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The New Martian Nomenclature of the International Astronomical Union

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A new nomenclature for Martian regions and topographic features uncovered by Mariner 9, as officially adopted by the International Astronomical Union, is described. About 180 craters, generally of diameters >100 km, have been named, as well as 13 classes of topographic features designated catena, chasma, dorsum, fossa, labyrinthus, mensa, mons, patera, planitia, planum, tholus, vallis, and vastitas. In addition seven craters and the Kepler Dorsum are named on Phobos, and two craters on Deimos. Coordinates and maps of each named feature are displayed.

In August 1970, a Working Group on Martian Nomenclature was appointed by J. S. Hall, then President of Commission 16 (Physics of the Planets) of the International Astronomical Union during its XIVth General Assembly at Brighton, England. The task assigned to this group was to develop concrete proposals implementing the following recommendations of a predecessor committee under the Chairmanship of the late G. P. Kuiper (Trans. IAU, XIVB, 1970, p. 129).

(1) Substantially define the province boundaries and, in the process, possibly add or delete a few provinces, as may appear desirable; and circulate among members a map showing coordinates and proposed boundaries.

(2) Apply the principles of topographic nomenclature to the regions adequately covered by the Mariner 1969 data, and by such 1971 data as may become available.

(3) Propose appropriate names for some prominent Martian topographic features (with reference to the lists of names already submitted by Commission 16 members).

The initial membership of the new Working Group included G. de Vaucouleurs (Chairman), A. Dollfus, C. Sagan, B. Smith, S. Miyamoto (members), and M. Davies (consultant). To broaden the competence and geographic representation of the Working Group, G. P. Kuiper, I. K. Koval, and V. I. Moroz were co-opted as members in 1971; H. Masursky of the U.S. Geological Survey (USGS) in Flagstaff and J. Blunck of Hamburg were co-opted as consultants in 1972. We received also valuable advice and contributions from D. Ya. Martynov of Sternberg Astronomical Institute, W. H. Pickering of the Jet Propulsion Laboratory (JPL), J. S. Hall of Lowell Observatory, D. H. Menzel of Harvard, D. W. G. Arthur of USGS, B. Y. Levin of Schmidt Institute, Moscow, T. C. Duxbury of JPL, and S. Soter and J. Veverka of Cornell.

† Deceased.

Between August 1970 and July 1973, the Working Group held seven formal meetings supplemented by extensive correspondence which was also used to obtain votes when required. Two final meetings were held in August 1973 during the XVth General Assembly of the I.A.U. in Sydney, Australia. All discussions and notes were summarized in 10 circulars which were transmitted to the President of Commission 16, G. H. Pettengill, as supporting documentation for the recommendations presented to the Commission.

The report of the Working Group and its specific recommendations were endorsed by the membership of the Commission and subsequently accepted by formal vote of the General Assembly, thereby becoming the official IAU Nomenclature for the major surface albedo and topographic features of Mars (Trans. IAU, XVB, 1973). This scheme is described in the following sections.

1. *Designation of provinces.* Instead of the original concept of "provinces" defined by classical albedo features which sometimes proved unworkable in practice because of the variability of many of these markings and the indefiniteness of their boundaries, the surface of the planet was divided into 30 geometric areas shown in Fig. 1. These "quadrangles" correspond to the individual charts of the 1:5 million scale atlases of topographic and albedo maps which are being produced at the U.S. Geological Survey and at The University of Texas from the Mariner 9 data. The equatorial areas between +30° and −30° latitude are covered by 16 maps in Mercator projection measuring 45° in longitude by 30° in latitude. The intermediate latitudes between ±30° and ±65° are covered by 12 maps in Lambert conformal projection each measuring 60° in longitude by 35° in latitude; the polar regions between ±65° and ±90° are covered by two maps in polar stereographic projection. The coordinates of the boundaries shown in Fig. 1 are

