Memoirs

OF THE

British Astronomical Association.

VOL. IX. PART III.

FOURTH REPORT OF THE SECTION

FOR THE OBSERVATION OF

MARS.

Director—E. M. Antoniadi F.R.A.S.

LONDON:
PRINTED AND PUBLISHED FOR THE ASSOCIATION,
BY EYRE AND SPOTTISWOODE,
HIS MAJESTY'S PRINTERS.

Price to Members Two Shillings. Non-Members Three Shillings.
PUBLISHED *February* 21, 1901.

Members of the Association receive one copy of this Report, post free, and if they require extra copies, can obtain them from the Assistant Secretary, Mr. T. Frid Maunder, 26, Martin's Lane, Cannon Street, E.C., at Two Shillings each. The price to Non-Members is Three Shillings. Postage, One Penny.

Eight Volumes of the Memoirs of the Association are now complete, and may be purchased either in complete volumes or as separate reports. Members desiring extra Copies of these Memoirs can procure them from the Assistant Secretary, at two-thirds the published price given below.

Volume I.—	Price to Non-Members, exclusive of Postage. s.	d.
Part 1.—The Moon	0	9
„ 2.—Meteor	0	9
„ 3.—Star Colours	0	9
„ 4.—Variable Stars	0	9
„ 5.—Jupiter	1	6
„ 6.—The Sun	1	6
The Set (unbound)	6	0

Volume II.—	Price to Non-Members, exclusive of Postage. s.	d.
Part 1.—Saturn	1	6
„ 2.—The Moon	1	6
„ 3.—The Sun	1	6
„ 4.—Star Colours	0	9
„ 5.—Jupiter	1	6
„ 6.—Mars	1	6
The Set (unbound)	8	3

Volume III.—	Price to Non-Members, exclusive of Postage. s.	d.
Part 1.—Meteors	0	9
„ 2.—Variable Stars	0	9
„ 3.—The Sun	1	6
„ 4.—Jupiter	1	6
„ 5.—The Moon	1	6
The Set (unbound)	6	0

Volume IV.—	s.	d.
Part 1.—Meteors	0	9
„ 2.—Jupiter	1	6
„ 3.—The Sun	1	6
„ 4.—Mars	1	6
The Set (unbound)	5	3

Volume V.—	s.	d.
Part 1.—Meteors	0	9
„ 2.—Variable Stars	0	9
„ 3.—Jupiter	1	6
„ 4.—The Sun	1	6
The Set (unbound)	4	6

Volume VI.—	s.	d.
Part 1.—Eclipse Expedition	1	6
„ 2.—Meteors	0	9
„ 3.—Mars	3	0
„ 4.—Jupiter	1	6
„ 5.—Solar	1	6
The Set (unbound)	8	3

Volume VII.—	s.	d.
Part 1.—Meteors	0	9
„ 2.—The Sun	1	6
„ 3.—The Moon	1	6
„ 4.—Jupiter	1	6
The Set (unbound)	5	3

Volume VIII.—	s.	d.
Part 1.—Meteors	0	9
„ 2.—The Sun	1	6
„ 3.—Photographic	0	9
„ 4.—Jupiter	1	6
The Set (unbound)	4	6

Volume IX.—	s.	d.
Part 1.—Meteors	0	9
„ 2.—Star Colours	1	6
„ 3.—Mars	3	0

POSTAGE.—The cost of Postage of Copies of the Memoirs is ½*d.* in the case of those parts charged at 9*d.* each to Non-Members, and 1*d.* in the case of parts charged 1*s.* 6*d.* and upwards, each.

JOURNALS.

Ten Volumes of the Journal of the Association are now complete, the price of each, unbound, being 15*s.* to Non-Members, post free, 15*s.* 6*d.* Members can obtain additional copies of any single number, price 1*s.* 1*d.* post free. Members desirous of completing their sets of the publications of the Association by the purchase of those issued prior to the Session in which they were elected, will be supplied with one set of such publications, including both "Journals" and "Memoirs," at the special rate of 10*s.* 6*d.* per Session, delivered post free. Members will find the dates of their election given in the List of Members, issued annually.

All orders for "Journals" and "Memoirs" should be addressed to the Assistant Secretary, Mr. T. Frid Maunder, 26, Martin's Lane, Cannon Street, London, E.C.

SECTION FOR THE OBSERVATION

OF

MARS.

DIRECTOR.—E. M. ANTONIADI, F.R.A.S.

REPORT OF THE SECTION, 1898—1899.

PART I.

PROLEGOMENA.

1. The Apparition of 1898-1899.

This opposition of Mars was, on the whole, a favourable one. Although the planet which, in 1896, approached us to within 0·561 (52,040,000 miles), was not nearer than 0·651 (60,390,000 miles) on 1899, January 15, yet its great northern declination atoned, to European astronomers, for its reduced disc, which, even at maximum, was not greater than 14″·76.

Phenomena.

