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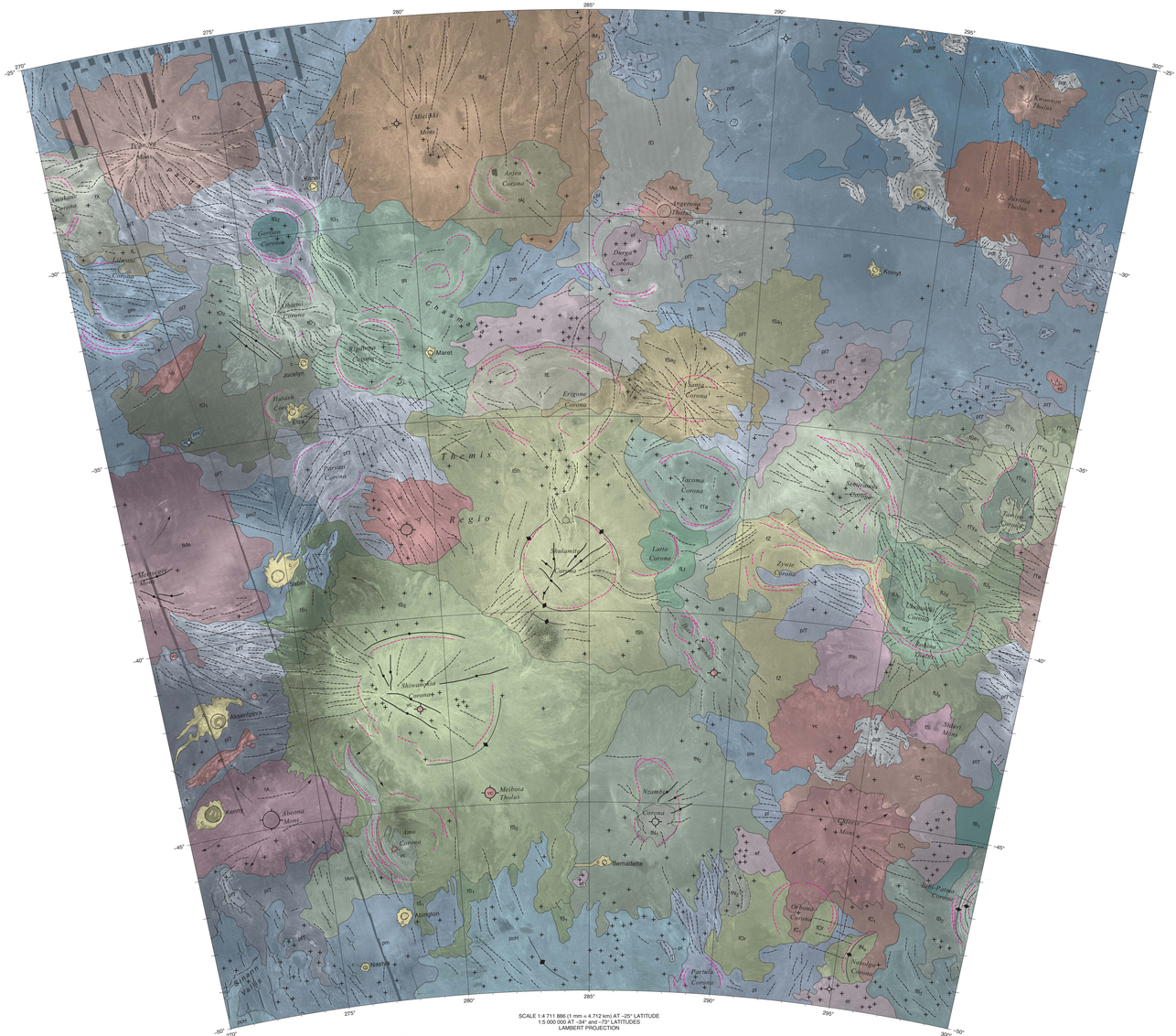
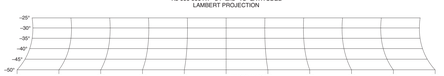
Prepared for the
National Aeronautics and Space Administration

