

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 (Barton, 1973, 1975). The major source of map data was the Mariner 9 television experiment (Mausky and others, 1970).

ADOPTED FIGURE
The figure of Mars used for the computation of the map projection is an oblate spheroid (flattening of 1/1923) with an equatorial radius of 3393.4 km and a polar radius of 3375.7 km. This is not the height datum which is defined below under the heading "CONTROL".

PROJECTION
The polar stereographic projection is used for this sheet, with a scale of 1:5,000,000 at 66° latitude. Longitudes increase to the west in accordance with usage of the International Astronomical Union (IAU, 1971). Latitudes are areographic (de Vasconcelos 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 Alys-O (lat 51°N, 51°W) within the crater Alys. No simple statement is possible for the precision, but local consistency is about 10 km.

MAPPING TECHNIQUE
Selected Mariner 9 pictures, transformed to the polar stereographic projection, were assembled in a mosaic at 1:5,000,000.

Shaded relief was copied from the mosaic and portrayed with uniform illumination with the sun to the west. Many Mariner 9 pictures had been those in the base mosaic were examined to improve the portrayal (Lorenz and others, 1973; Hord and others, 1975; Hord and Bridges, 1976). The shading is not generalized and may be interpreted with nearby photographic reliability (fig. 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 telescopic albedo data.

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

CONTOURS
Since Mars has no sea 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 6.2 millibar atmospheric pressure surface derived from radio-occultation data (Kjore and others, 1973; Christensen, 1975; Wu, 1975).

The contour lines (Wu, 1975) were compiled from Earth-based radar determinations (Dovest and others, 1971; Petrogali 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.

NOMENCLATURE
All names on this sheet are approved by the International Astronomical Union (IAU, 1974, 1975). Double and high letter designations for craters refer to position on the map and are derived from a grid based on equatorial meridians and parallels. The alphabet (I and O omitted) runs in the direction of increasing longitude (W and letters P-Q). The complete designation of a crater is the name of the quadrangle followed by a double or triple letter. The prefix BDR (identifying the Mare Boreum sheet) is part of the complete designation but, for brevity, is not shown on most craters. Some craters have commemorative names. Letters designations for these craters are shown in parentheses. Where craters lie mostly on an adjacent map, their letters are derived from that map; where craters lie exactly on the boundary of two maps, their letters are derived from the eastern or southern map.

Abbreviation for Mars Chart 1, M 5M 90/0 RMC: Abbreviation for Mars 1:5,000,000 series: craters, center, latitude, 0° longitude, shaded relief map, 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.

—, 1976, Cartography of Mars, 1975. *The American Cartographer*, v. 3, no. 1, p. 57-63.

Barton, R. M., and Inge, J. L., 1976, Albedo boundaries on Mars in 1972. *Results from Mariner 9*, *Jour. Geophys. Research*, v. 81, no. 4, p. 531-536.

Christensen, E. J., 1975, Martian topography derived from occultation, radar, spectral, and optical measurements. *Jour. Geophys. Research*, v. 80, no. 26, p. 2909-2913.

Conrath, B. J., Curran, R. K., Tiedt, R. A., Keszthelyi, V. C., Shapiro, W. W., French, J. C., Piragallo, J. A., Walker, J., and Marke, T. J., 1973, Atmospheric and surface properties of Mars obtained by infrared spectroscopy on Mariner 9. *Jour. Geophys. Research*, v. 78, no. 20, p. 4247-4274.

Davies, M., 1973, Mariner 9. *Primary control net*. *Photogram. Eng.*, v. 39, no. 12, p. 1247-1262.

Davies, M. E., and Arthur, D. W. G., 1973, Martian surface coordinates. *Jour. Geophys. Research*, v. 78, no. 20, p. 4354-4394.

Dovest, G. S., Goldstein, R. M., Green, R. R., and Morice, A., 1971, Mars radar observations, preliminary report. *Science*, v. 174, no. 4016, p. 124-127.

Green, W. B., Jessen, P. L., Krenner, J. E., Katz, R. M., Schwartz, A., and Soderstrom, J. B., 1975, Removal of instrument signatures from Mariner 9 television images of Mars. *Applied Optics*, v. 14, no. 1, p. 105-114.

