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

ATLAS OF MARS
1:5,000,000 TOPOGRAPHIC SERIES
MEMNONIA QUADRANGLE
M 5M–15/158 R, 1978
I-1075 (MC-16)

NOTES ON BASE

This is one map in a series of topographic map sheets covering the entire surface of Mars at nominal scales of 1:25,000,000 and 1:5,000,000 (Batson, 1973; 1976). The major source of map data was the Mariner 9 television experiment (Masursky 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 3375.7 km.

PROJECTION

The Mercator projection is used for this sheet, with a scale of 1:5,000,000 at the equator and 1:4,336,000 at lat 30°. Longitudes increase to the west in accordance with usage of the International Astronomical Union (IAU, 1971). Latitudes are areographic (de Vaucouleurs 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-O (lat 5.19° S) within the crater Airy. No simple statement is possible for the precision, but local consistency is about 10 km.

MAPPING TECHINQUE

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, using airbrush techniques described by Inge (1972), and Inge and Bridges (1976). To improve portrayal, various computer enhancements of many pictures besides those in the base mosaic were used. (Computer enhancement of Mariner 9 pictures is described by Levinthal and others, 1973, and Green and others, 1975.) Viking orbiter pictures were also examined and used where they significantly clarified Mariner 9 image data. No attempt was made to portray all information in the Viking pictures, however.

Shaded relief analysis and representation were made by Anthony G. Sanchez.

