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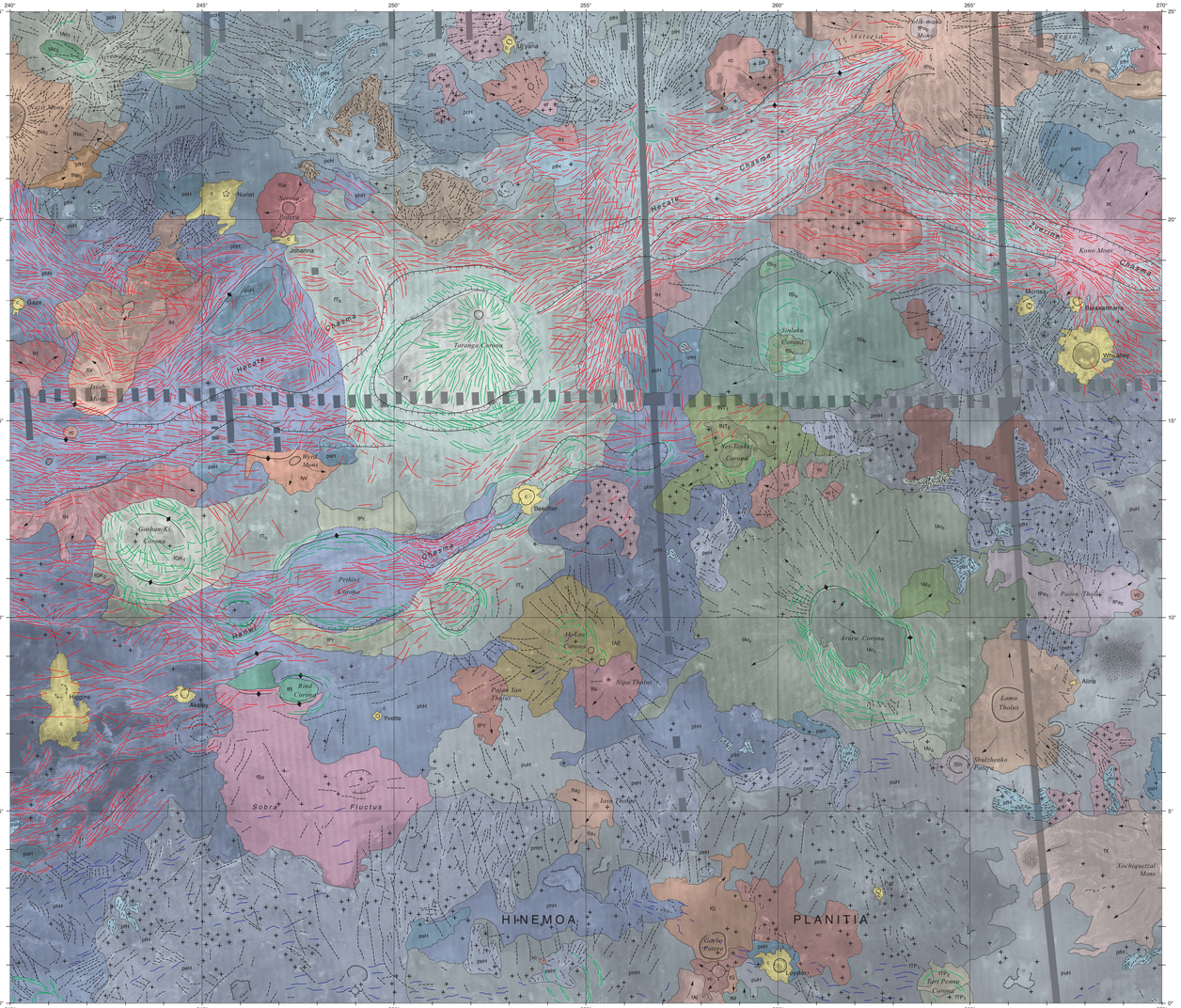
National Aeronautics and Space Administration

