

**NOTES ON BASE**  
This map is one in a series covering the entire surface of Mars at a nominal scale of 1:5,000,000. The series was originally compiled from Mariner 9 data (Batson and others, 1979). The original shaded relief base was revised and augmented with image data from Viking Orbiter, but feature positions were not shifted to fit controls derived from Viking.

**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 3,393.4 km and a polar radius of 3,375.7 km.

**PROJECTION**  
The Mercator, Lambert Conformal Conic, and Polar Stereographic projections are used for this map series. The scale of the series is 1:5,000,000 at the equator. The projections have common scales of 1:4,336,000 at lat 43° and 1:4,306,000 at lat 45°. Standard parallels for the Lambert Conformal Conic projection are at lat 43° 8' and 45° 2'. Longitude increases to the west in accordance with astronomical convention for Mars. Latitude is planetographic.

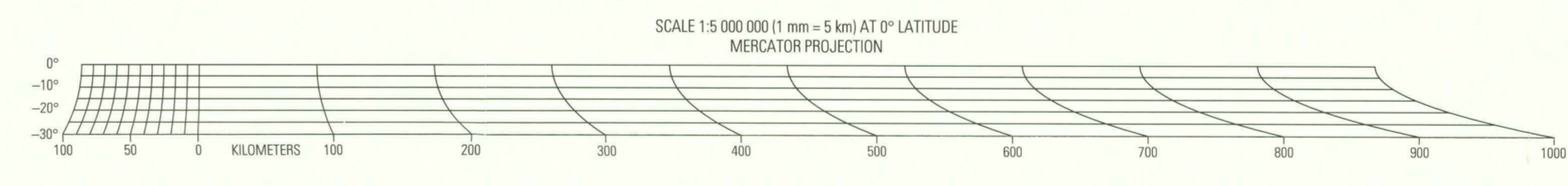
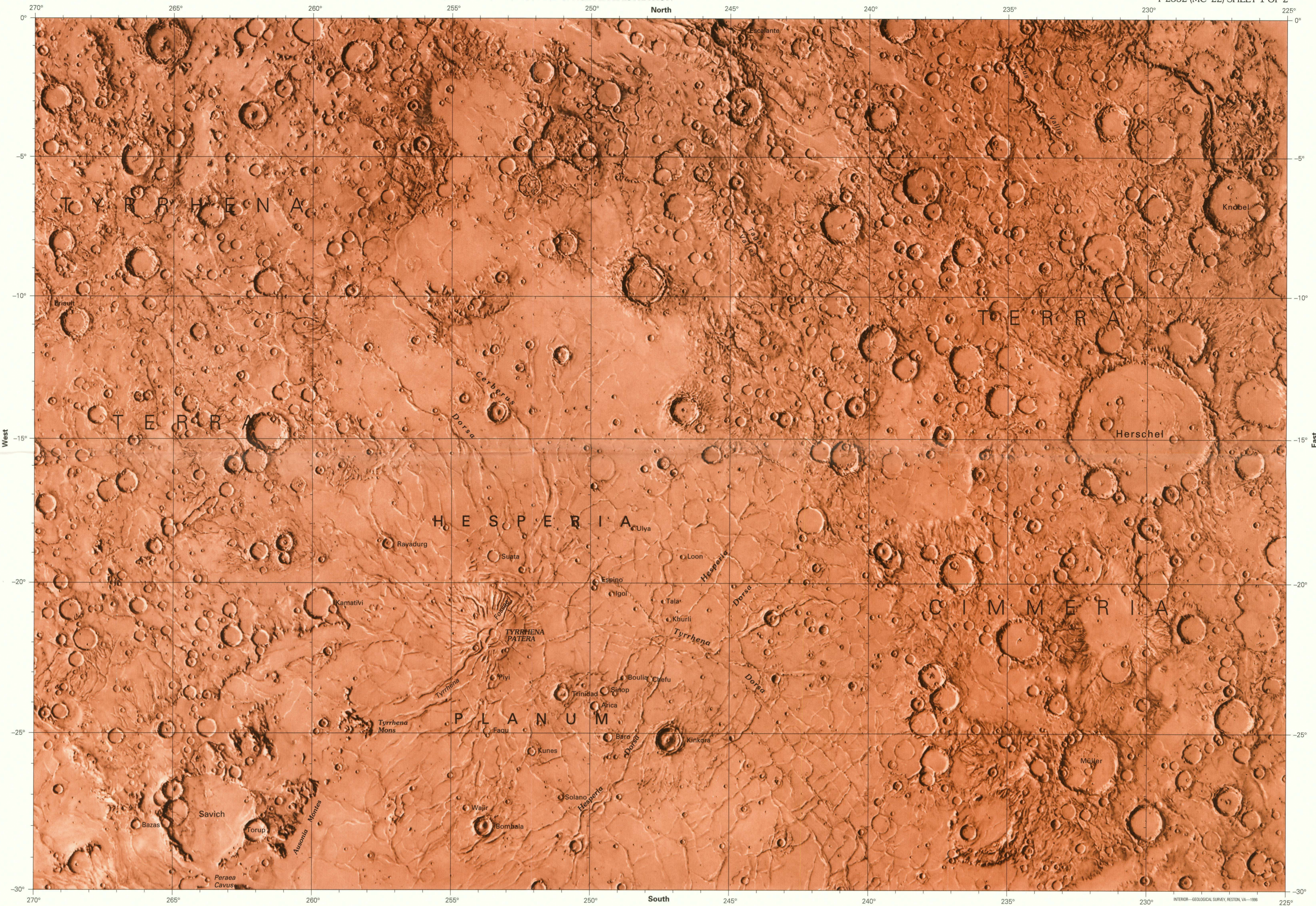
**CONTROL**  
Planimetric control of the shaded relief is provided by photogrammetric triangulation using Mariner 9 images (Davies, 1973; Davies and Arthur, 1973) and the radio-tracked position of the Mariner 9 spacecraft. The first meridian passes through the center of a small crater, Atry-O (lat 5.19° S, long 0°), within the crater Atry. Primary controls used in the network include the Viking Orbiter Secondary Experiment Data Record, radio-occultation measurements from both Mariner 9 and Viking Missions (Lorell and others, 1972; Kliore and others, 1973; Lindal and others, 1979), Earth-based radar observations (Petengill and others, 1971; Downs and others, 1975), and the Mars primary control network of the Rand Corporation (Davies and others, 1978).

