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British Astronomical Association.

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FIFTH REPORT OF THE SECTION

FOR THE OBSERVATION OF

MARS.

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, 1900—1901.

PART I.[1]

PROLEGOMENA.

1. The Apparition of 1900–1901.

The first opposition of Mars in the twentieth century occurred on 1901 February 22, and was not a favourable one. At that time the planet was very close to the aphelion of its orbit, the immediate result of that vicinity being to remove our ruddy neighbour almost to its greatest apparitional distance from the earth. And thus Mars, who still approached us to within 0·651 (60,400,000 miles) on 1899, January 15, was no nearer the earth than 0·677 (62,800,000 miles) on 1901, February 15. But the considerable N. declination of the planet in 1900–1901 atoned in some measure to European observers for the reduction of the disc, which did not subtend more than 14″·17 at the date of opposition.

Phenomena.

Vernal Equinox of N. hemisphere Autumnal Equinox of S. hemisphere	1900, Sept. 24.
Passage of Mars through Aphelion	1901, Feb. 25.
Summer Solstice of N. hemisphere Winter Solstice of S. hemisphere	1901, April 11.

It was the N. pole that the planet presented to the earth throughout the apparition, the latitude of the centre of the disc at opposition being + 20°·8.

2. The Members of the Section.

The following table gives the names of the Members who constituted the Mars Section in 1900–1901, their telescopes, as well as the number of drawings forwarded by each to the Association :—

Observer.	Locality.	Aperture of Instrument in Inches.	No. of Drawings sent to the Association.
ANTONIADI, E. M., F.R.A.S.	Juvisy, France	$6\frac{1}{2}$ Spec. $9\frac{3}{4}$ O.G. $49\frac{1}{4}$ O.G.	40
ATTKINS, E. A. L.	Highgate, N.	$6\frac{1}{2}$ Spec.	31
BOLTON, S.	Leeds	$4\frac{1}{8}$ O.G.	10
BUCHANAN, W. E.	Simla, India	$6\frac{1}{2}$ Spec.	5
CORDER, H.	Bridgewater	$6\frac{1}{2}$ Spec.	2
CRAIG, Rev. S. R., B.A., LL.B., F.R.A.S.	Moville, Londonderry.	$4\frac{1}{2}$ O.G. 5 Spec.	5
HALL, W. J.	Nantwich, Cheshire	$4\frac{7}{8}$ Spec. $6\frac{1}{2}$ Spec.	5
KIBBLER, W. A., M.B.	Stamford Hill, N.	$9\frac{1}{4}$ Spec.	12
KILLIP, Rev. R., F.R.A.S.	Liverpool	$4\frac{1}{2}$ O.G. 5 O.G.	11
MOLESWORTH, Capt. P. B., R.E., F.R.A.S.	Trincomalee, Ceylon	$12\frac{1}{2}$ Spec.	*0
PHILLIPS, Rev. T. E. R., M.A., F.R.A.S.	Yeovil and Croydon	$9\frac{1}{4}$ Spec. 3 O.G.	16
PRICE, W. S.	Wellington, Somerset	3 O.G. $8\frac{1}{2}$ Spec.	4
SMITH, H. F.	Luton, Bedfordshire	$6\frac{1}{2}$ Spec.	—
TOWNSHEND, H. J.	Leeds	$9\frac{1}{2}$ Spec.	4

* Capt. Molesworth's 71 fine drawings and charts were lent to the Director for this Report.

* * * * *

The Director of the Section regrets to record the death, on January 6, of one of its ablest workers, Mr. G. L. BROWN, of Stirling. Mr. Brown was an original Member of the Section, and took part in the work of 1892, 1894, and 1899. His detailed drawings of Mars were excellent, and disclosed more than one interesting discovery, conspicuous among which was his observation, in 1899, of the knotted appearance of the "canal" *Chaos*, bounding *Elysium* on the N. side.

3. On the Method of observing Mars.

The first condition of success in areography is the absence of bias from the observations. "I am working in absolute inde-

" pendence," says Mr. Attkins, "I have no idea whatever as to " what is being observed by others on Mars this opposition." And it is impossible to lay too much stress on this fundamental principle of astronomical investigation.

With regard to the choice of power on Mars, Capt. Molesworth says:—" Comparing the two celestial objects I am best acquainted " with, Mars and Jupiter, I have always found Mars stand high " powers very much better. High powers, if the air will stand " them, seem to show the delicate details far better than the " lower ones."

Fine nights are not a rarity, even in London. Mr. Attkins found that a few of "the nights have been beautifully clear, but " the wind from the E. quarter has spoilt definition completely." Again, "some of the nights recently have been really splendid, " and my $6\frac{1}{2}$-in. has borne 480 with ease many times."

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4. The Martian Detail.

" In spite of the small disc," says Mr. Attkins, "there is a lot " of detail to be picked up with a sufficiently high power and " steady air—and patience." Dr. Kibbler remarks in his report that "invariably there was seen a large amount of complex detail " which could not be adequately represented in any drawing."

" Those who have not had the privilege of studying Mars with " a considerable aperture, high powers, and really good seeing," says Capt. Molesworth, "can have no conception of the amount of " detail visible under these conditions. It is quite a revelation. " The *Maria* themselves are shaded, streaked, and variegated in " the most bewildering way, and the continents show exactly " the same state of things in a slightly less degree."

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5. The Colours of the Disc.

Mr. Attkins remarks that the "planet has exhibited much more " colour (in 1900–1901) than it did two years ago. Generally " the centre of the disc is red or yellowish red, and, curiously, " this yellowish red tint appears to have a strong partiality for " the canal region. Where canals are more numerous this colour " appears to be intense."

" The centre of the disc," says Dr. Kibbler, " varied in tint " from almost white to orange-brown," and "the limb light could " always be distinctly seen, and was a very marked feature."

Dr. Kibbler further calls attention to the fact that " the dark " markings, called seas, were always of an ultramarine grey and " without any tinge of green." The Director confirms this impression to the letter. But Capt. Molesworth, who observed the planet under superior conditions, remarks that "the tints of " the *Maria* are very variable. There is generally a prevailing " bluish tinge, almost faint indigo, but at the moments of best " definition this uniform tinge breaks up into splashes and flecks " of almost every subdued shade of blue and greenish grey. This " is especially the case in the *Syrtis Major* and *Auroræ Sinus*."

Mr. Killip says:—"During February and March the green "tint of what are known as the dusky markings was, to my eye, "most pronounced. . . . . I have never before noticed "the striking green of these portions as during the apparition "now ending."

On 1901, March 1, under $\omega = 154°$, Mr. Attkins found "all the "dusky markings exceedingly faint."

6. Observation of a Depression on the Terminator.

On 1901, March 16, under $\omega = 19°$, Mr. Attkins noted that the terminator seemed flattened in the position of the rising *Auroræ Sinus*. This may correspond to a real difference of level, although it can, with more propriety, be ascribed to irradiation.

7. Seasonal Variation in the Darkness of the "Maria."

Most of the Members of the Section have noticed the decoloration of the *Mare Acidalium* in 1900–1901. *Trivium Charontis* also appeared paler than usual, and Dr. Kibbler calls attention to a similar fading of the "canals" *Casius* and *Nilosyrtis* towards the close of the apparition.

"The darkening of the *Maria*," says Capt. Molesworth, "appears again to have been synchronous with the beginning of "the melting of the polar cap. It would, therefore, appear that "the two phenomena very nearly coincide with the vernal "equinox of the N. hemisphere, being a little earlier than the "equinox in 1896 and 1898, and a little later in 1900."

8. The "Lakes."

The number of "lakes" shown by each Member of the Section on the drawings to hand is as follows:—

Observer.	"Lakes."				
	Schiaparelli.	Unnamed "Lakes" of Schiaparelli.	Gale and Lowell.	New "Lakes."	Total.
Capt. Molesworth	19	6	8	11	44
The Director	14	3	0	0	17
Attkins	10	2	2	1	15
Kibbler	10	2	0	0	12
Hall	9	1	0	0	10
Phillips	9	1	0	0	10
Buchanan	6	0	0	0	6
Bolton	5	1	0	0	6
Killip	2	0	0	0	2
Price	2	0	0	0	2
Townshend	2	0	0	0	2
Corder	1	0	0	0	1
Craig	1	0	0	0	1

Forty-eight "lakes" are recorded in 1900–1901. Of these 28 belong to Schiaparelli's maps, nine to Gale's and Lowell's, while 11 are new, having been mostly discovered by Capt. Molesworth. A complete list of these "lakes" will be found on p. 133 in the description of our Chart for the past apparition.

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9. The "Canals."

GENERAL REMARKS.—Capt. Molesworth writes: "A large "number of the so-called canals have been seen during the obser- "vations. They vary from large, broad, well-defined markings, "almost like narrow seas (*e.g.*, *Cerberus*), down to the faintest "possible streaks, just visible under the best conditions.

"What has struck me most during this apparition is that almost "all the canals appear as *streaks*, and not as *lines*. This streaky "aspect cannot be ascribed to the imperfect seeing of a narrow "black line. Curiously enough, I have found their appearance "more 'streaky' with the 12½-in. than I did with the 9¼-in. "This cannot be explained by any defect in the larger instrument "which defines most exquisitely, while the clock driving and the "stability of the mounting give it an enormous advantage over "the altazimuth stand of the smaller telescope. Some few canals, "very few, are sharp and line-like; but the great majority are "diffuse with all powers even when seen under perfect definition, "in the most favourable circumstances. I cannot regard the "delicate 'spider's-web' appearance shown on Lowell's drawings "as being in the least a true rendering of the actual appearance "of the canals."

Dr. Kibbler remarks that "very often the two extremities of a "canal would be seen, the middle part being quite indistinct."

With regard to the reality of the "canals," Capt. Molesworth reports as follows:—"After careful consideration I am inclined to "believe with Signor Cerulli, that the canals are not true continu- "ous lines at all. I think an increase of power, if attainable, "would show many of them as chains of discontinuous irregular "markings, giving the idea of straight hard lines, by their com- "bined impression. Take, for instance, the case of *Eumenides-* "*Orcus*, with the numerous lakes on it. Under the best conditions "I have repeatedly seen not only this canal but others of the "larger canals (notably those surrounding *Elysium*) very 'spotty,' "as if consisting of a chain of lakes. *Chaos-Hyblæus* this year "was repeatedly seen almost disconnected in this way. *Agatho-* "*dæmon* in 1896 was another example."

GEMINATION.—"The gemination of Martian canals," says Capt. Molesworth, "appears to be real, and not illusive, and, I think, "is due, in almost every case, to the existence and variable "visibility of two almost parallel, distinct canals; sometimes one "canal, sometimes both being visible. This would explain the "apparent anomaly of a canal being seen single and double at "the same time by different observers. When both canals are "seen, the space between them is generally slightly shaded, and "this shaded streak often gives the impression of a single, broad, "diffuse canal, when the darker edgings are not seen."

"CANALS" OF 1900-1901.—The total number of "canals" seen by the Members of the Section at the last apparition is 111. Of these 84 belong to Schiaparelli's Charts, 6 to Mr. Lowell's 1894 Map, 3 to Signor Cerulli's Map of 1898–1899, 1 to the Sectional observations of 1896-1897, while 17 are to a large extent new, or of doubtful identification. A complete list of these "canals" will be found on pp. 134–135, in the description of the Chart. The number of double "canals" seen in 1900–1901 does not exceed 11.

The following table gives the number of "canals" shown by the Members on their recent drawings:—

Observer.	"Canals."						
	Schiap.	Lowell.	Cerulli.	B.A.A. 1896.	New.	Total.	Percentage of Canals seen as edges to shades.
Capt. Molesworth	75	4	2	1	12	94	48
The Director	47	0	1	1	3	52	46
Atfkins	44	2	0	1	3	50	44
Phillips	28	0	0	1	1	30	50
Bolton	28	0	0	0	0	28	43
Kibbler	25	0	0	1	1	27	48
Buchanan	17	0	0	0	1	18	44
Hall	16	0	0	0	0	16	50
Craig	12	0	0	0	0	12	33
Killip	11	0	0	1	0	12	17
Price	11	0	0	1	0	12	17
Townshend	8	0	0	0	0	8	13
Corder	7	0	0	0	0	7	29

THE "CANALS" CONSIDERED AS EDGES TO FAINT SHADINGS.—This theory, which was enunciated by the late Mr. Green in 1879, and which was confirmed by the Rev. P. H. Kempthorne and other Members of the Section in 1898–1899, is again corroborated by the observations of the last apparition. Capt. Molesworth, who has given particular attention to the subject lately, writes:—"I have been very careful this year to observe "whether the tint of the surface is exactly the same on both sides "of a canal, and I have come to the conclusion that in the great "majority of cases the canals, especially the fainter ones, are the "slightly darker borders of very faintly shaded areas. In some "cases (*e.g. Poros* and *Cantabras*) no true canal is visible, but "simply the outline of a shaded area. But there is generally a "distinct bounding streak slightly darker than the area (*e.g.*, "*Pactolus*). Often (*e.g.*, *Protonilus*, *Hiddekel*, *Gehon*) decidedly "and unmistakably darker. In other cases (*e.g.*, *Eumenides-Orcus*) the side of the canal towards the brighter area is fairly

" sharp and well-defined; the other edge fading gradually into " the shaded portion."

It is a significant fact that exactly one half of the "canals" seen in 1900-1901 by the Members of the Section correspond to edges of indefinite half tones. And if the objectivity of the " canals " is not a demonstrated truth, yet no one would think of questioning the reality of the great majority of those vast, though delicate, shadings, so intricately diversifying the Martian surface. We could hardly expect *a priori*, that the N. hemisphere of the planet is characterised by a gloomy yellow uniformity; and we gladly find the latest observations undermining that fallacious notion. By depriving Mars of his delicate shadings, many classical charts, and especially those of Mr. Lowell, become inaccurate and unphilosophical; and the slightest glance thrown on the variously checkered expanses of the Martian deserts appeals more sympathetically to the reflecting mind than any amount of bewildering canalization.

10. " Canals " in the Dark Regions.

Five of these markings were seen by Capt. Molesworth, two in the *Syrtis Major* and three in *Auroræ Sinus* (p. 135.)

11. Bright Spots of the Disc, and Projections on the Terminator.

The number of white spots seen on the disc in 1900-1901 is 16. Their positions will be found on p. 136. Some of these may be contrast effects, but the majority must be real. On March 28 Dr. Kibbler found that the " *Syrtis Major* seemed to be separated " from *Hadriacum Mare* by a whitish band, more marked " towards E., and which looked extremely like a cloud belt."

Under $\omega = 53°$, Rev. T. E. R. Phillips wrote on Jan. 2 :— " Most brilliant white spot (Fig. 1) seen at S.W. terminator. " Appeared as a distinct projection, but this may have been an " irradiation effect. Probably *Argyre* (*Argyre* was seen intensely " brilliant on 1899, Feb. 21, 25 and 26)." The Director would perhaps be inclined to see in this spot a real projection, as (1) the longitude of the centre of the disc at the time, and (2) the fact

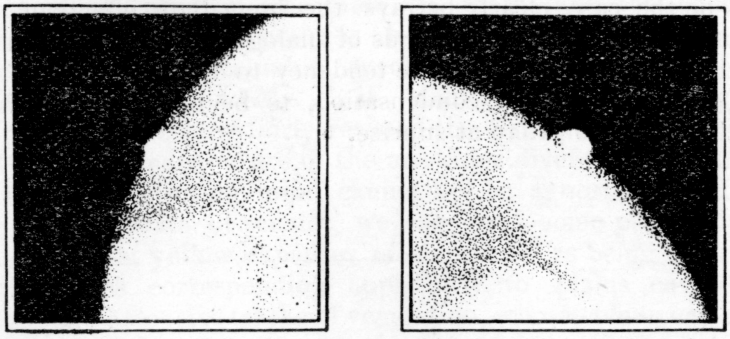

Fig. 1. 1901, Jan. 2 (*Phillips*). Fig. 2. 1901, March 7 (*Molesworth*).
Bright projections observed on the terminator of Mars.

that the spot in question preceded the left boundary of *Mare Acidalium* by fully 20°, show it to have been situated somewhere about the zero meridian of the planet, in latitude — 40°, which corresponds to the *f* coast of *Noachis*, an island where several projections were seen in 1894.

On March 7 Capt. Molesworth saw "a small projection . . . . " in the S. portion of *Thaumasia*. It was very bright, and con- " sisted of a small white spot, partly inside the limb" (Fig 2); and on April 9 Mr. Attkins called attention to a very white spot at the same place, seeming " to follow *Solis Lacus*," though not protruding beyond the limb. Mr. Phillips' projection had a height, not corrected for irradiation, of 67 miles. Captain Molesworth's projection had a height, also not corrected for irradiation, of 70 miles.

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12. The Lands Whitening with the Obliquity of the Solar Rays.

" On looking through my observing journal," says Mr. Attkins, " I was somewhat struck by the way in which the same object " was variously described as white, whitish, ground tint (*i.e.*, " tint of Green's forms for drawing the planet), yellow, yellowish, " red and ruddy." From an analysis of the phenomenon, " it will " be noticed that there is undoubtedly a gradual change from " white at sunrise to a ruddy tint at sunset."

"*Elysium*, *Tempe*, and *Amazonis* appear to attain their brightest " yellow or red tint at Martian noon; whereas *Libya* and *Aeria* " do not seem to lose their whiteness until well past the central " meridian; probably owing to their being further south."

Again, " it seems hard to escape from the explanation that the " appearances are caused by the gradual melting of deposits of " hoar frost, accumulated during the Martian nights."

These results of Mr. Attkins are highly interesting, as establishing the objectivity of the brightening lands, due to the obliquity of the *solar* rays. An analogous brightening, but subjective in its origin, as subordinated to the obliquity of the *visual* rays, is necessitated by the theory of contrast.* But then, after making due allowance for phase, the self-same land could not be brighter at sunrise than at sunset. The fact that the contrary may sometimes be the case clearly betrays the immediate effects of solar radiation, and tightens the bonds of analogy existing between Mars and the earth, by showing the tendency to the formation of hoar frost, or other kindred condensation, to be more languid in the Martian afternoon than at sunrise.

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* *Vide* "Report" of the Section for 1898–1899, p. 104, consideration 4.

PART II.

THE OBSERVATIONS.

Introductory.

In dealing with such a large number of drawings, Mr. Maunder's excellent programme of 1892 was followed, in arbitrarily dividing the planet's surface into eight sections, of which six, each having a mean breadth of 60° in longitude, extend from + 60° to — 60° of latitude, while the remaining two sections deal with the polar regions.

Section.	Breadth.	Limits of		Region.	Drawings.
		Longitude.	Latitude.		
I.	60°	310° to 10°	+ 60° to − 60°	*Sinus Sabæus* -	32
II.	60	10 „ 70	+ 60 „ − 60	*Mare Acidalium* -	29
III.	50	70 „ 120	+ 60 „ − 60	*Solis Lacus* -	14
IV.	60	120 „ 180	+ 60 „ − 60	*Mare Sirenum* -	13
V.	70	180 „ 250	+ 60 „ − 60	*Mare Cimmerium*	24
VI.	60	250 „ 310	+ 60 „ − 60	*Syrtis Major* -	33
VII.	360	0 to 360	− 60 to − 90	South Polar Region	—
VIII.	360	0 „ 360	+ 60 „ + 90	North Polar Region	145

As in 1896-1897 and 1898–1899, Schiaparelli's areographical nomenclature has been adopted to the exclusion of any other. The dark areas have been systematically alluded to as "seas," or anything implying the more or less direct presence of water (*Mare*, *Sinus*, *Fretum*, *Lacus*, *Palus*, "marsh," "swamp," "shoal," "strait," "channel," "canal"; *Fons*, *Lucus*, *Silva*, &c.) The yellow background has received names conveying the idea of "land" (*Regio*, *Promontorium*, *Chersonesus*, *Pons*, *Insula*, "coast" &c). All this is a mere convention. The kinetic theory of gases, based on mere probabilities, can prove nothing as to the presence, or absence, of water on Mars; and the conclusions deduced from that hypothesis by Dr. Johnstone Stoney are negatived by the valuable spectroscopic investigations of Sir William Huggins and Mr. E. W. Maunder, which, although made many years ago, have fairly resisted the test of time.

On the intimate nature of the markings diversifying the Martian surface the reflecting mind cannot but be agnostic. And yet, in the present state of science, we can, with some probability, consider the vast yellow expanses of the planet as being deserts; the dusky areas corresponding apparently to plains covered with water, and extensive tracks of vegetation, whose colour varies in fair accordance with the rigours of winter, the return of spring, or with the scorching radiance of an æstival sun.

* * * * *

The question of the "canals" has increased in interest since Mr. Lowell's discovery of subjective linear markings on Mercury, Venus, and the Jovian satellites. But our knowledge in this domain, on Mars, is still so limited as to scarcely justify any attempts to a complete solution of the mystery. What we want is a careful analysis of all the phenomena attending the visibility of the "canals"; and it is in such an analytical work that we may look forward to the final theoretical illumination.

Considerations like these have prompted the Director to carefully note, in the Sectional observations, all conditions likely to throw any light on the subject, and to record the darkness, visibility, and optical peculiarities of the "canals," as well as to measure their breadth on all the drawings of 1900-1901. The present "Report" gives a complete account of these results.

The width of the "canals," and the dimensions of the "lakes," are given in equatoreal degrees, one such degree equalling 37·3 miles on Mars. Linear sensations were experienced, with the larger aperatures, as subtending only 0″·11, or some 37 miles at the time; whereas the 12½-in. Calver reflector of Captain Molesworth showed "lakes" subtending only 0″·26 in diameter, which, at the moment, corresponded to 85 miles—a very creditable achievement, not only for our Ceylon *confrère*, but also for the maker of his telescope.

The following abbreviations will be found in this Report:—

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; N. = North; S. = South; E. = areographic East (West for the observer); W. = areographic West (East for the observer); p = preceding; f = following; and C.M. = central meridian of the planet.

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

SECTION I.

Sinus Sabæus and Mare Erythræum.

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

HAMMONIS CORNU.—This remarkable promontory is shown with its usual outline by Attkins, Kibbler, Phillips, and Price. Molesworth notes that it is "regularly rounded," and that "the "curve of the *Mare* is, as a rule, complete, but in some of the "sketches the *Mare* is considerably lighter in the centre of the "curve." This statement is confirmed by the Director, who on January 15 found the cape so pronounced as to sever *Sinus Sabæus* from *Deltoton Sinus*.* The Sectional observations of 1898–1899 have shown that, then also, the *Mare* was much brighter S.E. of the cape than to N.E. and N.W., doubtless owing to the presence of *Solis Pons*, extending almost as far as *Hellas*.†

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* Names not given on our Chart, Plate I., will be found on the General Reference Map of the minor Martian detail, Plate VI.

† "Report for 1898–1899, p. 76.

PHAROS INSULA was observed "generally whiter than the rest" by Molesworth, who thinks that the canal severing it from the mainland is not a true canal, but merely the edge to N.W. of this bright little area.