Hord, C. W., Simmons, K. E., and McLaughlin, L. K., 1974, Mariner 9 ultraviolet spectrometer experiment. *Pressure altitude measurements on Mars*. *Jour. Geophys. Research*, v. 79, no. 3, p. 292-302.

Inge, J. L., 1972, Principles of lunar illustration. *Aeronaut. Chart and Inf. Center Ref. Pub.*, RP-721-001, p. 1-10.

Inge, J. L., and Bridges, P. M., 1976, Applied Photoconcentration for Aeronaut. Cartography. *Photogram. Eng.*, v. 42, no. 6, p. 749-760.

International Astronomical Union, Commission 19, 1973, Physical study of planets and satellites, in Proc. 14th General Assembly, 1970. *Internat. Astron. Union Trans.*, v. XIV B, p. 123-147.

—, 1975, Physical study of planets and satellites, in Proc. 15th General Assembly, 1973. *Internat. Astron. Union Trans.*, v. XV B, p. 103-108.

—, 1977, Physical study of planets and satellites, in Proc. 16th General Assembly, 1976. *Internat. Astron. Union Trans.*, (in press).

Jordan, J. E., and Lorell, Jack, 1973, Mariner 9, an instrument of dynamical science. Presented at NASA/IAU Astrodynamic Conf., Vall. Colo., July 16-18, 1973.

Kjore, A. J., Erdős, Gunnar, Seidel, L. L., Skyes, M. J., and Wootenby, 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.

Lorenz, E. C., Green, W. B., Cutts, J. A., Jabalka, E. D., Johnson, E. A., Sander, M. J., Soderstrom, J. B., Young, A. T., and Soderstrom, L. A., 1975, Mariner 9. *Image processing and products*. *Jour. Geophys. Research*, v. 80, no. 1, p. 75-101.

