

DEPARTMENT OF THE INTERIOR  
UNITED STATES GEOLOGICAL SURVEY

Prepared in Cooperation with the  
JET PROPULSION LABORATORY, CALIFORNIA INSTITUTE OF TECHNOLOGY  
FOR THE LANGLEY RESEARCH CENTER  
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NOTES ON BASE

This is one map in a set of topographic map sheets covering areas of special interest on Mars at nominal scales of 1:1,000,000 and 1:250,000 (Barton, 1973). The major source of map data was the Mariner 9 television experiment (Mausny and others, 1970).

ADOPTED FIGURE

The figure of Mars used for the computation of the map projection is an oblate spheroid (flattening of 1:192) with an equatorial radius of 3393.4 km and a polar radius of 3375.3 km.

PROJECTION

The transverse Mercator projection is used for this sheet, with a scale of 1:1,000,000 at 10° longitude. Longitudes increase to the west in accordance with usage of the International Astronomical Union (IAU, 1971). Latitudes are geographic, i.e., Vanousovers and others, 1973).

CONTROL

Planimetric control is provided by photogrammetric triangulation using Mariner 9 pictures (Davies, 1973; Davies and Arthur, 1973) and the radio-tracked position of the spacecraft. The first meridian passes through the crater Airy-0 (lat 51°N, 51°W) with the crater Airy-1 (lat 51°N, 51°W) as the center. No simple statement is possible for the precision, but local consistency is 2 km.

MAPPING TECHNIQUE

A series of mosaics of Mercator projections of Mariner 9 pictures was assembled at 1:5,000,000. Shaded relief was copied from the mosaics and portrayed with uniform illumination with the sun to the west. Many Mariner 9 pictures besides those in the base mosaic were examined to improve the portrayal (Levinthal and others, 1973). The shading is not generalized and may be interpreted with photographic reliability (Inge, 1972).

Shaded relief analysis and representation were made by Jay L. Inge.

ALBEDO MARKINGS

The markings superimposed on the shaded relief were hand copied from pictures that were computer enhanced especially to show low-frequency tone variation (Barton and Inge, 1976). The surface in these pictures is illuminated from a variety of angles from the camera line of sight. The markings therefore delineate boundaries of local brightness variations only and should not be considered as a true measure of albedo. No attempt was made to use Earth-based telescope albedo data.

Airbrush portrayal of albedo markings was done by Jay L. Inge.

CONTOURS

Since Mars has no seas and hence no sea level, the datum (the 0 km contour line for altitudes is defined by a gravity field described by spherical harmonics of fourth order and fourth degree (Jordan and Lorell, 1973) combined with a 6.1 millibar atmospheric pressure surface derived from radio-occultation data (Kliore and others, 1973; Christensen, 1975). This datum is a triaxial ellipsoid with semimajor axes of A=3784.6 km, B=3393.3 km, and a semiminor axis of C=3376.3 km. The semimajor axis A intersects the Martian surface at long 105°.

The contour lines (Inge, 1975) were compiled from Earth-based radar determinations (Downs and others, 1971; Pettengill and others, 1971) and measurements made by Mariner 9 instrumentation, including the ultraviolet spectrometer (Inge and others, 1974), infrared interferometer spectrometer (Inge and others, 1973), and stereoscopic Mariner 9 television pictures (Inge and others, 1973).

Formal analysis of contour-line accuracy has not been made. The estimated vertical accuracy of each source of data indicates a probable error of 1.2 km.

COLOR

No attempt was made on the map to precisely duplicate the color of the Martian surface, although the color used does approximate it.