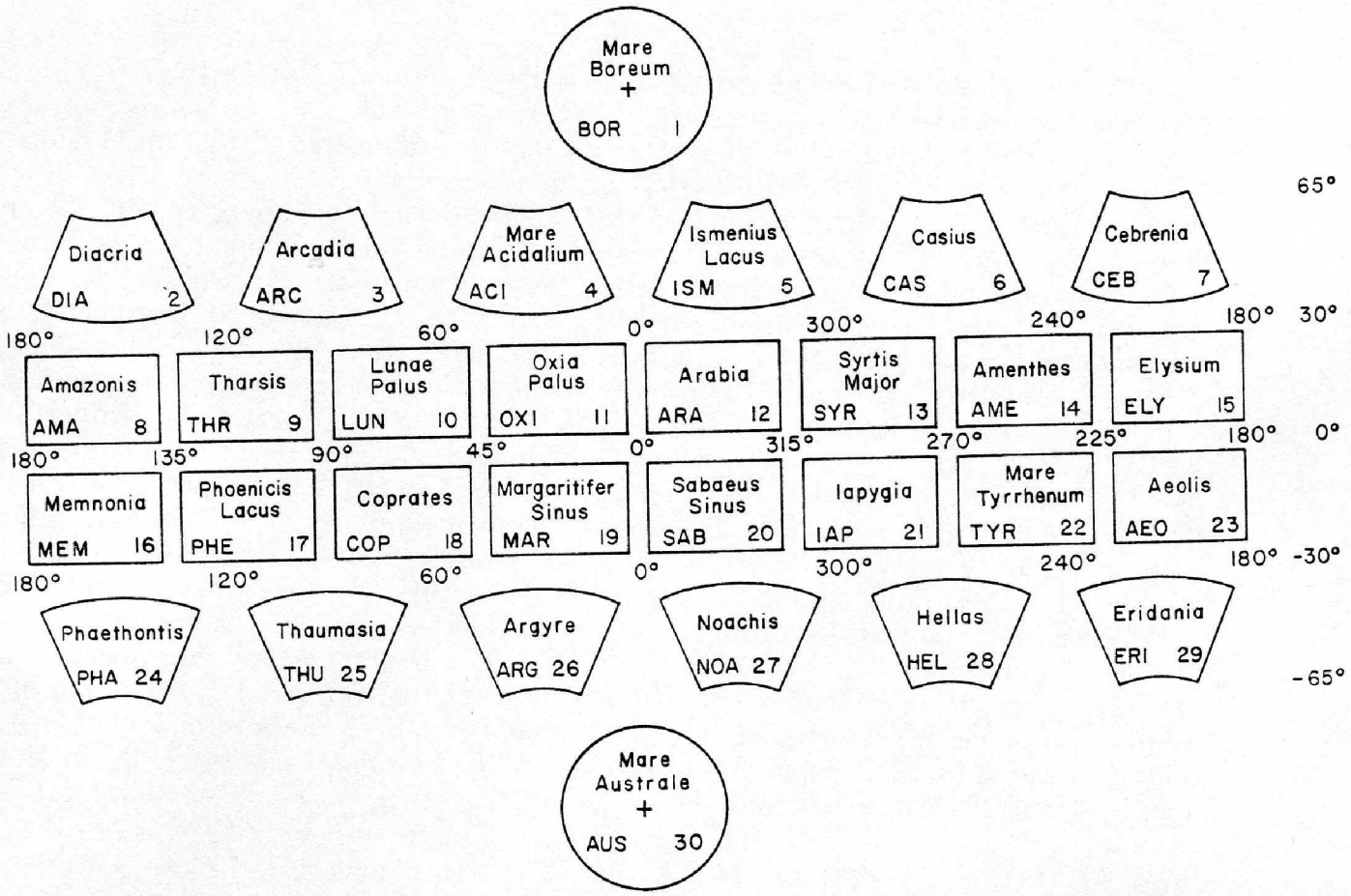

FIG. 1. Distribution and nomenclature of thirty designated regions or "quadrangles" comprising the Martian surface.

precisely defined by the edges of the Mariner 9 1:5 million charts (1973 edition) and are in close agreement with a new aerographic coordinate system proposed at the Sydney meeting in separate resolutions of Commissions 4 and 16 and adopted by the IAU General Assembly (Trans. IAU, XVB, 1973).