Passage of Mars through Perihelion -	1898, April 30.
Summer Solstice of S. hemisphere -	1898, May 31.
Winter Solstice of N. hemisphere -	
Autumnal Equinox of S. hemisphere -	1898, Nov. 6.
Spring Equinox of N. hemisphere -	
Passage of Mars through Aphelion -	1899, April 8.
Winter Solstice of S. hemisphere -	1899, May 24.
Summer Solstice of N. hemisphere -	

The latitude of the centre of the disc was negative early in the apparition, but became positive on 1898, August 19, when the earth passed through the plane of the Martian equator.

---

2. The Work of the Section.

The following are the names of the Members having joined the Mars Section in 1898–1899.

Observer.	Locality.	Aperture of Instrument in Inches.	No. of Drawings sent to the Association.
ANTONIADI, E. M., F.R.A.S.	Juvisy, *France* -	$10\frac{1}{2}$ O.G. / $6\frac{1}{2}$ Spec.	65
ATTKINS, E. - -	Highgate, London -	$6\frac{1}{2}$ Spec.	11
BROWN, G. L. - -	Stirling, Scotland -	$10\frac{1}{4}$ Spec.	5
CORDER, H. - - -	Bridgewater -	$6\frac{1}{2}$ Spec.	12
CROWLEY, L. A. - -	Paris, *France* -	7 O.G.	5
HALL, W. J. - -	Nantwich, Cheshire	$4\frac{7}{8}$ Spec.	5
KEMPTHORNE, Rev. P. H., M.A., F.R.A.S.	Wellington College, Berkshire.	$12\frac{1}{2}$ Spec.	5
KILLIP, Rev. R., F.R.A.S. -	St. Annes-on-the-Sea, Lancashire.	5 O.G.	5
MEE, A., F.R.A.S. - -	Cardiff, Wales -	$8\frac{1}{2}$ Spec.	3
MOLESWORTH, Capt. P. B., R.E., F.R.A.S.	Trincomali, *Ceylon*	$12\frac{1}{2}$ Spec.	* 0
PHILLIPS, Rev. T. E. R., M.A., F.R.A.S.	Yeovil, Somerset -	$9\frac{1}{2}$ Spec.	20
TOWNSHEND, H. J. - -	Leeds - -	$9\frac{1}{2}$ Spec.	† 0
WILLIAMS, A. A. - -	Cardiff, Wales -	5 Spec.	7
WILLIAMS, A. STANLEY, F.R.A.S.	Brighton - -	$6\frac{1}{2}$ Spec.	1

A comparison of the preceding Table with those given in the last "Reports" will show a diminution in the membership as well as in the geographical extent of the Section—a change which, instead of going the other way, that is *pari passu* with the great increase in the Membership of the Association, seems to have unexpectedly followed the constant reduction of the Martian disc since 1892. If the change be cyclical, we may look forward for fuller collaboration in the immediate future.

It is fortunate, however, that, through the exertions of our European Members, there is no corresponding decline in the value of the results obtained.

* Capt. Molesworth was enabled to make 172 drawings of the planet during the apparition. These, however, were not presented to the Association, but merely sent to the Director for inspection. A summary of the Ceylon results is given in the present Report.

† The drawing shown on Plate III. Fig. 3., was only temporarily lent to the Director.

A complete list of the 144 drawings of Mars sent to the Association in 1898–99 is given in the following Table :—

D stands for the diameter of the disc ; ω and ϕ represent the longitude and the latitude of the centre of the disc.