COLOR

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

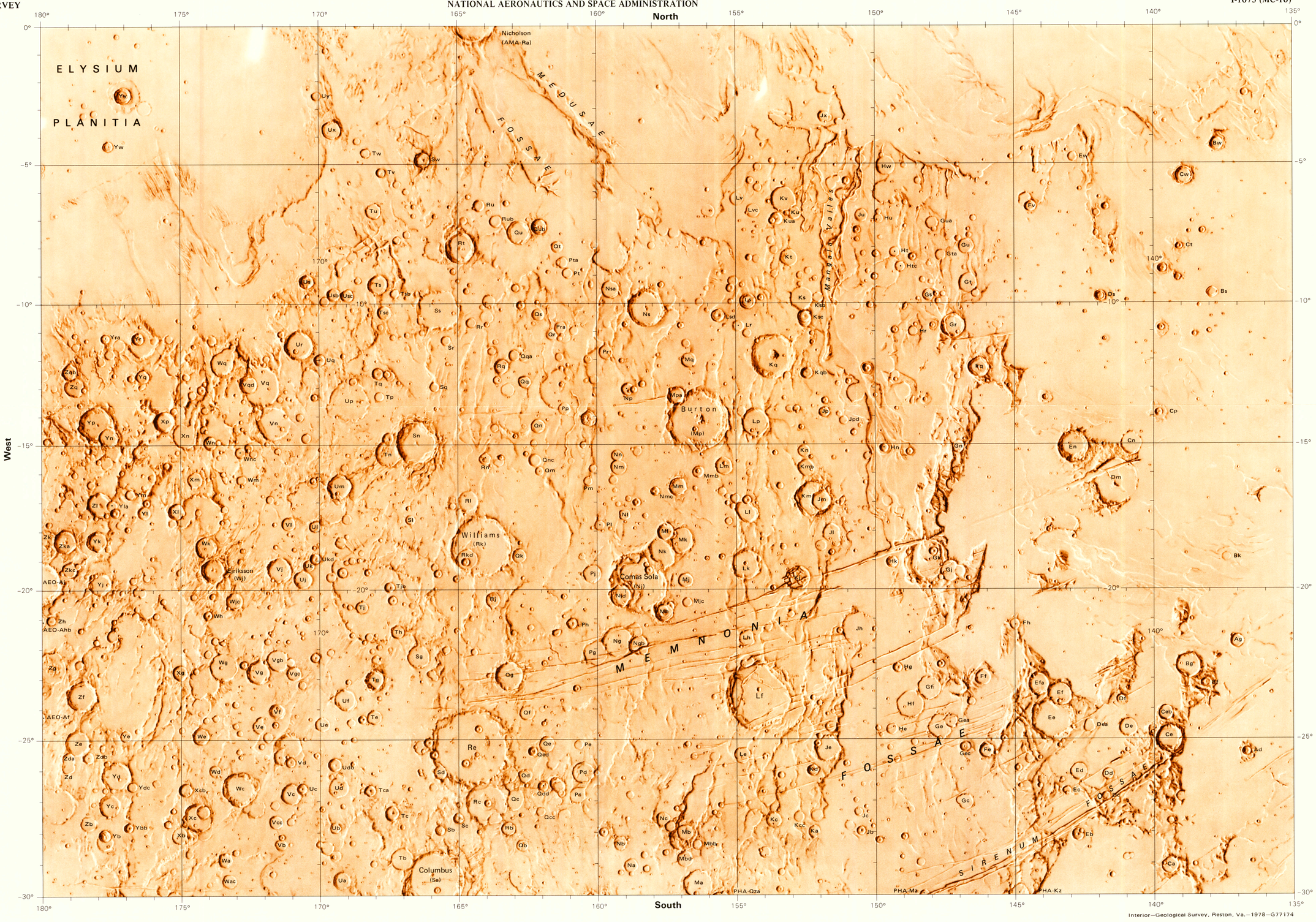
NOMENCLATURE

All names on this sheet are approved by the International Astronomical Union (IAU, 1974, 1977). Double and triple letter designations for craters refer to position on the map and are derived from a grid based on equidistant meridians and parallels; the alphabet (I and O omitted) runs in the direction of increasing longitude (W) and latitude (N). The complete designation of a crater is the name of the quadrangle followed by a double or triple letter. The prefix MEM (identifying the Memnonia quadrangle) is part of the complete designation but, for brevity, is not shown on most craters. Some craters have commemorative names; letter designations for these craters are shown in parentheses. Where craters lie mostly on an adjoining map, their letters are derived from the other map; where craters lie exactly on the boundary of two maps, their letters are derived from the eastern or southern map.

MC-16: Abbreviation for Mars Chart 16.
M 5M–15/158 R: Abbreviation for Mars 1:5,000,000 series; center of sheet, 15° S lat, 158° long; shaded relief map, R.

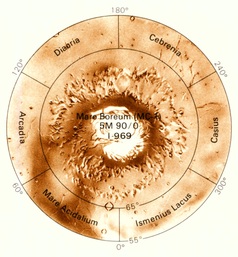
REFERENCES

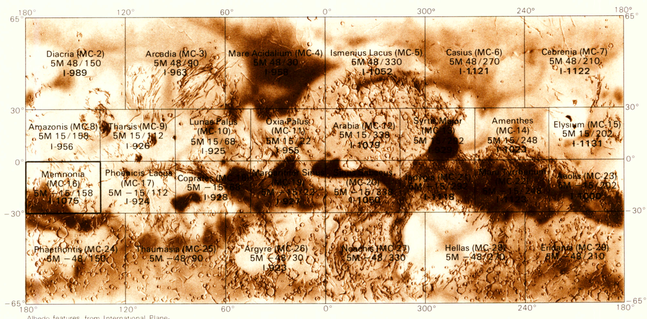
Batson, R. M., 1973, Cartographic products from the Mariner 9 mission: Jour. Geophys. Research, v. 78, no. 20, p. 4424–4435.
——— 1976, Cartography of Mars, 1975: The American Cartographer, v. 3, no. 1, p. 57–63.
Davies, M. E., 1973, Mariner 9: Primary control net: Photogramm. Eng., v. 39, no. 12, p. 1297–1302.
Davies, M. E., and Arthur, D. W. G., Martian surface coordinates: Jour. Geophys. Research, v. 78, no. 20, p. 4355–4394.
Green, W. B., Jepsen, P. L., Krezner, J. E., Ruiz, R. M., Schwartz, A. A., and Seidman, J. B., 1975, Removal of instrument signatures from Mariner 9 television images of Mars: Applied Optics, v. 14, no. 1, p. 105–114.
Inge, J. L., 1972, Principles of lunar illustration: Aeronaut. Chart and Inf. Center Ref. Pub. RP-72-1, 60 p.
Inge, J. L., and Bridges, P. M., 1976, Applied photointerpretation for airbrush cartography: Photogramm. Eng. v. 42, no. 6, p. 749–760.
International Astronomical Union, Commission 16, 1971, Physical study of planets and satellites, *in* Proc. 14th General Assembly, 1970: Internat. Astron. Union Trans., v. XIVB, p. 128–137.
——— 1974, Physical study of planets and satellites, *in* Proc. 15th General Assembly, 1973: Internat. Astron. Union Trans., v. XVB, p. 105–108.
——— 1977, Physical study of planets and satellites, *in* Proc. 16th General Assembly, 1976, Internat. Astron. Union Trans., v. XVIB, p. 325, 331–336, 355–362.
Levinthal, E. C., Green, W. B., Cutts, J. A., Jahelka, E. D., Johansen, R. A., Sander, M. J., Seidman, J. B., Young, A. T., and Soderblom, L. A., 1973, Mariner 9–Image processing and products: Icarus, v. 18, no. 1, p. 75–101.
Masursky, Harold, Batson, R. M., Borgeson, W. T., Carr, M. H., McCauley, J. F., Milton, D. J., Wildey, R. L., Wilhelms, D. E., Murray, B. C., Horowitz, N. H., Leighton, R. B., Sharp, R. V., Thompson, T. W., Briggs, G. A., Chandeysson, P. L., Shipley, E. N., Sagan, Carl, Pollack, J. B., Lederberg, Joshua, Levinthal, E. C., Hartmann, W. K., McCord, T. B., Smith, B. A., Davies, M. E., de Vaucouleurs, G. D., and Leovy, C. B., 1970, Television experiment for Mariner Mars 1971: Icarus, v. 12, no. 1, p. 10–45.
de Vaucouleurs, G. D., Davies, M. E., and Sturms, F. M., Jr., 1973, The Mariner 9 areographic coordinate system: Jour. Geophys. Research, v. 78, no. 20, p. 4395–4404.



