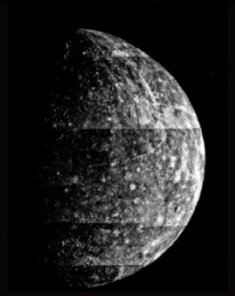
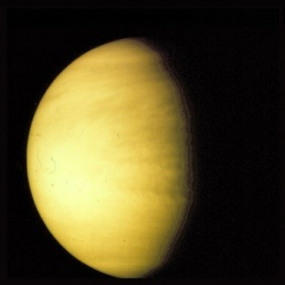
Venus: Craters, Coronae, and Chasmata



Donna M. Jurdy

Northwestern University

	Mercury	Venus	Earth	Moon	Mars
					
Radius (km)	2439	6052	6378	1738	3398
Mass (kg)	3.30×10^{23}	4.87×10^{24}	5.98×10^{24}	7.35×10^{22}	6.42×10^{23}
Density (kg/m^3)	5420	5250	5520	3340	3940
Distance from the Sun (A.U)	0.387	0.723	1.000	---	1.524
Mean Surface Pressure (bars)	---	92	1	---	0.006
Mean Surface Temp (K)	452	726	281	250	230
Atmosphere	---	CO_2	N_2, O_2	---	CO_2

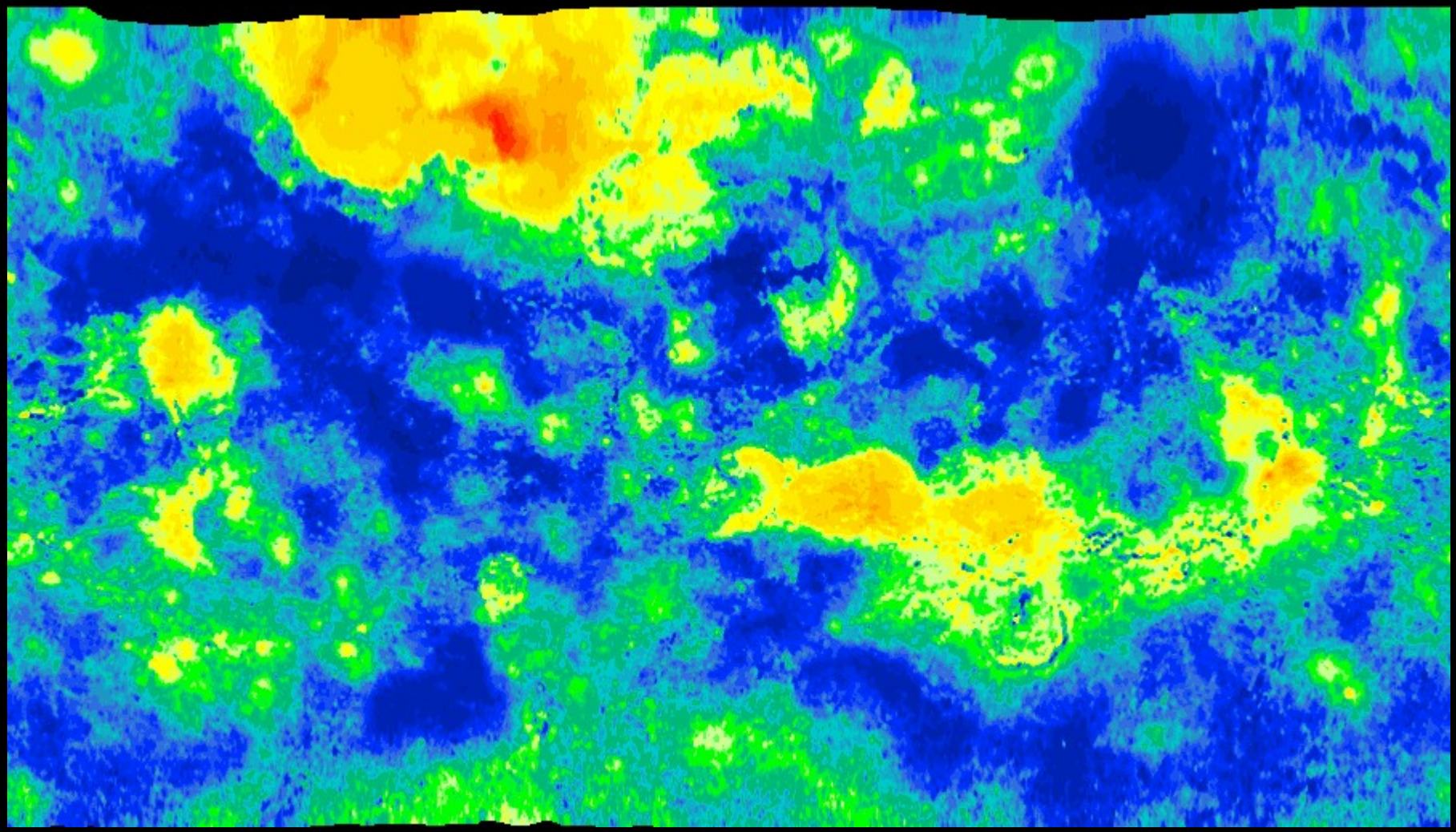
