GEOLOGIC MAPPING OF V11-SHIMTI TESSERA AND V12-VELLAMO PLANITIA, VENUS

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Introduction. Previously the adjoining Venus quadrangles, Shimti Tessera (V-11) and Vellamo Planitia (V-12) were partially mapped and the results presented in the mid to late 1990s and early 2000s [1]. Initial results included the description and interpretation of a new terrain unit, the *shield plains* or Akkruva shield (volcano) plains, a distinctive plains unit consisting of widespread small volcanoes. Following these initial reports of the Akkruva shield plains, authors of other mapped Venus quadrangles also identified and mapped similar *shield plains* or shield terrain units [2]. Subsequently, *shield plains* unit(s) were described as an important component of local-scale resurfacing [3], a new model of plains resurfacing [4], and included in a proposed global stratigraphy of Venus [5]. Quadrangles V11-12 provided the original definition and type example of this unit; however, the early mapping was not published. Revised geologic maps of V11-12 have now been completed using modern GIS map standards and submitted to the Planetary Mapping Program. The new maps are providing additional information to better understand the geologic and stratigraphic character of small shield volcanoes and the emplacement of *shield plains* on Venus.

Shield Fields. Small volcanoes on Venus were initially identified in Venera 15 and 16 data and interpreted to be predominantly shield-type volcanoes [6]. Enhanced concentrations of small volcanoes distributed over a quasi-circular region of modal diameter from 100 to 150 km were called "*shield fields*" [7] following terrestrial usage of the term volcanic field. Globally, Venus *shield fields* occur that are stratigraphically older than, younger than, or contemporaneous with, the surrounding regional plains [8]. It is probable that the formation of *shield fields* has occurred locally throughout Venus geologic history, produced by melt source regions of limited extent and low magma supply rates [9].

Shield Plains in V-11 and V-12. The *shield plains unit*, mapped in these quadrangles, is substantially different in number and density of shields than the previously described *shield fields*. The small shield volcanoes of the *shield plains* occur distributed uniformly over regions of the surface for thousands to millions of square kilometers. *Shield plains* lie stratigraphically above tessera and below regional plains. The *shield plains* unit appears in most instances to be spatially associated with tessera and deformed plains units. Two current hypotheses for this association include: (1) the style of volcanism represented by the shield plains is allied with the late stages of tessera formation or its obliteration, or (2) shield plains are particularly preserved near tessera due to higher topography and less inundation by later plains events. Whatever the origin, the *shield plains* unit itself appears to have formed by the eruption of multiple small shields, and associated flows, over a discrete period of geologic time. The question remains whether particular surfaces are produced in a punctuated, catastrophic, or continuous formation [10]. For thermodynamic considerations related to extensive shallow melting of the upper mantle, it is unlikely that all of the small shield volcanoes were active simultaneously or that the unit formed geologically instantaneously as, for

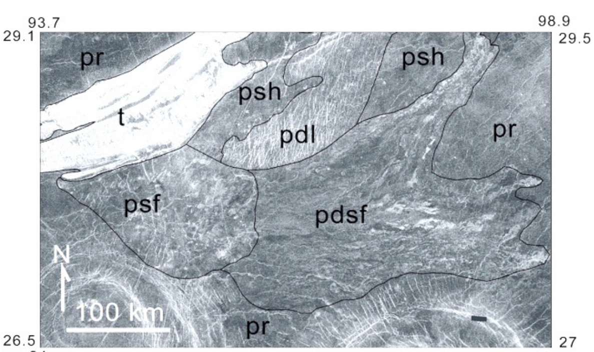

Figure 1. Shield Field in Shimti Tessera V-11. Initial studies classified this shield field, without the flow field, as predating or synchronous with the regional plains. However, the associated flow field overlays the regional plains and the shield field buries some of the structural margin of Eurynome 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.

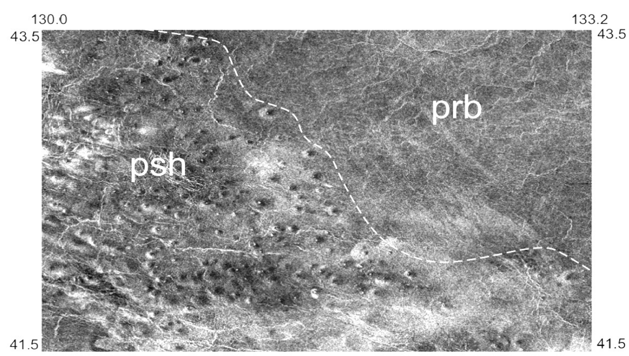

Figure 2. Contact between Shield Plains and Regional Plains in Vellamo Planitia V-12. The shield plains represent a style of resurfacing of Venus that is clearly different from that of the regional plains [15].