Scientific Investigations Map 3163
Atlas of Venus: Hecate Chasma Quadrangle (V–28)
Pamphlet accompanies map



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

SCALE 1:5 198 991 (1 mm = 5.199 km) AT 0° LATITUDE
1:4 711 886 AT 25° LATITUDE
MERCATOR PROJECTION

500 400 300 200 100 0 KILOMETERS 100 200 300 400 500

Prepared on behalf of the Planetary Geology and Geophysics Program, Solar System Exploration Division, Office of Space Science, National Aeronautics and Space Administration

Edited by Theresa Iki
Cartography by Darlene A. Ryan
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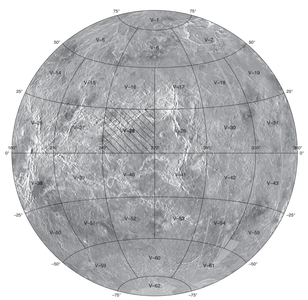


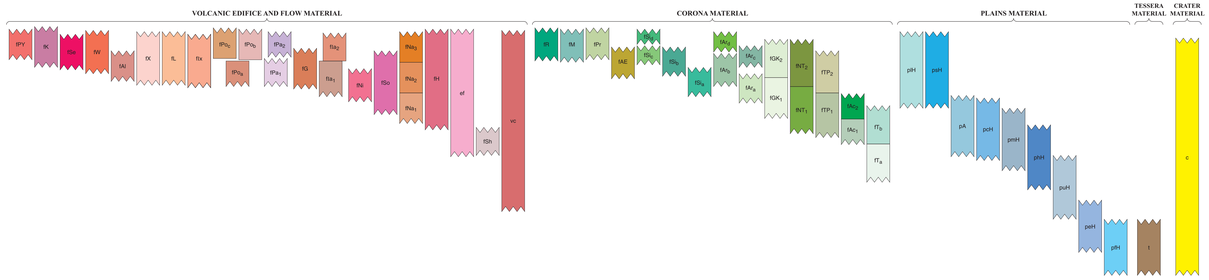
QUADRANGLE LOCATION
Photomosaic showing location of map area. An outline of 1:5,000,000-scale quadrangles is provided for reference.

Geologic Map of the Hecate Chasma Quadrangle (V–28), Venus

By
Ellen R. Stofan,[1] John E. Guest,[2] and Antony W. Brian[2]

2012

SEQUENCE OF MAP UNITS



DESCRIPTION OF MAP UNITS

VOLCANIC EDIFICE AND FLOW MATERIAL

Pajan Yan Tholus material—Low- to intermediate-backscatter, sheet-like, lobate deposits occurring on the summit and flanks of Pajan Yan Tholus. Superposes units pbH, fAE, and puH. *Type locality:* Lat 8° N., long 252.5° E. *Interpretation:* Lava flows from central or flank vents of the Pajan Yan edifice

Kono Mons material—Intermediate- to high-backscatter digitate deposits on the flanks of an edifice cut by Zverine Chasma. *Type locality:* Lat 20° N., long 269° E. Flows both superpose and are cut by fractures of Zverine Chasma. Superposes units pA and c. *Interpretation:* Lava flows from central or flank vents of Kono Mons

Serova Patera material—Variable backscatter materials with lobate boundaries and digitate to sheet-like form radiating from a circular depression. Superposes units pbH, pcH, c, and fTb. *Type locality:* Lat 20.5° N., long 247.5° E. *Interpretation:* Lava flows from Serova Patera

Wyrd Mons material—Intermediate- to high-backscatter digitate deposits on the summit and flanks of Wyrd Mons. Superposes units pbH, fTb, and psH. *Type locality:* Lat 13.8° N., long 247° E. *Interpretation:* Lava flows from central or flank vents of the Wyrd Mons edifice