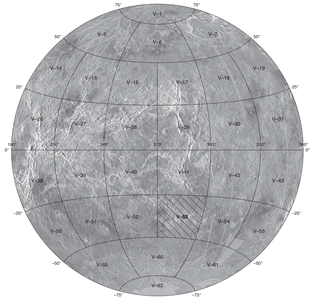
Scientific Investigations Map 3165
Atlas of Venus: Themis Regio Quadrangle (V–53)
Pamphlet accompanies map



SCALE 1:4 711 886 (1 mm = 4.712 km) AT –25° LATITUDE
1:5 000 000 AT –34° and –73° LATITUDES
LAMBERT PROJECTION



Descriptions of nomenclature used on map are listed at http://planetarynames.wr.usgs.gov/



QUADRANGLE LOCATION
Photomosaic showing location of map area. An outline of 1:5,000,000-scale quadrangles is provided for reference.

Geologic Map of the Themis Regio Quadrangle (V–53), Venus

By
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2012

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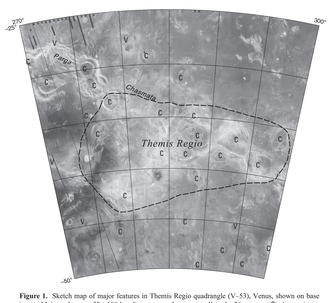
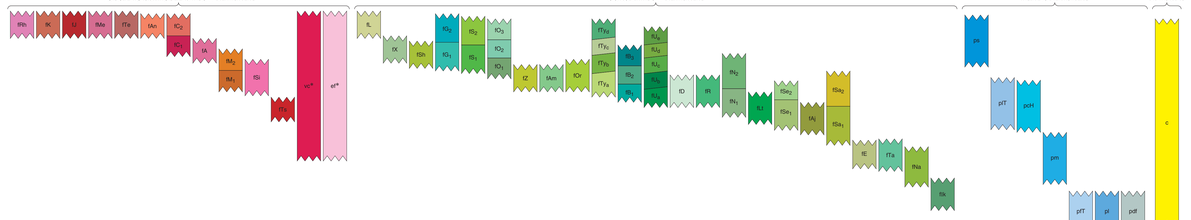


Figure 1. Sketch map of major features in Themis Regio quadrangle (V–53), Venus, shown on base image. Major volcanoes (**V**) >100 km diameter are shown, as well as the 26 coronae (**C**). Approximate location of Parga Chasmata is shown, as well as Themis Regio (dashed line indicates approximate location of rise).

SEQUENCE OF MAP UNITS



*Units represent collections of distinct outcrops with local age-range constraints that have broad age ranges when viewed collectively.

DESCRIPTION OF MAP UNITS

[Subunits (members) in the map area associated with a specific source are numbered, if stratigraphic relations between them could be determined (for example, units fSe_1 and fSe_2), or lettered, if not all members are in contact and, therefore, age relations are ambiguous (for example, units fTy_a, fTy_b, fTy_c, fTy_d)]

VOLCANIC EDIFICE AND FLOW MATERIAL

Material typically of limited extent from identifiable source

fRh **Rohina Tholus flow material**—Intermediate- to high-backscatter, digitate deposits extending from Rohina Tholus, which sits upon Ukemochi Corona. *Type area:* lat 39° S., long 294° E. *Interpretation:* Lava flows from central or flank vents of the Rohina Tholus edifice

fK **Kwannon Tholus flow material**—Intermediate-backscatter, sheet-like deposits occurring on the flanks of the Kwannon Tholus edifice. *Type area:* lat 26.4° S., long 297° E. *Interpretation:* Lava flows from central or flank vents of the Kwannon Tholus edifice

fJ **Justitia Tholus flow material**—Lobate to sheet-like deposits with low to intermediate backscatter located on the Justitia Tholus edifice. *Type area:* lat 28° S., long 296.5° E. *Interpretation:* Lava flows from central or flank vents of the Justitia Tholus edifice

