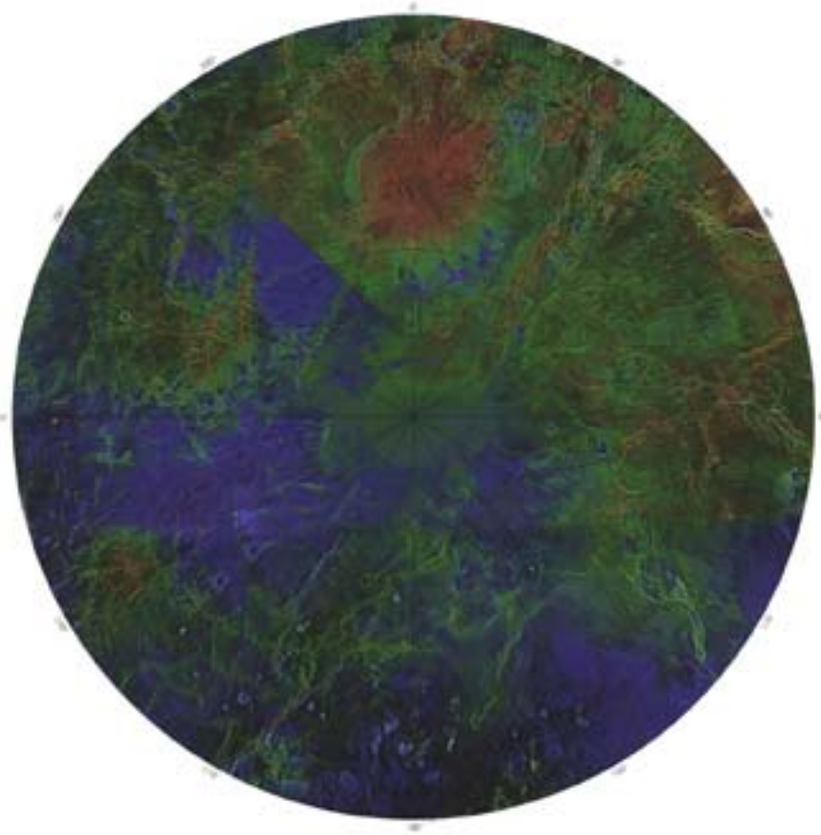
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

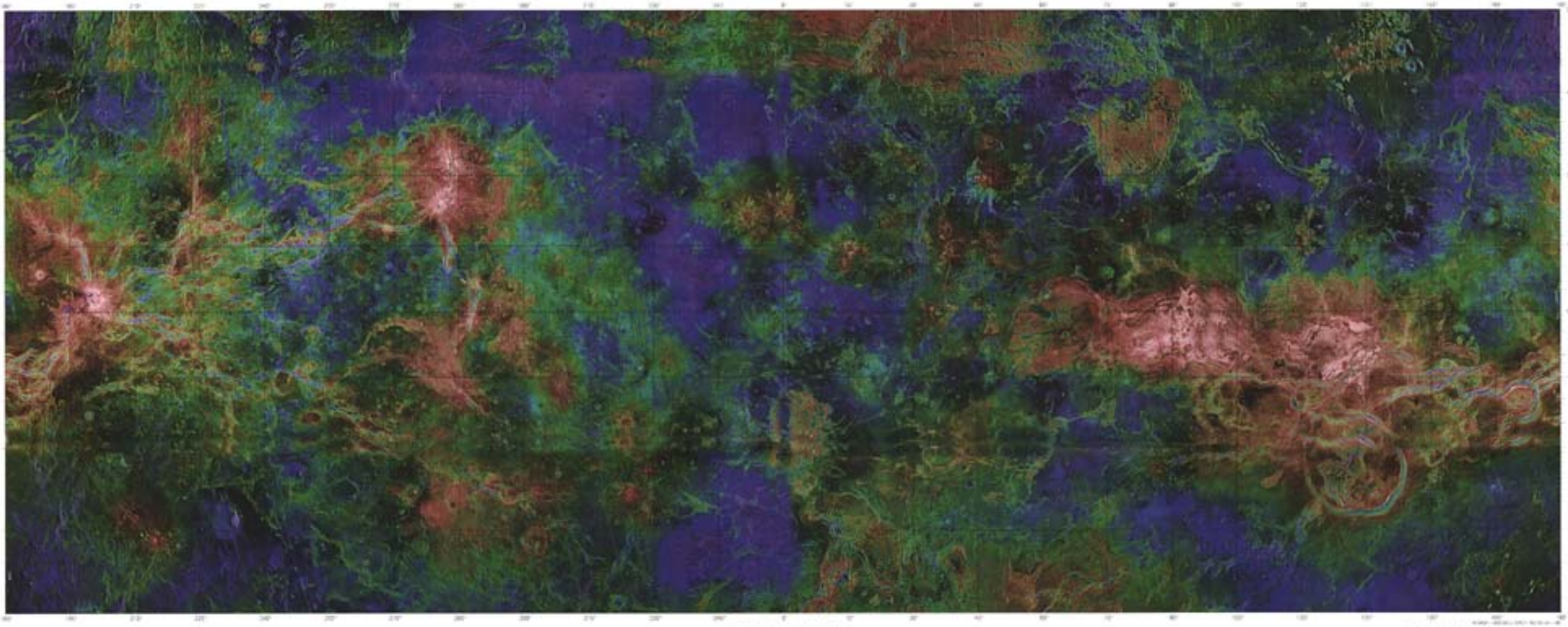
ATLAS OF VENUS
1:50,000,000 SERIES
V 50M 0/0 CMK, 1997
I-2444 SHEET 3 OF 4

