'POLYGONAL' FABRICS ON VENUS—POLYGENETIC, POSITIVE AND PRIMARY? D. A. Young, Department of Geological Sciences, Southern Methodist University, Dallas TX 75275-0395 (dyoung@mail.smu.edu)

Introduction: Kilometer-scale 'polygonal' fabrics of radar-bright lineaments have been observed in many disparate regions of Venus' lowland flow fields [1,2]. Contributing lineament widths are often thinner than the ~100 m resolution of Magellan Synthetic Aperture Radar imagery; however as the polygonal fabrics resemble the map patterns of lava cooling jointing, the assumption has been than these fabrics represent open fractures [1]. This interpretation has lead to models where isotropic thermal extension is the mechanism for fabric formation, the driving heat pulse originating locally from the mantle [1], or globally due to fluctuations in atmospheric chemistry [2].

In order to test this hypothesis, three questions need to be answered:

1. Is lineament topography positive or negative? If the lineaments represent ridges, this would contradict the jointing idea.
2. Are these structures primary—caused by or strongly influenced by emplacement of the hosting material unit—or secondary, tectonic features that not influenced by the history of the geology they cut?
3. Lastly, are individual examples of this fabric similar enough to suggest that they are the work of a single genetic process?

Data: Detailed geological mapping of Llorona Planitia and Rusalka Planitia, as part of the USGS VMAP program [3], has required interpretation of small-scale structural fabrics. Tools we can use for understanding the timing and morphology of lineaments include the details of flow margins, interactions with volcanic channel forms, and the relationship between lineaments and impact halo deposits [4, 5]. We apply these techniques to regions with polygonal fabrics within these areas. While not a global search like other studies [2] we can test our polygonal fabric observations against independent geological constrains from our geological mapping.

Results: The topographic basins of Llorona and Rusalka planitiae are dominated by radar-bright flows emanating from Ituana Corona and the Zaryanitsa Dorsa coronae complex respectively. Parts of these flows (an example located at 1˚N/173˚E is shown in Figure 1) bear subdued polygonal fabrics similar in pattern to those described in [1]. Based on contact relations, the radar-bright coronae flows (fcZy) embay typically radar-dark undifferentiated flows (fu) and are embayed by darker shield-sourced flows (sfZy). What is apparent in many locations that bear polygonal fabric is that the fabric does not extend into the undifferentiated flows, and that the bright lineaments that comprise the polygonal fabric propagate into the overlying sfZy. The implication is that the polygons are restricted to given material units, and more importantly, that these lineaments represent positive topography. Another similar example (not shown here) located at 18˚N/147˚E the polygonal fabric appears to follow the fu/coronae flow contact, as well as localizing on channel-like forms within the coronae-flow.

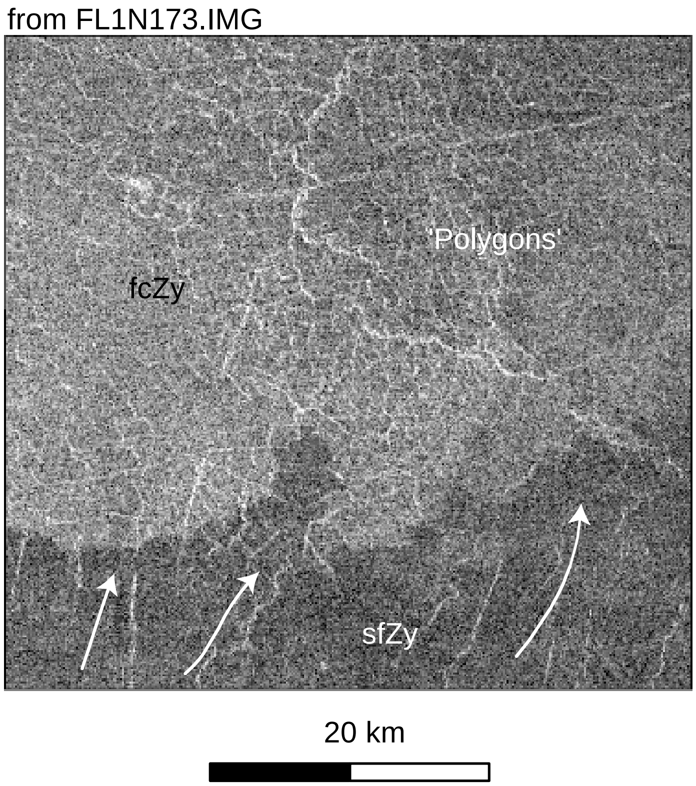
A second region useful for assessing the nature of the polygonal fabrics is located at 17˚N/171˚E, at the edge of the dark halo surrounding the crater Caccini (Figure 2). Fine impact-derived dust is thought to comprise dark haloes [6], and appears to highlight subtle structures within the lowlands of Venus [4]. In the case of Caccini, the halo appears to increase the relative radar-brightness between polygonal lineaments and their background. While open fractures should be subdued by even a fine mantle of dust, this observation is consistent with the lineaments as ridges.

