GEOLOGIC EVIDENCE FOR A THICK VOLCANIC CRUST IN PART OF TELLUS TESSERA, VENUS.

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Introduction: A fundamental objective of future exploration of Venus is to understand the degree to which crustal composition varies across the planet. The results from the Venera missions indicate that the plains are generally basaltic in composition [1,2]. From a morphologic standpoint, the presence of high standing (kilometers above the surrounding plains) continent-sized uplands of tessera has led to the suggestion that these regions (approximately nine percent of the surface of Venus) may represent sites of evolved crustal composition. In terms of formational mechanisms, one class of models invokes thrusting and imbrication of crustal materials to generate regions of thickened, high standing, topography [3,4]. Alternatively, competing models suggest that these areas may be composed of deformed granite-like crust analogous to terrestrial continents [5]. Geologic mapping is performed here to provide insight into the make-up of part of Tellus Tessera and suggests that some of this terrain may be a thick sequence of volcanic deposits.

Geology of Tellus Tessera: Tellus Tessera is centered near 35° N, 80° and covers an area of approximately 530,000 km^2. Elevations range from 1 to 3-km relative to the surrounding plains with the highest topography associated with the eastern margin of the plateau. Previous mapping has concentrated on determining regional geologic and structural relations within Tellus [6,7]. The area of interest discussed here covers a segment of the northern part of Tellus containing some of the lowest elevations where the tessera is fragmented by eight caldera/corona structures into local high standing crustal blocks (Fig.1a). Volcanism from these features has resulted in extensive, relatively recent, flooding and embayment of older, high standing materials. Although the tessera has been highly modified, in some locations, older structures have been preserved. For example, to the east of Eliot patera (38°N, 78°) chains of craters, a number of which are disrupted by later deformation, are identified (Fig. 1b and 1c). These depressions may be (1) secondary impact craters, (2) sites of early volcanic activity within the tessera, or (3) early volcanic centers that emplaced material that was later deformed to become the Tellus upland. The lack of evidence for a nearby large impact structure suggests an origin as secondaries is not likely. The alignment of these depressions as chains suggests that they are most likely volcanic pits. Their presence and relation to other units indicates that various episodes of lava emplacement occurred over the history of this region and that volcanism may have produced the initial tessera material. Located farther to the east (36° to 40°N, 80° to 84°; Fig. 2) lie, irregularly shaped, high standing crustal blocks separated by arcuate "valleys", some of which appear flooded with plains-like material. Cropping out on the slopes of the high-standing blocks are sets of lineaments, which have spacings of several hundred meters in plan view, are continuous and parallel, appear to consistently follow the approximate contours of topography and can be traced for over 100 km as they wrap around nearly 180° of a high-standing block (Fig. 2). These features are arranged in a "stair-step" pattern and are interpreted to be cross-sectional exposures of sub-horizontally stacked rock layers. The lack of an obvious tectonic mechanism to produce such layering implies that the rocks may have been originally deposited in layers. Based on evidence for early volcanism forming pit chains and the presence of significant layering, it is suggested that this part of Tellus Tessera is made up of sequences of volcanic (presumably basaltic) rocks forming a thickened crust that sits isostatically higher than the surrounding plains.

Conclusions: This analysis provides some of the first evidence for the origin of materials that make up part of Tellus Tessera. Geologic relations suggest that in the vicinity of Eliot Patera, the rocks units emplaced that would ultimately be deformed into tessera terrain are made up of sequences of layered volcanics. Over time, these horizontal units were uplifted and deformed leaving exposures reminiscent to those seen on the Columbia River plateau. Subsequent plains volcanism and that associated with calderas/coronae have resulted in recent modification of this region.

It must be noted that the area examined in this study represents only a small part of Tellus and that it is likely that tessera terrains elsewhere may represent a variety of crustal compositions. It will be up to future missions to facilitate *in situ* analyses to provide greater insight into the range of rock types that make up the surface of Venus.

References: [1] Surkov, Yu.A. (1977) *Proc. LPSC 8*, 2665-2680. [2] Surkov, Yu.A. (1984) *JGR, 89,* 393-402. [3] Bindschadler, D. L. and Head, J. W. (1991) *JGR, 96*, 5889-5907. [4] Solomon, S. C. *et al., (*1992) *JGR*, *97*, 13199-13255. [5] Basilevsky, S. A. et al. (1986), JGR, 91, D399-D411. [6] Gilmore, M. S. et al. (1998), *JGR*, *103*, 16813-16840. [7] Hansen, V. L. et al. (2000) *JGR*, *105*, 4135-4152.

