

Figure 1. SAR image of Helen Planitia quadrangle (V-52), Venus. A. Showing major features (left-looking radar image in Lambert projection). B. Showing the Parga Chasmata and Helen Planitia regions and subregions defined by local geologic features.

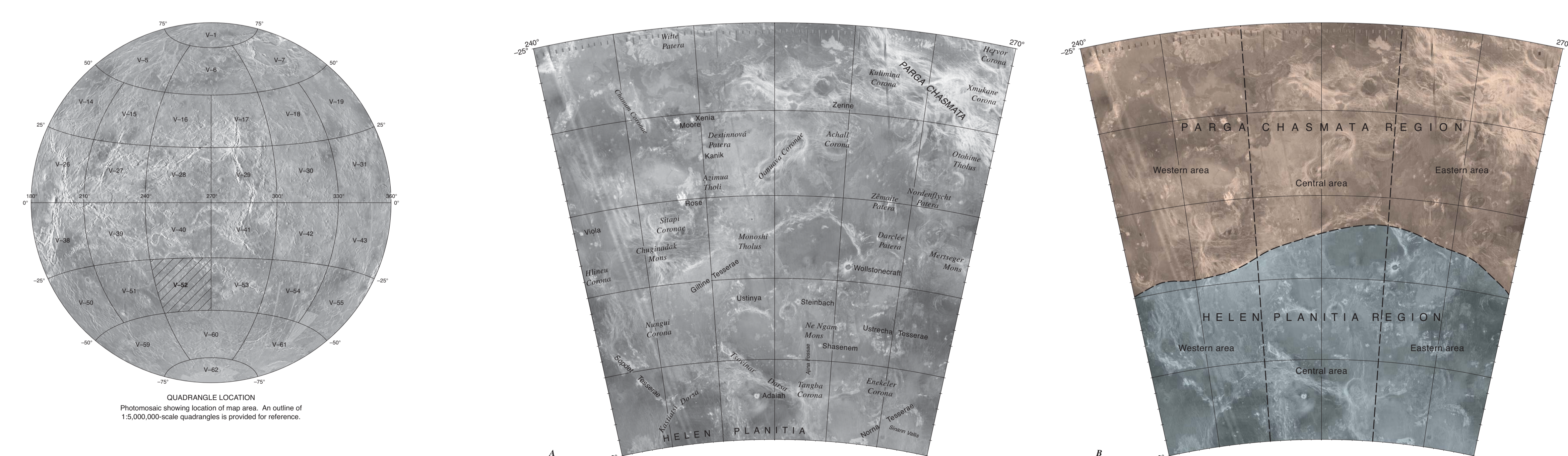


Figure 2. Ancillary data sets for Helen Planitia quadrangle (V-52), Venus. A. Altimetry (Global Topography Data Record 3.1; color stretch is nonlinear to bring out topographic details). B. Reflectivity showing efficiency of surface materials in reflecting electron radiation. C. Root mean square (RMS) slope. D. Emissivity showing that rough areas and low dielectric content materials have higher values.

