STRUCTURAL BELT IN THE LACHESIS TESSERA QUADRANGLE (V-18), VENUS: IMPLICATIONS FOR A CHANGE IN CRUSTAL PROPERTIES?
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Introduction: We have completed the geologic map (Fig. 1) of the V-18 Lachesis Tessera quadrangle (25º-50ºN, 300º-330ºE) of Venus, a lowlands region just to the SSW of Ishtar Terra and to the east of Beta Regio. Regional plains, including parts of Sedna and Guinevere Planitiae, cover ~80% of the quadrangle. The region includes 2 deformation belts and embayed fragments of 1-2 possible additional belts. There are 4 large central volcanoes, abundant small shield volcanoes, 13 impact craters, 3 named coronae, many coronae-like features, arachnoid-like features, pancake domes and maculae.

A prominent structural belt [1], linking a fracture belt to several coronae, extends from the western boundary of the quadrangle at about 36ºN southeastward to near the southern boundary of the quadrangle at about 324ºE (Fig. 2).

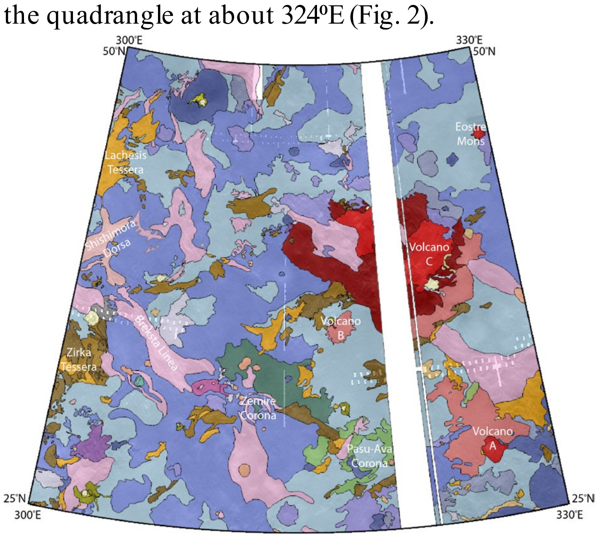

Figure 1. Geologic map of the V-18 quadrangle. Blues = plains materials; browns = basement materials; pinks = deformation belt materials; yellow = crater materials; greens = coronae materials; reds = volcanic materials. Features of note are labelled.

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 [2].

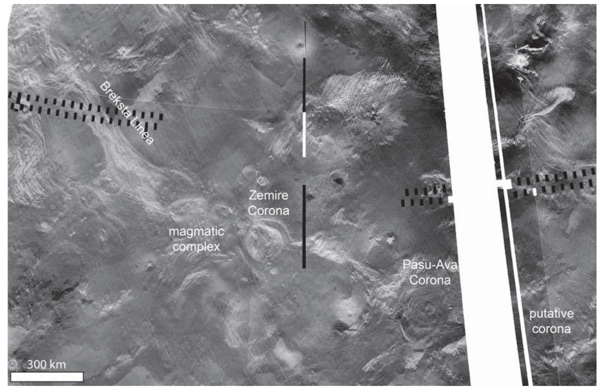

Figure 2. *Magellan FMAP mosaic of the structural grouping at 1:5M, including Breksta Linea, the magmatic complex, Zemire Corona, Pasu-Ava Corona, and a putative corona.*

Geology: The structural grouping starts in the NW at 39ºN, 300.6ºE with Breksta Linea (Fig. 2), the largest fracture belt in V-18. The fracture belt is ~700 km long, and ends at 33.8ºN, 307.4ºE. Breksta Linea is elevated relative to adjacent regional plains and consists of closely spaced fractures and graben, most of which trend with approximately the same azimuth as the belt itself. The fractures appear to be younger than the regional plains adjacent to Breksta Linea – they crosscut the contact between two regional plains units, in about the center of the belt.

At the SE end of Breksta Linea is a raised magmatic complex (Fig. 2) centered at 32.4ºN, 309.2ºE, with two calderas and associated flows. A number of pancake domes are also associated with this complex. There is a field of small shield volcanoes to the south of the complex; a few isolated small shields are also identified north of the complex.

Along the linear trend, continuing to the SE are Zemire corona, Pasu-Ava corona and finally putative, partially imaged corona (Fig. 2).

Zemire Corona is located at 31.5ºN, 312.5ºE, and is approximately 200 km in diameter. It is a Concentric Double Ring corona, as defined by [3]. Zemire flows, the most extensive corona flows in the quadrangle are moderately bright to bright and are locally digitate. Many small shield volcanoes and several paterae can be found both within and adjacent to the corona.

Pasu-Ava corona is located at 29.0ºN, 319.0ºE, and is approximately 250 km in diameter. Pasu-Ava corona material occurs within and adjacent to the corona. It is moderately bright and homogeneous with no clear flow forms.

A putative, partially imaged corona a short distance east of Pasu-Ava corona at 323ºE, 28ºN is approximately 220 km in diameter. All but the eastern part of this putative corona is within a wide strip of no image coverage that crosses the quadrangle. There are no associated imaged flows.

