TOPOGRAPHY OF GEOMORPHIC-TECTONIC UNITS IN FORTUNA TESSERA, VENUS: EVIDENCE OF CRUSTAL THICKENING AND DEFORMATION. **R.W. Vorder Bruegge and J.W. Head, Dept. of Geo. Sci., Brown Univ., Providence, RI 02912.**

Introduction: The Fortuna Tessera region in central Ishtar Terra displays evidence of extensive tectonic deformation (1, 2, 3). This high plateau (2 to 5 km above the mean planetary radius) shows a transition in morphology towards the Maxwell Montes linear mountain belt (6 to 12 km above m.p.r.), which is reflected in the unit map of Figure 1.

An inspection of the topography of this region reveals that the patterns of deformation generalized in this unit map are reflected in the topography of this region. In this paper, we investigate the relationships between the topography and the observed deformation.

Observations: *Maxwell Montes* : Maxwell Montes represents the highest topography on Venus, with altitudes of 6 to 12 km. The topography is asymmetric with the western face representing the steepest slope on the planet (4) (7 km in under 200 km horizontal distance), while the eastern slope is more gentle (5 km in over 300 km). This asymmetry is reflected in the morphology of this region in which the western slope is characterized by narrow ridges with a spacing of 5 to 10 km, while broader ridges with a 10 to 15 km spacing occur on the summit and eastern slope. *Arcuate-Ridged Tessera* : This unit mainly occurs above 4 km, reaching elevations above 6 km in some locations. The observed wrap-around of ridges in this unit about Maxwell Montes is paralleled by a wrap-around of topographic contours, such that the ridges here run parallel to these contours as they do in Maxwell Montes. Included in the topography of this area is a broad, linear trough near the boundary with Maxwell Montes which also exhibits the wrap-around nature of the rest of this topography. *Chevron Tessera* : This unit shows a wide range of heights from over 5 km down to 1.5 km. The decrease in altitude occurs across this unit from west to east, as contours run north-south, and corresponds directly to a change in morphology. This slope from west to east is far more steep than in the Arcuate-Ridged Tessera. At the western boundary with the Arcuate-Ridged Tessera, the altitude is over 5 km and the morphology resembles that of typical tessera areas (3) - very short ridges (less than 50 km long) intersecting at a variety of angles. Between 4 and 5 km, this small-scale pattern continues, but the large-scale deformation characterized by the chevrons dominates the texture. Between 3 and 4 km, while large-scale chevrons are still present, the small-scale texture consists of semi-continuous narrow, parallel ridges, occasionally dissected by shorter narrow ridges. Below 3 km, this unit consists of smooth plains areas bounded by large-scale chevron-type features, and some areas with the typical tessera pattern of intersecting ridges. The northern boundary of this unit parallels the 3 km contour and is suggestive of embayment by plains from the north.

Normal Tessera : In contrast to the area to the west, the Normal Tessera unit occurs in an area where the topography slopes to the north and south, not west to east. The morphology of this unit also correlates with the topography. The southernmost part of this unit has a smooth texture and occurs around 3 km altitude. Immediately to the north (3 km to over 4 km) the texture is one of dissected ridges, identical to that observed at the same altitude in the Chevron Tessera. Unlike the Chevron Tessera, however, the pattern continues here to the north, down to an altitude of 2 km, where the ridges become so disrupted as to achieve a typical tessera pattern of intersecting ridges. This pattern continues to the northernmost extent of this unit where the altitude drops from 2 km to below 1 km. This is in contrast to the Chevron Tessera to the west where low areas appear to be embayed. *Plumose Ridges* : Narrow ridges fan away from an apex in the NW. This apex corresponds directly to a narrow valley that slopes down and broadens to the south, exactly as the ridges do. The ridges thus trend directly downslope, perpendicular to the contours. The altitude of this unit drops from 5.5 km at the extreme northwest apex down to 3 km at the southern boundary. This unit terminates abruptly at the 3 km contour and the ridges appear to be embayed here. *Ridge Belt* : Descends from > 5 km just north of Maxwell Montes to < 1 km in the north polar plains. In the area just north of Maxwell Montes, the ridges in this unit occur in a shallow valley, sloping down to the north. Here the ridges follow the trend of this valley, parallelling its sides. When this low valley opens up into the plains the ridge belt becomes associated solely with a steep scarp that drops from 3 km to less than 1 km. Along this scarp the ridge segments closely parallel the contours, suggesting that they may be related. Compressional deformation along this scarp resulting in the ridges is suggested.