No.	Observer.	Date.	D.	ω	ϕ
			″	°	°
1	Corder	1899, Jan. 19	14·7	0	+11·5
2	Antoniadi	,, Feb. 27	11·5	16	+ 8·7
3	Antoniadi	,, Feb. 25	11·7	24	+ 8·6
4	Antoniadi	,, Feb. 20	12·3	28	+ 8·5
5	Phillips	,, Feb. 26	11·6	29	+ 8·6
6	Corder	,, Jan. 14	14·8	32	+12·2
7	Phillips	,, Mar. 1	11·3	32	+ 8·7
8	Kempthorne	,, Feb. 21	12·1	34	+ 8·5
9	Brown	,, Jan. 16	14·8	36	+11·9
10	Antoniadi	,, Feb. 20	12·3	38	+ 8·5
11	Antoniadi	,, Feb. 25	11·7	39	+ 8·6
12	Antoniadi	,, Feb. 24	11·9	42	+ 8·6
13	Attkins	,, Feb. 24	11·9	42	+ 8·6
14	Antoniadi	,, June 17	5·3	44	+23·7
15	A. A. Williams	,, Feb. 26	11·6	44	+ 8·6
16	Corder	,, Jan. 13	14·7	48	+12·5
17	Antoniadi	1898, July 14	5·6	49	−10·3
18	Antoniadi	,, Aug. 19	6·2	51	− 0·2
19	Antoniadi	1899, Feb. 24	11·9	53	+ 8·6
20	Antoniadi	,, July 23	4·7	55	+26±
21	Stanley Williams	,, Feb. 23	11·9	57	+ 8·6
22	Killip	,, Feb. 22	12·0	58	+ 8·5
23	Hall	,, Jan. 14	14·8	59	+12·3
24	Phillips	,, Jan. 13	14·7	59	+12·4
25	Antoniadi	,, Feb. 24	11·8	60	+ 8·6
26	Kempthorne	,, Feb. 23	11·9	60	+ 8·6
27	Corder	,, Jan. 13	14·7	63	+12·5
28	Phillips	,, Apr. 3	8·5	70	+12·0
29	Attkins	,, Feb 23	11·9	71	+ 8·6
30	Corder	,, Feb. 16	12·7	72	+ 8·6
31	Phillips	,, Jan. 14	14·8	73	+12·3
32	Antoniadi	,, Feb. 17	12·6	79	+ 8·6
33	Antoniadi	,, Jan. 9	14·7	85	+13·1
34	Crowley	,, Feb. 17	12·6	86	+ 8·6
35	Antoniadi	,, Feb. 17	12·6	87	+ 8·6
36	Crowley	,, Jan. 9	14·7	87	+13·1
37	Phillips	,, Feb. 14	12·9	91	+ 8·7
38	Antoniadi	,, Jan. 9	14·7	92	+13·1
39	Antoniadi	,, Feb. 17	12·6	94	+ 8·6
40	Antoniadi	1898, July 8	5·5	99	−12·0
41	Antoniadi	1899, Feb. 17	12·6	101	+ 8·6
42	Antoniadi	,, Jan. 8	14·6	101	+13·2
43	Attkins	,, Feb. 17	12·6	106	+ 8·6
44	Antoniadi	,, Feb. 17	12·6	109	+ 8·6
45	Antoniadi	,, Jan. 8	14·6	116	+13·2
46	Phillips	,, Jan. 8	14·6	118	+13·2
47	Antoniadi	1898, Oct. 22	8·5	123	+13·7
48	Attkins	1899, Mar. 27	8·9	124	+11·1
49	Attkins	,, Feb. 17	12·6	130	+ 8·6
50	Antoniadi	1898, Oct. 22	8·5	131	+13·7
51	Antoniadi	1899, July 14	4·8	143	+25·8

No.	Observer.	Date.	D.	ω.	φ.
			″	°	°
52	Antoniadi	1899, Feb. 10	13·3	153	+ 8·9
53	Phillips	„ Jan. 4	14·3	153	+13·8
54	Hall	„ Feb. 12	13·1	156	+ 8·8
55	Crowley	„ Feb. 10	13·3	158	+ 8·9
56	Antoniadi	1898, Sept. 13	6·9	159	+ 6·4
57	A. A. Williams	1899, Jan. 4	14·3	167	+13·9
58	Antoniadi	„ Feb. 10	13·3	168	+ 8·9
59	Crowley	„ Feb. 10	13·3	171	+ 8·9
60	Hall	„ Jan. 4	14·3	171	+13·8
61	Antoniadi	„ Mar. 16	9·9	178	+ 9·8
62	Killip	„ Mar. 15	10·0	178	+ 9·6
63	Phillips	1898, Dec. 31	14·2	180	+14·4
64	Antoniadi	1899, Mar. 14	10·0	189	+ 9·6
65	Antoniadi	„ June 2	5·7	189	+21·6
66	Antoniadi	„ July 9	4·9	189	+25·6
67	Antoniadi	„ Feb. 10	13·3	194	+ 8·9
68	Antoniadi	„ June 1	5·7	194	+21·5
69	Corder	„ Feb. 7	13·6	196	+ 9·0
70	Antoniadi	„ Feb. 10	13·3	201	+ 8·9
71	Crowley	„ Feb. 10	13·3	203	+ 8·9
72	Kempthorne	„ Feb. 2	14·0	205	+ 9·6
73	Hall	„ Feb. 3	13·9	206	+ 9·4
74	Attkins	„ Mar. 14	10·0	207	+ 9·6
75	Phillips	„ Feb. 1	14·1	210	+ 9·7
76	Antoniadi	„ Feb. 4	13·9	214	+ 9·4
77	Antoniadi	„ May 30	5·8	217	+21·3
78	Antoniadi	1898, Nov. 18	10·3	217	+16·3
79	Corder	1899, Feb. 1	14·1	224	+ 9·6
80	Antoniadi	„ Feb. 4	13·9	225	+ 9·4
81	Brown	„ Feb. 1	14·1	225	+ 9·7
82	Antoniadi	„ Jan. 28	14·3	228	+10·1
83	Antoniadi	„ May 30	5·8	228	+21·3
84	Attkins	„ Feb. 3	13·9	234	+ 9·4
85	Mee	„ Feb. 2	14·0	235	+ 9·6
86	Antoniadi	„ Jan. 28	14·3	236	+10·1
87	Antoniadi	„ Feb. 2	14·0	242	+ 9·6
88	Phillips	1898, Dec. 25	13·8	245	+15·1
89	Phillips	1899, Apr. 21	7·3	245	+14·9
90	Phillips	„ Mar. 14	6·3	249	+ 9·6
91	Antoniadi	1898, Dec. 21	13·4	249	+15·5
92	Hall	1899, Feb. 2	14·0	251	+ 9·5
93	Corder	1898, Dec. 27	13·9	253	+14·8
94	Antoniadi	1899, Apr. 19	7·5	254	+14·6
95	Attkins	„ Mar. 14	10·0	255	+ 9·6
96	Kempthorne	„ Feb. 2	14·0	255	+ 9·6
97	Antoniadi	1898, Dec. 21	13·4	257	+15·5
98	Antoniadi	1899, Feb. 2	14·0	257	+ 9·6
99	Antoniadi	„ May 27	5·9	257	+20·8
100	A. A. Williams	„ Feb. 2	14·0	259	+ 9·6
101	Antoniadi	„ Apr. 19	7·5	261	+14·6
102	A. A. Williams	1898, Dec. 26	13·8	262	+15·0
103	Killip	1899, Mar. 13	10·1	266	+ 9·5
104	Antoniadi	1898, Dec. 21	13·4	268	+15·5
105	Mee	1899, Jan. 27	14·4	268	+10·6
106	Antoniadi	1898, Dec. 20	13·3	269	+15·6
107	Antoniadi	„ Dec. 22	13·5	270	+15·4
108	Phillips	1899, Feb. 1	14·1	272	+ 9·7
109	Corder	„ Jan. 26	14·5	273	+10·4
110	Phillips	1898, Dec. 20	13·3	276	+15·6
111	Antoniadi	„ Dec. 22	13·5	277	+15·4

