Flow field stratigraphy in north Mahuea Tholus quadrangle (V-49), Venus

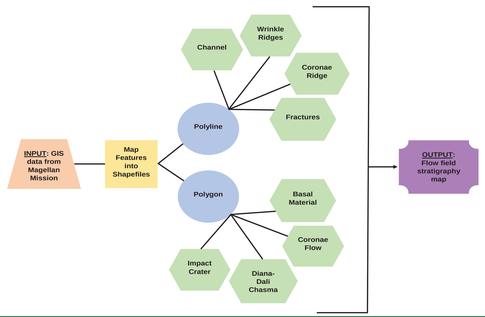
Rogers, KayLeigh A., Covley, Margaret T., Lang, Nicholas P. and Thomson, Bradley James

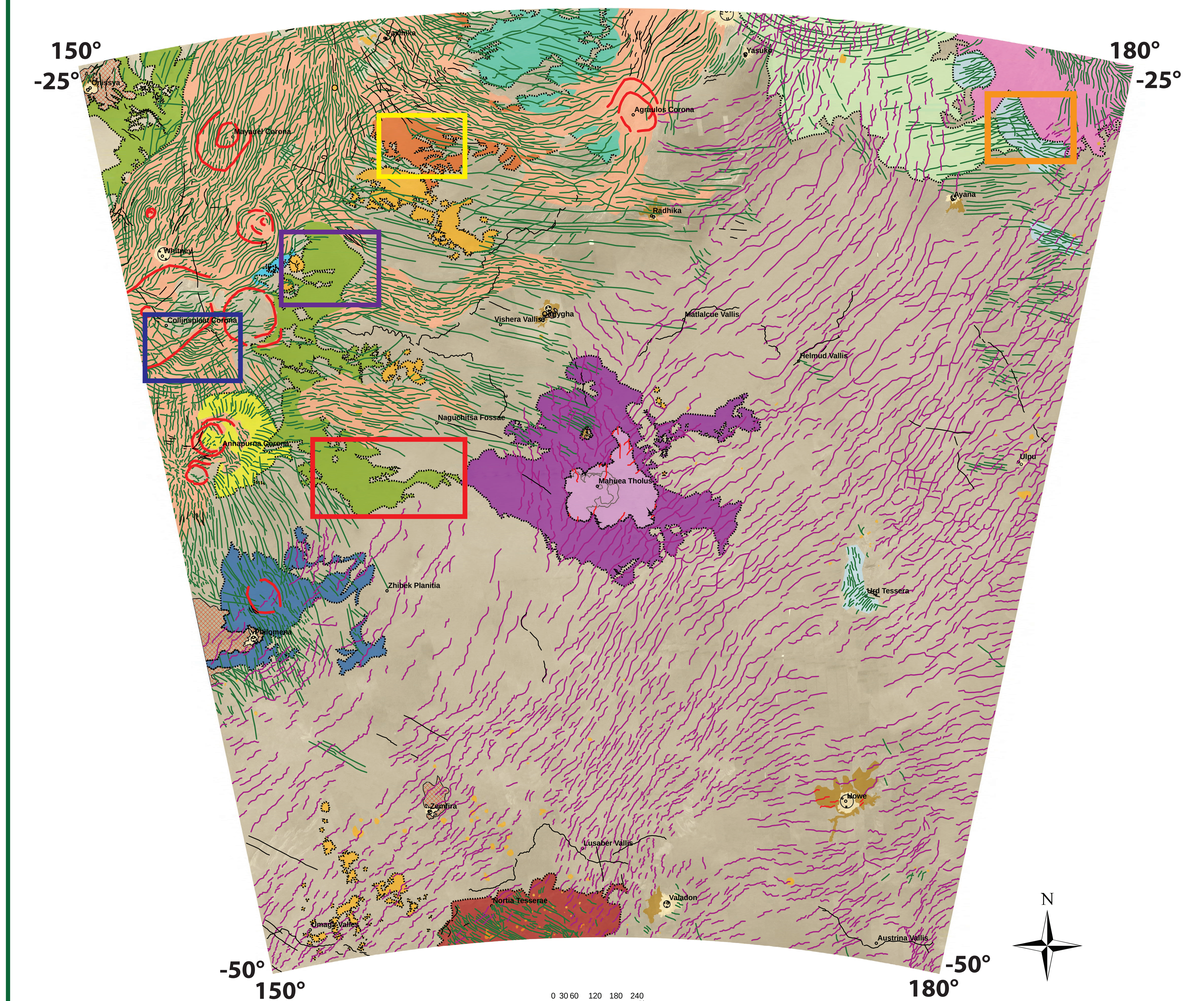
1) Intro

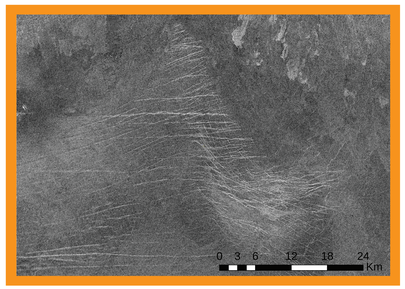
The northern third of the Mahuea Tholus quadrangle of Venus (V49; 25-50°S, 150-180°E) hosts Diana-Dali Chasma – a significant ~NE-SW trending zone of extension. Emanating from this zone are multiple lava flows that appear to be sourced from both coronae and individual fractures. Flow materials have traveled both north and south of this zone, creating an extensive flow field that encompasses an area of 1.2 x 10^6 km^2 across the northern and central portions of V-49. As part of an effort to constrain the geologic history of the V-49 quadrangle, we have been unraveling the stratigraphy of the flow field associated with this rift zone. In the surrounding quadrangles, the Diana-Dali Chasma has been divided by major coronaassociated flow fields that continue into V-49. These flows are identified as the central points of volcanism within the rift zone and were used to help in determining stratigraphy. Specifically, we have utilized NASA Magellan SAR imagery (~100 m/pxl) and altimetry data (~5 km/pxl) to geologically map individual flow units and their associated features.

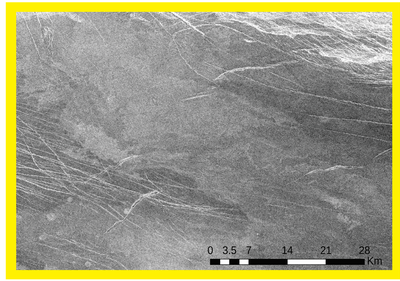
2) Methodology

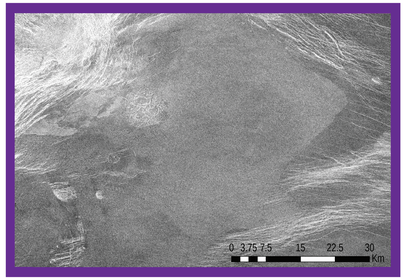
