SHIMTI TESSERA (V-11) AND VELLAMO PLANITIA (V-12) QUADRANGLES, VENUS

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Introduction. Adjoining quadrangles Shimti Tessera (V-11) and Vellamo Planitia (V-12) were partially mapped in the mid-90s, early 2000s. Initial results included description and interpretation of what was then a proposed new unit named *shield plains* (Akkruva shield plains) consisting of widespread small shield volcanoes and associated lava flows [1]. Following the initial study, many other mapped Venus quads also identified shield plains or shield terrain units [2]. Revised geologic maps of V-11 and V-12 have now been completed using GIS map standards and submitted to the planetary mapping program. The new maps provide better stratigraphic control on the shield plains in the type location.

Shimti Tessera (V-11) and Vellamo Planitia (V-12) are located in the northern hemisphere of Venus, from 25° to 50°N and from 90° to150°E. During analysis of the Venera 15/16 data [3] some regions on Venus were recognized as extensive areas of small hills and given the feature name "colles." One of these regions is an unusual terrain, Akkruva Colles, [4] that extends across the V-12 and V-11 quadrangle boundary. The hills were interpreted to be volcanoes based on Venera 15/16 data [5]. During analysis of the Magellan data [6] these regions were confirmed as extensive areas of abundant, small, predominantly shield-type volcanoes.

Map Units and stratigraphic relationships for these quadrangles are defined based on full resolution Magellan synthetic aperture radar (SAR) data and incorporate Magellan altimetry, emissivity, Fresnel reflectivity, and roughness data. Material units are mapped independently of tectonic structures, but in some cases, structure is a consistent characteristic of a unit and is used to define it. Material units are interpreted to represent one (or a range of related) material(s) deposited by one (or a range of related) process(es) over a specific geologic time interval. Mapping has defined four general categories of material units in these quadrangles and general stratigraphic relationships. The oldest units are characterized by bright radar backscatter, elevated terrain, and structural elements. *Tessera (t)* is stratigraphically the oldest unit in both quadrangles and characterized by closely spaced ridges and grooves oriented in at least two directions. *Densely lineated plains material (pdl)* and *Ridged and grooved plains material (prg)* overlay *tessera* and are characterized by closely spaced narrow parallel to anastomosing lineaments *(pdl)* and sets of relatively broad, sinuous, parallel ridges, arches, and lineations *(prg)*. Plains Units are the most widespread units in both quadrangles. *Shield plains material (psh)* covers the eastern portion of V-11 and the western portion of V-12 and consistently overlays the units described above (where stratigraphic relationships can be observed) and is consistently overlain by *Regional plains material (pr)* in both quadrangles. (Fig.1). Local Plains Units associated with individual volcanic centers are the youngest plains units in both quadrangles. In V-11 these include the *Lobate plains material of Maa-Ema Corona (plme)* and *Hei Chu Patera (plhc)* as well as a *shield field (psf)* and associated *flow field (pdsf)(Fig.2),* and in V12 *Lobate plains material of Ved-Ava Corona (plva).*

Shield Fields and Shield Plains. Two end-member interpretations of areas of small shields have been debated over the years: (a) they represent a *local or regional* time-stratigraphic unit [7]; or (b) they represent a *global* time-stratigraphic unit [8]. Attempts to test the two hypotheses have focused on inconsistencies in stratigraphic relationships between surrounding plains and the clusters of small volcanoes, or *shield fields*, a term that follows terrestrial usage of the term volcanic field [9]. V11 and V12 quadrangles include examples of the difference between *shield fields* and *shield plains* and illustrate the two distinct processes in their formation. *Shield fields* are comparable to terrestrial volcanic fields; melt areas of limited extent and low magma rates delivered to the surface occurring locally throughout Venus geologic history. *Shield plains,* however, are more analogous to the Snake River Plains shield volcanoes [10] or terrestrial seamounts [11]; that is, volcanism associated with widespread melt sources available *during a restricted period of geologic time. Shield plains* differ from *shield fields* in larger number and greater areal extent and in their restriction to a limited stratigraphic interval. Stratigraphic relationships in V-11 and V-12 indicate a major accumulation of small shield activity occurred during a specific period in Venus geologic time prior to formation of the vast regional plains [12]. The question remains whether the *shield plains* surface is produced in a punctuated, catastrophic or continuous formation [13,14].