Sci Fi View of Venus



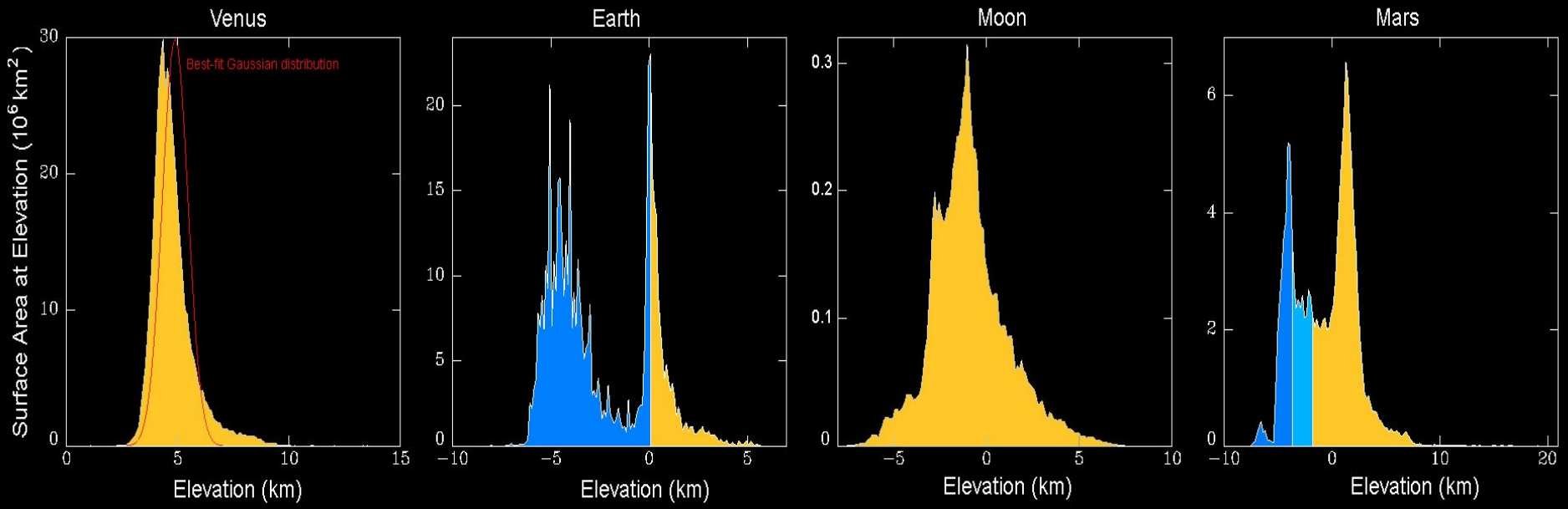
Venus, photos by Veneras 9, 10

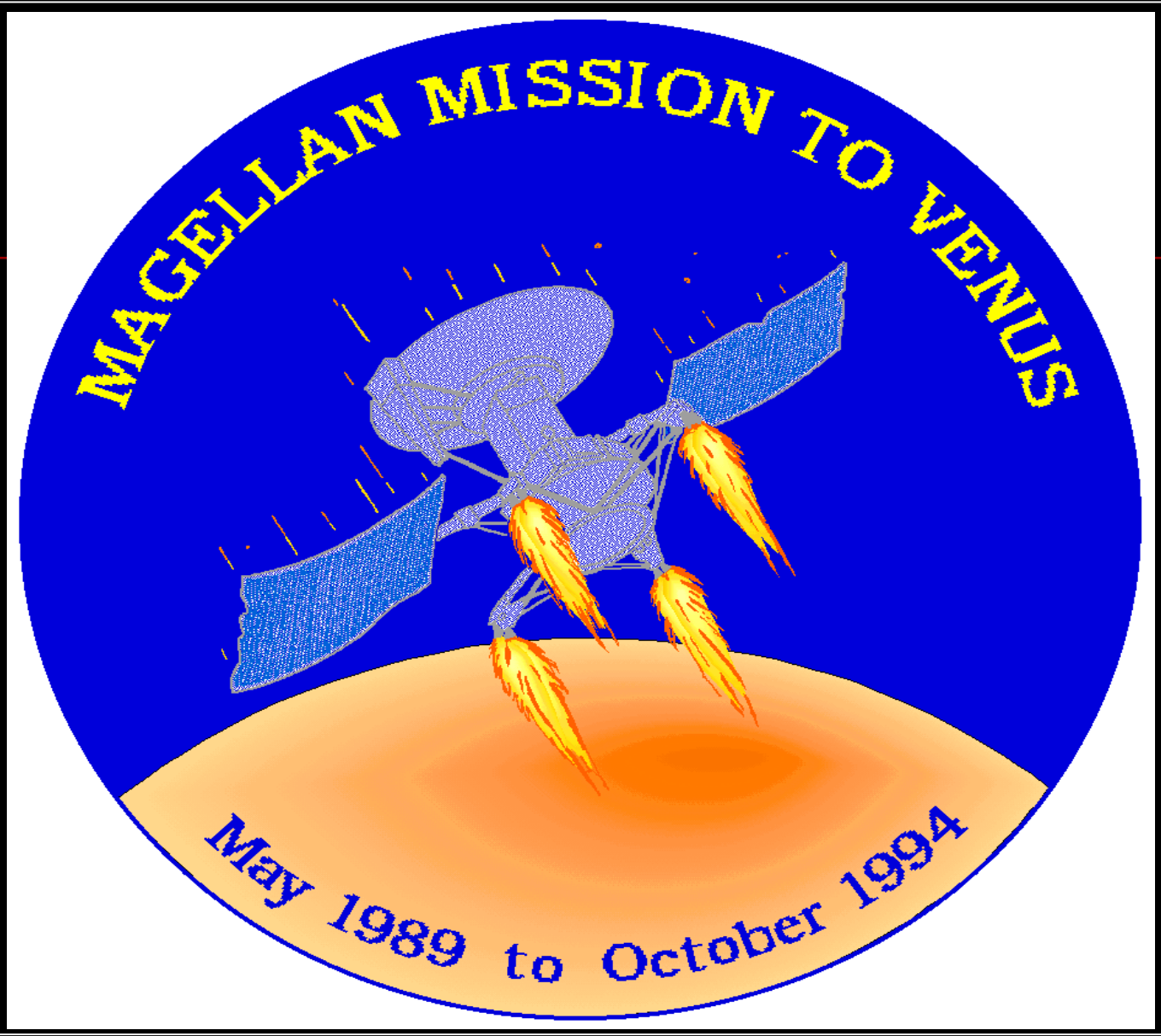


Pioneer Venus Topography



Inner Solar System Hypsography

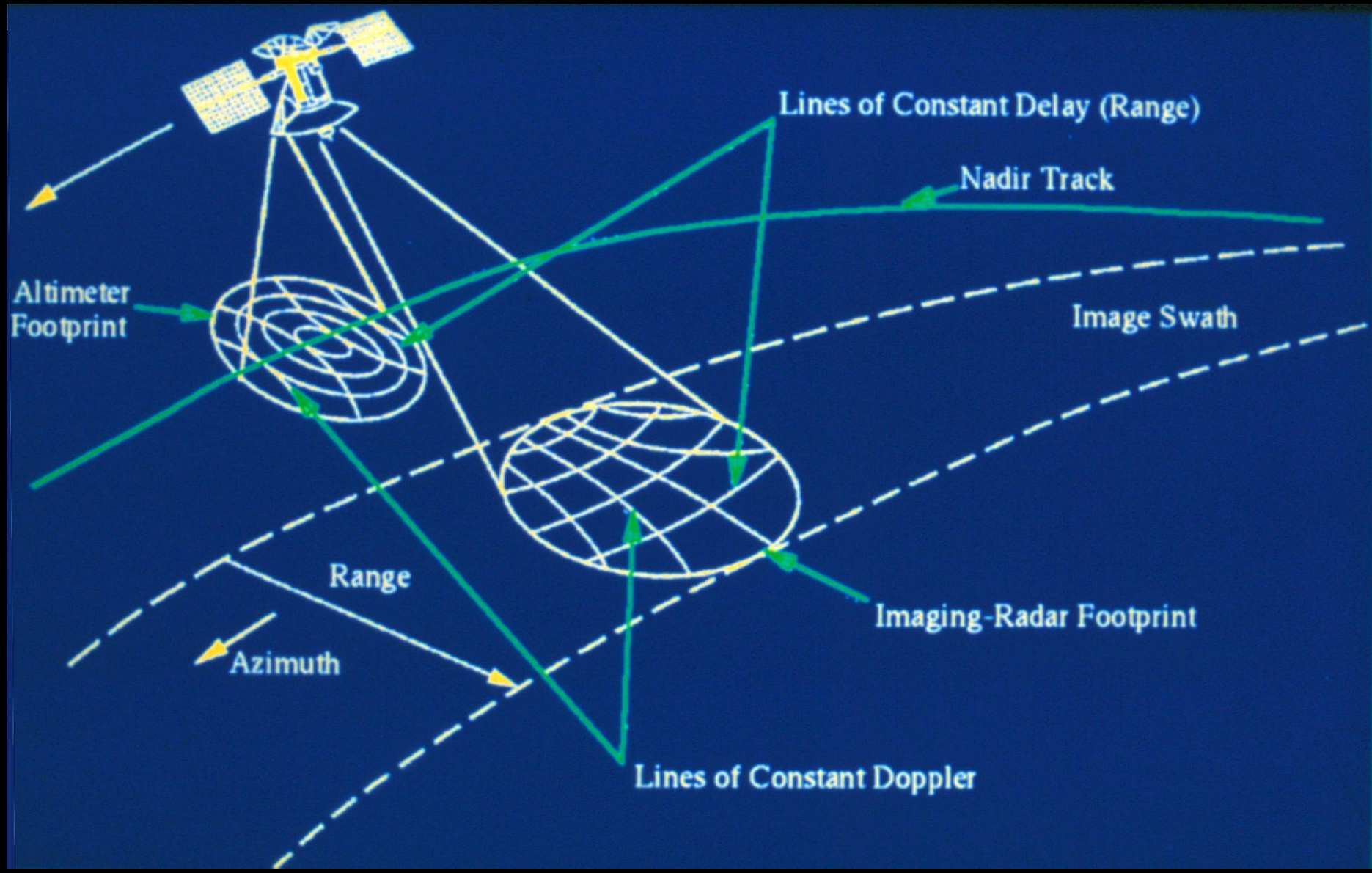



MAGELLAN MISSION TO VENUS
May 1989 to October 1994

Magellan Deployment



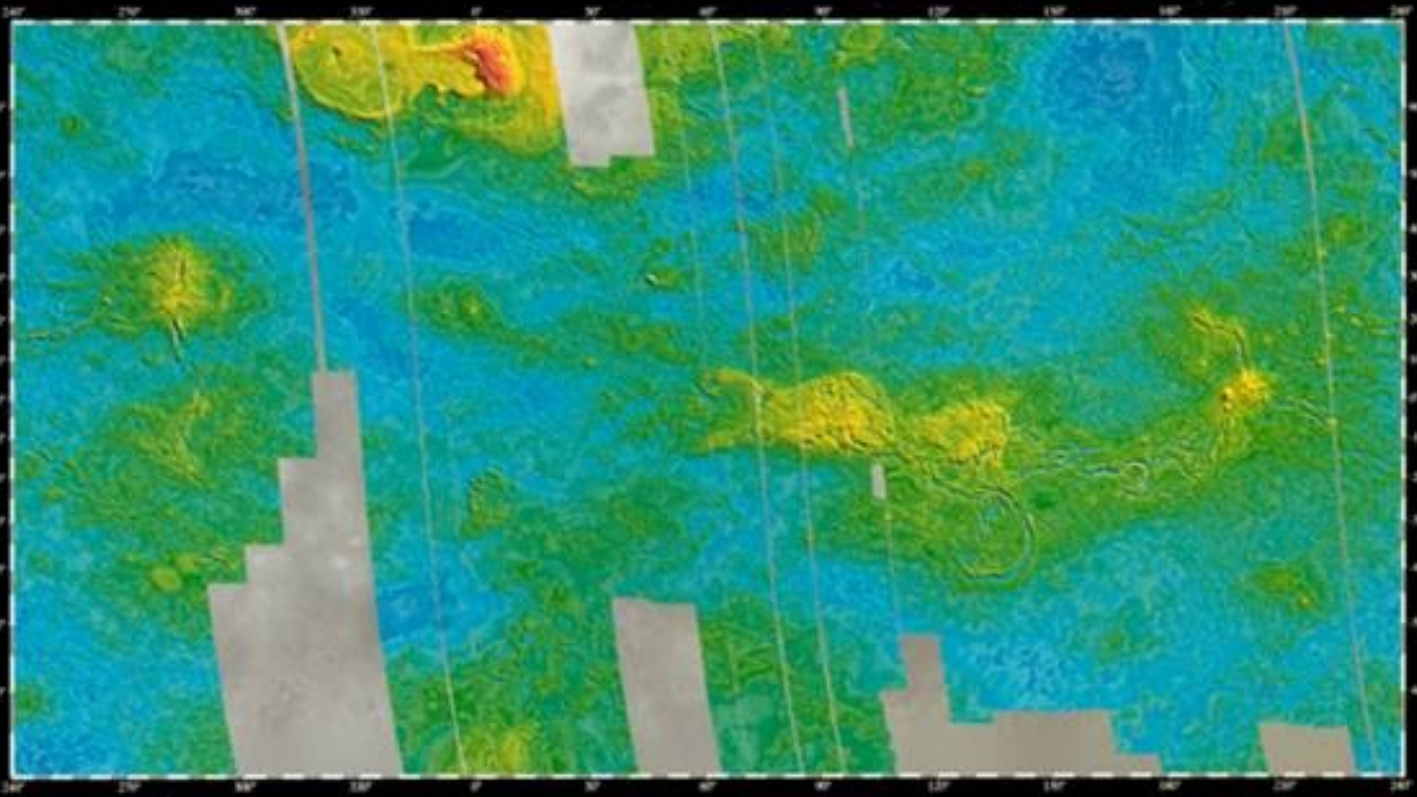
Magellan Radar Mapping

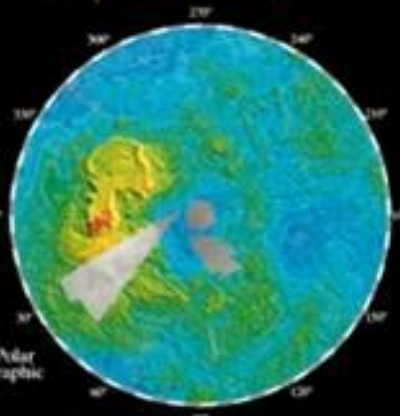




Massachusetts Institute of Technology | National Aeronautics and Space Administration | Jet Propulsion Laboratory