fMe **Merteger Mons flow material**—Low- to intermediate-backscatter, digitate to sheet-like deposits occurring on the summit and flanks of the Merteger Mons edifice. *Type area:* lat 38° S., long 271° E. *Interpretation:* Lava flows from central or flank vents of the Merteger Mons edifice

fTe **Tefnut Mons flow material**—Intermediate- to low-backscatter, sheet-like deposits occurring on the flanks of the Tefnut Mons edifice. *Type area:* lat 38° S., long 300° E. *Interpretation:* Lava flows from central or flank vents of the Tefnut Mons edifice

fAn **Angerona Tholus flow material**—Variable backscatter deposits occurring on the flanks of the Angerona Tholus edifice. *Type area:* lat 30° S., long 287° E. *Interpretation:* Lava flows from central or flank vents of the Angerona Tholus edifice

Chloris Mons flow material

fC_2 **Member 2**—Digitate to sheet-like, variable backscatter deposits on the summit and flanks of the Chloris Mons edifice. *Type area:* lat 46° S., long 294° E. *Interpretation:* Lava flows from central or flank vents of the Chloris Mons edifice

fC_1 **Member 1**—Low- to intermediate-backscatter, sheet-like deposits occurring on the flanks of the Chloris Mons edifice. *Type area:* lat 44° S., long 296.5° E. *Interpretation:* Lava flows from central or flank vents of the Chloris Mons edifice

fA **Abeona Mons flow material**—Variable backscatter, lobate to sheet-like deposits occurring on the summit and flanks of the Abeona Mons edifice. *Type area:* lat 45° S., long 273° E. *Interpretation:* Lava flows from central or flank vents of the Abeona Mons edifice

Mielikki Mons flow material

fM_2 **Member 2**—Digitate to sheet-like, variable backscatter deposits occurring on the summit and flanks of the Mielikki Mons edifice. *Type area:* lat 28° S., long 282° E. *Interpretation:* Lava flows from central or flank vents of the Mielikki Mons edifice

fM_1 **Member 1**—Sheet-like, low-backscatter deposits occurring on the flanks of the Mielikki Mons edifice. *Type area:* lat 26° S., long 285° E. *Interpretation:* Lava flows from central or flank vents of the Mielikki Mons edifice

fSi **Siduri Mons flow material**—Sheet-like deposits occurring on the Siduri Mons edifice. *Type area:* lat 42.8° S., long 297° E. *Interpretation:* Lava flows from central or flank vents of the Siduri Mons edifice

fTs **Ts'an Na Mons flow material**—Intermediate-backscatter, digitate to sheet-like deposits occurring on the summit and flanks of the Ts'an Na Mons edifice. *Type area:* lat 27.5° S., long 273° E. *Interpretation:* Lava flows from central or flank vents of the Ts'an Na Mons edifice

vc* **Volcanic center flow material**—Flow material having radar-dark to radar-bright backscatter coefficients and lobate boundaries. Multiple occurrences in map area with varying superposition relations. *Type area:* lat 43° S., long 293.5° E. *Interpretation:* Lava flows from central or flank vents of an unnamed volcanic complex

ed* **Edifice field flow material**—Numerous small shields and cones surrounded by lobate deposits with moderate backscatter. Multiple occurrences in map area with varying superposition relations. *Type area:* lat 33° S., long 283° E. *Interpretation:* Fields of small volcanic edifice and associated flows of varying ages

CORONA FLOW MATERIAL

Material related to coronae, typically of limited extent and varying from deformed materials to digitate or sheet-like deposits

fL **Liliwani Corona flow material**—Intermediate-backscatter materials with lobate boundaries in the interior of Liliwani Corona. Flows superpose rift faults. *Type area:* lat 30° S., long 272° E. *Interpretation:* Lava flows from vents in the interior of Liliwani Corona

fX **Xmukane Corona flow material**—Digitate to sheet-like, variable backscatter flow material extending in a fan from the rim and interior of Xmukane Corona. *Type area:* lat 28° S., long 270.5° E. *Interpretation:* Lava flows from vents on the rim and the interior of Xmukane Corona

fSh **Shulamite Corona flow material**—Intermediate- to high-backscatter, digitate to sheet-like flow material extending from the rim and interior of Shulamite Corona. Flows deformed by and cover rift faults. *Type area:* lat 36° S., long 283° E. *Interpretation:* Lava flows from vents in the interior, rim, and flanks of Shulamite Corona