**MAPPING TECHNIQUE**  
Shaded relief was portrayed by photointerpretive methods described by Inge and Bridges (1976). Uniform sun illumination from the west was used throughout. The original rendition of feature positions, sizes, and shapes was taken from a controlled base mosaic of Mariner 9 images. Various computer enhancements of many Mariner 9 and Viking Orbiter images besides those in the base mosaic were examined in an attempt to portray the surface as accurately as possible. Initial shaded relief analysis and representation were made by Barbara J. Hall; revisions were made by Ralph O. Aeschliman.

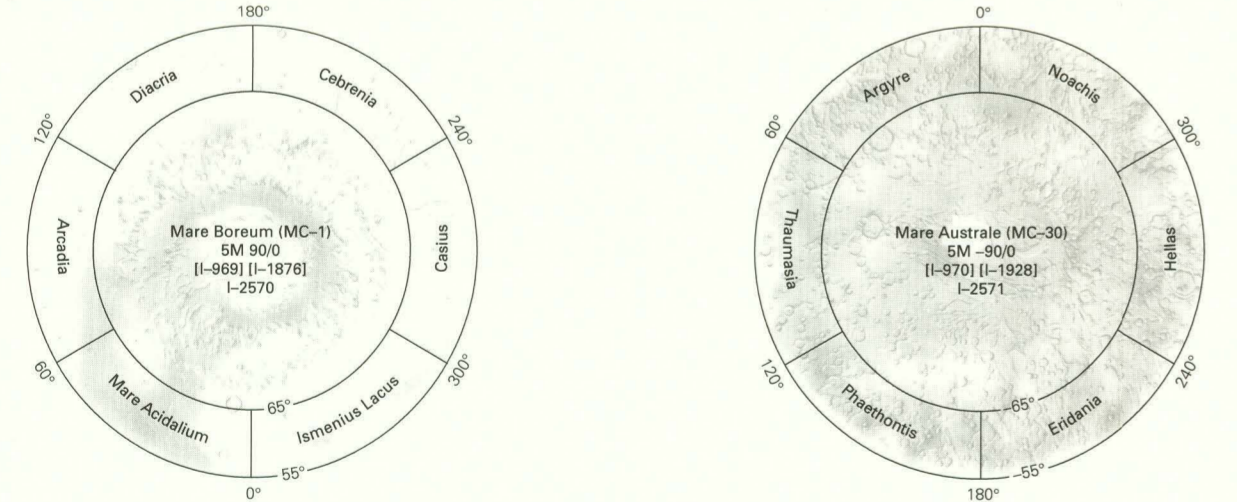
**COLOR**  
No attempt was made on the map to duplicate precisely the color of the martian surface, although the color used may approximate it.

**NOMENCLATURE**  
Names on this sheet are approved by the International Astronomical Union (IAU, 1974, 1977, 1983, 1992).  
MC-22: Abbreviation for Mars Chart 22.  
M 5M-15/248 RN: Abbreviation for Mars; 1:5,000,000 series; center of sheet, lat 15° S., long 248°; shaded relief map (R) with nomenclature (N).