Aleyone Tholus material—Sheet-like, lobate, intermediate-backscatter deposits that extend from Aleyone Tholus. Superposes units pmH and vc, superposed by unit fM. *Type locality:* Lat 0.3° N., long 257.5° E. *Interpretation:* Lava flows from central or flank vents of the Aleyone Tholus edifice

Xochiquetzal Mons material—Digitate, variable backscatter deposits on the summit and flanks of Xochiquetzal Mons. Superposes units puH, ef, and pbH. *Type locality:* Lat 3° N., long 269° E. *Interpretation:* Lava flows from central or flank vents of the Xochiquetzal Mons edifice

Lama Tholus material—Intermediate-backscatter, digitate to sheet-like deposits on the summit and flanks of Lama Tholus. Superposes units puH, ef, and pbH. *Type locality:* Lat 7.8° N., long 266° E. *Interpretation:* Lava flows from central or flank vents of Lama Tholus edifice

Ixtab Mons material—Intermediate- to low-backscatter, digitate to sheet-like deposits on the summit and flanks of Ixtab Mons on the margin of Hecate Chasma. Flows cut by faults of Hecate Chasma. Superposes units pbH and fM, superposed by units psH and c. *Type locality:* Lat 16° N., long 243° E. *Interpretation:* Lava flows from central or flank vents of the Ixtab Mons edifice

Polik-mana Mons material, member c—Digitate deposits of variable backscatter on the flank of Polik-mana Mons. Superposes units fP_{Db}, fH, pPH, and pA. *Type locality:* Lat 23° N., long 269° E. *Interpretation:* Lava flows from flank vents of the Polik-mana Mons edifice

Polik-mana Mons material, member b—Low-backscatter deposits in the central summit depression of Polik-mana Mons. Superposes unit fP_{Da}. *Type locality:* Lat 24.2° N., long 263.8° E. *Interpretation:* Lava flows ponded in the central caldera of the Polik-mana Mons edifice

Polik-mana Mons material, member a—Intermediate- to high-backscatter, digitate to sheet-like deposits on the summit and flanks of Polik-mana Mons. Partially deformed by but also superposing fractures of the Hecate Chasma rift. Superposes unit pA, embayed by units fP_{Dc} and fP_{Da}. *Type locality:* Lat 23.5° N., long 264° E. *Interpretation:* Lava flows from the central and flank vents of Polik-mana Mons

Paoro Tholi material, member 2—Variable backscatter, digitate and sheet-like deposits on the summit and flanks of Paoro Tholi. Superposes units fPa_1, pbH, puH, and vc. *Type locality:* Lat 10.5° N., long 268.5° E. *Interpretation:* Lava flows from central or flank vents of the Paoro Tholi edifices

Paoro Tholi material, member 1—Intermediate-backscatter, lobate and sheet-like deposits on the summit and flanks of Paoro Tholi. Superposes units pbH and fAr_3, and embayed by unit fPa_2. *Type locality:* Lat 10° N., long 267.5° E. *Interpretation:* Lava flows from central or flank vents of the Paoro Tholi edifices

Garbo Patera material—Intermediate-backscatter, sheet-like deposits flooding and surrounding a quasi-circular depression. Superposes units pmH, pbH, puH, and vc, embayed by units pbH, vc, and fM. *Type locality:* Lat 2.5° N., long 258° E. *Interpretation:* Lava flows from central vent of the Garbo Patera volcano

Iaso Tholus material, member 2—Intermediate- to high-backscatter, sheet-like deposits on the summit and flanks of Iaso Tholus. Superposes units fIa_1, pbH, puH, and pmH. *Type locality:* Lat 5° N., long 255° E. *Interpretation:* Lava flows from the central vent of Iaso Tholus edifice

Iaso Tholus material, member 1—Low- to intermediate-backscatter, sheet-like deposits on the flank of Iaso Tholus. Superposes units pbH and pmH, embayed by unit fIa_2. *Type locality:* Lat 4° N., long 255° E. *Interpretation:* Lava flows from the central or flank vents of Iaso Tholus edifice