Gertjon Corona flow material

fG_2 **Member 2**—Sheet-like, low-backscatter flow material in the interior of Gertjon Corona. *Type area:* lat 30° S., long 276° E. *Interpretation:* Lava flows from vents in the interior of Gertjon Corona

fG_1 **Member 1**—Digitate, low- to intermediate-backscatter material extending from the rim and interior of Gertjon Corona. *Type area:* lat 30° S., long 277.5° E. *Interpretation:* Lava flows from vents on the rim and the interior of Gertjon Corona

Shiwanokia Corona flow material

fS_2 **Member 2**—Intermediate- to high-backscatter, digitate to sheet-like flow material extending from the rim and interior of Shiwanokia Corona. *Type area:* lat 44.5° S., long 280° E. *Interpretation:* Lava flows from vents of Shiwanokia Corona

fS_1 **Member 1**—Sheet-like, low- to intermediate-backscatter flow material extending from the rim and interior of Shiwanokia Corona. Flows deformed by and cover rift faults. *Type area:* lat 39.5° S., long 276° E. *Interpretation:* Lava flows from vents of Shiwanokia Corona

Obiemi Corona flow material

fO_3 **Member 3**—Digitate, variable backscatter flow material extending in a fan from the flank of Obiemi Corona. *Type area:* lat 32° S., long 274° E. *Interpretation:* Lava flows from a vent on the flank of Obiemi Corona

fO_2 **Member 2**—Low- to intermediate-backscatter, digitate to sheet-like, variable backscatter flow material extending from the interior of Obiemi Corona. *Type area:* lat 32° S., long 276° E. *Interpretation:* Lava flows from vents in the interior of Obiemi Corona

fO_1 **Member 1**—Digitate, intermediate-backscatter flow material from the rim and interior of Obiemi Corona. Deformed by rift faults and rim of Obiemi. *Type area:* lat 34° S., long 274° E. *Interpretation:* Lava flows from vents of Obiemi Corona

fZ **Zywie Corona flow material**—Variable backscatter, sheet-like flow material extending from the rim and interior of Zywie Corona. *Type area:* lat 38° S., long 291° E. *Interpretation:* Lava flows from vents of Zywie Corona

fAm **Ama Corona flow material**—Low- to intermediate-backscatter, sheet-like flow material with lobate boundaries extending from the rim and interior of Ama Corona. *Type area:* lat 46.5° S., long 276° E. *Interpretation:* Lava flows from vents of Ama Corona

fOr **Orbona Corona flow material**—Intermediate- to high-backscatter, digitate to sheet-like flow material associated with Orbona Corona. *Type area:* lat 47.5° S., long 292° E. *Interpretation:* Lava flows from vents of Orbona Corona

Tamiyo Corona flow material

fT_{Ty} **Member d**—Low-backscatter, sheet-like flow material in the interior of Tamiyo Corona. Deformed by rift faults. *Type area:* lat 35.5° S., long 299° E. *Interpretation:* Lava flows from vents in the interior of Tamiyo Corona

fT_{Tc} **Member c**—Fan-shaped, digitate, intermediate-backscatter flow material extending from the rim of Tamiyo Corona. *Type area:* lat 34° S., long 297.5° E. *Interpretation:* Lava flows from vents near the rim of Tamiyo Corona.

fT_{Tb} **Member b**—Variable backscatter, digitate to sheet-like flow material extending from the rim of Tamiyo Corona. *Type area:* lat 34° S., long 299° E. *Interpretation:* Lava flows from vents of Tamiyo Corona

fT_{Ta} **Member a**—Intermediate- to high-backscatter, sheet-like flow material extending from the rim and interior of Tamiyo Corona. Deformed by corona rim and by rift faults. *Type area:* lat 36° S., long 298.3° E. *Interpretation:* Lava flows from vents of Tamiyo Corona