No.	Observer.	Date.	D.	ω	φ
			″	°	°
112	Antoniadi - -	1898, Dec. 20 -	13·3	278	+15·6
113	Brown - -	1899, Jan. 26 -	14·5	280	+10·5
114	Antoniadi - -	1898, Dec. 20 -	13·3	284	+15·6
115	Brown - -	1899, Jan. 25 -	14·5	285	+10·6
116	Attkins - -	„ Jan. 26 -	14·5	288	+10·5
117	Phillips - -	„ Mar. 10 -	10·4	290	+ 9·2
118	Mee - -	„ Jan. 25 -	14·5	292	+10·6
119	Antoniadi - -	1898, Nov. 11 -	9·8	297	+15·9
120	Phillips - -	1899, Jan. 30 -	14·2	301	+ 9·9
121	Antoniadi - -	1898, Nov. 11 -	9·8	306	+15·9
122	Killip - -	1899, Jan. 26 -	14·5	306	+10·5
123	Attkins - -	„ Mar. 2 -	11·2	309	+ 8·7
124	Phillips - -	1898, Dec. 17 -	13·0	309	+15·9
125	Antoniadi - -	1899, Jan. 25 -	14·5	309	+13·1
126	A. A. Williams -	„ Jan. 26 -	14·5	314	+10·4
127	Corder - -	„ Jan. 22 -	14·6	319	+10·9
128	Antoniadi - -	„ Feb. 27 -	11·5	320	+ 8·6
129	Antoniadi - -	„ Jan. 25 -	14·5	320	+10·6
130	Killip - -	„ Jan. 24 -	14·5	321	+10·7
131	A. A. Williams -	„ Mar. 5 -	10·9	325	+ 8·9
132	Antoniadi - -	„ Feb. 27 -	11·5	327	+ 8·6
133	Antoniadi - -	„ Jan. 25 -	14·5	328	+10·6
134	Brown - -	„ Jan. 23 -	14·6	330	+10·9
135	Kempthorne -	„ Jan. 27 -	14·4	330	+10·3
136	Corder - -	„ Jan. 19 -	14·7	331	+11·5
137	A. A. Williams -	„ Jan. 23 -	14·6	332	+10·9
138	Antoniadi - -	„ Feb. 27 -	11·5	334	+ 8·6
139	Phillips - -	„ Apr. 9 -	8·0	337	+13·0
140	Antoniadi - -	„ July 30 -	4·7	340	+25·0
141	Attkins - -	„ Feb. 27 -	11·5	345	+ 8·6
142	Corder - -	„ Jan. 19 -	14·7	345	+11·5
143	Antoniadi - -	„ July 29 -	4·7	347	+26±
144	Phillips - -	„ Jan. 24 -	14·5	357	+10·7

The Section may be congratulated on having amongst its Members such skilful observers as Capt. Molesworth and the Rev. T. E. R. Phillips. The recent areographic work of the former, based on 172 drawings of the planet, is a worthy sequel to that made at the 1896–97 apparition, though the observer was now obliged to absent himself during the most favourable part of the planet's visibility. Meantime, the Rev. T. E. R. Phillips was even more successful in 1898–99 than two years previously. His results have been so fully confirmed from all quarters as to stamp him as one of the very first observers in the British Isles. Also, by his detection of the canals as edges to diffused shadings, the Rev. P. H. Kempthorne did more than anybody else in these days to increase our knowledge of those enigmatical lines. Work of a high order was further done by Messrs. Attkins and Brown, Hall, Corder, Mee, and A. A. Williams, while Messrs. Killip and Townshend supplied valuable drawings and notes. It is, however, to be regretted that the Section did not have the advantage of the full collaboration of Mr. Stanley Williams, though the few diagrams and notes sent are worthy of his work in the past.