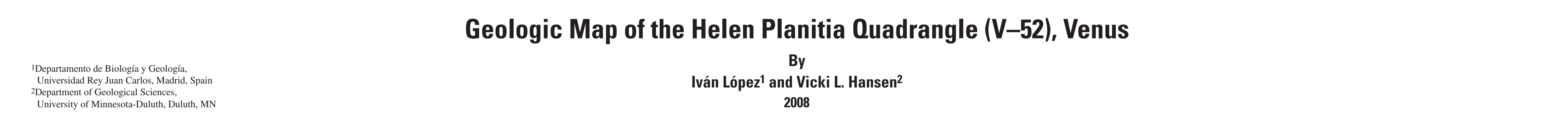
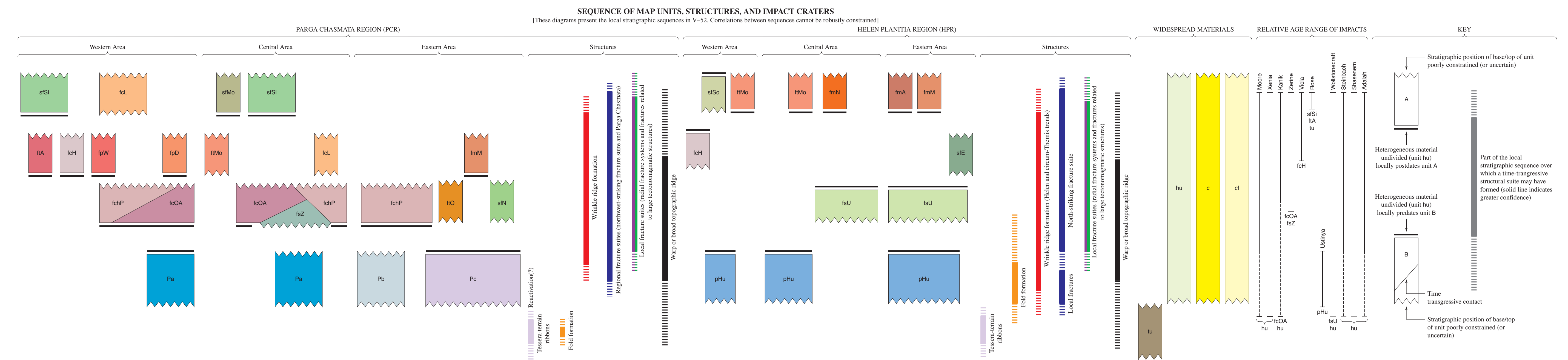


Figure 3. Map showing structural ridges underlain by altimetry data, Helen Planitia quadrangle (V-52), Venus.

Figure 4. Map of regional (blue) and local (green) fracture suites underlain by altimetry data, Helen Planitia quadrangle (V-52), Venus. The figure also shows the location of large tectonotectonic features (red lines, coronae, annuli) and radial fracture systems (brown lines), a center of structure centered on Dardalea Patera, a structure centered on Monashi Tholus, a structure centered on cinder cones located at lat 48.9° S, long 238° E.



**DESCRIPTION OF MAP UNITS**

The absence of distinctive temporal markers and their impact count during techniques (Haskell and others, 1998; Crampbell, 1999) precludes correlation of units across the map area. Instead of the classical order of unit descriptions from youngest to oldest, we use units by geographic location within the Parga Chasmata (PCR) and Helen Planitia (HPR) regions and subregions (western, central, and eastern) units that are in contact with and/or intert with various structures of units or structures provide local temporal relationships.

**PARGA CHASMATA REGION**

**Western Area**

- gS** **Shield field and associated material around Sitaip Corona**—Variable backscatter and variable textured materials with different morphologies that form edifices 10–20 km diameter. Shields form clusters locally associated with Sitaip Corona. Deformed by local corona fracture suites and regional north-south-trending fractures. *Type locality:* Lat 33.5° S, long 245° E. *Interpretation:* Composite shield unit that cannot be used as a marker unit across the map area.
- gH** **Flow material from Hileon Corona**—Intermediate to low backscatter and homogeneous texture. Intermediate-size volcanic features and clusters of shields inside and around the corona contribute to the unit. Locally cut by corona-related concentric fractures, northwest-trending regional fractures, and north-south-trending wrinkle ridges. *Type locality:* Lat 35° S, long 241° E. *Interpretation:* Lava flows related to formation of Hileon Corona.
- gA** **Flow material from Amina Thol**—High backscatter and reticulate to mottled texture. The origin of the material is unclear. Partially covered by an apron related to lateral flank failure of a near steep-sided dome. The material is deformed by northwest-trending wrinkle ridges and northeast-trending fractures. *Type locality:* Lat 34° S, long 248.8° E. *Interpretation:* Volcanic flows of undetermined origin.
- gD** **Flow material from Deshmora Patera**—Intermediate backscatter and homogeneous texture. Composite flows that emerged to the north and radial flows near the caldera. Deformed by north-south-trending wrinkle ridges. *Type locality:* Lat 31.5° S, long 250° E. *Interpretation:* Volcanic flows associated with Deshmora Patera.
- gP** **Flow material from White Patera**—Intermediate to high backscatter flows. Comprises numerous individual flows radiating from White Patera (lat 25.8° S, long 247.6° E). Materials are cut by local fracture suites and by fractures and grabens of Parga Chasmata. Unit correlates with corona material, undivided unit (c) of the Galindo quadrangle (V-48; Chapman, 1999). *Type locality:* Lat 26.2° S, long 247.2° E. *Interpretation:* Volcanic flows related to White Patera.
- gS** **Flow material from Labona Corona**—Intermediate to high backscatter. Unit is composed of multiple overlapping flows that display homogeneous texture and lobate flow morphologies. Flows are locally cut by fractures and grabens of Parga Chasmata. Unit correlates with corona material, unit (m) of the Galindo quadrangle (V-48; Chapman, 1999). *Type locality:* Lat 26° S, long 250° E. *Interpretation:* Lava flows related to Labona Corona.
- gP** **Parga Chasmata material a**—Intermediate to high backscatter. Preserved as a local topographic high. Contains shields (age unknown). Extensively deformed by north- and northwest-trending fractures, northwest-trending grabens, and local fracture suites. *Type locality:* Lat 28.5° S, long 245.5° E. *Interpretation:* Volcanic materials that predominate local reservoirs. Locally deformed by a pervasive deformation fabric. This unit could represent materials formed before the formation of Parga Chasmata, preserved within the extensional deformation belt, or emplaced during initial stages of extensional deformation belt evolution. Predates adjacent corona-related lava flows (unit gNP).

