VENUS QUADRANGLES SHIMTI TESSSSERA (V-11) AND VELLAMO PLANITIA (V-12): IMPLICATIONS OF THE VENUS SHIELD PLAINS UNIT J.C. Aubele (New Mexico Museum of Natural History & Science, 1801 Mountain Rd. NW, Albuquerque, NM 87104; jayne.aubele@state.nm.us)

Introduction: 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° to 150°E, and were partially mapped in the mid-90s to early 2000s by this author. 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]. Subsequently, over 20 other mapped Venus quads also identified similar shield plains or shield terrain units [2]. The V-11 and V-12 mapping has been revised, completed, and submitted using GIS map standards [3]. Mapping has addressed: (1) observations of the shield plains in its type location; (2) distinction between shield fields and shield plains; (3) implications of the shield plains unit, including possible relationship to an early phase of Venus' single-lid tectonics.

Shield Fields: More than 600 Venus *shield fields,* a term that follows terrestrial usage of the term volcanic field [4], were originally identified in the Magellan Catalog of Volcanic and Magmatic Features [5]. They are defined as concentrated clusters of 10s-100s of vents (density of 4-10 vents/1000km^2) distributed over a quasi-circular region of modal diameter 100-150 km with an obvious boundary beyond which there are very few, and only very scattered, small shields. They are sometimes associated with surrounding eruptive materials and frequently associated with larger magmatic or volcanic edifices. They have been mapped throughout Venus geologic history, stratigraphically older than, younger than, or contemporaneous with, adjacent regional plains [5].

Shield fields have been suggested to be comparable to terrestrial volcanic fields; that is, melt areas of limited extent and low magma rates delivered to the surface, occurring locally throughout Venus geologic history [6], representing a local time-stratigraphic unit.

Shield Plains: *Shield plains material (psh)* covers the eastern portion of V-11 and the western portion of V-12 and consistently overlays the three oldest mapped units, including *Tessera (t),* and is consistently overlain by *Regional plains material (pr)* in both quadrangles. The *shield plains unit*, mapped in these quadrangles, is substantially different in number and density of shields than are the *shield fields*. The volcanoes of the *shield plains* appear distributed relatively uniformly over extensive regions of the surface for thousands to millions of square kilometers, with a density of ~4500 vents/10^{6}km^2. The vents and their associated eruption materials can be mapped as a major terrain unit in these quadrangles, with consistent contacts and consistent stratigraphic relationships above tessera and below regional plains. The revised and completed mapping has confirmed that the unit maintains these consistent stratigraphic relationships across an extensive area, overlays ridges and fractures associated with older units, and shows a near absence of organized patterns or alignments of shields, indicating that each shield formed independently of surrounding shields with no apparent pervasive structural control. Where the shield plains unit overlays other units the associated material around and in between the shields embays or covers preexisting units. Where the shield plains unit is overlain by younger units, kipukas are often formed by an edifice and its immediately surrounding volcanic materials. The contact stratigraphic relationships are consistent around the entire unit. There is some indication that the size of the shields as well as their density or spacing may be different between shield fields and shield plains, but that remains to be confirmed in other regions.

Shield plains have been suggested to be more analogous to the Snake River Plains shield volcanoes [7] or terrestrial oceanic seamounts [8]; that is, interpreted as distributed volcanism associated with a widespread melt source, and formed during a restricted and specific (but perhaps very long) geologic time [3], and therefore representing a regional, or possibly global, time-stratigraphic unit. An estimate by Richardson [10] of the total erupted volume of shield plains and two selected shield fields in Vellamo Planitia, in comparison to the East Snake River Plains Volcanic Field (ESRP), shows a substantial difference

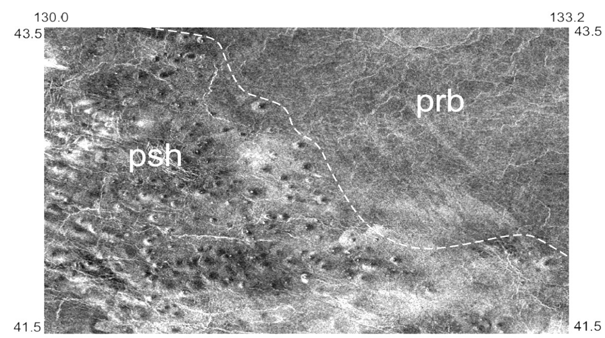

Figure 1. Contact between Shield Plains and Regional Plains in Vellamo Planitia V-12. The shield plains represent a style of resurfacing of Venus that is clearly different from that of the regional plains [21].

between total volume and erupted volume per unit area between the shield plains and the shield fields, while the shield plains and the ESRP appear to have similar erupted volumes per unit area. There are uncertainties due to spatial resolution of Venus stereo topography, morphology of the individual edifices, and the likely significant volume of the lava flows associated with the edifices; however, this analysis does provide some evidence validating the comparison with the ESRP.

Implications: However, the Snake River Plains are not a global unit; and the significance of the shield plains in Venus geologic history is still unclear. Some researchers have described the shield plains as a local/regional stratigraphic unit [11], others as a proposed global stratigraphic marker unit [12].

In total, shield plains unit(s) cover >18% of the surface of Venus [13]. In most mapped locations, the unit appears in the same stratigraphic position, and spatially associated with tessera. The style of volcanism represented by the shield plains, at least locally or regionally, is either allied with late stages of tessera formation, or it may be particularly preserved and visible near tessera due to higher topography and represent a major peak of small shield activity after the formation of tesserae and prior to the formation of the regional plains [14]. This constrained time period in the stratigraphy of shield plains units is consistent with a change in the mechanism of formation of plains either regionally or globally. To answer the question of regional vs global, we need to know the following: (1) what was the temporal extent of that period of time; (2) did the shield plains form in a catastrophic or punctuated eruption style during that time period [15]; and (3) is that stratigraphic time period the same absolute time everywhere on Venus?

Single-lid tectonics: The shield plains may represent part of the proposed mechanisms for cyclical resurfacing of Venus; for example, as a result of the substantial heat loss required by catastrophic global resurfacing [16] or as a mechanism of regional incremental resurfacing [17]. The shield plains are also consistent with a phase in the development of Venus' single-lid tectonics [18]. Interpretations of single-lid tectonic regimes imply that the insulated interior would trap heat in the asthenosphere and heat release would be accomplished by magmatic outbursts and thinning of the lithosphere [19], which could produce one or more episodes of distributed volcanism. Understanding Venus' shield plains may have implications for understanding the evolution of Earth tectonism since it appears that earlier single-lid tectonic regimes on Earth led to modern plate-tectonics and there is evidence for cycling between single-lid and plate-tectonic styles preserved in Earth's rock record [20].

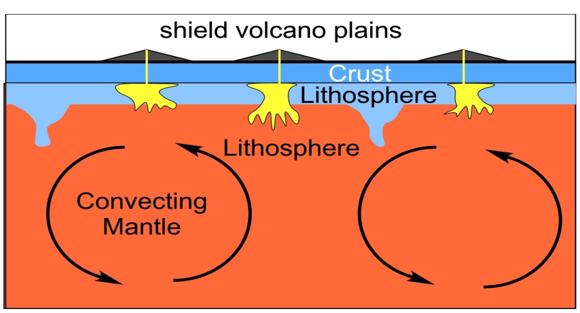

Figure 2. Shield plains are consistent with an early phase in a model of Venus' single-lid tectonics. Adapted from [20]

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