3. On the Representation of Uncertain Detail.

Rev. T. E. R. Phillips reports as follows on this important point:—

"Faint markings have been glimpsed now and then, and it "would be easy, by the 'scientific use of the imagination,' to "conjure them into lines and streaks harmonising with Schia- "parelli's charts, but I am careful to represent on my drawings "only what I feel I can see with certainty and hold with "tolerable steadiness."

---

4. The Canals.

Notwithstanding the natural scepticism of many scientific men, every opposition brings with it its own contingent of confirmation of Schiaparelli's discovery of linear markings, apparently furrowing the surface of the planet Mars. The differentiation between objective and subjective in the dædalian phenomena presented by these appearances will be the work of future generations. But the value of the great Italian's results will be everlasting.

As at the last apparition, the canals have been seen by all the Members of the Section. Some notes as to their visibility will certainly be of interest here.

"I may say," says Mr. Attkins, "that I started work on Mars "in the hope that I should not see any of the so-called 'canals,' "and I was very much astonished at what I did see. I have, "however, no doubt about those I have shown, as every detail on "both occasions stood out perfectly defined, the air being very "steady and clear."

Writing under date 1898, December 16, the Rev. T. E. R. Phillips says:—

"Such canals as I have certainly seen have been very broad and "diffused, reminding one forcibly of Mr. Mee's 'amorphous "smudges.' I have no doubt this appearance is due to im- "perfect seeing, and that, could I have observed under better "conditions, the markings would have seemed narrower and more "distinct." But on 1899, January 30:—"The canals in the "neighbourhood of the *Nilosyrtis* seemed almost Schiaparellian "in their sharpness and definiteness."

Now, next to observers so emphatic on the question, some Members of the Section might, perhaps, protest in finding their names included among the canal-seers.

"I have never joined the Mars Section, because I cannot see "canals," says Mr. Henry Corder, the valued late Director of the Meteoric Section of the Association, and no statement as to the contrary would be made here were the present "Memoir" to be a mere compilation of reports. But, inasmuch as the material composing it is based on a careful analysis of every shading shown on the drawings to hand, it would be illogical to speak of some shadings, and say nothing of others. Like Mr. Mee, Mr. Corder shows diffuse markings at the exact positions of, and having a similar trend to, the Schiaparellian "canals." Hence the justification for including these features under that conventional name, And, it might be, that this very apparent incongruity pays the

highest tribute to the accuracy of Messrs. Corder and Mee's observations.

The following Table shows the number of canals shown by the Members of the Section on their recent drawings :—

Observer.	Canals.				
	Schiap.	Lowell.	"New" 1896–97.	New, 1898–99.	Total.
Capt. Molesworth	75	3	4	3	85
Rev. T. E. R. Phillips	44	0	1	0	45
Antoniadi	41	0	2	1	44
Brown	35	1	1	1	38
Rev. P. H. Kempthorne	26	2	0	0	28
Attkins	22	0	1	0	23
Stanley Williams	17	0	0	0	17
Corder	15	0	1	0	16
Hall	10	0	1	0	11
Rev. R. Killip	9	0	0	0	9
Mee	7	0	0	0	7
Crowley	2	0	0	0	2
A. A. Williams	1	0	1	0	2
Townshend	0	0	1	0	1

The total number of canals seen by the Section in 1898–99 is exactly 99. Of these, 84 belong to Schiaparelli's charts, six to Lowell's, four to our 1896–97 chart, one to Cerulli's map of 1896, while four others were apparently seen for the first time at the past apparition.

A complete exposition of the names or symbols of these canals is given in the four following tables. Duplicity is indicated by a (*d*).

I. SCHIAPARELLI'S MAPS (1877–88).

Adamas.	*Ceraunius* (*d*).	*Galaxias.*
Æsacus.	*Cerberus* (*d*).	*Ganges* (*d*).
Æthiops.	*Chaos.*	*Gehon* (*d*).
Agathodæmon.	*Chrysorrhoas.*	*Gigas.*
Alcyonius.	*Clarius.*	*Gorgon* (*d* ??).
Amenthes.	*Cyclops* (*d*).	*Granicus.*
Antæus.	*Dardanus.*	*Gyndes.*
Anubis.	*Deuteronilus.*	*Hades* (*d*).
Arnon.	*Eosphoros.*	*Hebrus.*
Asclepius.	*Erebus.*	*Heliconius.*
Astaboras.	*Eumenides-Orcus.*	*Hiddekel.*
Astapus.	*Eunostos.*	*Hyblæus.*
Astusapes.	*Euphrates.*	*Hydaspes.*
Athyr.	*Euripus.*	*Hydraotes.*
Boreas.	*Eurotas.*	*Iamuna* (*d*).
Boreosyrtis.	*Fevos.*	*Iaxartes.*
Callirrhoe.	*Fortuna.*	*Indus.*