Each chart is also designated by the name of a prominent classical albedo feature within its confines and by a three-letter abbreviation (shown on Fig. 1) which will be used as a prefix to the crater designation scheme described in Section 2 below.

2. *Crater designations.* Within each chart all craters larger than approximately 20km are to be assigned a two-letter designation from Aa to Zz in which the first letter is in order of increasing longitude from East to West and the second in order of increasing latitude from South to North as shown in Fig. 2.

A total of approximately 6000 craters have been so designated and are marked on the charts of the atlas of topographic maps prepared at the U.S. Geological Survey, Astrogeology Branch, Flagstaff, Arizona. In a few heavily cratered areas, the capacity of the two-letter scheme is exceeded and a third letter was added to provide a designation for all craters larger than the 20km limit. It is recommended that Martian craters be identified by the chart prefix followed by the letter designation (e.g., SYR Aa).

3. *Named craters.* In addition to the letter scheme, a selection of the largest craters, generally larger than 100km in diameter, received names of prominent, deceased individuals having contributed either to the scientific study of Mars, or the lore of the planet, or to basic discoveries of significance to the exploration of Mars or the interpretation of its phenomena. After extensive discussion about 180 names were selected which are listed in Appendix I and shown on Fig. 3.[1]

4. *Other topographic features.* Thirteen classes of topographic features have been designated. Of these, twelve are named for nearby classical albedo features taken from the Schiaparelli or Antoniadi maps. Usually following the name is the class of feature, e.g., Olympus Mons. One class of features, the Sinuous channels, are treated differently and named after "MARS" in various largely non-Indo European languages. Names and locations are listed in Appendices IIa and IIb and shown on Fig. 4. Definitions and examples are as follows.

(a) *Catena.* Crater Chain. A chain or line of craters. There are three named, e.g., Tithonia Catena.

[1] Early in 1974, on a proposal of C. Sagan, members of the (defunct) Working Group voted unanimously (but without IAU authority) to add two craters to this list in honour of G. P. Kuiper (157°, −57°) and W. Vishniac (276° −77°). We recommend this resolution to the successor IAU committee on Planetary Nomenclature.

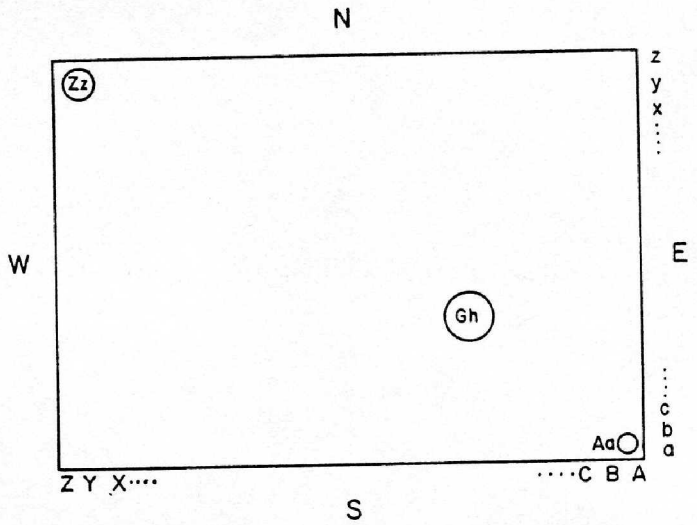

FIG. 2. Double letter crater designation scheme within each 1:5 000 000 map quadrangle.

(b) *Chasma*. Canyon. An elongated, steep-sided depression, e.g. Coprates Chasma. Thirteen have been named.