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Shaded relief revised in September 1990 on behalf of the Planetary Geology Program, Solar System Exploration Division, Office of Space Science, National Aeronautics and Space Administration.  
This map supersedes map I-1123.  
Edited by Doris Weir and Derrick D. Hirsch; cartography by Roger D. Carroll Darlene A. Casebeer and Sandra K. Castro.  
Manuscript approved for publication January 13, 1992.



| Quadrangle          | SM                                    | MC                      | SM                                    | MC                   | SM                                    | MC                         | SM                                    | MC                    | SM                                    | MC                   | SM                                    | MC                     |                                       |
|---------------------|---------------------------------------|-------------------------|---------------------------------------|----------------------|---------------------------------------|----------------------------|---------------------------------------|-----------------------|---------------------------------------|----------------------|---------------------------------------|------------------------|---------------------------------------|
| Diacria (MC-2)      | SM 48160<br>I-1889 (I-1892)<br>I-2572 | Arcadia (MC-3)          | SM 48160<br>I-1889 (I-1477)<br>I-2573 | Mare Acidulum (MC-4) | SM 48160<br>I-1889 (I-1476)<br>I-2574 | Ismenius Lacus (MC-5)      | SM 48160<br>I-1889 (I-1495)<br>I-2575 | Cassius (MC-6)        | SM 48160<br>I-1121 (I-1646)<br>I-2576 | Cerberia (MC-7)      | SM 48160<br>I-1121 (I-1475)<br>I-2577 |                        |                                       |
| Amazonia (MC-8)     | SM 15158<br>I-1889 (I-1822)<br>I-2484 | Tharsis (MC-9)          | SM 15158<br>I-1889 (I-1511)<br>I-2485 | Lunae Palus (MC-10)  | SM 15158<br>I-1889 (I-1511)<br>I-2486 | Oxia Palus (MC-11)         | SM 15158<br>I-1889 (I-1511)<br>I-2487 | Arabia (MC-12)        | SM 15158<br>I-1889 (I-1704)<br>I-2488 | Syrtis Major (MC-13) | SM 15158<br>I-1889 (I-1704)<br>I-2489 | Amazethus (MC-14)      | SM 15248<br>I-1121 (I-1809)<br>I-2490 |
| Memnonia (MC-15)    | SM 15158<br>I-1075 (I-1554)<br>I-2491 | Phoenicis Lacus (MC-16) | SM 15158<br>I-1889 (I-1252)<br>I-2492 | Coprates (MC-17)     | SM 15158<br>I-1889 (I-1253)<br>I-2493 | Margaritifer Sinus (MC-18) | SM 15158<br>I-1889 (I-1253)<br>I-2494 | Sinus Sabaeus (MC-19) | SM 15158<br>I-1889 (I-1253)<br>I-2495 | Isopygia (MC-20)     | SM 15158<br>I-1889 (I-1253)<br>I-2496 | Mare Tyrrhenum (MC-21) | SM 15292<br>I-1181 (I-1123)<br>I-2350 |
| Phaethontis (MC-24) | SM 48160<br>I-1181 (I-2353)           | Thaumasia (MC-25)       | SM 48160<br>I-1181 (I-2354)           | Argyre (MC-26)       | SM 48160<br>I-1181 (I-2355)           | Noachis (MC-27)            | SM 48160<br>I-1181 (I-2356)           | Helles (MC-28)        | SM 48160<br>I-1181 (I-2357)           | Eridania (MC-29)     | SM 48160<br>I-1181 (I-2358)           |                        |                                       |

**QUADRANGLE LOCATION**  
Number preceded by I refers to published shaded relief map. (Number in brackets refers to earlier map superseded by revised version.)

**NOTE TO USERS**  
Users noting errors or omissions are urged to indicate them on the map and to forward it to U.S. Geological Survey, Building 4, Room 450, 2255 North Gemini Drive, Flagstaff, Arizona 86001. A replacement copy will be returned.