Prepared for the
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NORTH POLAR REGION



SOUTH POLAR REGION



ALTIMETRIC RADAR IMAGE MAP OF VENUS

V 50M 0/0 CMK

1997

NOTES ON MAP

This chart is one in a series of maps of Venus at nominal scales of 1:50,000,000 and 1:10,000,000 (Planetary Cartography Working Group, 1994; 1995; Batson and others, 1996). It is based primarily 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 6,051.8 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 (Konopliv, Ford and Pettengill, 1992).

PROJECTION

The Mercator projection is used between the 57° parallels, and the polar stereographic projection is used for the polar regions north and south of the 57° parallels. The scale is 1:50,000,000 at lat 0° (Mercator) and 1:38,573,361 at ±90° (polar stereographic); both projections share a common scale of 1:27,959,665 at lat ±56°. Due to the retrograde rotation of Venus, longitude increases from east to west in accordance with usage of the International Astronomical Union (1971).

CONTROL

Planetocentric control is derived from the radio-tracked position of the spacecraft. The first meridian passes through the central peak of the crater Ariadne, at lat 4.5° N., according to current International Astronomical Union convention. Ariadne replaces the feature 'Eve', which, at the same longitude, originally fixed the location of the prime meridian (Batson and others, 1984). The Venerian cartographic coordinate system was described by Davies and others (1992).

MAPPING TECHNIQUES

This chart incorporates the knowledge of the Venusian surface **obtained through intensive radar investigations between** 1972 and 1994 was created by combining Magellan and pre-Magellan image and altimetry data. The maps base consists of a mosaic of radar images with approximately 98% of the planet covered by Magellan synthetic aperture radar data. The mosaic of the images appears above as chart 3 and its processing is described there. Most of the area imaged by Magellan is illuminated from the east, but some areas are illuminated from the west. Gaps in the Magellan coverage were filled with data from the Soviet Venera 15 and 16 spacecraft (north of 30° latitude) or from the ground-based Arecibo radar telescope (for the hemisphere centered roughly on 0° latitude and 200° longitude). The 1- to 2-kilometer spatial resolutions of the Venera images (Alexandrov and others, 1988) and Arecibo images (Campbell and others, 1989) are considerably poorer than that of the Magellan data but are adequate for the scale of this map. The Venera images are illuminated from the east; the effective illumination direction for the Arecibo data is variable from the center of the imaged hemisphere. A small number of remaining gaps near the north pole were filled with a radial trend. The composite mosaic of image data was digitally filtered to enhance small details and stretched for optimum contrast.