SABÆUS SINUS.—Attkins found the *Sinus* from *Hammonis Cornu* to the Forked Bay "pale" on February 7 and 11; "palish" on March 16; "narrow and dark" on March 21; "faint" on March 27; and "indistinct" on April 28. On his drawing of March 11 Buchanan shows it moderately dark, and Craig's impressions in February seem to have been analogous. To Hall the *Sinus* appeared perhaps faintish on March 21 with $6\frac{1}{2}$ inches. But at the same date Kibbler depicted it fairly dark, though not much more shaded than *Margaritifer Sinus* (Plate V., Fig. 6). The sketch of Killip (Plate V., Fig. 5) gives all a good 5-in. O.G. can show here under ordinary circumstances. Meantime Molesworth writes that *Sinus Sabæus* was "very dark "throughout, of a distinct indigo tinge," and "the N. edge is "very sharply defined, the continent bordering it being very "white" (Plate V., Fig. 4). The strait is further represented as dark by Phillips on January 5 (Plate III., Fig. 1), very shaded by Price, and dark blue by Townshend. The Director was struck with the similarity which the outline of the *Sinus*

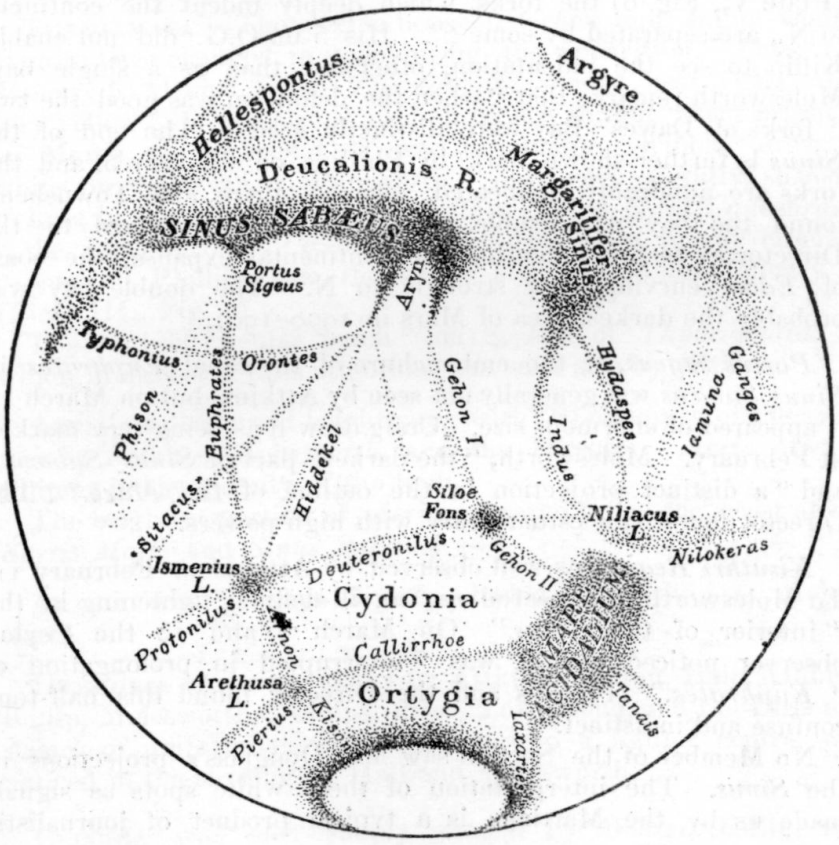

Fig. 3. The *Sinus Sabæus* and *Mare Acidalium* regions of Mars in 1900–1901 (*The Director*).

[From "Knowledge," April 1902.]

bore to Herr O. Lohse's delineation of it in his chart of 1883–1884.* As remarked by Molesworth, the N. edge of the band was its darkest portion (*vide* Fig. 3, which together with Figs. 6, 9, and 11, gives a synthesis of the Director's areoscopic impressions in 1900–1901. These four combined views originally appeared in "Knowledge" for 1902, and for the permission to reproduce them in this Report, the Director is indebted to the kindness of Messrs Witherby & Co., publishers of "Knowledge").

Dawes' Forked Bay†, to which the name of *Furca Sini Sabæi*, or simply *Furca*, is now given, was not an easy object to see in its true form, since a small aperture will show it sometimes as a single and sharply pointed bay, while on other occasions the two forks and dark area to the S. are blended into the classical knob of Beer and Mædler. Thus on January 5 Attkins saw only the *f* fork; on February 7 and 11 both; on March 16 the *f* only; on March 21 both, and on April 28 the *p* only. Bolton shows distinctly both forks always, an almost incredible achievement for a $4\frac{1}{8}$-in. achromatic. Buchanan saw the forks beautifully on March 11; Craig less distinctly in February. With his customary accuracy and truthfulness Hall could not see *Furca* otherwise than as a dark knob with $6\frac{1}{2}$-in. This part of *Sinus Sabæus* was admirably depicted by Kibbler, on whose drawing (Plate V., Fig. 6) the forks, which deeply indent the continent to N., are separated by some 6°. His 5-in. O.G. did not enable Killip to see the indentation, otherwise than as a single bay. Molesworth remarks that "when the definition was good the two "forks of Dawes' Bay were distinctly seen." The end of the *Sinus* is further shown dark by Phillips on January 5, and the forks are admirably delineated, whereas Price and Townshend found the bay irresolvable. Lastly, *Furca* appeared to the Director as deeply indenting the continental expanse, the coast of *Edom* curving very strongly to N. The double bay was probably the darkest area of Mars in 1900–1901.

Portus Sigeus, or the embouchure of the canal *Euphrates* in *Sinus Sabæus* was generally not seen by Attkins, but on March 16 it appeared of enormous size. Craig drew it as being very marked in February. Molesworth, "the darkest part of *Sinus Sabæus*." and "a distinct projection in the outline of the *Mare*." The Director found this estuary easy with high powers.

Xisuthri Regio was well observed by Attkins on February 11. To Molesworth it appeared as "an ill-defined lightening in the "interior of the *Sinus*." On March 9 and 10 the Ceylon observer noticed that it was "interrupted in prolongation of "*Euphrates*." Phillips and the Director found this half-tone confuse and indistinct.

No Member of the Section saw Mr. Douglass's projections in the *Sinus*. The interpretation of these white spots as signals made us by the Martians is a typical product of journalistic

* *Publicationen des Astrophysikalischen Observatorium zu Potsdam*, No. 28, 1891.

† The forks were discovered by Galle in 1839.

sensationalism, and an interested abuse of the credulity and scientific ignorance of mankind.

FASTIGIUM ARYN.—Whenever Attkins saw both bays of *Furca*, he always represented *Aryn* blunted; but Buchanan and Kibbler drew it sharper. Molesworth "always more or less shaded, the "degree of shading being very variable." Again, it was "particularly shaded in October and December, but hardly so in "March." "The shade extended from *Hiddekel* to *Gehon*, but "was always darkest near Dawes' Bay." The Director saw no shading here in 1901.

EDOM PROMONTORIUM was almost always "bright and plain" to Attkins, Molesworth, and Phillips. Molesworth calls it "the "brightest intensification of all the bright coast line bordering "the *Sinus*." Contrast with the dark *Sinus* may brighten this cape.

EDOM.—This land was white along its coast to several observers; but, as in the case of the promontory, the brightness may be subjective, seeing that it is necessitated by the theory of contrast.

EDEN.—"Slightly shaded in all but the earlier drawings" (Molesworth).

THYMIAMATA.—The region between *Gehon* and *Indus* would seem to have changed in tone during the apparition. Thus, on January 5 Attkins found *Thymiamata* shaded near C.M., and very yellow. It was also shaded on March 16, but "very bright" on March 21 between C.M. and terminator. Kibbler drew it white on April 28. Molesworth "only very slightly shaded. "Late in the apparition it was slightly shaded N. of *Cantabras*; "the portion S. of *Cantabras* appearing as a bright circular "patch." Phillips saw the whole area shaded on January 5 (Plate III., Fig. 1).

The "bright circular patch" on S. end of *Thymiamata*, to which Molesworth calls attention, was seen also by Attkins.

AERIA was observed brightening with the obliquity of the solar rays by Attkins, Molesworth, and the Director. *Aeria* always whitens in the vicinity of the limb.

The brightest portion of *Aeria* appeared to be the coast along *Syrtis Major* and *Sinus Sabæus*.

ARABIA was "always slightly shaded" according to Molesworth.

DIOSCURIA is shown dusky by Attkins, Bolton, Hall, Kibbler, Killip, Molesworth, Phillips, Price, Townshend, and the Director. A lack of uniformity, with a tendency to a lighter centre, was noticed in the shading by Hall and Molesworth.

CYDONIA was seen simply shaded by Bolton, Killip, and Price; but Attkins, Kibbler, Molesworth, Phillips, Townshend, and the Director have observed a more or less distinct white spot in its centre, near the *Mare Acidalium*. This spot was "equal "to polar cap in brightness" near *p* limb on March 6, according

to Attkins, while Phillips saw it with only 3-in. aperture on February 11. The dimensions of this spot are variable on the drawings, but a mean of the estimates gives it 17° from E. to W., and 7½° from N. to S. It is impossible to say if it is a cloud or not. But if a real cirrus formation it was, at any rate, singularly immovable to remain in $\Omega = 0°$, $\Phi = +54°$ from January 1 to March 21—a very remarkable object indeed.

SIRBONIS PALUS.—"Very diffuse and ill-defined," says Molesworth. "It appears to lie on *Typhonius-Orontes* between "*Euphrates* and *Phison*, but its exact outline is difficult to make "out, as this region is slightly shaded up to *Sigeia Portus*."

ISMENIUS LACUS was observed by six observers quite distinctly. Attkins gave it a length of 20° E. to W. and a breadth of 5° N. to S. on March 16; Craig 25° long and 10° broad in February; Hall, exceedingly diffuse, some 15° long and 7° broad on March 21; Kibbler, vague traces only; Molesworth, generally 8° long and 6° broad; the Director, 10° long and 5° broad. *Ismenius Lacus* was in longitude 334° in 1901, and not in 342° as in 1888, so that it occupied the position it had in 1886 at the last apparition.*

ARETHUSA LACUS.—"Similar to *Ismenius*, fairly distinct," says Molesworth, but the Director could not see it except by rare glimpses.

SILOE FONS is drawn by Kibbler as a very faint circular spot on April 28 S.E. of *Mare Acidalium*. The Director, however, saw it as a distinct knot at junction of several canals.

SPHINGOS LACUS.—A name now given to Lowell's 1894 "*Arethusa Fons*" on intersection of *Hiddekel* and *Eulæus*, with a view to avoiding having two lakes "*Arethusa*" on the planet. This marking corresponds to lake *j* of our 1898–1899 Chart, and was seen distinctly by Molesworth in 1900–1901.

DEUCALIONIS REGIO is represented narrower than usual by Attkins and Phillips (Plate III., Fig. 1), whereas Molesworth and the Director give it rather its normal breadth (Plate III., Fig. 2). With the exception of Kibbler, who, on March 21, depicted the island white on C.M., the other Members of the Section agree in showing *Deucalionis Regio* darker than the continent to N. The channel separating it from *Thymiamata* is not traceable on Phillips' drawings, but most of the other Members show it fairly dark and definite. The other channel to the S. was faint. Molesworth suggests that *Deucalionis Regio* was "more distinct" in 1901 than in 1899.

NOACHIS was white on S. limb according to Attkins, Hall, Kibbler, Molesworth, Phillips, Townshend, and the Director.

A bright projection on the terminator was seen by Phillips on January 2 somewhere about the *f* border of *Noachis* (Fig. 1 and Chart, Plate I.).

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* *See* "Report" for 1898–1899, p. 78.

HELLESPONTUS appeared like a curved, dark streak, trending obliquely to the S. pole to Molesworth and the Director. Attkins, however, remarked that on March 26 the *Mare* S. of *Hammonis Cornu* was faint.

CANALS.

ARNON.—Seen by Bolton on March 21, width 7°, and diffuse.—Molesworth: generally 3½° broad, "distinct, broader, and darker than *Euphrates*" —The Director: generally 3° wide, easier than *Euphrates*, but still visible by rare glimpses only.

CALLIRRHOE.—Attkins: February 7 and 11, mere edge of polar shadings; March 16, ditto.—Buchanan: March 11, width 6°.—Kibbler: March 21, mere edge of polar shading.—Molesworth: mean width 3½°, edge to shade at N.—Phillips: January 5, edge to shaded *Ortygia*.—The Director: width 3°, edge to polar shadings.

CANTABRAS.—Molesworth: edge of shade to N.

DEUTERONILUS.—Attkins: March 16, breadth 1°, edge to shaded *Cydonia*; April 28, width 3°, edge of shade to N. In both cases this canal is shown running distinctly into *Niliacus Lacus*.—Bolton: in March 3° wide, edge to shade to N.—Buchanan: March 11, anomalous in width, some 5°, and somewhat knotted.—Hall: March 21, diffuse and 5° wide.—Molesworth: mean width 3°, "faint and diffuse," edge to shade to N.—Phillips: January 5, width 5° to E., but narrowing to a point before reaching *Niliacus Lacus*.—The Director: generally 2° wide, and edge to shade in *Cydonia*.

EULÆUS.—Molesworth: mean breadth 2°; "this canal was seen fairly "distinctly early in the apparition as far as *Sigeia Portus*. On March 6 it "was traceable only to *Sirbonis Palus*, and later still (in April) was visible "only as far as *Hiddekel*. This looks like a progressive change."

EUPHRATES.—Bolton: March 21, a diffuse band, 6° wide.—Molesworth: generally 4° wide, "faint and diffuse."—The Director: January 15 and February 10, visible as a strong black line 2½° broad, but only by very rare glimpses. May be illusive.

GEHON I.—Attkins: January 5, almost straight, if not convex to W., 1½° wide; February 7, straight, 1½° wide; March 16, convex to E., 1° wide, edge to shade in *Thymiamata*; March 21, straight, 2½° broad, and "dark"; April 28, straight, 3° wide, "smudgy."—Bolton: April 21, convex to E., width 3°, edge of shade towards *Hiddekel*.—Killip: January 31, diffuse near terminator; March 9, width 2°; March 13, very diffuse; March 21, convex to E., 3° wide to S., 1° near *Mare Acidalium*.—Molesworth: convex to E., mean width 2°, "edge of shade to E." On March 6 Molesworth drew the *Gehon* as running into *Lacus Niliacus*, while on the following day it ran, as usual, into *Mare Acidalium*. Such discrepancies, which cannot be objective, show how very frail is our knowledge of the minor Martian detail.—Phillips: October 28, convex to E., width 4°, edge of shade to E.; January 5 width 3°, edge to shade to W.—Price: February 13, straight, narrow, some 1½° wide only.—Townshend: March 16, convex to E., width 2°, pale blue in colour; March 21, wider, 4°.—The Director: always straight to *Siloe Fons*, and thence curving into *Mare Acidalium* (*Gehon II.*); January 10, width 4° diffuse; January 11, width 2°; January 15, width 3°; February 10, breadth 4°. On one occasion a streak was glimpsed emerging from the *p* fork of the *Sinus*, and running parallel to the *Gehon*, but this was not certain. The *Gehon* was very easy to see in 1901.

It will be seen from these observations that the *Gehon* was sometimes an edge to shade to E., and at others to W. The discrepancy may be due to the fact that *Thymiamata* was shaded to N. and that *Fastigium Aryn* may have been a littte darker than *Eden*. To N., therefore, *Gehon* was bordered by duskiness on the W. side, while *Fastigium Aryn*, being more shaded than S. *Thymiamata*, formed a shading E. of *Gehon*.

HIDDEKEL.—Attkins: February 11, width 1°, "plain"; March 21, width 1° "faint"; April 28, width 3°, "smudgy but fairly well seen." Diameter of disc = 9″·5.—Bolton shows it as the edge of a shade extending to *Gehon*.—Molesworth: "narrow" (2°) and sharp, edge of a shading between it and *Gehon*.—Phillips: January 5, width 2° "glimpsed."—The Director: width 1°, very faint, visible by the rarest flashes only. Certainly one of the most difficult canals to see properly.

ORONTES.—Molesworth: "diffused and curved edge of shade in *Eden*," mean width some 3°.—The Director: an amorphous shading of extreme faintness, but more sharply marked to S. than to N., where it forms the boundary of a delicate shade. The appearance may be wholly subjective, a mere contrast with the bright coast and dark *Sinus Sabæus*.

PHISON.—Attkins: February 14, "fairly wide" (about 1½°); March 27, width 3°, "well seen"; March 28, N. part only, 1½° wide.—Bolton: March, 5° wide, or as edge to shade at W.—Killip: March 21, N. end only, 3° wide.—Molesworth: generally 3½° broad, "faint and diffuse."—Phillips: January 11, N. end only, 3° wide, diffuse.—Price: January 11, N. end only, 2° wide.—The Director: width 4°, very faint, edge of shade to W., and possibly a mere contrast effect, but may have been *double*.

PIERIUS.—Bolton: in March, drawn as a faint shading.—Hall: March 21, edge of shades to N.—Molesworth: mean breadth 5°, edge of a shaded area to N.—Phillips: edge to shading N.—The Director: width 3° dark and easy, but possibly an edge to shaded *Cecropia*.

POROS.—Molesworth: edge of shade to N.W.

PROTONILUS.—Attkins: March 27, seen easily; March 28, width 2°, "easy"; May 5, mere edge of shade to N.—Bolton: March, 5° broad, edge to shade in *Dioscuria*.—Buchanan: March 11, width 6°, anomalous in breadth, and knotted.—Hall: March 21, very diffuse, some 6° wide, edge of shading N.; March 28, width 4°.—Kibbler: April 28, edge of faint shade to N.—Molesworth: generally 3° wide, "rather faint," sharp to S., diffuse to N., edge of shading in *Dioscuria*.—Phillips: January 11, width 2°.—Price: February, 13°, width 3°.—The Director: width 2° generally, edge of shade in *Dioscuria*.

SITACUS.—The Director: as an optical illusion.

TYPHONIUS.—Molesworth: mean breadth 3°, "broad and diffuse, sharp to "S. shading away gradually to N."—The Director: possibly a contrast effect, edge to shade to N.

XENIUS.—Molesworth: 2° wide, faint.

SECTION II.

Margaritifer Sinus, Auroræ Sinus, and Mare Acidalium.

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

MARGARITIFER SINUS.—This gulf was seen but little indenting the coast on February 3 and 7, but sharply pointed on March 21 by Attkins, who depicted it almost as dark as *Sinus Sabæus*. On March 15 Buchanan found it sharply pointed also, and fairly dark. Craig, ditto. Kibbler confirms this, and gives Schiaparelli's outline to the *Sinus*, which he found very dark (Plate V., Fig. 6). With his 5-in. O.G. Killip saw *Margaritifer Sinus* a little fainter. Molesworth writes that it was "darkening in October," and that on the single night it was observed in December

(December 31) he thinks that "there must have been some local "obscuration, as the *Sinus* was very inconspicuous. But later "in the apparition it was very dark, though not quite so dark as "Dawes' Bay." On January 5 Phillips found the bay moderately dark, and the impressions of Price and Townshend have been analogous. The Director thought that there could be no doubt as to the darkening of *Margaritifer Sinus* in 1901, as compared to what he saw from 1894 to 1899.

OXIA PALUS, or the "Pearl," was seen by Molesworth "as a "small, dark knot at junction of *Indus* and *Oxus*."

AROMATUM PROMONTORIUM was white to Kibbler and Molesworth. Kibbler gives it its true Schiaparellian outline, while Molesworth, Phillips, and the Director agree in depicting it decidedly more blunted and less prominent.

CHRYSE.—With the exception of Bolton, who shaded this land on April 17, all Members show *Chryse* bright, while Hall, Kibbler, Molesworth, and the Director have observed it to whiten in the vicinity of the limb or terminator.

A bright spot was seen by Attkins on *Chryse*, on March 12, close to the estuary of the *Ganges*.

AURORÆ SINUS seems to have been darker in 1901 than during the apparitions of 1894, 1896, and 1899. On January 30 Attkins found it "very dark" near terminator; on February 3 "about "same tone as *Niliacus*"; on February 7 "dark to limb," and so on. Hall and Kibbler confirm these statements, the latter saying that on April 21 and 23 it was "quite as dark as, if not "darker than, *Mare Acidalium*." Craig noticed a remarkable indentation formed on the continent by *Auroræ Sinus*, at the estuary of the *Ganges*. Molesworth writes: "the appearance of "the *Sinus* in October was most peculiar, as the tone of the "*Mare* was very light, crossed by darker canal streaks. Later "it assumed more or less its normal appearance, and was very "dark, especially at the estuary of the *Ganges*. When near the "edge of the disc it appeared to lose very little in depth of tone." Early in the apparition, Phillips found the gulf almost invisible, such was its faintness from October to December. Townshend and the Director have both drawn the *Sinus* dark in 1901, the latter feeling sure that it was darker than in 1899, and at the previous apparitions.

The observations of Molesworth and Phillips establish the objectivity of a change of intensity in *Auroræ Sinus* between October 1900 and February 1901. This is a most remarkable fact, as denoting either the presence of very thin cirrus over the gulf in October, or, preferably, an intensification of the dusky material, such as would be necessitated by a changing vegetation. Were we, therefore, to suppose that, towards the autumnal equinox of the S. hemisphere, the region in question had its grass scorched, or its leaves yellowed, after long exposure to a zenithal sun; and that, at the approach of winter, the grass became greener or the leaves had fallen, unveiling the darker trunks beyond, we might launch on an interpretation of the observed appearances.

On 1896 November 25, the Director observed two dark circular condensations in *Auroræ Sinus*,* which were not confirmed, however, by anyone at the time. But in 1901 Molesworth found both these spots easy, and they will be seen on Plate I. under the symbols α and β. According to the Ceylon observer, these condensations were united by the canal in a dark region *Hipparis*, while two other similar canals in the "*Mare*," *Dargamanes*, and *Garrhuenus* ran in prolongation of *Nectar*. Plate III., Fig. 4, shows that Attkins saw a curious bright marking in *Auroræ Sinus*, corresponding to Lowell's *Caicus* and to Signor Cerulli's *Ogyges*, to the combination of which the name *Eos* is given on the Chart. Attkins saw these markings in 1898–1899 also.†

LUNÆ LACUS.—Attkins, Bolton, Buchanan, Hall, Kibbler, Molesworth, Phillips, and the Director all agree in representing this lake as faint and very diffuse in its edges.

NILIACUS LACUS.—On January 31 Attkins wrote that *Niliacus Lacus* was "practically as dark as *Acidalium*"; February 3, "much fainter than *Acidalium*"; March 6, "faint"; March 12, "dark"; and April 17, "indistinct." Kibbler: March 12, vastly fainter than *Mare Acidalium;* and so also subsequently. Molesworth defines it as "an elongated oval spot, sometimes slightly "curved, a good deal fainter than *Mare Acidalium*," as on Plate III., Fig. 2. Townshend, however, painted it as black as the sky on March 16, and forming part of the *Mare* to N. The Director could never see *Niliacus Lacus* in 1901 much darker than the canal *Nilokeras* (Plate III., Fig. 3).

ACHILLIS PONS was noted as "narrow, bright, and yellowish" by Attkins on January 31; "*pointing S.W.*" on February 3; "invisible" on February 7 and March 7 ("under the sharpest "view of the season"); and again "plain" on March 12. Hall: "seen once, on February 6." Kibbler: distinct on March 12, but seen confused subsequently (Fig. 4). Molesworth: "slightly shaded." Phillips: "*appeared strangely slanting S.W.–N.E.*" January 2; January 4, ditto. Townshend missed the bridge, which the Director could always see without difficulty.

The inclination to S.E.‡ noted by Attkins and Phillips is remarkable, and has been followed on the Chart. Usually *Achillis Pons* is parallel to the equator, and on 1888 June 2, Schiaparelli found the bridge inclined the other way, trending from S.W. to N.E.

A bright spot at W. end of *Achillis Pons* was seen by Attkins on March 12.

The region to the E. of *Niliacus Lacus* was, in October, as dark as the *Mare*, according to Molesworth.

MARE ACIDALIUM.—The impression of Attkins was that this great dark area was in 1901 "as dark as last opposition"; on

* "Report" of the Section for 1896–1897, p. 75, Fig. 3.

† "Report" for 1898–1899, p. 81.

‡ The observers say S.W., but evidently speak of the E. and W. of the telescopic field, not giving to those terms their areographic sense.

