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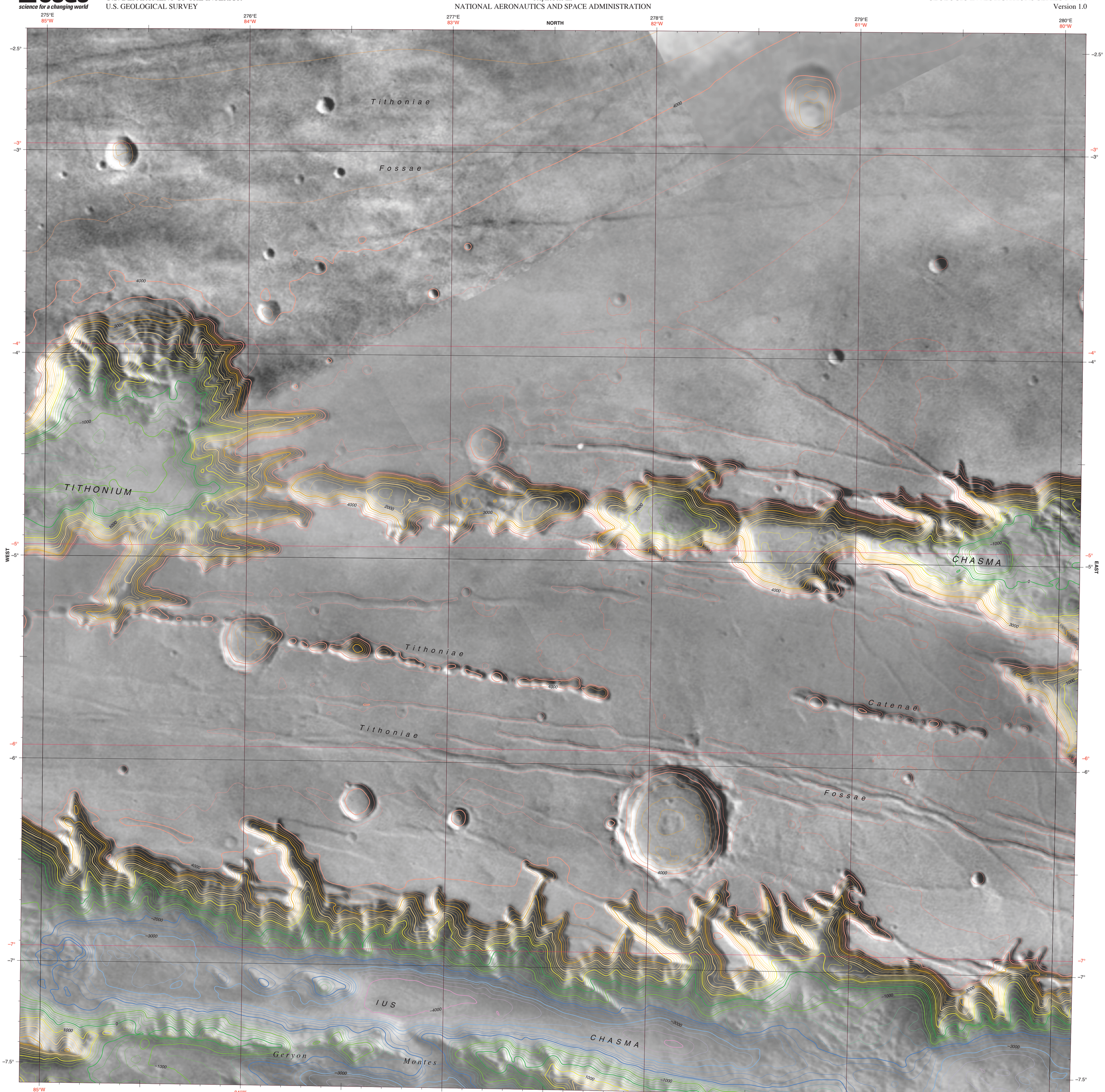

SCALE 1:502 000 (1 mm = 502 m) AT 270° E. (90° W.) LONGITUDE
TRANSVERSE MERCATOR PROJECTION

10 10 20 30 40 60 70 80 90 100
KILOMETERS

CONTOUR INTERVAL 250 METERS

Planetocentric latitude and east longitude coordinate system shown in black.
Planetographic latitude and west longitude coordinate system shown in red.

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

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NOTES ON BASE

This map, compiled photogrammetrically from Viking Orbiter stereo image pairs, is part of a series of topographic maps of areas of special scientific interest on Mars.

ADOPTED FIGURE

The figure of Mars used for the computation of the map projection is an oblate spheroid (flattening of 1/176.875) with an equatorial radius of 3396.0 km and a polar radius of 3376.8 km (Kirk and others, 2000). The datum (the 0-km contour line) for elevations is defined as the equipotential surface (gravitational plus rotational) whose average value at the equator is equal to the mean radius as determined by Mars Orbiter Laser Altimeter (MOLA; Smith and others, 2001).

