Bindschadler et al., manuscript in preparation, 1991]. Extensional features formed by relaxation should be younger than those created during formation of the topographic high and are therefore expected to superpose or crosscut structures created during a formational stage. Large regions of tessera are commonly characterized by relatively steep boundaries and lower relief interiors, yielding a plateau-like shape. Model results [*Bindschadler*, 1990] show that if the upper crust is stronger than the lower crust [*Zuber*, 1987; *Banerdt and Golombek*, 1988], then these steep sides are expected to decay more quickly than the overall relief of a region of tessera. This would allow high-relief boundaries between tesserae and plains regions (type II boundaries) to evolve into lower-relief type I boundaries.

Relaxation does not appear to be consistent with most regions of subparallel ridged terrain (T_{sr}). Most areas of T_{sr} are not associated with any extensional features and are unlikely to have resulted from gravity-driven processes. Troughs and ridge-and-trough structures within the T_{tr} are consistent with an extensional origin. However, simple models of the relaxation process do not explain why extension in the T_{tr} would be manifested differently in one orientation (troughs) than in another (ridges/valleys).

It is more likely that some regions of disrupted terrain have been modified by relaxation. Grooves are relatively common within the T_{ds} (Figure 5) and appear to indicate relatively late stage extensional deformation. Intratessera plains in Tellus Regio, within the disrupted terrain, tend to occur at relatively high elevations (Figure 7). All other factors being equal (such as the availability of magma at depth), potential energy considerations suggest that eruptions should occur preferentially at lower elevations. However, high elevations may favor eruptions for two reasons, both consistent with relaxation. In the first, if the thermal gradient is sufficiently steep, crustal materials (presumably basaltic or diabasic) will cross the solidus before they cross the basalt-eclogite phase transition. If so, melting can occur, and magma is available to be erupted. Temperatures near the solidus also tend to enhance thermally activated creep and favor relaxation of Airy-compensated topography. The second reason is that relaxation models predict an extensional stress regime throughout the crust, which tends to enhance crack propagation and allow melt easier access to the surface.

One region within Tellus Regio exhibits features which are best explained by gravitational relaxation (Figure 12). In this region, three linear troughs crosscut the disrupted terrain and are therefore relatively young. This crosscutting relationship is most clearly developed in the westernmost trough. The southern part of the trough is floored by smooth plains material, but slightly to the north, remnants of the ESE trending structures which dominate the terrain to the west of the trough are crosscut by the N-S trending structures of the trough itself. The troughs are interpreted to be extensional in nature on the basis of their topographic shape and the presence of numerous discontinuous subparallel structures similar to those observed in Devana Chasma and interpreted as fault scarps [*Stofan et al.*, 1989]. Between troughs there are numerous grooves and small, faint, linear structures that parallel the strike of the troughs. These features also appear to crosscut ENE trending structures and are interpreted to indicated pervasive extensional deformation throughout the region. These extensional features lie at high elevations (Figure 12*b*) and are approximately parallel to a broad trend defined by the highest elevations in Tellus Regio. The plains-tesserae boundary in this region is similar to type II boundaries (Figure 7) by virtue of its relative linearity at the 100-km scale and the presence of ridges in the adjacent plains, but the boundary lacks a region of subparallel ridged terrain. Plains ridges lie at elevations below ~1.5 km and appear to be asymmetric. However, this appearance is likely to be due to layover and/or foreshortening in the radar image, caused by the steep topographic slope (Figure 12*b*). Similar effects are observed within Akna Montes. We therefore interpret the ridges as compressional features.

The topographic relationship of extensional and compressional structures in eastern Tellus, their close proximity, and the relatively late stage nature of extensional structures in this region are all consistent with gravitational relaxation. While gravity sliding might explain some aspects of the structural framework of the region, the large area involved and the large width of features such as the troughs suggest that deformation is not thin-skinned. In addition, the westernmost of the three troughs lies along a relatively gentle westward facing slope, yet no parallel compressional features are observed in the tessera terrain to the west of this trough. Therefore we favor a relaxation model over one involving thin-skinned deformation. None of the four formational models predicts the structural and topographic relationships described in this part of eastern Tellus. On the basis of this example and the consistency of observations in the T_{ds} with the model predictions, we suggest that relaxation is a significant part of the evolution of tessera terrain.

Relaxation, or gravitational collapse, is also suggested by numerous workers to be a significant process in many terrestrial mountain belts, including the Basin and Range Province [*Froidevaux and Ricard*, 1987], the Hercynian belt in southern Europe [*Ménard and Molnar*, 1988], and the Appalachians [*Dewey*, 1988]. Extension has also occurred from the Quaternary to the present within the Altiplano [*Dalmayrac and Molnar*, 1981; *Sébrier et al.*, 1985] and the Tibetan Plateau [*Chen and Molnar*, 1981; *Armijo et al.*, 1986]. This process may be an integral part of the evolution of terrestrial mountain belts [*Froidevaux and Ricard*, 1987; *Dewey*, 1988], which are the principal loci of crustal thickening on the Earth. All other factors being equal, the high surface temperature of Venus should enhance such a process [*Weertman*, 1979].

SUMMARY AND CONCLUSIONS

We have tested a set of basic tectonic models for the formation and modification of tessera terrain against observations derived from PV and Venera data. Mantle upwelling, crustal underplating, and gravity sliding do not appear to satisfy basic observational constraints for the majority of tesserae. Mantle upwelling fails to predict shallow apparent depths of compensation, and tessera terrain contains neither large shield volcanoes nor large rift systems that would be consistent with more evolved or fossil upwellings. As presently understood, crustal underplating produces no compressional features and therefore is not responsible for the formation of T_{sr} or T_{ds}. In order to produce a region of T_{tr} such as Laima Tessera for underplating requires unrealistically large heat input within a geologically short period of time. Gravity sliding may be important on a local scale (e.g., Moira "Tessera", Figure 10) but is not favored for larger regions of tessera because the predicted structural framework and its