January 5 it was "dark on limb"; January 30, "black at terminator"; January 31, "black"; February 3, "very black, with diffused edges"; February 11, "black at limb"; March 6, "darkish"; March 7, "dark, but not black"; March 10, ditto, but fainter; March 12, "dark" (Plate III., Fig. 4); March 21, "very dark"; April 17, "black"; April 28, "not very dark," and so also on May 31. Bolton remarks that it is the darkest area on Mars, and that it faded towards the end of the apparition. Buchanan drew it very dark on limb, to left, on February 28, and merging into *Niliacus Lacus;* but on March 15 he depicted it fainter than *Margaritifer Sinus* under $\omega = 27°$. Craig found it rather faint in January. Hall: "not noticeably lighter than in 1898–1899." Kibbler: March 12, just a shade darker than *Auroræ Sinus;* March 21, fainter than either *Furca*, or *Margaritifer Sinus;* April 21 and 23, not so dark as *Margaritifer* and *Auroræ Sinus*, bell-shaped (Fig. 4). Killip draws it generally

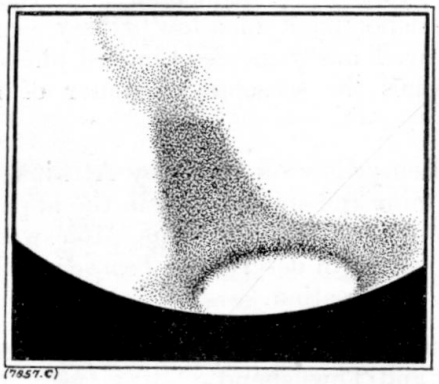

Fig. 4. *Mare Acidalium*, 1901 April 23^d 23^h 0^m G.C.M.T. (*Kibbler*).

fairly dark. Molesworth: "very dark indeed, but probably not "quite so dark as in 1896 and 1898. Its shape appears to be a "trapezium, with the S. edges slightly rounded, darkest near its "S. edge, but very irregular and mottled in tone. It is still one "of the darkest areas on Mars, and preserves its tint well as it "nears the edge of the disc. Its colour is an indigo grey with a "blackish tinge. There are glimpses of a streaky and mottled "structure, but no definite islands have been seen. The sides of "the trapezium are prolonged by two very dark, slightly curved, "streaks, ending in dark lakes in the polar marshes. A third "streak (*Tanais*) curves round to form the N. boundary of "*Tempe* [Plate III., Fig. 2]. The area included between the "first two streaks is lighter than the surrounding region (*Baltia*). "This latter portion is crossed diagonally by *Iaxartes*, which "grew considerably darker as the apparition drew on; the two "great side canals *Callirrhoe II.* (*Arius*) and *Tanais II.* (*Silis*) "slightly fading simultaneously." On January 2 *Mare Acidalium* was "very dark" to Phillips, "prominent, and well separated "from *Niliacus Lacus;* and on January 5 it was again recorded "as being darker than other markings." Price, on February 13, depicted it no darker than the *Maria* to S. Townshend: March 16, "very heavy black; in fact, it was the most conspicuous area on Mars" to him. The Director observed *Mare Acidalium* as

merging into the polar marshes in January and February, but when the snow cap diminished in March, it was possible to see exactly the whole outline of this remarkable feature; it was then pentagonal in shape, the acutest angle being directed to N. At that time it recalled very vividly to memory the appearance given it by Burton in 1871 and 1873, as the half-tones *Baltia* and *Nerigos* had no more their Schiaparellian darkness of 1883–1890 (Plate III., Fig. 3). With regard to the darkness of the *Mare*, it may safely be said that in 1901 it was certainly inferior in tone to what it was in 1896 and in 1899.

The Sectional records throw much light in this grand phenomenon of the decoloration of *Mare Acidalium*. Emerging from the dreariness of a long winter in 1896, that striking marking was almost ink-black in colour;* but a lengthier exposure to the rays of a vernal sun interfered with its darkness in 1899,† while the process of decoloration was still more active towards the summer solstice of the Martian N. hemisphere in 1901. Such would probably be the deportment of a low, grassy vegetation; and the fact that Schiaparelli has witnessed kindred phenomena from 1884 to 1890 establishes the seasonal character of those remarkable variations.

TEMPE was seen yellow on C. M. by Attkins; and Molesworth found it "very faint and shaded early in the apparition," brightening later very considerably. Attkins, Molesworth, Phillips, and the Director, all agree in describing *Tempe* as whitening with the obliquity of the illumination.

PYRRHÆ REGIO is shown by Kibbler, Molesworth ("lighter "towards E.") and Townshend.

PROTEI REGIO is vaguely indicated by Craig and Molesworth.

MARE ERYTHRÆUM "showed a decided blue-grey tinge at "times" says Molesworth. "It was very uneven in tone, and "appeared to consist of streaks rather than even shading."

ARGYRE.—Indicated as a brilliant white spot on S. limb by Kibbler, Molesworth and the Director. No trace of the neighbouring lands, the tilt of the axis interfering with the scrutiny of those sequestered regions.

CANALS.

DARDANUS.—Attkins: January 30, width 2°; January 31, ditto, but not running in the same course as Schiaparelli; March 12, width 2°, and in its Schiaparellian position.—Buchanan: February 28, edge to shade to S.—Kibbler: April 21, a dark streak, 5° wide.—Phillips: January 2, width 4°, faintish.

GANGES.—Attkins: January 31, single, "faint," 1° broad only; March 6, width 2½°, diffuse at edges; March 7, width 2½°: March 10, width 2°; March 12, ditto.—Bolton: 5° wide, edge to shade in *Chryse*.—Craig:

* *Memoirs*, British Astronomical Association, "Report" for 1896–1897, p. 76.

† "Report" for 1898–1899, p. 83.

January, 2° wide, only near *Auroræ Sinus*.—Hall : January 30, width 8°, edge of bright *Chryse*. [This is much more likely than Bolton's observation of a shading on *Chryse*].—Kibbler : April 21, width $2\frac{1}{2}°$, faint ; April 23, edge to bright *Chryse*.—Molesworth : usually 5°, "broad" and "dark," suspected *double*. —Phillips : October 21, a band 5° broad ; January 2, width $3\frac{1}{2}°$.—The Director : a 6° wide band, may have been *double*.

GEHON II.—Shown as a continuation of *Gehon I.* by Attkins, Killip, Molesworth, Phillips, Price, Townshend, and the Director. This canal did not lie in the direction of *Gehon I.*, but trended further westwards.

HYDASPES.—Molesworth : "not seen till late in the apparition, faint and "($2\frac{1}{2}°$) narrow" on April 16.—Price : February 13, vague traces.—The Director : width $2\frac{1}{2}°$ curved, convex to W., but very smudgy and faint.

HYDRAOTES.—Molesworth : edge of shade to N.

IAMUNA.—Attkins : January 31, "faint and fairly wide (2°) ;" March 12, single, "held steadily," 2° wide, curving near limb like a real great circle of the sphere.—Bolton : an 8° band in April.—Molesworth : mean breadth 3°, "diffuse and fairly broad."—Phillips : January 2, width 3°.—Townshend : March 16, width $2\frac{1}{2}°$, pale bluish-green in tint.—The Director : a band 4° broad, faint and diffuse, may have been seen double by others.

INDUS.—Attkins : February 3, "suspected," convex to E., 1° wide ; March 16, straight, single, 1° wide edge to shade in *Thymiamata* ; May 31, "very "wide (3°) and fairly easy" on a disc of 7″·4.—Bolton : diffuse.—Hall : diffuse in March, $2\frac{1}{2}°$ wide, and convex to E.—Kibbler : March 12, width 5° ; March 21, vaguely indicated ; April 21 and 23, width 3° ; always convex to E. —Killip : January 31, diffuse.—Molesworth : generally dark, tapering and well-defined ; convex to E., mean width 3°, edge shade to N.E.—Phillips : January 4, convex to E., width 3°, edge to shaded *Thymiamata*.—Price : February 13, narrow, some $1\frac{1}{4}°$, and scarcely curved.—Townshend : March 16, width 3°, straight and pale bluish-green in tint.—The Director : generally curved, convex to E., and $2\frac{1}{2}°$ wide.

IORDANIS.—This canal may be considered as a branch of *Deuteronilus*, which runs into *Mare Acidalium*. It was seen by Molesworth as a 3° wide band.

NILOKERAS.—Attkins : January 31 : "strongly suspected (anomalous) "*duplicity* ;" March 6, width 3°, diffuse ; March 7, "a yellow band with grey "edges," but anomalously *double*, branches 4° apart to W., 9° near *Lacus Niliacus* ; March 10, a broad shading ; March 12, *double* anomalously, bands 5° apart to W., 8° to N.E. (Plate III. Fig. 4) ; March 16, and subsequently, confuse and very broad.—Bolton : edge of shade in *Chryse*.—Craig : distinct in January as a dark, diffuse shading.—Hall : January 30, breadth 8°, boundary of bright *Chryse*.—Kibbler : April 21, single, but broader to E., 4°, than to W. $2\frac{1}{2}°$; April 23 edge to bright *Chryse*.—Killip : March 9, wide by some 10° to E., and dark.—Molesworth : "broadly and anomalously *double*, the two "streaks including a shaded area. The N. component curves round into "*Tanais*, without appearing to enter the S. portion of the *Mare Acidalium* ; "the S. component enters *Niliacus Lacus*." On the Ceylon drawings, each of the bands has a breadth of $2\frac{1}{2}°$ generally, the distance separating them being 3° to W. and 10° to E.—Phillips : October 21, anomalously *double* very likely, total breadth being 7° to N.E. and 5° to S.W. ; January 1, narrower, 3° to S.W., 5° to N.E.—The Director : exceedingly dark, and easy to see, 7° broad to E., 4° to W.

OXUS.—Molesworth : 3° wide, edge of shade N.W.

SILIS.—A name given to Molesworth's canal "*Tanais II.*", running from the W. angle of *Mare Acidalium* to N.W., over *Baltia*. Molesworth remarks that the canal in question was a "very dark broad streak, joining *Mare Aci-* "*dalium* with *Lacus Hyperboreus*, fading later."

TANAIS.—Attkins ; January 30 to March 10, edge of shade to N.—Bolton : diffuse.—Buchanan : February 28, edge of polar shading.—Hall : January 31,

edge of polar shade.—Kibbler: always edge of shading to N.—Molesworth: width 6° generally, "broad and dark, suspected (anomalously) double," edge of shading to N.—Phillips: January 2, edge of shade in *Baltia-Neriyos*.—The Director: in January and February the canal formed the S. edge of the polar marshes, but it subsequently was seen as the border of a very faint half-tone to N.

SECTION III.

Solis Lacus.

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

THAUMASIA was seen white by Attkins and Molesworth, which is a consequence of the tilt of the axis. According to the Ceylon observer, the N.E. segment of that vast circular region was shaded, between *Nectar*, *Agathodæmon*, and *Chrysorrhoas* produced.

As already mentioned (p. 92), a bright projection on the terminator was seen by Molesworth on March 7 towards the S. part of *Thaumasia*, a little following *Solis Lacus* (Chart, Plate I.); and this marking was seen as a white spot by Attkins on April 9, when it was estimated as brilliant as the polar snows.

SOLIS LACUS.—Visible only with the greatest difficulty to Attkins, Buchanan (Plate III., Fig. 6), Hall (Plate III., Fig. 5), Kibbler, and the Director. But Molesworth remarks that it was "by no means a difficult object" during the latter part of the apparition (Fig. 5).

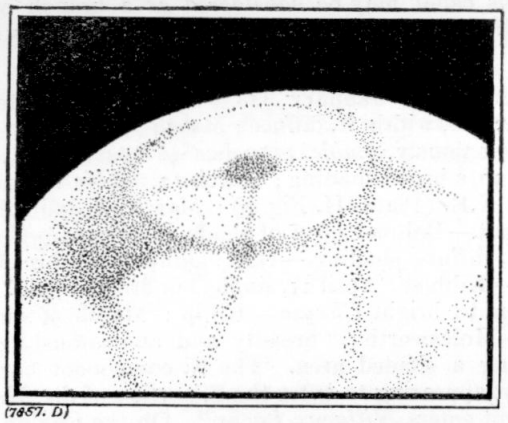

Fig. 5. *Solis Lacus* on 1901, February 28 (*Molesworth*).

TITHONIUS LACUS was generally invisible to Attkins, but on March 7 he saw it beautifully as a round, dark spot, 6° in diameter, and strung on the double *Agathodæmon* (Plate I.). Buchanan shows on February 28 a round black spot in $\Omega = 77°$, $\Phi = -17°$ (Plate III., Fig. 6) which the Director considers as a representation of *Tithonius Lacus*. On March 12 Kibbler saw it as a slight broadening of *Agathodæmon* only. Killip: January 31, dark and distinct. Molesworth: "distinct knot on *Agathodæmon*, but "never easy to see; decidedly fainter than *Solis Lacus*." The

lake is reduced to a streak by Phillips, on November 26, and was not seen by the Director (Fig. 6).

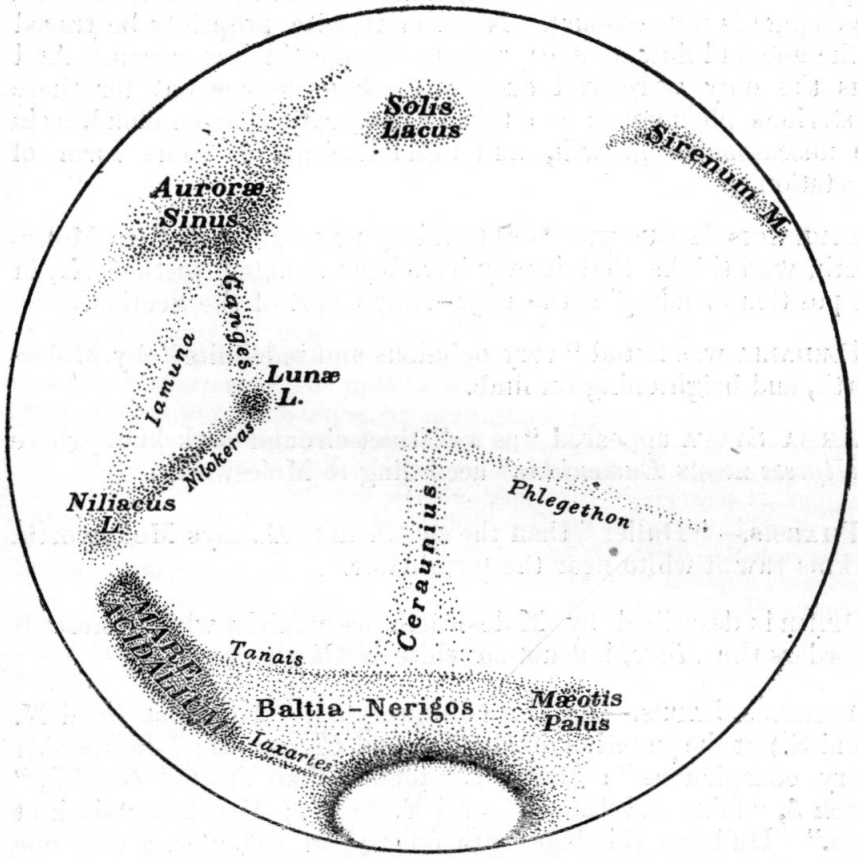

Fig. 6. The *Solis Lacus* region of Mars in 1900–1901. (*The Director.*)
[From "Knowledge," April 1902.]

AUREA CHERSONESUS.—The existence of this peninsula as shown by Schiaparelli in 1877 and 1879 is certainly not confirmed by the Section's work in 1900–1901. As in 1894, 1896, and 1899, the peninsula was either vastly reduced in extent, or totally missing at the last apparition.* The distance separating the *p* coast of *Thaumasia* from the *p* end of *Solis Lacus* was as follows on the Sectional drawings of 1901 :--

Attkins - -	12°	Molesworth -	14°
Hall - -	12°	The Director -	12°

These figures, which are in excellent agreement with one another, show that in 1901 the coast of *Auroræ Sinus* was twice as near the great lake as it was in 1879. Assuming, as we have every right to do, the accuracy of Prof. Schiaparelli's drawings of 1879, and that *Aurea Chersonesus* was not a mere cloud, we can scarcely avoid the conclusion that the dark material of the "*Mare*" has advanced towards *Solis Lacus* by some 400 miles in 22 years.

AONIUS SINUS furnishes us with a kindred example, although in this case it was the bright, and not the sombre, material, which

* "Report for 1896, p, 81.

showed the encroachment. After having been almost the darkest area of Mars in 1879,* *Aonius Sinus* vanished in 1894, never to reappear since that time. Here, as well as in *Aurea Chersonesus*, the change is not seasonal. Nor can it with propriety be traced to the ebb and flow of a capricious, though tideless, ocean. And thus the only terrestrial analogies left us to account for these mysterious phenomena lie either in obscuration† from cloud, or in the unseasonable growth, and rapid decline, of some form of vegetation.

PHŒNICIS LACUS was "faint and by no means easy" to Molesworth, who thinks that it may have been situated further N., in the position of lake *f* of the 1896–1897 Chart of the Section.

DÆDALIA was found "very nebulous and indefinite" by Molesworth, and brightening on limb.

ARSIA SYLVA appeared "as a distinct circular dark knot where "*Ulysses* meets *Eumenides*," according to Molesworth.

THARSIS.—"Duller" than the continent to E., says Molesworth. Attkins saw it white near the terminator.

OPHIR is described by Molesworth as "fairly white where it "borders the *Mare*, but not so white as *Chryse*."

ASCRÆUS LACUS.—Attkins: January 30, "dark spot (oval N. "and S.) at the junction of *Fortuna* and *Ceraunius*;" January 31 "very conspicuous"; March 1, "plainer than *Nodus Gordii*;" March 3, "faint and diffuse," oval E. to W.; March 6, "dark at times." Hall saw this lake with only $4\frac{7}{8}$-in reflector, a very fine performance. Molesworth: "a dark, distinct, diffuse, circular spot "at the extremity of the double *Ceraunius*. It never showed any "signs of gemination." Phillips depicted *Ascræus Lacus* as diffuse on January 2.

MAREOTIS LACUS is the name given by the Director to the dusky spot on *Ceraunius*, at its junction with *Nilus-Phlegethon*, and discovered by Schiaparelli in 1881–1882. It was double at that time, and quadruple in 1883–1884. This lake was seen by Attkins on March 7, when it extended over 8° in longitude and 5° in latitude, and again on March 10 and 12.

LABEATIS LACUS.—Probably seen by Attkins on March 7, in $\Omega = 77°$, $\Phi = +40°$, as an elliptical spot, 10° long and 5° broad.

ASCURIS LACUS.—Name now given to a lake seen by Molesworth at the junction of *p* band of *Ceraunius* with *Tanais* and *Clarius*. Probably identical with a lake seen a little to the W. of this position by Schiaparelli in 1888.

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* Webb, *Celestial Objects*, 5th ed., Vol. I., pp. 157–158, Plate by Burton and Dreyer.

† *Obscuration on Mars*; as seen from the earth, clouds on the planet should be white, and hence appearing to whiten, not obscure, the dark areas over which we may suppose them to float.

MÆOTIS PALUS is shown as a very faint half tone by Attkins, Buchanan, Molesworth, Phillips, and the Director.

ARCADIA.—"Slightly shaded," according to Molesworth. A large white spot was seen on *Arcadia* by Attkins on March 5 in $\Omega = 112°$, $\Phi = +45°$. The major axis of this marking extended over 18° in longitude.

CANALS.

AGATHODÆMON.—Attkins: January 30, "diffuse"; January 31, anomalously double; bands 5° apart to E., and each 1° wide, blended into *Fortuna*; February 3, "dark and wide" (3°); March 3, width 3°, diffuse near limb; March 6, breadth 2½°, single; March 7, *double* anomalously at E. end, bands 5° apart to E., 3° to W.; March 10, anomalously *double*, as on Plate I., but estuary much larger, as measuring some 18° from N. to S.; and as both bands have triangular embouchures in *Auroræ Sinus*, the intermediate space ends in a semicircle to E.; March 12, under perfect definition the canal is very wide, some 3½°, but not double; April 17, "very wide."—Bolton: diffuse.—Buchanan: February 28, width 6°.—Craig: January, 3° wide near *Auroræ Sinus*.—Kibbler: March 12, dark, and 6° wide.—Molesworth: "dark and knotted as far as *Tithonius Lacus*, and was strongly suspected *double*.—The rest of the canal is fainter, fairly sharp towards *Thaumasia*, but diffuse to N." Generally depicted as widening into a huge estuary on *Auroræ Sinus*; mean breadth 2½°.—Phillips: January 2, width 3°, not very marked.

ARAXES.—Attkins: 3° wide in March.

BÆTIS.—Attkins: 2° wide in March.

CERAUNIUS.—Attkins: January 30, described as "wide"; March 7, single, 3° wide; March 10, single, 3½° wide, curving into *Tanais*; March 12, ditto; April 17, "glimpsed."—Buchanan: February 28, huge faint duskiness near centre of disc, seems of unusual shape.—Molesworth: "anomalously *double*, "as shown in Schiaparelli's charts; the two components including a shaded "area;" both bands are usually drawn as having a breadth of some 4°, while their distance increases from 6° to S. up to 20° opposite *Nerigos*.—Phillips: November 26, as a vertical streak, 3° broad.—The Director: a very amorphous and diffuse shading of feeble intensity.

CHRYSORRHOAS.—Attkins: January 31, width 1°; March 7, "very wide," 2½°, easy; March 10, faint, 2° broad; March 12, width 2°.—Bolton: diffuse.—Kibbler: April 23, suspected, 5° wide, diffuse.—Molesworth: "faint and narrow (3°)."

Molesworth saw *Chrysorrhoas* prolonged to *Solis Lacus*.

CLARIUS.—Attkins: April 9, width 4°.—Buchanan: February 28, edge of polar marsh.—Molesworth: "clear of the polar marshes", general width 4°, edge to shaded *Nerigos*.—Phillips: January 2, edge to shade N.—The Director: faint edge to shade.

ENDYMION.—A name now given to the prolongation of *Agathodæmon* to W., as far as *Nodus Gordii*. Attkins: March 7, single, 3° wide; March 10, *double*, bands 5° apart, enclose shading; April 9, single 3½° wide.—Buchanan February 28, width anomalous, but 4° as a mean, single.

EOSPHOROS.—Molesworth: 2½° wide, faint.

FORTUNA.—Attkins: 1½° wide.—Molesworth: 3°.

IRIS.—Molesworth: 2½° wide, faint.

ISSEDON.—Kibbler: April 21 and 23, followed a short distance out of *Lunæ Lacus* in continuation of *Ganges*.—Molesworth: "faint", 2° broad in April.

MACROBIUS.—A name now given to a canal seen by Attkins uniting *Nodus Gordii* to *Ascræus Lacus*. March 1, 3, and 10, width 3°.—Molesworth: generally 2° wide, faint.

NECTAR.—Attkins: March 12, width 3°, "seen splendidly" (Plate III., Fig. 4).—Buchanan: February 28, dark and obvious, some 7° broad.—Kibbler: April 21, diffuse, 5° wide.—Molesworth: mean width $2\frac{1}{3}$°, "prolonged into the *Mare* by *Garrhuenus*."

NILUS.—Attkins: January 31, faint, 1° wide; March 6, invisible; March 7, "wide (2°) and plain"; March 10, width 2°; March 12, single, 2° wide; April 17, "very wide."—Bolton: diffuse.—Hall: January 31, very diffuse, suspected only.—Molesworth: "broad (generally 6° wide) and diffuse, "almost certainly (anomalously) *double*", distance between the components being usually 5° to E. and 8° to N.W.—Phillips: November 26, diffuse, 3° wide, edge to shade N.; January 2, diffuse, 3° wide, edge of shade to W.,

PHASIS.—Molesworth: edge of shade to W.

URANIUS.—Attkins: 5° wide in March.

SECTION IV.

Mare Sirenum.

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

ICARIA was "very nebulous and indefinite", according to Molesworth, and brightening near the limb; a fact which was noticed also by the Director.

PHAETHONTIS.—Brilliant on S. limb to Molesworth, Price, and the Director.

SIRENUM MARE is shown fainter than usual by Attkins, Craig, Kibbler, Molesworth, Phillips, and the Director. At Ceylon it was found that the darkest parts of the *Mare* were its E. end and *Titanum Sinus*.

ATLANTIS I. was strongly suspected by Attkins, and better seen by Molesworth and the Director. *Atlantis II.* was not seen.

MEMNONIA appeared to Molesworth as being of "a warm yellowish white, whitest where it borders the *Mare*."

AMAZONIS.—Yellow and ruddy to Attkins, was seen slightly shaded all over by Molesworth. The Director thought it brightened when nearing the limb.

