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OF THE

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VOL. XVII. PART III.

EIGHTH REPORT OF THE SECTION

FOR THE OBSERVATION OF

MARS,

DEALING WITH THE APPARITION OF 1907.

Director—E. M. Antoniadi, F.R.A.S.

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SECTION FOR THE OBSERVATION OF MARS.

DIRECTOR.—E. M. ANTONIADI, F.R.A.S.

REPORT OF THE SECTION, 1907.

PART I.

PROLEGOMENA.

1. The Apparition of 1907.

The opposition with which we are now concerned, and which occurred on 1907, July 6, was a very favourable one on account of the distance at which the planet approached the Earth. For, while Mars was within 0·537 (49,800,000 miles) of us on 1905, May 16, he passed off only at 0·408 (37,800,000 miles) on 1907, July 13. But the great S. declination of the planet, which reduced its altitude when southing at Greenwich on the day of opposition to 10° 36′, rendered the 1907 apparition one of the worst we had for a very long time in Europe; and it is fortunate that, under such untoward circumstances, the Section has received hearty support from skilled observers in South Africa, Australia, India, and South America.

Phenomena.

Summer Solstice of N. hemisphere Winter Solstice of S. hemisphere	1906, December 2.
Mars in W. Quadrature with the Sun	1907, March 10.
Autumnal Equinox of N. hemisphere Vernal Equinox of S. hemisphere	1907, June 3.
Mars in Opposition with the Sun	1907, July 6.
Heliocentric longitude of Mars in Opposition	283° 23′.
Position of Mars in Opposition	$\alpha = 19^h\ 1^m.$ $\delta = -28°\ 0'.$

Diameter of Mars in Opposition -	22″·8.
Position angle of the N. pole of Mars in Opposition - - - - -	18°·9.
Latitude of the centre of the disc at Opposition - - - - -	− 4°·6.
Mars in Apparitional Perigee - -	1907, July 13.
Diameter of Mars in Apparitional Perigee - - - - - -	23″·0.
Mars in Perihelion - - - - -	1907, September 26.
Winter Solstice of N. hemisphere - } Summer Solstice of S. hemisphere - }	1907, October 27.
Mars in E. Quadrature with the Sun	1907, November 11.

The negative latitude of the centre of the disc varied from − 9°·2 on 1907, June 1, to − 1°·6 only on August 6, after which it increased towards the end of the apparition, attaining the value of − 10°·1 on September 30.

2. The Members of the Section.

The following table gives the names of the Members who constituted the Mars Section in 1907, the aperture of their telescopes, as well as the number of drawings forwarded by each to the Association :—

Observer.	Locality.	Aperture of Instrument in Inches.	Drawings.
ANTONIADI, E. M., F.R.A.S.	Paris - - -	8½ Spec.	3
BEATTIE, E. H. - - -	Sydney, N.S.W., Australia.	6⅛ O.G.	1
BUCHANAN, W. E. - -	Simla, India - -	6½ Spec.	17
COBHAM, A. B. - - -	Mosman, Sydney, N.S.W., Australia.	8½ Spec.	14
DOBBIE, A. W. - - -	Adelaide, S. Australia	?	8
EDDIE, MAJOR L. A., F.R.A.S	Grahamstown, Cape Colony.	9¼ Spec.	22
GIVIN, R. D., M.D., L.R.C.P., M.R.C.S.	Sydney, N.S.W., Australia.	3·6 O.G.	22
HOSKINS, G. H. - - -	Burwood, N.S.W., Australia.	12 Spec.	7
NANGLE, J. - - -	Sydney, N.S.W., Australia.	6¼ O.G.	7
SHEARER, D. - - -	Mannum, S. Australia.	?	4
TORNQUIST, M. - - -	Buenos Ayres, S. America.	4¼ O.G.	13
			118

The observations cover a period of 3 months and 5 days, the first record being that of Nangle on 1907, June 4, the last one that by the Director on September 9.

3. Observational Notes.

Buchanan says: "I have had no difficulty in seeing all the "general features, but I fear the air here is not good enough for "delicate observation." And, "as Simla is situated 7,000 feet "above sea level, I find I have plenty of light."

The same observer "was struck by the wonderful improve- "ment in definition caused by mist or thin cloud."

Writing on July 29, $\omega = 245^\circ$, Major Eddie, whose 1907 results on Mars are superior to those of any other observer using such an aperture, noted that "many reticulations and differential "shadings were occasionally glimpsed in fleeting moments of "good seeing, too brief, alas! to be fixed or reproduced "throughout the N. ruddy portions of the planet."

The Director attributes the loss of the faint half-tones on some drawings of Schiaparelli and Lowell to an abuse of high powers and to a tired eye.

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4. Streaks.

The Members of the Section saw 63 streaky and allied markings, of which two do not figure on the charts of the planet.

The number of streaks seen by each observer is as follows:—

Major Eddie	33
Buchanan	31
Cobham	25
Dobbie	20
Nangle	12
Tornquist	11
Dr. Givin	10
The Director	10
Hoskins	8
Shearer	8
Beattie	1

On the drawings of Major Eddie the streaks have a natural appearance, as they are often knotted and always irregular. Buchanan also avoids regularity here. Nangle, Hoskins, and Shearer show them broad and diffused. They are more uniform on the fine drawings of Cobham; yet never line-like and sharp, but always soft and faint.

No "geminations" were seen. Of the streaks recorded, 34 per cent. are edges of half-tones; while three of them have been resolved into their principal components.

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5. Martian Meteorology.

On June 30 Eddie found "all markings N. of equator very "faint during the present apparition up to this date." On the same day, under $\omega = 157^\circ$, the "colour of general surface of "planet [was] very light yellow." Again, the same phenomenon was seen on July 7, $\omega = 99^\circ$, and on July 31, $\omega = 233^\circ$.

Also, on August 6, $\omega = 172°$, we find the note: "colour of "planet almost straw colour."

From August 8, $\omega = 26°$, onwards, Givin saw that the dark markings were "much fainter than at the earlier observations."

While the old school of observers, like Lockyer, J. Phillips, Lassel, Dawes, Browning, Green, Burton, Maunder, Denning, and others, laid stress on the very important part played by cloud in modifying the appearance of the dusky areas, Prof. Lowell believed that "from one end of the year to the other, "nothing appears to veil the greater part of the planet's "surface."* But observation has not confirmed this statement. The temporary disappearance in 1909 of the dark areas, including *Syrtis Major*, the most conspicuous spot on the planet, establishes beyond doubt the momentous action of Martian cloud; and, instead of a world subjected to sudden inundations, and furrowed with straight lines appearing alternately single and double on the same night, we now see in Mars a planet with natural markings, frequently obliterated by the interposition of haze.

The great interest of this cloud question has prompted the Director carefully to study, in the present Report, the outlines and intensity of the dark areas, as shown on the various drawings, and thus to establish, as it were, a daily meteorological record of the planet. Due regard was paid in this enquiry to the individual mode of representation, as well as to the apparent fading of the spots about the limb, or terminator. During the 1907 apparition, *Sinus Sabæus*, *Hellespontus*, *Margaritifer Sinus*, *Auroræ Sinus*, *Acidalium Mare*, *Argyre*, *Solis Lacus*, *Aonius Sinus*, *Sirenum Mare*, *Cimmerium Mare*, *Elysium*, *Pambotis Lacus*, *Trivium Charontis*, *Mare Tyrrhenum*, *Mare Hadriacum*, *Hellas*, *Syrtis Major*, the S. and N. polar regions, &c., all gave more or less evidence of temporary pallor. One of the darkest markings, *Pandoræ Fretum*, discovered in the XVIIIth century, was practically invisible in 1907; *Mare Cimmerium* had even its *form* temporarily altered by cloud; while the sudden bright glow of *Libya*, appearing more intense than the S. polar cap on July 29, constituted the most striking feature of the apparition.

White cloud was seen by Eddie on June 15, $\omega = 298°$, when he noted a "glare along S.W. border extending from the snow cap," in a region where there are no "lands." As to the yellow obscuring medium, whose assumption was a necessity to Burton in 1879,† to Prof. A. E. Douglass in 1899,‡ to Prof. W. H. Pickering in 1905,§ and to the Director in 1909,‖ its existence is proved by Buchanan's observation of July 21, when the S. polar cap appeared unexpectedly "yellowish."

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* *Mars*, 1896, p. 45.

† *Mars Report* for 1905, p. 37.

‡ When Mr. Douglass spoke of yellow dust in the Martian atmosphere (Flammarion, *Mars*, Vol. II., p. 476).

§ *Mars Report* for 1903, p. 59.

‖ *Journal* B.A.A., Vol. XX., p. 24.

From observational evidence, we are thus led to the following general inferences :—

I. *The surface of Mars is liable to be veiled locally by thin clouds, of which some are white, others yellow;* and

II. *Such clouds, which diminish the intensity, and can disfigure the outlines of the dark areas over which they drift, may either form and dissolve quickly, or remain for months together over certain regions.*

The lustre of a transparent white cloud on Mars must increase under oblique view. Let M (Fig. 1) be the centre of the planet, as well as the projection of its axis, ABC its equator, coinciding with the plane of the figure, DFG the outer limit of the Martian atmosphere, exaggerated in height, ME the projection of the Earth's direction, MS that of the Sun's, both Earth and Sun being supposed above the plane of the equator, and BT the projection of the terminator; and let us conceive a transparent cloud mass, composed of coarsely scattered white

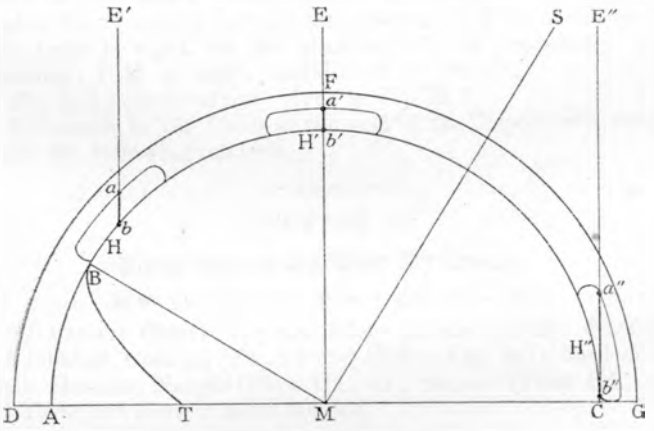

FIG. 1.

particles. The cloud rises on the terminator, at H, and we see particles along the projected depth ab. Rotation then carries the mass on the central meridian, at H', and we see particles to the projected depth $a'b'$. Here the cloud transmits a great part of the ochrey colour of the soil beyond, and it will appear yellow. And at the limb, at H'', we see particles to the projected extent $a''b''$. But as

$$a'b' < ab\,; \qquad \text{and} \quad ab < a''b'',$$

the eye will see more particles about the direction $a''b''$ than along ab, and again more along ab than about $a'b'$.

Hence

Any transparent white haze on Mars must appear brighter near the terminator than on the central meridian, and again brighter near the periphery than on the terminator.

6. The "Lands" Whitening with the Obliquity

are readily accounted for by the above principle, as their marginal brightening is not constant, while any "continental" region of Mars may occasionally appear whitish under oblique view. But the "lands" most liable to show the phenomenon may be elevated plateaus, favouring condensation, and Prof. Campbell has shown that on such districts the melting of the snow is retarded. It seems less plausible to assume that the appearance would be due to a peculiarity of the surface, whose increasing whiteness under oblique sight may be now and then checked by the yellow atmospheric element. At any rate, the hoar-frost theory is untenable, M. Touchet, Secretary of the Astronomical Society of France, having shown the impossibility of conceiving hoar-frost to form in the afternoon on a soil long warmed by the solar rays.

PART II.

THE OBSERVATIONS.

Introductory.

We have followed in this Report, as usual, Mr. Maunder's conventional division of the surface of the planet into eight sections, of which six, each having a mean breadth of 60° in longitude, extend from + 60° to − 60° of latitude, while the other two deal with the polar regions.

The following abbreviations are used in the discussion of the observations :—Ω = areocentric longitude, reckoned from *Fastigium Aryn* to the right ; Φ = areocentric latitude ; ω = longitude of the centre of the disc ; ϕ = latitude of the centre of the disc ; N. = North ; S. = South ; E. = Areographic East (west, or left, for the observer) ; W. = Areographic West (east, or right, for the observer) ; p = preceding ; f = following ; C.M. = central meridian of the planet.

The dates are invariably given in G.C.M.T.

Reference to the Chart at the end of the Report will render clearer the following analysis.

SECTION I.

Sinus Sabæus and Mare Erythræum.

$\Omega = 310°$ to $10°$; $\Phi = + 60°$ to $- 60°$.

Hammonis Cornu appears fairly pointed on the drawings of Buchanan, Cobham (Fig. 2), and Eddie (Fig. 14) ; but Dobbie, Givin, Hoskins, Nangle (Plate III., 12), Shearer (Plate III., 11), and Tornquist show it more blunted.

Sinus Sabæus had its usual winding course in 1907, according to Buchanan, Cobham (Fig. 2), Eddie, Givin, Hoskins, and Nangle (Plate III., 12). Dobbie, Shearer, and

FIG. 2.—*Sinus Sabæus*, as seen on 1907, August 15, by Cobham.

Tornquist represent it straighter. Its width appeared moderate to Buchanan, Cobham, Dobbie, Nangle, Shearer, and Tornquist. It is broader on Eddie's fine sketches, narrow on those of Givin, such narrowness being probably a result of increased diffraction in a small aperture. On 1907, August 15, Cobham depicted it somewhat contracted to E., and this is corroborated by Buchanan on July 22, and by Nangle on July 5.* The further narrowness of the *Sinus* over *Edom Promontorium*† is well shown by Buchanan and Nangle, and particularly so by Cobham (Fig. 2). As to the intensity of this marking, it was always inferior to the *Syrtis*, according to Buchanan, Eddie, Givin, Hoskins, Shearer, and Tornquist. On the other hand, Cobham, Dobbie, and Nangle shade it sometimes as much as *Syrtis Major*. Eddie found a "blue green" colour here, "approaching to "black or dark blue grey along N. boundary, which was well "defined and very conspicuous." He further saw the whole *Sinus* "mottled" on July 19. The darkness along the N. coast was also drawn by Cobham and Nangle. Givin calls attention to the fading of the marking in August—a probable effect of haze.

The observations of Buchanan, Cobham, Dobbie, Eddie, Givin, Hoskins, Nangle, Shearer, and Tornquist show the "strait" dark on June 4, 12, 15; faintish on June 24 and 26; dark on July 3, 4, 5, 7, 8; faintish on July 10–13 and 15–17; dark on July 19; faintish on July 20–22; dark on July 23–25 and 28; and faintish on August 8, 10, 14, 15, 17, and 20. The hazy obliterations of July 10–13, 15–17, 20–22, and of August are certain.

XISUTHRI REGIO is faintly shown by Cobham, but only on August 15 (Fig. 2). No trace of it on July 3, 7, 8, August 10 and 17. Eddie also saw it on June 15, July 19, 20, 23, and 24. Probably a contrast effect.

SINUS FURCOSUS,‡ or "Dawes's Forked Bay," was irresolvable in the small instruments of Givin (Plate II., 1) and Tornquist. It was less confuse to Nangle (Plate III., 12) and to Shearer. Buchanan found it often dimly defined; but on July 17 and August 20 he doubles the fork. So also Hoskins on July 10. Cobham and Eddie (Plate II., 2) seemed to have had no difficulty in resolving the "bay." Hoskins saw *Sinus Furcosus* extended to S.W. (Fig. 3), which is correct; Cobham giving it a more Schiaparellian form here (Fig. 2). The fork indents the "continent" deeply on Buchanan's views.

As usual, the intensity of the "Forked Bay" was great in 1907, although occasionally dimmed by haze. From the joint

* MM. Jarry-Desloges and Fournier, using a 14½-in. from Mont Revard (altitude = 5,084 feet), saw in 1907 the *p* end of the "strait" very contracted indeed (*Observations des Surfaces Planétaires*, Vol. I., Plates of p. 46).

† Recognised by Galle in 1839 (Flammarion, *Mars*, Vol. I., p. 125, Fig. 72B).

‡ A modification of our previous name *Furca*, with a view to presenting the name of "Forked Bay" in a way more in harmony with the established nomenclature.

data of Buchanan, Cobham, Dobbie, Eddie, Givin, Hoskins, Nangle, Shearer, and Tornquist, *Sinus Furcosus* appeared faintish on June 4 ; normally dark on June 12, 24, and 26 ; faintish again on July 3 ; darker on July 5, 7, and 10 ; faintish on July 13 ; very faint on July 14 ; darker on July 15 ; very dark on July 16, especially in the prongs ; faintish on July 17 ; normal on July 19, 20, 23, 25, and 28 ; faintish on August 8, 10, 14, and 15 ; and dark on August 20. It would thus appear that "Dawes's Forked Bay" was perhaps normal in tone up to July 10 ; that it was probably obliterated by thin haze towards July 14, in order to resume its intensity on July 16 ; and that it once more faded off from August 8 to 15.