Bibi-Patma Corona flow material

fB_3 **Member 3**—Sheet-like flow material with variable backscatter extending from Bibi-Patma Corona. *Type area:* lat 49.5° S., long 299° E. *Interpretation:* Lava flows from vents of Bibi-Patma Corona

fB_2 **Member 2**—Intermediate-backscatter, sheet-like flow material extending from Bibi-Patma Corona. *Type area:* lat 47.5° S., long 299° E. *Interpretation:* Lava flows from vents of Bibi-Patma Corona

fB_1 **Member 1**—Sheet-like flow material with low backscatter extending from Bibi-Patma Corona. *Type area:* lat 44.5° S., long 299.5° E. *Interpretation:* Lava flows from vents of Bibi-Patma Corona

Ukemochi Corona flow material

fU_e **Member e**—Digitate, intermediate-backscatter flows extending from the rim of Ukemochi Corona. Type area: lat 41.5° S. long 297.5° E. *Interpretation:* Lava flows from vents on the rim of Ukemochi Corona

fU_d **Member d**—Low-backscatter, sheet-like flow material in the interior of Ukemochi Corona. *Type area:* lat 38.5° S., long 297.5° E. *Interpretation:* Lava flows from vents in the interior of Ukemochi Corona

fU_c **Member c**—Intermediate- to high-backscatter, digitate to sheet-like flow material extending from the rim and interior of Ukemochi Corona. Deformed by rift faults. *Type area:* lat 38° S., long 298°. *Interpretation:* Lava flows from vents of Ukemochi Corona

fU_b **Member b**—Low- to intermediate-backscatter, sheet-like flow material in the interior of Ukemochi Corona. *Type area:* lat 38° S., long 297° E. *Interpretation:* Lava flows from vents in the interior of Ukemochi Corona

fU_a **Member a**—Intermediate- to high-backscatter material in the interior and rim of Ukemochi Corona. Deformed by corona rim and rift faults. *Type area:* lat 42° S., long 297° E. *Interpretation:* Deformed lava flows from vents of Ukemochi Corona

fD **Durga Corona flow material**—Intermediate-backscatter, sheet-like flow material extending from the interior of Durga Corona. Flows deformed by rift faults. *Type area:* lat 27.5° S., long 287° E. *Interpretation:* Lava flows from vents of Durga Corona

fR **Rigatona Corona flow material**—Sheet-like, low- to intermediate-backscatter flow material extending from the rim and interior of Rigatona Corona. Flows deformed by rift faults. *Type area:* lat 32° S., long 280° E. *Interpretation:* Lava flows from vents of Rigatona Corona

Nzambi Corona flow material

fN_2 **Member 2**—Variable backscatter, digitate to sheet-like flow material extending from the rim of Nzambi Corona. *Type area:* lat 46° S., long 287.5° E. *Interpretation:* Lava flows from vents of Nzambi Corona

fN_1 **Member 1**—Low- to intermediate-backscatter, sheet-like material in interior of Nzambi Corona. *Type area:* lat 45° S., long 286° E. *Interpretation:* Lava flows from vents in the interior of Nzambi Corona

fA **Latta Corona flow material**—Intermediate-backscatter, sheet-like flow material extending from the rim and interior of Latta Corona. Flows deformed by rift faults. *Type area:* lat 38° S., long 287° E. *Interpretation:* Lava flows from vents of Latta Corona

Semiramus Corona flow material

fSe_2 **Member 2**—Intermediate- to high-backscatter, digitate to sheet-like flow material extending from the rim and interior of Semiramus Corona. Flows deformed by corona rim fractures and rift faults. *Type area:* lat 36° S., long 294° E. *Interpretation:* Lava flows from vents of Semiramus Corona

fSe_1 **Member 1**—Sheet-like, intermediate-backscatter flow material extending from Semiramus Corona. Flows deformed by rift faults. *Type area:* lat 34.9° S., long 296.8° E. *Interpretation:* Lava flows from vents of Semiramus Corona

fAj **Anjea Corona flow material**—Intermediate- to high-backscatter, digitate to sheet-like flow material associated with Anjea Corona. *Type area:* lat 30° S., long 282.5° E. *Interpretation:* Lava flows from vents of Anjea Corona