NODUS GORDII is described by Attkins on February 25 as "oval and darkish" near *p* limb, and somewhat "diffuse." On March 3 it was elongated from N.E. to S.W., measuring 12° in length and 6° in breadth, almost on the equator (Plate I). Molesworth saw it three times as a "faint spot."

PHRYGIUS LACUS.—A name given by the Director to the easternmost of the lakes discovered on *Eumenides Orcus* by Mr. W. F. Gale in 1892. It was seen by Molesworth as "a faint "spot" in 1901.

LUCUS MARICÆ.—"Distinct under good definition," says Molesworth. "This and *Ammonium* are the darkest of the chain "of lakes."

AMMONIUM.—Attkins: February 28, "dark spot on *Eumenides-* "*Orcus* about halfway between *Nodus Gordii* and *Trivium* "*Charontis*"; 6° across. Molesworth: "quite distinct at the "junction of *Titan* and (*Orcus*)." In 1888 *Ammonium* was doubled into round spots.

TITANIA.—A name now given by Molesworth to the dark shadings of 1901, S.E. of *Propontis*. On April 10 Attkins saw all this region shaded as far as $\Phi = 33°$, where the dusky area seemed enveloping the canals *Lycus*, *Lycaon* and *Phlegethon*, and culminating in a darkish condensation to S.E. This is confirmed by Hall, who notes that the "region between 'lake' *d* "(*see* Map of the last "Report") and *Propontis* dark." Molesworth says the shading is darkest near *Plutus*. The detail seems "to differ greatly from previous representations . . . . . "under the best definition the shaded groundwork itself appears "to consist of streaks and variable shades, which tend to confuse "the eye." As shown on Plate IV., Fig. I., Phillips confirms these impressions of Attkins, Hall, and Molesworth to the letter. Price also shows traces of the duskiness, and so also does the Director on December 22 and April 4, although he could never observe this region under first-rate conditions in 1901.

TITANUM LACUS.—A name now given to a lake seen by Molesworth at the intersection of *Titan* with *Pyracmon*, described as "a rather dark diffuse spot where *Acheron* meets *Titan*; the "edges are rather diffuse, but the spot appears circular."

FERENTINÆ LUCUS of Lowell was seen by Attkins on April 10 in $\Omega = 151°$, $\Phi = +34°$. Diameter some 10°.

EREBI FONS.—Name given by Molesworth to a lake seen by him in 1896–1897 (*see* "Report" of that apparition, p. 85), and reobserved in 1898–1899 and 1900–1901. It appeared to be "a "very dark spot". The first indication of this lake was noticed by Schiaparelli on 1884 February 27, when the double *Erebus* was much darker at its junction with *Titan* than to W.; and on 1888 June 13, Schiaparelli was enabled to detect a neat gemination of this marking with the 19-in. Merz refractor.

PROPONTIS was never observed as a band in 1901, but always as a slightly elliptical spot. This is the form given to it by Attkins, Kibbler, Molesworth, and the Director. Darker perhaps than *Trivium Charontis*. But this singular spot was much smaller in longitude than Schiaparelli's representations of *Propontis* from 1883 to 1888, when it extended over 14 equatorial degrees from E. to W. The following dimensions of *Propontis*,

taken on the sectional drawings, will show that the E. half of the lake has practically disappeared since 1888 :—

Date.	Size of Lake in equatorial degrees.		Observer.
	Length.	Breadth.	
	°	°	
1900 December 22 -	9	5	The Director.
1901 February 17 -	8	7	Molesworth.
,, ,, 19 -	7	7	,,
,, ,, 20 -	11	5	The Director.
,, ,, 21 -	9	5	,,
,, ,, 25 -	9	7	Attkins.
,, ,, 28 -	6	6	Molesworth.
,, ,, 28 -	5	4	Attkins*
,, March 24 -	9	9	Molesworth
,, ,, 26 -	5	4	,,
,, ,, 29 -	6	5	,,
,, ,, 30 -	6	5	,,
,, ,, 31 -	8	5	,,
,, April 4 -	10	7	The Director.

EUXINUS LACUS.—As a compensation for the disappearance of the E. end of *Propontis*, we have to record the formation of another lake, some 18° to the E., first discovered by Molesworth on February 17, and, quite independently, by Attkins on February 28 (Plate IV., Fig. 2 ; and the annexed Fig. 7). This discovery gives great credit to both observers, and especially to

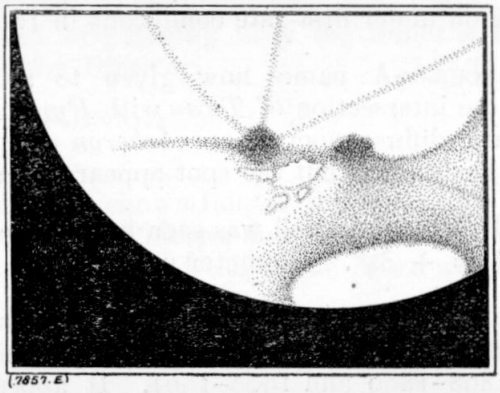

Fig. 7. *Propontis* and new lake to the left, on 1901 February $28^d\ 22^h\ 30^m$ G.C.M.T. (*Attkins.*)

Attkins, since he used an aperture of only $6\frac{1}{2}$-in. It would seem that the new lake, which, from its vicinity, has now received the name of *Eurinus Lacus*, was somewhat smaller, and certainly fainter, than *Propontis*, since it has been missed more than once by Molesworth and Attkins, when *Propontis* was readily visible.†

* Very fine definition.

† It should be added that in his 1898–1899 map (*Nuove Osservazioni di Marte*, Collurania, 1900), Signor Cerulli shows *Propontis* doubled in bands, as seen by Schiaparelli in 1886 ; and that he further depicts a round lake *p Propontis*, which is probably identical with our *Euxinus Lacus*.

A white spot was seen N. of the line joining *Propontis* and *Euxinus Lacus* by Attkins on February 28.

CASTORIUS LACUS.—Molesworth defines this spot as "a dark "knot further N., at junction of *Hebrus* and *Fevos*." Smaller than *Propontis*.

DIACRIA.—A name now given to the vast shaded continental region N.E. of *Propontis*. The shading was seen by Attkins, Hall, Kibbler, Molesworth, Phillips, and the Director.

CANALS.

ARDUENNA.—Molesworth: $2\frac{1}{2}°$ wide.

BELLEROPHON.—A name now given to a canal seen by Attkins uniting *Sinus Titanum* to *Nodus Gordii*. From March to April it had a breadth of $2\frac{1}{2}°$.

BRONTES.—Seen by Attkins on March 3 as the edge of shaded *Diacria*, between $\Phi = +40°$ and 60°.

CREON.—Name given to a canal seen by Molesworth, uniting *Euxinus Lacus* to *Erebi Fons*. "Dark and distinct," 3° wide, edge of shade to N.W.—Phillips: December 29, edge of shade to N.W.

DAMASTES.—Name given to a canal uniting *Titanum Lacus* to *Euxinus Lacus*; very faint, 2° wide, according to Molesworth, who discovered it.

EUMENIDES.—Attkins: March 1, wide 2°; April 9, width 3°.—Molesworth: generally 3° wide and "diffuse, but rather faint," edge of shade to N.

EUROTAS.—Molesworth: $3\frac{1}{2}°$ wide.

FEVOS.—Molesworth: $2\frac{1}{2}°$ wide.

GIGAS.—Kibbler: April 21, "could be detected," but not shown on the drawing.—Molesworth: "rather faint and diffuse," 3° wide, "the triangle "*Gigas-Eumenides-Titan* is slightly shaded."

LYCAON.—A name now given to a canal detected by Molesworth and running between *Phrygius Lacus* and *Euxinus Lacus*, width 3°, broad and distinct.

LYCUS.—Attkins: February 25, "very dark" (3°) wide; N.E. edge to yellow *Amazonis*; February 28, wide and diffuse; March 1 and 3, width 3,° diffuse: April 10, edge to shade to E.—Molesworth: width some 5° to N.—Price: January 23, smudgy, identification doubtful."

PARCÆ.—Molesworth: faint, 2° wide.

PHLEGETHON.—Attkins: February 28, width 4°; March 1, fully 6° wide to W; March 3 and 5 faint, 3° wide and merging into the *Diacria* shades; March 10, anomalously broad, 3° wide to E., and some 10° to W.—Buchanan: February 28, edge of shading to S.—Molesworth: usually 4° wide to E., and 6° to W., "broad and diffuse, broader to N.W."—The Director: width 3° to E. and diffuse to W.

PYRACMON.—A name now given to a canal seen by Molesworth to run out of *Titanum Lacus* to the N.E., 4° wide, edge to shade to N.W.

TITAN.—Attkins: February 28, seen only between *Euxinus Lacus* and *Ammonium*, 2° wide; April 9, width 2°.—Molesworth: "faint and rather "diffuse," 3° wide, edge of shading to E.—Phillips: December 29, N. end only, edge to shade to N.E.—Price: Jan. 23, smudgy, convex to E., 3° wide.—The Director: width 2° to S.

ULYSSES.—Molesworth, generally $2\frac{1}{2}°$ wide, "distinct and narrow," and "prolonged to *Lacus Ascræus* on May 11."

SECTION V.

Mare Cimmerium, Elysium, and Trivium Charontis.

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

MARE CIMMERIUM was darker than *Mare Sirenum*, while in 1896 the reverse was the case.* Attkins' description of the *Mare* is "dark," "fairly dark," "darkish," &c. Craig did not find it very dark in February, but he saw the *f* end clearly rounded, and with the embouchure of *Æthiops*, as shown on Plate IV., Fig. 5. This is an excellent piece of work. Hall's representations of the *Mare* show it to have been normal; Kibbler: moderately dark; Killip: cigar-shaped to W. Molesworth, writes: "This sea was "rather indefinite early in the apparition. Later it was seen darker "and of a definite indigo tinge, darkest at the estuaries of *Læstrygon* "and *Cerberus*. The darkest part of the *Mare* was all along "its N. edge, shading gradually to S. It faded considerably to- "wards the W. end. It was decidedly darker than *Mare* "*Sirenum*." Phillips deemed it darkest along its N. border; Townshend: normal, and so also the Director, who found it, moreover, indented at estuaries of *Læstrygon* and *Cyclops*. The latter indentation was seen also by Attkins, Corder, and Molesworth. *Cimmeria Insula* "is shown rather indefinitely on some "of the sketches" of Molesworth.

HESPERIA appeared "plainer" than in 1899 to Attkins, who attributes this to the probably greater darkness of *Mare Cimmerium* and *Mare Tyrrhenum*. Buchanan shows it very narrow on February 13 and March 19. Craig, who saw this region admirably in February (Plate IV., Fig. 5), draws the peninsula curving beautifully round in its junction with *Æthiopis*, and also rather destitute of shading. On April 4, Kibbler saw *Hesperia* shaded. Molesworth: "quite distinct throughout, but decidedly shaded. "It is crossed by faint streaks in prolongation of *Cerberus* (the "canal *Sinnys* of the Chart) and *Læstrygon*." Townshend found this land distinct and narrow; the Director, more confuse and shaded.

MARE TYRRHENUM (E.) is fairly dark in the great majority of the drawings.

ELECTRIS.—"Generally very white close to the S. limb," says Molesworth; and this was noticed also by the Director.

ERIDANIA.—Attention is called by Attkins, Molesworth, and the Director to the whiteness of this land on limb.

ZEPHYRIA was "almost invariably brilliant where it borders the "Mare," but "more dull to the N.," according to Molesworth. The Director found *Zephyria* to brighten with the obliquity of the illumination.

AQUÆ APOLLINARES are described by Molesworth as a "very "faint spot, very nearly at the limit of vision."

* "Report" for 1898–1899, p. 90.

ÆOLIS.—"Fainter than *Zephyria*," according to Molesworth.

CYCLOPIA.—A name given by the Director to the dusky triangle formed by the canals *Cyclops* and *Cerberus* produced, with the coast of *Mare Cimmerium*. The shaded area was well observed by Kibbler and Molesworth.

ÆTHIOPIS.—Attkins drew this land whitish near C.M. on April 1; and Molesworth found it "rather fainter than *Æolis*," slightly shaded N. of *Pactolus*.

ELYSIUM seemed "white at limb" on February 25, $\omega = 183°$, to Attkins, but losing its whiteness when near the C.M. On February 28, $\omega = 170°$, "white at limb"; March 3, "white area "on terminator," under $\omega = 123°$; March 30, yellow an C.M., "so also on April 1. May 10, rising "distinctly whiter at termi- "nator than nearer *Trivium Charontis* where it is ground tint," and also as ground tint of planet on C.M.* Buchanan drew *Elysium* smaller than usual; Kibbler: "of a lightish tint," and on April 9, "decidedly bright." On March 21, Killip wrote that it was "exceeding brilliant, whiter that N. pole cap," and on April 30, "brilliantly white" on limb. Molesworth: "not well "seen early in the apparition. Later it was very bright, certainly "the whitest of the continental areas, excluding those bordering "the southern *Maria* . . . never as white as *Edom*. It appears "almost exactly circular, the angles at *Trivium Charontis* and "*Lucrinæ Lacus*" being gently rounded off. It is brightest "where it borders *Cerberus* and *Styx*. No canals were seen "traversing the bright circular area. *Elysium* seems to have "been brighter in March than in either February or April." Phillips did not find *Elysium* particularly bright,‡ an impression which is confirmed by the Director, who was struck by the dull yellow colour of the pentagon in 1900–1901, as compared to what it was in 1896 and in 1899. The Director further noticed, when the image was steady, that the E. half of *Elysium* was brighter than the W., the line of separation of the two tints being indicated by the canal **E** of the 1896–1897 Chart, now termed *Galaxias-Zephyrus*.

The brightening of *Elysium* with the obliquity of so ar radiation was noticed by almost all the members of the Section in 1901.

Attention is called by Attkins, Hall, Molesworth, Phillips, and the Director to the white spot on the E. angle of *Elysium*.

PAMBOTIS LACUS.—"Very dark and distinct, like a smaller "edition of *Trivium Charontis*," after Molesworth; but very diffuse to the Director. This lake was seen triple by Molesworth in 1896–1897§. It was discovered by Schiaparelli in 1888.

TRIVIUM CHARONTIS.—Attkins: February 25, "triangular, "pointing S.E., at about 45,° extremely dark"; February 28,

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* *See* also p. 92.

† *Pambotis Lacus* of Signor Cerulli. The 1894 chart of Lowell is so inaccurate S. of *Elysium*, that it is preferable not to try any identifications with it.

‡ Except, of course, when near the limb or terminator.

§ "Report" for 1896–1897, Chart and p. 92.

"dark and triangular," and of a huge size; March 28, "a dark "crescent"; March 30, "triangular," dark; May 10, "smudgy" and "barely darker than the canals." Buchanan: dark when

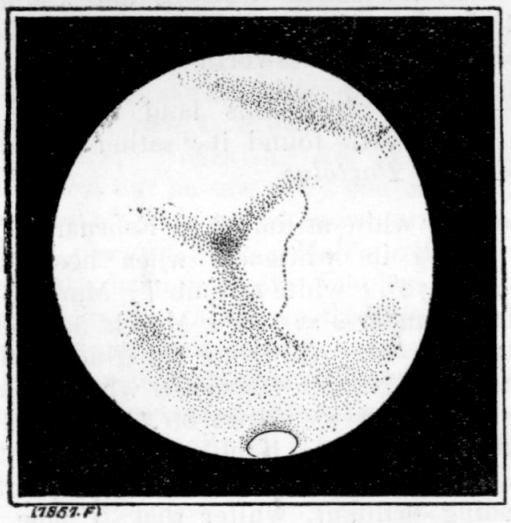

Fig. 8. *Trivium Charontis* and *Elysium*, on 1901 April 1^{d} 19^{h} 15^{m} G.C.M.T. (*Hall.*)

near the limb. Hall depicted it as a small dark spot in April (Fig. 8.). On April 4, 5, and 9, Kibbler saw it very plain and

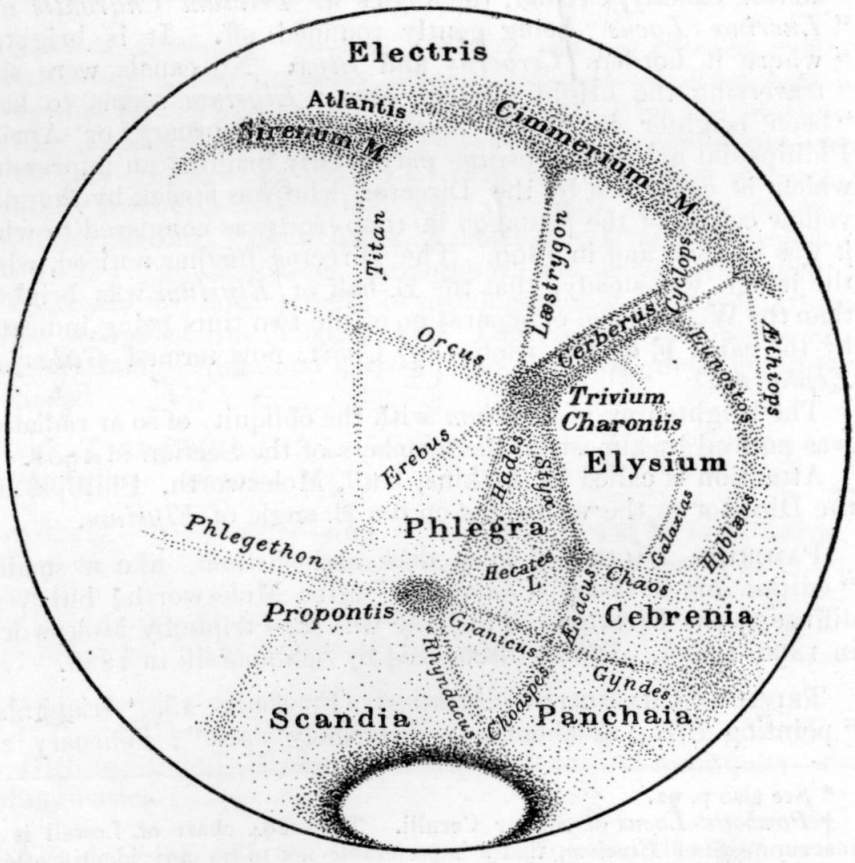

Fig. 9. The *Trivium Charontis* region in 1900-1901. (*The Director.*)
[From "Knowledge," April, 1902.]

dark, giving it, moreover, a distinct tendency to gemination in oval spots, trending towards the *Orcus* (Plate IV., Fig. 3). Molesworth: "intensely dark, circular spot, the outline being "slightly broken where the canals enter it. The edges were slightly "diffuse, but I have never seen any signs of gemination, or of "a bright centre. The *Trivium*, *Cerberus* and (*Pambotis Lacus*) "formed one of the most striking objects of the apparition." Phillips: December 21, "scarcely so prominent as last apparition," a view which is fully corroborated by the Director's impressions, who found it distinctly discoloured since 1896 and 1899, being just a little darker than the *Cerberus*, or the heavy shaded area on the N. side (Fig. 9).

STYGIA PALUS.—A name given by Molesworth to a small "dark "lake on *Styx*, just S. of *Hecates Lacus*, nearly midway between "the latter and *Trivium Charontis*." He discovered it in 1896–1897. This may have been the N. of the two black spots composing *Trivium Charontis* in 1896.

HECATES LACUS was "dark and distinct as an enlargement "of *Styx*, where *Chaos* leaves it," according to Molesworth; but was more difficult to the Director. Discovered by Schiaparelli in 1888, and independently re-discovered by Molesworth in 1896–1897*, at a time when the 1888 Milan results were not published.

MORPHEOS LACUS is the name given by the Director to a lake discovered by Schiaparelli in 1888 at the N.W. angle of *Elysium*, and independently re-discovered by the late Mr. G. L. Brown, of the Mars Section, in 1898-1899.† It was "dark, small, and "distinct" to Molesworth in 1901.

LAKE *a* of the Chart, seen by Molesworth, may by identical with lake *e* of the 1898–1899 "Report," also discovered by the late Mr. Brown.‡

LAKE *b* of the Chart is new, and was discovered by Molesworth.

SINTIUS LACUS.§—Name given by the Director to a small lake discovered by Molesworth, N.W. of *Pambotis Lacus*. Inconspicuous.

PHLEGRA.—Attkins, Craig, Hall, Kibbler, Molesworth, Phillips, and the Director, all agree in showing the W. part of this region strongly shaded in 1900–1901. Attkins and Molesworth further call attention to an ill-defined lighter patch in the middle of the distance separating *Styx* from *Hades*. The E. part of *Phlegra* is also shown a little shaded by Attkins, Molesworth, and the Director.

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* "Report" for 1896–1897, lake *k* of the Chart, and p. 92.
† "Report" for 1898–1899, lake *f*, of the Chart, and p. 92.
‡ *Ibid*, lake *e* of Chart, and p. 92.
§ From the vicinity of *Hephæstus*. Οἱ Σίντιες were the old inhabitants of Lemnos.

AORNOS LACUS.—Name given by the Director to a new lake, detected by Molesworth at the intersection of *Plutus* and *Hades*. Small and difficult.

CEBRENIA.—Attkins: March 30, shaded (Plate IV., Fig. 4.), and April 1, "dark." Corder found it intensely shaded on March 30. Hall and Kibbler less so. Molesworth: "decidedly "shaded between *Hades* and *Styx-Æsacus*. A fainter shading "covers the region between *Æsacus*, *Chaos*, and *Anian*." The Director: very slightly shaded, just a little more than *Elysium*, thus resulting in the great faintness of the canal *Chaos*.

STYMPHALIUS LACUS.—Vaguely seen by the Director. Discovered by Schiaparelli in 1888, and independently observed by Molesworth in 1896.*

SITHONIUS LACUS.—Molesworth: "distinct but diffuse, con- "siderably fainter than *Hecates Lacus*." Discovered by Schiaparelli in 1888.

GARGAPHIE FONS.—A name given by the Director to a new lake discovered by Molesworth on *Alcyonius* in $\Omega = 250°$, $\Phi = +46°$. A minute knot.

ÆTHERIA.—Shaded according to Attkins, Buchanan, Corder, Craig, Molesworth, and the Director.

CANALS.

ADAMAS.—Molesworth: "fairly distinct," mean width 3°; edge "to "shade between it and *Amenthes*."—The Director: width 3°; edge to shade to W.

ÆSACUS.—Attkins: March 30, darkish; edge of shade to W.; April 1, very dark, and 4° wide; edge of shade in *Cebrenia*.—Corder: March 30, width 8°; dark.—The Director: width $2\frac{1}{2}°$ generally; faint.

ÆTHIOPS.—The Director: 2° wide.

ALCYONIUS.—Attkins: always edge to shaded *Utopia*.—Bolton: edge of shade to W.—Corder: edge of shade to W.—Kibbler: May 5, very dark, and 3° broad.—Molesworth: "anomalously *double*," running in a curve from *Nubis Lacus* to *Sithonius Lacus*, S.E. edge of shaded Utopia; each of the two bands is some 3° wide, and the distance separating them increases from 4° to S. up to 7° at N.E.—Phillips: edge of shade to W.

ANIAN.—Killip: 3° wide.—Molesworth: 2°, edge of shade to E.

ANTÆUS.—Molesworth: edge to shade to N.

AVERNUS.—Molesworth: 2° wide.

BOREAS.—Molesworth: 2° wide, faint.