**Central Area**

- gMA** **Shield field near Monashi Tholus**—Intermediate backscatter. Discontinuous layer resulting from the point-sourced nature of the shield-related flows and deposits. Deformed by a local radial fracture system. Some shields appear to be aligned along fractures, suggesting volcanic control of emplacement. *Type locality:* Lat 36° S, long 252° E. *Interpretation:* Local volcanic shield field and associated volcanic materials.
- gMA** **Flow material from Monashi Tholus**—Intermediate backscatter and mottled texture. Composite unit made of volcano-related flows and shields. A radial fracture system associated with Monashi Tholus cuts, but is also partially covered by, materials of the unit. *Type locality:* Lat 38.6° S, long 251.2° E. *Interpretation:* Volcanic flows associated with Monashi Tholus and shield-related materials.
- gCA** **Flow material from Osmara Corona and Achal Corona**—Moderate to high backscatter and smooth to reticulate texture. Includes sheet flows related to Osmara Corona and Achal Corona and materials related to intermediate-size volcanoes, shield fields, and associated flow materials formed in the interior of the large coronae. Locally fractured by corona-related fractures and by grabens of Parga Chasmata. *Type locality:* Lat 32° S, long 252.5° E. *Interpretation:* Lava flows from Osmara Corona and Achal Corona, local intermediate-size volcanic features, and shield-related materials; composite unit that cannot be used as a temporal reference marker unit.
- gP** **Flow material from fractures and coronae of Parga Chasmata**—Variable backscatter and texture. Composite unit formed by digitate to lobate flows that emerged from fractures of Parga Chasmata, Kellinae, Heros, and Xenolake Corona; and an unnamed corona located at lat 27.5° S, long 267.5° E. Flow indicators mapped on the basis of lobate and digitate flow boundaries and the presence of primary structures, such as channels, that indicate the source of some flows. Locally deformed by corona-related fracture suites, the fractures and grabens of Parga Chasmata, and north-south-trending wrinkle ridges. Correlates with unit (g) and corona material, undivided unit (c) of the Galindo quadrangle (V-48; Chapman, 1999). *Type locality:* Lat 27° S, long 259° E. *Interpretation:* Lava flows related to Parga Chasmata, Kellinae, Heros, and Xenolake Corona; and an unnamed corona; composite unit that cannot be used as a temporal reference marker unit.