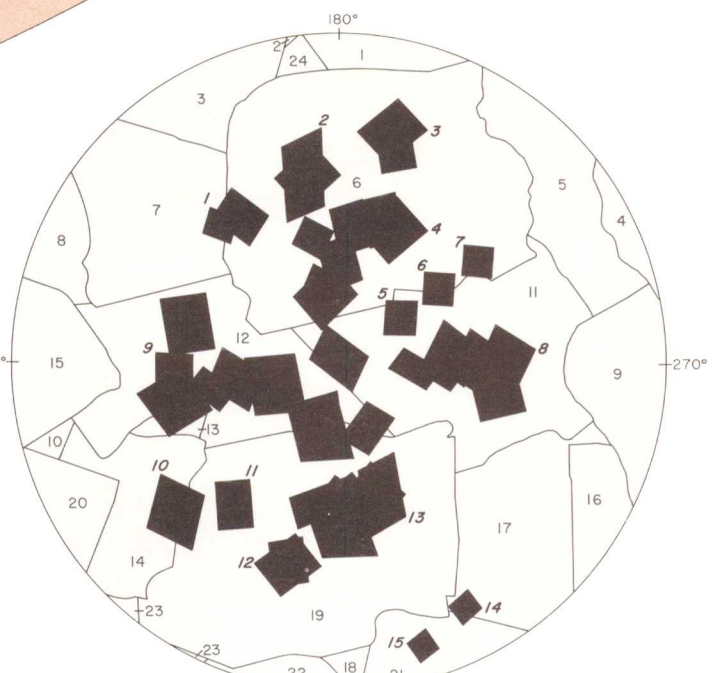
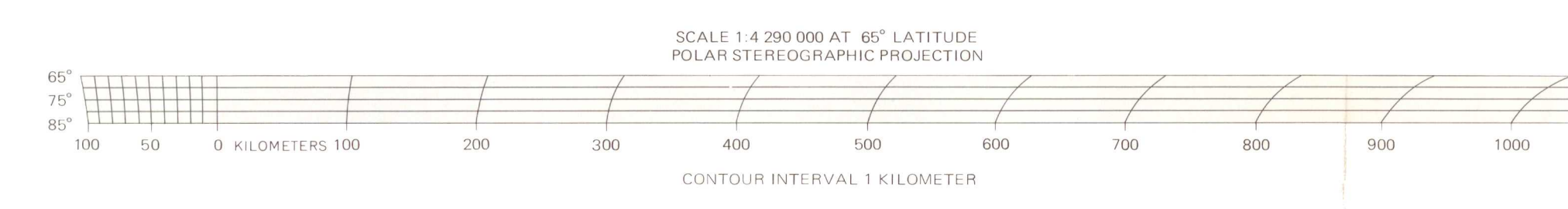
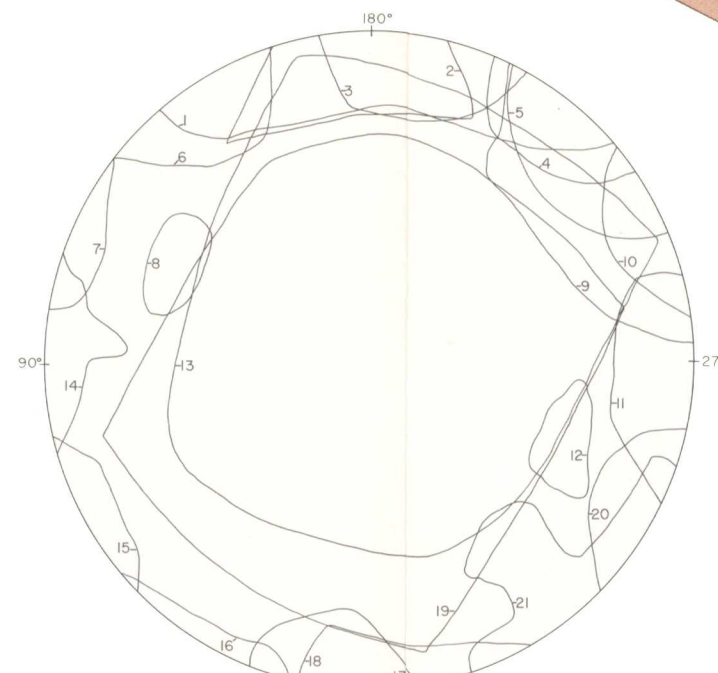
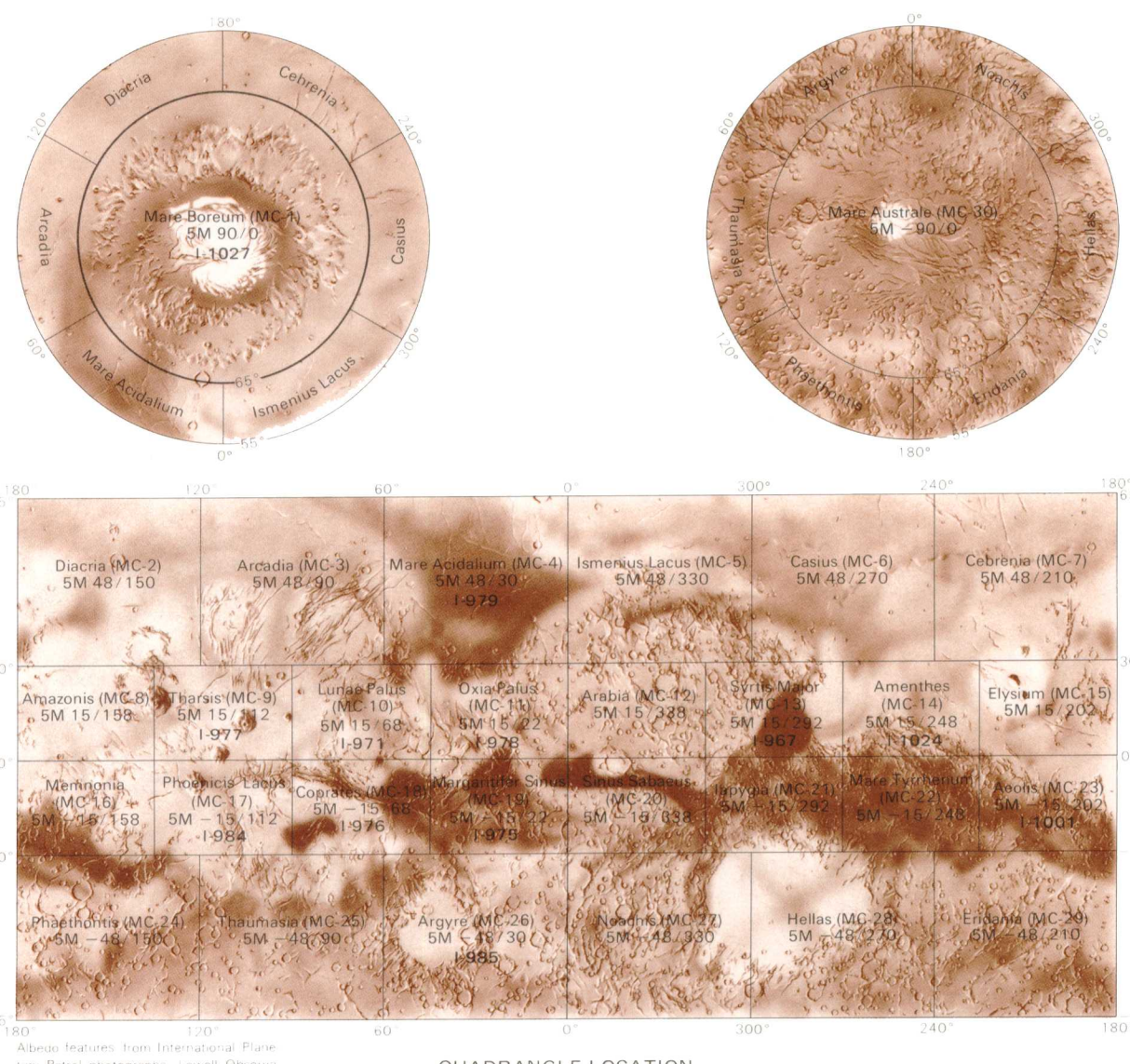
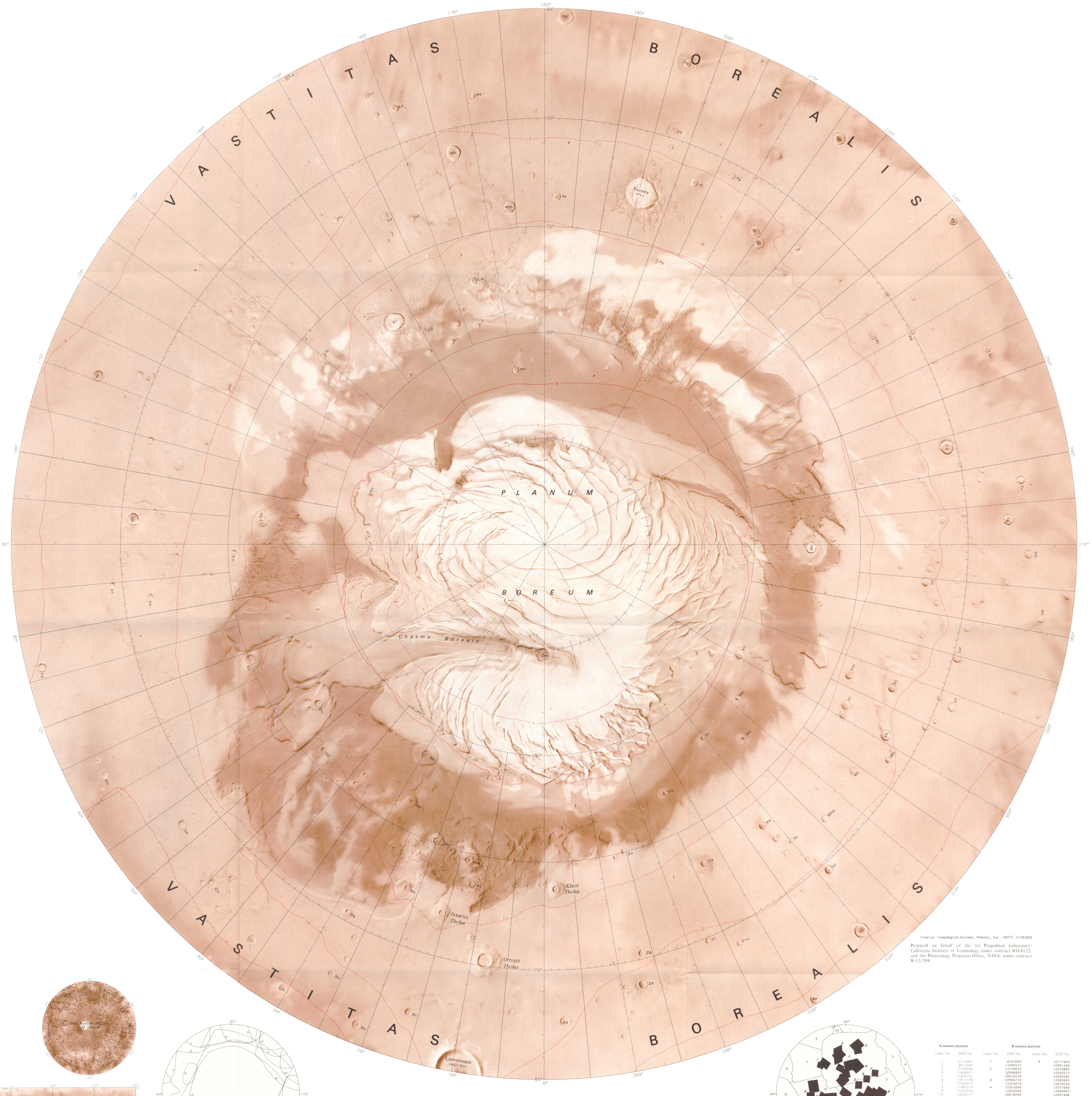
Mausky, Harold, Barton, R. M., Borgerson, W. T., Carr, M. H., McCauley, J. L., Milton, D. J., Wiley, E. L., Wilhelms, D. E., Morris, B. C., Horowitz, N. H., Leighton, R. B., Sharp, R. V., Thompson, T. W., Briggs, G. A., Chandross, P. L., Shipley, E. N., Sagan, Carl, Pollack, J. B., Ledebner, Joshua, Lorenz, E. C., Hartmann, W. K., McLeod, F. B., Smith, B. A., Davies, M. E., de Vasconcelos, G. D., and Leroy, C. B., 1970, Television experiment for Mariner Mars 1971. *Jour. Geophys. Research*, v. 75, no. 1, p. 104-114.