Nipa Tholus material—Digitate deposits with variable backscatter on the summit and flanks of Nipa Tholus. Superposes unit pbH, embayed by unit fAE. *Type locality:* Lat 8° N., long 256° E. *Interpretation:* Lava flows from central vent of Nipa Tholus

Sobra Fluctus material—Flow material having intermediate backscatter with low backscatter along some margins. Lobate boundaries. Superposes units pbH, puH, pbH, embayed by unit fR. *Type locality:* Lat 5° N., long 248° E. *Interpretation:* Lava flows from an unidentifiable vent

Nazit Mons material, member 3—Intermediate- to high-backscatter, digitate deposits on the flank of Nazit Mons. Superposes units fNa_1, fNa_2, pcH, pbH, and pbH. *Type locality:* Lat 20.8° N., long 242.5° E. *Interpretation:* Lava flows from flank vents of the Nazit Mons edifice

Nazit Mons material, member 2—Variable backscatter, digitate and sheet-like deposits on the summit of Nazit Mons. Superposes units fAc_1, fNa_1, pbH, and embayed by unit fNa_3. *Type locality:* Lat 23° N., long 240° E. *Interpretation:* Lava flows from the central vent of the Nazit Mons edifice

Nazit Mons material, member 1—Intermediate-backscatter, lobate to sheet-like deposits on the flanks of Nazit Mons. Superposes units fAc_2 and pcH and embayed by units fNa_2 and fNa_3. *Type locality:* Lat 22° N., long 243° E. *Interpretation:* Lava flows from central or flank vents of the Nazit Mons edifice

Hecate Chasma flow material—Digitate to sheet-like flow material with variable backscatter along the margins of Hecate Chasma. Multiple occurrences in map area with varying superposition relations. *Type locality:* Lat 12.5° N., long 242° E. *Interpretation:* Lava flows from fissures along Hecate Chasma

Edifice field material—Numerous small shields and cones surrounded by lobate deposits with moderate backscatter. Multiple occurrences in map area with varying superposition relations. *Type locality:* Lat 12.5° N., long 255.5° E. *Interpretation:* Volcanic edifice fields of varying ages

Shulzhenko Patera material—Intermediate- to low-backscatter, lobate deposits filling and surrounding a central circular depression. Superposes unit puH, embayed by units fL, fAr_6, and fAr_5. *Type locality:* Lat 7° N., long 264.8° E. *Interpretation:* Lava flows from central vent of Shulzhenko Patera

Volcanic complex material—Flow material with low to high backscatter and lobate boundaries. Multiple occurrences in map area with varying superposition relations. *Type locality:* Lat 2° N., long 261° E. *Interpretation:* Lava flows from central or flank vents of an unnamed volcanic complex

CORONA MATERIAL

Rind Corona material—Flow material with intermediate backscatter. Unit is ponded in the interior of Rind Corona, and extends to the surrounding plains. Superposes units fSe and pbH. *Type locality:* Lat 2° N., long 261° E. *Interpretation:* Lava flows from the interior of Rind Corona

Miti Corona material—Lobate flow material with intermediate backscatter extending from Miti Corona. Superposes units puH, fG_1, fAl, and vc. *Type locality:* Lat 0° N., long 259° E. *Interpretation:* Lava flows that originated from vents in the flanks or interior of Miti Corona

Prthivi Corona material—Lobate flow material with intermediate backscatter, emanating from fractures along the rim of Prthivi Corona. Superposes units fT_b and pbH. Superposes and is cut by Hecate Chasma faults. *Type locality:* Lat 13° N., long 250° E. *Interpretation:* Lava flows from fissures along the rim of Prthivi Corona

Ak-Ene Corona material—Flow material with intermediate backscatter with lobate boundaries, deformed by the rim and radiating fractures of Ak-Ene Corona. Flow material extends beyond the corona rim. Superposes units fT_b, pbH, and fNi, embayed by unit fPY. *Type locality:* Lat 9° N., long 254° E. *Interpretation:* Lava flows from Ak-Ene Corona deformed during corona formation