**Eastern Area**

- gO** **Flow material from Obolime Tholus**—Intermediate to high backscatter flows associated with Obolime Tholus (lat 32° S, long 268.2° E). Locally cut by regional fractures. *Type locality:* Lat 32.2° S, long 268.2° E. *Interpretation:* Local flows related to formation of the Obolime Tholus.
- gM** **Flow material from Messenger Mons**—Low to intermediate backscatter flows associated with Messenger Mons (lat 38.1° S, long 270.3° E); shields locally present. Flow indicators mapped on the basis of lobate and digitate flow boundaries. Cut by radial fractures of Messenger Mons. *Type locality:* Lat 39° S, long 269° E. *Interpretation:* Local shields and volcanic flows related to formation of Messenger Mons.
- gPI** **Shield field and associated materials near Nordquityia Patera**—Low backscatter and homogeneous textured materials that form small shields with summit pit craters. Deformed by northeast-trending fractures and wrinkle ridges. *Type locality:* Lat 36.5° S, long 267° E. *Interpretation:* Volcanic shields associated with a local tectonotectonic feature.
- gS** **Parga Chasmata material b**—High backscatter. Preserved as local topographic high. Extensively deformed by local north-south-trending fracture suites and by fractures and grabens of Parga Chasmata. *Type locality:* Lat 27.5° S, long 267° E. *Interpretation:* Material of unknown genetic origin deformed by a pervasive deformation fabric. This unit could represent materials formed before the formation of Parga Chasmata and preserved within the extensional deformation belt or materials emplaced during initial stages of extensional deformation belt evolution. Predates adjacent corona-related lava flows (unit gNP).
- gP** **Parga Chasmata material c**—Intermediate to high backscatter and homogeneous to mottled texture. Contains shields and intermediate-size volcanic features with associated flows. Locally cut by a local reticulate fracture fabric, as well as fractures, grabens of Parga Chasmata, and wrinkle ridges. *Type locality:* Lat 33.8° S, long 268° E. *Interpretation:* Lava flows and other volcano-related materials of unknown age. Predates adjacent chasma- and corona-related flows (unit gNP).

**HELEN PLANITIA REGION**

**Western Area**

- gS** **Shield field and associated material of Sopleit Tessera**—Intermediate backscatter and local reticulate texture material formed by small shields with summit pit craters and associated flows. *Type locality:* Lat 43.5° S, long 242° E. *Interpretation:* Local volcanic shields and associated materials that predominate tessera terrain in Sopleit Tessera terrain.

**Central Area**

- gM** **Flow material from Ne Ngam Mons**—Intermediate backscatter flows. Flow indicators mapped on the basis of lobate and digitate flow boundaries and channels that indicate emplacement style. Interacts with Ajnae Fossae. *Type locality:* Lat 47° S, long 256.8° E. *Interpretation:* Volcanic flows related to the formation of Ne Ngam Mons.
- gP** **Helen Planitia material, undivided**—Intermediate to high backscatter with textures that vary from homogeneous to a kilometer-scale reticulate texture. Backscatter variations caused by the mantling of Adah's halo. Contains shields and associated shield material. Locally deformed by north-northeast wrinkle ridges, north-south-trending fields in Tessera Dorsa local fracture suites, and regional fracture suites. *Type locality:* Lat 41.7° S, long 251° E. *Interpretation:* Lava flows and other volcano-related materials that locally predominate the tessera terrain. Predates adjacent heterogeneous materials and shield-related materials.

**Eastern Area**

- gA** **Flow material from Aboona Mons**—Low to intermediate backscatter material. Flow indicators mapped on the basis of digitate flow boundaries. Flows bounded by unit (b). *Type locality:* Lat 46° S, long 270° E. *Interpretation:* Dual volcanic flows related to the formation of Aboona Mons in the Tessera Regio quadrangle (V-53).

