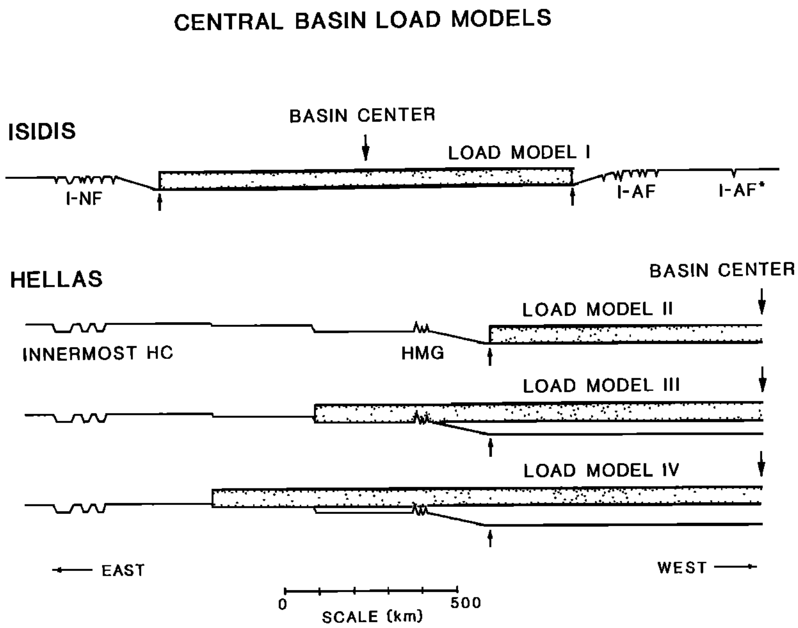

Fig. 12. Modeled loads of central basin fill in Isidis and Hellas for the elastic flexure calculations of Table 1. Profile and vertical scale are schematic; large arrows denote basin center in each profile and the smaller arrows locate the edge of observed central basin plains units. Basin-concentric structures are identified and plotted for reference, with the exception of the HC, which extend another 500 km off the Hellas profiles to the west.

however, consists of a thick, unconformable deposit with a friable, incoherent surface that covers or is interbedded with earlier basin filling units [*Grizzaffi and Schultz*, 1989]. While the underlying units may be basaltic in composition and of sufficient thickness to initiate flexure by themselves, the presence of an underlying basalt unit is not necesary to induce fracture. For a sedimentary basin load with a sediment density between 2.0 and 2.5 g/cm^3, deformation in the massif rings requires a minimum fill thickness of only 1.5 to 2.0 km. Relict craters in Isidis indicate that the surface layer there is of the order of 1 km thick, but the presence of either an equivalent thickness of sediments underneath this unit or an additional transient deposit like that proposed by *Grizzaffi and Schultz* [1989] would be sufficient to initiate fracture purely by sedimentary loading.

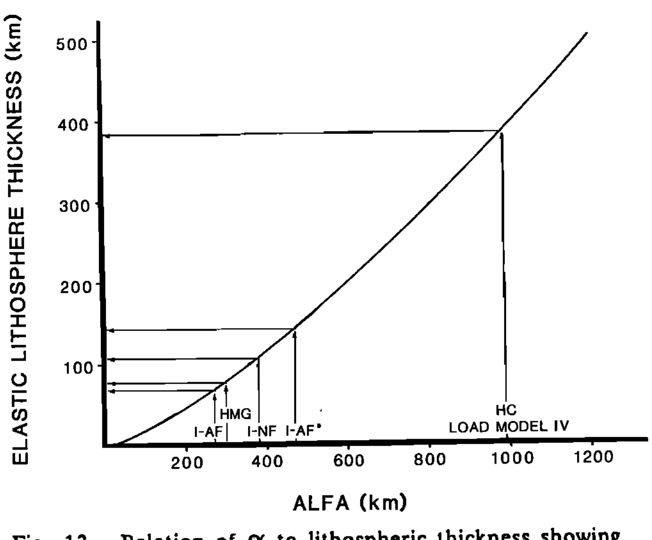

Fig. 13. Relation of α to lithospheric thickness showing the inversion of basin-concentric features to lithospheric thickness values. The distance of the outermost feature in a system from the edge of the load model is the value of α used for the inversion.

Origin of the Basin Radial Troughs

A similar but inverted basin-centered stress distribution results if a negative (rather than positive) basin load acts on the lithosphere. *Melosh* [1976] specifically proposed that isostatic equilibration of the basin cavity is equivalent to flexure under a negative load and leads to upwarping of the lithosphere around the basin. The resulting hoop stresses are extensional with peak values 2–3 α from the load edge with radial compressive stresses throughout the region (Figure 15). Although initial stress magnitudes might be insufficient to initiate fracturing, a viscoelastic lithosphere with depth-dependent viscosity allows ductile deformation at depth to concentrate stress near the surface. Deformation under these stress conditions would favor a delayed development of faulting, dikes and volcanic vents in basin-radial patterns [*Melosh*, 1976].

Such a stress history fits the observed stratigraphy of the basin radial troughs (Figures 9 and 10). The Amenthes Rupes system developed soon after basin formation but followed a distinct time interval when vertical stress concentration could precede faulting. The 900-km (2–3 α) extent of the Amenthes Rupes outside the Amenthes Fossae is consistent with the location of peak hoop stresses (Figure 15) if the I-AF represent a distance 1 α from the cavity edge. Although the trough northwest of Hellas has not