I. SCHIAPPARELLI'S MAPS (1877–88)—*continued.*

Iordanis.	*Orontes.*	*Sirenius.*
Iris.	*Oxus.*	*Styx.*
Issedon.	*Pactolus.*	*Tanais.*
Kison.	*Phasis.*	*Tartarus.*
Læstrygon.	*Phison.*	*Thoth.*
Lethes.	*Phlegethon.*	*Titan.*
Nectar.	*Pierius.*	*Triton.*
Nepenthes.	*Plutus.*	*Typhonius.*
Nilokeras (*d*).	*Poros.**	*Uranius.*
Nilosyrtis.	*Protonilus.*	*Xanthus.*
Nilus (*d*).	*Pyriphlegethon.*	*Xenius.*

* A name given provisionally by the Director to Schiaparelli's unnamed canal, forming *Pharos Insula,* and putting into communication *Sinus Sabæus* with the *Syrtis Major.* Πόρος, in Greek, is a narrow *passage, strait,* or *channel.*

II. LOWELL'S CHART (1894).

"*Arosis.*"	"*Cantabras.*"	"*Eulæus.*"
"*Brontes.*"	"*Elison.*"	"*Hypsas.*"

III. CANALS OF THE 1896–97 CHART.

Ω and Φ represent areographic longitude and latitude respectively.

Symbol, 1896–97.	Name.	Discovered by.	Extent (1898–99). From Ω	From Φ	To Ω	To Φ
			°	°	°	°
A	"*Iamuna II.*"* -	Molesworth, 1896	35	− 1	40	−12
E	"*Hyblæus II.*"* -	„ „	208	+33	214	+ 9
I	"*Rhesus*"† -	Stanley Williams, 1890.	254	− 3	279	+ 8
L	"*Nasamon*"‡ -	Lowell, 1894 -	265	+40	282	+30
—	"*Sitacus*"§ -	Cerulli, 1896 -	298	+40	354	+ 8

* Names given by Captain Molesworth.

† Christened by Cerulli.

‡ Name given to this canal by the Director, from its African vicinity. Lowell and Cerulli both call it "*Astapus,*" though its course makes an angle of 45° with Schiaparelli's *Astapus.* Hence the necessity of a new name for this important marking.

§ Lowell called "*Sitacus*" a line running from the preceding fork of *Sinus Sabæus* to the northern end of *Syrtis Major.* But the canal seen by the Members of the Section in 1898–99 unites the same fork to *Coloe Palus,* thus being identical with Cerulli's "*Sitacus.*"

IV. NEW CANALS SEEN IN 1898–99.

Symbol, 1898–99.	Name (in Cerulli's Map, 1900).	Discovered by.	Extent. From Ω	From Φ	To Ω	To Φ
A	- - -	Molesworth -	42°	+43°	98°	+30°
B	- - -	,, -	106	+30	150	+20
C	- - -	Brown - -	220	+19	232	+14
D	"*Axon*" - -	Antoniadi - - / Molesworth - -	232	+30	265	+40

It is evident from the above tables that very few canals were seen double in 1898-99.

CANALS IN THE DARK REGIONS.—"I have been fortunate "enough to trace several of Lowell's canals traversing the *Maria*. "These features appear to me in prolongation of, and are "obviously connected with, the true canals."—(Captain Molesworth.)

---

5. The Canals considered as Edges to Faint Shadings. A Step towards the Solution of the Mystery.

The most important feature of the apparition in connexion with the canals is the detection, made by the Rev. P. H. Kempthorne, that a considerable number of them are merely the edges of diffused shadings. At least a dozen canals were thus seen by the Rev. P. H. Kempthorne. Such observations are of the highest import, as throwing immense light on an obscure corner of science. Probably optical phenomena have something to do with the visibility of the canals. Meantime, the sensibility of some eyes in detecting almost insensible half-tones stands in curious opposition to the inability of others in that line.

Messrs. Corder, Molesworth, Phillips, A. A. Williams, and the Director, also saw a very few canals as borders to faint dusky areas. But the stone added to the edifice of truth here by Mr. Kempthorne is weightier alone than the sum of those brought by the other Members of the Section together.

The idea that some of the canals might be due to the edges of shadings was enunciated by Mr. Maunder in 1882.

---

6. The Lakes.

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

Observer.	Lakes.			
	Schiap.	Lowell or Cerulli.	"New."	Total.
Capt. Molesworth	14	5	6	25
Rev. T. E. R. Phillips	12	2	3	17
Antoniadi	13	0	1	14
Brown	8	1	4	13
Attkins	7	0	1	8
Rev. P. H. Kempthorne	6	0	1	7
Hall	6	0	1	7
Stanley Williams	4	0	0	4
Corder	2	0	1	3
Mee	1	0	1	2
Crowley	2	0	0	2
Rev. R. Killip	1	0	0	1
A. A. Williams	1	0	0	1
Townshend	0	0	0	0

In all 33 lakes are recorded. Of these, 18 are Schiaparelli's, 4 Lowell's, 1 Cerulli's, and 10 new. The latter seem to have mostly been seen for the first time in 1898–99.