CERBERUS.—It was with much propriety that Phillips compared this canal to a small "sea,"† for it was certainly the darkest canal of Mars in 1900–1901, almost rivalling in darkness *Mare Cimmerium* itself. Several Members

* "Report" for 1896-1897, Chart, lake *l* and p. 92.
† "Report" for 1898-1899, p. 93.

saw the *Cerberus doubled* at the last apparition, so that it is a duty to carefully consider the observations in order to see if the doubling took place suddenly, as claimed by Schiaparelli for some canals; if it was governed by a slow process; or if, again, the canal was double throughout the apparition. Hence the following table:—

Date.	Breadth of Canal.		Single or Double.	Darkness.	Observer.
	To N.E.	To S.W.			
	°	°			
1900, Dec. 22 -	6	5	Single	Very dark	The Director.
„ „ 22 -	7	6	do.	do.	Phillips.
1901, Feb. 13 -	7	6	do.	Grey	Molesworth.
„ „ 13 -	10	8	do.	Dark	Buchanan.
„ „ 17 -	5	5	*Double*	Grey	Molesworth.
„ „ 18 -	9	8	*do.*	Very dark	The Director.
„ „ 20 -	6	3	Single	Dark	Attkins.
„ „ 20 -	8	7	*Double*	Very dark	The Director.
„ „ 21 -	8	7	*do.*	do.	do.
„ „ 25 -	5	2	Single	Dark grey	Attkins.
„ „ 25 -	10	5	do.	Dark	Phillips.
„ Mar. 19 -	8	8	do.	Very dark	Buchanan.
„ „ 20 -	8	4	do.	do.	Molesworth.
„ „ 22 -	7	6	do.	Dark	do.
„ „ 23 -	6	5	do.	Very dark	do.
„ „ 24 -	6	5	do.	Exceedingly dark	do.
„ „ 24 -	5	3	do.	Dark	The Director.
„ „ 25 -	4	3	do.	do.	Molesworth.
„ „ 26 -	6	5	do.	Very dark	do.
„ „ 29 -	6	5	do.	do.	do.
„ „ 30 -	5	4	*Double*	do.	Attkins.
„ „ 30 -	7	7	Single	do.	Corder.
„ „ 31 -	6	4	do.	do.	Molesworth.
„ „ 31 -	7	7	*Double*	do.	Bolton.
„ Apr. 1 -	7	7	Single	Dark	Hall.
„ „ 1 -	4	3	*Double*	do.	Attkins.
„ „ 4 -	8	6	Single	Very dark	Kibbler.
„ „ 5 -	9	5	Single?	do.	do.
„ „ 9 -	5	4	Single	do.	do.
„ „ 30 -	7	5	do.	do.	Molesworth.
„ May 1 -	5	4	do.	do.	do.
„ „ 10 -	3	1	do.	Dark	Attkins.

These data are very instructive, as showing the canal to have been *double* throughout the apparition, the duplicity being distinctly visible only under very fine seeing. Whenever the definition was only moderate, the two bands

were blended into a single streak, whose breadth was equal to the breadth occupied by the gemination. It is also evident that this was a case of *anomalous gemination*, the mean values of breadth being $6\frac{1}{2}°$ to N.E. and 5° to S.W. Unlike its past appearance, the Director saw the duplication of *Cerberus* extend as far as *Mare Cimmerium*; and, owing to the superior brightness of *Elysium*, and to the duskiness of *Cyclopia*, alluded to above, *Cerberus* was also an edge to shading throughout its length, from *Trivium Charontis* to the southern *Mare*.

Molesworth calls attention to the *knotted* structure of *Cerberus* under high powers.

CHAOS.—Shown as the mere edge of slightly shaded *Cebrenia* by Attkins, Bolton, Buchanan, Craig, Hall, Kibbler, Molesworth, and the Director. Probably fainter than in 1896–1897 and 1898–1899.

CHOASPES.—The Director: 4° wide.

CYCLOPS.—Attkins: February 25, "broad and darkish;" 4° wide: March 27, "starts from indentation on *Mare Cimmerium*, and is fairly "dark:" March 30, indefinite; 4° broad; April 1, width 3°, and not running along the meridian, but more to N.E.—Corder: March 30, depicted as starting from an indentation in *Mare Cimmerium*, 6° wide.—Craig: 6° wide in February.—Kibbler: E. edge of shaded *Cyclopia* in April.—Killip: March 28, very dark, and 6° wide.—Molesworth: faint, broad (generally 3°), possibly *double*; edge of shade to W.—Phillips: December 22, very faintly indicated.—The Director: 3° wide; easier than during the past apparitions.

EREBUS.—Attkins: February 25, "more difficult than any of the other canals visible;" 2° wide; February 28, narrow; 1°; faint.—Molesworth: $1\frac{1}{2}°$, narrow, "faint and diffuse," to W., thence increasing in width to $2\frac{1}{2}°$ to N.E.; "suspected anomanously *double* on March 29." The Director: 3° wide; edge to N.W. shade.

EUNOSTOS.—Attkins: February 14, "easy," 3° wide; February 20, "wide (2°), and most easy to see;" February 25, difficult, 1° broad; March 27, "wide and dark;" March 28, "wide and plain," 3° wide; March 30, edge to shade to S.E.—Bolton: edge of *Elysium* brightness.—Buchanan: February 13 and March 19, faint edge to *Elysium*.—Craig: February, W. boundary of *Elysium*.—Kibbler: May 5, very diffuse, and some 5° wide near *Nubis Lacus*.—Killip: March 28, width 3°.—Molesworth: generally 3° wide, diffuse, and dark . . . . possibly *double*; edge of shade.—The Director: width 5° generally; edge to bright *Elysium*; fainter than in 1898–1899.

GALAXIAS.—Suspected by Attkins, and seen by the Director, as distinctly breaking up *Elysium* on the N. side.

GRANICUS.—Attkins: February 25, edge of shade to N.; February 28, dark streak 2° wide.—Molesworth: $2\frac{1}{2}°$ wide generally; diffuse; edge of shade to N.—The Director: dark, and 2° wide.

GYNDES.—The Director: 2° wide, dark.

HADES.—Attkins: February 25, "very dark and wide (2°)"; edge of shading to N.W., and of yellow area towards *Amazonis*; February 28, edge of shade to W.; March 1, do.; March 3, "one of the darkest markings on "the disc;" May 10, edge of shading to W.—Kibbler: April 5, edge of shading in W. *Phlegra*, 5° wide; strongly concave to E.; April 9, ditto.—Molesworth: "fairly dark, rather narrow, and well defined;" breadth $2\frac{1}{2}°$ generally; edge of shade to W.—Phillips: December 21, "dark and broad "streak" (4° wide); anomalous width, 6° to S., 10° to N.; edge to shade.—The Director: width 3° generally; edge to shade in W. *Phlegra*.

HELICONIUS.—Molesworth: "diffuse and dark . . . . S. edge of a shading "in *Uchronia*;" mean width 4°.—The Director: width 3°.

HYBLÆUS.—Attkins: February 25, "rather difficult," 1° wide; March 30 edge of shade in *Ætheria*; April 1, ditto.—Bolton: edge to shaded *Ætheria*.—

Buchanan: February 13 and March 19, edge to shade to N.W.—Craig: boundary of *Elysium*, and edge to shaded *Ætheria*.—Hall: merely the border of bright *Elysium*.—Molesworth: "dark and diffuse and knotted;" 4° wide; edge to shade to N.W.—The Director: width 4° generally; edge to faintly shaded *Ætheria*; fainter than in 1896 and in 1898–1899.

LÆSTRYGON.—Molesworth: 2° wide.—The Director: $1\frac{1}{2}$°.

MARSYAS (Cerulli).—Molesworth: 2° wide.

MYRMIDON.—A name given by the Director to the canal seen by Molesworth uniting *Hecates Lacus* to *Sithonius Lacus*; $2\frac{1}{2}$° wide.

ORCUS.—Attkins: February 25, "dark and ($2\frac{1}{2}$°) wide;" N. edge to yellow area of *Amazonis*; February 28, "wide (2°) and diffuse"; March 1, invisible; March 30, width 3°; April 9 and 10, ditto.—Hall: April 1, diffuse, 6° wide.—Kibbler: April 5, vague, 5° broad, faint.—Molesworth: "(4°) "broad and diffuse, but rather faint; the S. edge is sharp, the canal forming "the edge of a shading in *Amazonis* and *Phlegra*. I cannot be certain of "the position of the lakes with reference to the canal; but I am inclined to "think that their centres are just to the N. of the well-defined S. edge "of the canal, and that their edges overlap it slightly. At times, however, "they appear completely immersed in the shaded band."—Phillips: December 21, "suspected at times;" very diffuse.—The Director: width $3\frac{1}{2}$°.

PACTOLUS.—Molesworth: edge to shade to N.E.

PAN.—Name given to a canal seen by Molesworth to unite *Morpheos Lacus* with *Copais Palus*.

PLUTUS.—Molesworth: 3° wide.

RHYNDACUS.—A name given by the Director to the canal seen by him to run out of *Propontis* in a N.W. direction; 3° wide to S., $4\frac{1}{2}$° near the pole.—Indications of *Rhyndacus* are shown by Kibbler on April 5.

SINNYS.—Another name given by the Director to a canal seen by Molesworth to continue *Cerberus* on *Hesperia*; diffuse, and $2\frac{1}{2}$° wide.

STYX.—Attkins: February 25, edge of shade between *Elysium* and *Hades*; February 28, ditto; March 1, ditto; March 28, "faint"; March 30, "broad and dark," width 5°; April 1, very dark, and 4° wide; May 10, edge of shade in *Phlegra*, 5° wide.—Bolton shows this canal *double*, with only $4\frac{1}{8}$-in. aperture!—Buchanan: February 13, very broad, 12°, and dark; March 19, breadth reduced to 8°, dark.—Corder: March 30, very dark, 10° wide.—Craig: 7° broad in February.—Hall: April 1, shaded towards *Phlegra*, and edge of *Elysium*.—Kibbler: April 4, very broad edge of a shading towards *Phlegra*, breadth fully 8°, "slightly curved"; April 5 and 9, ditto.—Killip: February 19, dark, and 8° wide near the limb.—Molesworth: "very dark and knotted . . . . . *double*," mean distance between branches $3\frac{1}{2}$°, edge of shade to E.—Phillips: December 21, a broad ($4\frac{1}{2}$°) dark streak; December 22, width 7°, edge of shade in W. *Phlegra*.—The Director: probably double in February and March, edge of shade to E.

TARTARUS.—Kibbler: vague traces of this canal near *Trivium Charontis*, 6° wide; April 9, "doubtful."—Molesworth: "very faint and (2°) "narrow."

TRITON.—Molesworth: $4\frac{1}{2}$° wide generally, "fairly sharp" to N., but shading off into shaded *Hesperia* ("more a strait than a canal").—Townshend: very broad, opening into *Mare Cimmerium* from *Syrtis Minor*.

ZEPHYRUS.—A name given by the Director to a canal seen by him to break up *Elysium* to the S.E., and to join *Galaxias* to the N.; edge to shade. Discovered by Molesworth in 1896–1897,* and re-observed by him and the late Mr. Brown in 1898–1899.†

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* "Report" for that apparition, Chart, and p. 91.

† "Report" for 1898–1899, Chart, and p. 93 ("*Hyblæus II.*").

SECTION VI.

Syrtis Major.

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

MARE TYRRHENUM (W.).—This portion of that long, sinuous *Mare* was found dark by Attkins, Kibbler, Killip, Molesworth, and the Director. Molesworth further calls attention to the "patchy" character of *Mare Tyrrhenum*.

SYRTIS PARVA.—Attkins has depicted this bay as a very slight indentation of the S. *Mare*; so also Buchanan, Kibbler, Price, and, perhaps, Molesworth. But Corder, Craig (Plate IV., Fig. 5), and the Director agree in giving it more prominence.

AUSONIA.—Attkins, Corder, Craig, Kibbler, Molesworth, and the Director show this land white on S. limb, and very indefinite in its edges.

A bright spot was seen on *Ausonia* by Attkins on March 31. From its description, it must have been situated somewhere about $\Omega = 236^\circ$, $\Phi = -46^\circ$. "As bright as polar cap."

MARE HADRIACUM was easy to almost all observers, as the N. boundary of *Hellas*. Molesworth saw it bluish. The Director: distinct all round *Hellas*, from which it becomes evident that the *Pontes* do not reach that remote island.

HELLAS.—Contrary to the general expectation, this island was not of that brilliancy which would have been necessitated from the tilt of the axis in 1901. On February 11 and 14, Attkins found it "whitish on limb"; on March 27 and 28, "white"; March 31, "whitish" May 5, "white." Bolton saw that it was "faint in "February, fairly bright in March, and very brilliant in April "and May." Buchanan: white in February and March. On March 24 it was white on limb to Corder. Craig and Hall found it also white. Kibbler, March 25, "very white," $\omega = 309^\circ$, so also on March 26 and 28, and "bright" on terminator on April 4. Molesworth: "Generally fairly distinct, of a rather dull white or "pale yellowish tinge; once or twice bright near the limb, but "never very brilliant. This was rather unexpected, as I should "have thought that it would have been very bright this year, "owing to the tilt of the axis." Phillips: not very bright, and so also Townshend. The Director called attention at the time to this unexpected ruddiness of *Hellas*, as his observations of the phenomenon gave him the following results: February 10, ruddy on limb; February 13, faintly whitish; February 15, ruddy on C.M., the ruddy tint persisting to sunset; March 22, not white on terminator; March 24, ditto; June 9, very white on limb. There can, therefore, be no doubt on the reality of this yellowness of *Hellas* in 1901, and this is a striking exception to the law of increase of brightness, in some Martian lands, with the obliquity of solar radiation.

LUNÆ PONS was conspicuous and bright to Attkins, but not extending to *Hellas*. Molesworth, Phillips, Price, Townshend, and the Director confirm this view.

SOLIS PONS was also easy to Attkins, Bolton, Molesworth, Phillips, Price (Plate IV., Fig. 6), and the Director.

The two *Pontes* united N. of *Hellas*, in a diffused dusky land S. of *Iapygia*. That confused half-tone was seen divided in two by Molesworth through the presence of the canal in a dark region *Acesines* (Plate I.).

IAPYGIA.—Shown vaguely by Kibbler as united to N.W. *Ausonia*, March 25; it was more distinct on May 5. Molesworth: "generally rather confused with *Solis Pons*."

ŒNOTRIA.—Bolton gives vague traces of it in March, also Molesworth: "distinct in March." Glimpsed occasionally by the Director.

SYRTIS MAJOR.—As usual, this was the most conspicuous marking of the planet in 1900–1901. Attkins calls attention to the "extreme grey-green tone" of the great bay. On February 11 he noticed that the *Syrtis* was "very dark"; on February 14 grey, with faint tinge of green; February 20, "darker than *Maria* to "the left"; March 26, "dark, particularly so at sides" March 27, "seems darker on *f* side," and "darkest at sides"; March 28, "dark," and *f* side darker than *p* side, considerable difference "in tone"; and, it is noteworthy that the boundary between the two unequally shaded areas corresponds to Lowell's *Dosaron*, which thus also becomes the edge of a darker shading in an already shaded area; March 31, "dark"; May 5, *f* side seems darker. Bolton: March 20, 21, 27, and 28, *Syrtis Major* has Lowell's form. Buchanan shows it with its true outline, but without any indentation in the position of *Mœris Lacus*, and slightly darker to the W. Corder: March 24, practically the same outline as Buchanan, and very dark (Plate V., Fig. 2). Craig, not sharply pointed in February, Hall: normal, and very wide to S. Kibbler gives it on March 25, a form resembling Lowell's, 1894, with a tendency to have several indentations; the darkest marking on the planet. Killip: normal, the *f* part of the *Syrtis* darker than the *p*. Molesworth confirms his representations of former years of this vast grey area, and adds: "it appears more regular in outline to me this year, the N. end "being sharper and less knobby. The colouring is very variegated "and patchy, the general tone being an indigo blue-grey, with a "decided greenish cast in parts. The N. part is very dark "indeed, the darkness extending for some distance up the shores, "on each side, under the best conditions. Its veined and "checkered appearance defies all attempts at drawing it." Phillips gives to the *Syrtis* the form which he depicted during the two past apparitions. Price shows it darker to W. than to E. Townshend draws it with a peculiar outline, and as if enclosing islands running paralled to the receding coasts on the S. side (Plate V., Fig. 1). The Director: as in 1896 and 1899, darkest

at the N. On transit over the central meridian the N. end seemed to pass just above the centre of the disc.

On March 28, Kibbler wrote that "*Syrtis Major* seemed to be "separated from *Mare Hadriacum* by a whitish band, more "marked towards E., and which looked extremely like a cloud "belt." (Fig 10.) In 1871 Gledhill had a similar impression.

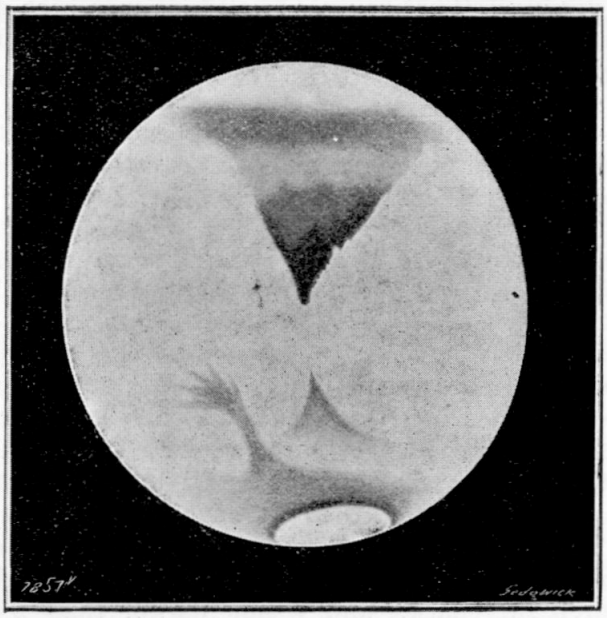

Fig. 10. Peculiar appearance of *Syrtis Major* on 1901 March $28^d\ 22^h\ 20^m$, G.C.M.T. (*Kibbler.*)

It results from this *resumé* of the observations that, in 1900–1901, *Syrtis Major* had:—(1.) The same outline as in 1896–1897 and 1898–1899; (2.) A bluish-green tinge. (3.) Its darkness was greater to W. than E.; and (4.) The greatest darkness was to the N., and extending along the receding coasts.

MŒRIS LACUS formed, as in 1896 and in 1899, a bay of the *Great Syrtis*. The notes and drawings of Attkins, Bolton, Corder, Craig, Hall, Kibbler, Killip, Molesworth, Phillips, Price, Townshend, and the Director are eloquent on this point. The identation formed by *Mœris Lacus* on *Libya* is strongest in the drawings of Attkins, Bolton (Plate V., Fig. 3), Corder (Plate V., Fig. 2), Hall, Kibbler, Molesworth, and the Director (Fig. 11), and least in those of Craig, Killip, Phillips, Price, and Townshend.

Molesworth found that the bight of *Lacus Mœris* was very dark on *Syrtis Major*.

LIBYA.—This remarkable land was still very bright in 1901, so that the changes of tone observed in 1883–1884 and 1886 cannot be seasonal. It was further seen to brighten with the obliquity of the solar rays. Its outline is represented under the form given it by Lowell, by Attkins, Bolton, Hall, Molesworth, Phillips, Price, and the Director, while Buchanan, Corder, Craig, and Kibbler

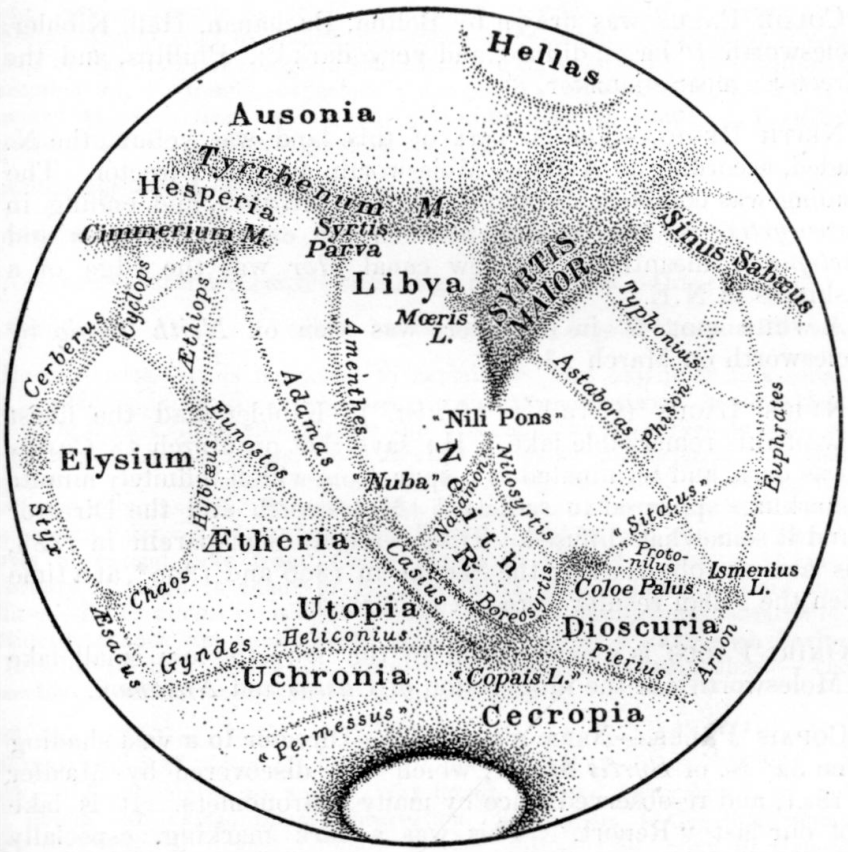

Fig. 11. The *Syrtis Major* region in 1900-1901. (*The Director.*)
[From "Knowledge," April, 1902.]

rather confirm Schiaparelli here. On March 28 Hall saw *Libya* as a sharp peninsula, projecting into the *Mare*, a somewhat frequent appearance in 1900–1901. According to Molesworth, *Libya* showed a slight indentation on its S. coast, as in 1896–1897.*

The S.W. part of *Libya* formed a bright spot.

ISIDIS REGIO was yellow on C.M. to Attkins, but whitish near the limb. Hall, Kibbler, and Molesworth also found it white, even on C.M.

Molesworth saw a white spot on *Isidis Regio*, immediately N. of *Mœris Lacus*. This cannot, of course, be *Nix Atlantica*.

NILI PONS.—Attkins, Bolton (Plate V., Fig. 3), Kibbler, Phillips, and the Director, all saw this bridge; but Molesworth did not.

Another white spot was seen on *Isidis Regio*, S. of *Nili Pons*, by Molesworth.

MEROE INSULA.—"Bright yellow," Attkins, February 14. Molesworth, "slightly shaded, except at its S. end, where a white "spot was seen," bordering the N. extremity of *Syrtis Major*.

This white spot was situated opposite the one just described on the E. side of *Nili Pons*.

* "Report" for that apparition, Fig. 11.

COLOE PALUS was drawn by Bolton, Buchanan, Hall, Kibbler, Molesworth ("large, diffuse, and very dark"), Phillips, and the Director; mean diameter, 8°.

NEITH REGIO.—The S. part of this land was yellow, the N. shaded, according to Attkins, Molesworth, and the Director. The shading was complex, beginning at the *Astapus*, and ending in *Boreosyrtis*; it was darkest between the canals *Nasamon* and *Asclepius*; meantime, the new canal *Hor* was the edge of a duskiness to N.E.

A white spot, 5° in diameter, was seen on *Neith Regio* by Molesworth on March 23.

NUBIS LACUS (Cerulli's "*Nuba.*")—Kibbler had the finest view of this remarkable lake. He says that on March 28 *Casius* "was dark, and terminated in a spur, from which infinitely minute "markings appeared to radiate." Molesworth and the Director found it somewhat diffused. Discovered by Schiaparelli in 1888, this lake was observed by the Section in 1896 and 1899*, at a time when the Milan results were not published.

ONIRI PALUS is a name given by the Director to a small lake of Molesworth's at the intersection of *Casius* and *Nasamon*.

COPAIS PALUS.—Name given by the Director to a vast shading some 32° N. of *Syrtis Major*, which was discovered by Mædler in 1841, and re-observed since by many astronomers. It is lake *h* of our last "Report." This was a dark marking, especially near the limb, but fainter than *Syrtis Major*.† It is well shown in 1901 in drawings by Attkins, Bolton, Hall, Kibbler, Molesworth, Phillips, and the Director, as an intense shading, with exceedingly diffuse edges.

