DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

Prepared for the
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ATLAS OF MARS
1:5,000,000 TOPOGRAPHIC SERIES
COPRATES QUADRANGLE
M 5M –15/68 RMC, 1976
I-976 (MC-18)

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). 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 5-10 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 Patricia M. Bridges.

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 (Batson 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 telescopic albedo data.

Airbrush portrayal of albedo markings was done by Patricia M. Bridges.

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 semi-major axes of A=3394.6 km, B=3393.3 km, and a semi-minor axis of C=3376.3 km. The semi-major axis A intersects the Martian surface at long 105°.

The contour lines (Wu, 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 (Hord and others, 1974), infrared interferometer spectrometer (Conrath and others, 1973), and stereoscopic Mariner 9 television pictures (Wu 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

All names on this sheet are approved by the International Astronomical Union (IAU, 1974; millman, written commun., 1975). Double and triple letter designations for craters refer to position on the map. 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-18: Abbreviation for Mars Chart 18.

M 5M –15/68 RMC: Abbreviation for Mars 1:5,000,000 series; center of sheet, 15° S latitude, 68° longitude; shaded relief map, R, with albedo markings, M, and contours, C.

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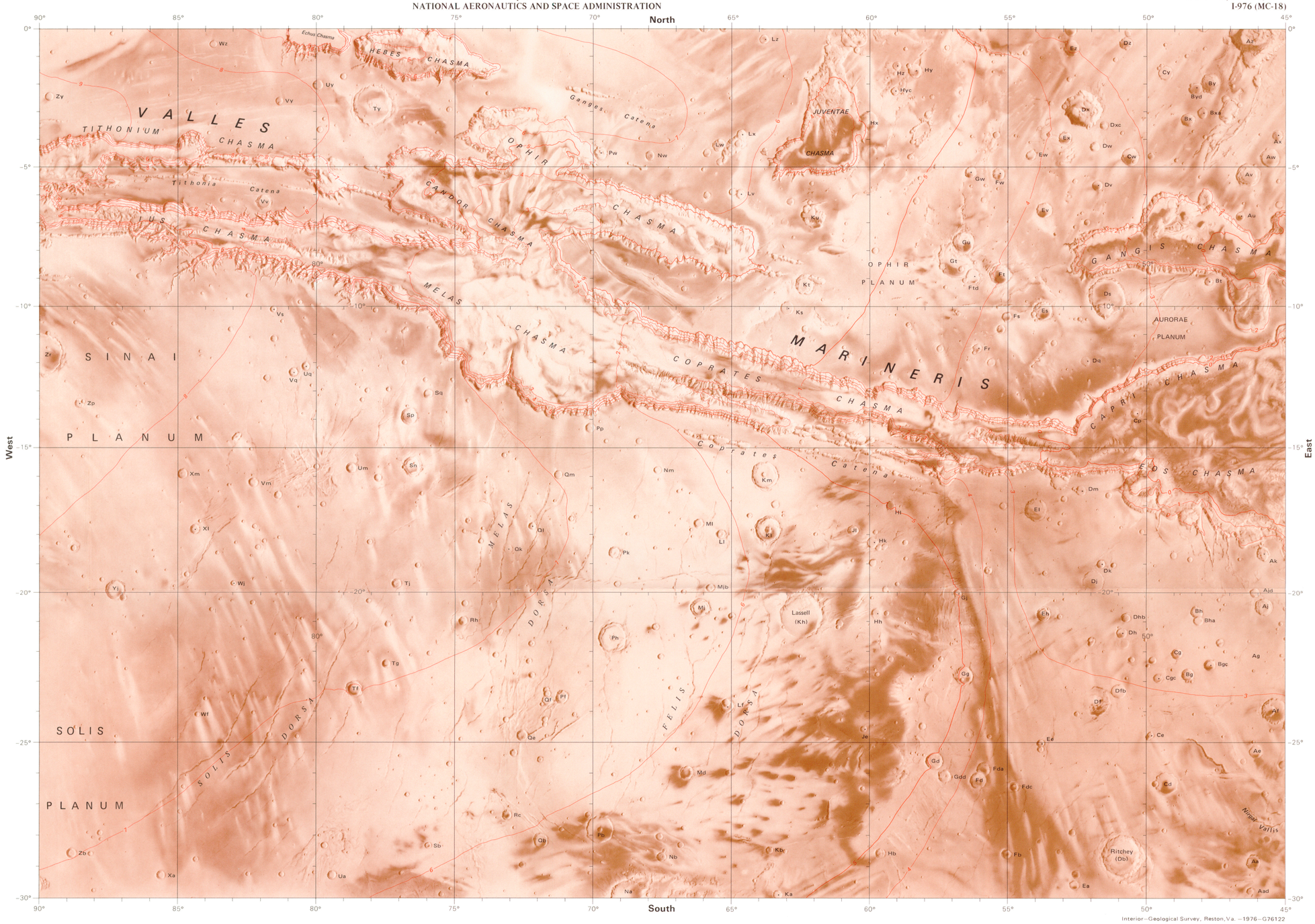
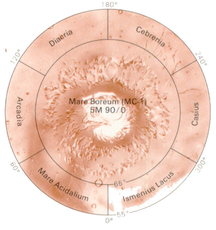
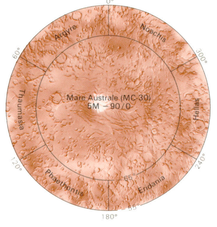
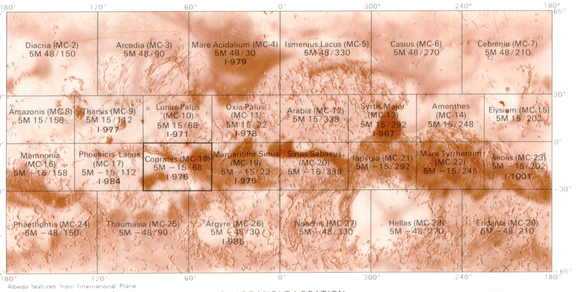