I. SCHIAPARELLI'S MAPS (1877–88).

Arethusa Lacus.	*Mæotis Palus.*	*Siloe Fons.*
Coloe Palus.	*Mœris Lacus.*	*Sirbonis Palus.*
Hecates Lacus.	*Niliacus Lacus.*	*Solis Lacus.*
Hephæstus.	*Nodus Gordii.*[a]	*StymphaliusLacus.*
Ismenius Lacus.	*Phœnicis Lacus.*	*Tithonius Lacus.*
Lunæ Lacus.	*Propontis.*	*Trivium Charontis.*

II. LOWELL'S CHART (1894).

"*Ammonium.*"	"*Lucus Maricæ.*"
"*Castalia Fons.*"	"*Nodus Gordii.*"

N.B.—Schiaparelli called *Nodus Gordii* the intricate dusky rendezvous of *Eumenides*, *Sirenius*, and *Gigas*, with centre at $\Omega = 127°$, $\Phi = 0°$. This is not Lowell's "*Nodus Gordii*," a small dot strung on the *Eumenides* towards $\Omega = 146°$. The beaded appearance of the canal *Eumenides-Orcus* was first recognised by Mr. Walter F. Gale, F.R.A.S., of Sydney, New South Wales, during the very favourable apparition of 1892.

III. CERULLI'S CHART (1900).

"*Pambotis Lacus*," on intersection of *Cyclops, Cerberus, Eunostos*, &c.

IV. NEW LAKES (1898–99).

Symbol.	Discoverer.	Approximate Position. Ω	Φ	Symbol.	Discoverer.	Approximate Position. Ω	Φ
		°	°			°	°
*a**	Phillips -	20	+30	*f*	Brown - -	225	+39
b	Molesworth -	100	+29	*g*	Brown - -	262	+34
	Phillips - -			*h*	Several observers.	280	+54
c	Molesworth -	122	− 9				
d	Molesworth -	167	+28	*i*	Molesworth -	312	+25
e	Brown - -	217	+39	*j*	Molesworth -	348	+18

* Different from the lake *a* of our 1896–97 chart.

7. The Colours of the Disc.

"Little colour has been noted on the disc," says Mr. Attkins. "Occasionally a very faint red on certain regions has been seen, "and also a bright yellow tint has been noticed. The seas have "generally appeared greyish (rather dark) with, perhaps, a faint "shade of green."

A blue tinge has often been noted in the *Maria* by Capt. Molesworth. Mr. Hall found them rather greenish. On January 4, Rev. T. E. R. Phillips remarked that the "planet appeared very "ruddy in morning light."

8. The Projections on the Terminator.

Capt. Molesworth forwards the following notes concerning these phenomena:—

"1898, August 15,—Projection near N. end of terminator, "actual not optical (*Baltia?*)

"August 19.—Optical (*Edom*).

"August 21.—Optical (white patch near *Hammonis Cornu*).

"September 9.—Slight bulge suspected on terminator close to its N. end (*Arcadia?*).

"September 12.—Minute white point suspected close to terminator just N.E. of *Lacus Phœnicis* (not a true projection).

"No irregularities noticed on limb."

9. The Fading of the Maria.

"The most noteworthy point during the period of these "observations," says Capt. Molesworth, "was the faintness of "all the *Maria* during August. The fading began towards the "end of July (50 to 60 days after the winter solstice of the N. "hemisphere). The *Maria* were so faint towards the end of "August and beginning of September that they were only "perceptible with great attention. The first sign of darkening "was noted on September 20 (112 days after the solstice and "48 before the equinox). After this date the *Maria* rapidly "recovered their normal darkness. It will be noticed that this "recovery of tone was just antecedent to the unveiling of the "N. polar cap, which was very indefinite up to September 28. "The faintness of the *Maria* was not caused by cloud or mist, "as, with sharp definition, the details, although so faint, were "seen quite distinctly; the edges of the *Maria* being clear cut, "and not 'fuzzy' as if obscured in any way. The fading appears "to have been due to a definite change in the *Maria* themselves, "and was shared by the larger lakes, *Lacus Solis*, *Lacus Lunæ*, "*Mare Acidalium*, *Trivium Charontis*, &c. These observations "confirm those of Lowell in 1894, when a similar general fading "of the *Maria* was noticed about 60 days after summer solstice "of the S. hemisphere (Lowell 'Mars,' 1896, p. 120). The "change, therefore, is probably seasonal, and possibly connected "with the development of the N. polar cap and its sudden "return to distinctness" (*see* p. 102).