UTOPIA.—Intensely shaded to all observers who represented this region of the planet in 1901, and to all the Members of the Section. Like *Copais Palus*, the shading was darkest when rising and setting near the limb or terminator, a fact which confirms the Director's idea that the Martian skies are so black at noon as to allow of the visibility of several magnitudes of stars. Townshend compares the "shadings of *Utopia* to 'auroral "'streamers,' radiating from the N. polar sea."

A white spot was seen by Attkins and Molesworth on *Utopia* in $\Omega = 267°$, $\Phi = +53°$. "Very plain," according to the former observer.

CANALS.

AMENTHES.—Attkins: February 14, "wide," 2°, curving according to perspective near the limb; February 20, "narrow," $1\frac{1}{2}°$; March 26, "wide"; March 27, width $2\frac{1}{2}°$, dark; March 28, breadth 2°, edge of a yellow area in

* *See* "Report" for 1896, Chart; and for 1898–1899 Chart, lake *g* and p. 98.

† It was darker that *Syrtis Major* itself in 1841. The absence of a serious analytical work on Mars is a great lacuna in areography, as the history of every point of the Martian surface is sure to greatly increase our knowledge of the planet.

Isidis Regio; March 31, "wide, and most easy." — Bolton: distinct. — Kibbler: May 5, edge to shaded *Æthiopis.*—Molesworth: diffuse from *Nubis Lacus* to *Syrtis Major;* edge of shaded area to E., mean width, 3°.—Phillips: December 16, "strongly suspected"; January 11, curved, narrow.—Price: January 11, seen near its N. end, $2\frac{1}{2}$° wide, edge to shade to E.—The Director: diffuse, 4° wide, edge to shade to E.

ASCLEPIUS.—Molesworth: edge to shade to E.

ASTABORAS.—Molesworth: 2° wide.—The Director: ditto.

ASTAPUS.—Attkins: convex to S., edge of shade to N.—Craig: ditto.

ASTUSAPES.—Craig: 6° wide.—Molesworth: 2°, edge of shade in *Meroe.*

BOREOSYRTIS.—It is important to explain the real extent of this canal. Up to 1886 Schiaparelli gave this name to the strongly curved band, which, emerging from *Coloe Palus,* runs to the N.E., and thence curves to S.E., in order to join *Nubis Lacus.* But in 1888 he called *Boreosyrtis* only that segment of the band which trends to N.E., giving the name *Casius* to the portion running to S.E. It is this last arrangement that we shall follow in the present "Report" (*see* the Chart, Plate I.), and we will consider *Boreosyrtis* to extend only from *Coloe Palus* to *Copais Palus.* — Attkins: February 14, edge to shade to E.; March 28, ditto.—Bolton: faint and diffuse.—Hall: almost invisible.—Kibbler: diffuse.—Molesworth: March 18, distinctly *double,* the bands being separated by 5° or 6°, and each having a breadth of $2\frac{1}{2}$°; March 20, ditto. — Townshend: inconspicuous. — The Director: a difficult band, some 4° wide, and diffuse.

CASIUS.—Attkins: February 14, shaded and lost in dusky area of *Utopia;* February 20, S.W. edge of shaded *Utopia;* March 27, ditto, 5° wide, and dark.—Bolton: March 20, and 21, very broad, 10°, and dark; March 27 and 28, *double*—an extraordinary observation for a $4\frac{1}{8}$-in. O.G.—Buchanan: very dark edge of shaded *Utopia.*—Corder: ditto.—Hall: edge to *Copais Lacus* shading.—Kibbler: March 25, 26, and 28, S.W. boundary of shaded *Utopia;* May 5, width 7°, very dark.—Killip: February 15, dark, 4° wide.—Molesworth: "the dark S.W. edge of a shaded triangle in *Utopia.* The "shading extends inwards, gradually lightening to *Adamas,* and is prolonged "in a lesser degree to *Alcyonius.* The edge of *Casius* where it borders *Neith* "is very dark, and rather irregular."—Phillips: January 11, "very dark and "(6°) broad," edge of shade in *Utopia.*—Price: January 11, very dark and distinct, edge to shade, with possible traces of anomalous *gemination* (Plate IV., Fig 6).—Townshend: February 17, shown on sketch, edge to shade to N.E.—The Director: February 13, diffuse, edge to shaded *Utopia,* 5° wide; February 15, ditto; February 20, ditto, confuse; March 22, ditto; March 24, *double,* branches 6° distant, and each $2\frac{1}{2}$° wide.

HOR.—A name given by the Director to Molesworth's new canal, continuing hook of *Nilosyrtis,* and edge to shade in *Neith Regio,* $2\frac{1}{2}$° wide.

NASAMON.—Attkins: edge to shade to N.W., generally 2° wide.—Kibbler: edge to shade to N.W.—Killip: ditto.—Molesworth: "rather faint," edge to shade to N.W., mean breadth 2°.—Phillips: January 11, seen as a faint edge of shade to N.W., 3° wide.—Price: January 11, distinct, 5° wide.—The Director: general width $2\frac{1}{2}$°, edge to shade to N.W.

NEPENTHES.—Molesworth: straight; 2° wide.

NILOSYRTIS.—Attkins: February 11, "narrow, but easy"; February 14, edge to shading to N.; February 20, "during 10 seconds of superb definition "... noted the apex of *Syrtis Major* and the *Nilosyrtis* to be perfectly "black with very sharp edges—an astounding sight"; March 26, edge to shade to N.; March 27, "wide and dark"; March 28, ditto, breadth 2°; May 5, mere edge of shade to N.E.—Bolton: always shaded N. of *Nasamon* —Buchanan: March 19, distinctly curving into *Coloe Palus,* its breadth being 2° to S. and 10° to N.W.—Corder: black, and 8° wide, on April 24.—Craig: February, 5° wide, most marked and dark. — Hall: March 21,

width 5°.—Kibbler: March, 25, 26, and 28, mere edge of shade in *Neith Regio*; so also on May 5.—Killip: February 11, width 6°; February 14, 8°; February 15, edge to shade in *Neith Regio*; March 21, width 3°; March 28, ditto; Killip shows this canal almost as a straight line, following the meridian of 283°.—Molesworth: mean width $2\frac{1}{2}°$, "very dark and well-defined, but "rather narrow. It has a very definite hook shape, the hook being some-"times gently curved, at others angular," edge to shade to N.E.—Phillips: January 11, very curved, 3° wide; edge to shade to N.E.—Price: January 11, very curved, irregularly wide, maximum breadth in the middle, where it it attains 7°.—Townshend: February 17, a straight line, almost following the 280th meridian, 1° wide only, and merging into the N. marshes.—The Director: strongly curved, $2\frac{1}{2}°$ wide, faintish, edge to shade in *Neith Regio*.

RHESUS.—Seen by Molesworth to run between *Mœris Lacus* and the bay viewed by him on the S. side of *Libya*; hence not running to *Syrtis Parva*, as in 1898–1899.* It forms "the demarcation line between the bright "circle of '*Abyssinia*' [*i.e.*, S.W. end of Libya] † and a slightly shaded "area N.E."

THOTH—Molesworth: $2\frac{1}{2}°$, N. end only.

SECTION VII.

The South Polar Region.

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

Owing to the fact that Mars showed us his N. pole, 21° inside the disk from the limb, the South Polar Region was invisible in 1900–1901.

SECTION VIII.

The North Polar Region.

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

For the first time we shall now describe the surface of the planet, uncovered by snows, beyond 60° of northern latitude. But inasmuch as the snow still subtended an areocentric arc of 28° at opposition, the scrutiny could not extend to the immediate vicinity of the polar regions. Plate II.‡ gives the results of the Members for this last Section, and should be consulted in connection with the following description:—

BALTIA.—This half-tone of the Northern Sea is shown by the Members as merging into the polar marshes, and Molesworth

* *See* "Report" for that apparition, chart, and p. 99.

† "Report" for 1896–1897, Fig. 11.

‡ In the preparation of this Plate the Director has entirely subordinated his observations to those of Capt. Molesworth, and has followed the Ceylon observer in giving to the N. snows a diameter of 40°. It must be confessed, however, that a reduction of the snow covered area to 20°, corresponding to the diameter of the ice at the summer solstice, would have been preferable, as showing the topographical details as far as 10° only from the pole.

describes it as intensely shaded. However, it was up to February only that the shading of *Baltia* was involved in the polar band. The diminution in area of the snows showed *Baltia* to the Director as being vastly fainter than in 1888 and 1890, when Schiaparelli and Terby depicted it almost as dark as *Mare Acidalium* itself.

Molesworth has remarked that *Baltia* was broken in two by the new canal *Silis*.

NERIGOS.—"Shaded and ill-defined," according to Molesworth. The Director found it united to *Baltia*, and of the same brightness as the latter.

ARCTICA PALUS.—A name given to Molesworth's lake in $\Omega = 85°$, $\Phi = +72°$, "indenting the snows." Molesworth identifies this with *Lacus Hyperboreus*. But it will be seen from Plate VII. that *Lacus Hyperboreus* begins only in $\Phi = +80°$, and this shows the marking in question to have been a new lake. It was very dark and definite at first, though fading slightly later.

IERNE was shaded, according to all the Members.

SCANDIA.—Shaded in polar marshes. Molesworth found it to have a "lighter centre." Phillips and the Director, shaded.

ARSENIUS LACUS was seen by Molesworth and the Director as a large, dark mass near the snows. "Sometimes seen to deform "the polar cap," says Molesworth.

PANCHAIA.—Shaded, according to Attkins, Molesworth, Phillips, and the Director.

UCHRONIA appeared intensely shaded to Attkins, Bolton, Buchanan, Corder, Killip, Kibbler, Molesworth, Phillips, and the Director.

CECROPIA.—Shaded in the drawings of Attkins, Bolton, Hall, Kibbler, Killip, and the Director, who found it darker than *Dioscuria*. Molesworth shows it brighter.

ARIA FONS.—Christened by the Director. Molesworth, who discovered it, describes it as "a large dark lake where '*Cal-*"*lirrhoe II.*' [*Arius*] enters the polar marshes. In some of the "sketches it seems extending as far as the N. end of *Kison*. "It is, I think, shown on my sketches taken late in the 1898–"1899 apparition."

ORTYGIA.—Shaded and very dark in polar swamps, according to Attkins, Kibbler, Killip, Molesworth, Phillips, and the Director.

CANALS.

ARIUS.—Named by the Director. Molesworth, who detected it, describes it thus: "very dark and slightly tapering, being broadest near *Mare Acida-*"*lium* ending to N. in lake B.B. [*Aria Fons*], in the polar marshes. This "canal is shown on some of the later sketches taken in 1899." Mean width 3°.

HEBRUS.—Molesworth: generally 3° or 4° wide.

IAXARTES.—Molesworth: "faint at first, darker later," mean width 4°.—The Director: 3° wide, very dark and easy.

KISON.—Bolton: March 21, diffuse, and 7° wide.—Molesworth: 3° wide usually, "fairly distinct and diffuse."—The Director: wide, 4°, and diffuse.

PERMESSUS.—Name given by the Director to a faint streak, 2° wide, seen by him in *Uchronia* not to touch any lake or other canal.

THE NORTHERN SNOWS.

THE POLAR BAND all round the snow, was very dark in the early observations, but later it faded considerably, so as to be almost imperceptible at the close of the apparition.

THE POLAR SNOW CAP was seen distinctly veiled in part by a "brown patch," by Price, January 23.

On April 10, Attkins found that the snows shone "with a "bluish-white light."

The outline of the cap was not uniformly circular. We have seen that Molesworth noticed the snows indented by two lakes (p. 129); and on February 3, $\omega = 39°$, Attkins found the cap "pointed in centre." All these details will be found on Plate II.

No rifts were seen in the snows by the Members of the Section. A typical view of the cap is given in Fig. 12.

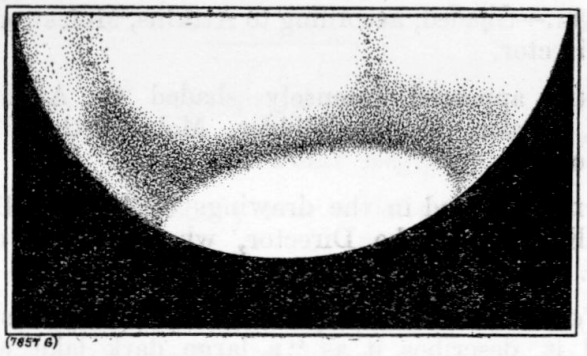

Fig. 12. The North Polar Snow Cap of Mars, on 1900 November 26. (*Phillips.*)

The diminution in the area of the snows was not uniform. Attkins calls attention to the fact that on May 31, $\omega = 30°$, the "cap was not so small as in the early part of May," while the Director noticed that, between March 24 and April 2, the snows were surrounded, or even partly veiled, by a dull white material, apparently increasing their size, but perhaps tarnishing their lustre. It will be remembered that in 1896–1897 phenomena of a kindred nature were disclosed by the Sectional records,* and there can be little doubt that in these glimmers we have evidence of some condensation of aqueous vapour. A slight, diaphanous,

* "Report" for 1896–1897, pp. 98–99.

fog, or cirrus cloud, would tarnish the whiteness of the snow beyond, not perhaps so much on account of possible differences of albedo, but rather through the slight shadow which it would cast on the snows, and which would be visible through the interstices of the aqueous spherules.

A comparison of the deportment of the melting snow cap in 1900–1901 with the Sectional data for 1898–1899 will not be out of place here, d in the following table, being the number of days before (—) or after (+) the summer solstice of the N. hemisphere; and α the areocentric arc subtended by the cap :—

d	α 1898–1899.	α 1900–1901.	d	α 1898–1899.	α 1900–1901.
− 225	53° ±	56° ±	− 75	35° ±	36° ±
− 200	53	40 ?	− 50	31	32
− 175	52	55	− 25	26	29
− 150	45	55	0	26	22
− 125	38	40	+ 25	22	23
− 100	38	37	+ 50	20	21

Captain Molesworth reports as follows on the melting of the northern snows in 1900–1901 :—

"The scattered and fragmentary nature of the earlier observations makes it impossible to give any consecutive account of the phenomena of the first melting of the polar cap.

"In the solitary observation in August the polar cap was still very indefinite, and the shades bounding it were very faint. During the short period covered by the October observations, the marshes grew decidedly darker, and a dark notch was seen in the edge of the polar cap in the region of *Mare Acidalium* (there were similar phenomena in 1896–1897). In December the marsh was still darker with a very dark knot projecting into the cap." This may be *Copais Palus*. "In February, when the observations were resumed, the marsh was still very dark and there was a deformation of the cap about *Lacus Arsenius*. The cap continued to decrease, but the outline remained symmetrical till April 1st, when another deformation was seen near *Lacus Arsenius*. A slight flattening of the edge of the cap is shown on April 16th," somewhere near the dark intensification of *Aria Fons*. "For a long time previous to this, the fading in intensity of the polar marshes could be seen on the sketches."

PART III.

CHART OF MARS IN 1900–1901.

The Charts (Plates I. and II.) at the end of the present Report are a combination of the results given in the drawings supplied by the Members of the Section. The process of combination was an arduous one. Notwithstanding, however, the somewhat arbitrary character of the task, the Director is firmly convinced that, by the mutual corroboration of most of their data, these Charts constitute the best representations of the planet during the last apparition.

Again, the Section wishes to express its great indebtedness to Mr. A. C. D. Crommelin, B.A., F.R.A.S., of the Royal Observatory, Greenwich, for his excellent "Ephemeris for Physical "Observations of Mars in 1900–1901," published in Vol. LX. of the "Monthly Notices" of the Royal Astronomical Society. The areographical co-ordinates of the centre of the disc, on the various drawings of the planet, have been invariably computed from the data of that invaluable ephemeris; and the transit of the Zero Meridian of Mars was found to occur in fair agreement with the forecast of Mr. Crommelin. Hence the justification for once more taking *Fastigium Aryn* as the Martian Greenwich on Plate I. At the same time, the measures of position taken by the Director on some of the most striking markings have shown (*a*) the general accuracy of Schiaparelli's charts, and (*b*) the absence of any appreciable changes in the location of the dark areas; and thus the backbone of the Charts is as accurate as can reasonably be expected.

I.—MEASURES OF POSITION OF NINE POINTS OF THE MARTIAN SURFACE BY THE DIRECTOR.—The longitude was obtained by estimated and observed transits over the central meridian about opposition, while the latitude was taken on carefully executed drawings of the regions under examination:—

No.	Marking.	Ω	Φ
1	E. end of *Mare Acidalium*	22°	+50° ±
2	Point of *Syrtis Parva*	258	− 8
3	Centre of *Copais Palus*	278	+52
4	N. end of *Syrtis Major*	284	+19
5	Estuary of *Astaboras*	291	+11
6	Centre of *Coloe Palus*	299	+41
7	*Hammonis Cornu*	313	−13
8	Point of *Portus Sigeus*	333	− 8
9	Centre of *Ismenius Lacus*	334	+39

These points are shown on Plate I. by small circles, to which are attached the figures indicating their order in longitude.

II.—LIST OF "LAKES" SEEN BY THE SECTION IN 1900–1901.

1. SCHIAPARELLI'S MAPS (1877–1888).

Arethusa Lacus.	*Lunæ Lacus.*	*Siloe Fons.*
Arsenius Lacus.	*Mæotis Palus.*	*Sirbonis Palus.*
Ascræus Lacus.	*Mœris Lacus.*	*Sithonius Lacus.*
Castorius Lacus.	*Niliacus Lacus.*	*Solis Lacus.*
Coloe Palus.	*Nodus Gordii.*	*Stymphalius Lacus.*
Hecates Lacus.	*Phœnicis Lacus.*	*Tithonius Lacus.*
Ismenius Lacus.	*Propontis.*	*Trivium Charontis.*

2. UNNAMED "LAKES" OF SCHIAPARELLI, NAMED BY CERULLI, CAPT. MOLESWORTH, AND THE DIRECTOR.

Ascuris Lacus (The Director).	*Morpheos Lacus* (The Director).
Copais Palus (The Director).	*Nubis Lacus* (The Director, this is Cerulli's "*Nuba*").
Erebi Fons (Molesworth).	*Pambotis Lacus* (Cerulli).
Mareotis Lacus (The Director).	

3. "LAKES" DISCOVERED BY MR. W. F. GALE IN 1892, AND BY THE FLAGSTAFF OBSERVERS IN 1894.

Ammonium.	*Ferentinæ Lucus.*	*Oxia Palus.*
Aquæ Apollinares.	*Labeatis Lacus.*	*Phrygius Lacus.**
Arsia Silva.	*Lucus Maricæ.*	*Sphingos Lacus.*†

4. NEW "LAKES" OF 1900–1901.

Name or Symbol.	Christened by.	Discoverer.	Approximate Position	
			Ω	Φ
Aornos Lacus	The Director	Molesworth	191°	+32°
Arctica Palus	The Director	Molesworth	82	+72
Aria Fons	The Director	Molesworth	355	+70
Euxinus Lacus	The Director	Molesworth / Attkins	162	+46
Gargaphie Fons	The Director	Molesworth	250	+47
Oniri Palus	The Director	Molesworth	266	+38
Sintius Lacus	The Director	Molesworth	233	+11
Stygia Palus	Molesworth	Molesworth	199	+30
Titanum Lacus	The Director	Molesworth	168	+25
Lake *a*, 1901	—	Molesworth	223	+39
Lake *b*, 1901	—	Molesworth	232	+35

* This is "*Nodus Gordii Lowelli*" of Plate VI., and has been re-christened by the Director in order to avoid having two lakes called "*Nodus Gordii.*"

† *See* p. 98.

This makes a total of 48 "lakes" for 1900–1901, as already mentioned on p. 89.

III. LIST OF "CANALS" SEEN BY THE SECTION IN 1900–1901.—These are the following:—

1. SCHIAPARELLI'S CHARTS (1877–1888).

Adamas.	*Eosphoros.*	*Kison.*
Æsacus.	*Erebus.*	*Læstrygon.*
Æthiops.	*Eumenides.*	*Lycus.*
Agathodæmon (d).	*Eunostos.*	*Nectar.*
Alcyonius (d).	*Euphrates.*	*Nepenthes.*
Amenthes.	*Eurotas.*	*Nilokeras (d).*
Anian.	*Fevos.*	*Nilosyrtis.*
Antæus.	*Fortuna.*	*Nilus (d).*
Araxes.	*Galaxias.*	*Orcus.*
Arnon.	*Ganges (d).*	*Orontes.*
Asclepius.	*Gehon I.*	*Oxus.*
Astaboras.	*Gehon II.*	*Pactolus.*
Astapus.	*Gigas.*	*Phasis.*
Astusapes.	*Granicus.*	*Phison.*
Avernus.	*Gyndes.*	*Phlegethon.*
Boreas.	*Hades.*	*Pierius.*
Boreosyrtis (d).	*Hebrus.*	*Plutus.*
Callirrhoe.	*Heliconius.*	*Poros.*
Casius (d).	*Hiddekel.*	*Protonilus.*
Ceraunius (d).	*Hyblæus.*	*Styx (d).*
Cerberus (d).	*Hydaspes.*	*Tanais.*
Chaos.	*Hydraotes.*	*Tartarus.*
Choaspes.	*Iamuna.*	*Thoth.*
Chrysorrhoas.	*Iaxartes.*	*Titan.*
Clarius.	*Indus.*	*Triton.*
Cyclops.	*Iordanis.*	*Typhonius.*
Dardanus.	*Iris.*	*Uranius.*
Deuteronilus.	*Issedon.*	*Xenius.*

2. "CANALS" OF LOWELL'S CHART (1894).

Arduenna.	*Brontes.*	*Eulæus.*
Bætis.	*Cantabras.*	*Parcæ.*

3. "CANALS" OF CERULLI'S CHART (1898–1899).

Marsyas.	*Sitacus.*	*Ulysses.*

4. "CANALS" OF THE SECTIONAL CHARTS.

Nasamon (observed by the Members in 1896–1897 and 1898–1899).

5. NEW "CANALS" OF 1900–1901.

Name.	Christened by	Discoverer.	Extent.			
			From		To	
			Ω	Φ	Ω	Φ
Arius	The Director	Molesworth	° 0	+ 70°	° 20	+ 46°
Bellerophon	,,	Attkins	135	− 5	170	− 20
Creon	,,	Molesworth, Phillips	162	+ 44	173	+ 38
Damastes	,,	Molesworth	162	+ 43	168	+ 28
Endymion (*d*)	,,	Attkins, Buchanan	92	− 5	127	− 3
Hor	,,	Molesworth	271	+ 22	281	+ 35
Lycaon	,,	,,	148	+ 5	160	+ 40
Macrobius	,,	Attkins, Molesworth	102	+ 18	127	0
Myrmidon	,,	Molesworth	204	+ 39	228	+ 56
Pan	,,	,,	230	+ 40	272	+ 52
Permessus	,,	The Director	230	+ 64	280	+ 63
Pyracmon	,,	Molesworth	153	+ 33	166	+ 27
Rhesus	,,	,,	270	− 8	276	+ 2
Rhyndacus	,,	The Director, Kibbler	181	+ 49	190	+ 64
Silis	,,	Molesworth	44	+ 53	73	+ 68
Sinnys	,,	,,	242	− 17	247	− 21
Zephyrus	,,	The Director	223	+ 22	208	+ 8

This makes a total of 111 canals for the apparition, as already stated on p. 90. The *double* canals are marked by a (*d*) in the foregoing tables.

IV.—CANALS IN THE DARK REGIONS.—These belong to Lowell's and Cerulli's maps, and are five in number. *Acesines*, *Dargamanes*, *Garrhuenus*, *Hipparis*, and *Orosines*. They have all been observed by Molesworth.

V.—THE LANDS WHITENING WITH THE OBLIQUITY are indicated by the symbol (*b*) on Plate I.