Buchanan, Givin, Hoskins, Nangle (Plate III., 12), and Shearer all support each other in showing *Sinus Furcosus* generally darker than the "strait." On July 10 Hoskins represented the *Hiddekel* prong of a deeper tone than the *Gehon* prong. A grey "bridge" was suspected by Buchanan to sever the fork on July 30 from *Fastigium Aryn* up to *Deucalionis Regio.*

PORTUS SIGEUS was observed as a more or less well-defined triangular "bay," single and not double, by Buchanan, Cobham (Fig 2), Eddie, Givin (Plate II., 1), Nangle (Plate III., 12), and Shearer, all of whom agree in drawing it generally darker than the "strait" in which it is situated.

FASTIGIUM ARYN is very sharp on Cobham's drawings. Eddie saw it well on July 16 (Plate III., 2) ; Buchanan, confuse on July 17. Hoskins shows it clearly, though somewhat shaded, on July 10.

EDOM PROMONTORIUM was seen deeply to indent *Sinus Sabæus* by Buchanan and Cobham (Fig. 2). Eddie, Givin, Hoskins, Nangle (Plate III., 12), Shearer, and Tornquist found it less prominent.

Givin saw the "cape" whitish on August 8. This is white spot 3 of our Chart.

EDOM appeared bright on the terminator to Dobbie on July 13.

EDEN presented nothing abnormal in 1907.

THYMIAMATA seemed narrower to S. than *Sinus Furcosus ;* but Cobham found it quite as large as the "Forked Bay."

AERIA was bright on limb to Buchanan on July 28, and on terminator to Eddie on July 27.

ARABIA was normal during this apparition.

DIOSCURIA can be seen dusky on the representations of Buchanan, Cobham, Givin, Hoskins, and Shearer, though not on those of Nangle, Eddie, and Tornquist.

CYDONIA was shaded to Buchanan near C.M. on July 14, and near the terminator on July 16 and 17. Cobham saw the

shading here on July 3, 7, 8, August 10 and 15. But on August 8 Givin found *Cydonia* whitish on C.M.

This region was bright on limb on June 12 to Eddie, who saw "a very great glare . . . on the extreme N.W. periphery." Probably an effect of whitish cloud.

SEMIRAMIDIS LACUS, a name now given by the Director to a small "lake" detected by Schiaparelli on *Euphrates* in 1890,* is well shown by Cobham on August 10 and 15 (Fig. 2), although somewhat more to N. than drawn 17 years previously. Vague indications of this marking may be found on Buchanan's drawing of July 17.

ISMENIUS LACUS was always confuse to Buchanan and Cobham, but dark and large to Dobbie on July 13. Eddie saw it darkish and oval on July 19, and this is confirmed by Givin in July (Plate II., 1).

DEUCALIONIS REGIO appeared, as usual, well defined to N., but very confuse and practically limitless to S., throughout the 1907 apparition. Its W. bend to N. was also badly defined, except on July 4, when Hoskins very correctly drew it narrower than usually represented. Nangle confirms this (Plate III., 12). The "island" is shown dusky by Buchanan, Cobham, Dobbie, Eddie, Givin, Hoskins, Nangle, Shearer, and Tornquist. On August 8 Givin observed it whitish near C.M. Hoskins saw *Deucalionis Regio* interrupted over *Sinus Furcosus* by the duskier shading *Neudrus*.†

JANI FRETUM, the name now given to the "channel" separating *Deucalionis Regio* from *Thymiamata*, was broad and intense to Buchanan, Cobham, Eddie (Plate II., 2), Givin (Plate II., 1), Nangle, and Tornquist, as shown on Green's fine

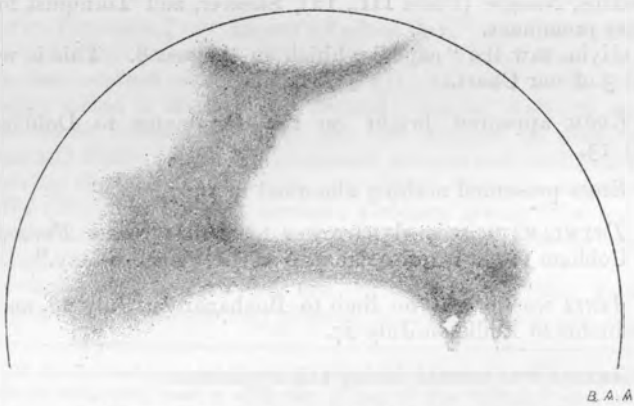

FIG. 3.—Characteristic invisibility of *Pandoræ Fretum* on 1907, July 10, after Hoskins.

* Flammarion, *Mars*, Vol. I., p. 474, Fig. 244.

† Seen, amid others, by Molesworth in 1896 (*Report* for that year, Fig. 1, p. 72).

drawings of 1877. On July 4 Hoskins could not see the *Fretum*, which Cobham depicted much narrower in August than in July.

PANDORÆ FRETUM was utterly invisible to Buchanan, Cobham, Dobbie, Givin (Plate II., 1), Hoskins (Fig. 3), Nangle (Plate III., 12), and Shearer (Plate III., 11). Eddie saw it most faintly on June 12 and 15, but could not find the slightest traces of it at the July presentation of this region. The "strait" is further dimly visible on Tornquist's sketch of July 28.*

We are here confronted with one of the most interesting cloud formations that have ever been observed on Mars. *Pandoræ Fretum* is a very dark area of the planet, having been discovered by Sir W. Herschel in 1783; but it seems particularly exposed to temporary hazy obliteration.† During the second half of the 1909 apparition it was as dark as *Sinus Sabæus;* and the fact that it was virtually invisible throughout the 1907 observations once more shows us to what an extent the configuration of the Martian spots is liable to be affected by the veils in the atmosphere of the planet.

NOACHIS seems confuse in outline, save to S.E., along the dark band of *Hellespontus*, on the drawings of Buchanan, Cobham, Dobbie, Eddie, Givin, Hoskins, Nangle (Plate III., 12), Shearer, and Tornquist. Givin saw it faintly separated from *Pyrrhæ Regio* on July 3 and 5.

On June 15, $\omega = 298°$, Eddie found *Noachis* near the limb "very bright, and surrounded by glare." It was also seen

* It is further practically invisible on the 1907 drawings of MM. Jarry-Desloges and Fournier. Nor is there any trace of it on a fine Lowell photograph for this apparition, as pointed out to the Director by M. Baldet.

† Flammarion, *Mars*, Vol. I., p. 57, Figs. 15, 16, and 17 of Herschel. Schröter saw *Pandoræ Fretum* as a very dark streak in 1798 (*Ibid.*, p. 74, Fig. 52, and p. 76, Figs. 83, 84, and 102 of Schröter); and while it was easy to him on 1798, October 8 and 9, he could not see it on the 10th (*Ibid.*, p. 76, Fig. 85). In 1800 it was invisible (*Ibid.*, pp. 78, 80, Figs. 161, 162, and 192). Again, no traces of it in 1813 to Arago (*Ibid.*, p. 92, Fig. 62). In 1862 Lockyer could not see it at $9^h\ 40^m$ on September 23; but between $10^h\ 25^m$ and $11^h\ 55^m$ it came into prominence as a dark streak, crossed obliquely by a bank of bright cloud, which would seem to have cleared off by $12^h\ 55^m$ (*Mem.* R.A.S., Vol. XXXII., Plate I.-IV.). Knott, however, saw it as easily as *Sinus Sabæus* on 1862, November 3 (Flammarion, *Mars*, Vol. I., p. 171, Fig. 110); although on September 23 it was invisible to him (Dr. Terby, *Aréographie*, Plate III., Fig. 26). In 1864 Dawes found it fairly dark (Flammarion, *Mars*, Vol. I., p. 187, Fig. 120, I.). On 1875, June 16, Prof. Holden could not see it. In 1877 it was dark to Green (*Mem.* R.A.S., Vol. XLIV., Plates), to Dr. Dreyer (*Sc. Trans. R. Dublin Soc.*, Vol. I., n.s., Plate II., facing p. 70), and to Schiaparelli (*Memoria Prima*, Plates). Visible early in the 1879 apparition to Burton, it was again obliterated by cloud later (*Sc. Trans. R. Dublin Soc.*, Vol. I., n.s., Plates VI. and VII.). In 1881-1882 it was again dark, according to Schiaparelli (*Memoria Terza*, Plate). So also in 1884, after Mr. Knobel (*Mem.* R.A.S., Vol. XLVIII., Plate V.). In 1890 it was darkish to Schiaparelli (Flammarion, *Mars*, Vol. I., p. 474, Fig. 244). Finally, the Reports of the Section show the "strait" dark in 1892, less so in 1894, faint in 1896, 1899, 1901, and 1903, and darker in 1905. This brief analysis establishes beyond doubt the variable visibility of *Pandoræ Fretum* through the interposition of Martian cloud.

bright at Grahamstown on July 19, $\omega = 336°$, and on July 22, $\omega = 306°$.

HELLESPONTUS appeared as a very conspicuous, though variable, marking in 1907 (Plates II., 1, and III., 10, 11, 12), running, as usual, up to the S. polar cap, where it ended in a large dusky area. "From *Sinus Sabæus*, in the E.," says Eddie, "*Hellespontus* stretched upwards to the S. and W., forming a "V-shaped figure with the former, and embracing the light-"coloured region of *Noachis*." On July 17 Buchanan found it irregular (Fig. 15).

The intensity of this band presented the following variations :—

Date.	Darkness of *Hellespontus*.	Observer.	Date.	Darkness of *Hellespontus*.	Observer.
1907.			1907.		
June 4	Faintish	Nangle	July 15	Faintish	Hoskins
„ 8	Faint	do.	„ 15	Faint	Buchanan
„ 12	Faintish	Eddie	„ 16	do.	do.
„ 15	Dark	do.	„ 17	Very dark	do.
„ 24	Faint	Tornquist	„ 19	Faintish	Eddie
„ 26	Very faint	do.	„ 20	do.	do.
July 3	Faintish	Givin	„ 21	do.	Buchanan
„ 4	Dark	Hoskins	„ 22	Very faint	do.
„ 5	Normal	Givin	„ 23	Faintish	Eddie
„ 5	Dark	Nangle	„ 24	Moderately dark.	do.
„ 10	Very dark	Hoskins			
„ 11	Faintish	Dobbie	„ 28	Very dark	Tornquist
„ 12	Very faint	Givin	Aug. 8	Very faint	Givin
„ 13	Normal	Shearer	„ 14	Faint	do.
„ 13	Dark	Dobbie	„ 15	Faintish	do.
„ 13	do.	Givin	„ 17	Faint	do.

We thus seem to have an obliteration by haze early in June ; then a second one between June 24 and 26 at least ; a third one on July 11–12 ; a fourth one between July 15 and 16 ; a fifth one from July 19 to 23 ; and a last fading in August. Probably *Hellespontus* was veiled by streamers emerging from the great immovable cloud mass over *Pandoræ Fretum*.

MARE ERYTHRÆUM (E.) was unevenly shaded, according to Buchanan, Cobham, Eddie, Givin (Plate II., 1), Hoskins, and Nangle. It seems to have been partly veiled by haze throughout the apparition.

STREAKS AND MINOR DETAIL.

CANTABRAS.—Eddie : July 16, 3° wide, darkish, to S.E. only.

DEUTERONILUS.—Buchanan : August 20, 12° wide, dark.—Cobham : August 10, 15, edge of shade in *Cydonia*.—Dobbie : July 11, 5° wide, dark.—Eddie : June 12, 5° wide, irregular, diffuse.—Givin : July 5, two small grey spots here.—Nangle : June 4, 3° wide, dark.

EUPHRATES.—Cobham : August 10, 15, 3° wide, faint.

GEHON.—Buchanan : August 20, 4° wide, convex to E., irregular, very dark ; July 13, 14, 15, 16, and 17, invisible.—Cobham : August 15, 3° wide, curved, exceedingly faint.

HIDDEKEL.—Buchanan : July 16, to S. only, 5° wide, faint, narrowing to N.—Cobham : August 10, 15, complete, 2° wide, faint.

NEUDRUS.—Hoskins : July 4, 4° wide, cutting *Deucalionis Regio* above *Sinus Sabæus* and *Sinus Furcosus.*

OXUS.—Cobham : August 15, edge of shaded *Oxia.*—Eddie : July 12, 5° wide, faint and diffuse.

PROTONILUS.—Buchanan : July 16, 21, edge of shade to N.—Cobham : July 7, 8, August 10, 17, do.—Dobbie : July 11, 13, 5° wide, intense.—Eddie : June 12, 15, July 19, 20, 23, 4° wide, irregular, diffuse.

TYPHONIUS.—Buchanan : July 17, 5° wide, faint, irregular.—Cobham : August 15, 3° wide, very faint.

SECTION II.

Margaritifer Sinus, Auroræ Sinus, and Mare Acidalium.

$\Omega = 10°$ to $70°$; $\Phi = +60°$ to $-60°$.

MARGARITIFER SINUS presented its normal form in 1907. Buchanan drew it as forming a slight hump on *Thymiamata* on Aug. 20 ; and it is tapering on the sketches of Givin and Tornquist. Most Members agree in showing it less dark than *Sinus Furcosus.* By combining the results of Beattie, Buchanan, Cobham, Eddie, Givin, Hoskins, Nangle, and Tornquist, we find that the "bay" was normal in tone from June 29 to July 1 ; faintish on July 2 ; normal on July 3 ; decidedly faint on July 4–5 ; faintish from July 11 to 13; dark from July 14 to 16; faintish on July 23–25 ; and normal on August 8, 14, 15, and 20. Here also the partial obliteration by haze makes itself felt. On July 13 Eddief ound it "very dark at extremity." On the following day he saw the "gulf" as on Fig. 4.

FIG. 4.—*Margaritifer Sinus, Niliacus Lacus,* and *Mare Acidalium,* as seen by Major Eddie on 1907, July 14.

AROMATUM PROMONTORIUM is shown bright and rounded, by Beattie (Plate II., 3), Buchanan, Cobham, Eddie (Fig. 4 and Plate II., 2), Givin, Hoskins, Nangle, and Tornquist.

CHRYSE was ruddy to Beattie on C.M. on July 2. Cobham shades it towards the *Ganges*.* Eddie remarks that on July 14, under $\omega = 43^\circ$, it was "very ochrey in colour."

AURORÆ SINUS seemed to have been abnormally notched at the "estuaries" of *Ganges* and *Agathodæmon* at this apparition, according to Buchanan, Cobham, Eddie (Fig. 5), and Nangle.

B.A.A.

FIG. 5.—*Auroræ Sinus*, *Lunæ Lacus*, and *Ganges*, on 1907, July 14, after Major Eddie.

Beattie (Plate II., 3), and Hoskins, show only the *Agathodæmon* "inlet." The consensus of evidence points to the fact that *Ophir* was bulging into *Auroræ Sinus* between the two notches in question. As to the intensity of this "bay," the joint results of Beattie, Buchanan, Cobham, Eddie, Givin, Hoskins, Nangle, and Tornquist show that it was normal on June 21, 27, 29, July 1, 2, 3, and 11; faint on July 12 and 13; normal on July 14 and 16; faint on July 23 and 25; and again normal on August 6, 8, and 20. Again a result of haze. On July 11 Buchanan found *Auroræ Sinus* darker at its centre, as if dimmed about the "coast." Similarly, Dobbie saw a dark knot in it on August 4 and 5. On July 13 Eddie observed it "very dark at *Ganges* "extremity."

LUNÆ LACUS appears diffuse on Cobham's and Dobbie's drawings. Eddie found it generally oval, 12° long by 8° broad, elongated E. to W., and dark (Fig. 5). On June 29 it was round, 9° wide, and darkish. Hoskins shows it very large and diffuse† and faint on June 28, and it was exceedingly faint to Nangle on the same day. Buchanan could never see this "lake" properly in

* This duskiness of the *Ganges-Jamuna-Nilokeras* triangle was observed already in 1884 by Dr. Böddicker with the 3-ft. reflector of Birr Castle, and its colour found to be "reddish-brown" (*Sc. Trans. R. Dublin Soc.*, Vol. II., n.s., p. 302).

† As on the 1907 photographs of Dr. Lowell.

1907. The observations of Beattie, Buchanan, Cobham, Dobbie, Eddie, Givin, Hoskins, Nangle, and Tornquist show that *Lunæ Lacus* was faint on June 26; invisible on June 27; faint on June 28; dark on June 29; invisible on July 1–3; faint on July 11; dark on July 12; invisible on July 13; dark on July 14, 18, August 4 and 5; very faint on August 6; and invisible on August 8 and 20.

Oxia is slightly shaded by Buchanan only.

