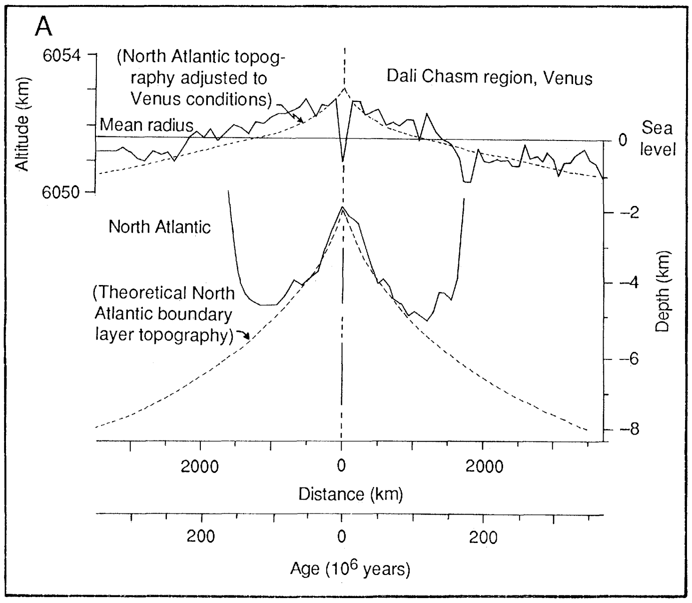

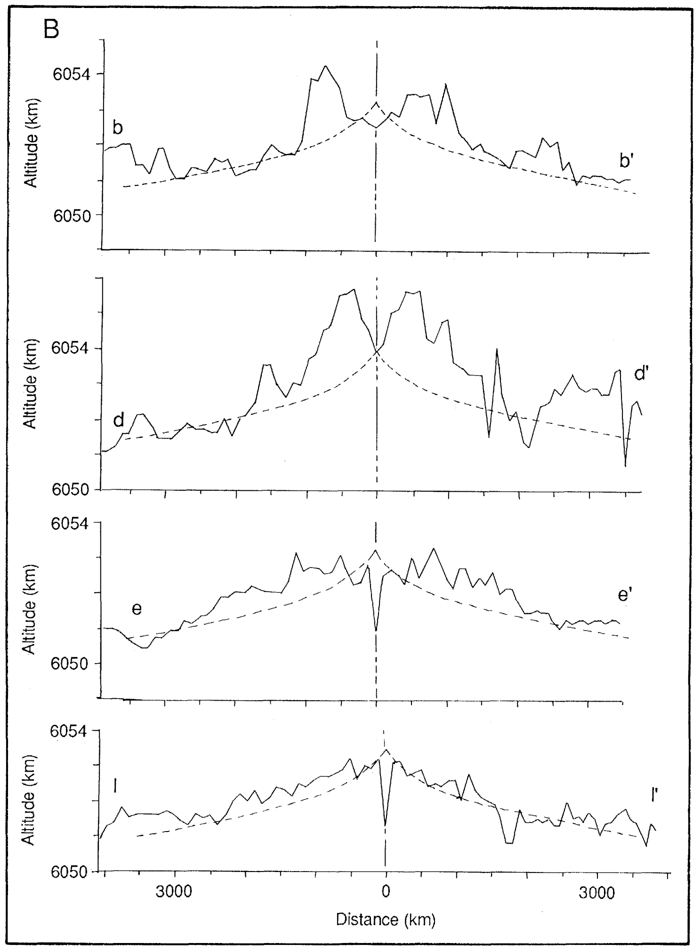

Fig. 5. Idealized divergent plate boundary profiles for Earth (*13*) and Venus. (**A**) Comparison of Earth (*40*) and possible Venus slow-spreading ridges. Solid line is observed profile, and dashed line is predicted profile. Idealized Venus profiles are obtained by boundary-layer theory relations discussed in (*14*), which take into account the Venus environment. (**B**) The slow-spreading idealized profile (dashed line) is compared to actual profiles from western Aphrodite Terra taken parallel to cross-strike discontinuities (*31*). Location of profiles is shown in Fig. 4A.

features oriented generally orthogonally to the rises (Fig. 3) and topographic symmetry in directions parallel to these features, (vi) lateral offset of the topographic rise at the fracture zone–like features (Fig. 3), (vii) topographic relations (step-downs) consistent with predictions for transform faults (Fig. 3), and (viii) probable volcanic features often located at the ridge crest. Given this strong similarity in topography (items i, ii, and iii), morphology (items iv, v, and vii), and configuration (items vi and vii), is there evidence for actual divergence and crustal spreading?

There are no seismic and magnetic data from Venus, and the present weak magnetic field combined with the high surface temperatures probably preclude the formation of detectable magnetic stripes. In addition, there is no direct evidence for the age of the rocks, and sufficient resolution for developing crater-count–related ages is not available in this part of Venus. Three factors, however, seem to provide positive evidence for active divergence and crustal spreading. First, as previously outlined, the magnitude and direction of topographic changes across the fracture zone–like features on Venus are consistent with changes in age implied by the ridge crest offsets (Fig. 3 A and B). Examples of topographic step-downs along the distal portions of fracture zones and cross-strike discontinuities further underline this relationship. Second, the broad aspects of bilateral topographic symmetry of the rises are consistent with a change in altitude as a function of time as newly created crust and lithosphere cools, thickens, and sinks as it moves away from the ridge crest. Comparison of actual profiles on Venus to idealized profiles for Venus and Earth (*13, 14*) (Fig. 5A) shows that the western Aphrodite region is comparable to slow-spreading centers on Earth, where rates are typically a few centimeters per year. Some aspects of the topography suggest that local accumulations of volcanic deposits such as those responsible for Iceland may be produced in which the plateau-like topography is superposed on the general thermal boundary-layer trends (compare upper and lower two profiles in Fig. 5B). In addition, the offset symmetry of topography in individual domains between fracture zone–like features (Fig. 3A) is positive evidence that the topographic symmetry is not simply thermal uplift associated with broad "hot spot" type regional plumes (*15*), but rather is linked to the properties of narrow individual segments of lithosphere between fracture zones (domains). Third, the nature of one aspect of the bilateral topographic symmetry of rises on Venus (that is, the individual features 100 to 500 km wide that appear in the same position on both sides of the broadly symmetrical profile; see Fig. 4B) could be interpreted as topographic segments that are formed initially at the ridge crest and then rifted and moved laterally apart to their present position equidistant from the ridge crest.

Examination of maps and series of profiles within domains (between fracture-zone–like features) in western Aphrodite Terra reveals several types of symmetrical elements or structures (Fig. 6), such as linear ridges 300 to 500 km wide arrayed parallel to the rise crest and normal to the fracture zone–like features, linear troughs 100 to 300 km wide arrayed parallel to the rise crest, linear scarps, and arcuate and circular structures of various sizes located within the domains and equidistant from the ridge crest. Similar features exist in terrestrial divergent zones (*27*), although they are not commonly studied and documented on Earth for chronological purposes because of the greater simplicity and elegance of the magnetic stripe method of seafloor dating. One common terrestrial type is segments of oceanic rises and plateaus that are created by periods of enhanced volcanism at ridge crests, then rifted apart and spread distally from the ridge crest (*32*). Another is the creation of individual volcanoes or ridges of volcanoes along the ridge crest and the splitting and lateral migration of these (*33*). The Venus examples (Fig. 6) are interpreted to be topographic segments that are formed initially at