abyssal hills may be a function of lithospheric strength in the vicinity of the spreading center, rather than spreading rate. If so, the higher surface temperature of Venus may extend the volcanic-dominated regime to slower spreading rates. In addition, the presence of a mantle hotspot might also be expected to increase the amount of volcanic topography and/or resurfacing because of increased availability of melt.

The roughly orthogonal pattern of terrestrial seafloor is most like the structural pattern of trough and ridge terrain (T_{tr}), with troughs corresponding to fracture zones and ridge and valley structures corresponding to abyssal hills [*Bindschadler and Head*, 1988*c*; *Head*, 1990*b*]. If disrupted or subparallel ridged terrain (T_{ds}, T_{sr}) originally possessed an orthogonal pattern, then that pattern has been so strongly overprinted by subsequent deformation as to be unrecognizable. Morphologic observations suggest that only the T_{tr} structural pattern could have originated as purely the result of a spreading process. We also note that the western Aphrodite region displays high values of RMS slope and diffuse scattering [*Bindschadler and Head*, 1988*a*], properties characteristic of much of the tessera terrain [*Bindschadler and Head*, 1989], including Laima Tessera (the type area for T_{tr}). A spreading process appears to be consistent with some of the basic properties of tessera terrain.

Specific comparisons can be made between a number of features in the trough and ridge terrain and the terrestrial seafloor that may help to resolve the applicability of the spreading hypothesis. Unlike many terrestrial fracture zones, troughs in the T_{tr} are not necessarily parallel and have not been demonstrated to define the distinct changes in regional elevations that result from the juxtaposition of lithosphere of different ages. Troughs also appear to be loci of plains volcanism, which is not a common characteristic of terrestrial fracture zones. Although important, such differences do not allow us to rule out a spreading analogy. On Earth, changes in poles of motion of plates and propagation of spreading centers can result in complex, nonparallel geometries for fracture zones. A lack of distinct elevation changes across fracture zones is commonly observed in terrestrial lithosphere older than ~80 m.y. and is thought to be due to thermal equilibration. The presence of volcanic deposits in the floor of troughs may simply reflect higher surface temperatures, thinner lithosphere, or more pervasive volcanism on Venus.

One characteristic of terrestrial seafloor is the presence of numerous small volcanoes or seamounts, many of which are thought to originate near a spreading center. Their distribution is not well characterized over the entire ocean floor, but statistical studies suggest number densities of the order of 200 seamounts with over 1 km of relief per 10^6 km^2 [*Smith and Jordan*, 1988]. Numerous small volcanic domes are observed on Venus [*Barsukov et al.*, 1986] and have been suggested to be analogous to terrestrial seamounts [*Aubele and Slyuta*, 1990]. According to *Smith and Jordan*'s [1988] values, there should be of the order of 300 seamounts within Laima Tessera (the location of most of the T_{tr}) with elevations >1 km and corresponding basal diameters >10 km. Differences between large volcanoes on Earth and Venus suggest that Venusian seamounts might be significantly lower in elevation [*Head and Wilson*, 1986] but would therefore have correspondingly larger diameters. Such factors, as well as unknown differences in the spreading process between Earth and Venus might lead to both lesser production of seamounts and difficulties in identifying those that are present. It is equally clear, however, that there are no easily identifiable volcanic domes larger than 10 km in diameter within the type area for T_{tr} (Figure 4).

A major identifiable characteristic of slow spreading terrestrial ridges is a rift valley, defined by fault-bounded escarpments. Deformation of newly formed crust is accommodated by numerous normal faults within the rift valley. However, even major faults (with up to 200 m of throw) persist for only 1-2 km along strike, while major features such as the rift valley walls persist for up to ~40-60 km along strike [*Macdonald*, 1986]. This lack of continuity contrasts strongly with the length and continuous nature of transform faults and their aseismic extensions and suggests that regions between transform faults deform independently of one another. If formed by a Venusian spreading process, ridge and valley structures in the T_{tr} should appear continuous across troughs only by coincidence. Most ridge and valley structures in the T_{tr} appear to be discontinuous across trough structures, but some do appear to crosscut troughs (Figure 4). A critical test would be to see whether most ridge and valley structures appear to disrupt the floors of troughs not partly filled by smooth plains. This test could be made using Magellan data.

A seafloor spreading process must be considered a candidate for the origin of the trough and ridge terrain. On the basis of analogies with terrestrial spreading, this process is consistent with the basic constraints (topography, gravity, orthogonal structural pattern) offered by observations. However, morphologic observations clearly show that if such a process is responsible for the T_{tr}, it produces a surface that is lacking in seamounts and commonly exhibits nonparallel transforms which are also loci for plains volcanism. The differences between terrestrial seafloor and T_{tr} suggest that further investigation will be needed to resolve the the origin of T_{tr}, possibly including analysis of high-resolution Magellan data. Important tests of the spreading hypothesis include understanding the nature of structural and age relationships between the troughs and ridge and valley structures and the nature of deformation that formed ridge and valley structure.

Gravity-Driven Modification

A number of terms have been used to denote gravity-driven tectonic processes, including gravity sliding, gravity spreading, and gravitational relaxation. In terms of Venus tectonics, two modes have been discussed. The first involves the formation of a detachment surface, creating either a brittle or ductile décollement over which a relatively thin slice or wedge of crust slides [e.g., *Sukhanov*, 1986; *Smrekar and Phillips*, 1988]. This process will be referred to as "gravity sliding." Over the large areas and at the relatively small regional slopes that characterize tessera terrain, gravity sliding is expected to occur at geologic strain rates ($<10^{-14}$ s^{-1}), rather than as a catastrophic event, such as a landslide. The second mode involves whole crustal deformation driven by gradients in vertical normal stresses associated with relief at the surface and/or along the crust-mantle boundary [e.g., *Ramberg*, 1968; *Artyushkov*, 1973] and will be referred to as "gravitational relaxation."

Gravity sliding. Previous studies suggesting a gravity-sliding origin for tessera terrain include *Sukhanov* [1986], who suggested that gravity sliding occurred above gentle asthenospheric upwellings, and *Kozak and Schaber* [1986], who conclude that Laima Tessera originated by gravity sliding. *Smrekar and Phillips* [1988] formulated a one-dimensional