PROJECTION

The projection is part of a Mars Transverse Mercator (MTM) system with 20° wide zones. For the area covered by this map sheet the central meridian is at 270° E. (70° W.). The scale factor at the central meridian of the zone containing this quadrangle is 0.9960 relative to a nominal scale of 1:500,000.

COORDINATE SYSTEM

Longitude increases to the east and latitude is planetocentric as allowed by IAU/IAG standards (Seidelmann and others, 2002) and in accordance with current NASA and USGS standards (Duxbury and others, 2002). A secondary grid (printed in red) has been added to the map as a reference to the west longitude/planetographic latitude system that is also allowed by IAU/IAG standards (Seidelmann and others, 2002) and has been used for previous Mars maps.

CONTROL

Horizontal and vertical control was established using the Mosaicked Digital Image Model 2.0 (MDIM 2.0; Kirk and others, 2000) and MOLA data. A portion of MDIM 2.0 covering the mapping area was extracted in simple cylindrical projection. This MDIM image was georeferenced to the MOLA data with an affine transformation. The MDIM image and georeferencing information were imported into a digital photogrammetric workstation (Miller and Walker, 1993) and used as an orthophoto to provide horizontal control to stereopairs of Viking imagery. The horizontal information was used to extract vertical control from the MOLA data. Note that the distribution of Viking Orbiter images suitable for mapping at a scale of 1:500,000 is uneven. Areas mapped in this series are chosen, often in blocks of two or more adjacent quadrangles, based on scientific interest as well as on the availability of suitable data for accurate mapping.

CONTOURS

Contours were derived from a digital terrain model (DTM) compiled on a digital photogrammetric workstation using Viking Orbiter stereo image pairs with orientation parameters derived from an analytic aerotriangulation. Contours were drawn automatically using a commercial geographic information system (GIS) software package (Environmental Systems Research Institute, 1994). For the stereomodels, the local expected vertical precision, based on image resolutions, parallax-to-height ratio (that is, convergence angle), and a matching accuracy of 0.2 pixel ranges from 42 m to 403 m, with a mean of 83 m. Elevation (in meters) is given with respect to the adopted Mars topographic datum (see "Adopted Figure" section). A comparison of the DTM values at the MOLA point locations shows that the DTM is on average 7 meters higher than the MOLA points (n=248,951; μ=7 m; σ=152 m). Contour lines were generated automatically using GIS software and were not edited. Because the contour lines were not edited, small closed contour lines, contour lines that intersect, and contour lines that do not match features are present. The post spacing for the DTM is 600 m; features that are less than 600 m in size will not be resolved and features that are smaller than 1800 m in size may only have four elevation measurements associated with them. This lack of elevation measurements may result in contour lines that do not adequately represent some features. The purpose of this mapping project is to produce the digital orthophoto and DTM. This map provides a graphical representation of the digital products that are available.

IMAGE BASE

The image base for this map employs Viking Orbiter images from orbits 682, 608, 912, and 334. An orthophotomosaic was created on the digital photogrammetric workstation using the DTM compiled from stereo models. Integrated Software for Imagers and Spectrometers (ISIS; Torson and Becker, 1997) provided the software to project the orthophotomosaic into the Transverse Mercator Projection.

NOMENCLATURE

Names on this sheet are approved by the International Astronomical Union (IAU). For a complete list of IAU approved names, see the Gazeteer of Planetary Nomenclature at http://planetarynames.wr.usgs.gov.

MTM 500k –05/277E OMKT: Abbreviation for Mars Transverse Mercator; 1:500,000 series; center of sheet latitude 5° S., longitude 277.5° E. in planetocentric coordinate system (this corresponds to –05/082; latitude 5° S., longitude 82.5° W. in planetographic coordinate system); orthophotomosaic (OM) with color-coded (K) topographic contours and nomenclature (T) [Greeley and Batson, 1990]

REFERENCES

Duxbury, T.C., Kirk, R.L., Archinal, B.A., and Neumann, G.A., 2002, Mars Geodesy/Cartography Working Group Recommendations on Mars Cartographic Constants and Coordinate Systems, *in* Joint International Symposium on Geospatial Theory, Processing and Applications, Ottawa, Canada, 2002, Commission IV, Working Group 9—Extraterrestrial Mapping, Proceedings; Ottawa, Canada, International Society for Photogrammetry and Remote Sensing [http://www.isprs.org/commission4/proceedings/ paper.html].

Environmental Systems Research Institute, 1994, Arc commands: Redlands Calif., Environmental Systems Research Institute, Inc.

Greeley, Ronald, and Batson, R.M., 1990, Planetary mapping: New York, Cambridge University Press, p. 261–276.

Kirk, R.L., Lee, E.M., Sucharski, R.M., Richie, J., Grecu, A., and Castro, S.K., 2000, MDIM 2.0: A revised global digital image mosaic of Mars *in* Lunar and Planetary Science XXXI:Houston, Lunar and Planetary Institute, abstract 2011 [CD–ROM].