Niliacus Lacus was always represented confuse and fainter than *Mare Acidalium* by Buchanan. On Cobham's drawings it is occasionally less smudgy. On July 14 Eddie found it irregular, elongated E. to W., and as dark as *Margaritifer Sinus* (Fig. 4). The joint results of Buchanan, Cobham, Eddie, Givin, and Hoskins show that the "lake" was invisible on June 29 and July 1; very faint indeed on July 3 and 11; dark on July 12; very faint on July 13; dark and large on July 14; dark but small on July 16, as if partly obliterated; also dark and small on August 8; and faint on August 20.

Achillis Pons is confuse on Buchanan's fine drawings. Eddie saw it distinctly on July 12 and 14 (Fig. 4). Cobham and Hoskins never caught any glimpses of it.

Acidalium Mare seems squarish on Buchanan's views. Eddie found it more irregular (Fig. 4); Hoskins bell-shaped; Nangle confuse. It was very small to Givin—probably a result of diffraction (Plate II., 1). Its intensity was generally slight, owing to the tilt of the axis, and to its frequent obliteration by haze, as can be seen from the following data of Beattie, Buchanan, Cobham, Eddie, Givin, Hoskins, Nangle, and Tornquist. Thus the *Mare* was dark on June 29, July 1 and 2; very faint on July 3; darkish on July 4; faint on July 5; darker on July 11; faint on July 12; dark on July 13–14; faint on July 15–17, 23, 25, and August 5; dark on August 8; and faintish again on August 14, 15, and 20.

Tempe looked always dusky to Buchanan; Cobham saw the shading in July, but in August he found this region bright, which is its normal appearance. A "bright glare" was seen on rising *Tempe* by Eddie on July 16.

Mare Erythræum (W.) appeared more or less unevenly shaded to Beattie, Buchanan, Cobham, Eddie, Givin (Plate II., 1), Hoskins, Nangle, and Tornquist. On July 16 Eddie observed a "very light tint" here—probably an effect of thin cloud; while to Givin it looked fainter in August than in July.

Eos was not seen by Buchanan, Cobham, Givin, Nangle, and Tornquist. But Eddie shows it confusedly.

Pyrrhæ Regio is faintly represented by Buchanan, Cobham, Eddie, and Givin. On June 12 and 13 it was bright on limb to Eddie.

Protei Regio appears as a vague light smudge on Buchanan's drawings of July 11, 13, and August 20.

OGYGIS REGIO is not shown by any Member of the Section in 1907.

ARGYRE I. is not recognisable as a separate "land" on the sketches of Buchanan, Cobham, Eddie, Givin, Hoskins, Nangle, and Tornquist. Evidently this "island" was merged in the great cloudy formation to the S. of *Sinus Sabæus*. Yet Givin glimpsed it whitish on July 3, under $\omega = 3^\circ$ (Plate I., 1), while Buchanan found it somewhat bright on limb on July 16.

STREAKS AND MINOR DETAIL.

INDUS.—Buchanan : July 11, 13, invisible, probably veiled by haze ; 14, exceedingly faint ; August 20, 5° wide, very dark and convex to N.E.—Cobham : July 3, August 8, 3° wide, convex to E., "very conspicuous."—Eddie : July 12, 14 (Fig. 4), 16 (Plate II., 2), well marked, drawn, knotted, and 4° wide.

JAMUNA.—Cobham : August 8, 2½° wide, faint.—Eddie : July 12, 5° wide, irregular, seen to S.W. only.

NILOKERAS.—Buchanan : July 11, 12, width 10°, very faint.—Eddie : August 6, 7° wide to N.E., 4° to S.W., darkish.—Tornquist : July 18, very broad and dark.

SECTION III.

Solis Lacus.

$\Omega = 70^\circ$ to 120°. $\Phi = +60^\circ$ to -60°.

BOSPORUS GEMMATUS was normally dark in 1907, appearing faintish only on July 12, according to Eddie. Such is the conclusion from the results of Beattie (Plate II., 3), Buchanan, Cobham, Dobbie, Eddie, Givin, Hoskins, Nangle, and Tornquist.

THAUMASIA is represented rounded, but somewhat oval, elongated N.E. to S.W., and culminating somehow into a blunted point,* by Beattie (Plate II., 3), Buchanan, Cobham, Dobbie, Eddie, Givin, Hoskins, Nangle, and Tornquist. No trace of shading on it was detected by the Members in 1907.

AUREA CHERSO protrudes, though not as a "peninsula," on Beattie's (Plate II., 3), Buchanan's, Dobbie's, Givin's, Hoskins's, and Nangle's drawings. Yet the last-named observer could not see it on June 26. Cobham shows it on August 6, but not on June 27. Eddie does not represent it at all.

SOLIS LACUS appears rather small, oval, and elongated N.E. to S.W. on Beattie's beautiful drawing of July 2 (Plate II., 3). Buchanan supports this. To Cobham it was round and small. Dobbie elongates it somewhat from E.S.E. to W.N.W. (Plate II., 4). Eddie saw it oval, elongated N.E. to S.W. (Fig. 6). Diffraction in Givin's small telescope seems to have

* This is confirmed on Dr. Lowell's beautiful photographs.

reduced the diameter to 7°. Hoskins shows it small. Nangle gave it a length of 15° and a breadth of 12°; pear-shaped, the small end to N.E., the larger one to S.W. But the most interesting statement on the appearance of the "lake" was made by Tornquist, who, in his diary, wrote on July 18: "I "think *Solis Lacus* is double" (Plate II., 5). This duplicity was pointed out by Dr. Lowell on 1907, May 18,* and might have been produced by a small cloud mass overhanging the marking.

FIG. 6.—*Solis Lacus*, *Aonius Sinus*, and *Mare Sirenum*, on 1907, July 5 (Major Eddie).

With reference to the darkness of the "lake," the joint data of Beattie, Buchanan, Cobham, Dobbie, Eddie, Givin, Hoskins, Nangle, and Tornquist show that *Solis Lacus* was observed very dark on June 26; faintish on June 27; dark on June 28, 29; faintish on July 1, 2, 5, 11; dark on July 12, 18, 30, August 5; again faintish on August 6 and 7; and invisible on August 14. Hence the "lake" was at no time very strongly obliterated by haze in 1907, except on August 14, when Eddie "could not see *Solis Lacus*, though several dark spots [were] "seen N., *Tithonius Lacus*, *Ascræus Lacus*, and *Nodus* "*Gordii*."

TITHONIUS LACUS is drawn concave to S. by Beattie (Plate II., 3), Givin, Hoskins, Nangle, and Tornquist. Buchanan shows it more confusedly, and is supported here by Cobham and Dobbie (Plate II., 4). To Eddie it was small and oval on July 12. The drawings of these Members suggest that the "lake" was very dark on June 26, 27, 28, and 29; invisible on July 1; faintish on July 2; faint on July 5, 11, and 12; dark on July 18, 30, August 4, 5; faint on August 6; and again dark (darker than *Solis Lacus*) on August 7. The faintness early in July seems objective.

MELAS LACUS, a name given by the Director to the E. component of *Tithonius Lacus*,† and justified by the fact that this marking was black at Meudon in 1909, was seen by

* *Journal* B.A.A., Vol. XVIII., p. 61.

† Seen as far back as 1862 (*Mem.* R.A.S., Vol. XXXII., Plate II., Fig. 1).

Buchanan on July 11 as an oval condensation some way to N.W. from the *Agathodæmon* "inlet."*

JUVENTÆ FONS was not observed by the Section in 1907. Perhaps it was obliterated by cloud whenever the telescopes of Eddie, Cobham, Hoskins, and Nangle were scrutinising this region.

AONIUS SINUS, which reappeared in 1905 after remaining so long invisible,† is indicated by Buchanan, Cobham, Dobbie (Plate II., 4), Eddie (Fig. 6), Givin, Hoskins, Nangle, and Tornquist. Yet none of these observers show it as a dark, deep, tapering "bay," as seen by Green and Schiaparelli in 1877,‡ the 1907 delineations supporting rather Dr. Dreyer's sketches of 1877,§ Burton's of 1879,‖ and Prof. Campbell's, Hussey's, and Keeler's views of 1892.¶ According to Buchanan, Cobham, Dobbie, Eddie, Givin, Nangle, and Tornquist, this "gulf" was very dark on June 26 and 28; faint on July 5; dark on July 18; faint on July 30 and August 6; dark on August 7; and faint on September 4. Eddie further made the important statement that the "W. circular boundary of *Thaumasia* " . . . . [was] clear and mottled" on July 5.

A bright streak was seen to cross *Sinus Aonius* from S. point of *Thaumasia* to W.S.W. by Givin on July 30.

PHŒNICIS LACUS is drawn irregular and doublish** by Dobbie on July 30 (Plate II., 4). Eddie represents it elongated N.E. to S.W., and it is confuse on Hoskins's sketch of June 26. The results of these Members, combined with those of Buchanan, Cobham, and Nangle, show the knot to have appeared dark on June 26; to have been invisible on June 28; and dark on July 5, 12, August 6 and 7. The "lake" is very expanded and diffuse on Cobham's view of August 6.

A nest of three small "lakes" appears on Dobbie's view of July 30 (Plate II., 4). These are the following, named by the Director :—

GYGIS LACUS is a very minute knot, due W. of *Phœnicis Lacus*.

OTI LACUS is the one to N.W. of *Phœnicis Lacus;* it is large and faintish.††

MINOIS LACUS is a swelling at the junction of *Araxes* and *Phasis*. This "lake" was also seen by Eddie on July 5 (Fig. 6).

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* This double structure of *Tithonius Lacus* was successfully photographed by Dr. Lowell in 1907.

† See *Mars Report* for 1905, p. 47.

‡ *Mem.* R.A.S., Vol. XLIV., Plates I.–II.; *Memoria Prima*, Plates.

§ *Sc. Trans. R. Dublin Soc.*, Vol. I., n.s., Plate II.

‖ *Ibid.*, Plate VI., 7, 10.

¶ *Publ. Astr. Soc. Pacific*, Vol. V., No. 30, Plates; *Mem.* R.A.S., Vol. LI., Plates III.-IV.

** In 1892 Prof. Hussey saw this "lake" bifurcated to S. (*Publ. Astr. Soc. Pacific*, Vol. V., No. 30, Plate H 3).

†† This marking was seen by the Director at Meudon in 1909. (*Journal* B.A.A., Vol. XX., Plate of p. 80, Fig. 2), and its detection by Dobbie with a small instrument is most praiseworthy.

DÆDALIA seems slightly shaded on Buchanan's and Cobham's drawings.

THARSIS, slightly shaded on July 11, appeared brightish on limb to Buchanan on August 7.

OPHIR was ruddy to Beattie on C.M. on July 2.

ASCRÆUS LACUS was only seen confusedly as a vast, faint shading by Buchanan on August 7.

MAREOTIS LACUS appeared extensive and very faint to Eddie on July 12 and to Nangle on June 26.

MÆOTIS PALUS is dimly recognisable on Buchanan's, Cobham's, Dobbie's (Plate II., 4), and Eddie's drawings.

STREAKS AND MINOR DETAIL.

AGATHODÆMON.—Beattie : July 2, mere extensions of *Tithonius Lacus.*—Buchanan : July 11, 13, August 7, 9° wide, faint.—Cobham : June 27, August 6, 4° wide, dark, " well seen."—Dobbie : July 30, August 4, 4° wide, knotted, dark.—Eddie : June 12, July 5, 3° wide, diffuse.—Givin : June 29, 2° wide, very faint.—Hoskins : June 26, 28, 4° wide, very dark ; July 1, invisible.—Nangle : June 26, 29, 5° wide, very dark.*

CERAUNIUS.—Buchanan : August 7, very broad and nebulous.—Dobbie : August 4, 15° wide, diffuse, intense ; August 5, invisible.—Eddie : July 5, 10° wide, faint, diffuse.—Nangle : June 26, smudgy, exceedingly faint.—Tornquist : July 16, do.

CHRYSORRHOAS.—Cobham : August 6, 4° wide to S.W., 7° to N.E., faint, but "easy."—Eddie : July 12, 4° wide, diffuse.†

EOSPHOROS.—Buchanan : August 7, only N.W. half, 5° wide, confuse.

FORTUNA.—Dobbie : August 4, very irregular, complex, and bifurcating to N.W., also darkish.—Nangle : June 29, 4° wide to S., narrowing rapidly to N.

GANGES.—Cobham : August 6 and 8, 4° wide, easy, edge of shade to E.—Dobbie : August 5, 12° wide, severed from *Auroræ Sinus*—probably an effect of haze ; August 6, continuous up to *Auroræ Sinus.*—Eddie : July 12, 14, 6° wide to S.E., 4° to N.W., irregular, drawn, knotted (Fig. 5).—Tornquist : July 18, edge of shade to E.‡

ISSEDON.—Perhaps seen by Dobbie on August 5, as a very faint, broad streak.

NECTAR.—Eddie : July 12, 2° wide, faint, trending W.S.W. to E.N.E. ; " well seen for first time."

NILUS.—Dobbie : August 4, 12° wide, dark ; August 5, invisible.—Nangle : June 26, 10° wide, exceedingly faint.§

OEROE.—Dobbie : July 30, 3° wide, very faint.

PHASIS.—Buchanan : August 7, 9° wide, straight, irregular, diffuse.—Dobbie : July 30, 5° wide, diffuse.—Eddie : July 5, curved edge of shaded *Icaria* (Fig. 6).

TITHONIUS.—Dobbie : July 30, $3\frac{1}{2}$° wide, intense.

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* *Agathodæmon* was successfully photographed in 1907 by Dr. Lowell.

† Faintly indicated on Dr. Lowell's photographs.

‡ The *Ganges* appears as an edge of shade to E. also on Dr. Lowell's photographs.

§ This broad and diffuse appearance of the *Nilus* was successfully photographed by Dr. Lowell in 1907.

SECTION IV.

Mare Sirenum.

$\Omega = 120°$ to $180°$; $\Phi = +60°$ to $-60°$.

ICARIA is strongly shaded, and limitless to S.E., according to Buchanan, Cobham, Eddie (Fig. 6), Givin, Hoskins, Nangle, and Tornquist (Plate II., 5); and it is shown particularly dark on the drawings of Cobham, Givin, and Nangle.

This intense grey tinge, which seems to be permanent,* explains the reason for which *Mare Sirenum* appears occasionally open into *Aonius Sinus*, as observed by the Director in 1892 and by Meares in 1896.†

PHAETHONTIS is also shaded and unbounded to S., on the views of Buchanan, Cobham, Eddie (Fig. 6), Givin, Hoskins, Nangle, and Tornquist.

PALINURI FRETUM was inconspicuous to all the Members of the Section.

SIRENUM MARE is confuse on Buchanan's sketch of August 7. Cobham (Plate II., 6), Dobbie, Eddie (Fig. 6), Givin, and Nangle agree in drawing it arched to N.E. Through the darkness of *Icaria*, it appears open to E. on the delineations of Cobham, Givin, Hoskins, Nangle, and Tornquist (Plate II., 5). But the fine view of Eddie (Fig. 6) solves the riddle, by representing *Mare Sirenum* intact, though confining to the heavily shaded district. On July 1 Eddie found that the "darkest portion of "*Sirenum Mare*" was the S. bend and *Titanum Sinus;* again on July 5 it was "very dark at portion nearly touching polar "cap, and enclosing a lighter space in the W." This is an observation of a very high order, as the darkness at the bend and the lighter space further W. were most remarkable two years later in the great telescope of the Meudon Observatory.‡ The intensity of *Mare Sirenum*, as shown by our Members, seemed variable in 1907. Thus the "sea" was very dark on June 21 and 26; fainter from June 29 to July 1; dark on July 5; faintish on July 16 and 18; dark on July 18, 20, 23; faintish perhaps on July 25; normal on July 26; faint on July 30, and very faint on August 4; faintish on August 5 and 6; dark on August 7; faintish on August 11, 30, 31; and faint on September 1 and 4. The fading at the close of the apparition is highly probable.

SIRENUM SINUS appears very broad on Buchanan's drawing of August 7. Cobham figures it moderately wide; Dobbie,

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* See *Mars Report* for 1905, p. 48.

† E. M. Maunder, *Mars Report* for 1892, p. 175, and Plate, Fig. 10; *Mars Report* for 1896, p. 84. The shading of *Icaria* is visible already on the drawing by Sir W. Herschel of 1783, October 10 (Flammarion, *Mars*, Vol. I., p. 57, Fig. 30, No. 19), and it was subsequently shown, among others, by J. Phillips in 1862 (*Ibid.*, p. 105, Fig. 107).

‡ *Journal* B.A.A., Vol. XX., Plate facing p. 80, Fig. 2.

confuse and faint on July 30. To Eddie it was pointed and dark (Fig. 6), and this is supported by Givin. Hoskins and Nangle draw it confuse.

GORGONUM SINUS was recognised by Eddie as a dusky notch on June 29, 30, and on August 6.