MAGELLAN — VENUS TOPOGRAPHY — GTDRP.1;3

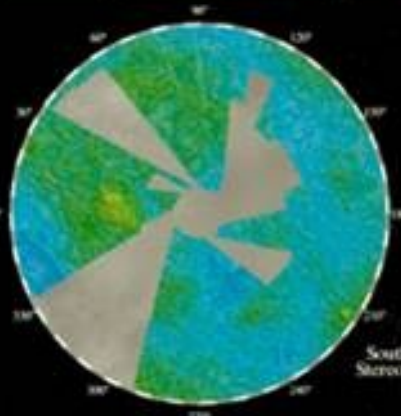




North Polar Stereographic

Mercator Scale

Polar Stereographic Scale



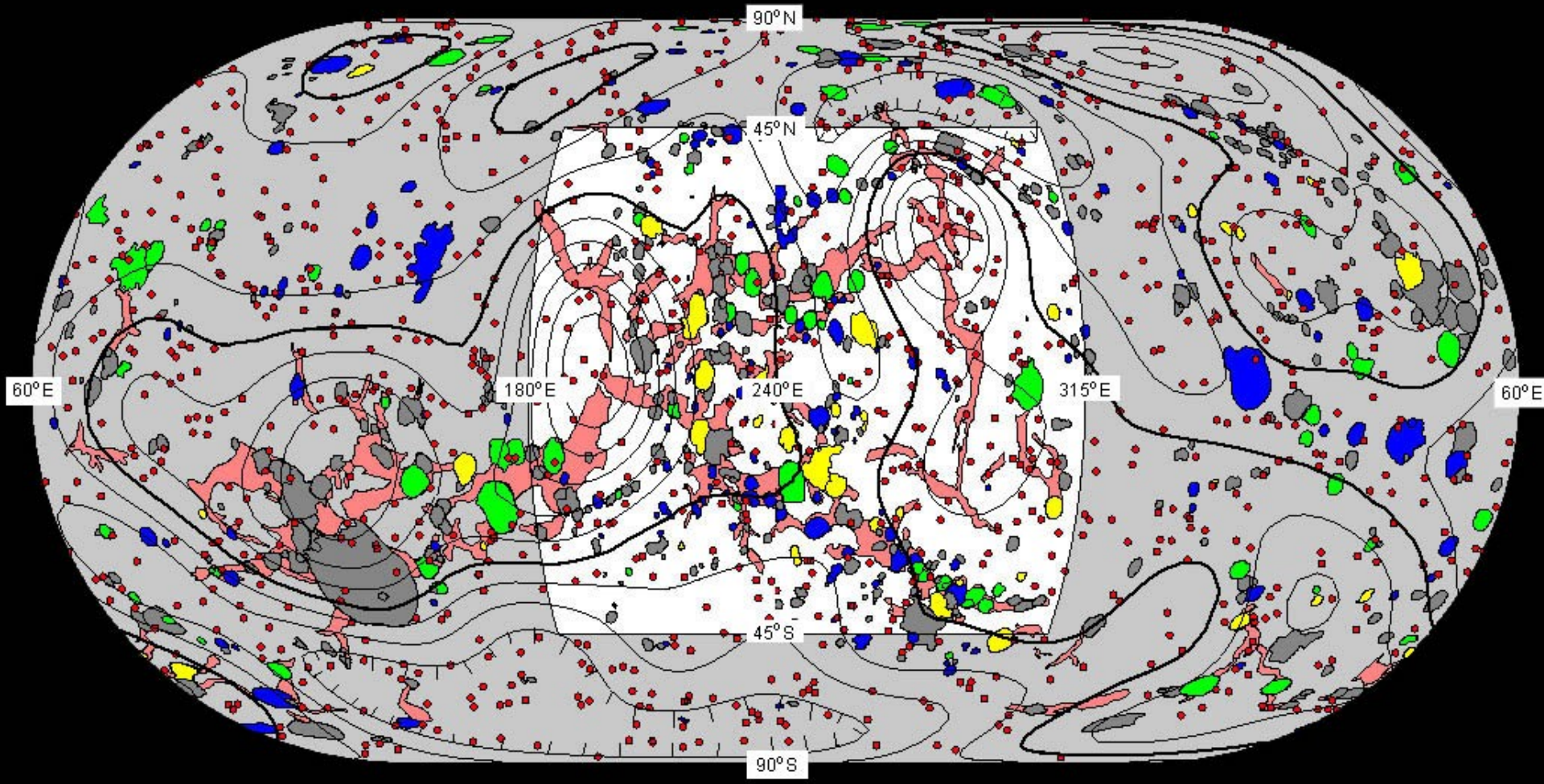
South Polar Stereographic

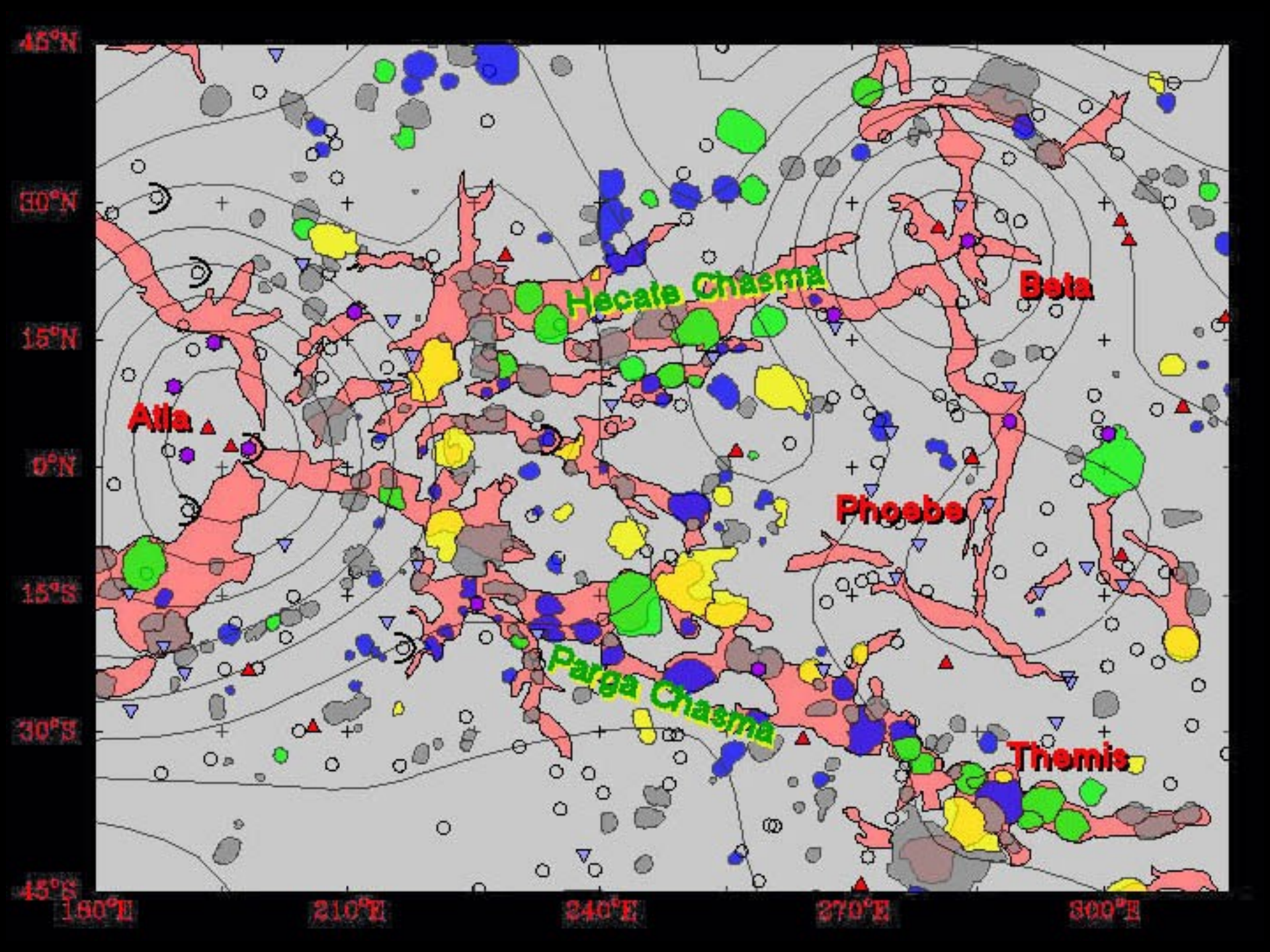
Planetary Radius (km)

PRODUCT ID:	GTDRP.1;3	PRODUCTION DATE:	11/02/91
STARTING ORBIT:	376	PRODUCTION TIME:	13:19:13
ENDING ORBIT:	2586	HARDWARE VERSION:	01
PIXEL SIZE:	5×5 km	SOFTWARE VERSION:	02

Venus Chasmata, Coronae, Craters, and Geoid

(Eckert IV projection)

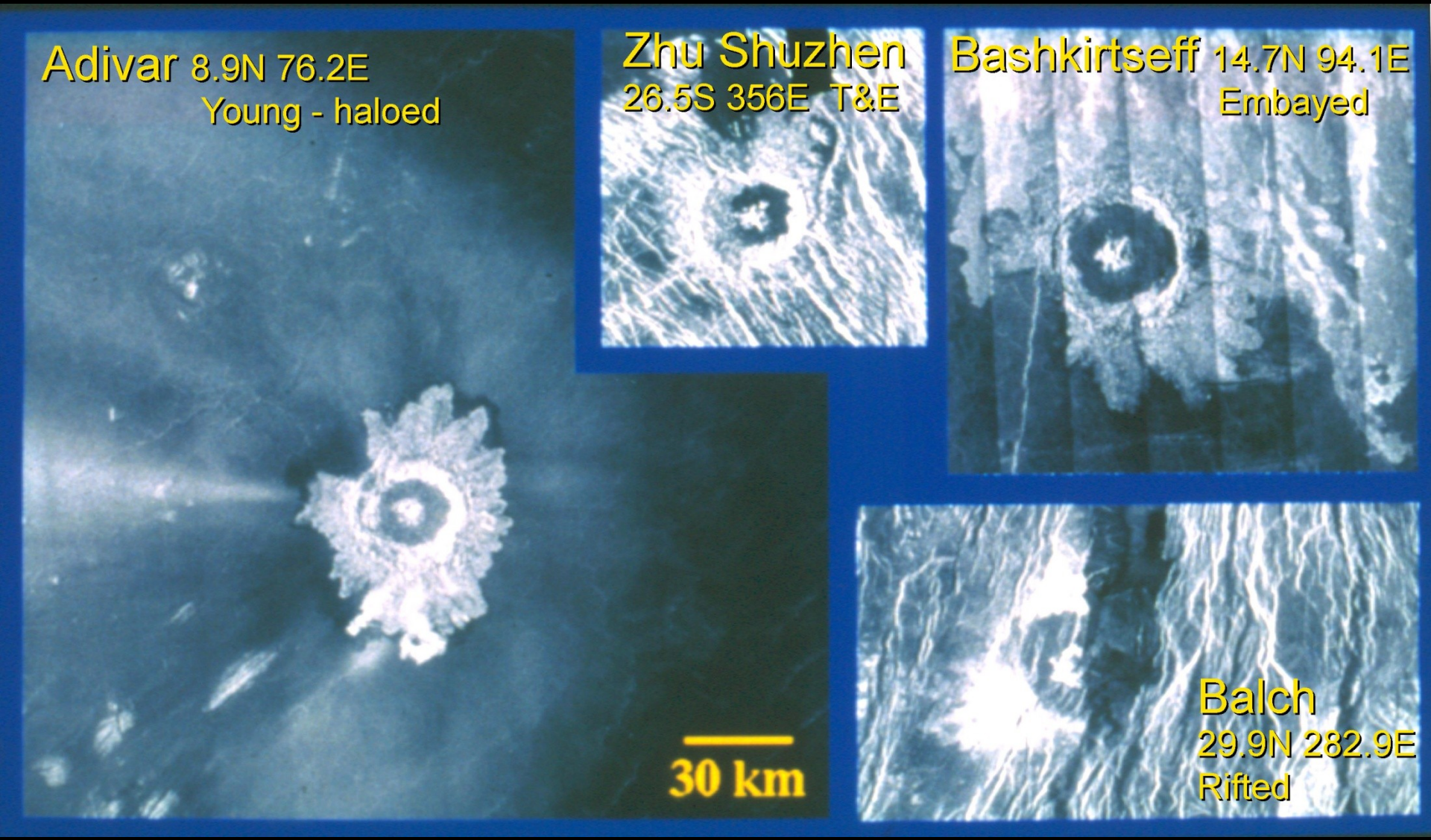



45°N
30°N
15°N
0°N
15°S
30°S
45°S
180°E
210°E
240°E
270°E
300°E
Hecate Chasma
Beta
Alla
Phoebe
Parga Chasma
Themis