VI.—WHITE SPOTS.—The following bright spots were recorded by the Members in 1900–1901 :—

No.	Length.	Position. Ω	Position. Φ	Discoverer.	No.	Length.	Position. Ω	Position. Φ	Discoverer.
	°	°	°			°	°	°	
1	10	0	+ 54	Several Members.	9	4	237	− 46	Attkins.
2	12	12	− 1	Attkins. Molesworth.	10	3	268	+ 53	Attkins. Molesworth.
3	4	46	+ 41	Attkins.	11	4	271	+ 38	Molesworth.
4	5	50	− 5	„	12	9	276	− 5	Attkins. Molesworth.
5	3	95	− 37	„	13	5	277	+ 5	Molesworth.
6	14	114	+ 46	„	14	5	281	+ 18	„
7	6	169	+ 48	„	15	5	289	+ 18	„
8	8	201	+ 20	„	16	12	348	− 4	Several Members.

The dimensions of these spots are given in equatorial degrees of the planet. A dotted outline marks the extent of each of the white areas on the Charts (Plates I. and II.).

VII.—BRIGHT PROJECTIONS ON THE TERMINATOR.—As already stated, these are two in number. The first in order of longitude was seen by Mr. Phillips on 1901, January 2, in $\Omega = 0° \pm$, $\Phi = -40°$; and the other, which corresponds to white spot No. 5, was detected by Captain Molesworth, on March 7, in $\Omega = 95° \pm$, $\Phi = -37°$.

* * * * *

It was deemed advantageous to follow the system inaugurated in the last "Report," and to draw the Chart on a large scale, and print it in such a manner as to enable the reader to have, at the same time, text and map before him. We may add that the last chart for 1898–99 was very carefully drawn; but that, being very delicate in its shadings, it was, unfortunately, not well suited to give a clear reproduction. This obliged the reproducer to re-touch the block, with the result that the relative values of the shadings, and, especially, the breadth and darkness of the canals, were exaggerated to an incredible extent. This object-lesson has prompted the Director to draw the new charts in a way which, if less artistic than the former, is at any rate more scientific, as completely obviating the chance of a catastrophe in the reproduction.

APPENDIX.

I.—General Reference Map of Mars for the Minor Detail.

With a view to facilitating research, the Director deemed it desirable to give in this Report a detailed Chart of the planet (Plates VI. and VII.), embodying all well-authenticated areoscopic impressions, but whose objectivity has not been proved up to the present time. These maps, which were originally drawn for Paris, and since completed, give a synthesis of the results of Prof. Schiaparelli and of our Sectional Members, and they express a sort of "mean state" of the appearances observed on the planet during the last quarter of a century.

II.—Standard Chart of the Physical Condition of Mars embodying all Trustworthy Markings seen on the Planet.

Several circumstances conspire to cast a shade on the objectivity of the "canals". In the first place, we have the significant observation of subjective "canals" on other planets; then Mr. Maunder's and Mr. B. W. Lane's valuable experiments, which show the "canaliform illusion" to be a physiological phenomenon of at least some eyes; and, lastly, the fact that one half of the "canals" seen by careful observers are the boundaries of faint half-tones. Under the conventional name of "canal", we find, however, markings of unquestionable reality. Such are the *Cerberus*, the *Styx*, the *Casius*, *Ceraunius*, *Nilokeras*, &c., although it is fair to add that the broad and irregular structure of these spots has generally nothing "canaliform" in its appearance.

Still the hard line-likeness of the "canals" is almost sure to be experienced by all painstaking observers of the planet; and this circumstance cannot be treated lightly as illusive. But, the disappointment of seeing our representations of Mars profaned by doubt, led the Director to take a possibly backward step, and to include, in a rough approximation, only the solid data bequeathed to us by the labours of the last 125 years. These results are given in Plate VIII., based on an analysis of the drawings of W. Herschel, Schrœter, J. Herschel, Mædler, Galle, De la Rue, Schmidt, Secchi, J. Phillips, Lockyer, Kaiser, Dawes, Burton, Dreyer, Green, Terby, Bœddicker, Lohse, Niesten, Trouvelot, Knobel, Maunder, Schiaparelli, W. H. Pickering, Hussey, Keeler, Gale, Denning, Stanley Williams, Cerulli, J. Rheden,* Millochau, Captain Molesworth, T. E. R.

* Herr J. Rheden, who took part in the Sectional work of 1896–1897, has published his observations of 1898–1899 in a fine memoir, entitled *Beobachtungen und Zeichnungen* des *Planeten Mars*, Vienna, 1901.

Phillips, Kempthorne, Cammell, Meares, Brown, W. J. Hall, Attkins, Kibbler, the other Members of the Section since 1892, and of the Director.

It appeared meantime necessary to give in Plate VIII., an adumbration of the physical phenomena of the Martian surface, such as the apparent changes in the outline of the *Maria*; and to differentiate the "seas" of changing intensity from those whose darkness seems but little affected by temporary, or seasonal, variations.

III.—On the part played by Contrast in the Martian Phenomena.

In the course of a series of experiments on artificial Mars disks, examined under very sharp and prolonged seeing, the Director came across the following physiological phenomena:—

(*a*) The superior whiteness of the limb;
(*b*) The canaliform darkening of the borders of all shadings generally, and of the "*Maria*" in particular;
(*c*) The concomitant brightening of the "coasts";
(*d*) The formation of subjective "canals," in accordance with the theories of Mr. Maunder and Mr. Lane;
(*e*) The bridging of dusky spots by white "material".

Contrast seems to play an important part in the production of at least some of these appearances; and the phenomena presented, under perfectly focussed seeing, by small grey ellipses (Fig. 13) were remarkable, as tending to distinctly geminate the markings into two round spots (Fig. 14), exactly as seen on Mars.

Fig. 13. Fig. 14.

Grey elliptical area and its doubled image, when seen from a distance under sharp seeing.

The consequences resulting from the late Mr. Green's theory that the canals are the edges of shadings are obvious and far-reaching. If, as has been observed, contrast is instrumental in so incredibly exaggerating the boundary of an imperceptible half-tone into a perfectly definite line, it is also sure to render the *Maria* darker at their borders; and this, as we have just seen, is in perfect harmony with trials on artificial disks, as well as with the Martian experience.* But the amorphous, elongated, duski-

* In 1888 Schiaparelli saw the majority of the *Maria* bounded by black "canals," and as it is impossible to admit the reality of such markings, we have here a striking vindication of the late lamented Mr. Green's edge to shade theory of the "canals."

nesses of the planet ought also to be affected by contrast, their borders deriving strength from opposition. A natural explanation of gemination, based on the purely physiological grounds of contrast, is thus presented to the mind; and it is noteworthy that all double "canals" observed by the Section in 1900–1901, although they may have been objective, are readiiy accounted for on the basis of that simple, but rational, interpretation.

The important points to be retained from the above remarks are the facts; the phenomena of the Martian "canals" and their gemination being too complex to warrant any statements made on their nature without the strictest, and most guarded, diffidence.

IV.—On the Naked-Eye Changes of Colour of Mars.

These have been already traced to the longitude and latitude of the centre of the disk,* although the Director did not see that idea expressed in print before. Disclaiming, therefore, any originality from the interpretation, he now wishes to say that Mars ought to appear the ruddiest during oppositions occurring in September, about the summer solstice of the planet's S. hemisphere, and under $\omega = 280°$ (Fig. 15); and that it would assume its maximum yellowness in oppositions taking place in March, towards the summer solstice of the N. hemisphere, and $\omega = 120°$ (Fig. 16).

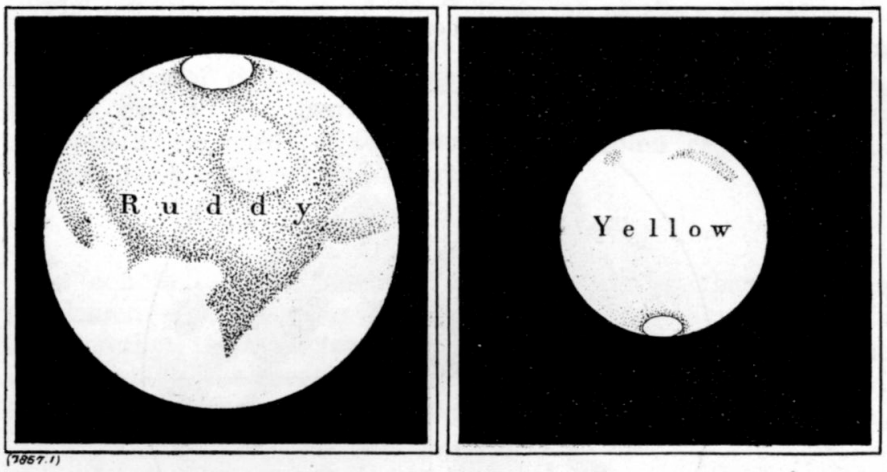

Fig. 15.
The disk of Mars showing us a maximum of ruddiness.

Fig. 16.
The disk of Mars showing us a maximum of yellowness.

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* Given on the evidence of a friend, who could not say when or by whom the theory was enunciated.

V.—The Appearance of the Full Moon with the Naked Eye.

A careful delineation of the naked-eye appearance of the full moon has, as suggested by the late Herr Marth, a direct comparative bearing on telescopic drawings of Mars. The latest attempt at such a representation of the lunar surface by the Director is given in Fig. 17; while Fig. 18, made at Mr. Maunder's suggestion, is a key-map of the chief markings on our satellite revealed by the unaided eye.

Fig. 17.
An elementary view of the Moon, as seen with the Naked Eye.

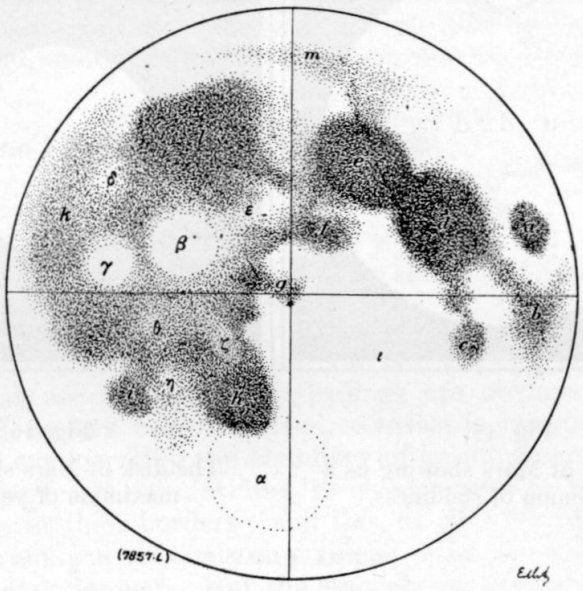

Fig. 18.
Chart of the most prominent Markings seen on the Moon without a Telescope.

Dark Spots.	Bright Spots.
a = *Mare Crisium.*	α = *Tycho* (it is only the bright mass that is visible, but not the crater).
b = *Mare Fœcunditatis.*	β = *Copernicus*, ditto.
c = *Mare Nectaris.*	γ = *Kepler*, ditto.
d = *Mare Tranquillitatis.*	δ = *Aristarchus* (very difficult).
e = *Mare Serenitatis.*	ϵ = *Apennines.*
f = *Mare Vaporum.*	ζ = Bright mass formed by *Guerike*, *Parry*, and *Bonpland.*
g = *Sinus Medii.*	η = Brightness between *Maria Nubium* and *Humorum.*
h = *Mare Nubium.*	θ = Faint whiteness of *Riphæan Mountains.*
i = *Mare Humorum.*	ι = Bright region N.W. of *Tycho.*
k = *Oceanus Procellarum.*	
l = *Mare Imbrium.*	
m = *Mare Frigoris.*	

The dark areas, whose combinations give rise to two human faces,* are not uniform in colour as seen with the naked eye. The sombre grey tint is most intense, apparently, in *Mare Tranquillitatis* and in *Mare Nubium*, although the darkness of the latter seems enhanced by contrast with the neighbouring brightness of *Tycho*. It is curious that *Mare Serenitatis* shows already its lighter interior without optical assistance. *Maria Imbrium* and *Fœcunditatis* are distinctly fainter than any of the preceding grey expanses, whereas the vicinity of the bright limb interferes with the darkness of the gloomy wilderness of *Oceanus Procellarum*.

The scientific interest of this delineation of the moon with the naked eye lies in the natural tendency of our sight to suppress irregularities of outline in objects subtending a very small angle, and to give to the markings of our satellite that unpleasant geometrical regularity of form with which some representations of Mars have rendered us so familiar.

In concluding the present Report, and in thanking the gentlemen who have so kindly accorded him their invaluable collaboration, the Director wishes to say a word or two on the way in which the Section may still more forcibly increase our knowledge of the planet. Judging from personal experience,

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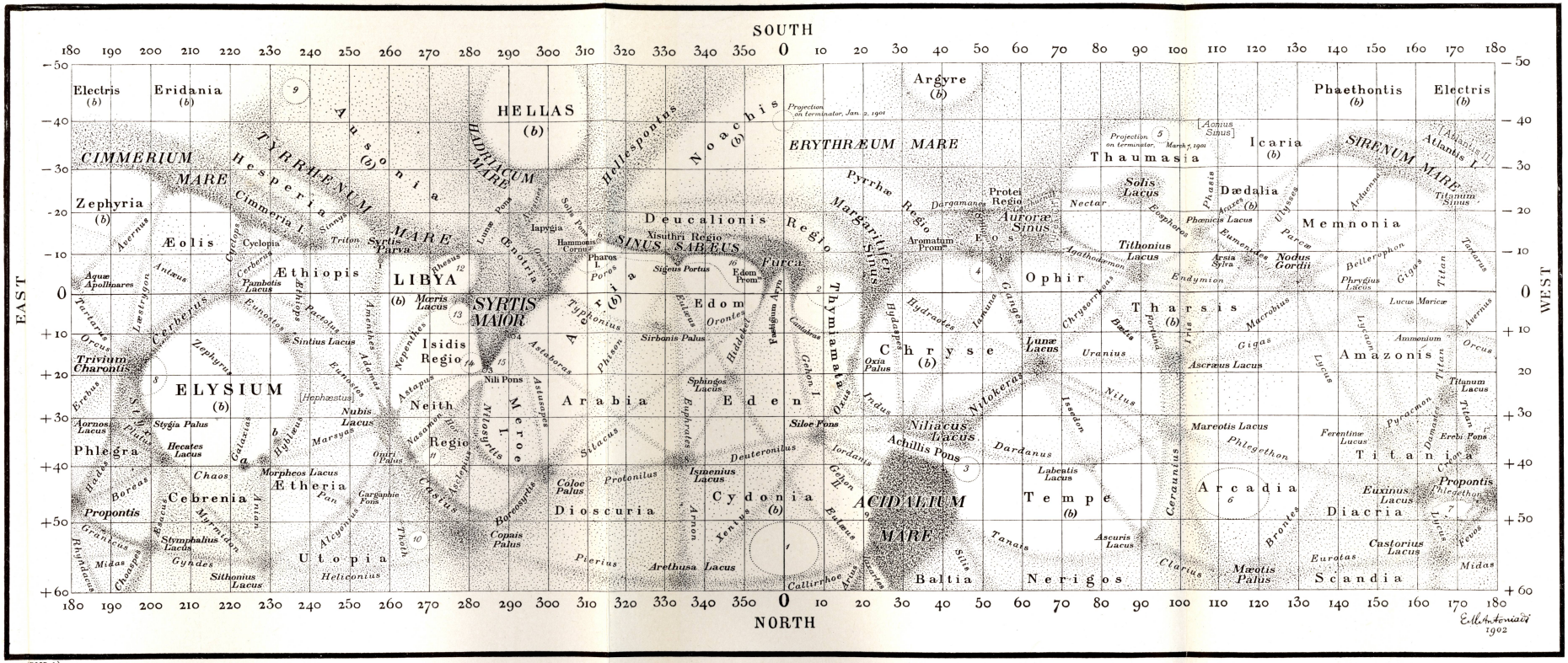
* The first of these, which wildly fixes the observer, consists in supposing *Mare Imbrium* to represent the right eye, *Maria Serenitatis* and *Tranquillitatis* the left, and *Mare Nubium* the mouth; while Signor Filippo Zamboni, of Vienna, has discovered an otherwise elegant and poetical figure. Assuming *Maria Serenitatis* and *Tranquillitatis* to represent the hair, he sees, in profile, a left eye in *Mare Vaporum*, the nose in the bright masses to S.E., the moustache in *Sinus Medii*; all the W. coast of *Mare Nubium* sketching the chin and neck of that remarkably truthful imitation of our lineaments.

Signor Zamboni's lunar figure is much more distinct than the ordinary one; and the discovery, on the moon, of such a robust and detailed human profile, to which a slight magnification adds a secondary chin, a thyroid cartilage, and a sparkling decoration (Tycho) on the chest, is most interesting, and one that gives credit to the Italian poet.

he would not recommend the choice of refractors from 4 to 5 inches, which would scarcely enable Members of the Association to master the more prominent markings of the planet; but he would rather back, in preference, the otherwise powerful, though less expensive, reflectors of between 6½ and 10 inches aperture. He would also like to see that instrument which, devised by Newton, and immortalised by Herschel, has become a national glory of the British nation, more readily diffused in the tropical latitudes and brighter skies of the Colonies. And thus, by a wider geographical distribution, a greater increase in numbers, and a more general amelioration of the instrumental equipment of its workers, the Section may enjoy, some day, the satisfaction of accomplished duty, in bringing forward a powerful contribution to the solution of the Martian mystery.

E. M. ANTONIADI,
Director of the Section.

Paris, 74, Rue Jouffroy,
1903, May 26.



(7857. A)

CHART OF MARS ON MERCATOR'S PROJECTION.

Prepared from the Observations of the Section in 1900-1901.

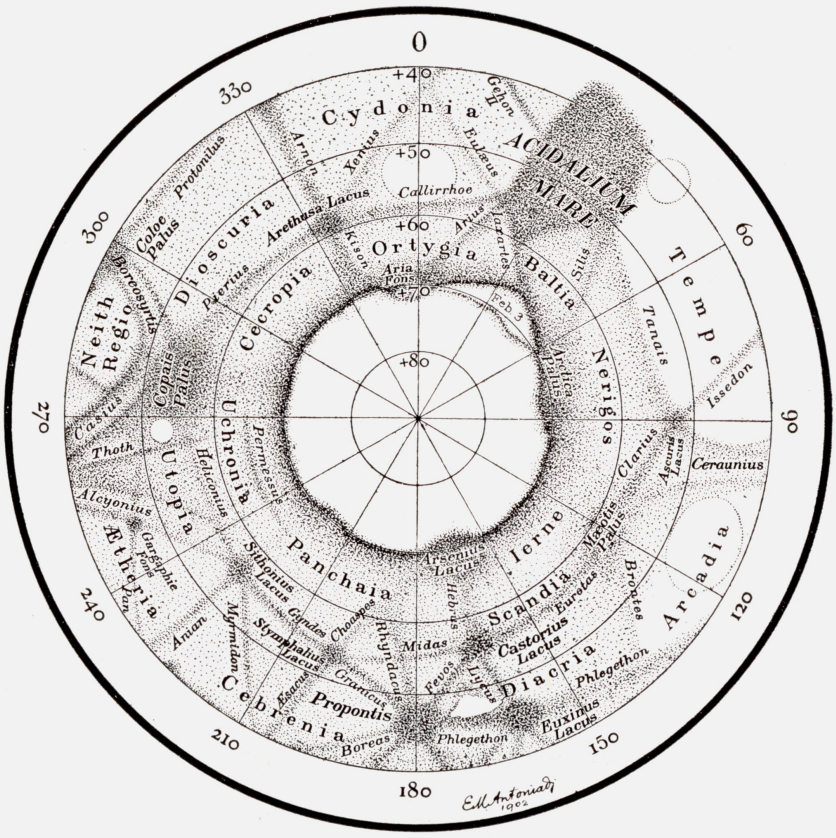


CHART OF THE NORTH POLAR REGIONS OF MARS.

Prepared from the Observations of the Section in 1900-1901.

Fig. 1. T. E. R. Phillips, $9\frac{1}{4}$ in. Spec.
1901, January, 5 d. 3 h. 0 m. $\omega = 4°$. $\phi = +23°$.

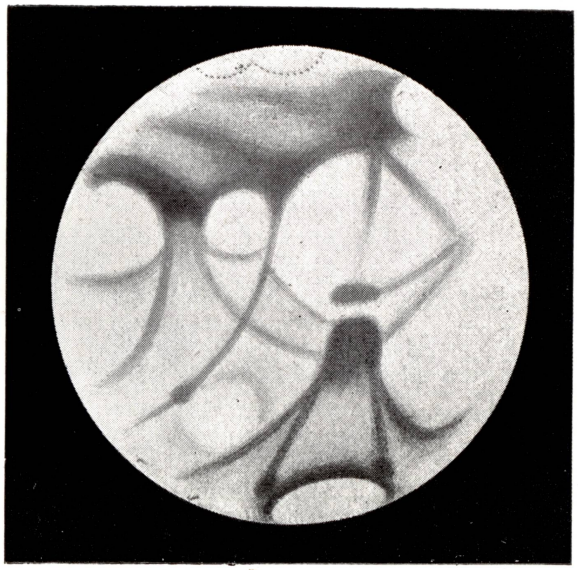


Fig. 2. P. B. Molesworth, $12\frac{1}{2}$ in. Spec.
1901, March, 7 d. 17 h. 2 m. $\omega = 28°$. $\phi = +20°$.

Fig. 3. E. M. Antoniadi, $9\frac{3}{4}$ in. O.G.
1901, April, 18 d. 19 h. 31 m. $\omega = 46°$. $\phi = +21°$.

Fig. 4. E. A. L. Attkins, $6\frac{1}{2}$ in. Spec.
1901, March, 12 d. 22 h. 40 m. $\omega = 67°$. $\phi = +20°$.

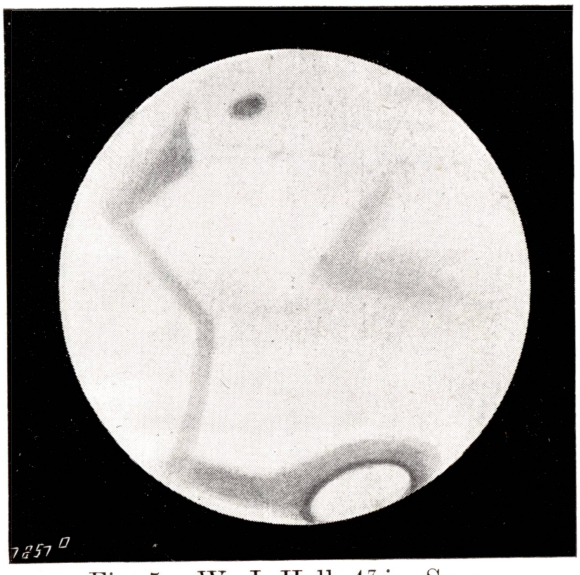


Fig. 5. W. J. Hall, $4\frac{7}{8}$ in. Spec.
1901, Jan., 31 d. 0 h. 0 m. $\omega = 85°$. $\phi = +22°$.

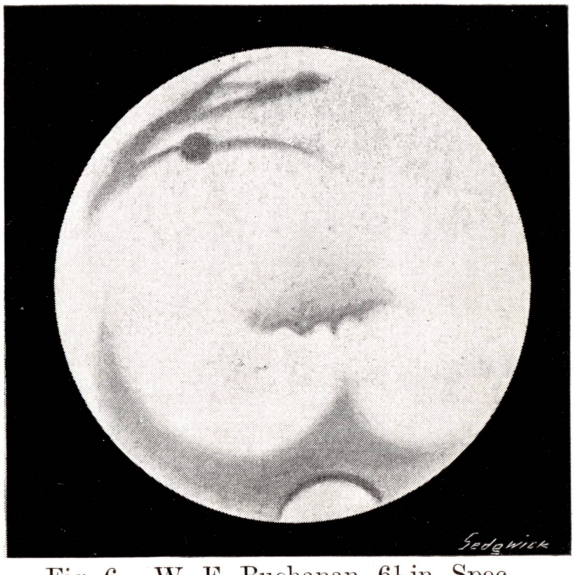


Fig. 6. W. E. Buchanan, $6\frac{1}{2}$ in. Spec.
1901, Feb., 28 d. 17 h. 38 m. $\omega = 99°$. $\phi = +21°$.