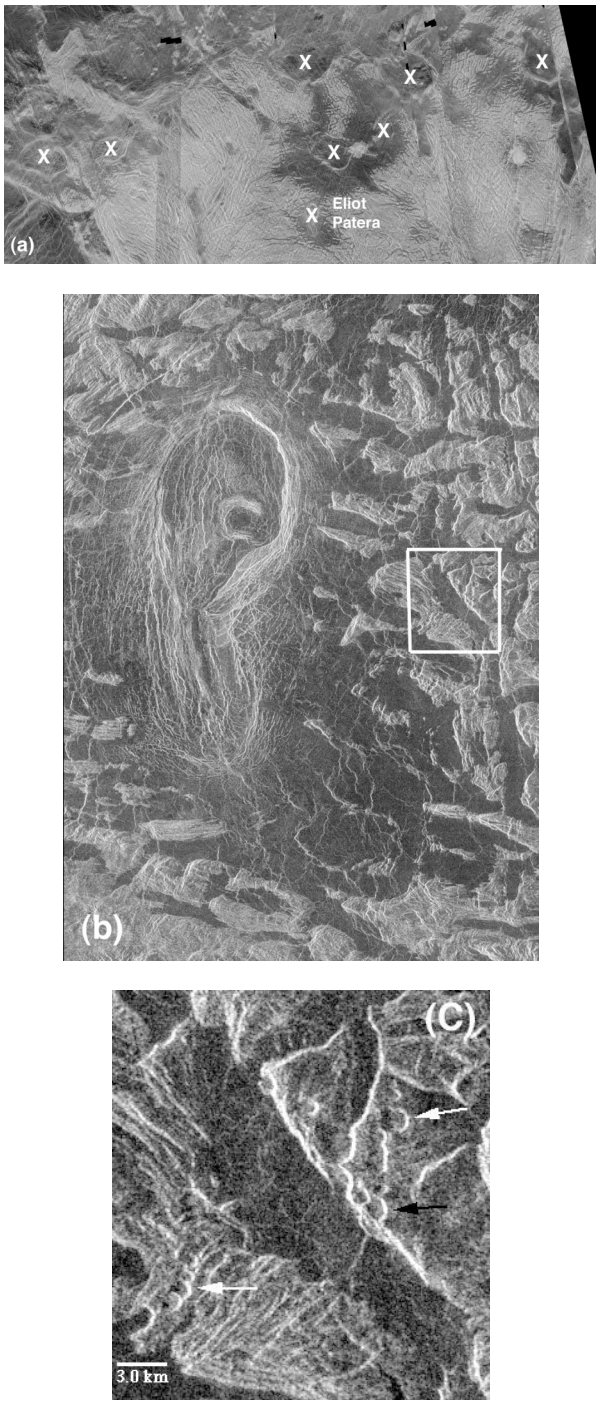

Figure 1. (a) Northern part of Tellus showing the embayment of the tessera by relatively recent volcanics. Source regions for some of the volcanic material are associated with a set of 8 calderas/coronae indicated by the "X's." (b) Part of Tellus in the vicinity of Eliot Patera. Inset box shows area of relatively old pit chains that are interpreted to be volcanic in origin shown in detail in (c) Details of chains of pit craters

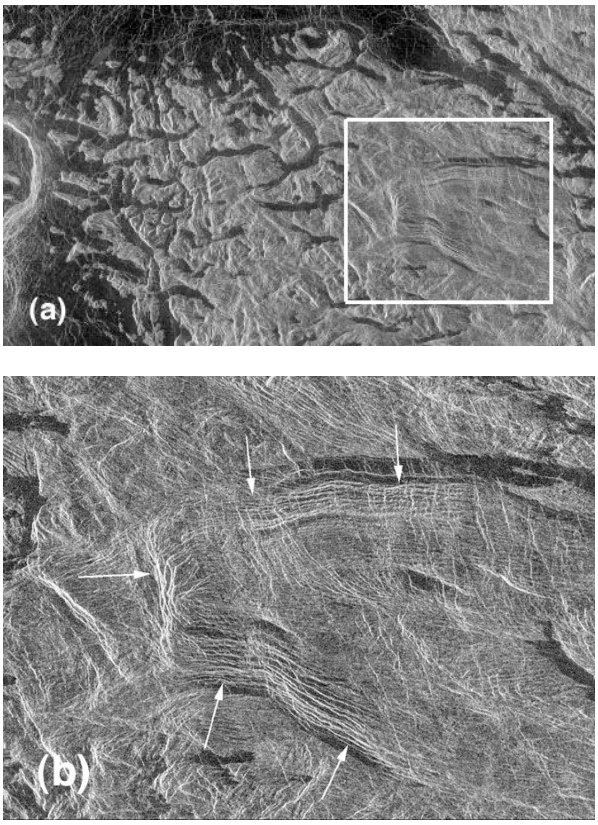

Figure 2. (a) Region of Tellus located to the east of Eliot Patera that is interpreted to be made up of layered out crops. The white box indicates the location of the area show in Figure 2b. (b) Lineaments shown by the arrows appear to follow the contours of topography and are interpreted to be the expression of out crops of layered rock.