Sinlaku Corona material, member d—Intermediate backscatter sheet-like flow material with lobate boundaries. Superposes unit fSl_d. *Type locality:* Lat 18° N., long 260° E. *Interpretation:* Lava flows from a vent on the flank of Sinlaku Corona

Sinlaku Corona material, member c—Low backscatter lobate flow material in the interior of Sinlaku Corona. Superposes unit fSl_a. *Type locality:* Lat 16° N., long 259.5° E. *Interpretation:* Lava flows from a vent within Sinlaku Corona

Sinlaku Corona material, member b—Digitate to sheet-like flow material with variable backscatter. Superposes units fNT_1, pA, pmH, and pbH and embayed by units vc and fSl_d. Unclear age relation with unit fSl_d. *Type locality:* Lat 17° N., long 262° E. *Interpretation:* Lava flows from Sinlaku Corona partially deformed by corona formation

Sinlaku Corona material, member a—Intermediate backscatter flow material on the plateau of Sinlaku Corona. Embayed by unit fSl_c. Unclear age relation with unit fSl_b. *Type locality:* Lat 17° N., long 260° E. *Interpretation:* Lava flows from central or flank vents of Sinlaku Corona

Araru Corona material, member d—Digitate, variable backscatter flow material that forms a fan from the rim of Araru Corona. Superposed on unit fAr_b. *Type locality:* Lat 10° N., long 264° E. *Interpretation:* Lava flows from a vent on the rim of Araru Corona

Araru Corona material, member c—Digitate to lobate flow material in the interior plateau of Araru Corona with variable backscatter. Superposes unit fAr_b. *Type locality:* Lat 8° N., long 263° E. *Interpretation:* Lava flows from vents in the interior of Araru Corona

Araru Corona material, member b—Intermediate backscatter flow material with digitate to sheet-like form, deformed by the rim and fractures of Araru Corona. Superposes units fSh, fAr_b, pbH, pmH, pbH, puH, and vc. Embayed by units fAr_c, fAr_d, fPa1, psH, and fL. *Type locality:* Lat 8° N., long 259° E. *Interpretation:* Extensive lava flow units of Araru Corona deformed during corona formation

Araru Corona material, member a—Sheet-like flow material with intermediate backscatter and lobate boundaries. Superposes units puH and fSh, embayed by unit fAr_b. *Type locality:* Lat 6.5° N., long 264° E. *Interpretation:* Lava flows originating from Araru Corona

Gashan-Ki Corona material, member 2—Flow material with low to intermediate backscatter and lobate boundaries. Superposes and is cut by Hecate Chasma faults. Superposes units fGK_2 and pbH, embayed by unit fH. *Type locality:* Lat 9.2° N., long 243.5° E. *Interpretation:* Lava flows from the flanks or interior of Gashan-Ki Corona

Gashan-Ki Corona material, member 1—Flow material and deformed material with variable backscatter and lobate boundaries. Superposes and is cut by Hecate Chasma faults. Superposes units fT_b and pbH, embayed by units fGK_2 and fH. *Type locality:* Lat 11° N., long 244° E. *Interpretation:* Lava flows from Gashan-Ki Corona and possibly pre-existing plains materials that have been deformed by corona formation

Nei-Teukez Corona material, member 2—Flow material with intermediate backscatter in the interior low of Nei-Teukez Corona. *Type locality:* Lat 14° N., long 258.5° E. Superposes unit fNT_2. *Interpretation:* Lava flows from vents in the interior of Nei-Teukez Corona

Nei-Teukez Corona material, member 1—Intermediate backscatter lobate material. Superposes units pbH, pbH, and pmH. Embayed by units vc, fNT_2, and fSl_b. *Type locality:* Lat 13.5° N., long 257.7° E. *Interpretation:* Lava flows originating from Nei-Teukez Corona