Craters

- About 1000 globally
- Apparent random distribution
- Most pristine, some modified
  - Tectonization
  - Embayed
  - West-opening Haloes (very young craters)

Craters on Venus



Chasmata

- Probable analog to Earth rifts, great circles
- Strongest relief on Venus: >7km variation over 30 km distance
- Total length of Venus chasmata system similar (adjusted for planetary radius) to that of Earth's rift system (c. ~98%)

Venus Chasmata

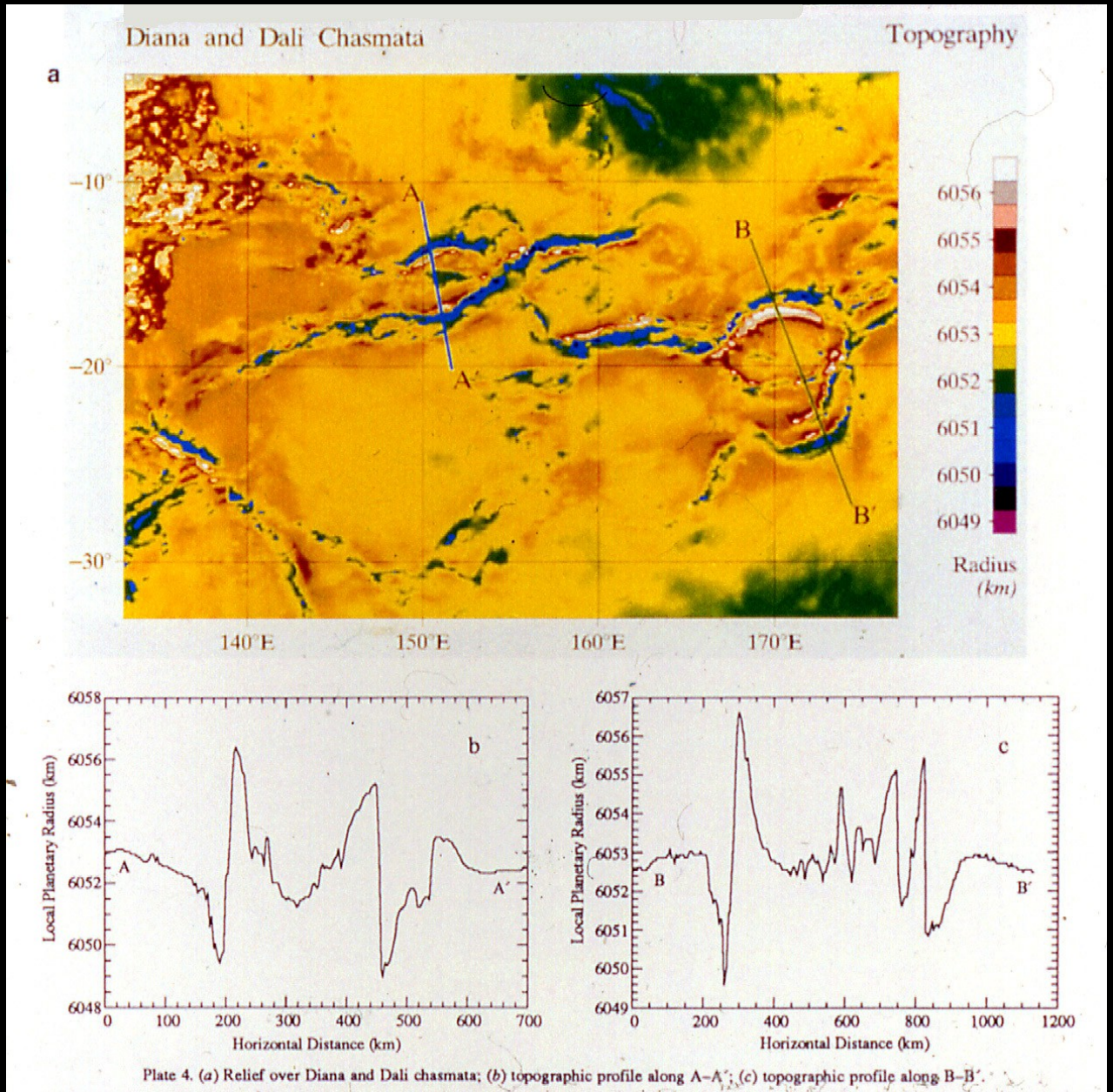
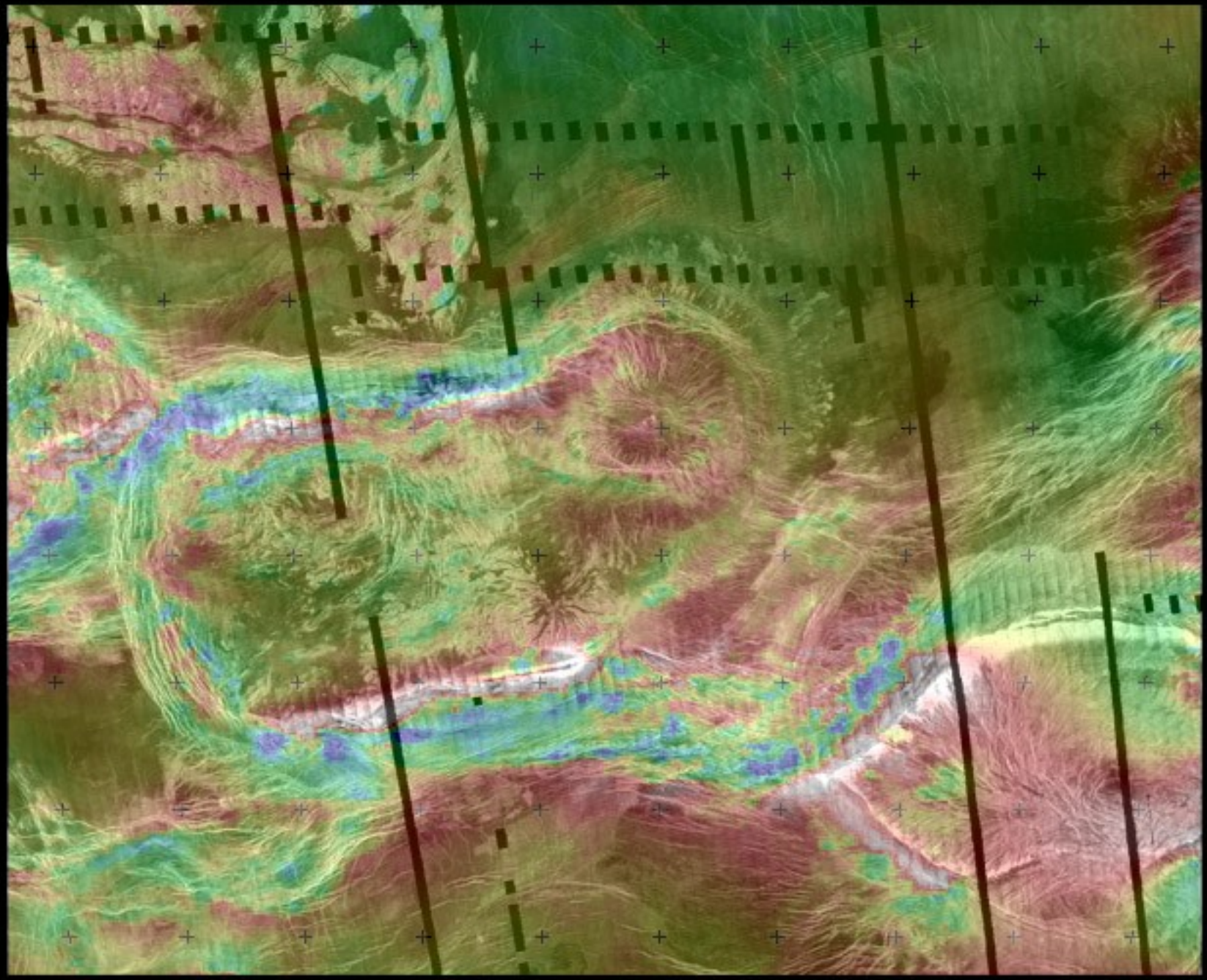


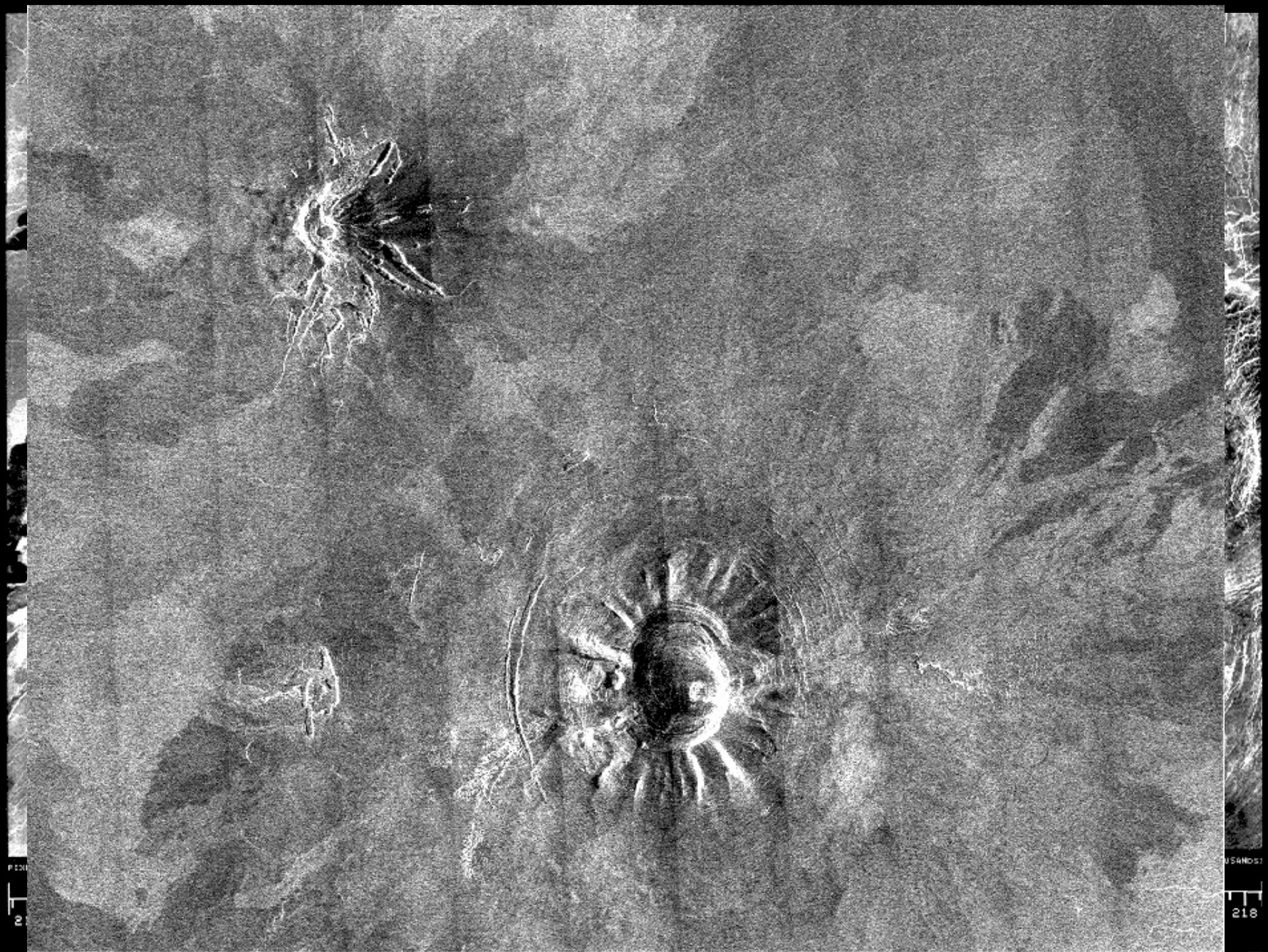
Plate 4. (*a*) Relief over Diana and Dali chasmata; (*b*) topographic profile along A–A′; (*c*) topographic profile along B–B′.