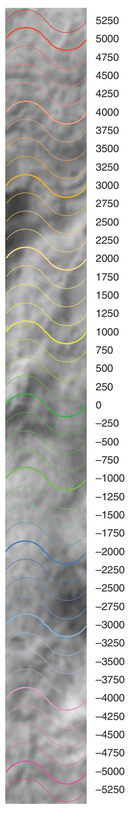
Miller, S.B., and Walker, A.S., 1993, Further developments of Leica Digital Photogrammetric Systems by Helava, ACSM/ASPRS Annual Convention and Exposition, Technical Papers, v. 3, p. 256–263.

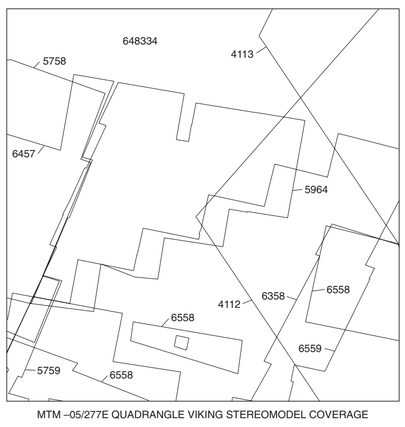
Seidelmann, P.K. (chair), Abalakin, V.K., Bursa, M., Davies, M.E., De Bergh, C., Lieske, J.H., Oberst, J., Simon, J.L., Standish, E.M., Stooke, P., and Thomas, P.C., 2002, Report of the IAU/IAG Working Group on Cartographic Coordinates and Rotational Elements of the Planets and Satellites: 2000: Celestial Mechanics and Dynamical Astronomy, v. 82, p. 83–110.

Smith, D.E., Zuber, M.T., Frey, H.V., Garvin, J.B., Head, J.W., Muhleman, D.O., Pettengill, G.H., Phillips, R.J., Solomon, S.C., Zwally, H.J., Banerdt, W.B., Duxbury, T.C., Golombek, M.P., Lemoine, F.G., Neumann, G.A., Rowlands, D.D., Aharonson, O., Ford, P.G., Ivanov, A.B., McGovern, P.J., Abshire, J.B., Afzal, R.S., and Sun, X., 2001, Mars Orbiter Laser Altimeter (MOLA)–Experiment summary after the first year of global mapping of Mars: Journal of Geophysical Research, v. 106, p. 23,689–23,722.

Torson, J.M., and K.J., Becker, 1997, ISIS—A software architecture for processing planetary images (abs.), *in* Lunar and Planetary Science Conference XXVIII: Houston, Lunar and Planetary Institute, p. 1443.

Contour Guide, in meters

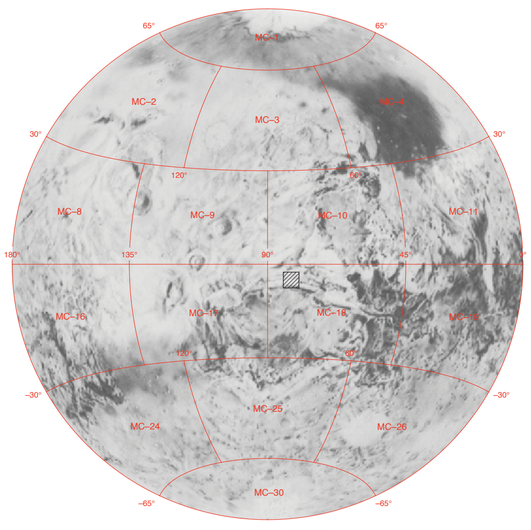




MTM –05/277E QUADRANGLE VIKING STEREOMODEL COVERAGE

The following is a list of image pairs used to produce the topographic information for this map. Numbers below correspond to the numbers on the diagram above.

ID	IMAGE PAIR	ID	IMAGE PAIR	ID	IMAGE PAIR
6559	065A12–059A22		065A11–059A22		059A25–064A27
	065A22–059A25		065A11–059A20		059A25–064A25
	065A20–059A25		065A10–059A20		059A24–064A27
	065A19–059A25	648334	648A10–334S44		059A24–064A26
	065A19–059A23	6558	065A21–058A73		059A24–064A25
	065A18–059A25		065A19–058A73		059A24–064A24
	065A18–059A24		065A13–058A71		059A24–064A23
	065A18–059A23		065A12–058A72		059A22–064A21
	065A17–059A23		065A11–058A74	5758	057A47–058A67
	065A16–059A24	6457	064A26–057A47		057A45–058A70
	065A16–059A23		064A24–057A45		057A43–058A70
	065A16–059A22		064A21–057A45	5759	057A43–059A22
	065A15–059A23	6358	063A44–058A73		057A43–059A20
	065A15–059A21		063A42–058A75		057A41–059A20
	065A14–059A22		063A42–058A73	4112	041A30–012A13
	065A13–059A21		063A40–058A76	4113	041A20–013A13
	065A13–059A20	5964	059A26–064A27		
	065A12–059A20		059A26–064A26		



QUADRANGLE LOCATION

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

Topographic Map of the Tithonium Chasma Region of Mars

MTM 500k –05/277E OMKT

By

U.S. Geological Survey

2004

Digital files available on World Wide Web at *http://pubs.usgs.gov/imap/i2806*