Tari Pensa Corona material, member 2—Flow material with intermediate backscatter in the interior of Tari Pennu Corona and extending beyond the rim. Superposes units fTP_1, puH, and pmH. *Type locality:* Lat 1° N., long 264.5° E. *Interpretation:* Lava flows from central or flank vents within Tari Pennu Corona

Tari Pensu Corona material, member 1—Flow material with intermediate backscatter and lobate boundaries. Includes the deformed rim of Tari Pennu Corona. Embayed by unit fTP_2. *Type locality:* Lat 0° N., long 264° E. *Interpretation:* Lava flows from Tari Pennu Corona partially deformed during corona formation

Acrea Corona material, member 2—Digitate flow material with intermediate backscatter located in a depression within Acrea Corona. Superposes unit fAc_1. *Type locality:* Lat 24° N., long 241.5° E. *Interpretation:* Lava flows from within Acrea Corona

Acrea Corona material, member 1—Flow material and deformed materials with intermediate backscatter, and lobate boundaries. Includes the interior and deformed rim of Acrea Corona and exterior flow materials. Superposes units pA and pcH, embayed by units fAc_2, fNa_3, and fNa_2. *Type locality:* Lat 24° N., long 243° E. *Interpretation:* Lava flows from Acrea Corona

Taranga Corona material, member b—Flow material with intermediate backscatter and lobate boundaries. Some portions of the unit are penetratively cut by Hecate Chasma fractures. Superposes units I, pA, pfH, and pmH, embayed by units fSe, fGK_1, fPr, fAE, fW, and c. Uncertain age relation with unit fT_a, but in part older. *Type locality:* Lat 13° N., long 252° E. *Interpretation:* Deformed and undeformed lava flows from the center of Taranga Corona

Taranga Corona material, member a—Materials in the interior of Taranga Corona, some with intermediate backscatter, others with high backscatter marked by secondary structures. Uncertain age relation with unit fT_b, but in part younger. *Type locality:* Lat 16° N., long 252° E. *Interpretation:* Lava flows from center of Taranga Corona that have been deformed during corona formation

PLAINS MATERIAL

Hinemoa lobate plains material—Generally flat-lying deposits with relatively uniform backscatter over hundreds of kilometers; minor occurrences of domes, cones, shields, fractures, and ridges. Superposed on pA. *Type locality:* Lat 25° N., long 257.2° E. *Interpretation:* Volcanic plains composed primarily of areally extensive flow units

Hinemoa smooth plains material—Areally limited deposits with relatively low radar backscatter, scattered small edifices and (or) pits. Embays all other plains units with which it is in contact (units pmH, peH, pfH, pA, pcH) and units fAr_b, vc, fG, and fM. Embayed by unit fSl_b. *Type locality:* Lat 20° N., long 244° E. *Interpretation:* Volcanic plains that have undergone little deformation

Asteria plains material—Extensive, generally flat-lying deposits with variable backscatter over hundreds of kilometers; occurrences of domes, cones, shields, and moderately spaced to closely spaced fractures. Superposed by pbH, pcH, pbH, pbH, fP_{Dc}, fP_{Da}, fK, fT_b, fAc_1, fSl_b, vc, fH, and ef. Embays unit pbH. *Type locality:* Lat 23° N., long 256° E. *Interpretation:* Volcanic plains composed primarily of areally extensive flow units cut by multiple suites of fractures

Hinemoa composite-flow plains material—Generally flat-lying deposits with variable backscatter with small volcanoes, fractures, and wrinkle ridges. Superposed by units psH, ef, vc, fSh, fNa_3, fNa_2, fAc_2, embays unit pA and pbH. *Type locality:* Lat 22° N., long 245° E. *Interpretation:* Volcanic plains of interfingered deposits that have been locally deformed

