THE LACHESIS TESSERA QUADRANGLE (V-18), VENUS. E. M. McGowan[1,2], D. L. Buczkowski[3], and G. E. McGill[1]. [1]University of Massachusetts, Amherst, MA; [2]Mount Holyoke College, South Hadley, MA; [3]Johns Hopkins Applied Physics Laboratory, Laurel, MD 20723, debra.buczkowski@jhuapl.edu.

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. There are 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, and a number of coronae-like features [2]. A linear grouping of a prominent structural belt, coronae, and coronae-like structures are locate oriented NW to SE in the southern half of the quadrangle [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 the draft geologic map (Fig. 1) completed by George McGill before his death.

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. Twenty units were grouped into six broad categories according to topographic setting or terrain type: 3 basement units, 4 plains units, 5 volcanic units, 4 coronae units, 2 deformation belt units, and 2 impact crater units.

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.

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, which likely explains the lack of clear crosscutting relations that normally characterize tessera.

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.

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: All 13 craters in V-18, ranging from 2.4 to 40 km diameter, 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**).

Structural geology: 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; they range in length from a few to scores of kms, and are generally >1 km in width. The greatest abundance occurs in the NE parts of the quadrangle, in Sedna Planitia, where they define a wavy E-W trend. To the SW, in Guinevere Planitia, wrinkle ridges are much less abundant. This distribution coincides approximately with local topography. There are also broader ridges scattered around the quadrangle that may be isolated inliers within younger regional plains or else local folds involving regional plains.

Many of the radar-bright, straight to arcuate linear features are inferred to be small faults or extensional fractures, although most are too narrow to define their geometries. Individual lineaments range in length from the limit of detection (1-2 km) to 100s of km. In places, there are 2 trends of straight linear features at high angle to each other, defining a “grid” pattern. Where wrinkle ridges cross plains with gridded lineaments it is clear that the wrinkle ridges are younger.

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 somewhat 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. While the material forming the ridges is the same age or younger as the surrounding regional plains, a detailed global study of the relative ages of ridge belts and adjacent plains on Venus indicates that the ridges are generally older than the plains [4].

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.

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 [4] McGill G.E. & Campbell B.A. (2006) *JGR 111*, doi:10,1029/2006 JE002705.

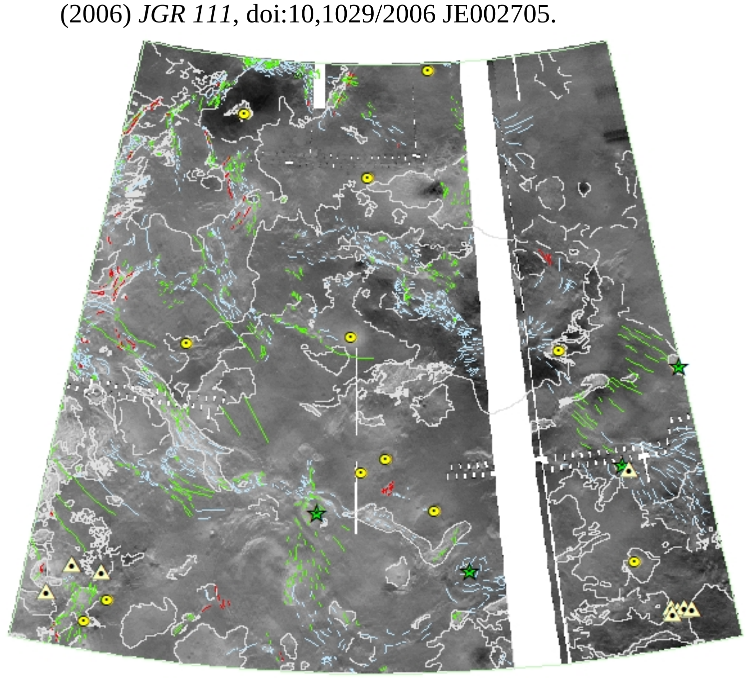

Figure 1. First draft of the geologic map of the V-18 quadrangle completed by George McGill. White lines are geologic contacts, green lines are graben, blue lines are lineaments, red lines are ridges, yellow triangles are shield volcanoes, green stars are coronae, and yellow circles are impact craters.