PRELIMINARY DETAILED STRUCTURAL MAP OF AN EQUATORIAL FRACTURE ZONE (15S-20S/ 110E-124E), WESTERN APHRODITE TERRA, VENUS.
D. Tovar[1], V.L. Hansen[1] & J.B. Swenson[1]. [1]Department of Earth and Environmental Sciences, University of Minnesota-Duluth, 1114 Kirby Drive, Duluth, MN 55812, USA (tovar035@d.umn.edu; vhansen@d.umn.edu; jswenso2@d.umn.edu)

Introduction: Venus and Earth are similar in size, density, composition, and heat budget. Plate tectonic processes play a key role in dissipating heat on Earth. Venus, however, lacks plate tectonics, raising the fundamental question: how does Venus dissipate heat? Similarities in the hypsometry of Earth's oceans and Venus' surface (sans crustal plateaus and Ishtar Terra) suggest that similar mechanisms might drive thermal isostasy at the global scale on Earth and Venus [1]. Venus' extensive fracture zones might be conceptually correlative to Earth's divergent boundaries, and likely mark regions of significant heat transfer. Extensive fracture zones are particularly well developed in an equatorial position in southern Aphrodite Terra. The fracture likely represent a subsurface magmatic plumbing system [2]. We are undertaking a detailed structural analysis of a targeted portion of an Aphrodite fracture zone in order to understand the architectural evolution through time and space and, ultimately, to construct thermal models in order to gain insight into possible mechanisms of heat transfer on Venus. The map area (15S-20S/110E-124E), characterized by extreme density of faults and pit chains, encompasses over 700,000 km^2. The map area has excellent coverage by Magellan SAR data (right-look, left-look and stereo), which we employ in mapping.

Map Area: The fracture zone (FZ) includes two zones characterized by E- and NNW-trending lineaments, respectively; a coronae-like feature with concentric and radial lineaments marks the intersection of the fracture trends (Fig. 1). The SW part of the map area encompasses the FZ boundary. Topographically the FZ sits high compared to its surroundings.

We delineated lineaments, lineament trends and structural domains using radar Magellan SAR and altimetry data. Primary lineaments include canali and lava flow directions. We focus here on tectonic lineaments, which characterize the FZ.

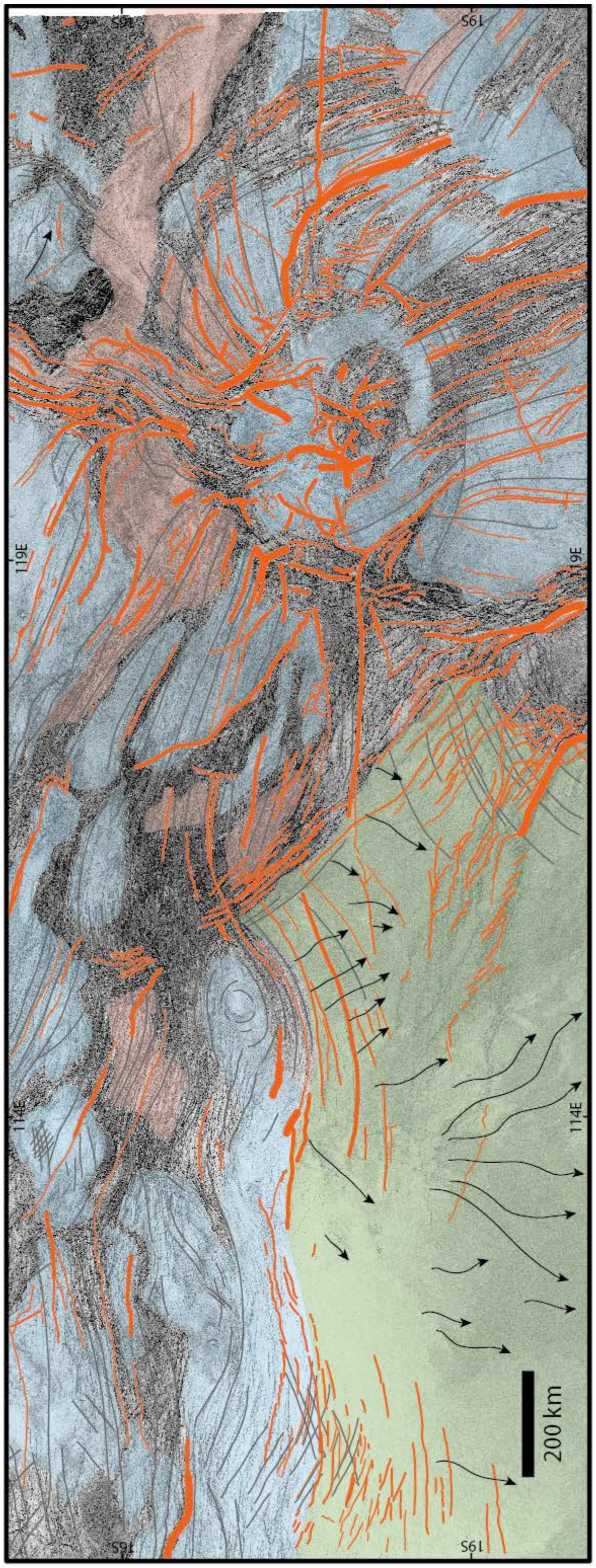
Tectonic lineaments. These lineaments defined four broad suites based on orientation and/or patterns. We map lineaments according to width; wider lineaments, which are easy to map, clearly represent pit chains with well-developed troughs; narrower lineaments clearly mark fractures, although detailed element interpretation is limited by data resolution. All of the lineaments are long narrow structures with extreme aspect ratios; lineament length scales are hundreds of kilometers. Wide lineaments are more widely spaced, contributing to ease in mapping, whereas narrow lineaments are so closely spaced, i.e. at or near data resolution, as to define a penetrative fabric across the map area. For narrow lineaments, trends, rather than individual lineaments are shown on the maps (Fig.1)

