would predict the formation of basin concentric fractures. Since hoop stresses are compressional and encircle the basin, basin–radial extension trends remain unexplained. Stresses are symmetric about the load with a compressional stress component; consequently, volcanism is also not particularly favored at any single location within a given annulus about the basin. Lithospheric flexure under a basin load thus seems most applicable to the formation of the distant Hellas concentric canyons and the massif ring graben. In order to test such an origin, two parameters are derived from each load model for comparison with independently derived estimates of the actual values.

The first of these parameters is the lithospheric thickness, for which estimates also have been derived by calculations of planetary thermal histories [*Schubert et al.*, 1979; *Toksoz and Hsui*, 1978; *Toksoz et al.*, 1978]. The formal inversion of flexural deformation for lithospheric thickness [*Comer et al.*, 1979] is based on the position and extent of concentric fractures about a modeled load. An underlying assumption is that fracturing occurs for stress values greater than some threshold value (σt), which is a fraction of the maximum attained stress level [$\sigma t = F \cdot \sigma\text{max}$ for $0 < F < 1$]. Thus fracturing is assumed to indicate an annulus where radial stress levels are in excess of σt. The stress distributions for a number of lithospheric thicknesses and F values are determined with a specific load model; and the distribution fitting the observed location of σt–level stresses then defines the inversion thickness and F value [*Comer et al.*, 1979]. In practice, however, this approach is more a test of a given load model than a systematic inversion of load–centered fracturing for lithospheric thickness.

An alternative inversion of fracture position assumes that faulting first occurs at the point of maximum stress, rather than at all stresses above some threshold value. The initial fracture is assumed to relieve or isolate stress in regions at greater radial distance; thereafter, fracturing is limited to regions of lesser radius as further deflection and vertical stress propagation dictate. *Comer et al.* [1979] briefly discussed such a model but noted that its ap-