Hinemoa mottled plains material—Extensive deposits with variable backscatter characterized by numerous small edifices, fractures, and wrinkle ridges. Superposed by units pbH, psH, vc, fG, fAl, fa_2, fa_1, fP_2, and fSl_b. Embays units pfH and peH; differing age relations with different occurrences of unit puH. *Type locality:* Lat 3.5° N., long 264° E. *Interpretation:* Volcanic plains composed of a number of interfingered deposits, locally deformed

Hinemoa hummocky plains material—Extensive deposits with variable backscatter characterized by numerous small edifices, areas of closely spaced fractures, and wrinkle ridges. Cut by fractures of Hecate Chasma, and superposed by numerous coronae. Superposed by units pcH, psH, fH, vc, ef, fG, fSh, fSo, fa_3, fPY, fNi_3, fNa_2, fNa_3, fT_b, fM, fAr_3, fR, fGK_2, fGK_1, fAE, fT_b, and fPr. Superposes units puH, pA, pmH, pfH, and peH. *Type locality:* Lat 7° N., long 243° E. *Interpretation:* Volcanic plains composed of interfingered deposits that have been locally deformed, as well as penetratively deformed by Hecate Chasma faults

Hinemoa uniform plains material—Extensive, generally flat-lying deposits with relatively uniform backscatter over hundreds of kilometers; minor occurrences of domes, cones, shields, fractures, and ridges. Superposed by units pbH, fT_{Pb}, fG, fa_2, fPY, fP_{Dc}, fa_1, fL, fSh, fX, fSo, fM, fAr_b, and fAr_a. Embays units peH and pfH; differing age relations with different occurrences of unit pmH. *Type locality:* Lat 1° N., long 268° E. *Interpretation:* Volcanic plains composed primarily of areally extensive flow units

Hinemoa edifice plains material—Limited extent, generally hummocky unit that exhibits low to high backscatter. Contains numerous small domes, cones and shields and associated lobate flows and fractures in multiple orientations. Superposed by fa_2, fP_{Dc}, fP_{Da}, fSo, fAr_b, vc, psH, pfH, puH, and pmH. Embayed by unit pfH. *Type locality:* Lat 6° N., long 257° E. *Interpretation:* Numerous small volcanic edifices and associated flows forming volcanic plains, cut by secondary structures. Occurs in multiple areas with indeterminate age relation between different outcrops

Hinemoa fractured plains material—Limited deposits with intermediate radar backscatter cut by closely spaced fractures. Typically higher standing and embayed by other plains units. Single orientation of fractures in an outcrop, but direction not consistent between outcrops. Superposed by pfH, peH, pmH, puH, vc, fL, fX, $fPDc$, fNa_3, fAr_b, and fT_b. *Type locality:* Lat 23.5° N., long 248° E. *Interpretation:* Plains of probable volcanic origin cut by single suite of fractures. Occurs in multiple areas, indeterminate age relation between different outcrops

TESSERA MATERIAL

Tessera material—Generally high backscatter, locally high standing material with two or more orientations of lineaments; typical occurrences are small and appear to be embayed by plains and flow materials. Embayed by units pbH, pcH, pA and fT_b. *Type locality:* Lat 21° N., long 252° E. *Interpretation:* Extremely tectonically deformed, locally older materials embayed by younger volcanic plains and flows

CRATER MATERIAL

Crater material, undifferentiated—Intermediate to high backscatter, hummocky ejecta materials surrounding radar bright or dark floor, with crater rim, wall, and central peak. See table 2 for age relations. *Type locality:* Lat 16.5° N., long 268° E. *Interpretation:* Deposits and structures formed by hypervelocity impact

