TELLUS REGIO, VENUS: EVIDENCE OF TECTONIC ASSEMBLY OF TESSERA TERRAIN AND IMPLICATIONS FOR EXPLORATION. M. S. Gilmore[1], [1]Dept. of Earth and Environmental Sciences, Wesleyan University, 265 Church St. Middletown CT 06549, mgilmore@wesleyan.edu

Introduction: Tellus Regio is a plateau-shaped highland in the northern hemisphere of Venus largely composed of tessera terrain characterized by complex deformation comprising at least two sets of intersecting ridges and grooves which contribute to high radar backscatter [1,2; Fig. 1]. Stratigraphic studies of tessera terrain occurrences establish that they are generally embayed by plains materials [1, 3-7], however, the density of craters on both terrains is similar where the tesserae yield a surface crater retention age of 1X [8] to 1.4X [9] the average Venus surface age of ~300 [8] to ~800 Ma [10]. Tessera terrain thus uniquely records the geologic history of an ancient (and tectonically extinct or dormant) Venus prior to and during plains emplacement, and constrains the character, magnitude and direction of surface strain and lithospheric structure at this time.

Tellus can be subdivided into a number of distinct units based on unique structural fabrics [11,12; Fig. 1]. Several of these tessera units are identified at the 1:5M scale in the SW quadrant of Tellus Regio, where a fold belt comprised of layered volcanics lies between the tessera units [11-13]. We have undertaken a preliminary detailed analysis of this region [12] (~24°-36° N, 73°-83° E) to better understand the sequence of events recorded there.

Methods: *Mapping.* Mapping of the region was completed in ArcGIS on a base of 100 m resolution FMAP SAR imagery (~1:100,000 scale). Map units are defined as geomorphologic units according to the interpreted textures, dominant structural patterns, (including recurrent features' size and density), regional relief, and radar backscatter primarily and emissivity, slope, topography and reflectivity data secondarily [e.g., 14].

Width and Spacing Analysis. Graben widths were measured from the top of the radar bright wall to the top of the radar dark wall and used to calculate depth to mechanical discontinuity as described in [15]. The wavelength of features interpreted to be of compressional origin was calculated from the center of ridge to center of ridge or center of trough to center of trough. The thickness of the competent layer was then calculated after [16] and [17].

Results and Interpretation: Results of preliminary mapping [12] can be summarized thusly: 1) the fold belt (zones NEa and SEa, Fig. 1) lies between 3 regions of tessera terrain (region 1 = Indenter, Fig. 1; region 2 = NEb, Fig. 1; region 3= SEb, Fig. 1), each with a distinctive structural fabric which we interpret to represent distinct strain histories.

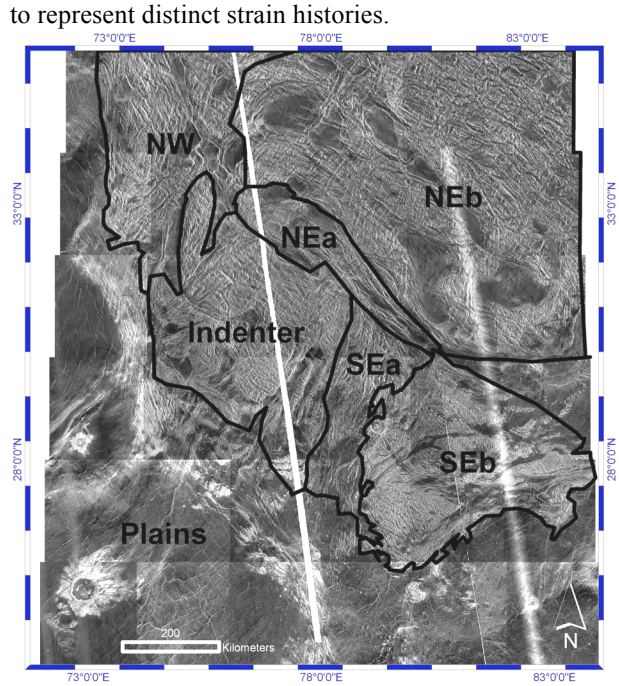

Figure 1. SAR Cycle 2 mosaic of SW Tellus Regio. Regional morphological units outlined.

2) The NW-trending orientation of the fold belt is mimicked in the deformation of the adjacent tessera interior (region 2). 3) The deformation associated with fold belt formation postdates the fabrics preserved in the 3 regions of tessera terrain mentioned above. The stratigraphic sequence of events for this region includes (Fig. 2): 1) formation of three structurally distinct regions of tessera terrain, 2) embayment of tessera by plains, 3) collision of the tessera and plains units forming folds both within the plains and the tessera interior, and 4) late stage graben radial to the indenter overprinting all earlier units.