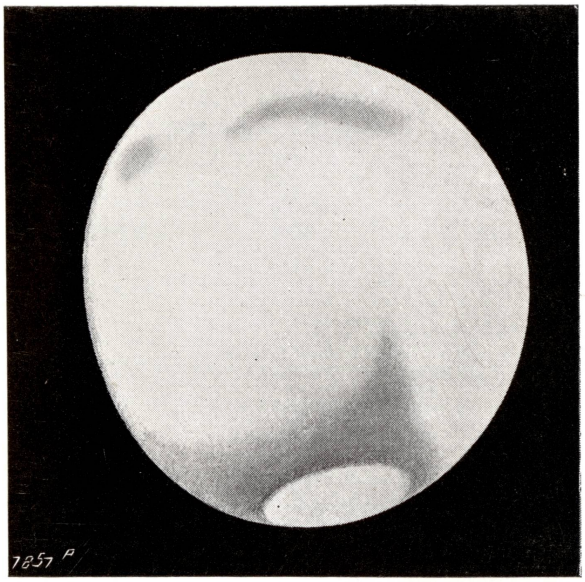


Fig. 1. T. E. R. Phillips, 9¼ in. Spec.
1900, Dec., 29 d. 8 h. 0 m. $\omega = 141°$. $\phi = +23°$.

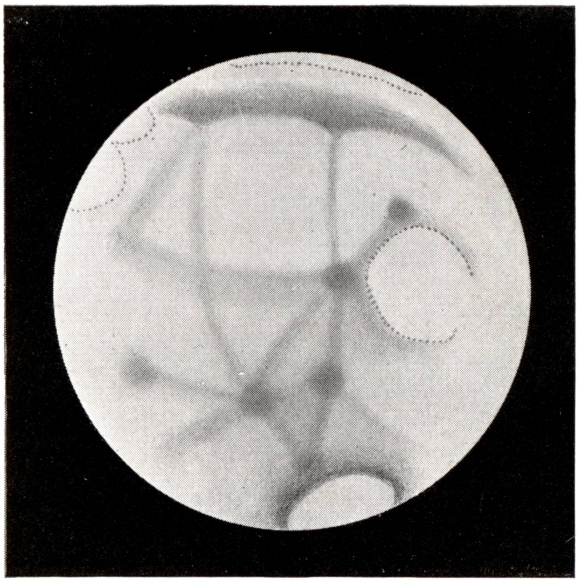


Fig. 2. P. B. Molesworth, 12½ in. Spec.
1901, Feb., 17 d. 17 h. 7 m. $\omega = 189°$. $\phi = +21°$.

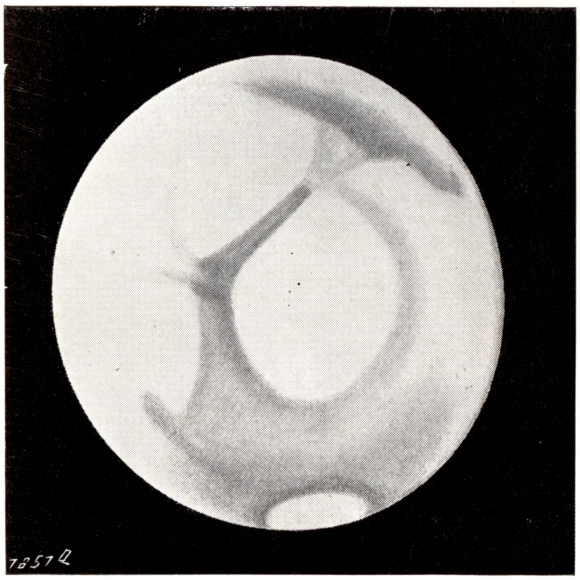


Fig. 3. W. A. Kibbler, 9¼ in. Spec.
1901, April, 5 d. 22 h. 30 m. $\omega = 209°$. $\phi = +20°$.

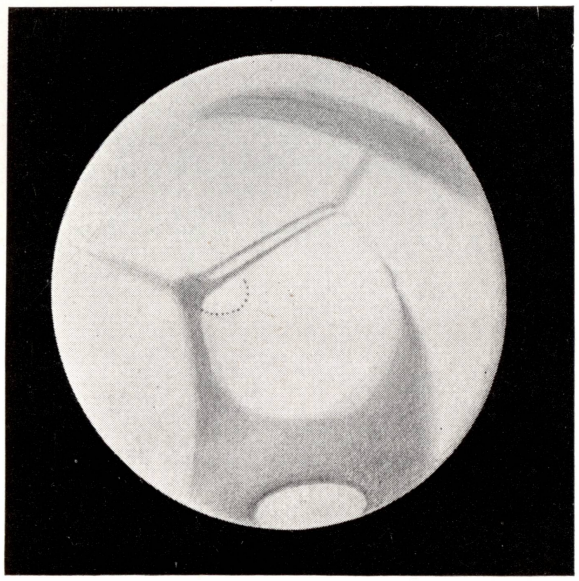


Fig. 4. E. A. L. Attkins, 6½ in. Spec.
1901, Mar., 30 d. 19 h. 30 m. $\omega = 220°$. $\phi = +20°$.

Fig. 5. S. R. Craig, 5 in. Spec.
1901, Feb. $\omega = 240°$. $\phi = +21° \pm$.

Fig. 6. W. S. Price, 8½ in. Spec.
1901, Jan., 11. $\omega = 268° \pm$. $\phi = +23°$.

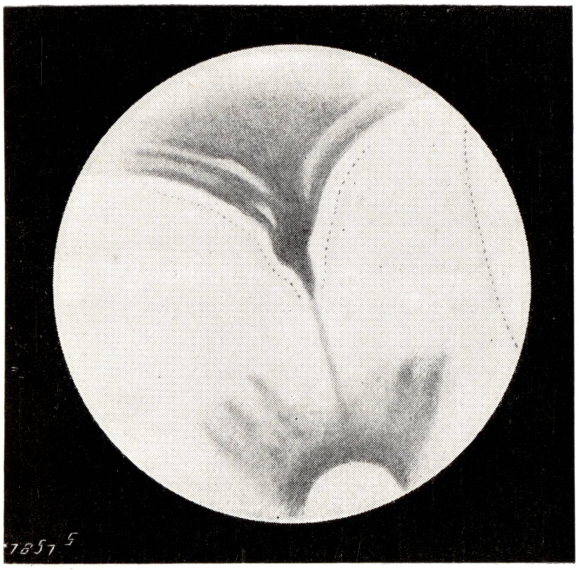


Fig. 1. H. J. Townshend, $9\frac{1}{2}$ in. Spec.
1901, Feb., 17 d. 23 h. 0 m. $\omega = 273°$. $\phi = +21°$.

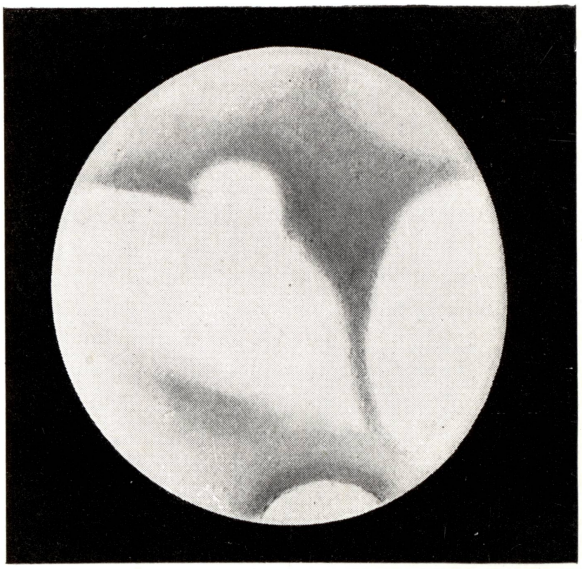


Fig. 2. H. Corder, $6\frac{1}{2}$ in. Spec.
1901, Mar., 24 d. 19 h. 45 m. $\omega = 278°$. $\phi = +20°$.

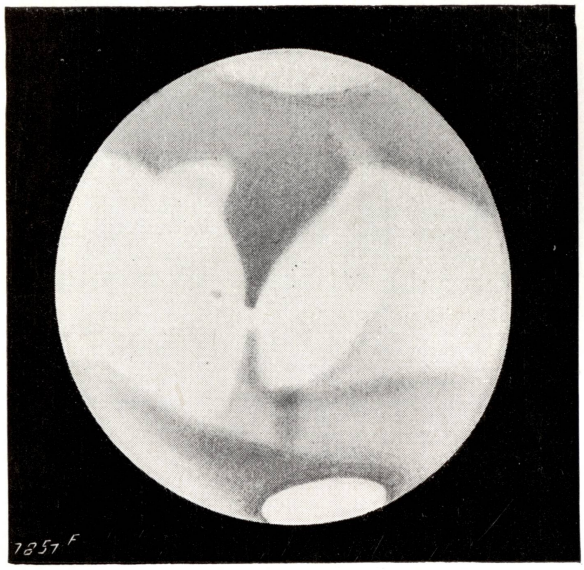


Fig. 3. S. Bolton, $4\frac{1}{8}$ in. O. G.
1901, Mar., 20 d. 19 h. 0 m. $\omega = 302°$. $\phi = +20°$.

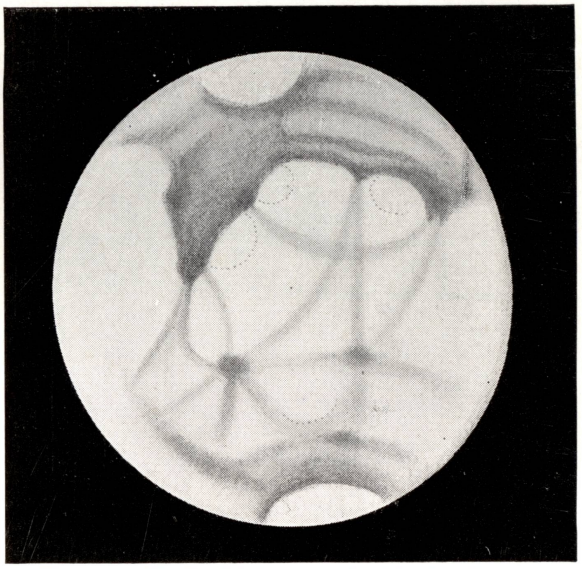


Fig. 4. P. B. Molesworth, $12\frac{1}{2}$ in. Spec.
1901, Mar., 14 d. 16 h. 6 m. $\omega = 312°$. $\phi = +20°$.

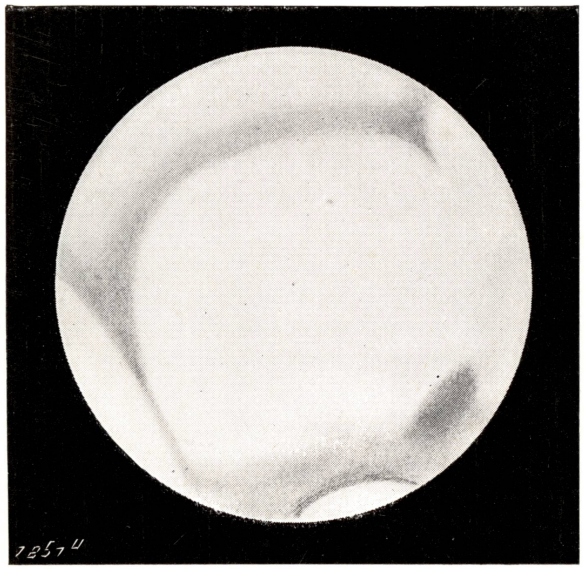


Fig. 5. R. Killip, 5 in. O. G.
1901, Feb., 11 d. 23 h. 0 m. $\omega = 325°$. $\phi = +21°$.

Fig. 6. W. A. Kibbler, $9\frac{1}{4}$ in. Spec.
1901, Mar., 21 d. 23 h. 30 m. $\omega = 359°$. $\phi = +20°$.

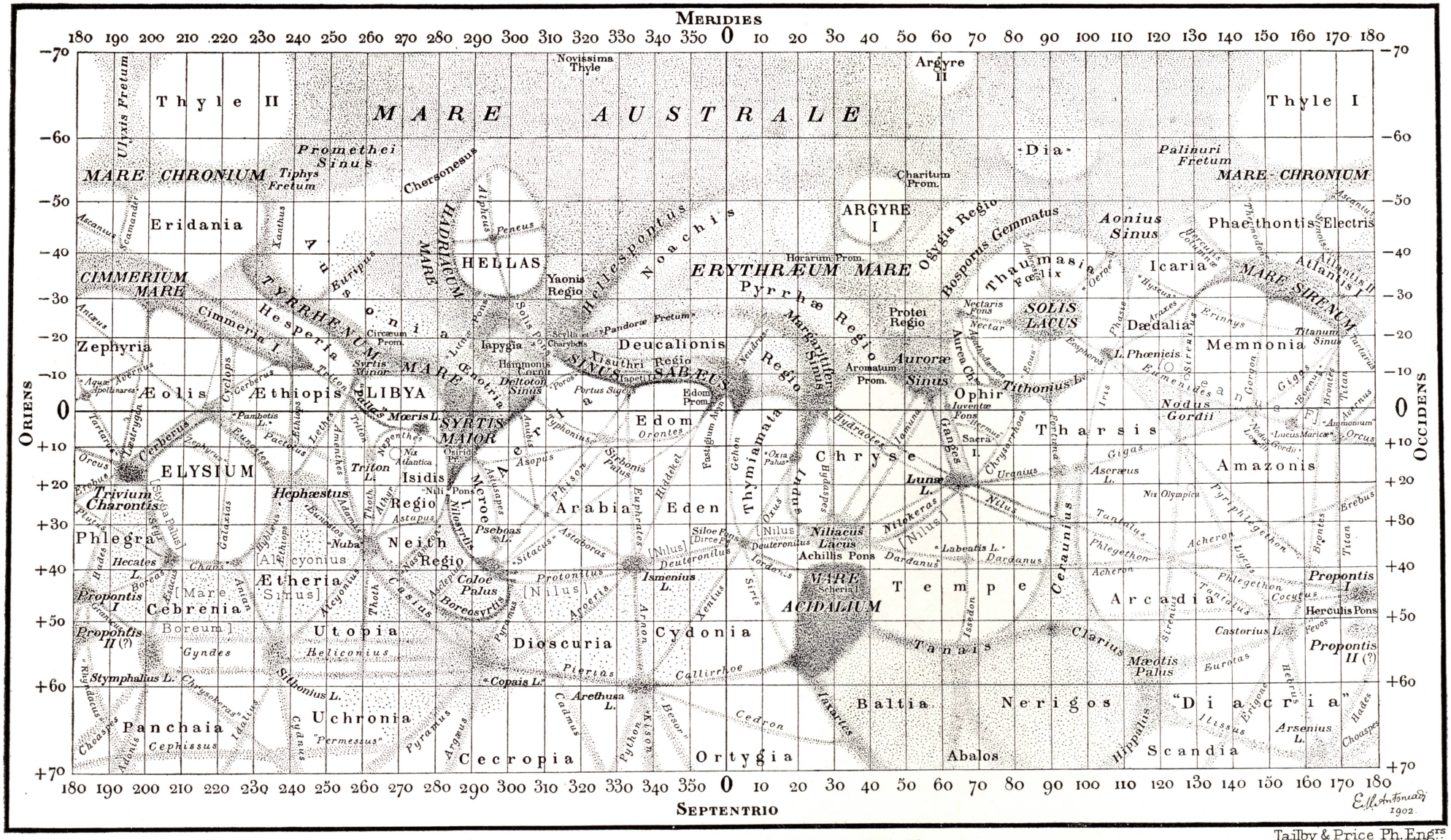
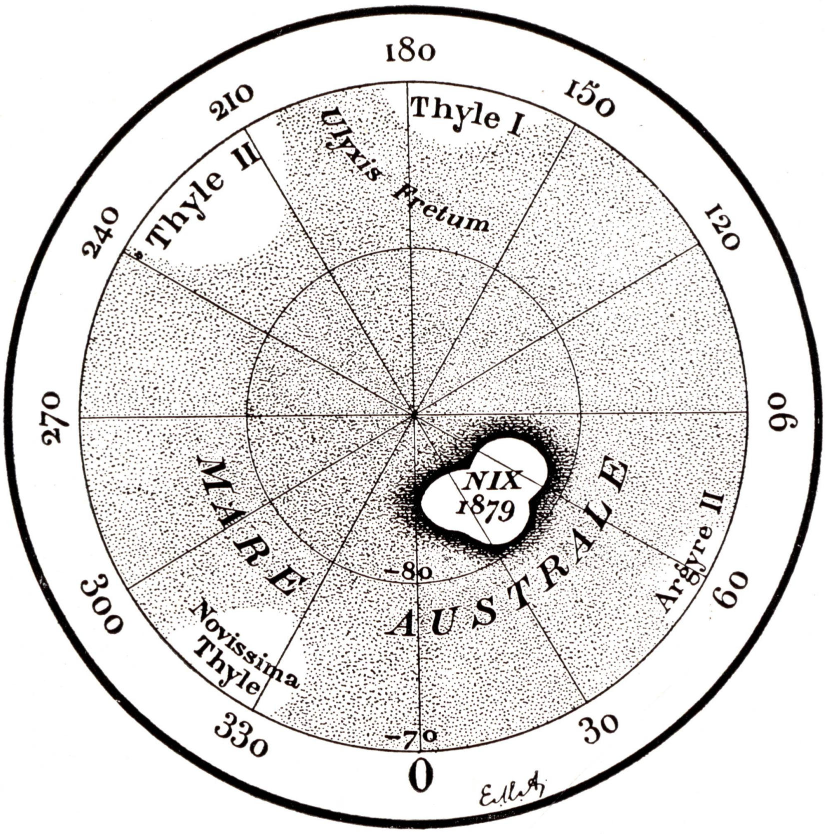


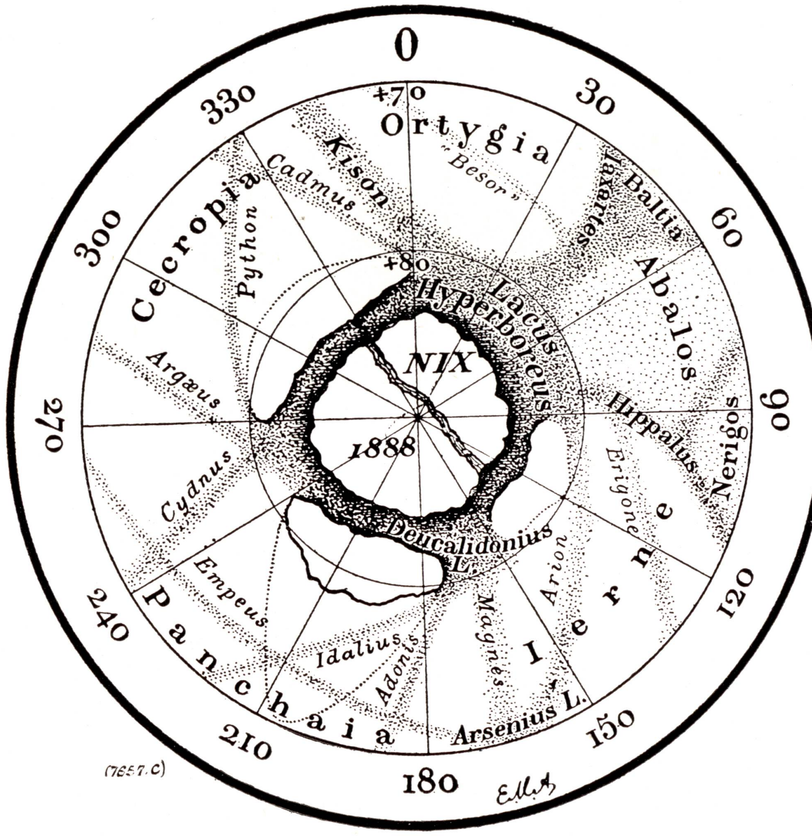
CHART OF MARS.

Of all Authenticated, but not necessarily Objective, Details.

PLATE VI.



SOUTH POLE.



NORTH POLE.

THE POLAR REGIONS OF MARS.

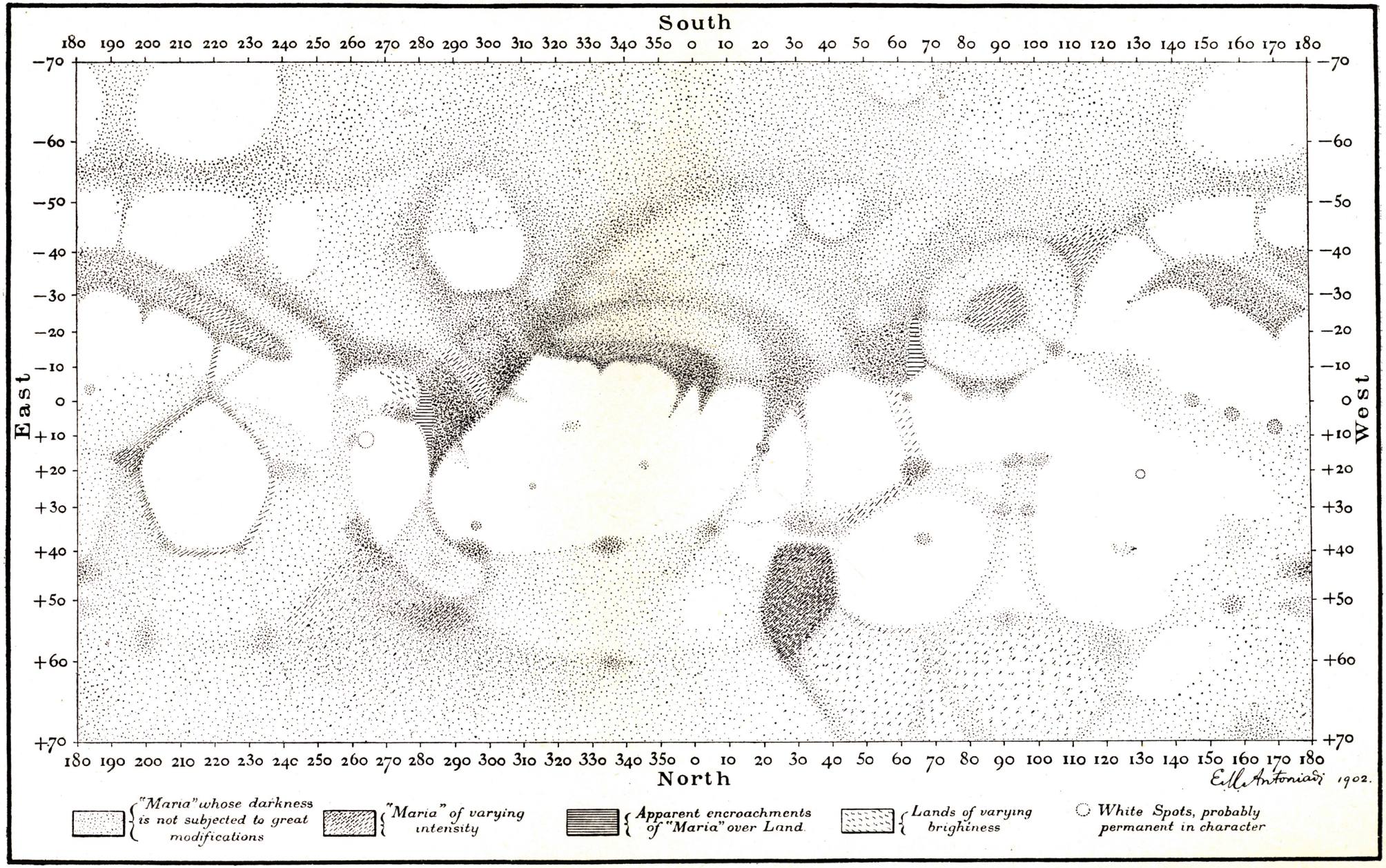


PLATE VIII.

PHYSICAL CHART OF MARS.— Only for the Objective Markings seen on the Planet from 1777 to 1901.