EXPLANATION OF MAP SYMBOLS

- **Contact**—Dashed where approximately located
- **Lineament**—Origin uncertain
- **Lineament associated with chasma**—Parallels chasma trough
- **Lineament associated with corona**—Typically rim fracture
- **Wrinkle ridge**—Interpreted as compressional deformation
- **Broad topographic ridges or warps**
- **Scarp**—Line marks top of slope; hatchures point downslope
- **Steep-sided volcanic dome**
- **Impact crater rim (diameter >10 km)**—Hachures on rim crests
- **Impact crater (diameter <10 km)**
- **Volcanic caldera**—Dashed where partially buried
- **Volcanic edifice (diameter <5 km)**
- **Flow direction**
- **Flow front**—Hachures point in flow direction
- **Surficial material**—Radar-dark, diffuse deposit
- **Channel**—Interpreted as formed by lava erosion

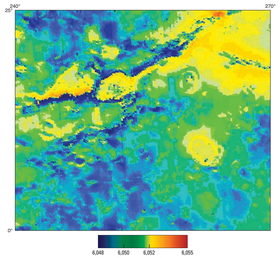


Figure 1. Magellan topographic map of quadrangle V–28, extending from lat 0°–25° N., long 240°–270° E. The lowest regions are found in the rift trough (6048.5 km), and the highest regions along the rift rim (6056.1 km).

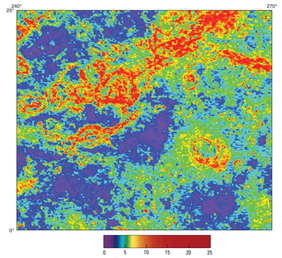


Figure 2. Magellan RMS slope roughness map of quadrangle V–28, extending from lat 0°–25° N., long 240°–270° E.

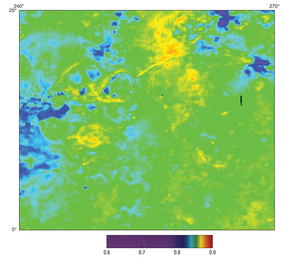


Figure 3. Magellan emissivity map of quadrangle V–28, extending from lat 0°–25° N., long 240°–270° E.

[1]Proxemy Research, Rectortown, VA
[2]University College, London, UK

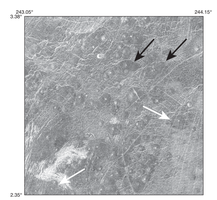


Figure 4. Portion of Hinemoa edifice plains material (unit peH) illustrating high concentration of small edifices within the unit, and the closely spaced lineaments that deform the unit. Black arrows indicate small edifices that postdate formation of the materials that make up unit peH and the fractures that deform the unit; white arrows indicate edifices that are cut by fractures that also cut the plains, illustrating that small edifices likely formed prior to the lineaments that cut the unit, as well as after the deformation that cuts unit peH. The image is approximately 100 km across; lineaments within the unit are spaced <10 km apart and are thus not mappable on the 1:5,000,000-scale map. The origin of the closely spaced lineaments is unknown; we interpret them to be polygonal fractures. More widely spaced, less sinuous lineaments can also be seen cutting unit peH, trending NNW as well as NE, along with an older, relatively higher standing patch of radar-bright terrain that is embayed by unit peH.

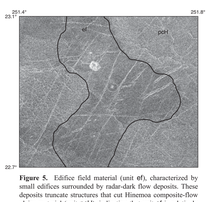


Figure 5. Edifice field material (unit ef), characterized by small edifices surrounded by radar-dark flow deposits. These deposits truncate structures that cut Hinemoa composite-flow plains material (unit pcH), indicating that unit ef is relatively younger. Other structures cut both units, indicating ongoing deformation in the region. Unit pcH is cut by polygonal fractures, similar to unit peH. This image is approximately 40 km across.

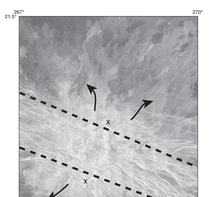


Figure 6. The volcano Kono Mons is cut in half by Zverine Chasma; the dashed lines indicate the location of the Zverine trough rim. Arrows indicate flows from Kono Mons, x's indicate the approximate location of the topographic edifice split by the chasma.

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