Petrogali, G. H., Rogers, A. E. E., and Shapiro, L. I., 1971, Martian craters and a map as seen by radar. *Science*, v. 174, no. 4016, p. 1321-1324.

de Vasconcelos, G. D., Davies, M. E., and Shapiro, L. I., Jr., 1973, The Mariner 9 areographic coordinate system. *Jour. Geophys. Research*, v. 78, no. 20, p. 4495-4498.

Wu, S. S. C., Schaller, F. J., Soderstrom, J. M., Jordan, Raymond, and Blanton, E. R., 1973, Photogrammetric evaluation of Mariner 9 television images. *Jour. Geophys. Research*, v. 78, no. 20, p. 4495-4410.

Wu, S. S. C., 1975, Topographic mapping of Mars. *U.S. Geol. Surv. Interagency Rept.*, 63, 191 p.



Acamera pictures		B-camera pictures	
Index No.	DAS No.	Index No.	DAS No.
1	1212287	1	1212287
2	1212288	2	1212288
3	1212289	3	1212289
4	1212290	4	1212290
5	1212291	5	1212291
6	1212292	6	1212292
7	1212293	7	1212293
8	1212294	8	1212294
9	1212295	9	1212295
10	1212296	10	1212296
11	1212297	11	1212297
12	1212298	12	1212298
13	1212299	13	1212299
14	1212300	14	1212300
15	1212301	15	1212301
16	1212302	16	1212302
17	1212303	17	1212303
18	1212304	18	1212304
19	1212305	19	1212305
20	1212306	20	1212306
21	1212307	21	1212307

TOPOGRAPHIC MAP OF THE MARE BOREUM AREA OF MARS

MC-1
M 5M 90/0 RMC
1977

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 central image area of the pictures are outlined. The DAS numbers may differ slightly (usually by 5) among various versions of the same picture.

INDEX TO MARINER 9 PICTURES
The mosaic used to control the positioning of features on this map was made with the Mariner 9 Acamera pictures outlined above, identified by vertical numbers. Also shown by solid black rectangles are the high-resolution B-camera pictures, identified by italic numbers. The DAS numbers may differ slightly (usually by 5) among various versions of the same picture.

For sale by Branch of Distribution, U.S. Geological Survey,
1200 South East Street, Arlington, VA 22202, and Branch of Distribution,
U.S. Geological Survey, Box 23286, Federal Center, Denver, CO 80226.