- NASA Magellan SAR Imagery (~100 m/pxl)
- Altimetry Data (~5 km/pxl)
- Hansen (2000) Methodology
- ArcMap

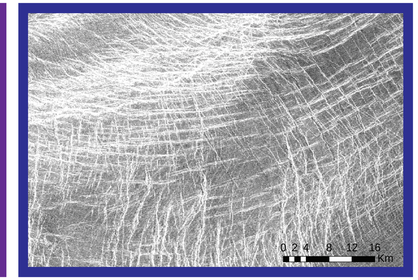


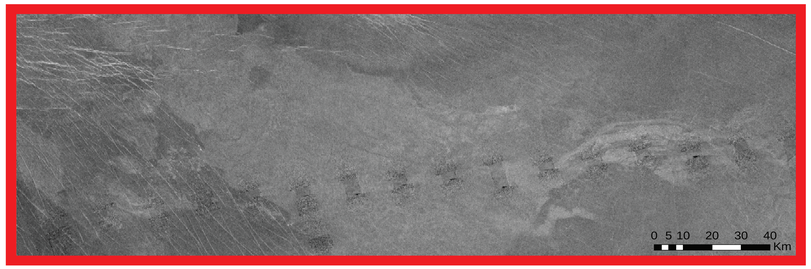












3) Conclusion

Following the methodology of Hansen (2000), we first identified tectonic structures, which allowed us to elucidate flow materials. Flow field stratigraphy was subsequently constrained using relative dating principles. There are four coronae present within the Diana-Dali Chasma in the Mahuea Tholus quadrangle: Agraulos, Annapuma, Colijnsplaat, and Mayauel. With these coronae flow fields are also Atahensik, Ceres, Bona, Miralaidji and Flidais coronae flows that originate from outside the quadrangle. Timing of fracture formation appears nonuniform with NE trending suites of fractures crosscutting EW trending fracture suites; this, suggests different parts of the rift zone were active at different times with the youngest episodes of riftassociated volcanism likely having occurred before and during formation of the NE-trending fractures. The total area of the Mahuea Tholus quadrangle is roughly 6.5 million km^2 and, within that area, the major coronae flow fields (Agraulos, Annapuma, Colijnsplaat and Mayauel) resurface ~25% of the quadrangle. Though they emanate predominantly from the northern part of V-49, coronae and rift-sourced lavas appear to have been the dominant source of volcanic resurfacing in this map area.

