thickness (about 30 km) which was initiated by an increase in upper mantle temperature of about 100°C and which has been spreading at about 1 cm/yr for the last 200 m.y.

In general, the environmental variations between the two planets modifies but does not seem to preclude crustal spreading processes. Left undetermined by existing studies is the influence that the different environmental conditions will have on the nature, morphology, and spacing of abyssal hills and fracture zones formed in the Venus environment. These factors are of the utmost importance because it is known that the thermal structure and rheology of the oceanic crust and the interplay of volcanism and tectonism have an important but not yet fully understood influence on the characteristics of fracture zones and abyssal hills on Earth. Some of the variations in otherwise generally similar features (Table 1) may be due to these factors, although it cannot be ruled out that differences in the environment preclude the formation of these features in a Venus crustal spreading regime. Thus particular attention must be paid to the continually improving models for the formation and evolution of fracture zones and abyssal hills on Earth and the application of these models to the Venus environment. Continued investigation of the nature of spreading processes under Venus conditions will also be of significance in terms of understanding the Earth's Archean, a time when the thermal structure of the Earth is thought to be similar to that of present-day Venus.

4.5. *Plateau-like nature of the trough-and-ridge tessera.* Tessera terrain in general lies at elevations of 2 km (±1 km standard deviation [*Bindschadler and Head*, 1989*b*]) above the mean planetary radius, while most plains units (which do not show the distinctive patterns of the trough-and-ridge tessera) lie at or within 1 km of mean planetary radius. Two types of topographic boundaries are observed at the edge of the trough-and-ridge tessera terrain: (1) abrupt, where the edge is marked by a distinctive topographic change over relatively short distances and by a zone of deformation, as in Kamari Dorsum at the eastern edge of Laima Tessera (Figure 1), and (2) transitional, where the trough-and-ridge tessera terrain slowly decreases in elevation and is embayed by the volcanic deposits forming the lowland plains, as in southern and western Laima Tessera (Figure 1). There are several possible explanations for these observations, many of which can be tested with existing data and data from the upcoming Magellan mission: (1) the trough-and-ridge tessera are high because they represent the thermally most youthful part of a crustal spreading system. This would require that spreading centers be located within zones of trough-and-ridge tessera and that they be currently active. (2) The trough-and-ridge tessera are high because of enhanced crustal thickness due to increased crustal thickness production along strike at the spreading center (the Iceland hot spot effect). This would require evidence that this process is operating at spreading centers and would predict that the terrain is in isostatic equilibrium. (3) The trough-and-ridge tessera are high because of enhanced crustal thickness related to deformational processes operating subsequent to its formation in the spreading center environment. This would seem to require significant surface deformation reflecting the deeper processes of crustal thickening. (4) The trough-and-ridge tessera are completely unrelated to processes associated with crustal spreading and the morphological and geometrical similarities are unrelated in terms of processes of formation.

Explanations 1-3 must also account for the apparent lack of the trough-and-ridge pattern in the lowlands, while no such explanation is required for 4. The apparent lack of trough-and-ridge pattern in the lowlands could be due to volcanic flooding of the pattern, as suggested by the embayment relationships along the southern and western margins of Laima Tessera (and preferential preservation of tessera terrain in areas of younger and/or thicker crust). In this case, lava thicknesses in the range of several hundred meters would be required to cover the texture, and one would expect to see transitional areas and patchy areas of exposed trough-and-ridge tessera. *Sukhanov* [1986] cited the patterns of irregular polygons in volcanic plains units that are adjacent to some tessera as evidence for regions of buried tessera. On the basis of the distribution of these patterns, he proposed that the actual abundance of tessera might be a factor of two more than what is presently exposed, perhaps representing some global process of "tesserization." Comprehensive analysis of existing and Magellan data will be required to evaluate fully this possibility. Alternatively, if the trough-and-ridge pattern is produced preferentially in regions of thicker crust, perhaps there is some factor in the production of normal thickness crust at Venus spreading centers (different thermal regime or different ratio of extrusion to intrusion) that might result in the lack of production or preservation of the orthogonal texture (i.e., thicker crust is better preserved than thinner crust, or only thick crust exhibits the orthogonal texture). Additional analyses and data are clearly required to test these ideas and to establish the relationship of the trough-and-ridge tessera to the surrounding plains.

Several additional properties of tessera may help to resolve the origin of the trough-and-ridge tessera. Tesserae in general are characterized by distinctive and anomalously high surface roughness at a range of scales from centimeters to decameters compared to plains units in general [*Bindschadler and Head*, 1989*b*]. Localized volcanism and pervasive faulting producing rift mountains/abyssal hills are responsible for the abnormally rough topography at the centimeter to decameter scale seen on the seafloor [*Gallo et al.*, 1984, Figures 8-9; *Searle*, 1984], which is very similar to the type of pervasive roughness seen in the tessera terrain [*Bindschadler and Head*, 1988*a*, 1989*b*]. High-resolution data obtained by the Magellan mission will permit the correlation of areas of enhanced surface roughness with specific geologic features and will allow further evaluation of the similarities and differences between the features on Venus and Earth.

Line-of-sight (LOS) gravity data exist for all or part of several tessera regions (Tellus Regio, Laima Tessera, and Alpha Regio) [*Sjogren et al.*, 1983]. Maps of LOS gravity anomalies show that these three regions are characterized by very small anomalies despite their topographic elevation, in contrast to the very large anomalies associated with other areas of high topography, such as Beta Regio. The small LOS gravity anomalies, together with the high topography characteristic of the tessera, may indicate compensation due to crustal thickness variations or shallow mantle processes. More widespread coverage and higher resolution gravity data will be of extreme importance in distinguishing between models for the formation and evolution of tessera in general, and trough-and-ridge tessera in particular.

5. Discussion and Conclusions

On the basis of the similarities in morphology, geometry, and spacing, it is concluded that processes analogous to those responsible for the ocean floor fabric on Earth are good