THE LACHESIS TESSERA QUADRANGLE (V-18), VENUS.

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Introduction: The Lachesis Tessera V-18 quadrangle (25º-50ºN, 300º-330ºE) includes parts of Sedna and Guinevere Planitiae; regional plains [1] cover ~80% of the quadrangle. The region includes 2 deformation belts and embayed fragments of 1-2 possible additional belts, 3 large central volcanoes, abundant small shield volcanoes and associated flow materials, 13 impact craters, 3 named coronae, many coronae-like features, arachnoid-like features, and dark spots [2]. The quadrangle contains a linear grouping of a prominent NW to SE oriented structural belt, coronae, and coronae-like structures [2]. Important individual structural features include radar-bright lineaments, graben, and wrinkle ridges, as well as broader ridges that may be local folds in regional plains. We present an updated version of the geologic map (Fig. 1).

Methods: Mapping was based on a 250 m/p Magellan cycle 1 synthetic aperture radar (SAR) 1:5M scale controlled mosaic, but most of the analysis utilized 75 m/p FMAPS. Topographic information was derived from digital elevation models and from gridded elevation data; altimetry data were combined with SAR data to create synthetic stereoscopic images.

Geology: Stratigraphic units were defined primarily by their radar brightness and surface textures, although crosscutting relations, relative ages, and apparent association with topographic or structural features were also considered.

Basement materials: Tessera material (**t**) appears very bright on SAR images, due to being heavily deformed by at least two dominant trends of graben, ridges and penetrative lineations at high angles to each other. Tessera are sharply embayed and/or truncated by all other mapped units and are thus inferred to be the oldest material in the quadrangle. The relative ages of isolated patches of tessera cannot be determined.

In some regions, tessera material is heavily embayed by plains or volcanic units to the extent that the surface has similar areas of both units but on a scale too small to be delineated at the map scale. These units have been labeled embayed tessera (**te**).

Tessera-like material (**tq**) does not exhibit a pattern of two or more well defined deformation trends at high angles to each other; instead it is characterized by multiple deformation trends that generally are spatially distinct from each other. However, **tq** is radar bright, highly deformed, and extensively flooded by plains materials.

Several very small patches of radar bright, hummocky to lineated material (**mb**) are clearly embayed by regional plains, and thus have a relative age similar to that of tessera. Exposures are widely scattered, and too small to determine age relations with tessera.

Plains materials: Regional plains, the most extensive materials in the quadrangle, are mapped as two units, based on radar brightness. While the number of impact craters superposed on the plains is too small to measure age differences between the emplacement of the darker (**pr1**) and brighter (**pr2**) regional plains units [3], stratigraphic markers imply that **pr2** is younger than **pr1**. However, clear cut examples of wrinkle ridges and fractures superposed on **pr1** but truncated by **pr2** have not been found, indicating that the age difference is very small.

Dark plains materials (**pd**) are a local plains unit that are defined by significantly lower radar backscatter; they are superposed on regional plains materials, with local inliers of regional plains. Mottled plains materials (**pm**) consist of intermingled patches of material that is either dark or moderately bright on SAR images, resulting in a mottled pattern at 50-100 km scale. Its age relative to the regional plains is uncertain.

Volcanic materials: Volcano "a" materials (**mva**) consist of a large field of digitate flows of variable brightness (mostly moderately bright) extending to the east and northeast from the caldera. Proximal flows are smaller and younger than distal flows. Volcano "b" materials (**mvb**) extend generally eastward from their caldera, and consist of a field of digitate flows of variable brightness, with the brightest parts of individual flows located farthest from the caldera. Flows are superposed on regional plains materials.

Shield flows (**fs, fsd**) are large flow fields associated with abundant small shields. Most exposures of **fs** are moderately brighter than regional plains, but in one locality shield flows (**fsd**) are darker. Small shields similar to those within unit **fs** are common as isolated small groups or individuals superposed on unit **pr1**. Isolated flows (**f**) are mostly moderately bright, relatively rare, digitate flows that generally do not have a resolvable construct at their source. Pancake domes are moderately bright and delineated as unit **vd**.

Corona materials: At least four coronae are present in V-18. These are widely separated, so it is not possible to determine their relative ages. The structures defining the coronae cut materials of both regional plains units. The ages of the generally sparse flows associated with the coronae relative to plains and other materials are ambiguous, although some corona materials appear to be younger than adjacent regional plains.

Zemire Corona has locally digitate flows (**fcZ**) that are moderately bright to bright, both within and adjacent to the corona, that include many small shields and several paterae; they are the most extensive corona flows in the quadrangle. Renenti Corona has moderately bright digitate flows (**fcR**) adjacent to the corona but not within it. Pasu-Ava Corona has moderately bright and homogeneous material (**fcPA**) with no clear flow forms that occurs within and adjacent to the corona. Jaszai Patera flows (**fcJ**) are moderately bright: there is a potential companion corona-like feature just NNE. There is a putative, partially imaged corona a short distance east of Pasu-Ava with no associated flows.