Description of Map Units

ba – **Basal Material, unit a** – Bright to Moderately Dark on SAR images; hosts abundant short NE to SW trending wrinkle ridges

bb1 – **Basal Material, unit 1b** – Bright on SAR images; hosts abundant fractures extensively cut with two dominate trends (NW and SE), and broad wrinkle ridges of two dominate trends (NE and SW); No lava flows within the false tesserae area

bb2 – **Basal Material, unit 2b** – Bright on SAR images; hosts abundant short NE to SW trending fractures

cMa – **Mayauel Coronae flow** - Moderately bright on SAR images; flow indicators mapped on the basis of lobate and digitate flow boundaries provide indications of local source regions; radial or concentric fractures locally deform the flows; low viscosity flows emplaced following preexisting topography

cc – **Covered Coronae** - Moderately bright on SAR; low viscosity flows; NW to SE trending fractures show evidence of a circular fracture zone, evidence of a covered coronae is visible

fDd – **Diana-Dali Chasma flow** - Moderately bright on SAR images; flow originates from within the chasma then follows topo trends into the shield field low plain

cAn – **Annapurna Coronae Flow** – Moderately bright on SAR images; flow indicators mapped on the basis of digitate flow boundaries provide indications of local source regions; also, provide evidence that in general these flows emanate from fractures that are radial or concentric

cFl – **Flidais Coronae Flow** – Moderately dark on SAR images; in general these flows emanate from fractures flow to SW and South from radial fractures in the Northern quadrangle; radial or concentric fractures locally deform the flows; low viscosity flows

fzDd – **Diana-Dali Chasma, fracture zone** - Bright on SAR images; Conglomeration of lava flows erupted from fractures associated with multiple coronae in the area; general fracture direction is NE to SW

cAg – **Agraulos Coronae flow** – Bright to moderately dark on SAR images; flow indicators provide evidence that in general these flows emanate from fractures that are either radial or concentric and locally deforming; low viscosity flows emplaced following preexisting topography

aMtf – **Mahuea Tholus flow, unit a** – Bright on SAR Images; NE – trending wrinkle ridges are underlying, relatively smooth layered planar surface; highly viscous flow

cUe – **Crater Material, undifferentiated ejecta**– Very bright on SAR images; includes floor, central peak, wall, rim, and ejecta material; Deposits and structures created by meteorite impact

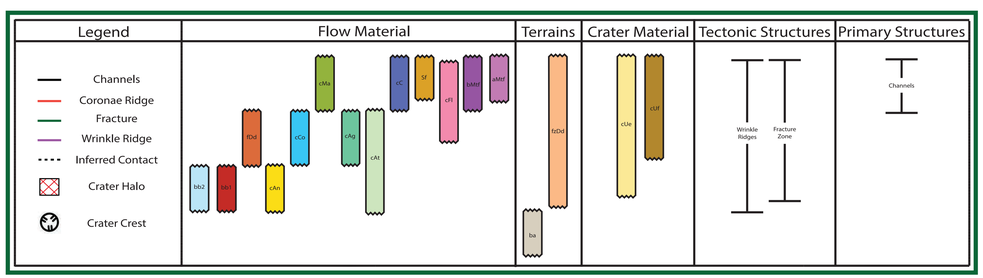
cAt – **Atahensik Coronae flow** – Moderately bright on SAR images; in general these flows emanate from fractures that are either radial or concentric; radial or concentric fractures locally deform the flows; low viscosity flows emplaced following preexisting topography

bMtf – **Mahuea Tholus flow, unit b** – Moderately bright on SAR Images; NE – trending wrinkle ridges amd NW fractures are underlying, relatively smooth planar surface; highly viscous flow

cUf – **Crater Material, undifferentiated flow** – Bright to Dark on SAR images; includes exterior flood lava materials; texture granular to smooth. Deposits and structures created by meteorite impact

cCo – **Colijnsplaat Coronae Flow** – Moderately bright on SAR images; flow boundaries provide indications of local source regions; in general these flows emanate from fractures that are either radial or concentric

Sf – **Shield flow material** – Bright to moderately bright on SAR images; mottled texture; generally circular flow patterns



References

V.L. Hansen, H.R. DeShon. Geologic Map of the Diana-Dali Chasma Quadrangle (V-37), Venus
N.P. Lang, V.L. Hansen. Geologic Map of the greenway Quadrangle (V-24), Venus
V.L. Hansen. *Geologic mapping of tectonic planets (2000)*

Acknowedgements

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