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GROUND-BASED PHOTOGRAPHY OF THE

MARINER IV REGION OF MARS

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GROUND-BASED PHOTOGRAPHY OF THE MARINER IV REGION OF MARS

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Photography of Mars in five color regions at New Mexico State University yielded a total of 339 plates covering central meridian longitudes 90° - 240°, thus including observable portions of the path of Mariner IV. Of that number, 251 plates were of sufficient quality to warrant composite copying in order to extract a maximum amount of information concerning this region. Although the linear resolution of the best of these plates is roughly two orders of magnitude poorer than that expected in the Mariner photographs, they nevertheless should be of some value in correlating the latter with features observable from the earth. The wave-length regions included were ultraviolet, blue, green, red, and near-infrared.

During most of the 1963 apparition a certain amount of general surface obscuration by atmospheric haze was suspected between areographic longitudes 80° and 150°. In addition, two large clouds invariably covered the Tharsis (λ 100°) and Arcadia (λ 130°) regions on blue and green plates. The appearance in 1965 was similar, but the haze density was probably greater during most of this apparition. However, a close comparison with the 1963 plates is very difficult to make, both because of the generally poorer seeing and the higher contrast images (different processing techniques were used) extant in 1963. The projected path of Mariner IV was relatively near the western limits of the haze, and appears to have been within it much of the time. Thus it is possible that not as much surface detail was recorded as might have been otherwise.

The date of formation of the haze is unknown. It appears to be present on the first green plate of usable quality obtained 9 December 1964. It was always strongest between longitudes 90° and 140°, and obscuration was greatest in early April 1965. The haze was still much in evidence as late as June 1965, as evidenced by a lack of visibility of the Trivium Charontis (λ 193°) and Propontis (λλ 150° - 180°) areas as well as the presence of limb brightening in all colors. The 6".5 disk of Mars on 14 July precluded the recording of much surface detail. However, it can be said that the increased contrast of the Trivium Charontis and Propontis at that time indicated a probable decrease in haze at those longitudes. Further east at λ 120° its continued presence was suggested by limb brightening on a red plate.

The diurnal behavior of the haze in the lower latitudes (i.e., north of Mare Sirenum) covered by Mariner IV was such that it generally seemed to clear considerably by local noon, but gradually formed again as the afternoon progressed. Such prominent features as Trivium Charontis and Propontis were often completely invisible on green plates during the morning hours, and barely perceptible even in the red. By the time these features reached the central meridian, they would appear reasonably normal in the red, but still indistinct in the green.

The dark features recorded along the Mariner path are summarized in Table I. Three of these markings, viz., Trivium Charontis, Titanum Sinus, and a feature identified in the table as Propontis I, were sufficiently prominent for direct positional determination with a Mann measuring engine. Only crude determinations of the other positions have so far been made due to problems of low contrast. The longitudes are referred to the zero point defined by the <u>American Ephemeris and Nautical Almanac</u>.

TABLE I

DARK FEATURES

Name	Feature Type	Position λ	Position ρ
Propontis I	oasis	181°	+33° (center)
Titanum Sinus	caret (M. Sirenum)	167°	-19½°
Trivium Charontis	oasis	193°	+12° (E. end)
Hecates Lacus (?)	oasis	190°	+24°
Saus	canal	160°-180°	(-9°)-(-7½°)
Tartarus	canal	167°-195°	(-19½°)-(+7°)
Saus-Tartarus intersection	canals	171°	-7½°
Gigas	canal	125°-167°	(+5°)-(-19½°)
Erebus	canal	144°-175°	(+32°)-(+20°)

The relatively large latitude discrepancy between the present and earlier determinations of Propontis I (~ 40° N) leads the writer to suspect this feature may not really be Propontis I, but a more recent dark development to the south. However, if this is true, then Propontis I is now an indistinguishable feature between this new marking and Propontis II, some 20° further north. Titanum Sinus appeared as a single pointed wedge, in contrast to the double-pronged character shown on maps by Slipher (1962), Tombaugh (1965), and others. However, the existence of another point may well be masked by the resolution limitations of the 30-cm. reflector. The commonly depicted triangular form of Trivium Charontis was not obvious on the plates. The reason for this is found in the completely different appearance of the southern part of the Trivium and the northern part which makes up the "triangle". The southern part appeared completely integrated with the Cerberus I, forming one long dark bar-like marking of uniform width and shading. The "triangle", on the other hand, was a very diffuse, lightly shaded region just to the north of the eastern end of the bar, and appeared to be more properly considered a part of the Hecates Lacus, described below.

A few canals were faintly recorded crossing the Mariner path. It seems worthwhile to emphasize that the term "canal" is merely a word used to denote a particular type of dark surface feature which is generally quite narrow in comparison to its length. The fact that such a high percentage of canals are near the limits of detection from the earth has led to much confusion and doubt concerning their existence. Actually, a goodly number of such markings have definitely been recorded photographically at this observatory over the past three apparitions, and their reality is indisputable. Of course, little can be said concerning the nature of these features other than the fact that their widths must be on the order of 80 km or more to be recorded from the earth. Some canals, such as the Gigas, even appear to have measurable widths, suggesting the true widths of 500 km or more.

The canal known as Hades, which is normally shown connecting Hecates Lacus with Propontis I (Slipher, 1962), appeared to be lost in the large peripheral development of Hecates Lacus itself. This development, though somewhat faint, was large enough to give the appearance of almost touching both the Trivium Charontis and Propontis. The feature referred to as the Erebus canal actually had the appearance of a broad diffuse area at least 650 km across near λ 150°. The latitudes given for this feature in Table I refer only to the center of the eastern and western limits of the area.

A number of bright regions were observed to repeatedly exhibit changes in brightness which can be due only to clouds, haze, or frost on the ground. Their recurrence in the same areas is strongly indicative of topographic influence. Several of these areas on or near the Mariner track are listed in Table II. Not all cloud regions displayed the same diurnal behavior. For example, clouds were common in all of these regions during morning hours; however, Lubar, Azania, and Phlegra were always free of clouds by early afternoon while Lumen was sometimes covered to some extent throughout the day. Elysium was usually (but not always) free of clouds by afternoon.

TABLE II

REGIONS OF CLOUDS OR BRIGHT HAZE

Region	Approximate Area (sq. km)	Position (center) λ	ρ
Phlegra	2×10^5	187°	+42°
Azania	12×10^3	185°	+26°
Elysium	12×10^5	215°	+20°
Atlantis	12×10^4	170°	-29°
Lumen	10×10^4	163°	-20°
Lubar	7×10^4	180°	-18°
Electris	7×10^5	180°	-50°

The composites of both green and red plates of 14 July suggest the presence of an arc of white over the south limb, comprising the Ausonia (λ 250°) and Eridania (λ 220°) regions. This arc is not visible on the blue plate, indicating either a low level cloud or frost on the ground. Earlier plates, exposed when the Mariner track was much nearer to the central meridian, are not of sufficient quality to yield cloud data for any of the regions of Table II.

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REFERENCES

Slipher, E. C. (1962). "A Photographic History of Mars", Lowell Observatory, Flagstaff, Arizona.

Tombaugh, C. W. (1965). "Provisional Topographic Map of Mars, Mariner 4 Region", TN-701-66-8, New Mexico State University Observatory, July 1965.