A global, composite digital terrain model was constructed in the same manner as the image base. The Magellan altimeter provided data for over 95% of Venus; gaps were filled with terrain resembling Venera 15/16 and Pioneer Venus altimetry data, or by smooth interpolation over the south pole. False colors were assigned to elevation values, and the elevation-derived color base was merged with the radar-image base as described by Edwards and Davis (1994). The color table is a continuous spectrum, from violet for low elevations to red for high. The distribution of elevations and colors is non-linear, chosen based on the relative of the elevation data so that equal areas of each hue appear on the global map. Violet hue also been used to identify the highest elevations, which occur only on a few isolated mountain peaks (for example, Maxwell, Rhea, Freyja, and Thetis regions), which comprise less than 1% of the surface area. The color bar shows both planetary radii and elevations relative to a reference radius of 6051.8 km.

Cartographic processing was done by Kenneth L. Edwards.

GEOMETRIC ACCURACY

V 50M 0/0 CMK—Relationships for Venus 1:50,000,000 series, center of map, lat 0°, long 0°, controlled mosaic 6,051 km (with radius arbitrary) (6).

REFERENCES CITED

Alexandrov, V.N., Bezrukov, A.T., Kostrukov, V.A., Petrov, G.M., Rzhiga, O.N., and Sukhanov, A.L., 1988, A global radiolocational Atlas of Venus radar imaging from the Venera 15 and Venera 16 spacecraft: Soviet Science Rev. B, Astrophysics and Space Physics, v. 4, p. 1-51.

Batson, R.M., Kirk, R.L., Edwards, K.F., and Morgan, N.A., 1994, Venus cartography: Journal of Geophysical Research, v. 99, p. 23,133-23,160.

Campbell, D.B., Head, J.W., Hine, A.A., Harmon, J.K., Senske, D.A. and Golish, P.C., 1989, Styles of volcanism on Venus: New Arecibo high-resolution radar data: Science, v. 246, p. 373-376.

Davies, M.E., and nine others, 1992, Report of the IAU/IAG/COSPAR Working Group on Cartographic Coordinates and Rotational Elements of the Planets and Satellites: Celestial Mechanics, no. 39, p. 103-133.

Davies, M.E., and eight others, 1995, The rotation period, direction of the north pole, and geodetic control network of Venus: Journal of Geophysical Research, v. 97, no. E8, p. 13,141-13,151.

Edwards, K.F., and Davis, P.A., 1994, The use of intensity-hue-**saturation transformation for producing color shaded-relief** images: Photogrammetric Engineering and Remote Sensing, v. 60, p. 1369-1374.

Ford, P.G., and Pettengill, G.H., 1992, Venus topography and kilometer-scale slopes: Journal of Geophysical Research, v. 97, p. 13,103-13,114.

International Astronomical Union, 1971, Commission 16: Physical study of planets and satellites, in Proceedings of the 14th General Assembly, Brighton, 1970: Transactions of the International Astronomical Union, v. 14B, p. 128-133.

Pettengill, G.H., and five others, 1980, Pioneer Venus radar results: Altimetry and surface properties: Journal of Geophysical Research, v. 85, no. A13, p. 8261-8270.

Pettengill, G.H., and five others, 1991, Magellan: Radar performance and data products: Science, v. 252, no. 5003, p. 260-265.

Phillips, R.J., and five others, 1979, The gravity field of Venus: A preliminary analysis: Science, v. 205, no. 4401, p. 91-96.

Planetary Cartography Working Group (Batson, R.G., and six others), 1988, Planetary cartography in the early decade (1988-1998): National Aeronautics and Space Administration Special Publication 477, 71 p.

Planetary Cartography Working Group (Dohlerman, J.R., and sixteen others), 1995, Planetary cartography 1991-2001: National Aeronautics and Space Administration, Planetary Cartography Working Group, 59 p.

Saunders, R.S., and Pettengill, G.H., 1991, Magellan: Mission summary: Science, v. 252, no. 5003, p. 247-249.

Prepared on behalf of the NASA Planetary Geology and Geophysics program and the Magellan Project Office of the Jet Propulsion Laboratory
Edited by Bernard Hirsch, cartography by Mark S. Sund
Manuscript approved for publication August 19, 1996