8°S
10°S
12°S
14°S
16°S
18°S
20°S
22°S
156°E
160°E
164°E
168°E
172°E

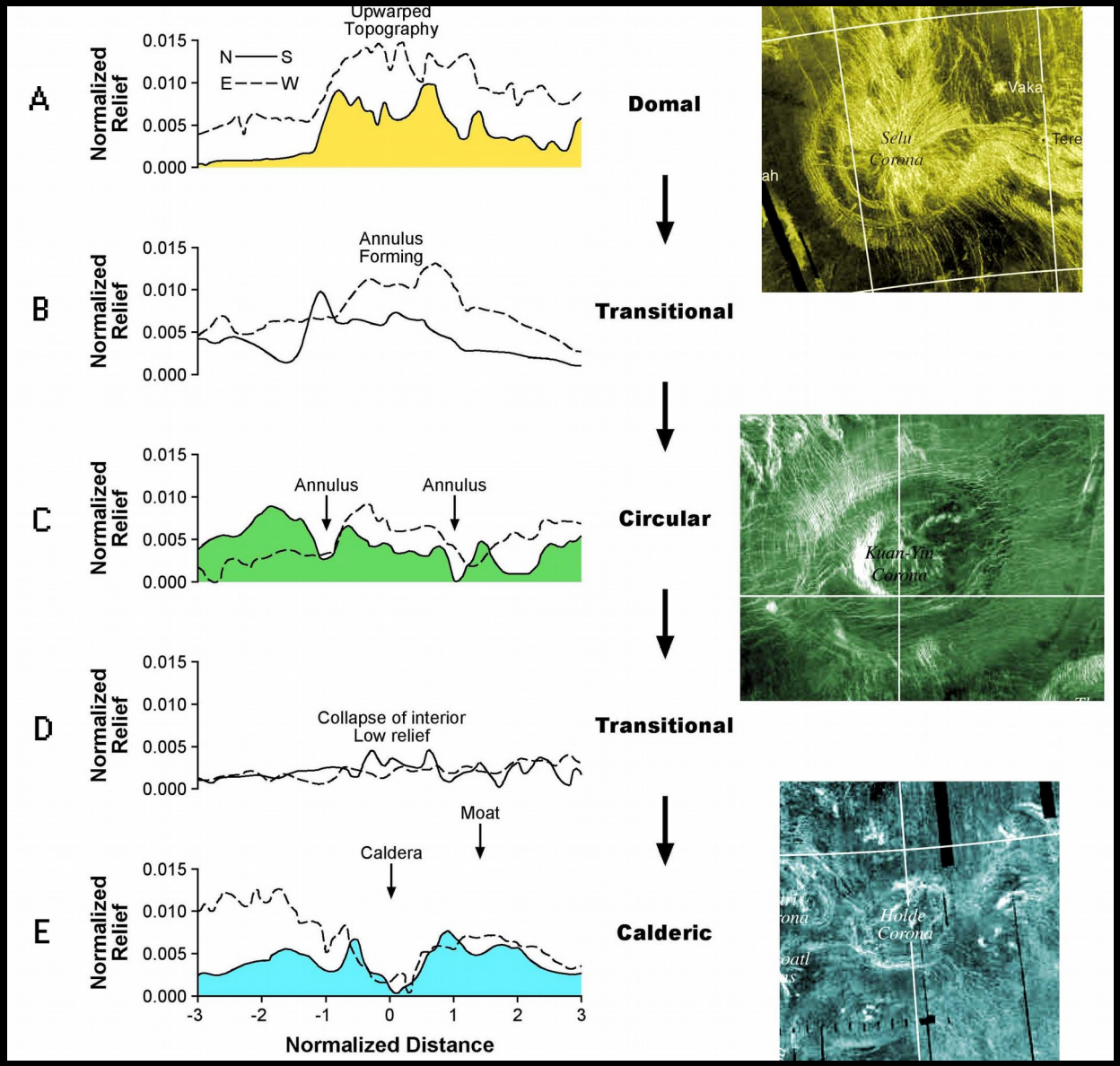
Coronae

- Large volcanic features, marked by central topographic high or low, surrounded by annulus
- About 670 identified
- Not randomly distributed – concentrations near chasmata and in the B-A-T region
- Possible evolution scheme determined…