Santa Corona flow material

fSa_2 **Member 2**—Intermediate-backscatter, digitate flow material extending from the rim and interior of Santa Corona. *Type area:* lat 33° S., long 291° E. *Interpretation:* Lava flows from vents of Santa Corona

fSa_1 **Member 1**—Intermediate- to high-backscatter, digitate to sheet-like flow material extending from Santa Corona. Flows deformed by rift faults. *Type area:* lat 34° S., long 288° E. *Interpretation:* Lava flows from vents of Santa Corona

fE **Erigone Corona flow material**—Sheet-like, low- to intermediate-backscatter flow material extending from the interior of Erigone Corona. Flows deformed by rift faults. *Type area:* lat 34° S., long 283° E. *Interpretation:* Lava flows from vents of Erigone Corona

fTa **Tacoma Corona flow material**—Intermediate-backscatter, sheet-like flow material extending from the interior of Tacoma Corona. Flows deformed by rift faults. *Type area:* lat 37° S., long 288° E. *Interpretation:* Lava flows from vents of Tacoma Corona

fNa **Navolga Corona flow material**—Sheet-like, low- to intermediate-backscatter flow material extending from the rim and interior of Navolga Corona. Flows deformed by faults. *Type area:* lat 48.3° S., long 295.5° E. *Interpretation:* Lava flows from vents of Navolga Corona

fIk **Ikas Coronae flow material**—Sheet-like, low- to intermediate-backscatter flow material extending from the rim and interior of Ikas Coronae. Flows deformed by faults. *Type area:* lat 40° S., long 288° E. *Interpretation:* Lava flows from vents of Ikas Coronae

PLAINS MATERIAL

Typically covers large areas and ranges from dark to moderate-backscatter cross section

pe **Smooth plains material**—Relatively radar dark, areally limited deposits, frequently characterized by indistinct small edifices and pits. Very low abundance of fractures or wrinkle ridges. Type area: lat 26.5° S., long 296.5° E. Interpretation: Volcanic plains composed of indistinct flow units emanating from pits and small edifices

pT **Themis Regio lobate plains material**—Limited, generally level deposits with lobate margins on the Themis Regio rise with relatively uniform backscatter over hundreds of kilometers; minor occurrences of domes, cones, shields, fractures, and ridges. *Type area:* lat 31° S., long 289° E. *Interpretation:* Volcanic plains composed primarily of flow units formed throughout the history of the formation of Themis Regio. May have emanated from coronae or fractures associated with rifting

pcH **Helen Planitia composite plains material**—Low- to intermediate-backscatter, mottled deposits covering large region, with wrinkle ridges, fractures, and patchy flow deposits. *Type area:* lat 49° S., long 285° E. *Interpretation:* Volcanic plains composed of indistinct flow units emanating unknown sources.

pm **Mottled plains material**—Extensive, generally level deposits with variable backscatter characterized by multiple patch volcanoes, areas of fracturing, wrinkle ridges, domes, cones, and shields. *Type area:* lat 32° S., long 295° E. *Interpretation:* Volcanic plains built up of a number of interfingered deposits, with minor extension and compression occurring locally

pT **Themis Regio fractured plains material**—Moderately deformed patches of plains that are located on and around the margins of the Themis Regio rise. *Type area:* lat 28° S., long 276° E. *Interpretation:* Volcanic plains that formed early in the stage of development of the Themis Regio highland area that were subsequently deformed by rifting and (or) corona formation. May have originally emanated from coronae or fractures associated with rifting

pI **Lineated plains material**—Expanses of moderately deformed deposits, typically higher standing and embayed by mottled plains units; moderate occurrence of domes, cones, and shields; intersecting patterns of fractures and wrinkle ridges typical. *Type area:* lat 30° S., long 299.5° E. *Interpretation:* Volcanic plains that have undergone multiple episodes of volcanism and extension

pdf **Densely fractured plains material**—Topographically complex, heavily fractured materials. *Type area:* lat 28° S., long 293.8° E. *Interpretation:* Volcanic plains units that have been warped and fractured by rifting and corona formation that may be related to the very early stages of formation of Themis Regio