Furthermore [12] find that the wavelengths of the folds varies from one tessera region to another and within the fold belt itself; two of the regions show two wavelengths of folding indicating involvement of both a strong crust and strong mantle in the deformation (e.g., 16). If these folds are indeed formed during the same collisional event, the wavelength differences suggest that each of the tessera regions had a distinct lithospheric structure at the time of collision. In general, stratigraphically older structures have shorter wavelengths than younger features.

Conclusion and landing site considerations: These data support the interpretation SW Tellus Regio was formed due to the assembly and collision of several distinct tessera and plains units. A similar interpretation has been made of structures in Ovda Regio [18, 19]. In Tellus, the structures associated with this collisional event can be morphologically and stratigraphically separated from pre-collisional structural fabrics, an unusual circumstance that allows these structures to serve as a time-stratigraphic marker.

These results imply that tessera fabrics can form under distinct (and disparate?) strain histories within an individual plateau, and that the lithosphere may be different under different regions of tessera and may be changing (thickening?) during the evolution of this plateau. The different tessera domains may be recording the heterogeneity of the lithosphere at the time of tessera and plateau formation. In SW Tellus, tessera terrain comprises both older structural fabrics and intervening plains that have acquired a tessera fabric during a collisional event. This collision contributes to plateau formation in SW Tellus, shortening and thickening the crust locally, elevating topography and thus facilitating the preservation of tessera materials from future embayment.

This study demonstrates that there is variability in both the relative ages and compositions of domains within tessera terrain. In the case of Tellus, it appears that stratigraphically recent plains materials are deformed and incorporated into the tessera plateau. For future missions, detailed stratigraphic mapping of the tesserae is necessary for judicious landing site selection, particularly if the goal is to access the oldest rocks or the materials that are best representative of tessera terrain.

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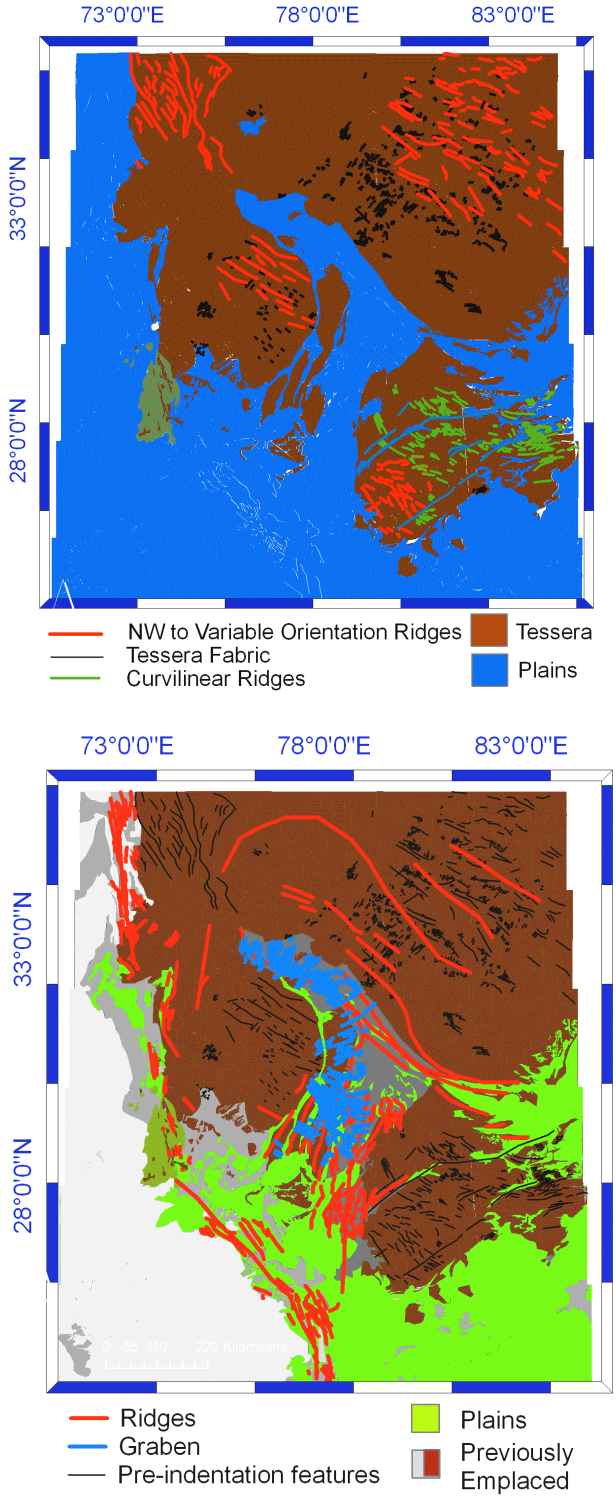

Figure 2. Mapped units and structures of SW Tellus. (top) Materials present prior to collision event. (bottom) Materials associated with collision event.