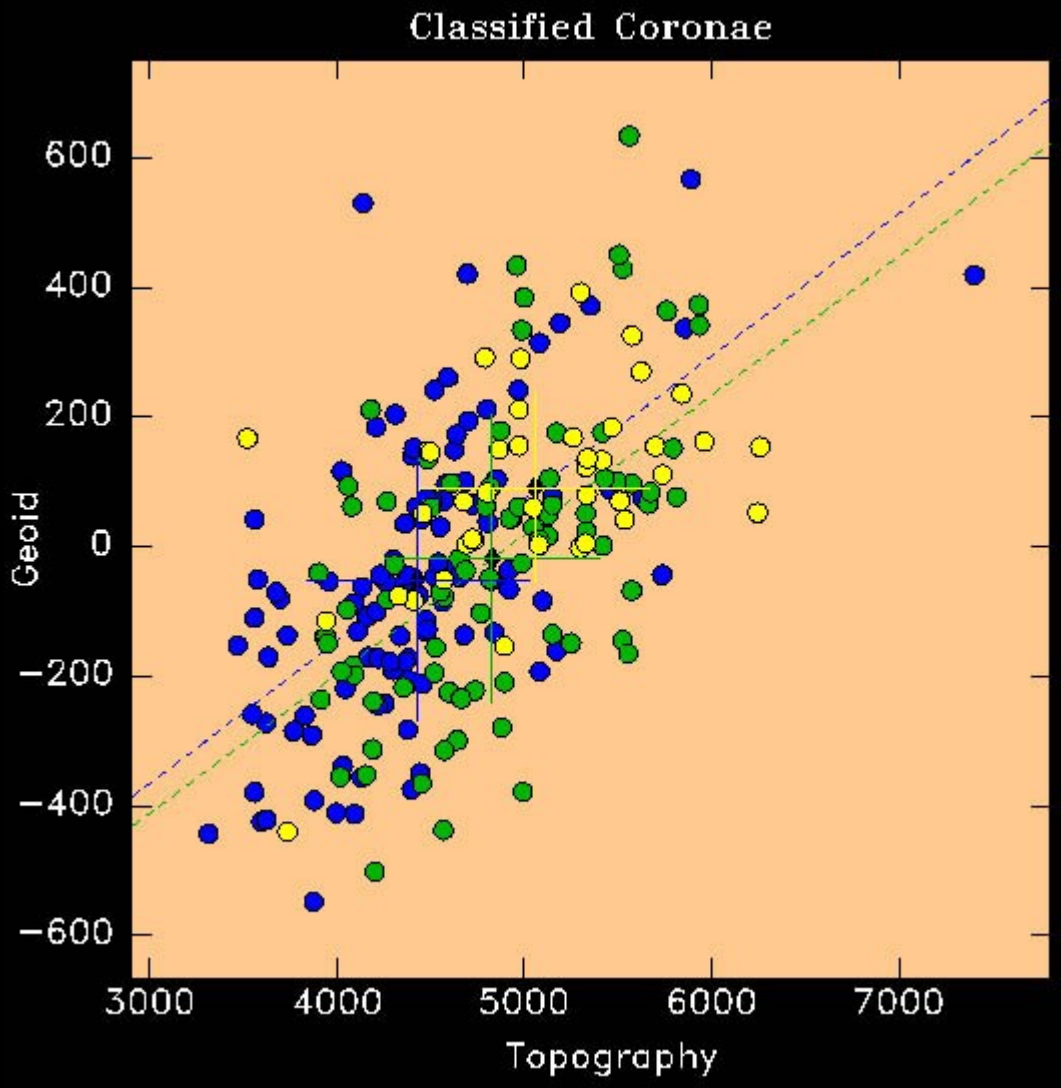
Coronae



Corona Evolution



Comparison of Coronae, by Type

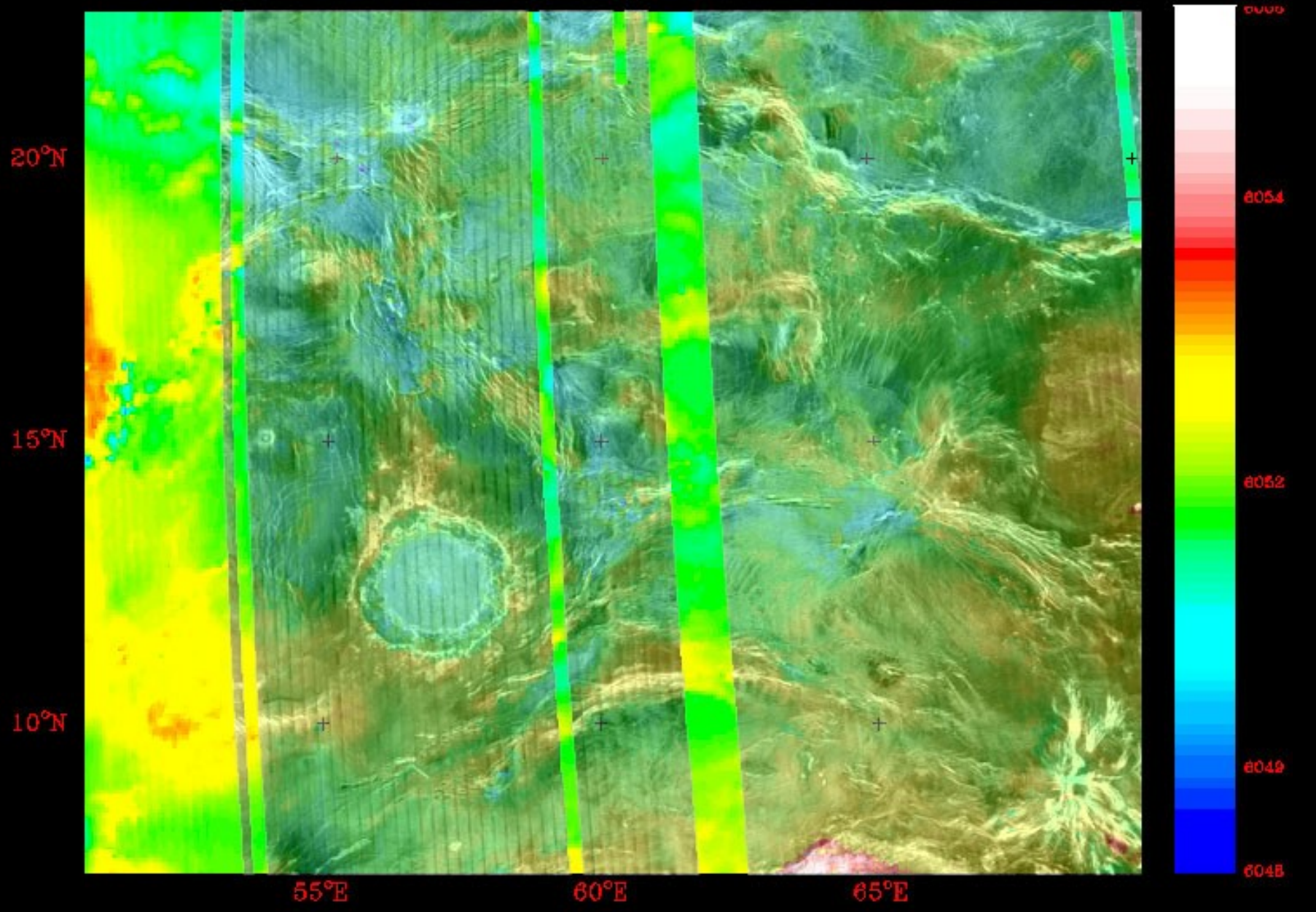


Craters vs. Coronae

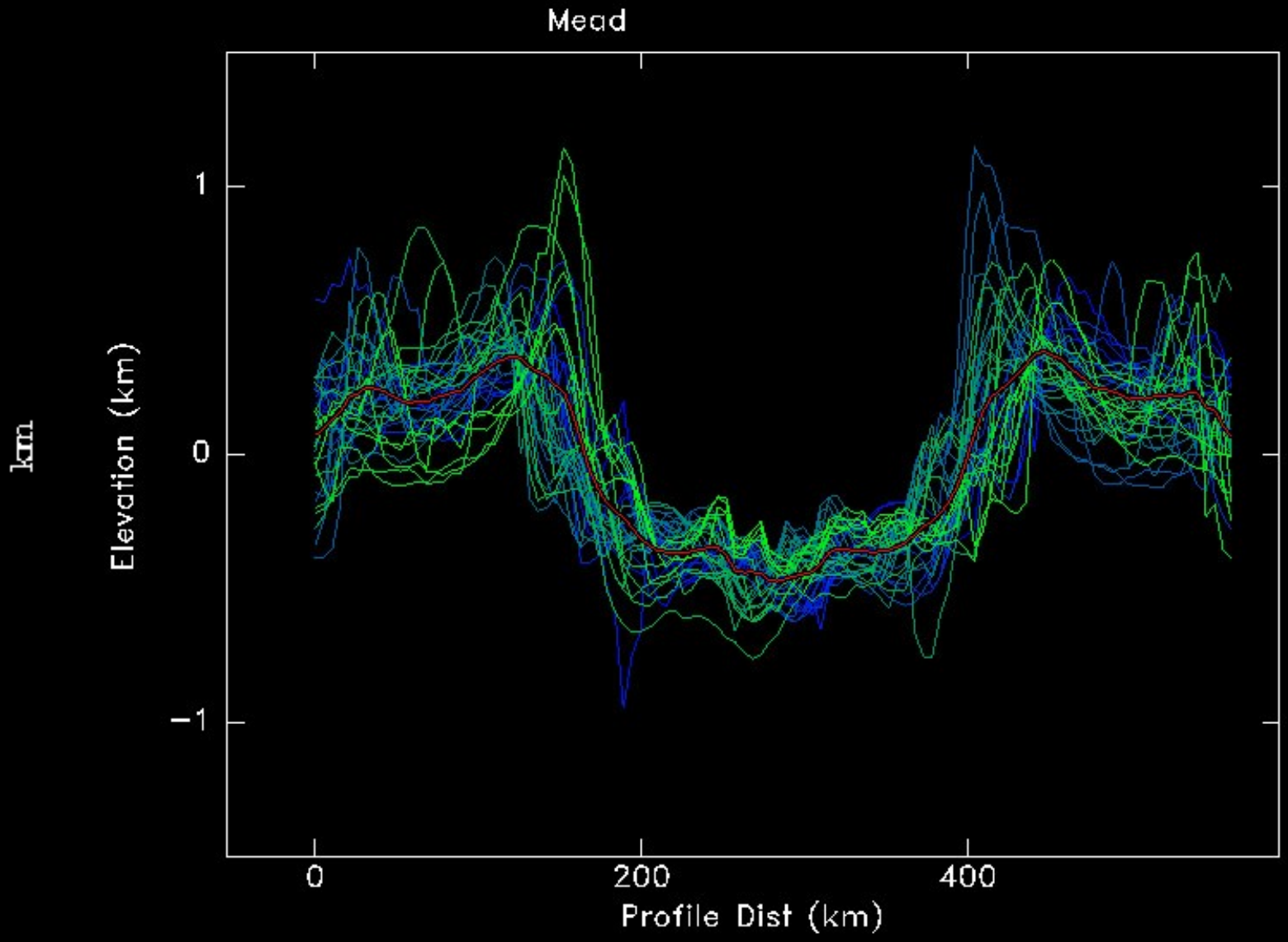
Several researchers (Hamilton, Vita-Finzi, e.g.) have suggested that coronae are actually craters.

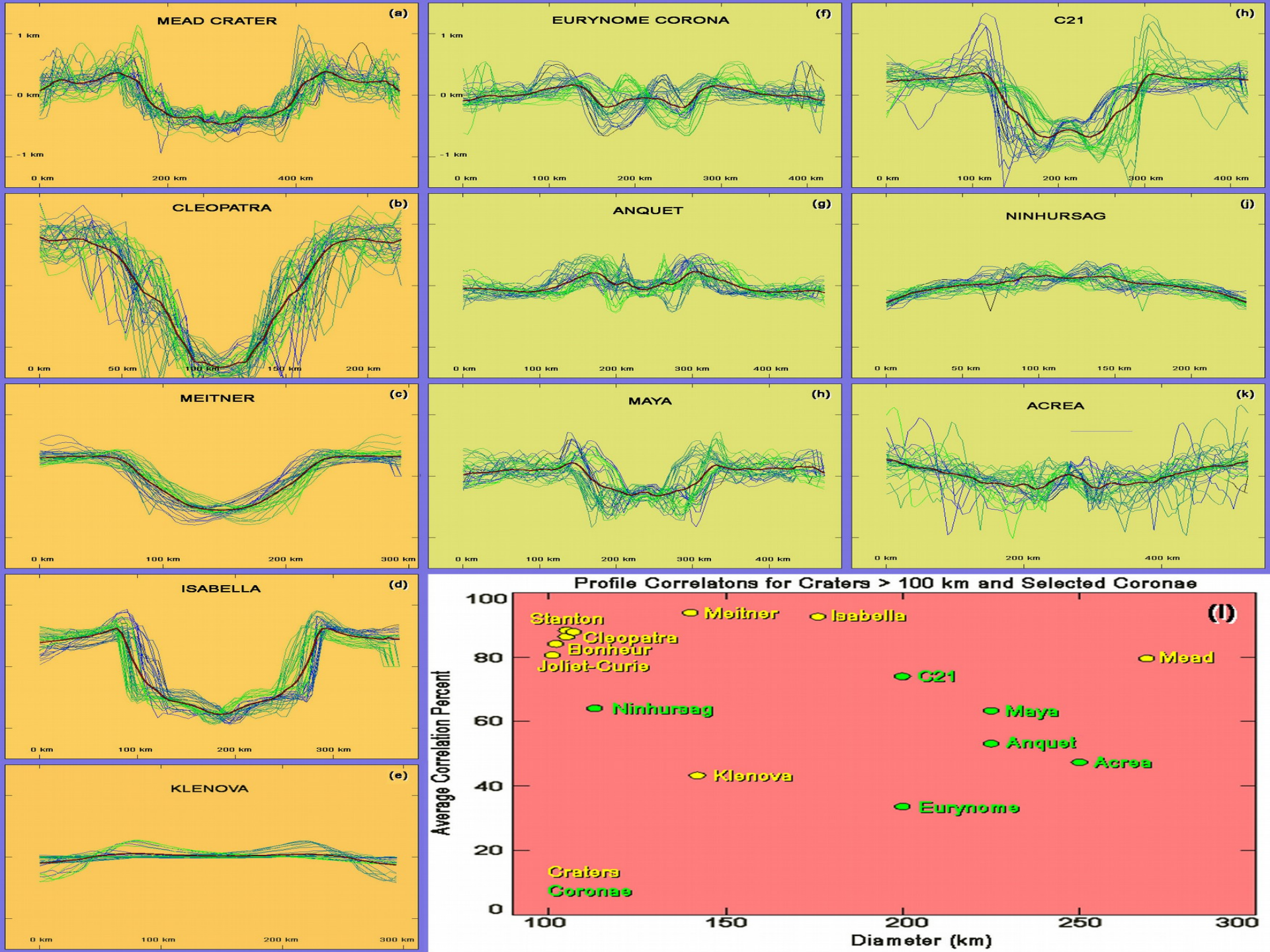
Comparison of topography may help assess this hypothesis.