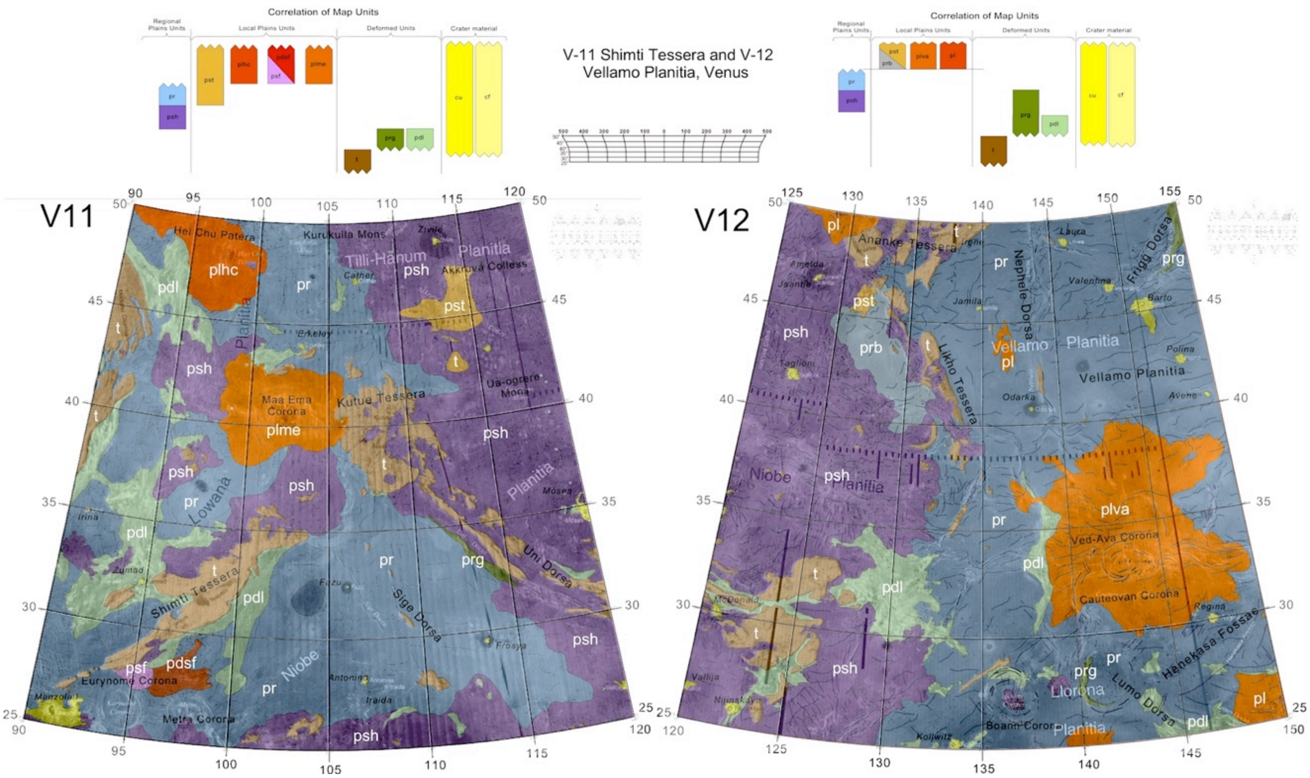

Figure 3. Geologic maps of V-11 and V-12 showing the extent of the shield plains (psh) which postdates tessera and predates the regional plains. Geologic unit color overlay on the Magellan 75 m/px left-look radar SAR image mosaics.

example, vallis-related flood basalt plains may have formed [11]. Instead, shield plains probably accumulated, either individually or in clusters (shield fields?) but over a restricted and specific period of geologic time followed in some cases by selective flooding by younger units.

Summary. The stratigraphic relationships within the Shimti Tessera (V-11) and Vellamo Planitia (V-12) quadrangles are evidence for a major peak of small shield volcanic activity prior to the formation of the vast regional (lava) plains [12]. In summary, *shield fields* can be compared to terrestrial volcanic fields; melt areas of limited extent, possibly deep magma sources, and low magma rates delivered to the surface and occurring locally throughout Venus geologic history. *Shield plains,* however, may be more analogous to the Snake River Plains shield volcanoes [13] or terrestrial oceanic seamounts [14]; that is, volcanism associated with widespread melt sources and formed during a restricted and specific geologic time. *Shield fields* and *shield plains* likely represent different volcanologic processes and different temporal associations in Venus geologic history.

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