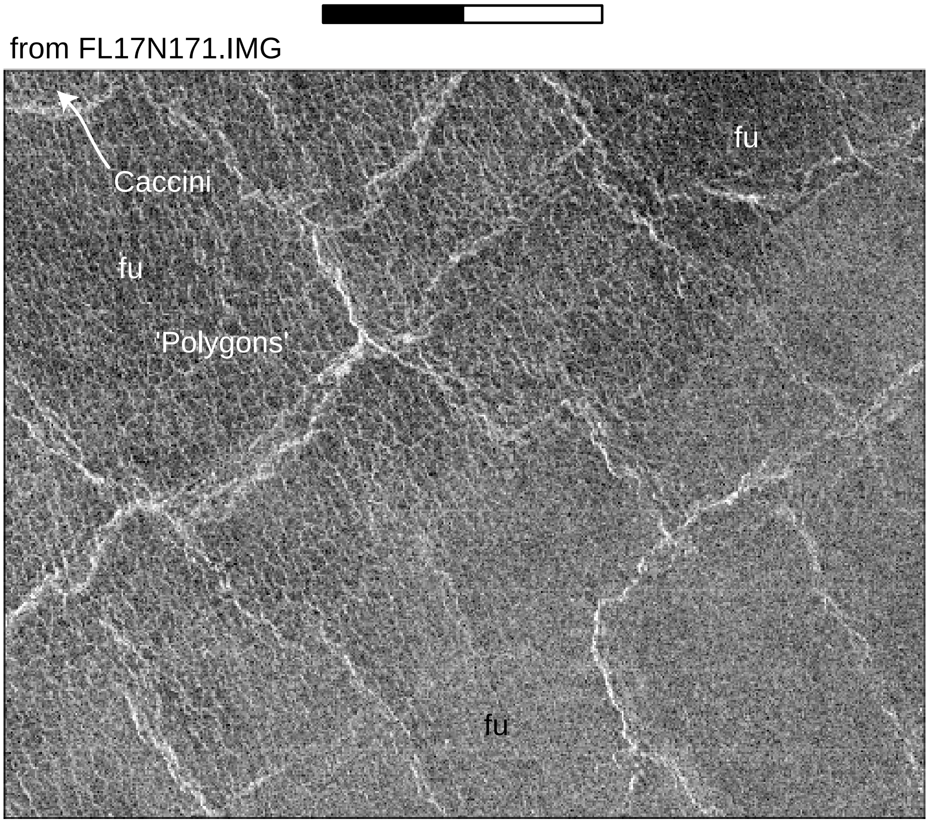
A third setting for polygonal fabrics is in association with shield fields. These polygonal fabrics are closely associated with fine wrinkle-ridge-parallel suites, with the two fabrics often intimately intertwined. The general topographic restriction on wrinkle ridges—they are confined to low elevations on Venus— also seems to apply to shield related fabrics. At 2˚N/168˚E the continuum between NW-trending wrinkle ridges and N-trending corona bounding folds is disrupted by a shield-polygonal terrain. Due to the clear presence of summit pits the location of the shields can be assessed. Polygons wrap around the shields. While the wrinkle ridge pattern is disrupted, the transition between the fine wrinkle-ridge-parallel fabric and polygons is gradual.

Conclusions: The above evidence cannot show that ridges comprise all polygonal fabrics, or even demonstrate that the examples presented were never fractures (there is always the potential for reactivation and inversion). However, it has been shown that primary, material unit specific features, play an important role in shaping polygonal fabrics, and that they cannot be assumed to have negative topography, implying that simple lumping of such fabrics is not valid.

References:

[1] Johnson, C. and Sandwell, D. (1992) *JGR, 97*, p. 13,601-13,610. [2] Anderson F. S. and Smrekar S. E. (1999) *JGR, 104* 30,743-30,757. [3] Young D. and Hansen V, U.S.G.S. V25, in review [4] Young D. (2001) *LPS XXXII* #1897 [5] DeShon H. et al (2000) JGR 105, 6983-6995 [6] Campbell, D et al (1992) JGR 97, 16,249-16,279





Frgure 1 (Top): Unit specific polygonal fabric near Hannahanna Corona.

Figure 2 (Bottom): Transition between the dark halo (with strong polygonal fabric) of Caccini crater and apparently more homogenous background surface (polygons are apparent with the lighter areas at some stretches)