TITANUM SINUS was blunted to Buchanan, Dobbie, and Tornquist. It seemed more pointed to Cobham (Plate II., 6), Eddie, Givin, Nangle, and to the Director. Its darkness was also considerable. On June 29 Eddie saw it "well, ... as " a hooked marking" with *Titan*.

ATLANTIS was not observed by Cobham, Givin, Nangle, and Tornquist. But Buchanan drew it bright on July 30 and 31, and this view is countenanced by Eddie on August 6.

On August 31 Buchanan saw *Atlantis* severed from the "continent" by a dusky "channel"—a fact which was fully corroborated at Meudon in 1909.

MEMNONIA did not present anything noteworthy in 1907.

AMAZONIS is slightly shaded by Buchanan, Cobham (Plate II., 6), and Givin. Our Sectional data since 1896 establish that this country is normally shaded; and the negative evidence of Schiaparelli and Lowell on this point is merely a result of high powers and eye-strain.

On June 21 E. *Amazonis* was bright to Nangle on the terminator; on September 8 W. *Amazonis* was white on limb to the Director.

ARCADIA appears shaded on Cobham's drawings.

One June 21 Nangle saw it bright on the terminator.

ARSIA SYLVA was observed by Eddie as a diffuse knot, some 8° wide, on June 30.

NODUS GORDII can be recognised on Dobbie's sketch of July 30 (Plate II., 4) as a dusky condensation on *Pyriphlegethon*. In 1905 Phillips saw something analogous.* On June 29 Eddie glimpsed this marking under the form of a large diffuse shading below the equator and near *p* limb. Givin's and Tornquist's (Plate II., 5) impressions were similar.

TATTA LACUS is a dusky knot which Eddie saw on the intersection of *Gorgon* and *Eumenides*.

PHRYGIUS LACUS was drawn by Dobbie on July 30 as a large and diffuse smudge. It seemed smaller to Eddie on August 6.

LUCUS MARICÆ is visible as a smaller knot than *Ammonium*, and immediately *p* it.

AMMONIUM was often observed by Eddie as a diffuse "lake."

* *Mars Report* for 1905, p. 49.

APHNITIS FONS was also seen by Eddie on June 30. It looked very faint at the time.

ASCANIA PALUS is very faint on Eddie's sketch of June 30.

PROPONTIS appears merged into the N. shadings on Buchanan's, Cobham's, and Givin's drawings. Eddie saw it as a faint, diffused spot on June 29, 30, July 1, 5, August 5 and 6. On July 18 Tornquist found it fairly intense near the terminator (Plate II., 5), while on August 11 he drew it very dark indeed, under $\omega = 191°$, noting meantime that it was "easy to see." Hence *Propontis* was visible through a pure Martian sky on these two dates.

CASTORIUS LACUS is represented as a very faint smudge near the N. polar white spots by Eddie on June 30, July 1 and 5, and also on August 5.

TITANIA looks dusky on Buchanan's and Cobham's drawings.

SCANDIA seemed bright on limb to Eddie, on June 30, $\omega = 157°$, when "a small bright glare" was noted to N.W. The same phenomenon was observed on July 1

STREAKS AND MINOR DETAIL.

ACHERON.—Eddie : July 5, 4° wide, faint and diffuse.—Hoskins : June 26, 10° wide, very diffuse.

ARAXES.—Cobham : July 26, 3° wide, faint.—Eddie : July 5, 4° broad, ending in a swelling on *Phasis* (Fig. 6).—Givin : July 30, 5° wide, strong.

EUMENIDES.—Cobham : July 25 (Plate II., 6), 26, edge of shading of *Amazonis.*—Dobbie : July 30, 3° wide, exceedingly faint.—Hoskins : June 26, 7° wide, dark, irregular, to E. only.

EUROTAS.—Eddie : July 1, August 5, 6, 4° wide, convex to N.W., faintish.—Givin : July 23, 25, August 30, edge of N. polar shades.—Tornquist : July 18, 5° wide, dark.

FEVOS.—Eddie : July 1, August 5 and 6, 5° wide, faintish.

GIGAS.—Eddie : July 1, confuse, short, of very small extent, and only to E.N.E. of *Tatta Lacus.*

GORGON.—Eddie : June 30, irregular, winding, 2° wide to N., 4° to S., near its "estuary."

HYSCUS.—Buchanan : N.E. edge of shaded *Icaria.*—Cobham : do.—Dobbie : do.—Eddie : do.—Givin : do.—Nangle : do.

PYRIPHLEGETHON.—Buchanan : August 7, to S.E. only, 10° wide, irregular, dark, and diffused.—Dobbie : to S.E. only, 5° wide, broadening into *Nodus Gordii.*

SIRENIUS.—Eddie : June 30, 3° wide, winding, trending to N.N.E., as far as *Arsia Sylva* ; July 1, do. ; also lower, N. part, 8° wide, irregular, only from $\Phi = +30°$ as far as *Eurotas.*

TITAN.—Cobham : July 26, 3° wide, faint, to S. only.—Eddie : June 29, "thin [2°] line stretching down to equator, and joining faint dark mark "nearly underneath" [*Ammonium*] ; drawn winding ; June 30, do. ; July 1, 4° wide, irregular ; August 5, do.—The Director : Sept. 9, 4° wide, faint.

TARTARUS.—Eddie : June 29, seen only near the S. end, winding, 2° wide.

SECTION V.

Mare Cimmerium, Elysium, and Trivium Charontis.

$\Omega = 180°$ to $250°$; $\Phi = +60°$ to $-60°$.

MARE CIMMERIUM usually appeared to the Members under its ordinary form, but with more detail. Like Ward in 1905, Buchanan saw it bulging on *Læstrygonum Sinus* and *Cyclopum Sinus*, and also rather pointed to W. While supporting such a representation, Eddie further resolves the hump about *Cyclopum Sinus* in two separate "bays,"* the *Cyclopum Sinus* proper, and the "estuary" of *Cerberus*, to which the name of *Cerberi Sinus* is now given. Beyond this point, the Grahamstown observer shows the *Mare* bending into a point to N.W. (Fig. 7, and Plate III., 8).† Now, all this was subsequently confirmed at Meudon,‡ as well as by the wonderful photographs of Prof.

FIG. 7.—The *f* part of *Mare Cimmerium*, as seen by Major Eddie on 1907, June 20, $\omega = 248°$.

Hale and of Prof. Barnard, made during the 1909 apparition. Cobham draws well the *Cyclops* "inlet." Dobbie saw also the *Cerberus* "estuary." With remarkable success, Givin sketched both the *Læstrygonum* and *Cyclopum* "inlets." The narrowness of the *Mare* to W. is accurately delineated by Nangle. Shearer saw the *Cyclops* "estuary." Lastly, Tornquist and the Director, who could not scrutinise this region in steady air, represent the "sea" with a straight outline to N.E.

From the joint results of Buchanan, Cobham, Dobbie, Eddie, Givin, Hoskins, Nangle, Shearer, Tornquist, and the Director, *Mare Cimmerium*, whose colour was "greenish blue" to Eddie, appeared faintish to W. on June 19; dark on June 20, 21, and 22; faintish on June 29; darkish on July 5; faint on July 6; dark on July 14, 15, 20, 23, 25 (especially to W.), 26 (do.), and 28 (do.); faintish to W. on July 29; dark to W. and centre on

* This double appearance seems to have been represented for the first time by Trouvelot in 1884 (*L'Astronomie*, September 1884).

† This was also photographed by Dr. Lowell in 1907.

‡ *Journal* B.A.A., Vol. XX., Plate of p. 80, Fig. 1.

July 30; very dark to E. on July 31; faint on August 6, 8, 10, 11, 18, 23, 25, 27, 29, 30, and 31; dark on September 7; dark to E., faintish to W., on September 8 (Plate III., 7); and faintish on September 9. What is certain from this enquiry is, that the *Mare* was almost free from cloud on July 14–15, and July 20-29, appearing then dark, and that it was veiled by haze in August.

But, independently of these hazy obliterations of intensity, the sectional data show that *Mare Cimmerium* had further its *form* altered by cloud in 1907. Thus, on July 30 Eddie drew this "sea" very narrow all along, in fact, having less than one-half its ordinary breadth (Fig. 8). The explanation of the phenomenon is furnished by Eddie himself, who says that "a "brilliant glowing . . . . . existed in patches along the

FIG. 8.—*Mare Cimmerium* invaded by cloud, and showing an apparent reduction of breadth on 1907, July 30, $\omega = 234°$, after Major Eddie.

"N. border of the *Cimmerium Mare*, of a deep golden hue." On July 31, "*Cimmerium Mare* [was] seen, but [it was] not "well defined" in South Africa. It is further interesting to note that on the latter date Buchanan saw this *Mare* segmented obliquely by a white streak, possibly due to cloud, which,

FIG. 9.—Light streak, cutting *Mare Cimmerium* obliquely, on 1907, July 31 (Buchanan).

starting to S.E. from a point *f Titanum Sinus*, reached *Æolis* to N.W., somewhere between the "estuaries" of *Læstrygon* and

Cyclops (Fig. 9).* The great length of *Mare Cimmerium* must render it more liable to partial hazy obliterations than most other dark areas of the planet.

LÆSTRYGONUM SINUS is shown to indent fairly well the "coast" of *Zephyria* by Buchanan. To Cobham it looked like a large, dark, shallowish notch (Plate II., 6). Eddie often found it sharp and dark. Givin and Nangle represent it more shallow.†

CYCLOPUM SINUS, faintly indicated by Buchanan and Cobham, is drawn deeper by Dobbie, Eddie (Fig. 7), and Givin. All agree in representing it dark.‡

CERBERI SINUS is shown by Dobbie. According to Eddie, it was a deep and dark notch, though less important than the preceding (Fig. 7).

TRITONIS SINUS, confuse, or blunted, on Cobham's drawing of August 17, has a more tapering appearance on the representations of Buchanan, Eddie (Fig. 7, and Plate III., 8), and Nangle.

HESPERIA seemed narrow and irregular to Buchanan, normal, though strongly arched, to Eddie, narrow to Nangle, and normal to the Director. Shearer saw traces of it on July 20. Its intensity appears further to have been variable in 1907; for the combined results of Buchanan, Cobham, Dobbie, Eddie, Givin, Hoskins, Nangle, Shearer, Tornquist, and of the Director show *Hesperia* to have been visible, though shaded, from June 19 to 22; bright on June 28; invisible on July 5 and 13; visible and shaded on July 14; invisible on July 15; visible shaded on July 20; invisible on July 23; seen dusky, but clearly, from July 25 to 29; visible bright on July 30; invisible on August 6, 17, 18, and 27; and, lastly, dusky from September 7 to 9. It is difficult to reach a conclusion from these data; yet it would seem that the "peninsula" appeared normal, or slightly shaded in the later part of June; that it darkened in the first half of July; that it tended to resume its usual duskiness from July 20 to 29; that it was bright on July 30; dark in August; and that it resumed its normal appearance in September. The darkness in mid-July is remarkable,§ and may perhaps be accounted for by something like Burton's dark orange veils,‖ possibly sand-dust clouds, casting their shadow on the surface beyond.

On July 25 Buchanan made the very important observation of a large, confuse shading, or "channel," on the central part of

* Some remarkable appearances on *Mare Cimmerium* were also observed on the Revard by MM. Jarry-Desloges and Fournier. On 1907, July 31, the "sea" was severed at right angles to its direction by a "bridge"; while on August 2 M. Fournier saw it doubled along its length (*Obs. Surf Plan.*, Vol. I., Plates facing pp. 16 and 18). Possibly, the bright patches seen by Eddie on July 30 may have drifted to S.W., causing the phenomena of the segmentation.

† This "gulf" too was photographed by Dr. Lowell in 1907.

‡ *Cyclopum Sinus* was also recorded on the Flagstaff photographs.

§ It is a striking feature of Dr. Lowell's photographs of 1907, July 11 (*M.N.* R.A.S., Vol. LXIX., Plate IV.).

‖ See *Mars Report* for 1905, p. 37.

Hesperia, and connecting apparently *Maria Cimmerium* and *Tyrrhenum* (see our Chart); and at this very spot, the Director saw a large, complex "lake" with the great refractor of Meudon in 1909,* subsequently photographed by Profs. Barnard and Hale.

A white spot, 1 of our Chart, appearing to have some character of permanence,† was seen towards the N. end of *Hesperia* by Eddie, whose observations run as follows on this point:—June 19, $\omega = 268°$: "Lighter space between *Syrtis* "*Parva* and *Cimmerium Mare* (*Hesperia*), only glimpsed at "intervals"; July 23, $\omega = 296°$: "Slight glare near *Syrtis* "*Parva*, on E. periphery"; July 29, $\omega = 245°$: "A small "bright spot on the E. of *Syrtis Parva*" (Plate III., 8); July 30, $\omega = 235°$: seen; July 31, $\omega = 233°$: again seen.

ELECTRIS is shaded by Buchanan, Cobham, Eddie, Givin, Nangle, Shearer, Tornquist, and the Director.

ERIDANIA, usually a land which brightens with the obliquity, was shaded, according to Buchanan (Plate III., 9), Cobham, Eddie (Plate III., 8), Givin, Nangle, Shearer, Tornquist, and the Director.

MARE CHRONIUM, viewed under great obliquity in 1907, seems further to have been often obliterated by haze. It is faintly shown by Eddie on June 20, 22, July 30, and August 6; by Cobham on July 25; and by Tornquist on July 16.

TIPHYS FRETUM was not well seen in 1907.

PROMETHEI SINUS was darkish to Buchanan on July 25.

ZEPHYRIA showed nothing abnormal in 1907.

ÆOLIS also did not present anything worth noting.

ÆTHIOPIS too had nothing remarkable about it.

ELYSIUM showed its blunted pentagonal form to Buchanan on July 30 and 31, and to Eddie on July 25. But the Grahamstown observer could never define it to W. on June 20, 21, 22, July 1, 27, 29, 30, and August 5, being supported here by Givin, Shearer, and the Director. Yet Nangle saw well the S.W. boundary on July 14. With the exception of Cobham, who found it bright near the terminator on July 25,‡ no other Member seems to have drawn *Elysium* whiter than the surrounding country—a very abnormal phenomenon indeed, yet explicable by the presence of yellow haze.

PAMBOTIS LACUS was one of the largest, darkest, and most conspicuous "lakes" of the apparition. The joint observations of Buchanan, Cobham, Dobbie, Eddie, Givin, Nangle, Shearer,

* *Journal* B.A.A., Vol. XX., Plate of p. 80, Fig. 1.

† An analogous spot was observed a little to N. of this position by Gledhill in 1871 (Dr. Terby, *Aréographie*, Plate IV., Fig. 41); and in 1882, Burton saw a white spot exactly in the position of Eddie's (*Sc. Trans. R. Dublin Soc.*, Vol. I., n.s., Plate XXXVIII., No. 4).

‡ On Dr. Lowell's photographs of 1907, July 11, *Elysium* is a little lighter than the adjoining deserts (*M.N.* R.A.S., Vol. LXIX., Plate IV.).

Tornquist, and the Director show *Pambotis Lacus* to have appeared very faint on June 20 and 21 ; faint on June 22 and July 14 ; dark on July 15 ; faintish on July 20 ; darkish on July 23 ; dark on July 25 ; exceedingly dark on July 30 ; dark on July 31, August 10, 11, 23, 25, 27 ; and faint on August 29 and September 7 to 9. Here also the obliterating effect of cloud makes itself strongly felt.

Pambotis Lacus was never drawn properly by Schiaparelli from 1877 to 1888. In 1896 Molesworth detected it as a small double "lake" ; in 1898 Brown and Molesworth saw it admirably as a larger spot ; in 1901 it was "very dark and distinct" to Molesworth, "like a smaller edition of *Trivium Charontis*" ; the same was noted by Molesworth in 1903 ; and in 1905 it appeared still most conspicuous to Phillips and Ward.* But in 1907 it was again larger and darker, according to Buchanan (Fig. 10), Cobham, and Shearer, hardly smaller than *Trivium Charontis*,

B. A. A.

FIG. 10.—July 31. $\omega = 213°$. (Buchanan.)

FIG. 11.—August 23, $\omega = 227°$. (Dr. Givin.)

Abnormal visibility of *Pambotis Lacus*, appearing as conspicuous as *Trivium Charontis*, in 1907.

being quite accessible to the 3·6-in. refractor of Givin (Fig. 11).† And as it is scarcely likely that it would have been always veiled by cloud prior to 1896, we deem it probable that, in this case, we have to deal with real change on the surface of the planet.

Buchanan found on July 30 that "a network of lines" seemed "to radiate like the spokes of a wheel from this spot" ; but that "it was impossible to draw."