Implications: It is not uncommon on Venus to find coronae associated with fracture belts. In fact, 68% of Type 1 coronae (with complete or nearly complete fracture annuli) as well as 43% of Type 2 coronae (fracture annuli <180º around), are found along fracture belts [4,5]. It is also common to find coronae in linear chains, especially concentric double ring coronae like Zemire [3].

The V-18 quadrangle is just to the northeast of the Beta Regio volcanic rise (Fig. 3). The Beta Regio region has a thickened lithosphere and thinned crust [6] and is a region where mantle upwellings are expected [7]. It is a region considered one of those most likely to be an active hot spot [e.g. 7-10].

Breksta Linea demarcates the northeastern end of Beta Regio; to the north of the fracture belt are the lowlying plains of Guinevere Planitia. While Breksta Linea itself is high-standing, the three coronae of the V-18 structural grouping are low-lying and in the plains.

Zemire is a Type 1 corona and Pasu-Ava seems to be a Type 2 coronae; it is impossible to tell if the putative corona is Type 1 or Type 2, as it is only partially imaged. Smrekar and Stofan [5] noted that density variations might explain the difference between Type 1 and Type 2 coronae.

Coronae are generally thought to be the surface expression of thermal upwellings in the Venus mantle [e.g. 7]. In addition, chains of coronae are interpreted to be an integrated system of upwelling and extension rather than a terrestrial-type hotspot chain [3]. However, the progression of the V-18 structural grouping from Breksta Linea on the high-standing Beta Regio to Pasu-Ava and the putative corona in the lowlying Guinevere Planitia might suggest a density interface along the linear chain. This might indicate that the crust under Pasu-Ava and the putative corona is thicker than the crust under Breksta Linea, the magmatic complex and Zemire corona. Another possibility could be that the crust between Zemire and Pasu-Ava is undergoing a basalt-to-eclogite transition [5].

References: [1] McGowan E.M. & McGill G.E. (2011) *LPSC XLII*, abs.1300 [2] Ford, J.P. et al. (1993) JPL Publication 93-24, p. 1-18 [3] Stofan E.R. et al (1992) *JGR 97(E8)*, 13347-13378 [4] Stofan E.R. et al. (2001) *GRL 28*, 4267–4270 [5] Smrekar S.E. & E.R. Stofan (2003) *JGR 108(E8)*, 5091. doi:10.1029/2002JE001930 [6] Anderson F.S. & S.E. Smrekar (2006) *JGR 111*, E08006. doi: 0.1029/2004JE002395 [7] Smrekar S.E. et al. (2018) *Space Sci. Rev. 214:*88. doi: 10.1007/s11214-018-0518-1 [8] Kiefer W.S. & B.H. Hager (1991) *JGR 96*, 20947–20966 [9] Smrekar S. & R.J. Phillips (1991) *EPSL 107*, 582–597 [10] Simons M. et al. (1997) *Geophys. J. Int. 131*, 24–44

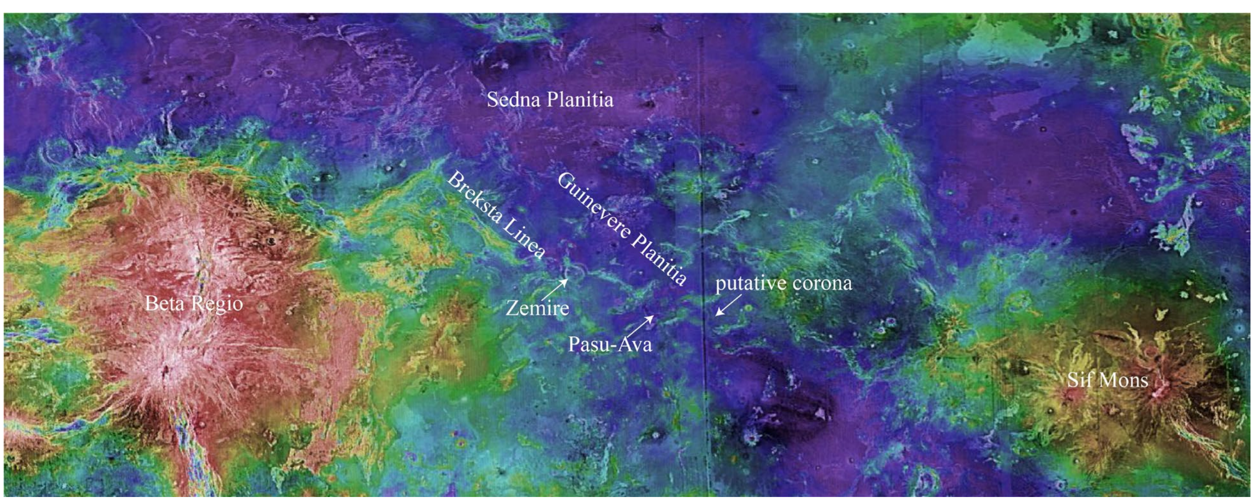

Figure 3. Topography of V-18 and beyond. Features of note are labelled.