VARIATIONS IN THE BACKSCATTER COEFFICIENT OF INTRA-TESSERA PLAINS. E. N. Haas[1] and J. L. Whitten[1], [1]Department of Earth and Environmental Sciences, Tulane University, New Orleans, LA. (ehaas3@tulane.edu).

Introduction: Tesserae are tectonically deformed, radar-bright geologic units unique to Venus. They have been likened to continents on Earth [1] and provide a lens through which to better understand the paleoclimate and surface modification history of Venus. Tesserae cover approximately 8% of the Venusian surface and are considered to be one of the oldest stratigraphic units on Venus [2]. Within these stratigraphically oldest geologic units on Venus [2], there exist younger materials (intra-tessera plains and parabolic ejecta deposits) which may provide further insight into the questions still remaining regarding the surface evolution of tesserae. Intra-tessera plains are radar-dark, irregularly shaped, smooth deposits surrounded by tesserae.

Intra-tessera plains are interpreted as lava flows, but their emplacement mechanism is not well constrained [3, 4]. Intra-tessera plains are superposed on tesserae which requires them to be relatively younger than their host tesserae. Because of their stratigraphic position, intra-tessera plains can facilitate the determination of relative stratigraphy with other post-tesserae materials, such as impact crater ejecta. These materials have different morphologies, with some containing volcanic shields and cones, and have been mapped as both regional plains and shield plains [5]. The radar properties of intra-tessera plains vary considerably and may therefore offer insight about their original roughness, modification history, and relative ages.

Parabolic ejecta deposits are radar-dark features associated with impact craters. These deposits derive from fine-grained ejecta thrown into the upper atmosphere by impact craters and are then carried westward by high-speed winds [6, 7, 8]. Models of parabolic ejecta formation have found that every impact on Venus resulting in a crater >5 km in diameter should form these deposits [8], revealing that a substantial portion of the surface was recently mantled with ejecta. However, only ~60 parabolic ejecta deposits are identified, indicating relatively rapid erosion of the fine-grained ejecta materials from the low-lying plains. It has been suggested that the parabolic ejecta can be preserved in the tesserae longer than on the plains [9, 10].

A comparison of the backscatter coefficient (σ^0) values of intra-tessera plains in areas of predicted overlap with parabolic ejecta may offer insight into the weathering and/or mantling of intra-tessera plains and adjacent tesserae. Here we measure backscatter coefficient values of (1) intra-tessera plains, (2) low-lying plains, and (3) known parabolic ejecta deposits [6] to better understand the surface evolution of tesserae. Specifically, one of our goals is to measure intra-tessera plains to understand whether they are sinks for fine-grained