Interior—Geological Survey, Reston, Va.—1978—G77174

Prepared on behalf of the Viking Project Office, National Aeronautics and Space Administration under contract L-55232

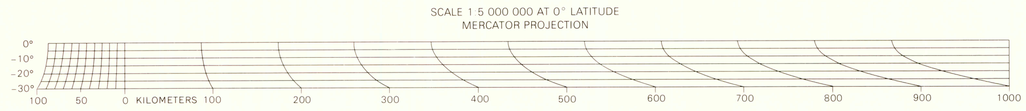




Albedo features from International Planetary Patrol photographs, Lowell Observatory, Flagstaff, Ariz.

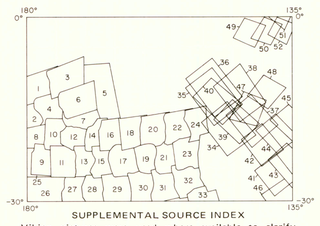
QUADRANGLE LOCATION
Number preceded by I refers to published shaded relief map

SCALE 1:5 000 000 AT 0° LATITUDE
MERCATOR PROJECTION



NOTE TO USERS

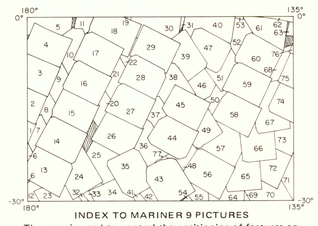
Users noting errors or omissions are urged to indicate them on the map and to forward the map to Astrogeologic Studies, Geologic Division, 2255 North Gemini Drive, Flagstaff, Arizona 86001. A replacement copy will be returned.



SUPPLEMENTAL SOURCE INDEX

Viking pictures were used where available to clarify Mariner 9 data. The outline for each sequence of pictures is shown.

Viking 1 Index No.	Viking 1 Picture No.	Viking 1 Index No.	Viking 1 Picture No.	Viking 2 Index No.	Viking 2 Picture No.
1	330A19	24	332A19	47	41B52
2	330A18	25	332A33	48	41B53
3	330A21	26	332A35	49	43B32
4	330A20	27	332A37	50	43B34
5	312A68	28	332A39	51	43B35
6	330A22	29	332A41	52	43B36
7	330A51	30	332A43		
8	332A03	31	332A45		
9	332A04	32	332A47		
10	332A05	33	332A48		
11	332A06	34	34A51		
12	332A07	35	34A52		
13	332A08	36	34A56		
14	332A09	37	34A57		
15	332A10	38	34A58		
16	332A11	39	34A61		
17	332A12	40	34A62		
18	332A13	41	56A01		
19	332A14	42	56A02		
20	332A15	43	56A03		
21	332A16	44	56A04		
22	332A17	45	56A06		
23	332A18	46	56A13		



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 outlined above. Useful coverage is not available in the cross-hatched areas. The DAS number may vary slightly (usually by 5) among various versions of the same picture.

A-camera pictures Index No.	DAS No.	Index No.	DAS No.	Index No.	DAS No.
1	6606773	27	6750693	53	6823213
2	6606843	28	6750763	54	5491183
3	6606913	29	6750833	55	5491253
4	6606983	30	6751183	56	6894473
5	6607333	31	8225879	57	6894543
6	8081393	32	5347263	58	6894613
7	8081463	33	5347333	59	6894683
8	8081533	34	6750623	60	6894753
9	8081603	35	8225319	61	6895103
10	8081673	36	8225389	62	6895173
11	6679223	37	8225459	63	8369449
12	5275373	38	8225529	64	8369099
13	6678593	39	8225599	65	8369169
14	6678663	40	6823143	66	8369239
15	6678733	41	5419223	67	8369309
16	6678803	42	5419293	68	8369379
17	6678873	43	8297279	69	5563213
18	8153913	44	6822583	70	8441269
19	6679293	45	6822653	71	8441339
20	8153493	46	6822723	72	6966503
21	8153563	47	6822793	73	6966573
22	8153633	48	8297349	74	6966643
23	8153283	49	8297419	75	6966713
24	8153353	50	8297489	76	6966783
25	6750553	51	8297559	77	6822513
26	6750623	52	8297629		

SHADED RELIEF MAP OF THE MEMNONIA QUADRANGLE OF MARS

MC-16

M 5M –15/158 R

1978

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