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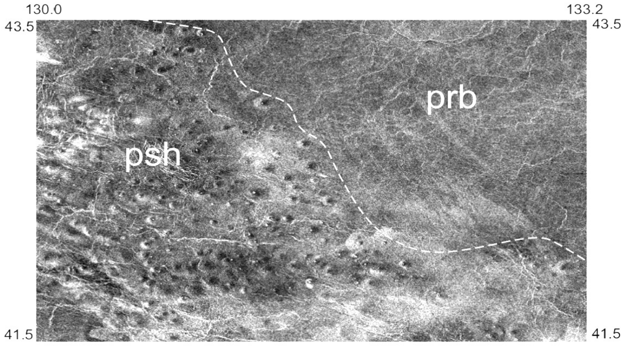

Figure 1. *Contact between Shield Plains and Regional Plains in Vellamo Planitia V-12. The shield plains represent a style of resurfacing of Venus that is clearly different from that of the regional plains [15]*

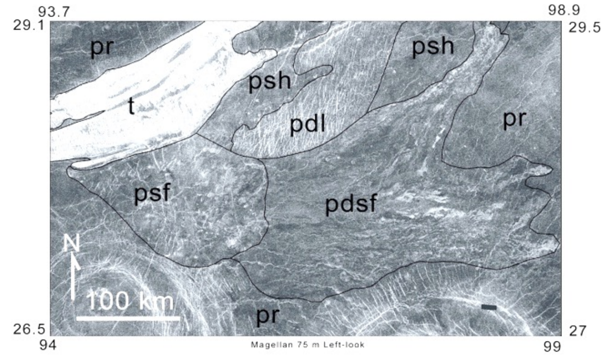

Figure 2. *Shield Field in Shimti Tessera V-11. Initial studies classified this shield field, without the flow field, as predating or synchronous with the regional plains. However, the associated flow field overlays the regional plains and the shield field buries some of the structural margin of Eurynome Corona, which appears to be stratigraphically synchronous with the regional plains. The shield field (psf) and its flow field (pdsf) are therefore interpreted to postdate the regional plains.*

References. [1] Aubele (2019) *USGS Geol Map, in review;* Aubele (2006) *Abst. 37th LPSC*; Aubele (1997) *GSA Abst. 29, no. 6,* A-138; Aubele (1996) *LPSC 27*, 49; Aubele (1995) *LPSC 26*, 59; Aubele (1994) *LPSC 25,* 45; Aubele (1993) *GSA Abst. 25*, A-221. [2] Kumar & Head (2013) *USGS Geol Map;* Lang & Hansen (2010) *USGS Geol Map;* Hansen (2009) *USGS Geol Map;* Lopez & Hansen (2008) *USGS Geol Map;* Ivanov & Head (2008, 2005, 2004, 2001) *USGS Geol.Maps;* McGill (2004, 2000) *USGS Geol Maps;* Bridges & Mercer (2002) *Abst. 33rd LPSC.* [3] Barsukov et al (1986) *JGR v.91*; Basilevsky et al (1986) *JGR v.91*. [4] Schaber (1988) LPSC19. [5] Aubele & Slyuta (1990) *EMP v.50/51*; Garvin & Williams (1990) *GRL v.17*. [6] Guest et al (1992) *JGR v.97*; Head et al (1992) *JGR v.97*; Aubele (1993) *GSA Abst. 25*, A-221; Crumpler et al (1997) *in* Venus II; Crumpler & Aubele (2000) *in* Encyclopedia of Volcanoes; [7] Guest & Stofan (1999) *Icarus, v.139*; Stofan et al (2004) *35th LPSC*; Hansen (2005) *GSA Bull 117*, no.5/6; [8] Basilevsky & Head (1998) *JGR v.103*; Basilevsky & Head (2000) *Pl & Sp Sci v.48*; Basilevsky & Head (2002) *Geol.v.30*; Ivanov & Head (2013) *Plan & Sp Sci, v.34* [9] Aubele & Crumpler (1992) *Abstr. LPI Contrib. #789;* Aubele et al (1992) *Abst. 23rd LPSC*; Crumpler & Aubele (2000) *in* Encyclopedia of Volcanoes; Crumpler et al (1997) *in* Venus II; Addington (1999) *Abst. 30th LPSC;* (2001) *Icarus, v.149*; Ivanov and Head (2004) *JGR v.109*; Crumpler et al (1997) *in* Venus II. [10] Richardson, et al, LPSC50; Shervais et al (2002) in Idaho Geol. Surv. Bull. 30; Malde (1991) *GSA Decade N.Am Geol v.K-2*. [11] Ernst & Desnoyers (2004) *Phys Earth & Plan Int v.146.* [12] Ivanov & Head (2004) *JGR v*.109. [13] Campbell (1999) *GRL v.104*. [14] Basilevsky & Head (1996) *GRL v.23*. [15] Basilevsky & Head (2002) *Geol v.30*; Ivanov and Head (2013) *Pl & Sp Sci v.84;* Hansen (2005) *GSA Bull.117, no.5/6*