TRIVIUM CHARONTIS appears as a round dark spot, some 10° in diameter, and not larger than *Pambotis Lacus*, on Buchanan's and Givin's drawings. Eddie shows it larger than *Pambotis Lacus*, 15° long from E. to W., and 12° broad. To Naugle it was streaky ; to Dobbie like a three-rayed star ; and to the Director roundish, 9° across (Plate III., 7). The results of the above Members, together with those of Shearer, show the "lake" to have appeared faint on June 22 ; dark on July 15 ; faintish on July 20 ; almost normal on July 23 ; dark on July 25 ; faint on July 30 and 31 ; dark on August 5 ; faint on August 6 ;

* *Mars Reports* from 1896 and after.

† It is also visible at a glance on the beautiful 1907 photographs of Dr. Lowell. On the first drawing made by MM. Jarry-Desloges and Fournier at the Revard, *Pambotis Lacus* is as dark and large as *Trivium Charontis*.

dark on August 10, 11, 23, 25; faint on August 29; and very dark on September 8 and 9.

STYGIA PALUS was suspected as a faintish dot by the Director on September 9.

HECATES LACUS can be seen on Cobham's drawing of July 25 as a dusky condensation.

MORPHEOS LACUS is recognisable on Eddie's sketch of June 21. A faint shading near N. limb.

SINTIUS LACUS was mentioned as seen by Eddie on July 31, under $\omega = 233°$, and described as a "dark marking" in the position of this "lake," but "apparently larger than this *Lacus* " is generally depicted."

PHLEGRA is shaded by Buchanan, Cobham, Eddie, and Shearer.*

CEBRENIA appears also dusky on the views of Buchanan, Cobham, Eddie, and Givin.

ÆTHERIA, shaded by Buchanan and Cobham, is shown brighter by Eddie.

STREAKS AND MINOR DETAIL.

ÆTHIOPS.—Dobbie: July 13, 5° wide, diffuse, to S. only.—Eddie: July 29 and 30, 4° wide, to S. only.—The Director: September 8, 2° wide, faint, to S. only.

ANTÆUS.—The Director: September 8, 3° wide, very faint.

BOREAS.—Buchanan: July 31, 12° wide, diffuse.—Shearer: July 23, S. edge of N. shades.

CERBERUS I.—Buchanan: July 30, 31 (Fig. 10), 8° wide, dark.—Cobham: July 25, 6° wide, dark, "easily seen," edge of bright *Elysium*.—Dobbie: August 27, invisible.—Eddie: June 20, 21, 22, 4° or 5° wide, intense; July 29, 30, uncertain.—Givin; July 15, 6° wide, dark; 23 do.; August 23 (Fig. 11) and 25, invisible; 29, diffuse and very broad.—Nangle: June 21, 2° or 3° wide, very dark; July 14, 3° wide, diffuse.—Shearer: July 20, faint; 23, 10° wide, very dark and diffuse.—Tornquist: July 5, 6, August 10, 11, a 6° wide, very dark, streak.—The Director: September 7, 8, 9, 5° wide, dark streak, as far as *Pambotis Lacus*, which is invisible.†

CERBERUS II.—The Director: September 8, 3° wide, faint.

CHAOS.—Buchanan: July 30, 31, 10° wide, dark.—Shearer: July 20, 23, edge of shaded *Cebrenia*.

CYCLOPS.—Buchanan: July 30, 6° wide, knotted, irregular; 31, 8° wide, diffuse.—Cobham: July 25, 3° wide, faint, "easily seen."—Eddie: June 20, 21, 22, 3° wide, dark, irregular, and tapering to N.; July 29 and 30 (Fig. 8), do.—Nangle: July 14, 3° wide, very diffuse.—The Director: September 7, 8, and 9, 5° wide, dark.

EUNOSTOS.—Buchanan: July 26, 12° wide, suspected; July 30, 31, 8° wide, irregular, dark.—Cobham: July 25, 4° wide, diffuse, "easily seen," edge of bright *Elysium*.—Tornquist: July 5, 6, 4° wide, faintish.—The Director: September 7, 8, 4° wide, faint.

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* The shading here was photographed by Dr. Lowell in 1907.

† *Cerberus* is dark on the Lowell photographs.

HADES.—Shearer : July 20, 23, edge of shaded *Phlegra*.

HYBLÆUS.—Buchanan : July 30, 7° wide, edge of bright *Elysium*.—Dobbie : July 15, 7° wide to S.W., intense, narrowing to N.E.—Nangle : July 14, 4° wide, diffuse.—Tornquist : July 5, 3° narrow, faint.

LÆSTRYGON.—Eddie : July 30, 4° wide to S. only ; August 5, 5° wide, dark, irregular, whole streak seen.—The Director : September 8 and 9, 3° wide, faint.

MARSYAS.—Buchanan : July 28, 5° wide, dark.

ORCUS.—Buchanan : July 31, 7° wide, darkish.—Cobham : July 25, 26, 4° wide, intensified edge of shaded *Amazonis*.

PACTOLUS.—Buchanan : July 28, 8° wide, irregular, diffused.—Nangle : July 14, 4° wide, diffuse.—Tornquist : July 5, 5° wide, a detached part only under *Syrtis Parva*.—The Director : September 8, 3° wide, faint.

STYX.—Buchanan : July 30, 31, 6° wide, darkish.—Cobham : July 25, 26, 6° wide, dark, "easily seen," edge of bright *Elysium* and dusky *Phlegra*.—Shearer : July 30, faint ; 23, 10° wide, very dark.—Tornquist : July 5, 6, 4° wide, faint ; August 11, 8° wide, darker at edges, very dark indeed.—The Director : September 8, 7° wide, dusky.*

NEW STREAK.

NEREIS.—Seen by Buchanan on July 31 to sever *Atlantis* from "continent" to N.W., and christened by the Director.

SECTION VI.

Syrtis Major.

$\Omega = 250°$ to $310°$; $\Phi = +60°$ to $-60°$.

MARE TYRRHENUM showed its usual form in 1907, according to Buchanan, Dobbie, Eddie (Plate III., 8), Nangle, Shearer, Tornquist, and the Director (Plate III., 7). Cobham and Givin drew it united with *Mare Cimmerium*, through the invisibility of *Hesperia*. Buchanan represents some indentations along the N.E. edges of this "sea," whose colour was blue green, according to Eddie. The intensity of *Mare Tyrrhenum*, as given by the above Members, seems to have undergone the following variations : it was faint on June 8 ; dark on June 19 and 20 ; faintish to E. on June 21, 22 ; faintish on June 24, 26 ; normal on July 5 ; faint on July 6 ; faintish on July 11 ; dark to E. on July 13 ; darkish on July 14, 15, 22 ; dark to E., faint to W., on July 25 ; faint, especially to W., on July 26 ; dark, save to W., on July 28 ; faintish on July 30 ; darkish on August 6 and 17 ; faintish on August 18 ; darkish to E. on September 7 ; faintish to E., at least, on September 8 and 9. The faintness to W., seen by Buchanan towards the close of July, seems to have been almost certainly due to cloud. No doubt, the great extension of *Mare Tyrrhenum* renders it, like *Mare Cimmerium*, particularly liable to partial hazy obliterations.

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* *Styx* also is visible on the 1907 photographs of Dr. Lowell.

SYRTIS MINOR appears as a deep dark notch on the "continent" on Buchanan's sketch of July 25 (Plate III., 9), and on Cobham's, Eddie's (Plate III., 8), Givin's, Hoskins's, Shearer's, and the Director's drawings. Dobbie, Nangle, and Tornquist represent the point much more blunted. From the drawings of these Members we gather that *Syrtis Parva* appeared faint on June 8 ; darkish on June 19, 20, 21, 22, 26 ; faint on June 28 ; dark on July 5 ; faint on July 6 ; dark on July 13, 14, 15 ; faintish on July 16 and 21 ; dark on July 22, 23, 24, 25 ; very faint on July 26 ; dark on July 27 ; faintish on July 28, 29, August 1 ; darkish on August 15 and 17 ; very faint on August 27 ; and faintish on September 7.

AUSONIA is confuse and dusky on all the drawings showing it by Buchanan, Cobham, Dobbie, Eddie, Givin, Hoskins, Nangle, Shearer, Tornquist, and by the Director. Eddie, however, has traced it less dimly on *Mare Tyrrhenum*. The Director found it brightish on September 7.

Ausonia was probably white on terminator to Eddie on August 4, while its S. part seemed also somewhat bright to Givin on August 17, under $\omega = 295^{\circ}$.

CHERSONESUS could be seen somewhat defined only by Eddie on June 19.

HADRIACUM MARE underwent considerable modifications in tone in 1907. The joint results of Buchanan, Cobham, Dobbie, Eddie, Givin, Hoskins, Nangle, and Tornquist establish that it was very faint on June 4 and 8 ; faint on June 15 ; very faint on June 19 ; invisible on June 20, 26, and 28 ; very faint on July 5 ; faint on July 7, 8, 11 ; invisible on July 12, 13 ; faint on July 14, 15 ; very faint on July 19, 20, 21, 22, 23, 24 ; almost invisible on July 25 and 26 ; totally invisible on July 29, August 6 and 10 ; and normally dark on August 15, 17, and 18. There can, therefore, be no doubt that this *Mare* was very strongly obliterated by haze from June 4 to August 10 ; and that it resumed its normal intensity later.

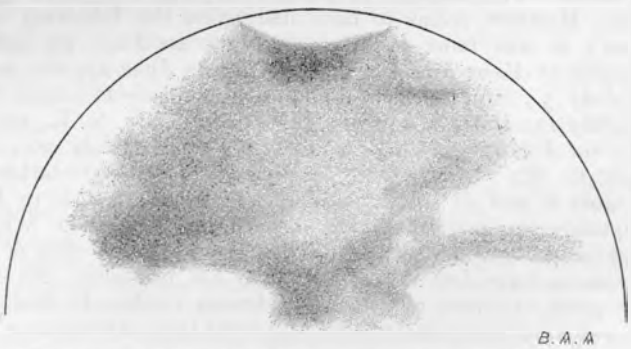

FIG. 12.—The "Island" of *Hellas* rendered invisible by haze on 1907, July 22, $\omega = 293^{\circ}$, after Buchanan.

HELLAS, also veiled by haze as a rule in 1907 (Plate III., 8, 9, and 11), appeared confusedly round and dusky to most observers. Its visibility depended to a large extent on that of *Mare Hadriacum*. Hence it may be practically studied on the foregoing enquiry on the intensity of that "sea." A representative view of the confuse state of *Hellas* in 1907 is subjoined on Fig. 12, and this was a very striking feature of the apparition.

The brightening of *Hellas* with obliquity also underwent great changes in 1907, as may be gleaned from the following table :—

Date.	ω	Appearance of *Hellas*.	Observer.
1907 :	°		
June 4	335	Not bright	Nangle.
„ 12	230	do.	Eddie.
„ 19	268	do.	do.
„ 20	248	do.	do.
„ 21	236	Faintly whitish	do.
„ 24	312	Bright	Tornquist.
July 5	229	Dusky	do.
„ 5	337	do.	Givin.
„ 5	351	do.	Nangle.
„ 6	241	do.	Tornquist.
„ 7	318	do.	Cobham.
„ 11	302	Not very bright	Dobbie.
„ 14	254	Not bright	Nangle.
„ 15	251	do.	Givin.
„ 15	274	Dusky	Dobbie.
„ 15	348	do.	Buchanan.
„ 16	339	do.	do.
„ 17	342	do.	do.
„ 19	336	*Hellas* "bright"	Eddie.
„ 21	236	"Glare . . . . ,as brilliant as S. polar cap."	do.
„ 25	263	Very dusky	Buchanan.
„ 26	261	do.	do.
„ 27	269	Not bright	Eddie.
„ 28	251	Dusky	Buchanan.
„ 28	312	do.	Tornquist.
„ 29	245	Not bright	Eddie.
„ 31	233	"Glare around S.E. periphery"	do.
Aug. 7	266	Lightish	Tornquist.
„ 10	342	Dusky	Cobham.
„ 14	355	do.	Givin.
„ 15	358	do.	Cobham.
„ 17	326	A little whitish	Givin.
„ 18	271	Whitish	do.
„ 31	301	"Bright and well seen"	Eddie.

Hellas further appeared whitish on C.M. to Givin on August 17, to Hoskins on July 11 (Plate III., 10), and to Nangle on June 8.

YAONIS REGIO is vaguely drawn by Eddie on June 15, July 22, 23, and 24.

LUNÆ PONS, smudgy to Buchanan, was easily seen by Hoskins on July 15. Cobham found it confuse on July 7 and 8, invisible later.

SOLIS PONS is faintly represented by Dobbie on July 13.

IAPYGIA is dimly defined on Buchanan's, Cobham's, and Eddie's delineation.

ŒNOTRIA was generally bright in 1907. Confuse to Buchanan, it was seen narrow, whitish, and sharply defined by Cobham on July 8. Dobbie glimpsed it faintly on July 15, Eddie on June 15 and July 27. On July 22 the Grahamstown observer saw "*Syrtis Major* very much lighter in region of *Œnotria*"; Givin found it always very bright and united to *Aeria* in July (Fig. 13)

FIG. 13.—*Syrtis Major*, *Œnotria*, and *Lacus Mœris*, as seen by Dr. Givin on 1907, July 13.

and August—a capital result*; while Hoskins also saw it faintly on July 11 and 15.

SYRTIS MAJOR showed Lowell's form to Buchanan, Cobham, Dobbie, Eddie (Fig. 14), and Givin. Hoskins (Plate III., 10), Nangle, Shearer (Plate III., 11), and Tornquist drew it more V-shaped and less bulging out about *Mœris Lacus*. As in 1905,† the swelling to E. was very marked at this apparition, and its existence was placed beyond doubt by photography.‡ Hence *Syrtis Major* had not, ever since 1894,§ the form drawn by Dawes in 1864.‖

This E. convexity of the most conspicuous dark area of Mars during the last seven apparitions will be the great Martian enigma of the future.

The extensive dusky area did not seem sharply pointed, but rounded somehow to N., and it was invaded to W. by a large "cape" from *Aeria*, according to Buchanan (Plate III., 9), Cobham, Dobbie, Givin, Hoskins (Plate III., 10), Nangle, and Shearer (Plate III., 11).

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* This was fully recognized by MM. Jarry-Desloges and Fournier at the time (*Obs. Surf. Plan.*).

† See *Mars Report* for that year, p. 54.

‡ According to the Lowell photographs, the E. protuberance of *Syrtis Major* was almost as pronounced in 1907 as it was in 1905.

§ *Mars Reports* from 1894 to 1905.

‖ Flammarion, *Mars*, Vol. I., p. 187, Fig. 120, 1 and 2.

Probably, *Syrtis Major* was the darkest area of Mars in 1907, being most intense at the N. end.* Under good definition, it appeared to Eddie's $9\frac{1}{4}$-in. "much mottled and showing differential "depths of tint." A dark streak, shown on the Chart, was observed by Cobham to run from the "bay" about *Lacus Mœris* to S.W., as far as *Iapygia*.

The E. edge appeared sometimes jagged to Buchanan (Plate III., 10), and it was fainter than the W. one, according to the same observer, and Cobham, Eddie, Givin, Hoskins, Nangle, Shearer, and Tornquist. From the combined data of all the Members of the Section, except those of Beattie and the Director, it appears that *Syrtis Major* was dark on June 4, 8, 12, and 15;

FIG. 14.—*Syrtis Major*, *Mœris Lacus*, and *Nix Atlantica*, as observed by Major Eddie on 1907, July 24, $\omega = 289°$.

faintish on June 19; dark on June 20, 21, 24; faintish or faint on June 26 and 28; dark on July 5; very dark on July 7 and 8; faintish perhaps on July 11; dark on July 12, 13, 14, and 15; faintish on July 16; dark on July 19; faintish on July 20; dark to centre only, faintish all round on July 21; dark to S.E. only, faintish in other parts on July 22; faintish on July 23; dark on July 24 and 25; faintish on July 26; very dark on July 27; dark on July 28, 29, and August 6; and faint on August 10, 15, 17, and 18. From these results we gather that the great "sea" was seen practically free from haze early in June; also from June 20 to 24; from July 5 to 8; from July 11 to 15; from July 24 to 25; and from July 27 to 29, and on August 6; that it was locally obliterated from July 21 to 22; and that its intensity was checked by haze in mid-August.

NILI SINUS, the name now given to the N. end of *Syrtis Major*, is generally shown blunted by the Members of the Section. As before stated, this was the darkest area of the *Mare*. Writing on June 13, Eddie says: "N. extremity of "*Syrtis Major* very dark, like dark extremity" of *Sinus Furcosus*.

* On a photograph of Dr. Lowell's in 1907 the *Syrtis Major* appears dark in its N. half, fainter to S.

TYPHONII SINUS, or "inlet" of the *Typhonius*, was sharply glimpsed by Cobham on August 15, and was an easy feature to Eddie (Fig. 14), who writes that often there was a "marked "hump on W. border, where *Typhonius* originates," and that on July 23, $\omega = 297°$, the "excrescence on W. border of *Syrtis* "*Major*, where *Typhonius* originates, could be traced farther "than previously."

