GEOLOGY OF ALPHA REGIO, VENUS FROM MAGELLAN DATA.

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Introduction. Alpha Regio, identified as a region of tessera in recent Arecibo images [1], is a polygonal topographic upland approximately 1300 km across, centered on 25°S, 4°E. Tesserae are broad, elevated regions characterized by intersecting sets of linear features with spacings throughout the range of 500 m to 20 km and lengths of the largest features predominantly in the range of 20 to 100 km. They represent a complex and widespread manifestation of Venus tectonic processes, covering on the order of 10-20% of the surface [2,3]. Comparison of predicted styles and sequences of deformation with observed tectonic features and their crosscutting and stratigraphic relationships will help to constrain the possible origins for tessera.

Observations. Four distinct morphologic types of features constitute the tectonic fabric of Alpha Tessera: parallel ridges and troughs spaced less than 1 km apart, broader ridges and troughs (spacing 10 - 20 km), linear disruption zones, and flat-floored valleys interpreted as graben. The most pervasive of these are the small parallel ridges and troughs. They tend to be found in small regions (about 10 - 50 km on a side), often associated with larger ridges and troughs (discussed below). Ridges within a single such region exhibit a consistent orientation, but the overall strike direction of different groups of ridges ranges from NW to NNE. Parallel ridges and troughs are consistently disrupted by other structures and appear to be relatively old. Their apparent age and widespread distribution suggests that these features could represent a primary tectonic fabric of Alpha.

A second morphologic type consists of broad ridges and troughs which group together to form distinct terrain types. The simplest terrain consists of areas dominated by parallel ridges and troughs spaced about 10 - 20 km apart; finer-scale ridges and troughs are also present and parallel the broad ridges. This terrain type dominates the western edge of Alpha but is less common elsewhere. A more complex terrain, usually found in the interior of Alpha and at high elevations, is characterized by domical to arc-shaped ridges and troughs about 10 km wide and less than 70 km in length. The smaller parallel ridges and troughs are most commonly oriented at high angles to the large, more irregular ridges and troughs. In terms of structural complexity, the majority of tessera terrain at Alpha is intermediate between these two end-members.

Linear disruption zones (LDZ's) which interrupt structural trends along distinct bands are the third type of feature observed at Alpha. These zones display a variety of signatures in radar images including: a) narrow (< 20 km wide) troughs partially filled with radar-dark plains; b) wider zones characterized by radar-bright lineaments, presumably comprised of scarps; and c) linear zones along which most cross-trending structures are truncated. LDZ's generally strike either ENE or ESE. They are rarely crosscut by graben (see below). The ESE-trending LDZ's are relatively short (< 100 km) and are concentrated in an arcuate band that bisects Alpha. The ENE-trending LDZ's are longer (75 - 200 km) and can be found throughout Alpha.

The fourth type of feature are flat-floored, steep-sided valleys, tens to hundreds of km in length and approximately 5 km in width, that are interpreted to be graben. Like the parallel ridges and troughs, these graben are found throughout much of the region. They also tend to form sets of numerous parallel structures, the largest of which cuts across an area approximately 250 km by 500 km in the southern half of the tessera. These features appear to be the youngest structures in Alpha. They are rarely crosscut except by one another and commonly crosscut other structures.

Intra-tessera plains are found throughout Alpha and appear to postdate most of the deformation associated with tessera formation. Plains regions are found within local lows at a variety of elevations within Alpha; in some cases they are located at the same elevation as the plains surrounding Alpha. Virually all these intra-tessera plains regions have small volcanic domes or narrow (< 5 km) graben. In some plains regions small volcanic domes are cut by narrow graben which are, in turn, covered elsewhere by volcanic domes, reflecting the interleaved nature of tectonism and volcanism within Alpha. Plains are also observed to largely surround Alpha. In general, the edges of the tessera have been embayed by plains, although in some regions (e.g. northern Alpha) graben that trend at a high angle to the edges of the tessera continue uninterrupted into the plains and therefore postdate plains formation.

Interpretations and Conclusions. Present analysis of Magellan data for Alpha Regio suggests that an identifiable sequence of tectonic and volcanic events has lead to the formation of the terrain observed today. The most recent events consist of widespread extension (manifested as graben) and more localized eruptions of plains-forming lavas. Oldest events include the formation of broad ridges and troughs, and the formation of narrow, parallel ridges and troughs. Linear disruption zones commonly appear to crosscut the older ridge and trough features but are crosscut by graben. Thus, we interpret LDZ's to occupy an intermediate position in terms of sequence. One possibility is that the LDZ's represent the effects of tectonic events that affected a broader region than Alpha, but most traces of which are buried beneath the surrounding plains. Several models have been proposed to explain the formation of tessera terrain including gravity sliding over a hotspot [2,4], a spreading plume plateau model [5], and a convergence / relaxation model [6]. We are currently assessing the styles, sequences, and patterns of deformation as inferred from Magellan images from this and other regions of tessera for comparison with the predictions of these various models.

References. [1] Campbell et al., *Lunar Planet. Sci., XX,* 142-143, 1989; [2] Sukhanov et al., *Geotectonics, 20,* 294-305, 1986; [3] Bindschadler and Head, *Icarus, 77,* 3-20, 1989; [4] Kozak and Schaber, *Lunar Planet. Sci., XVII,* 444-445, 1986; [5] Head, J. Geophys. Res., *95, 7119-7132,* 1990; [6] Bindschadler and Head, *J. Geophys. Res., in press,* 1991.