Mead Crater – Radar and Topography

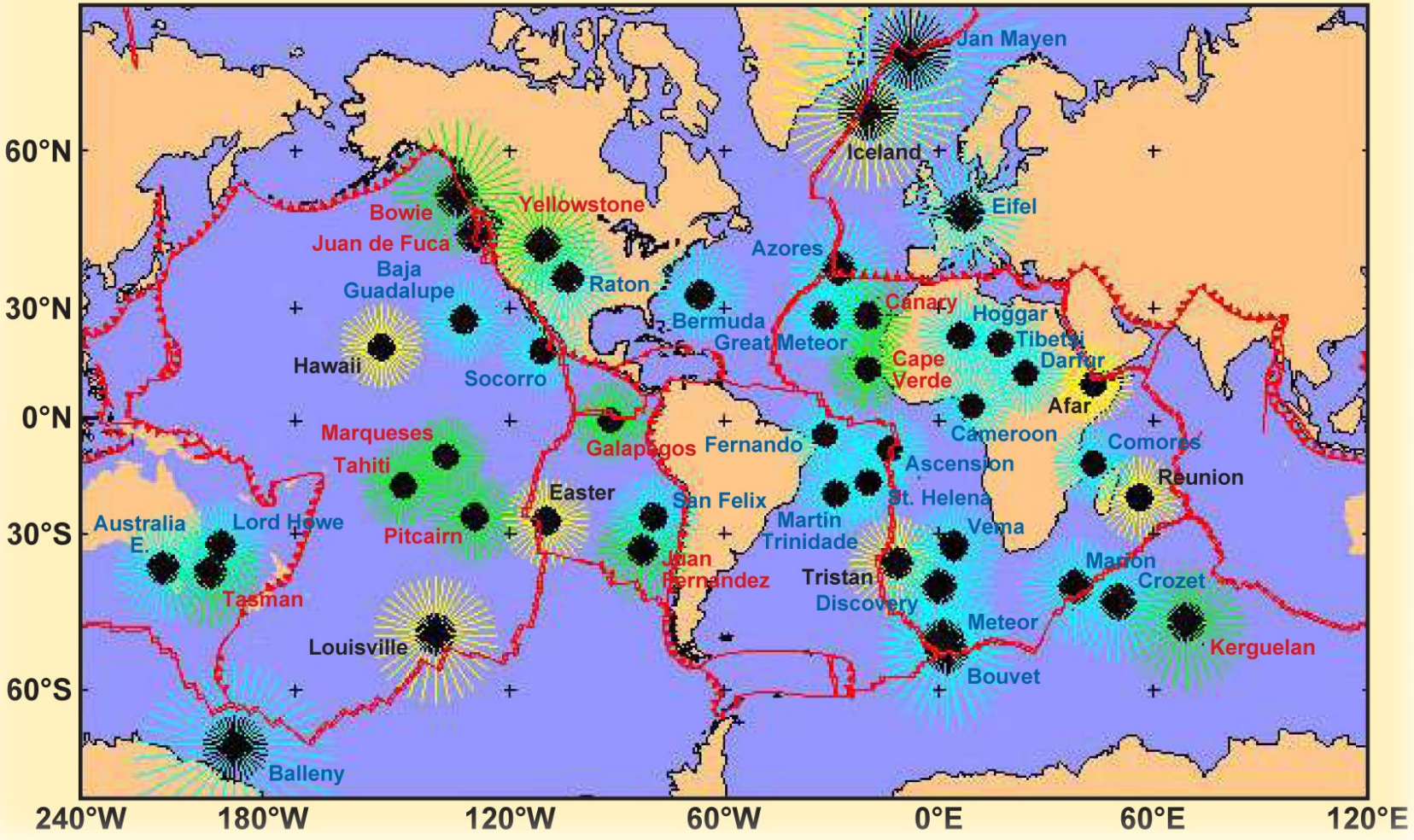


Cross-Correlation Mead Crater

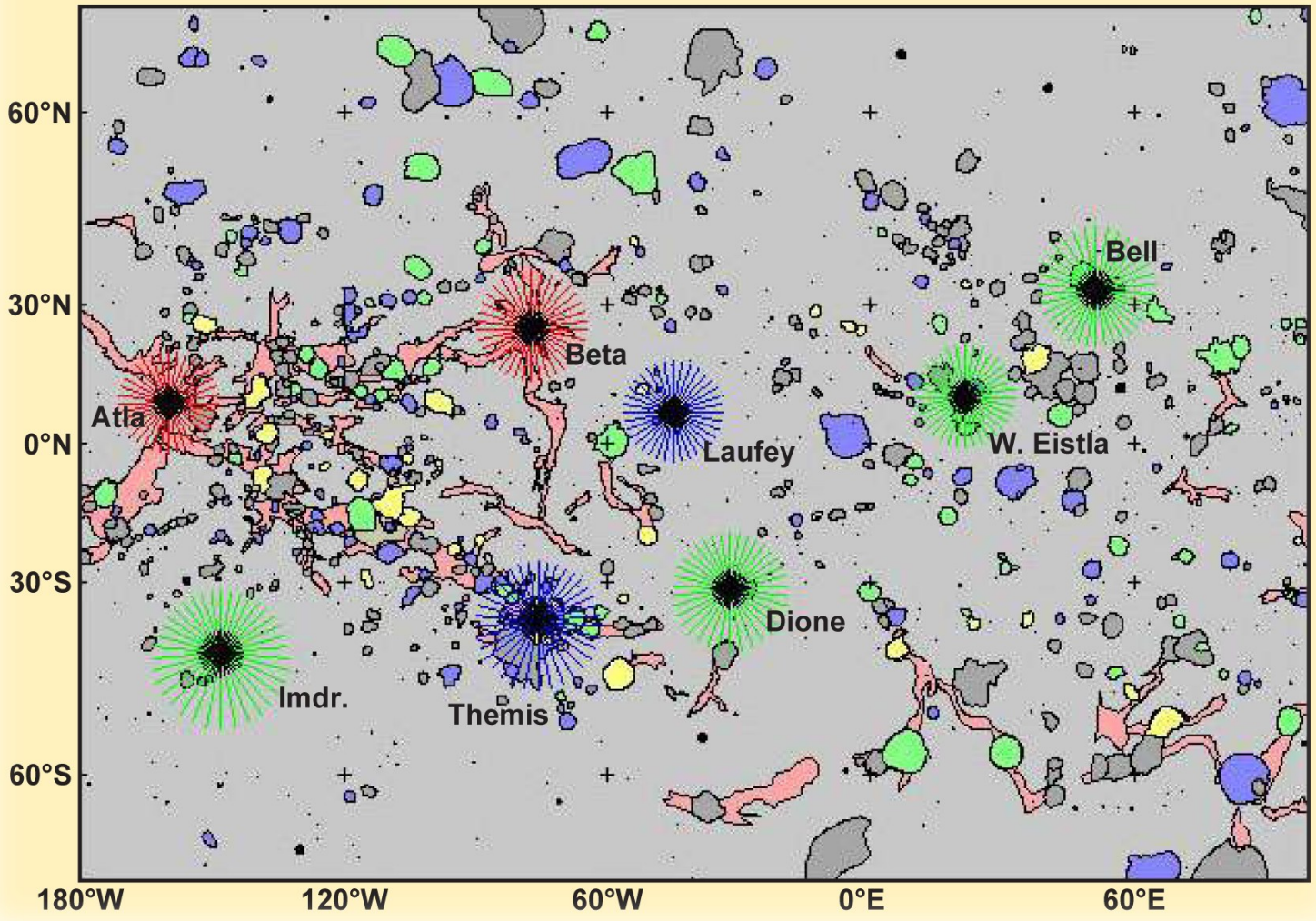



MEAD CRATER
(a)
1 km
0 km
-1 km
0 km
200 km
400 km
EURYNOME CORONA
(f)
1 km
0 km
-1 km
0 km
100 km
200 km
300 km
400 km
C21
(h)
0 km
100 km
200 km
300 km
400 km
CLEOPATRA
(b)
0 km
50 km
100 km
150 km
200 km
ANQUET
(g)
0 km
100 km
200 km
300 km
400 km
NINHURSAG
(j)
0 km
50 km
100 km
150 km
200 km
MEITNER
(c)
0 km
100 km
200 km
300 km
MAYA
(h)
0 km
100 km
200 km
300 km
400 km
ACREA
(k)
0 km
200 km
400 km
ISABELLA
(d)
0 km
100 km
200 km
300 km
KLENOVA
(e)
0 km
100 km
200 km
300 km
Profile Correlatons for Craters > 100 km and Selected Coronae
(l)
Average Correlation Percent
Diameter (km)
100
80
60
40
20
0
100
150
200
250
300
Stanton
Cleopatra
Bonheur
Joliet-Curie
Meitner
Isabella
Mead
C21
Ninhursag
Maya
Anquet
Acrea
Klenova
Eurynome
Craters
Coronae

Earth


Jan Mayen
Iceland
Eifel
Bowie
Yellowstone
Juan de Fuca
Baja
Guadalupe
Raton
Azores
Canary
Hoggar
Tibesti
Darfur
Bermuda
Great Meteor
Cape
Verde
Afar
Hawaii
Socorro
Marqueses
Tahiti
Galapagos
Fernando
Cameroon
Comores
Ascension
Reunion
Easter
San Felix
St. Helena
Australia
E.
Lord Howe
Pitcairn
Martin
Trinidade
Vema
Juan
Fernandez
Tristan
Discovery
Marion
Crozet
Tasman
Meteor
Louisville
Kerguelan
Bouvet
Balleny
60°N
30°N
0°N
30°S
60°S
240°W
180°W
120°W
60°W
0°E
60°E
120°E

Venus Profiles



Venus profile lines for regiones. For each uplift feature, 36 radial profiles are taken through

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared for the
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ATLAS OF VENUS
1:10,000,000 SERIES
V 10M 90/0 RTK, 1998
I-2490 SHEET 4 OF 4

NOTES ON BASE

This chart is one in a series of maps of Venus at nominal scales of 1:10,000,000 on the Lambert conformal conic projection. Cartography Working Group, 1984, 1993; Batson, 1994). It is based on data from the Magellan Synthetic Aperture Radar (SAR) and radar altimetry instruments. The Magellan Mission was described by Saunders and Pettengill (1991). Magellan radar characteristics were described by Pettengill and others (1991).

ADOPTED FIGURE

The figure of Venus used for the computation of the map projection is a sphere with a mean radius of 6,051.0 km, consistent with the preliminary gravity figure reported by Phillips and others (1979) that was used for previous maps of Venus. Slightly larger values of the mean radius of Venus have subsequently been reported based on Pioneer Venus (Pettengill and others, 1980) and Magellan altimetry (Ford and Pettengill, 1992).

PROJECTION

The Mercator projection is used for this sheet. The scale is 1:16,354,349 at 0° latitude; it is 1:9,145,190 at 956.0° latitude, as is the scale at this latitude in the polar stereographic projection. Due to the retrograde rotation of Venus, longitude increases from west to east in accordance with usage of the International Astronomical Union (1971).

CONTROL

Planimetric control is derived from the radar-tracked position of the spacecraft. The first meridian passes through the central peak of the crater Ariadne, at lat 63.8° N., according to current International Astronomical Union usage (Davies and others, 1989). A feature 'Eve,' which, at the same longitude, originally fixed the location of the prime meridian (Davies and others, 1986a). The venusian cartographic coordinate system was described by Davies and others (1992).

CONTOURS

Because Venus has no surface water and hence no sea level, the topographic datum (the 0 km contour) is defined as a sphere with a radius of 6,051.0 km. Data for topographic contours were derived from computer processing of Magellan radar altimetric data provided by the Massachusetts Institute of Technology (Pettengill and others, 1991).