ASTABORÆ SINUS, or the estuary of the homonymous streak, was seen by Buchanan, Cobham, Eddie (Fig. 14), and Hoskins.

DELTOTON SINUS bulges slightly on *Aeria* on Buchanan's, Cobham's, Eddie's (Fig. 14), Givin's (Fig. 13), and Nangle's drawings. It was generally a little lighter than the *Syrtis Major*.

MŒRIDIS SINUS, or the "bight" of the great "sea" towards *Lacus Mœris*, is recognisable as a more or less shallow indentation of the "coast" on Buchanan's (Plate III., 9), Cobham's, Dobbie's, Eddie's, Givin's, Nangle's, Shearer's, and Tornquist's drawings.

MŒRIS LACUS, or the "inland lake" itself, was represented as a faint, dusky shading by Cobham on July 7 and 8, and by Eddie on July 23, 24 (Fig. 14), and 29 (Plate III., 8), when it measured 6° in length and 4° in breadth, being, moreover, connected with the *Syrtis* by a short, dusky streak. On June 19 Eddie "glimpsed" this "lake," and "as if jutting into *Libya*." On July 23 it was "very marked." Notwithstanding the modesty of his aperture, Givin, with remarkable ability, saw *Mœris Lacus* on July 13 (Fig. 13) and on August 18 as a round, faint, dusky spot, 8° across, and separated from *Syrtis Major* by its diameter.*

Thus, after eluding the attention of observers since 1894,† *Mœris Lacus* has reappeared under substantially the same form it had in the past. Could cloud have hidden it during five successive apparitions ?

LIBYA, generally arched to S., according to Buchanan, Cobham, Givin, Hoskins, Nangle, Shearer, and Tornquist, presented the *Abyssinia* lobe to Dobbie and Eddie. This country looked bright in 1907 to all these observers—a probable effect of haze.

The observations of *Libya* by Eddie are of extraordinary interest. On June 19, under $\omega = 268°$, he found the region "bright." On June 20, $\omega = 246$, it was "very bright, the "brightest region on Mars, excepting, of course, the snow cap." On July 23, $\omega = 297°$, it was "bright"; on July 24, $\omega = 289°$, "very "bright." But a remarkable phenomenon was witnessed by our South African co-worker on July 29, $\omega = 245°$ (Plate III., 8). He says: "Marvellous glare or brilliancy on *Libya*, the whole "land shining with a brilliant yellow glow, almost more con-"spicuous than the S. polar cap . . . . This glowing land,

* *Mœris Lacus* appears on Dr. Lowell's photographs of July 11 as an extensive grey marking of great faintness.

† *Mars Reports* from 1896 to 1905.

" *Libya* [attracted] the observer's notice immediately the eye " was placed at the eye-piece. I have never before noted any- " thing so sudden in its enhanced appearance, for no record had " been made of any excessive brillancy on Saturday, 27th July. " I had noticed and recorded on Tuesday and Wednesday last a " brightness in this neighbourhood, but nothing abnormal." And " the *Libya* brilliant region was about $\frac{1}{6}$ to $\frac{1}{7}$ of the polar diameter. " It resembled polished brass, with the brightest lustre in " the centre of a nearly circular form, and as if it were convex. " I watched it till $9^h\ 15^m$ p.m., $\omega = 261°$, but though nearing " the C.M. it still retained its lustre and abnormally conspicuous " appearance " (Plate III., 8).* On July 30, $\omega = 235°$, " as *Libya* " advanced on the disc . . . . . the brilliancy noted in this " region last evening was still visible." But on August 31, $\omega = 301°$, *Libya* was " not conspicuous."

Nothing but brilliant yellowish cloud can account for this truly unique appearance, which shows that sudden changes and great movements are by no means impossible in the atmosphere of Mars near perihelion.

NIX ATLANTICA was very probably rediscovered on July 24 by Eddie, whose admirable observations of 1907 raise him to the rank of the foremost areographers. Under $\omega = 289°$, and a definition improved by " slight cirrus haze," he detected a " small " bright spot below *Mœris Lacus*, seen for first time " (Fig. 14). The position of this spot, 2 of our Chart, whose greatest size did not exceed 80 miles, agrees very closely with Schiaparelli's *Nix Atlantica*, so that the identity is rendered highly probable. *Nix Atlantica* was discovered by Schiaparelli in 1877, when its breadth subtended 8°, and its form was square. He again saw it in 1879, when it seemed to be round, with a diameter of 8°. In 1881–1882 the marking was still there, but not always visible. Since then it was not seen† until 1898, when Molesworth drew a white spot in the same position.‡ But these various observations, ranging, as they do, over five oppositions, tend to establish the permanent character of the marking ; and it is not improbable that *Nix Atlantica* may be a group of equatorial snow-cloud, and often cloud-girt, mountains, like Kilimanjaro on the Earth.

The yellow atmospheric material may now and then swamp it into invisibility.

ISIDIS REGIO appears bright on Buchanan's and Cobham's drawings.

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* M. Jarry-Desloges, observing on the same evening from Mt. Revard, wrote : " One sees *Libya* extraordinarily brilliant on the centre of the disc. " It is much more brilliant than the polar spot. This region darkens " quickly, no doubt owing to rotation, and becomes almost invisible towards " the close of the evening " (*Obs. Surf. Plan.*, Vol. I., p. 16). Such close agreement between the observations in South Africa and France gives great credit to both observers.

† Schiaparelli, in Flammarion, *Mars*, Vol. I., p. 441. It was claimed that this tiny white spot was seen clearly between 1890 and 1894 at Barcelona with a 4¼-in., when the largest telescopes, including the 36-in. Lick, did not show any traces of it.

‡ *Mars Report* for 1898–1899, p. 97.

NILI PONS, invisible to Buchanan and Eddie, is drawn confuse by Cobham, Dobbie, and Nangle, but bright by Tornquist.

MEROE seemed bright to Buchanan and Cobham.

COLOE PALUS looks like a darkish condensation on Cobham's sketch of July 7, on that of Hoskins of July 11 (Plate III., 10), and on the drawing by Tornquist of June 26. It was generally confuse to Givin in the N. shades.

NEITH REGIO was dusky to N.W., after Cobham, Dobbie, Givin, and Shearer.

NUBIS LACUS was drawn confusedly by Cobham as a dusky knot on August 17. Other Members represent it merely as the apex of the *Casius* shadings.

UTOPIA is shaded by Buchanan, Cobham, Dobbie, Eddie, Givin, Nangle, Shearer (Plate III., 11), and Tornquist.*

STREAKS AND MINOR DETAIL.

ALCYONIUS.—Dobbie: July 13, 15, edge of shaded *Utopia*.—Hoskins: July 15, do.

AMENTHES.—Buchanan: July 26, 12° wide to S., dark, tapering and invisible to N.: 28, complete, 9° wide.—Cobham: August 17, 3° wide, diffuse, "no doubt about *Amenthes*."—Eddie: June 21, 3° wide, slightly winding, intense, though diffuse.

ASCLEPIUS.—Cobham: August 15, 3½° wide, dark.—Dobbie: July 13, edge of shade to N.W.—Givin: August 18, very faint edge of shaded *Neith Regio*.—Hoskins: July 15, do.—Shearer: July 15, do.

ASTABORAS.—Buchanan: July 21, near the "estuary" only, 4° wide, very faint.—Cobham: August 17, 2½° wide, to S.E. only, "certain," though diffused.

ATHYR.—Eddie: June 19, 3° wide, faint, to S. only.

CASIUS.—Buchanan: July 22, 10° wide generally, dark.—Dobbie: July 13, 15, edge of shade to N.E., at *Utopia*.—Eddie: June 27, July 9. 5° wide, convex to N.E.—Givin: July, 12, 13, 15, 12° wide, irregular, edge of *Utopia* shades.—Hoskins: July 11 invisible; 15, dark edge of *Utopia* dusky area.—Nangle: July 14, 4° wide, diffused.—Shearer: July 13, faint.—Tornquist: June 28, a 3° wide, faint, streak.

EURIPUS.—Buchanan: July 30, 12° wide, dark.—Eddie: June 20, 5° wide, faint and diffuse.

HELICONIUS.—Buchanan: July 22, 10° wide, dark.

NILOSYRTIS.—Buchanan: July 22, 8° wide, convex to N.E., dark.—Cobham: July 7, beginning to N.E. of *Nili Sinus*, 4° wide, curved, fairly dark, "conspicuous": July 8, August 10, 15, 17, beginning at the bottom of the *Syrtis*, generally 4° wide, convex to N.E., conspicuous.—Dobbie: July 11, invisible: 13, 15, convex to N.E., 5° wide, edge of shade to N.E., and starting distinctly to the N.E. of *Nili Sinus*.—Eddie: June 15, July 19,

* An eloquent instance of the evils of eye-strain and of the use of high magnification is afforded us by Schiaparelli and Lowell, who have both missed the dark *Utopia* shadings without resolving them into a network of "canals." An exhausted eye is blind to half-tones, and seems particularly prone to be deceived by subjective straight lines. The *Utopia* shading is quite conspicuous on the Flagstaff photographs; and if we recollect that it was discovered by Hooke in 1666, how can we avoid the conclusion that, in the representation of delicate shades, the Milan and Flagstaff charts of Mars are inferior to the rudest drawings obtained with the most primitive means?

20, 23, and 24, 5° wide, angular, dark.—Givin: July 13, August 15, 17, and 18, 3° wide, convex to N.E., faint, edge of *Neith Regio*.—Hoskins: July 11, invisible; 15, 3° wide to S., dark, then becomes mere edge of *Utopia* shadings.—Nangle: July 14, 5° wide, convex to N.E., dark.—Shearer: July 13, edge of shade to N.E.—Tornquist: June 26 and 28, 3° wide, convex to N.E., dark and conspicuous.*

TRITON.—Eddie: June 19, 21, edge of *Hesperia* shading.—Givin. 13, 15, August 18, do.

NEW STREAK.

ERIS.—Seen by Buchanan between *Æthiops* and *Amenthes*, and named by the Director.

SECTION VII.

The South Polar Region.

$\Omega = 0°$ to $360°$; $\Phi = -60°$ to $-90°$.

As a consequence of the insufficiency of the tilt of the axis, and of the large extent of the snows, it was not possible in 1907 satisfactorily to scrutinise the surface of the planet beyond the 60th degree of S. latitude.

MARE AUSTRALE is shown grey by almost all Members, and darker, by contrast near the polar snows. According to Eddie, it was notching the outline of the cap in approximate $\Omega = 10°$, 53°, 80°, 210°, and 330°, and in mean $\Phi = -76°$.

ARGYRE II. was not seen. But the dark notches at $\Omega = 53°$ and $\Omega = 80$ would seem to indicate that, as recognised by Prof. Campbell,† the retreating snows melted, or evaporated, move quickly on either side of this invisible "island" than over its surface.

THYLE I. and *THYLE II.* may be fairly recognised on Eddie's drawings of June 20 and 22. The former "island" is further shown as a lighter part of *Mare Australe* by Buchanan on August 7; *Thyle II.* in the same way on July 25. On August 11 Eddie saw a small snow mass over *Thyle I.*‡, and on August 9 possibly another one over *Thyle II.*

ULYXIS FRETUM is depicted to S. as the dark indentation of the cap towards $\Omega = 210°$, by Eddie on August 5. Here also the snows vanished first on the dark material.

PROMETHEI SINUS appears as an intense dark spot on Buchanan's fine sketch of July 25 (Plate III., 10).

NOVISSIMA THYLE was not seen, being, like *Argyre II.*, at the edge of the cap in July. But the notch on the snows detected by Eddie towards $\Omega = 330°$, corresponds to the *Mare* beyond its *f* "coast"; and this furnishes one more proof of the veracity of the principle established by Prof. Campbell.

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* *Nilosyrtis* was also successfully photographed by Dr. Lowell.

† *Publ. Astr. Soc. Pacific*, Vol. VII., p. 40 *sqq*.

‡ See p. 103.

DEPRESSIO HELLESPONTICA is the name given by the Director to a large dark spot in the *Mare Australe*, at the S. end of *Hellespontus*. This marking is not new.* On his drawing of July 17, Buchanan shows here a very dusky shading, which he calls "dark" (Fig. 15). Above this, Eddie depicts his inlet, on the snow border, towards $\Omega = 330°$. On June 15, the South African observer found the "indentation on snow cap

FIG. 15.—*Depressio Hellespontica* and *Hellespontus*, as drawn by Buchanan on 1907, July 17, $\omega = 342°$.

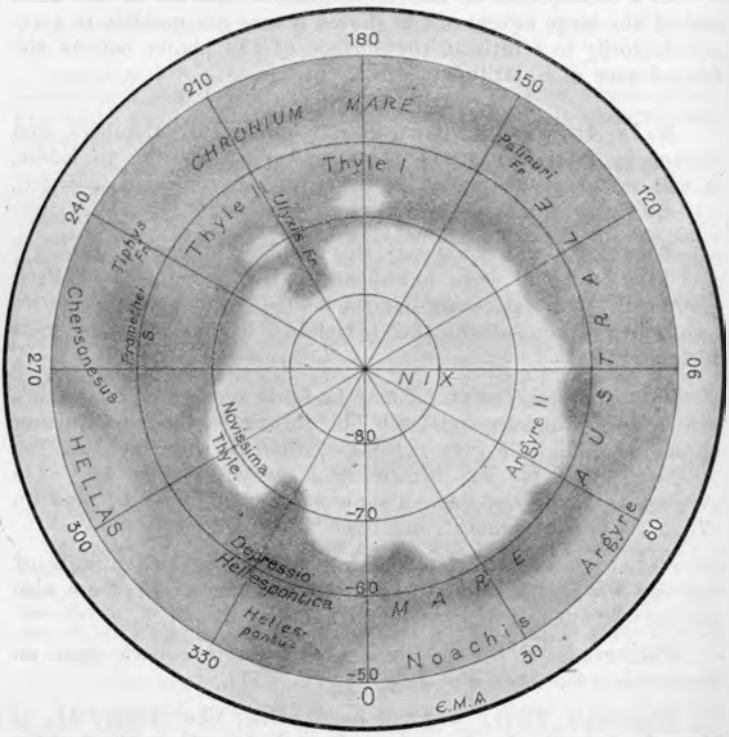


FIG. 16.—A stereographic projection of the regions about the South Polar Snow Cap, as recorded by the Section in 1907.

* It can be identified already on Schröter's sketch of 1798, September 3 and 4 (Flammarion, *Mars*, Vol. I., p. 74, Fig. 41). In 1892 Prof. Hussey saw it well (*Publ. Astr. Soc. Pacific*, Vol. V., No. 30, Plate H_2), and it was also noted by the Director in 1894 (*Mars Report* for 1894, Plate IV., Fig. 21).

" very dark where *Hellespontus* appears to originate, giving the " appearance of *Hellespontus* being a channel by which the " liquefied matter from snow cap is conducted northward." Again, on July 22, " very dark [spot] on border of S. polar " cap where *Hellespontus* bounds it and in locality of indenta- " tion." *Depressio Hellespontica* was dusky to Given. Hoskins shows it dark on July 4, 10 (Fig. 3), and 11 (Plate III., 10); Nangle very dark on June 4 and 8, less so on July 5 (Plate III., 12). It was also dark to Shearer on July 13.

Fig. 16 will help to study the appearance of the S. polar regions during the apparition.

THE SOUTH POLAR SNOW CAP.

THE DARK POLAR BAND round the snows was seen by the great majority of the Members of the Section. Eddie often found "a thin dark margin" girding the cap; and this was occasionally visible on one side of the snows, and towards the *Depressio Hellespontica* indentation.

EXCENTRICITY OF THE CAP.—The S. snows were, as usual, excentric in 1907. Eddie's drawings seem to place their centre in the rough position of $\Omega = 45°$, $\Phi = -84°$. When *Mare Cimmerium* was on the disc, the cap was very narrow on C.M.

INDENTATIONS IN THE OUTLINE OF THE SNOWS.—According to the Grahamstown observer, the limits of the cap appeared often jagged and irregular. Of the five indentations seen here, mention has already been made above.*

FIG. 17.—June 15, $\omega = 298°$.

FIG. 18.—July 12, $\omega = 60°$.

FIG. 19.—August 5. $\omega = 180°$.

Irregularities and notches in the outline of the Southern Snows in 1907, after Major Eddie.

Figs. 17, 18, and 19 show the appearance of these irregularities.

DETACHED SNOW MASSES were also observed by Eddie. Thus on August 9, $\omega = 152°$, he found "a bright white spot on W. [*f*], as if a piece of the frozen matter had become detached." Again, on August 11, $\omega = 130°$, he saw a "bright white patch " to W. [*f*] of similar appearance to the snow cap." This covered the S. part of *Thyle I.*†

* *See* pp. 101, 102.

† A hooked extension of the snows over *Thyle I.* was seen by Prof. Hussey on 1892, August 7, at Lick (*Publ. Astr. Soc. Pacific*, Vol. V., Plate H_2, No. 1).