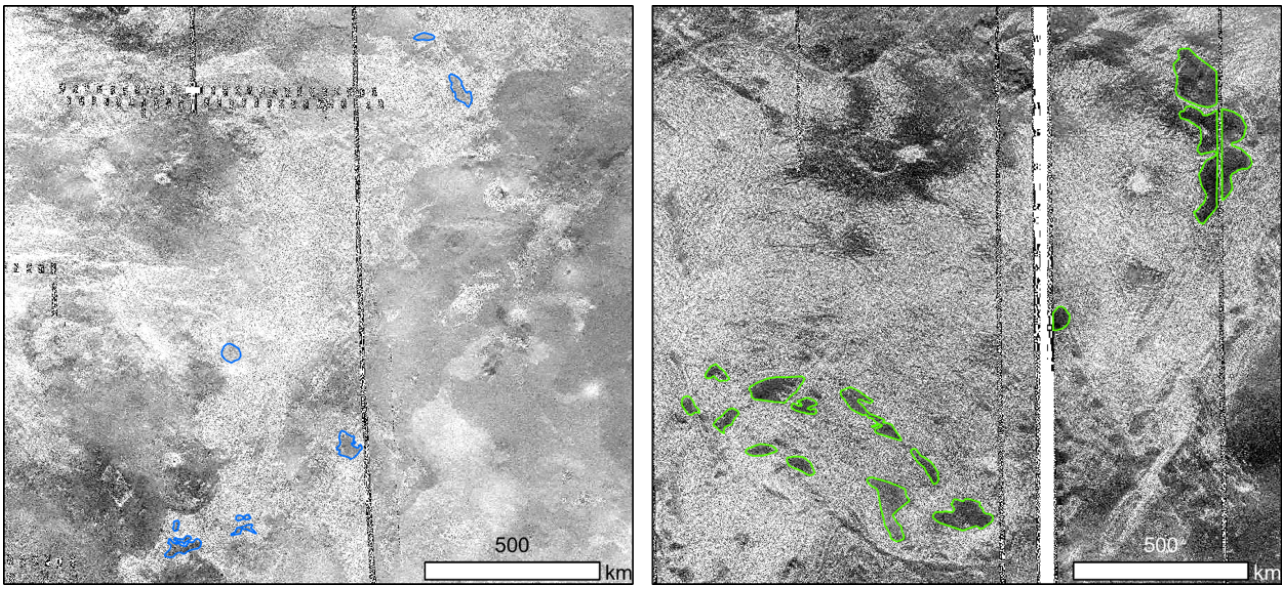

Figure 1. Polygons showing mapped intra-tessera plains in Hyndla (left) and Tellus (right). Hyndla is located in the BAT region of Venus, while Tellus is situated in a unactive tectonic region.

parabolic ejecta. These results regarding the distribution of crater ejecta have important implications for upcoming Venus missions that intend to measure the rock type of tesserae. Uncontaminated tesserae must be identified to get an accurate picture of the diversity of tesserae rock types.

Methodology: Intra-tessera plains were mapped in Alpha, Tellus, Hyndla, Doyla, Phoebe, and Nedoyla tesserae using the Magellan SAR left look global mosaic (spatial resolution of 75 m/pixel) at a scale of 1:1,000,000. Intra-tessera plains were identified by their radar-dark, irregular shapes within tessera. The Ivanov & Head [5] global geologic map was used to compare our map boundaries with theirs.

Backscatter coefficient values depend primarily on surface roughness and composition. Smoother surfaces at the scale of the emitted energy produce lower backscatter coefficient values and appear radar dark. A backscatter coefficient map [11] produced using the methods of Campbell (1995) [12] was used to derive the average σ^0 value for each intra-tessera deposit. Histograms of the observed σ^0 variations were then created to quantify how much radar brightness varies among the intra-tessera deposits. The average σ^0 values will be compared with both tessera and intra-tessera plain morphology and tectonic landforms to identify spatial correlations.

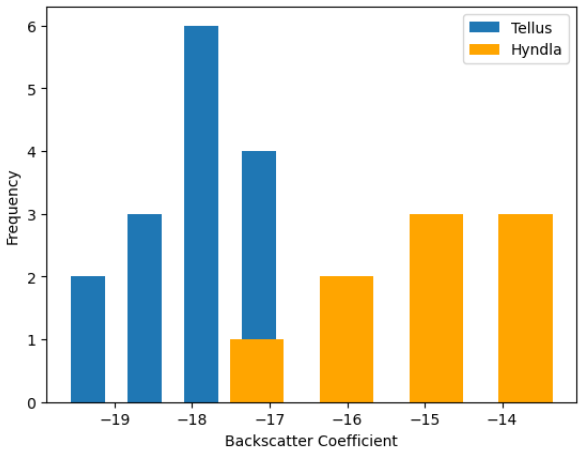

Figure 2. Histograms of backscatter coefficient for intra-tessera plains in Hyndla and Tellus tesserae.

Intra-tessera σ^0 values will also be compared with those of low-lying plains across Venus to determine whether there is a relationship between the small-scale roughness properties of intra-tessera plains and nearby regional plains. Average emissivity values for the largest intra-tessera deposits will also be measured to constrain whether σ^0 variations are largely due to changes in surface roughness or if they are related to changes in the material dielectric constant.

Preliminary Results and Discussion: The quantity and size, as well as the backscatter coefficient of intra-tessera plains vary among tesserae. In total, we identify 100 intra-tessera plains deposits, 30 in Alpha, 15 in Tellus, 9 in Hyndla, 23 in Doyla, 15 in Phoebe and 8 in Nedoyla. Their areas range from 167 km^2- 15,339 km^2. Preliminary results show that intra-tessera plains located in Hyndla exhibit higher backscatter coefficient values than Tellus (Figure 2). For both Hyndla and Tellus, the intra-tessera plains are a combination of regional and shield plains [5].

Alpha, Tellus, Hyndla, Doyla, Phoebe, and Nedoyla were chosen for this study because they represent both tesserae with known superposed deposits of parabolic ejecta. The variations observed in backscatter coefficient between Hyndla and Tellus may be attributed to the presence of known parabolic deposits at Tellus and the lack of ejecta at Hyndla. Ejecta would act to smooth surfaces, so the fact that Tellus intra-tessera plains have lower backscatter is consistent with presence of ejecta.

Future work: We will continue to measure the backscatter coefficient of low-lying plains and known parabolic ejecta deposits [6] to compare with our measured intra-tessera plains backscatter measurements. These measurements will allow us to assess whether there are obvious patterns in backscatter coefficient that can be linked to specific geologic processes.

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