Interior—Geological Survey, Reston, Va.—1976—G76122

Prepared on behalf of the Jet Propulsion Laboratory, California Institute of Technology under contract WO-8122, and the Planetology Programs Office, NASA, under contract W-13,709



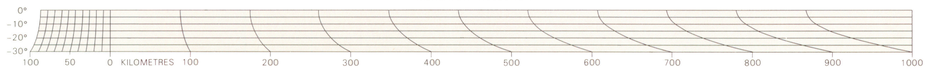




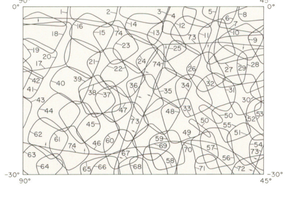
Albedo features from International Planetary Patrol photographs, Lowell Observatory, Flagstaff, Ariz.

QUADRANGLE LOCATION
Number preceded by I refers to published topographic map

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



CONTOUR INTERVAL 1 KILOMETRE



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1	7327143	26	9017229	51	9088979
2	7399103	27	10492619	52	7686173
3	7471063	28	7614423	53	12180067
4	6139733	29	9089119	54	9160799
5	7542953	30	7686243	55	7686103
6	6283513	31	9089049	56	9088909
7	7614843	32	7614353	57	6211133
8	10492689	33	9017159	58	9017019
9	9089189	34	7542463	59	7542323
10	7614493	35	8945269	60	8945129
11	9017299	36	7470523	61	8873229
12	7542603	37	7470503	62	7398473
13	8945409	38	12010324	63	5995323
14	7470713	39	8873379	64	8873169
15	8873519	40	7398613	65	8945059
16	7398753	41	7326653	66	5452683
17	10704919	42	8729529	67	6139173
18	7326793	43	7326583	68	9016949
19	8729689	44	7398543	69	5524713
20	7326723	45	8873309	70	5596673
21	7398683	46	7470433	71	9088839
22	8873449	47	8945199	72	9160729
23	7470643	48	7542393	73	5524783
24	8945339	49	9017089	74	5380793
25	7542533	50	7614283		

INDEX TO MARINER 9 PICTURES USED TO MAKE THE ALBEDO MARKINGS OVERLAY

Most of the pictures indexed above were specially processed to accentuate albedo markings. Only the useful image areas of the pictures are outlined.

A-camera pictures

Index No.	DAS No.	Index No.	DAS No.	Index No.	DAS No.
1	7326583	26	8873169	51	9017229
2	7326653	27	6067213	52	9017159
3	7326723	28	6067283	53	9017089
4	7326793	29	6067353	54	9017019
5	8729599	30	7470503	55	9016949
6	7327143	31	7470573	56	6211063
7	8801559	32	7470643	57	6211133
8	8801489	33	7470713	58	7614283
9	8801419	34	7471063	59	7614353
10	8801349	35	6139733	60	7614423
11	5923438	36	8945409	61	7614493
12	5995253	37	8945339	62	7619733
13	5995323	38	8945269	63	9089189
14	7398473	39	8945199	64	9089119
15	7398543	40	8945129	65	9089049
16	7398613	41	8945059	66	9088979
17	7398683	42	6139103	67	9088909
18	7398753	43	6139173	68	9088839
19	7399103	44	6139243	69	6211623
20	8873519	45	7542393	70	6282953
21	8873449	46	7542463	71	9160729
22	8873379	47	7542533	72	6283023
23	12010324	48	7542603	73	7686173
24	8873309	49	7542953	74	7686243
25	8873239	50	8017299		

B-camera pictures

Index No.	DAS No.	Index No.	DAS No.	Index No.	DAS No.
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2	*7326828*		*10204604*		*12010289*
3	*7399068*		*12003974*	*35*	*7398578*
4	*7398788*		*10204884*	*36*	*8801314*
5	*7471028*		*10132994*	*37*	*7398508*
6	*7470748*		*10132924*	*38*	*8873274*
7	*6139768*		*7326758*	*39*	*7470468*
8	*7542918*		*10204114*	*40*	*8945164*
9	*7542638*		*10204044*	*41*	*7542258*
10	*6355438*		*10132064*	*42*	*7614248*
11	*7614808*	*21*	*7326688*	*43*	*7686138*
12	*7614528*	*22*	*8801454*	*44*	*12185957*
13	*10492654*	*23*	*7398648*	*45*	*6282988*
14	*9017674*	*24*	*7470608*	*46*	*6211658*
	10492584		*5995918*	*47*	*6211098*
15	*7614458*		*12865572*	*48*	*6139208*
16	*7542568*	*25*	*8945304*	*49*	*6067318*
17	*7470678*	*26*	*7542498*	*50*	*8944744*
18	*7398718*	*27*	*7614388*		*8947814*
19	*5851998*	*28*	*10492514*	*51*	*5995258*
20	*10204954*	*29*	*7686208*	*52*	*6067248*
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	10204534	*31*	*7542428*		
	10276624	*32*	*7470538*		
	10276564	*33*	*8873414*		

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 some cross-hatched areas. Pictures other than those shown in the mosaic were used for portrayal in the other cross-hatched areas. Also shown (by solid black rectangles) are the high-resolution B-camera pictures, identified by italic numbers.

TOPOGRAPHIC MAP OF THE COPRATES QUADRANGLE OF MARS

MC-18

M 5M –15/68 RMC

1976

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