Lineaments of all widths define similar regional patterns. The northern part of the FZ is defined by intersecting suites of penetratively developed fractures that define scallop-like packages with ~30° of curvature over ~500 km; the eastern FZ is dominated by the corona-like structure. Wide-lineaments (pit chains) occur mostly in the eastern part of the map area, defining concentric to radial trends. Wide lineaments also mark short connected pit chains in the corona-interior. Cross-cutting relations indicate that the lineaments formed time transgressively and preserve a record of FZ evolution.

Structural domains A-D, defined based on lineament density, represent structural facies and not material units. Domains A-D define regions of decreasing fracture density and, together with cross-cutting relations, provide a record of progressive evolution of the FZ architecture and, by extrapolation, the magmatic plumbing system. Domain D (lowest density) occurs outside and along the boundary of the FZ. Domain D lies at the lowest elevation in the map area, and slopes away from the FZ. Domain D preserves lava flow structures and canali, which clearly indicate that local tectonic lineaments served as magma conduits; pit chains leak, cut, and are buried by flows; flow is consistent with contemporary regional slope. Domain C occurs within the FZ and along the inside of the FZ; lineaments are widely spaced, yet clearly cut across domain boundaries. Domain A, with the highest fracture density, typically includes interesting suites of fractures. Domain B is transitional between A and C. Topographically, domains A-C cross topography; that is, there is no a simple relationship between topography and domain boundaries, as with domain D.

The FZ preserves a record of time transgressive lineament (suite) development, and local surface burial occurring during FZ evolution. Lineament suites extend beneath cover in regions of domains C and B within the FZ. Low lineament density in domain D and in the regions of domain C along the FZ boundary result from fewer numbers of lineaments formed during the evolution of the FZ, rather than burial of earlier formed lineaments.

References: [1] Rosenblatt, P. et al. (1994) *GRL., 21*, 465-468. [2] Le Corvec, N. et al. (2013) *JGR SE, 118,* 968-984.



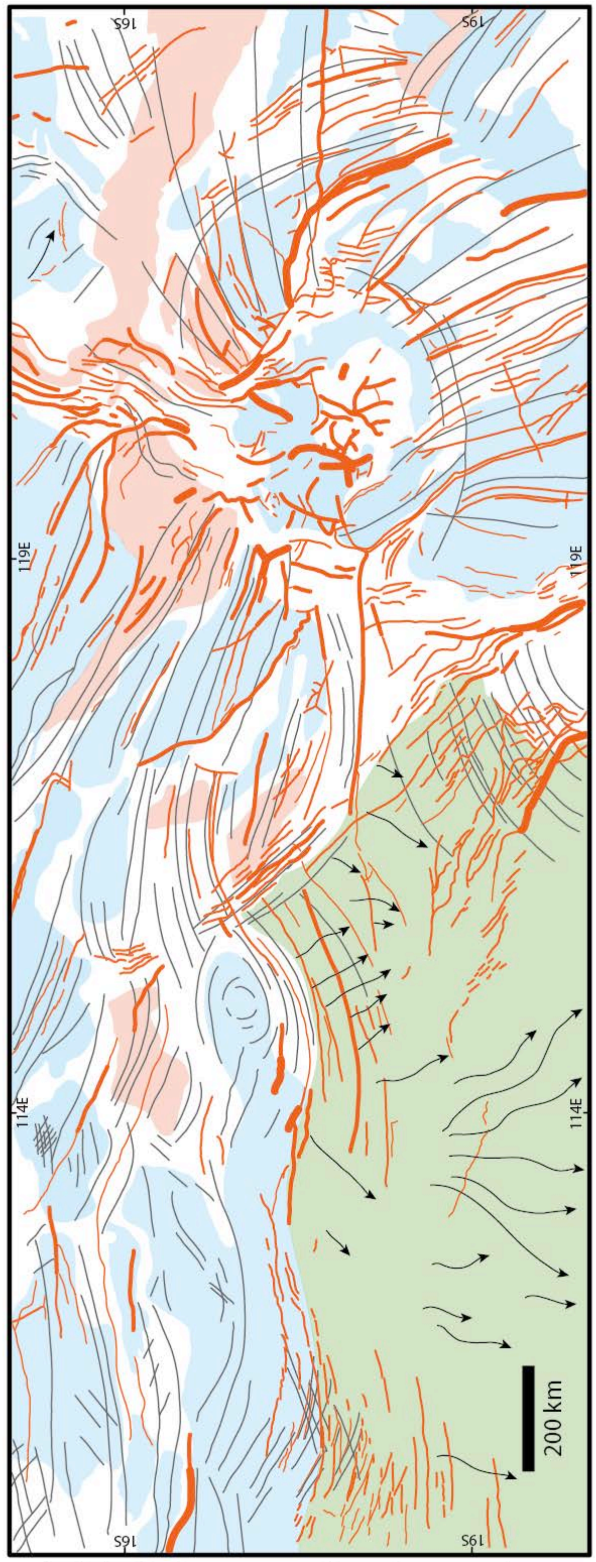


Figure 1. Mercator projection of structural domain and lineament maps of a portion of a fracture zone (15S-20S/110E-124E), southern Aphrodite Terra, Venus. Maps shown with and without Magellan inverted right-look SAR base.