DIMINUTION IN AREA OF THE SOUTH CAP.—The snows shrank as follows in 1907 :—

In this table, α is the areocentric arc subtended by the cap; and d the number of days preceding the summer solstice of the S. hemisphere :—

Date.	ω	α	d	Observer.	Date.	ω	α	d	Observer.
1907.	°	°			1907.	°	°		
June 4	355	42	−145	Nangle.	July 11	302	20	−108	Dobbie.
„ 8	280	42	−141	do.	„ 11	46	52	−108	Buchanan.
„ 12	330	44	−137	Eddie.	„ 11	53	56	−108	do.
„ 15	298	42	−134	do.	„ 12	288	42	−107	Givin.
„ 19	268	38	−130	do.	„ 12	60	45	−107	Eddie.
„ 20	248	44	−129	do.	„ 13	277	36	−106	Givin.
„ 21	175	46	−128	Nangle.	„ 13	277	28	−106	Dobbie.
„ 21	236	42	−128	Eddie.	„ 13	286	41	−106	Shearer.
„ 22	229	36	−127	do.	„ 13	313	42	−106	do.
„ 24	312	42	−125	Tornquist.	„ 13	25	50	−106	Buchanan.
„ 26	287	60	−123	do.	„ 14	254	39	−105	Nangle.
„ 26	93	51	−123	Hoskins.	„ 14	23	41	−105	Buchanan.
„ 26	96	42	−123	Nangle.	„ 14	43	45	−105	Eddie.
„ 27	59	55	−122	Cobham.	„ 15	251	30	−104	Givin.
„ 28	270	48	−121	Tornquist.	„ 15	259	—	−104	Dobbie.
„ 28	57	55	−121	Hoskins.	„ 15	270	41	−104	Hoskins.
„ 29	43	49	−120	Nangle.	„ 15	348	29	−104	Buchanan.
„ 29	43	52	−120	Givin.	„ 16	110	48	−103	Tornquist
„ 29	165	38	−120	Eddie.	„ 16	339	27	−103	Buchanan
„ 30	157	36	−119	do.	„ 16	23	43	−103	Eddie.
July 1	38	55	−118	Hoskins.	„ 17	342	36	−102	Buchanan
„ 1	148	39	−118	Eddie.	„ 18	93	44	−101	Tornquist.
„ 2	55	43	−117	Beattie.	„ 19	330	38	−100	Eddie.
„ 3	3	46	−116	Givin.	„ 20	212	45	− 99	Shearer.
„ 3	9	55	−116	Cobham.	„ 20	307	40	− 99	Eddie.
„ 3	16	36	−116	Dobbie.	„ 21	299	35	− 98	Buchanan.
„ 4	357	55	−115	Hoskins.	„ 22	293	27	− 97	do.
„ 5	229	52	−114	Tornquist.	„ 23	10	50	− 96	Tornquist.
„ 5	337	40	−114	Givin.	„ 23	183	30	− 96	Givin.
„ 5	351	49	−114	Nangle.	„ 23	196	36	− 96	Shearer.
„ 5	111	46	−114	Eddie.	„ 23	296	44	− 96	Eddie.
„ 6	241	49	−113	Tornquist.	„ 24	289	45	− 95	do.
„ 7	318	45	−112	Cobham.	„ 25	8	44	− 94	Tornquist.
„ 8	314	53	−111	do.	„ 25	156	26	− 94	Givin.
„ 10	329	40	−109	Hoskins.	„ 25	177	32	− 94	Cobham.
„ 11	291	42	−108	do.	„ 25	195	34	− 94	do.

Date.	ω	α	d	Observer.	Date.	ω	α	d	Observer.
1907.	°	°			1907.	°	°		
July 25	263	26	− 94	Buchanan.	Aug. 11	191	26	− 77	Tornquist.
„ 26	154	31	− 93	Cobham.	„ 14	355	28	− 74	Givin.
„ 26	261	26	− 93	Buchanan.	„ 15	303	31	− 73	Cobham.
„ 27	269	41	− 92	Eddie.	„ 15	305	27	− 73	Givin.
„ 28	251	—	− 91	Buchanan.	„ 15	358	35	− 73	Cobham.
„ 28	318	50	− 91	Tornquist.	„ 17	295	23	− 71	Givin.
„ 29	245	38	− 90	Eddie.	„ 17	278	30	− 71	Cobham.
„ 30	120	30	− 89	Dobbie.	„ 17	307	25	− 71	do.
„ 30	122	28	− 89	Givin.	„ 17	326	23	− 71	Givin.
„ 30	233	18	− 89	Buchanan.	„ 18	271	24	− 70	do.
„ 30	234	30	− 89	Eddie.	„ 20	19	23	− 68	Buchanan.
„ 31	213	—	− 88	Buchanan.	„ 20	38	23	− 68	do.
Aug. 4	87	19	− 84	Dobbie.	„ 23	227	17	− 65	Givin.
„ 5	75	19	− 83	do.	„ 25	212	17	− 63	do.
„ 5	180	32	− 83	Eddie.	„ 27	229	10	− 61	Dobbie.
„ 6	77	44	− 82	Cobham.	„ 29	209	—	− 59	Givin.
„ 6	172	24	− 82	Eddie.	„ 30	163	23	− 58	do.
„ 7	135	30	− 81	Buchanan.	„ 31	153	20	− 57	do.
„ 7	266	—	− 81	Tornquist.	Sept. 1	146	15	− 56	do.
„ 8	26	28	− 80	Givin.	„ 4	117	16	− 53	do.
„ 8	37	36	− 80	Cobham.	„ 7	250	—	− 50	The Director.
„ 10	201	28	− 78	Tornquist.	„ 8	240	11	− 49	do.
„ 10	342	37	− 78	Cobham.	„ 9	231	14	− 48	do.

Fig. 20 gives a graphic representation of the phenomenon; the ordinates corresponding to the dates, the abscissæ to the areocentric arc of the cap. The dotted line unites Eddie's values

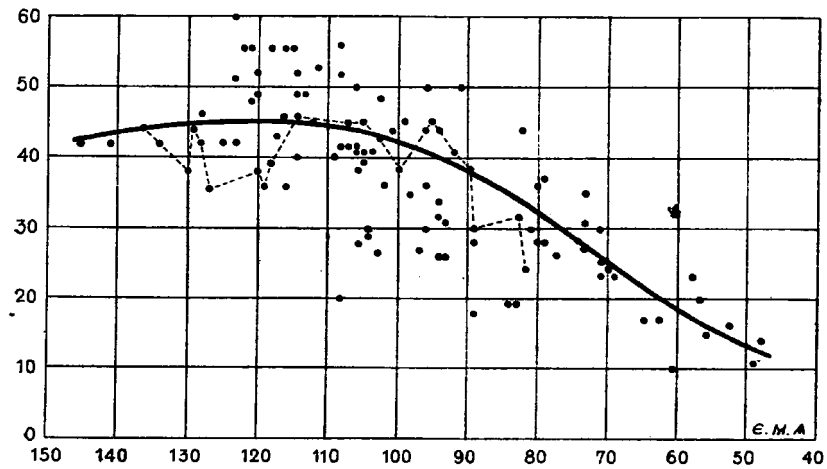


FIG. 20.—Curve illustrating the diminution in size of the South Polar Snow Cap in 1907.

of the diameter of the snow mass. Although the errors of estimation and delineation are large, yet the general result shows that the cap appeared to increase slightly in size during the first month of the observations, and that it diminished very quickly towards the end of July, and especially in August, some 75 days before the solstice.

HAZE ON, OR ABOUT, THE SOUTHERN SNOWS.—The preceding table shows that the S. cap was invisible to Hoskins on July 15, to Buchanan on July 28 and 31, to Tornquist on August 7, to Givin on August 29, and to the Director on September 7. Buchanan found it "very faint" on July 26, and "faint but noticeable" on July 30.

Such phenomena are, of course, due to haze, as shown long ago by the Sectional data. But an observation of great moment was made by Buchanan on July 21, $\omega = 299°$, when the S. cap was described to have been "*yellowish*"; for here we have evidence of the transit of real, *yellow haze*, due probably to sand or dust clouds, over the ice fields.

On July 23, 25, 30, and on August 8, Givin saw a bright streak round the S. snows.

SECTION VIII.

The North Polar Region.

$\Omega = 0°$ to $360°$; $\Phi = +60°$ to $+90°$.

PROJECTION.—Givin noticed "a somewhat conical bright "projection, *apparently* seen on the N.N.E. limb, and the "brightest spot on the disc" on July 15. It had "a dark "collar" to S., and "was associated with (apparent) flattening "of the limb on each side of the point" (Fig. 21). The position

FIG. 21.—Projection seen by Dr. Givin on 1907, July 15, $\omega = 251°$.

of the marking would be somewhere towards $\Omega = 210°$, $\Phi = +80°$. An optical phenomenon, due to irradiation from a bright area.

On the following day Tornquist saw a small white spot in about $\Omega = 80°$, $\Phi = +70°$.

WHITE MATERIAL OVER THE NORTH POLE.—A glare of very variable intensity and visibility often appeared to cover the N. polar regions of the planet in 1907. Subjoined is a complete account of the phenomenon :—

Date.	Particulars of the Glare.	Observer.
1907.		
June 4	Scarcely any brightness.	Nangle.
,, 8	No white spot to N.	do.
,, 12	do.	Eddie.
,, 15	do.	do.
,, 19	"Undefinable" glare	do.
,, 20	No white spot to N.	do.
,, 21	do.	Nangle.
,, 21	do.	Eddie.
,, 22	do.	do.
,, 24	do.	Tornquist.
,, 26	White spot, $\alpha = 43°$	do.
,, 26	No white spot to N.	Hoskins.
,, 26	do.	Nangle.
,, 27	Very faint whiteness to N.	Cobham.
,, 28	No white spot to N.	Tornquist.
,, 28	do.	Hoskins.
,, 29	do.	Nangle.
,, 29	do.	Givin.
,, 29	do.	Eddie.
,, 30	do.	do.
July 1	do.	Hoskins.
,, 1	do.	Eddie.
,, 2	do.	Beattie.
,, 3	do.	Givin.
,, 3	do.	Cobham.
,, 3	do.	Dobbie.
,, 4	do.	Hoskins.
,, 5	do.	Tornquist.
,, 5	do.	Givin.
,, 5	Faint shimmer, $\alpha = 35°$.	Nangle.
,, 5	"Undefined" great glare.	Eddie.
,, 6	No white spot to N.	Tornquist.
,, 7	Faint glimmer, $\alpha = 43°$.	Cobham.
,, 7	$\omega = 100°$. Glare "nearly absent."	Eddie.
,, 8	Rather bright, $\alpha = 36°$.	Cobham.
,, 9	$\omega = 83°$. "Bright glare."	Eddie.
,, 10	No white spot to N.	Hoskins.
1907.		
July 11	Bright spot, $\alpha = 28°$	Hoskins.
,, 11	Faint glimmer, $\alpha = 30°$.	Dobbie.
,, 11	Very faint, $\alpha = 38°$	Buchanan.
,, 11	No glare - - -	do.
,, 12	"As bright as S. "cap," $\alpha = 52°$.	Givin.
,, 12	No brightness at all	Eddie.
,, 13	Bright, $\alpha = 46°$	Givin.
,, 13	White spot, $\alpha = 45°$	Dobbie.
,, 13	Faint shimmer, $\alpha = 36°$.	Shearer.
,, 13	Faint, $\alpha = 40°$	do.
,, 13	Very faint, $\alpha = 38°$	Buchanan.
,, 14	White spot, $\alpha = 30°$	Nangle.
,, 14	"Light tint," $\alpha = 28°$.	Buchanan.
,, 14	"Glare at N. pole"	Eddie.
,, 15	Excentric, white, $\alpha = 50°$.	Givin.
,, 15	Not shown - -	Dobbie.
,, 15	Whitish spot, $\alpha = 40°$.	Hoskins.
,, 15	Very faint, $\alpha = 36°$	Buchanan.
,, 16	No white spot to N.	Tornquist.
,, 16	"Very faint white," $\alpha = 40°$.	Buchanan.
,, 16	No whiteness - -	Eddie.
,, 17	"Whitish," $\alpha = 42°$	Buchanan.
,, 18	White spot, $\alpha = 50°$	Tornquist.
,, 19	N. limb bright -	Eddie.
,, 20	Faint, $\alpha = 27°$	Shearer.
,, 20	"N. pole very "bright."	Eddie.
,, 21	"Brighter than S. "cap," $\alpha = 34°$.	Buchanan.
,, 22	Dusky - - -	do.
,, 22	$\omega = 306°$. Glare "completely absent."	Eddie.
,, 23	Nothing at N. pole -	Tornquist.
,, 23	Faint shimmer, $\alpha = 40°$.	Shearer.
,, 23	Bright glare, $\alpha = 43°$.	Givin.
,, 23	"No glare at N." -	Eddie.
,, 24	"Glare reappeared "in N."	do.
,, 25	White spot, $\alpha = 35°$	Tornquist.
,, 25	Bright, $\alpha = 43°$	Givin.

Date.	Particulars of the Glare.	Observer.
1907. July 25	Bright spot, $\alpha = 43°$	Cobham.
„ 25	do. $\alpha = 36°$	do.
„ 25	White, $\alpha = 23°$	Buchanan.
„ 26	Bright spot, $\alpha = 52°$	Cobham.
„ 26	No white spot to N.	Buchanan.
„ 27	do.	Eddie.
„ 28	do.	Buchanan.
„ 28	White spot, $\alpha = 43°$	Tornquist.
„ 29	"Cap was of a "bluish white ". . . and ap- "peared to be "formed of two "semicircular re- "gions" (Fig. 22).*	Eddie.
„ 30	White spot, $\alpha = 40°$	Dobbie.
„ 30	White, $\alpha = 40°$	Givin.
„ 30	Faint glimmer, $\alpha = 44°$.	Buchanan.
„ 30	"Still a conspicuous "object."	Eddie.
„ 31	Faint, $\alpha = 40°$	Buchanan.
„ 31	$\omega = 233°$. "Not so "conspicuous."	Eddie.
Aug. 4	White spot here, $\alpha = 35°$.	Dobbie.
„ 4	$\omega = 204°$. "Glare"	Eddie.
„ 5	White spot, $\alpha = 30°$	Dobbie.
„ 5	"Glare well seen, "surrounded by "dusky marking."	Eddie.
„ 6	Bright spot, $\alpha = 42°$	Cobham.
„ 6	"Glare conspicuous, "surrounded by "faint dark "shade."	Eddie.
„ 7	"Light here," $\alpha = 25°$.	Buchanan.
„ 7	Nothing at N. pole -	Tornquist.
1907. Aug. 8	Whitish mass, $\alpha = 38°$.	Givin.
„ 8	Very bright, $\alpha = 45°$.	Cobham.
„ 10	$\omega = 135°$. "Great "glare."	Eddie.
„ 10	Large white spot, $\alpha = 50°$.	Tornquist.
„ 10	Bright glare, $\alpha = 38°$.	Cobham.
„ 11	White spot, $\alpha = 42°$	Tornquist.
„ 14	Bright mass, $\alpha = 44°$	Givin.
„ 15	Bright spot, $\alpha = 40°$	Cobham.
„ 15	Bright, $\alpha = 43°$	Givin.
„ 15	White glare, $\alpha = 40°$	Cobham.
„ 17	White spot, $\alpha = 38°$	Givin.
„ 17	Whitish spot, $\alpha = 48°$.	Cobham.
„ 17	Bright spot, $\alpha = 42°$	do.
„ 17	Fairly intense still, $\alpha = 34°$.	Givin.
„ 18	do. $\alpha = 34°$	do.
„ 20	No white spot to N.	Buchanan.
„ 20	do.	do.
„ 23	Faintish, $\alpha = 30°$	Givin.
„ 25	Faint, $\alpha = 30°$	do.
„ 27	No white spot to N.	Dobbie.
„ 29	do.	Givin.
„ 30	Faintish, $\alpha = 25°$	do.
„ 31	do. $\alpha = 23°$	do.
Sept. 1	No white spot to N.	do.
„ 4	Exceedingly faint, $\alpha = 22°$.	do.
„ 7	No white spot to N.	The Director.
„ 8	do.	do.
„ 9	do.	do.

* The W. one was brighter than the E.

The value of ω in each of the above observations may be had immediately from the table showing the diminution of the S. polar cap.