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Conclusions: 1) There is a systematic elevation difference that we have linked to progressive deformation characteristics and intensity, as interpreted from the surface morphology (5). The extreme height of Maxwell Montes corresponds with the extreme folding and/or thrusting implied by the closely-spaced ridges which parallel the topographic contours on its steep western slope. Farther east, the gentler slopes and decrease in height are reflected by the Arcuate-Ridged Tessera whose ridges wrap around the mountain belt. Finally, the steep lower slope across the Chevron Tessera exhibits a change in deformation with altitude.

2) The change in topography and deformation from west to east has implications for the large-scale convergence of material and the process of crustal thickening. Using a simple Airy isostatic model and assuming a basaltic crust of density 3.0 g/cc over a mantle of density 3.4 g/cc, we can make a first order estimate of the amount of crustal thickening required to produce the observed topography in each of the units described above. Figure 2 shows the predicted range of thicknesses of crust for each unit. There is a systematic trend of increasing crustal thickness from east to west, consistent with: 1) the systematic change in intensity of deformation as mapped in the morphology of surface units and 2) the direction of tectonic transport described in previous studies (6, 7).

Increased thicknesses are expected in regions of compressional deformation where folding, thrusting, and stacking of crustal materials can occur. Fortuna Tessera and Ishtar Terra show extensive evidence for compressional deformation, especially in the Akna Montes, Freyja Montes, and Maxwell Montes orogenic belts. The high topography and deformational character of Ishtar Terra and Fortuna Tessera suggest that this area has undergone extensive compressional deformation and crustal thickening. Future work will involve a more quantitative determination of the extent of this deformation, as well as a more precise determination of the sequence of events in this deformation and their orientations.

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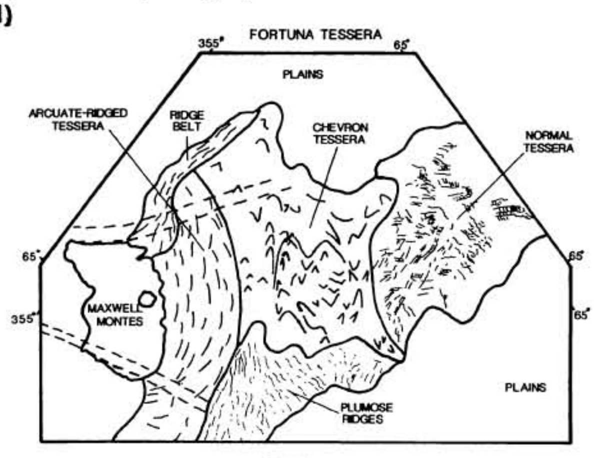
Figures: 1) Geomorphic-Tectonic map of Fortuna Tessera. 2) Predicted crustal thickness versus topography of units in Fortuna Tessera. Units plotted at median altitude and show predicted range of thicknesses for range of altitudes. Model assumes simple Airy isostasy with a 3.0 g/cc layer overlying a layer of density 3.4 g/cc, and no crust at the minimum altitude of 2 km below mean planetary radius.

1)



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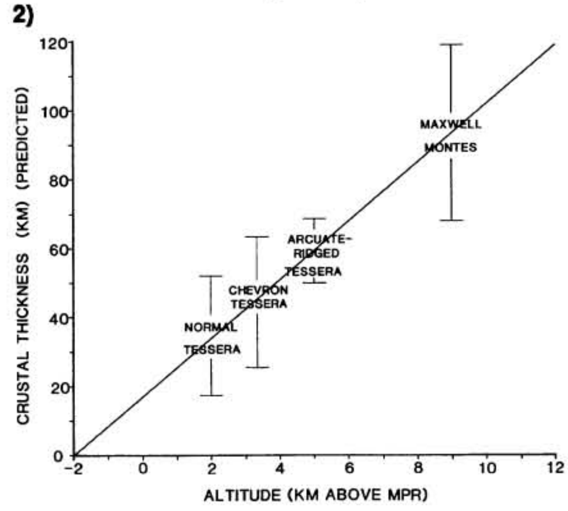

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