Interpretive image processing was used to remove artifacts, to enhance the digital-image details, and to add distinctive surface features taken from SAR images by use of pentagal and photointerpreter methods previously used to airbrush cartographic data (edited by Inge and Bridges (1976). Gaps in coverage by the Magellan SAR were filled with Pioneer Venus altimetry data (Ford and others, 1989; Pioneer Venus and Venus 15 and 16 mosaics), providing uniform portrayal of detail. Contours were generated at one kilometer elevations intervals from the altimetry data and matched to the new relief image. From these modified contours the color slice was generated.

Colors were chosen to lead the viewer to intuitively accept elevation information, that is, the colors help the viewer automatically see one elevation as higher or lower than other elevations. Also, colors selected suggest a rocky landscape rather than water or vegetation. A deliberate color contrast between a mid-white green for the lowlands and a yellow-brown for the highlands at the planetary boundary (radius of 6,051.0 km). The color slice was then merged with the relief image.

Shaded relief image (interpretation and portrayal), elevation contours, and cartographic processing by Ralph Aeschliman.

NOMENCLATURE

V 10M 90/0 RTK: Abbreviation for Venus; 1:10,000,000 series; center of map, lat 90° N., long 0°; shaded relief (0) with contours (7) and color slice (6).

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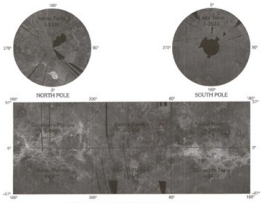
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Phillips, R.J., and five others, 1979, The gravity field of Venus: A preliminary analysis: Science, v. 205, no. 4401, p. 93–96.

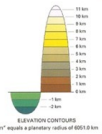
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INDEX OF THE 1:10,000,000 SCALE MAP SERIES OF VENUS
Number preceded by "I" indicates published map.



ELEVATION CONTOURS
"0 km" equals a planetary radius of 6051.0 km

SCALE 1:9,145,190 AT 0° LATITUDE
AND 956.0° LATITUDE
POLAR STEREOGRAPHIC PROJECTION



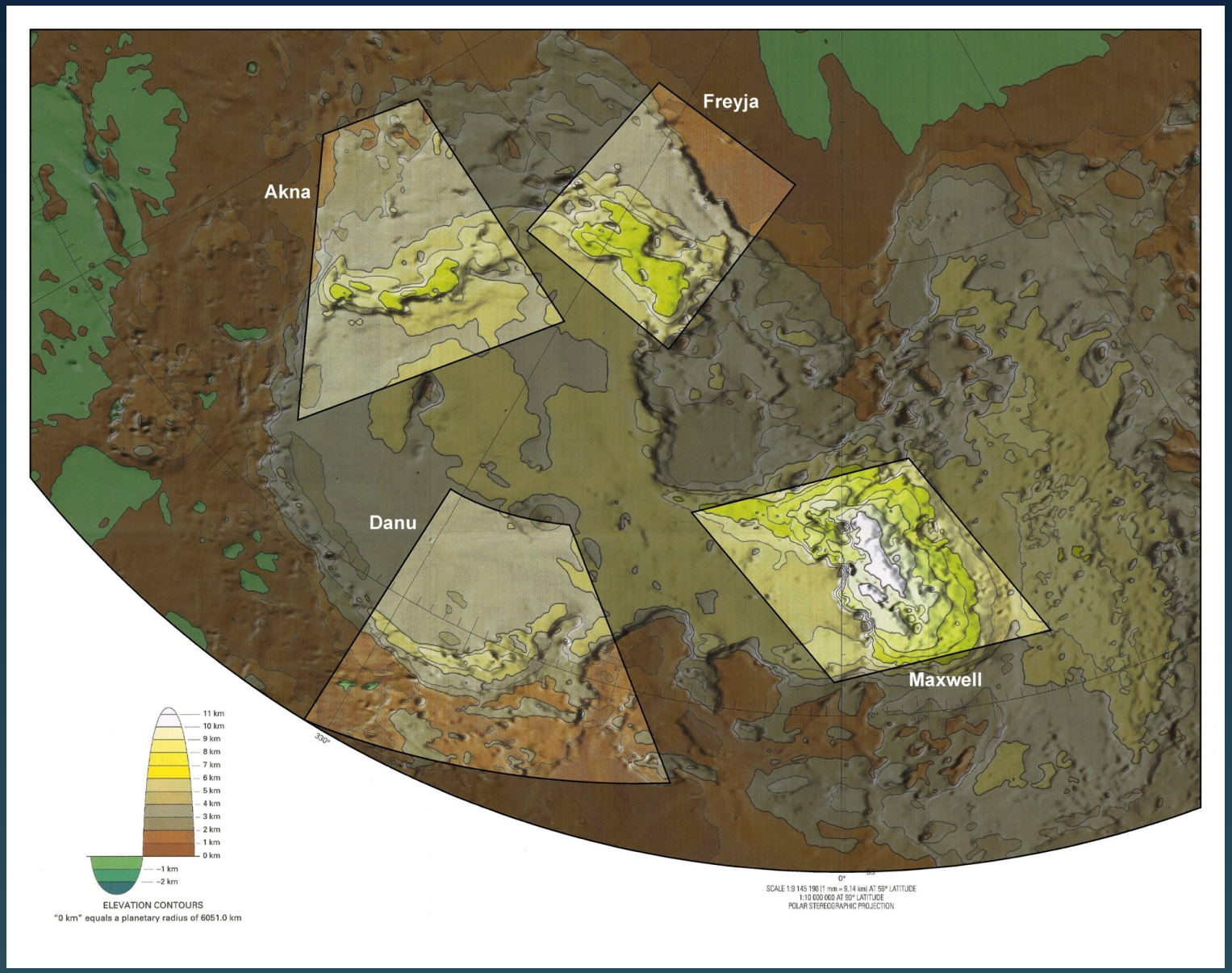
TOPOGRAPHIC MAP OF THE ISHTAR TERRA REGION OF VENUS
V 10M 90/0 RTK
1998

Prepared on behalf of the NASA Planetary Geology and Geophysics programs and the Magellan Project Office of the Jet Propulsion Laboratory
Edited by Bernd Hirsch; cartography by Roger E. Carroll and Earlene A. Cavaliere
Manuscript approved for publication April 28, 1998

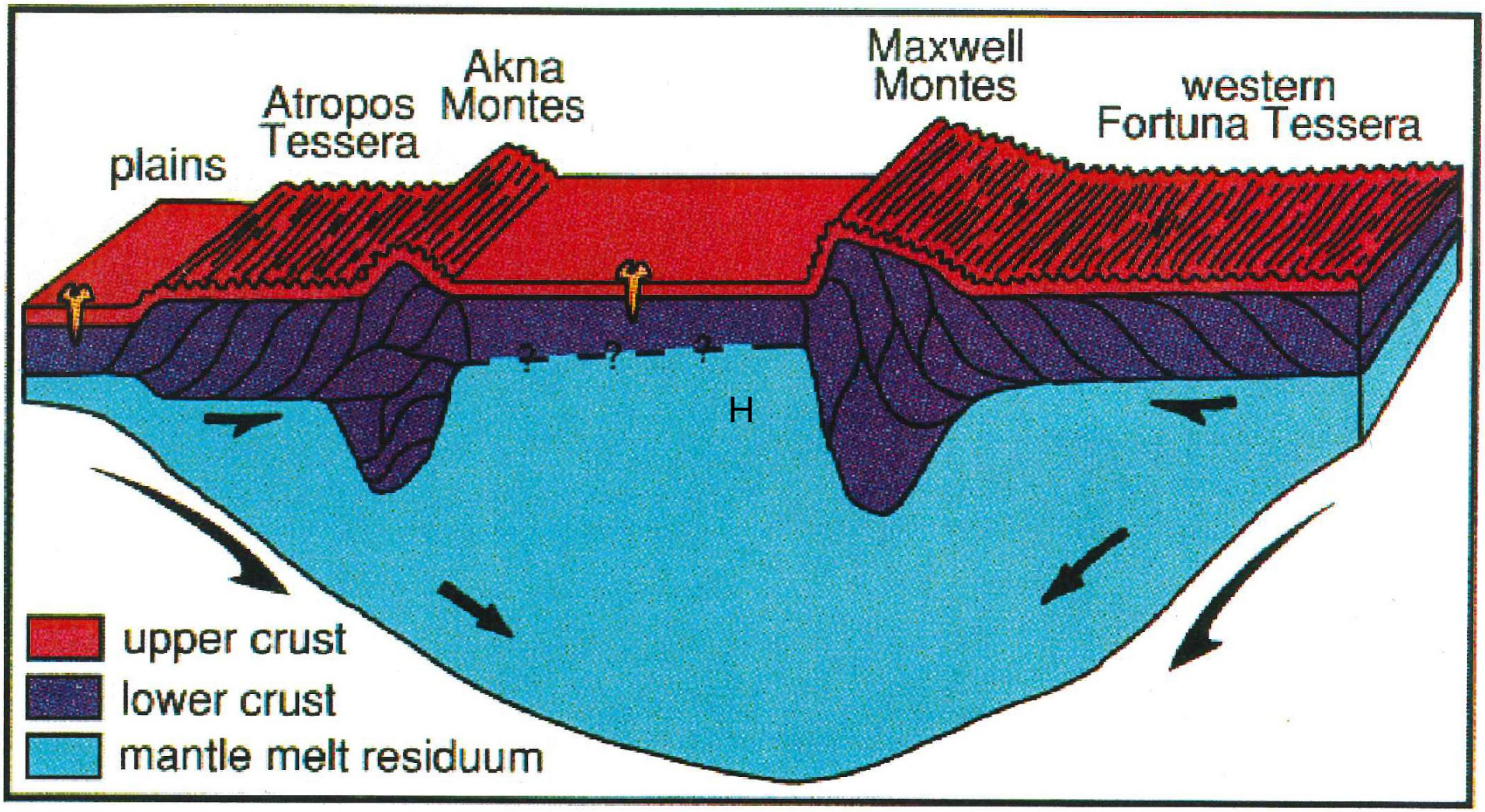
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Box 25286, Federal Center, Denver CO 80225

NOTE TO USERS
Users noting errors or omissions are urged to indicate them on a photocopy and send to: Planetary Cartography, MS 639, Room 341, 2255 N. Gemini Drive, Flagstaff, AZ 86001. A replacement copy will be returned.

Venus Mountains



Orogenic Model – (Hansen & Phillips, 1995)



Conclusions

Venus closely resembles Earth globally, but significant differences exist:

- Atmosphere: pressure, composition, temperature
- Tectonic Style: PT vs global overturn
- Crater distribution, age of surface

Conclusions

- Venus may have been totally resurfaced in a very short time frame (~100 Ma?) between 300 Ma and 1 Ga.
- If features classified as coronae actually are craters, this history must be rewritten.
- Analysis indicates that classification must be done carefully, feature-by-feature