Thus we see that, while the N. polar regions appeared practically destitute of shimmers in June, the occasional brightness of the white material on the lower limb was very remarkable

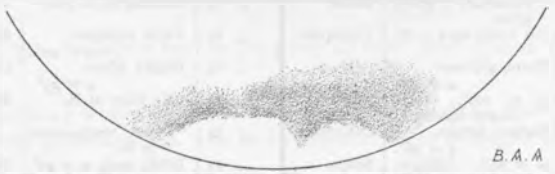


FIG. 22.—Bright glare over the N. polar regions of Mars, on 1907, July 29, after Major Eddie.

in July and August. The visibility of the phenomenon seems largely to depend on the conditions of the Martian atmosphere; and this, whether the glare be due to snow on the surface, now and then veiled by sand dust, or, more probably, to whitish cloud, rapidly forming and dissolving, and also obscured occasionally by the interposition of the yellow element. But, in any case, what is certain is that we are witnessing *rapid atmospheric changes occurring on a large scale*. Among the many instances which establish this, we may consider the phenomena observed between July 20 and 22. Under $\omega = 307^\circ$, on the first day, Eddie sees the N. pole very bright. On July 21, $\omega = 299^\circ$, Buchanan finds the N. shimmers "brighter than the S. cap." But, on the following day, both Buchanan and Eddie, under the respective values of $\omega = 293^\circ$ and $\omega = 306^\circ$, agree in seeing no glare whatever. The sudden change took place over a region at least 1,200 miles long; and as such appearances are easy to detect, we are bound to admit that they are real, and not within the errors of observation.

PART III.

CHART OF MARS IN 1907.

The Chart (Plate I.) at the end of the present Report is, as usual, a combination of the results given in the drawings by the Members of the Section.

The areographical co-ordinates of the centre of the disc, on the various drawings, have been computed from the "Ephemeris " for Physical Observations of Mars," published in the *Nautical Almanac* for 1907; and the transit of the Zero Meridian was found to occur in fair agreement with the data of the ephemeris.

The lists of new "lakes," streaks, and white spots are as follows :—

I.—NEW "LAKES."

Name given by the Director.	Discoverer.	Approximate Position.	
		Ω	Φ
Gygis Lacus	Dobbie	116°	— 12°
Oti Lacus	do.	117	— 3
Minois Lacus	do.	121	— 22
	Eddie		

II.—STREAKY MARKINGS.

Acheron.	*Eumenides.*	*Nectar.*
Æthiops.	*Eunostos.*	*Neudrus.*
Agathodæmon.	*Euphrates.*	*Nilokeras.*
Alcyonius.	*Euripus.*	*Nilosyrtis.*
Amenthes.	*Eurotas.*	*Nilus.*
Antæus.	*Fevos.*	*Oeroe.*
Araxes.	*Fortuna.*	*Orcus.*
Asclepius.	*Ganges.*	*Oxus.*
Astaboras.	*Gehon.*	*Pactolus.*
Athyr.	*Gigas.*	*Phasis.*
Boreas.	*Gorgon.*	*Protonilus.*
Cantabras.	*Hades.*	*Pyriphlegethon.*
Casius.	*Heliconius.*	*Sirenius.*
Ceraunius.	*Hiddekel.*	*Styx.*
Cerberus I.	*Hyblæus.*	*Tartarus.*
Cerberus II.	*Hyscus.*	*Titan.*
Chaos.	*Indus.*	*Tithonius.*
Chrysorrhoas.	*Issedon.*	*Triton.*
Cyclops.	*Jamuna.*	*Typhonius.*
Deuteronilus.	*Læstrygon.*	
Eosphoros.	*Marsyas.*	

NEW STREAKS.

Nereis.—From $\Omega = 180°$, $\Phi = +27°$, to $\Omega = 185°$, $\Phi = +30°$; seen by Buchanan and named by the Director.

Eris.—From $\Omega = 249°$, $\Phi = +2°$, to $\Omega = 258°$, $\Phi = +8°$; seen by Buchanan also, and named by the Director.

This makes a total of 63 streaks, as mentioned on p. 67.

III.—WHITE SPOTS.

No.	Length.	Position.		Observer.
		Ω	Φ	
1	3°	255°	— 6°	Eddie.
2	3	278	+ 12	do.
3	18	347	— 4	Givin.

The dimensions of these spots are given, as usual, in equatorial degrees.

The "lands" which have whitened occasionally under oblique view are indicated by the symbol (*b*) on the Chart.

CHARACTERISTICS OF THE 1907 APPARITION.

A summary of the most striking features of the apparition we have been considering may be given as follows :—

(1) The persistence of the E. convexity of *Syrtis Major*, seen for the last time in 1907;

(2) The reappearance of *Lacus Mœris* as a "lake";

(3) The remarkable appearance of the *Aeria* "promontory" in *Syrtis Major;*

(4) The brightness of *Œnotria;*

(5) The further development, in size and darkness, of *Pambotis Lacus;*

(6) The central dark spot on *Hesperia;*

(7) The darkness of *Depressio Hellespontica;*

(8) The great duskiness of *Icaria*, causing *Mare Sirenum* to appear open to E.

(9) The differential shading of *Mare Sirenum;*

(10) The rediscovery of *Nix Atlantica;*

(11) The existence of a white spot to the N. of *Hesperia;*

(12) The excentricity and irregularities in the outline of the S. polar cap;

(13) The notches in the boundary of the S. cap towards *Argyre II.*, *Ulyxis Fretum*, and W. of *Novissima Thyle;*

(14) The detached snow masses about the S. cap, covering part of *Thyle* "islands";

(15) The frequent evidence of haze or thin cloud, giving rise to the following phenomena:—

(16) The transit of a yellow veil over the S. polar cap;

(17) The obliterations of the S. cap;

(18) The bright glimmers about the N. pole;

(19) The faintness of *Mare Acidalium;*

(20) The veiling of *Hellas* and *Argyre;*

(21) The faintness of *Hadriacum Mare;*

(22) The indistinctness of *Elysium;*

(23) The extraordinary invisibility of *Pandoræ Fretum;*

(24) The narrowness of *Mare Cimmerium* on July 30, when bright golden dust masses concealed its N. edge; and last, but not least,

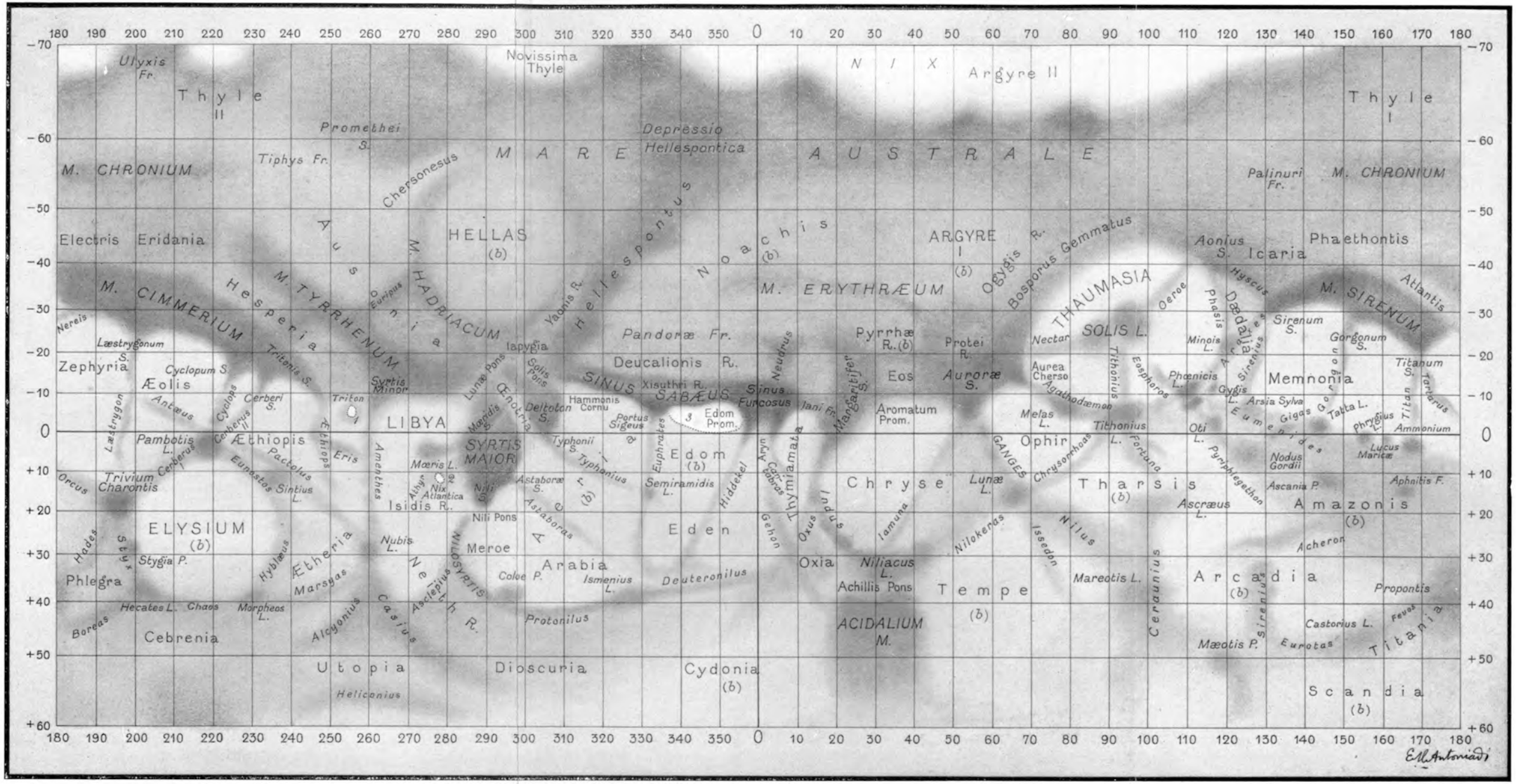
(25) The sudden and wonderful glare of *Libya* on July 29.

E. M. ANTONIADI,
Director of the Section.

Paris, 74, Rue Jouffroy,
1910, November 18.

Published 21*st December* 1910.

SOUTH



NORTH

EAST

WEST

CHART OF MARS ON MERCATOR'S PROJECTION.

Prepared from the Observations of the Section in 1907.

[Abbreviations :—M. = *Mare*; S. = *Sinus*; Fr. = *Fretum*; L. = *Lacus*; P. = *Palus*; F. = *Fons*; R. = *Regio*; Pr. = *Promontorium*.]

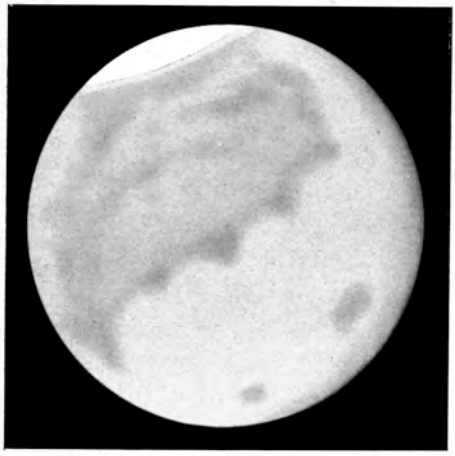


FIG. 1.—R. D. GIVIN. 3·6-in. O.G.
1907, July 3. $\omega = 3°$. $\phi = -5°{\cdot}0$.

FIG. 2.—L. A. EDDIE. 9¼-in. spec.
1907, July 16. $\omega = 23°$. $\phi = -3°{\cdot}0$.

FIG. 3.—E. H. BEATTIE. 6⅛-in. O.G.
1907, July 2. $\omega = 55°$. $\phi = -5°{\cdot}2$.

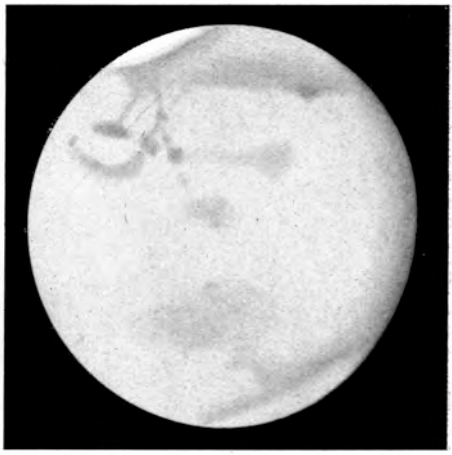


FIG. 4.– A. W. DOBBIE.
1907, July 30. $\omega = 110°$. $\phi = -1°{\cdot}8$.

FIG. 5.—M. TORNQUIST. 4¼-in. O.G.
1907, July 18. $\omega = 93°$. $\phi = -2°{\cdot}7$.

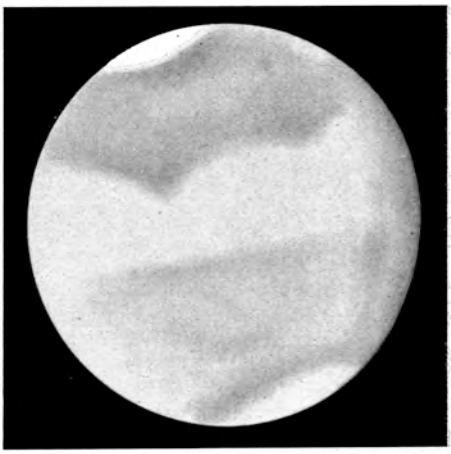


FIG. 6.—A. B. COBHAM. 8½-in. spec.
1907, July 25. $\omega = 177°$. $\phi = -2°{\cdot}0$.

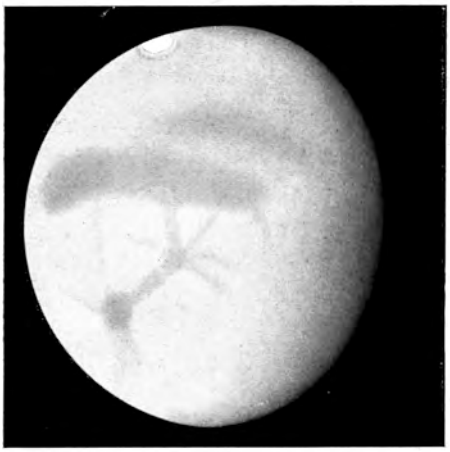


FIG. 7.—E. M. ANTONIADI. $8\frac{1}{2}$-in. spec.
1907, September 8. $\omega = 240°$. $\phi = -5°{\cdot}3$.

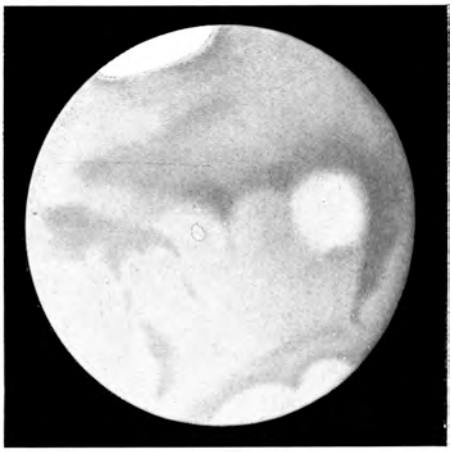


FIG. 8.—L. A. EDDIE. $9\frac{1}{4}$-in. spec.
1907, July 29. $\omega = 245°$. $\phi = -1°{\cdot}8$.

FIG. 9.—W. E. BUCHANAN. $6\frac{1}{2}$-in. spec.
1907, July 25. $\omega = 263°$. $\phi = -2°{\cdot}0$.

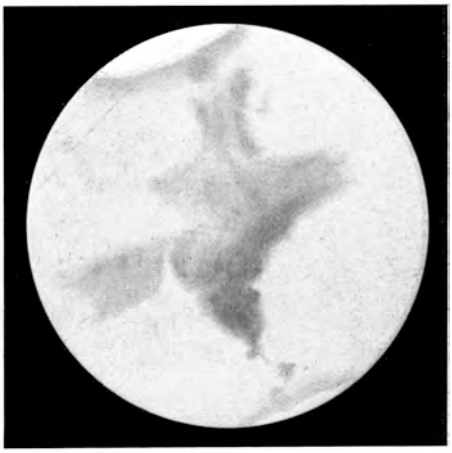


FIG. 10.—G. H. HOSKINS. 12-in. spec.
1907, July 11. $\omega = 291°$. $\phi = -3°{\cdot}8$.

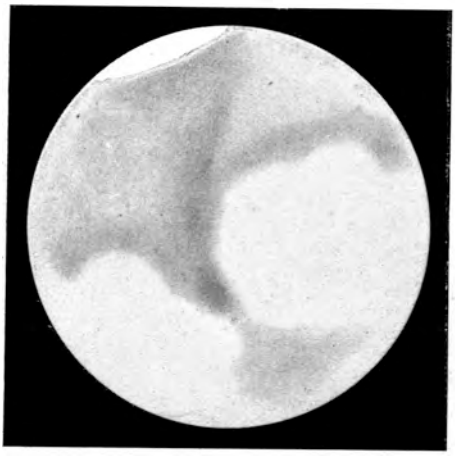


FIG. 11.—D. SHEARER.
1907, July 13. $\omega = 313°$. $\phi = -3°{\cdot}5$.

FIG. 12.—J. NANGLE. $6\frac{1}{4}$-in. O.G.
1907, July 5. $\omega = 351°$. $\phi = -4°{\cdot}7$.

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