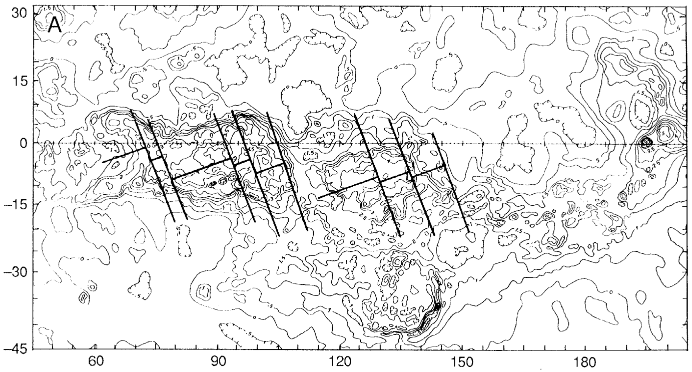

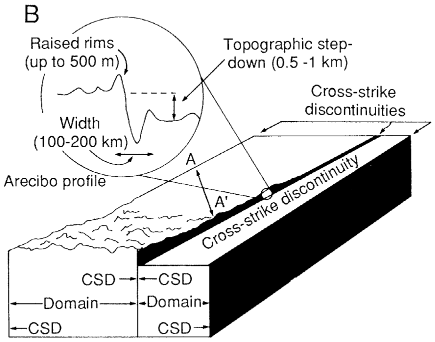

Fig. 3. Cross-strike discontinuities in Aphrodite. (**A**) Map view (*21, 31*). Cross-strike discontinuities strike in a north-northwest direction. Lines normal to the cross-strike discontinuities represent the centers of symmetry of topographic profiles shown in Fig. 4. (**B**) Generalized block diagram showing topographic and morphologic characteristics of cross-strike discontinuities [high-resolution data from (*23*)].

linear discontinuities extend for several thousand kilometers across Aphrodite Terra and into the surrounding lowlands, trend in a N20°W direction nearly perpendicular to the approximately east-west trend of Aphrodite, and are separated by distances of many hundreds of kilometers (Fig. 3A). Examination of these linear topographic features where they cross near-equatorial high-resolution altimetry tracks (*20, 21*) reveals that they are characterized by abrupt topographic changes from one side to the other, steep slopes within the zone, and associated central troughs and lateral peaks, all occurring over a distance of 100 to 200 km (Fig. 3B). These linear discontinuities are topographically most distinctive in and at the edge of the central Aphrodite Terra area and become less pronounced as they trend into the surrounding lowlands. The linear discontinuities thus subdivide western Aphrodite into a series of rectangular segments or domains 400 to 500 km wide and several thousand kilometers long, each parallel and striking in a northwest-southeast direction (Fig. 3A). These cross-strike discontinuities clearly share many of the topographic, morphologic, and scale characteristics of fracture zones on Earth (compare Figs. 2B and 3B).

Bilateral topographic symmetry. One fundamental characteristic of topographic rises on Earth is that topography is bilaterally symmetrical across rises in a direction broadly parallel to fracture zones (Fig. 2A) (*30*), and is less symmetrical in directions more parallel to the general, more sinuous, topographic trend of the rises. Thus, additional tests for the presence of divergent plate characteristics on Venus would be to examine the degree of symmetry of topography across Aphrodite in directions broadly parallel to the fracture zone–like linear cross-strike discontinuities, and to test for potentially rifted and separated topographic elements analogous to oceanic plateaus symmetrically distributed across the rise.

Topographic profiles across Aphrodite Terra that are oriented parallel to the cross-strike discontinuities show bilateral symmetry (*21, 31*) (Fig. 4B) and are characterized by several components: a broad sweeping bilaterally symmetrical shape extending laterally for several thousand kilometers, a central bilaterally symmetrical steep-sided plateau approximately 2000 km in width with flanking lows, and individual features 100 to 500 km in width that appear in the same position on both sides of the broadly symmetrical profile. The bilateral nature of the symmetry is illustrated by reversing profiles and then comparing them by centering them on their axis of symmetry (Fig. 4B) and by other quantitative tests (*31*). Additional characteristics of these profiles are the patterns in which they are arrayed: within a domain between cross-strike discontinuities, parallel profiles are very similar to each other (Fig. 4C), and when topographic profiles are compared between zones, the general bilateral symmetry of each profile is clear, but the details of symmetry differ. When profiles are taken at large angles to the trend of the cross-strike discontinuities, the bilateral symmetry is reduced (*31*).

Thus, the western Aphrodite region shows bilateral topographic symmetry and symmetry patterns in a manner similar to oceanic rises and divergent plate boundaries on Earth. Examination of the nature of the centers of symmetry of these profiles should provide a further test of the similarity between western Aphrodite and terrestrial divergent plate boundaries.

Nature of axial regions of rises. On Earth, axial regions of rises are highly linear between fracture zones and are offset up to several hundred kilometers at the fracture zone or transform fault (Fig. 2). The detailed structure and morphology of axial regions is linked to spreading rates. On slow spreading ridges such as the mid-Atlantic ridge, the summit is characterized by a median valley or rift a few kilometers wide and several hundred meters deep, extensive intrusions and localized extrusive volcanism, and occasional larger volcanoes on the floor and flanks. On fast-spreading ridges like the East Pacific Rise, there is strong axial symmetry, and local volcanoes, but no median rift valley. In other places (Iceland, for example), greater-than-average rates of volcanic activity independent of spreading rate, perhaps related to hot spots, produce broad plateaus several kilometers higher than typical mid-ocean rises and several hundred kilometers wide, superposed on the divergent boundaries. In general, the average elevation of the rise crest is remarkably uniform throughout the global mid-oceanic rift system on Earth (*13*). Exceptions include plateau regions such as Iceland; the presence of additional Icelandic-type plateaus on Earth would considerably alter this relationship.

In western Aphrodite Terra, within a domain between cross-strike discontinuities, the centers of symmetry of adjacent topographic profiles define a linear crest of symmetry extending from one cross-strike structure to the next (Fig. 4C) and trending about N70°E. The detailed structure of these linear axial regions is complex and variable. In some zones, the axial region is characterized by a 100- to 300-km wide, 1- to 2-km deep linear trough, with local domical topography on the flanks (Fig. 4B, profiles d and e). On the basis of high-resolution images of central Beta Regio, where the topography is similar, these features are interpreted to be rift zones with associated volcanoes (*7*). This type of topography is especially well developed in the Dali Chasma area of central Aphrodite (Fig. 4B, profile e). In other zones, the axial region is characterized by a linear topographic crest with no apparent axial trough (Fig. 4B, profile c), and often by a broad plateau (Fig. 4B, profiles b, c, and d). Thus, in terms of their general linearity and range of morphology, the axial ridges in western Aphrodite are comparable to axial regions of divergent plate boundaries on Earth.

Transform faults. On Earth, the region between ridge offsets along the fracture zone is known as a transform fault, and is characterized by ridge crest separation distances of up to 1000 km, intense shear, different age crust on opposite sides of the zone, changes in topography across the zone linked to the difference in ages (young crust is topographically high relative to older crust), and enhanced earthquake activity. Ridge crests can be offset in a left-