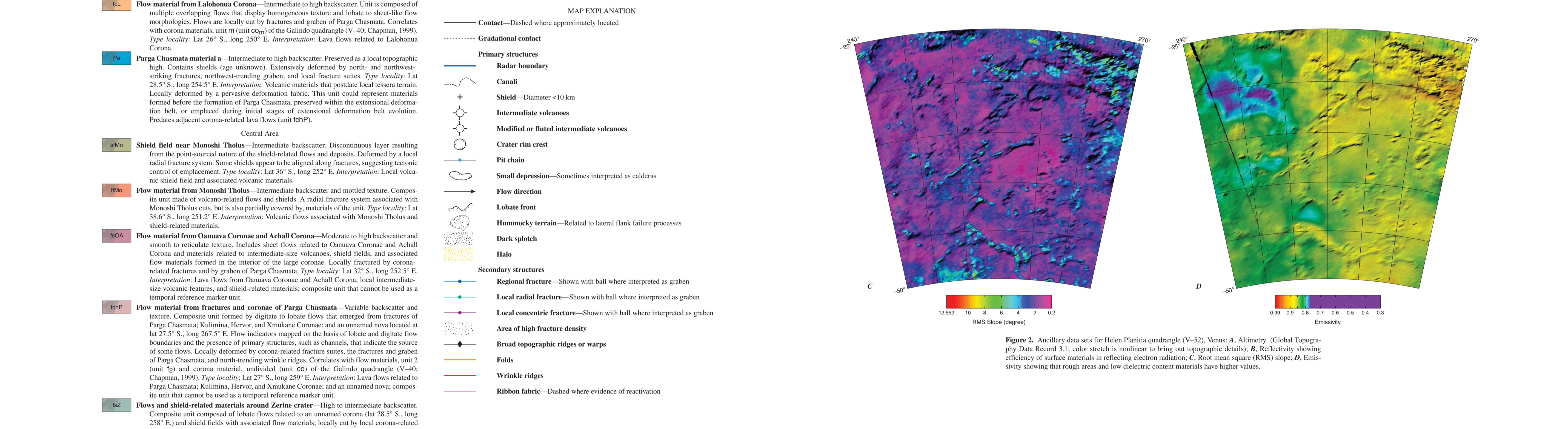


Figure 6. Map showing structural ridges underlain by altimetry data, Helen Planitia quadrangle (V-52), Venus.

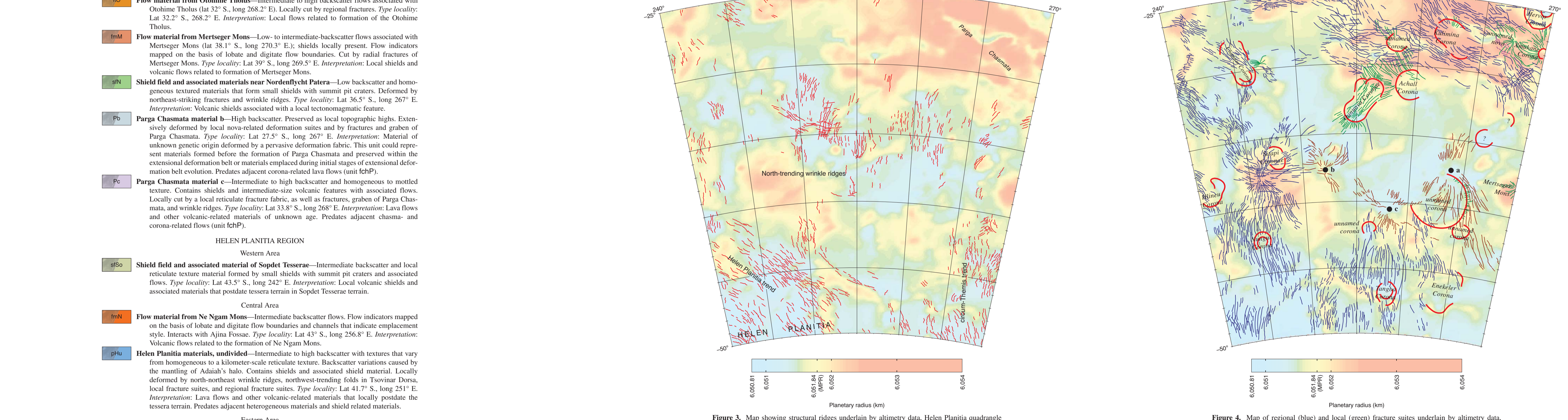


Figure 7. Map of regional (blue) and local (green) fracture suites underlain by altimetry data, Helen Planitia quadrangle (V-52), Venus. The figure also shows the location of large tectonotectonic features (red lines, coronae, annuli) and radial fracture systems (brown lines), a center of structure centered on Dardalea Patera, a structure centered on Monashi Tholus, a structure centered on cinder cones located at lat 48.9° S, long 238° E.