IMPACT CRATER MATERIAL

d **Crater material, undifferentiated**—Generally very radar bright floor, central peak, wall, rim, and ejecta materials. *Type area:* lat 38.5° S., long 274.8° E. *Interpretation:* Deposits and structures formed by hypervelocity impact

EXPLANATION OF MAP SYMBOLS

- **Contact**—Dashed where inferred
- **Fault, lineament, fracture**
- **Lineament**—Associated with corona rim, typically fracture
- **Graben**—Interpreted as extensional deformation
- **Wrinkle ridge**—Interpreted as contractional deformation
- **Broad topographic ridge crest**
- **Impact crater rim**—Hachures on rim crest
- **Depression**—Line marks top of slope. Hachures point downslope
- **Volcanic edifice (>5 km diameter)**—Hachures at base of edifice
- **Steep-sided dome**
- **Volcanic edifice (<5 km diameter)**
- **Flow direction**
- **Channel**—Interpreted as formed by lava erosion
- **Surficial material**—Radar-dark diffuse deposit

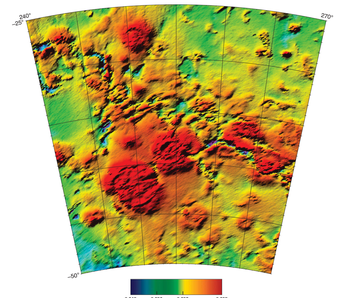


Figure 2. Magellan topographic data of Themis Regio quadrangle (V–53), Venus.

Figure 3. Magellan rms slope map of Themis Regio quadrangle (V–53), Venus.

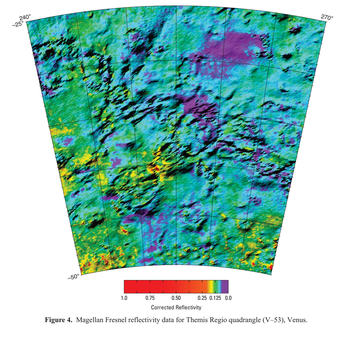


Figure 4. Magellan Fresnel reflectivity data for Themis Regio quadrangle (V–53), Venus.

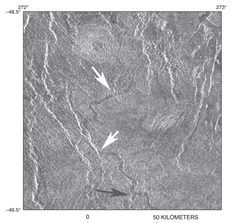


Figure 5. Magellan SAR image of an unnamed channel on unit pm in Themis Regio quadrangle (V–53), Venus. White arrows indicate where channel appears to be deformed; black arrow indicates where channel appears to cut and emboy structures.

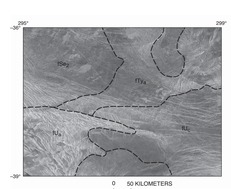


Figure 6. Magellan SAR image of east-central Themis Regio quadrangle (V–53), Venus, illustrating the relations between Semiramus flow material, member 2 (unit fSe_2), Tamiyo Corona flow material, member a (unit fTy_a), and Ukemochi Corona flow material, members a and c (units fU_a and fU_c). The flows associated with Semiramus are the youngest, overlying units fTy_a and fU_a. Ukemochi and Tamiyo units have a complex relation, with unit fU_c superposed on unit fTy_a, which in turn is superposed on unit fU_a. Contacts are shown as dashed so that unit relations can be seen.

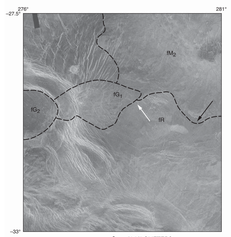


Figure 7. Magellan SAR image of northwestern Themis Regio quadrangle (V–53), Venus, illustrating the complex relations between corona and volcano flows. White arrow shows where Gertjon Corona flow material, member 1 (unit fG_1), superposes flows from Mielikki Mons flow material, member 2 (unit fM_2); black arrow shows where flows from Mielikki superpose Rigatona Corona flow material (unit **fR**).

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