**12,000,000-SCALE CONTROLLED PHOTOMOSAICS**

I-Series Quadrangle

I-1468 MC-22 NW  
I-1469 MC-22 NE  
I-1471 MC-22 SW  
I-1470 MC-22 SE

| Index No. | Picture No. | Index No. | Picture No. |
|-----------|-------------|-----------|-------------|
| 1         | 101A0       | 23        | 350A1       |
| 2         | 101A11      | 24        | 350A3       |
| 3         | 101A13      | 25        | 350A5       |
| 4         | 101A15      | 26        | 350A7       |
| 5         | 101A17      | 27        | 350A9       |
| 6         | 101A19      | 28        | 350A11      |
| 7         | 101A21      | 29        | 462A2       |
| 8         | 101A23      | 30        | 462A4       |
| 9         | 101A25      | 31        | 462A6       |
| 10        | 101A27      | 32        | 462A8       |
| 11        | 109A20      | 33        | 462A2       |
| 12        | 109A21      | 34        | 462A4       |
| 13        | 109A22      | 35        | 462A6       |
| 14        | 109A23      | 36        | 462A8       |
| 15        | 109A24      | 37        | 462A10      |
| 16        | 109A25      | 38        | 758A7       |
| 17        | 109A26      | 39        | 758A10      |
| 18        | 109A27      | 40        | 800A5       |
| 19        | 109A28      | 41        | 800A6       |
| 20        | 109A29      | 42        | 802A7       |
| 21        | 109A30      | 43        | 802A8       |
| 22        | 109A31      |           |             |
| 23        | 109A32      |           |             |

**INDEX OF VIKING SOURCES**  
This shaded relief map has been revised by utilizing 1:2,000,000-scale controlled photomosaics and supplementary Viking pictures outlined above. Copies of various enhancements of these pictures are available from National Space Science Data Center, Code 601, Goddard Space Flight Center, Greenbelt, MD 20771.

**VIKING 1**

| Index No. | Picture No. | Index No. | Picture No. |
|-----------|-------------|-----------|-------------|
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| 2         | 101A11      | 24        | 350A3       |
| 3         | 101A13      | 25        | 350A5       |
| 4         | 101A15      | 26        | 350A7       |
| 5         | 101A17      | 27        | 350A9       |
| 6         | 101A19      | 28        | 350A11      |
| 7         | 101A21      | 29        | 462A2       |
| 8         | 101A23      | 30        | 462A4       |
| 9         | 101A25      | 31        | 462A6       |
| 10        | 101A27      | 32        | 462A8       |
| 11        | 109A20      | 33        | 462A2       |
| 12        | 109A21      | 34        | 462A4       |
| 13        | 109A22      | 35        | 462A6       |
| 14        | 109A23      | 36        | 462A8       |
| 15        | 109A24      | 37        | 462A10      |
| 16        | 109A25      | 38        | 758A7       |
| 17        | 109A26      | 39        | 758A10      |
| 18        | 109A27      | 40        | 800A5       |
| 19        | 109A28      | 41        | 800A6       |
| 20        | 109A29      | 42        | 802A7       |
| 21        | 109A30      | 43        | 802A8       |
| 22        | 109A31      |           |             |
| 23        | 109A32      |           |             |

**INDEX OF 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 crosshatched areas. The DAS number may vary slightly (usually by 5) among different versions of the same picture.

**A-camera pictures**

| Index No. | DAS No. | Index No. | DAS No. | Index No. | DAS No. |
|-----------|---------|-----------|---------|-----------|---------|
| 1         | 7201163 | 21        | 7435983 | 41        | 7558413 |
| 2         | 7298913 | 22        | 7434733 | 42        | 7558343 |
| 3         | 7280743 | 23        | 7434663 | 43        | 6103186 |
| 4         | 8765579 | 24        | 7434593 | 44        | 8981389 |
| 5         | 8765509 | 25        | 7434523 | 45        | 8981319 |
| 6         | 8765439 | 26        | 7434453 | 46        | 8981249 |
| 7         | 8765369 | 27        | 7434383 | 47        | 8981179 |
| 8         | 7361223 | 28        | 6901233 | 48        | 8981109 |
| 9         | 7362773 | 29        | 8904229 | 49        | 8981039 |
| 10        | 7363703 | 30        | 8905259 | 50        | 7578933 |
| 11        | 7362653 | 31        | 8906289 | 51        | 7578863 |
| 12        | 7362603 | 32        | 8907219 | 52        | 7578793 |
| 13        | 7362553 | 33        | 8908249 | 53        | 7578723 |
| 14        | 5995943 | 34        | 8909279 | 54        | 7578653 |
| 15        | 8887339 | 35        | 7507463 | 55        | 7578583 |
| 16        | 8887269 | 36        | 7507393 | 56        | 6175153 |
| 17        | 8887199 | 37        | 7507323 | 57        | 6175083 |
| 18        | 8887129 | 38        | 7506253 | 58        | 9053279 |
| 19        | 8887059 | 39        | 7506183 | 59        | 9053209 |
| 20        | 8886989 | 40        | 7506113 | 60        | 9053139 |

# REVISED SHADED RELIEF MAP OF THE MARE TYRRHENUM QUADRANGLE (MC-22) OF MARS