Deformation belts: Many individual structures occur in poorly defined belts that do not include associated mappable materials. However, there are instances where deformation belts include mappable material that can be distinguished from surrounding regional plains, although the relative ages are ambiguous. Ridge belt material (**br**) consist of closely spaced ridges, radar-bright lineaments and, rarely, graben. Fracture belt material (**bf**) forms radar-bright belts defined by closely spaced graben and lineaments.

Impact crater materials: V-18 craters range from 2.4 to 40 km diameter and are superposed on either regional plains or on flows that are, in turn, superposed on regional plains. Craters are mapped as crater materials, undifferentiated (**c**) including materials of central peaks, walls, rims, floors and ejecta. These materials are bright to very bright. Very bright digitate flow material associated with some craters is mapped as crater flow material (**cf**).

Features of Interest: Important individual structural features in the V-18 quadrangle include radar-bright lineaments, graben, and wrinkle ridges, all of which are abundant and pervasive. Wrinkle ridges are sinuous, radar-bright linear features that formed approximately normal to compressive stresses in the shallow crust.

Deformation belts vary widely in trend with respect to each other, even exhibiting significant variations within individual belts. Shishimora Dorsa is the largest and most clearly defined ridge belt, with ~250 km within V-18. The belt trends NE and is elevated relative to adjacent regional plains. Although dominated by ridges, the belt also includes radar-bright lineaments with two distinct azimuths that define a grid pattern.

Breksta Linea is the largest fracture belt in V-18, at about 500 km long. It consists of closely spaced fractures and graben, most of which trend with about the same azimuth as the belt itself. The fractures appear to be younger than the regional plains adjacent to Breksta Linea, as they crosscut the contact between pr1 and pr2 in about the center of the belt. Breksta Linea is elevated relative to adjacent regional plains.

Coronae and fragments of other ridge belts extend to the southeast of Breksta Linea forming the most prominent structural grouping in the quadrangle. Coronae here are commonly flanked by pancake domes.

George McGill identified 3 large central volcanoes and mapped flow units for two of them. The third large volcano is in a data gore, but topography and radial fractures strongly suggest the location of a third large volcano despite the lack of radar imagery.

We have verified 13 impact craters identified by McGill; 11 of these craters are named. We have identified 5 other features that may also be impact craters and require further characterization.

We also observe >10 dark spots between 10-50 km without topographic relief. These are not uncommon features on Venus and are often interpreted as fine debris. At least 6 of the observed dark spots in this quadrangle have a distinct annulus that suggests a possible relationship to impact craters or other degraded or eroded circular surface phenomena.

References: [1] McGill G.E. (2000) V-20 quadrangle [2] McGowan E. M. & McGill G. E. (2011) *LPSC XLII*, abs.1300 [3] Campbell B.A. (1999) *JGR 104*, 21,951-21,955.

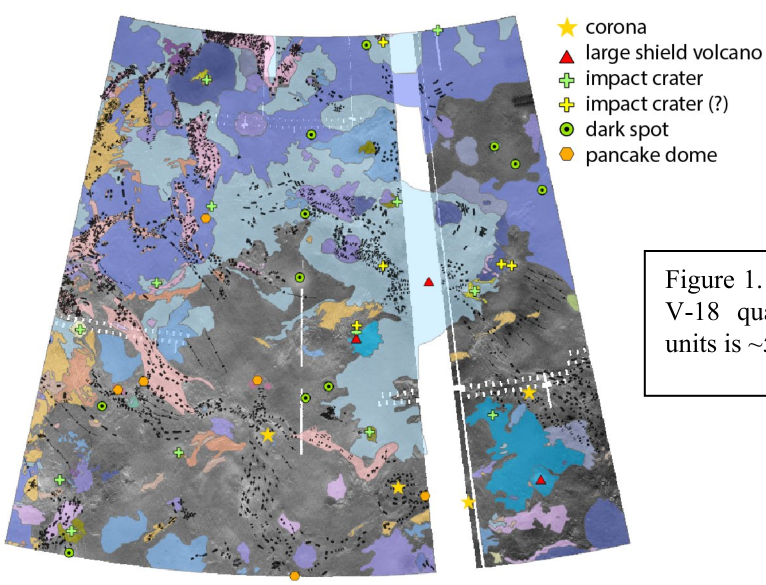

Figure 1. Draft of the geologic map of the V-18 quadrangle. Mapping of geologic units is ~50% complete.