MORPHOTECTONICS OF VENUS; V. J. Finn and V. R. Baker, Department of Geosciences, University of Arizona, Tucson, AZ 85721; A. Z. Dolginov, Lunar and Planetary Institute, 3600 Bay Area Boulevard, Houston, TX 77058.

Venus topography can be mapped morphostructurally to reveal nested hierarchical patterns of quasi-circular upland/lowland complexes. These patterns are interpreted as surficial effects of hierarchically structured, long-acting mantle convection. Beta Regio, Alpha Regio, and Artemis illustrate this process of dynamical interaction between the deforming lithosphere and the convecting mantle.

For the oceanic portions of Earth's surface, the kinematic theory of plate tectonics [1,2] has proven to be immensely successful [3]. Problems with its ability to explain some continental areas [4] may be resolved through the secondary theory of plume tectonics [5]. The planet Venus, with its first order geophysical similarities to Earth [6], should logically provide an objective test of the theory. Indeed, several plate-tectonic attributes were ascribed to Venus [7,8] based on inclusive pre-Magellan data. Such prediction by theoretical constructs and testing against previously unknown phenomena are considered to be philosophical essentials for proper science [9,10]. Is the theory falsified because Magellan mission data clearly indicate the inability of plate-kinematic theory to explain Venusian tectonics [11,12]? Indeed, those few local phenomena so explicable has become major foci of study [13,14]. If we accept the view that a scientific theory must not be restricted to one case (Earth) but rather should generalize to multiple cases (Earth and Venus), then a more general model than the plate-tectonic one is clearly required.

The surface of Venus is dominated by large quasi-circular topographically elevated regions separated by lowland plains, many of which also are quasi-circular in planimetric shape. These features occur at various scales and morphological types, and are given the arbitrary names coronae, arachnoids, dome-like uplands, and plateaus. They are presently explained through various processes of mantle upwelling [15,16], downwelling [17,18], or combinations of these [19].

We proposed that the various quasi-circular upland/lowland complexes of Venus comprise hierarchical patterns of morphostructures produced by endogenetic processes [20]. The quasi-circular global-hierarchical morphostructures (QGMs) include even the large Lakshmi [21] and Artemis structures [22]. Nikishin et al. [23] also proposed such a genetic association, including Lakshmi [24], but did not map the hierarchical patterns. The latter are of great importance, since they seem to reflect directly the influence of convective pattern scales arising from various levels of the mantle [25]. We believe the convective scale hierarchy to be the characteristic of long-acting mantle convection in the stratified and random inhomogeneous mantles of the terrestrial planets [25]. Venus, unlike Earth, rather faithfully records the hierarchical patterns in its topography. This may be because the lack of an asthenosphere, possibly arising from a dehydrated upper mantle [26], permits rather direct stress transfer through the Venusian lithosphere. Blocks of lithosphere are deformed into patterns that mimic the underlying patterns of mantle flux. Examples of Venusian QGMs are discussed below.

<u>Beta Regio</u>, previously studied for its complex history of rifting and volcanism associated with Devana Chasma [27], can be shown topographically to consist of a 3000-km megastructure divided by radial fracture zones into interior megablocks. A hierarchical pattern of daughter quasi-circular morphostructures can be discerned at successively smaller scales, as follows: 1450, 1200, 900, 500, 380, and 200 km in diameter. These extend from inside the domal megastructure to the surrounding plains. Both positive (uplifted) and negative (depressed) morphostructures occur in regular associations.

Alpha Regio, with its local surficial complexes of compressional ridges and lateral shear/graben structures [28], has 1450-km diameter QGM core containing hierarchically nested smaller scale QGMs of 480-500, 380 and 200 km diameters. The QGM patterns are expressed in regional topography and are independent of the local structural detail of compressional ridges.

Artemis, conventionally interpreted as an unusually large corona [29], is one of 10 very large QGMs comprising a chain that manifests itself topographically as Aphrodite Terra. Artemis itself is a 2800-km QGM. Second-order QGMs, about 1400-1500 km in diameter, fill its interior plan. Lower order QGMs in the local hierarchy have scales of 1000, 570, and 300 km. The mapped pattern [22] is analogous to laboratory simulations of mantle plume-head interactions with the lithosphere [30]. However, the global Venusian QGM pattern is much more than the mere assembly of isolated plume-head-lithosphere interactions. Various QGMs probably comprise complex stages in an evolutionary sequence.

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