NOMENCLATURE

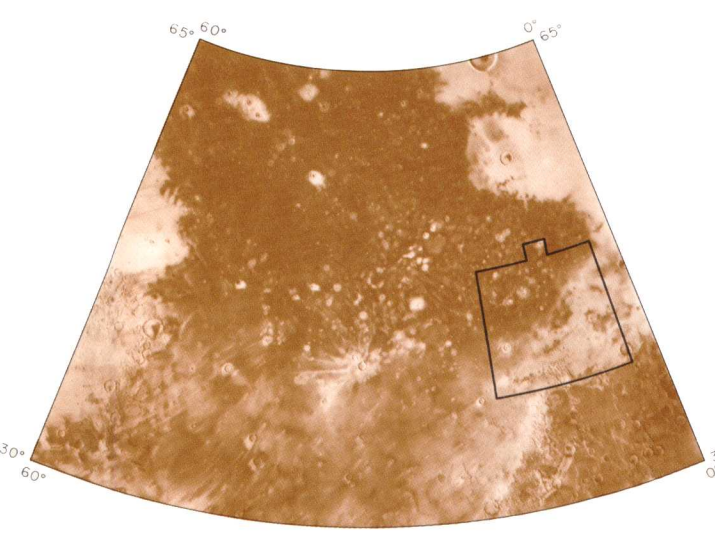
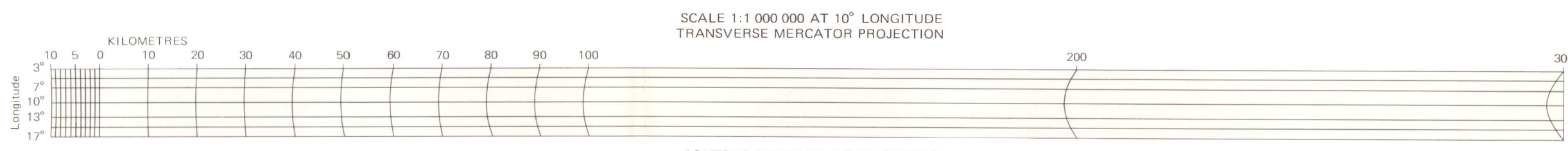
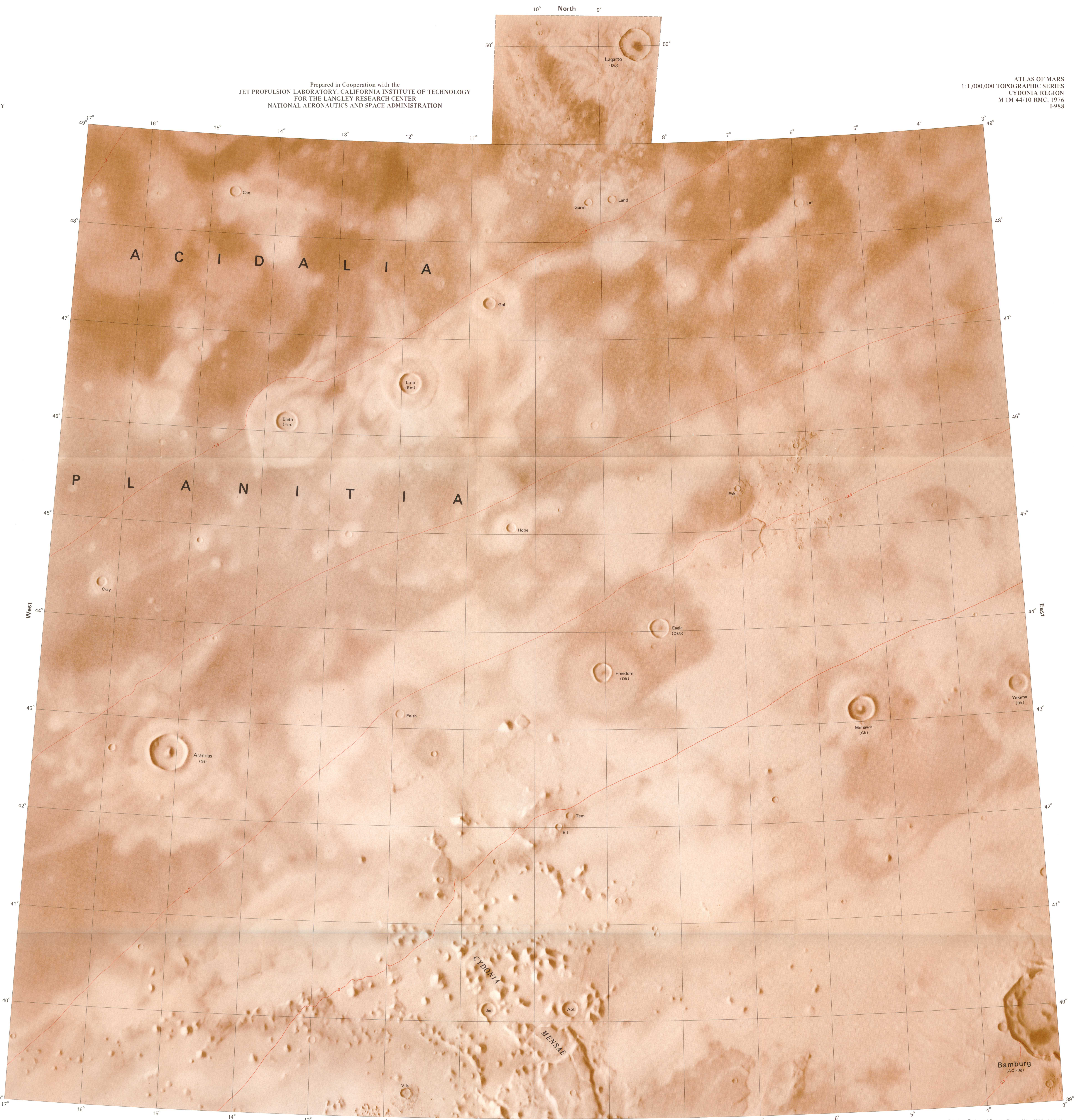
Names on this sheet have been approved by the International Astronomical Union (1974; Millman, written communication, 1975), except for the following which is provisional: Cydonia Mensae. Named craters bearing double and triple letters in parentheses are designated by the same letters on the 1:5,000,000 Mars Acidalium sheet which covers this area. The prefix ACI (identifying the Mars Acidalium sheet) is part of the complete designation but, for brevity, is not shown on most craters.