(c) *Dorsum* (*Dorsa*). Ridge(s). Irregular, elongate prominence. One has been named, Argyre Dorsum.

(d) *Fossa* (*Fossae*). Ditches. Long, narrow, shallow depression. They generally occur in groups and are straight or curved. Thirteen have been named, e.g., Claritas Fossae.

(e) *Labyrinthus*. Valley complex. Complex, intersecting valleys, of which there is only one example, Noctis Labyrinthus.

(f) *Mensa* (*Mensae*). Mesas. Flat topped prominence with clifflike edges. Three have been named, e.g., Nilosyrtis Mensae.

(g) *Mons* (*Montes*). Mountains. A large topographic prominence or chain of elevations. Ten such features are designated, e.g., Ascraeus Mons.

(h) *Patera*. Irregular crater or a complex one with scalloped edges. Nine have been designated, e.g., Alba Patera.

(i) *Planitia*. Plain. Smooth, low areas. Ten have been designated, e.g., Hellas Planitia.

(j) *Planum*. Plateau. Smooth elevated area. Seven have been named, e.g., Solis Planum.

(k) *Tholus*. Hill. Isolated domical small mountain or hill. Eleven have been named, e.g., Albor Tholus.

(l) *Vallis* (*Valles*). Valley. A sinuous channel, many with tributaries. These are named "Mars" in many languages, e.g., Al Qahira Vallis is derived from the Arabic word for Mars. Eleven have been named.[1]

(m) *Vastitas*. Extensive plain. The vast northern circumpolar plain is named Vastitas Borealis.

5. *Craters on satellites*. Craters on Phobos are named, by a subcommittee chaired by C. Sagan, after those involved with the discovery, dynamics, or properties of the Martian satellites who are not already commemorated on Mars. Craters on Deimos are named after authors of literary or artistic allusions to the Martian satellites. Only Western Hemisphere craters on Phobos are named. The ridge emanating from Crater Stickney is named *Kepler Dorsum*. Adopted names are listed in Appendix III and locations on Phobos are shown on Fig. 5, which is a slight correction of a map first published by Veverka *et al.* (1974). The two named craters on Deimos are located in the photographic atlas of Veverka *et al.* (1974).

[1] In addition, and with apologies to latinists, Valles Marineris, a name suggested by W. H. Pickering, commemorates the Mariner space probes which revealed the Martian topography.

APPENDIX I: LARGE CRATER NAMES ON MARS

Name	λ	φ	Name	λ	φ	Name	λ	φ
Adams, W. S.	197°	+31°	Bianchini, F.	97°	−64°	Chamberlain, T. C.	124°	−66°
Agassiz, J. L. R.	89	−70	Bjerknes, W.	189	−43	Charlier, C. V. L.	169	−69
Airy, G. B.	0	− .5	Boeddicker, O.	197	−15	Clark, A.	134	−56
Antoniadi, E. M.	299	+22	Bond, G. P.	36	−33	Coblentz, W. W.	91	−55
Arago, F.	330	+10	Bouguer, P.	333	−19	Columbus, C.[a]	166	−29
Arrhenius, S.	237	−40	Brashear, J. A.	120	−54	Comas Sola, J.	158	−20
			Briault, P.	270	−10	Copernicus, N.	169	−50
Bakhuysen, H. G. (van de Sande)	344	−23	Burroughs, E. R.	243	−72	Crommelin,	10	+ 5
Baldet, F.	295	+23	Burton, C. E.	156	−14	Cruls, L.	197	−43
Barabashov, N.	69	+47				Curie, P.	5	+29
Barnard, E. E.	298	−61	Campbell, W. W. and J. W.	195	−54	Daly, R. A.	22	−66
Becquerel, H.	8	+22	Cassini, J. D.	328	+24	Dana, J. D.	32	−73
Beer, W.	8	−15	Cerulli, V.	338	+32	Darwin, G. H. and Ch.	20	−57

[a] Mariner IV designations; see IAU Trans. XIIIB, 99, 1967.