M 1M 44/10 RMC

Abbreviation for Mars, 1:1,000,000 series, center of sheet, 44°N latitude, 10° longitude, shaded relief map, R, with albedo markings, M, and contours, C.

REFERENCES

Barton, R. M., 1973, Cartographic products from the Mariner 9 mission, *Jour. Geophys. Research*, v. 78, no. 20, p. 4424-4435.  
 Barton, R. M., and Inge, J. L., 1976, Albedo boundaries on Mars in 1972: Results from Mariner 9 in press.  
 Christensen, F. J., 1975, Martian topography derived from occultation, radar, spectral, and optical measurements, *Jour. Geophys. Research*, v. 80, no. 20, p. 2909-2913.  
 Conrath, B. J., Curran, R. A., Haert, R. A., Kinsie, V. G., Maguire, W. W., Pearl, J. C., Pirajala, J., Welker, J., and Burke, E., 1975, Atmospheric and surface properties of Mars obtained by infrared spectroscopy on Mariner 9, *Jour. Geophys. Research*, v. 78, no. 20, p. 4264-4278.  
 Davies, M. E., 1973, Mariner 9: Primary control net, *Photogramm. Eng.*, v. 39, no. 12, p. 1297-1302.  
 Davies, M. E., and Arthur, D. W. G., 1973, Martian surface coordinates, *Jour. Geophys. Research*, v. 78, no. 20, p. 4333-4394.  
 Downs, G. S., Goldstein, R. M., Green, R. R., and Morris, G. A., 1971, Mars radar observations: a preliminary report, *Science*, v. 174, no. 4016, p. 1234-1237.  
 Hood, C. W., Simmons, K. L., and McLaughlin, L. K., 1974, Mariner 9 ultraviolet spectrometer experiment: Pressure altitude measurements on Mars, *Icarus*, v. 21, no. 3, p. 292-302.  
 Inge, J. L., 1972, Principles of lunar illustration, *Aeromat. Chart and Inf. Center Ref. Pub.*, RP-72-1, 60 p.  
 International Astronomical Union, Commission 16, 1971, Physical study of planets and satellites, in *Proc. 14th General Assembly, 1970*, Internat. Astron. Union Trans., v. XIV, p. 128-137.  
 ———, 1974, Physical study of planets and satellites, in *Proc. 15th General Assembly, 1973*, Internat. Astron. Union Trans., v. XV, p. 105-108.  
 Jordan, J. L., and Lorell, Jack, 1973, Mariner 9: an instrument of dynamical science, *Presented at NASA/AMA Astrodynamic Conf.*, Natl. Colo., July 16-18, 1973.  
 Kliore, A. J., Lelands, Gunter, Seidel, B. L., Sykes, M. J., and Wozniak, P. M., 1973, Sound radio occultation measurements of the atmosphere and topography of Mars with Mariner 9: Extended mission coverage of polar and intermediate latitudes, *Jour. Geophys. Research*, v. 78, no. 20, p. 4331-4351.  
 Levinthal, J. C., Green, W. R., Cutts, J. A., Jabelka, E. D., Johnson, R. A., Sanders, J. J., Seidman, J. B., Young, A. L., and Soderblom, I. A., 1973, Mariner 9: Image processing and products, *Icarus*, v. 18, no. 1, p. 75-101.  
 Mausny, Harold, Barton, R. M., Bergson, W. T., Carr, M. H., McCauley, J. L., Milson, D. J., Wilkey, R. L., Williams, D. E., Murray, B. C., Horowitz, N. H., Leighton, R. B., Sharp, R. V., Thompson, T. W., Briggs, G. A., Chudryson, P., Shipley, E. N., Sagan, Carl, Pollack, J. B., Lederberg, Joshua, Levinthal, J. C., Hartmann, W. K., McCord, T. B., Smith, B. A., Davies, M. E., de Vauousovers, G. D., and Leovy, C. B., 1970, Television experiment for Mariner 9 (1971), *Icarus*, v. 12, no. 1, p. 104-105.  
 Pettengill, G. H., Rogers, A. E., and Shapiro, I. L., 1971, Martian craters and a scarp as seen by radar, *Science*, v. 174, no. 4016, p. 1231-1234.  
 de Vauousovers, G. D., Davies, M. E., and Sturms, I. M., Jr., 1973, The Mariner 9 stereographic coordinate system, *Jour. Geophys. Research*, v. 78, no. 20, p. 4395-4414.  
 Wu, S. S. C., Schuler, J. J., Nakata, G. M., Jordan, Raymond, and Blasius, K. R., 1973, Photogrammetric evaluation of Mariner 9 photography, *Jour. Geophys. Research*, v. 78, no. 20, p. 4405-4410.  
 Wu, S. S. C., 1975, Topographic mapping of Mars: U.S. Geol. Survey Interagency Rept. 63 (in press).



INDEX TO MARINER 9 PICTURES

The mosaic used to control the positioning of features on this map was made with the Mariner 9 A-camera pictures shown above by solid outlines. The albedo markings overlay was made with pictures specially processed to accentuate albedo markings. The useful image areas of these pictures are shown by dashed lines. Also shown are the high resolution B-camera pictures, which are identified by italic numbers.

A-camera pictures		High resolution B-camera pictures	
Index No.	DAIS No.	Index No.	DAIS No.
1	1218801-1	1	12188932
2	9182024	2	9182059
3	9182084	3	9182119
		4	9242489

Albedo pictures	
Index No.	DAIS No.
1	12188012
2	9182024
3	9182084
4	9182119

TOPOGRAPHIC MAP OF THE CYDONIA REGION OF MARS  
M 1M 44/10 RMC  
1976