---

10. On the Transparency of the Martian Atmosphere.

On 1899, January 25, the Director found the *Mare Tyrrhenum* very dark right up the *p* limb, an observation which has been frequently confirmed subsequently. The *Boreosyrtis* also was almost black when rising on the limb or terminator. This remarkable visibility of dark spots through so thick an atmospheric layer shows us, beyond doubt, that the gaseous envelope of Mars is exceedingly transparent, and, to a large extent, destitute of anything capable of scattering sunlight. On Mars, therefore, the sky ought to be nearly black in broad daylight, a circumstance which would enable faint stars to be easily visible.*

---

* This idea was suggested by M. Flammarion and the Director in their joint paper on Mars, 1898–99, published in the *Bulletin de la Société Astronomique de France*, for September 1899.

PART II.

THE OBSERVATIONS.

Introductory.

In dealing with so large a 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, 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 Ω	Limits of Φ	Region.	Drawings.
I.	60°	310° to 10°	+ 60° to − 60°	*Sinus Sabæus* -	20
II.	45	10 „ 55	+ 60 „ − 60	*Auroræ Sinus* -	19
III.	65	55 „ 120	+ 60 „ − 60	*Solis Lacus* -	26
IV.	60	120 „ 180	+ 60 „ − 60	*Mare Sirenum* -	17
V.	70	180 „ 250	+ 60 „ − 60	*Mare Cimmerium*	28
VI.	60	250 „ 310	+ 60 „ − 60	*Syrtis Major* -	34
VII.	360	0 to 360	− 60 to − 90	South Polar Region	144
VIII.	360	0 „ 360	+ 60 „ + 90	North Polar Region	144

As in 1896–97, Schiaparelli's charming areographical nomenclature has been adopted here to the exclusion of any other. The dark areas have been systematically alluded to as seas, or anything signifying water (*Mare*, *Sinus*, *Fretum*, *Lacus*, *Palus*, "marsh," "shoal," "canal," &c.). The yellow background has received names conveying the idea of land (*Insula*, *Chersonesus*, *Promontorium*, *Pons*, "coast," &c.). All this is mere convention. We have no direct proof of the existence of water on Mars, while we seem to have some vague suspicions as to its absence. The kinetic theory of gases, as developed by Daniel Bernouilli, Joule, Maxwell, and Clausius, and, especially, as applied to planetary atmospheres by Dr. Johnstone Stoney, tends to show us the critical velocity on Mars to fall short of the maximum probable speed of the molecules of aqueous vapour. In that case the white polar caps would not be ordinary snow caps, but caps of solid carbonic acid. This heavy gas condenses, in fact, into an intensely white solid Viewed in the face of our own earth's snow caps, the idea of endowing Mars with caps of such a deleterious substance seems far fetched. It must be borne in mind, however, that Maxwell's "probable maximum speed" is not a demonstrated verity, and that it is not at all certain that aqueous vapour is absent on Mars either. We gladly quit this field, lying, as it does, entirely beyond the pale of accurate knowledge.

SECTION I.

Sinus Sabæus and Mare Erythræum.

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

[The words *East* and *West* are invariably used in their areographic sense.]

HAMMONIS CORNU.—This striking promontory is shown blunted by Corder and A. A. Williams. Brown saw it exactly as depicted on Schiaparelli's Charts, with a short canal* running on the mainland behind, from *Syrtis Major* to *Sinus Sabæus*, thus showing the Cape to be the S.E. point of *Pharos Insula*. Attkins found the *Cornu* "well-defined, rather pointed and whitish," and is supported in this by Phillips and Antoniadi. Molesworth also notes "that the region near *Hammonis Cornu* was . . . very "bright on (1898) August 21." On January 27, Kempthorne saw the promontory united to a white patch in the *Mare* southwards, at $\Omega = 312$, $\Phi = -18°$, extending as far as *Scylla et*

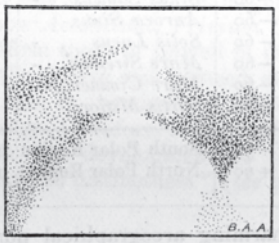

Fig. 1, January 27.
(*Kempthorne.*)

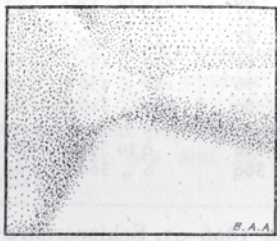

Fig. 2, January 30.
(*Phillips.*)

Hammonis Cornu in January 1899.

Charybdis, and thus severing *Sinus Sabæus* from *Hellespontus* (Fig. 1), an observation which received full confirmation at the hands of Phillips, three days later (Fig. 2).†

SINUS SABÆUS.—The *Sinus* was found "dark, but not so much "so as *Dawes's Bay*," by Attkins, January 19; and "very pale" February 26 and March 1. Most Members show it uniform in tint, *Xisuthri Regio* being much less marked than in 1896–97. This half tone was, however, an easy feature to Antoniadi on February 27. Molesworth noticed, on 1898, August 21, "a pale "greenish grey tinge in the *Sinus Sabæus*." *Portus Sigeus*, the embouchure of the *Euphrates* was, as usual, a marked feature of the *Sinus*, appearing as a dark triangular spot on the drawings of Brown, Corder, Kempthorne, Molesworth, and Antoniadi. *Dawes's Forked Bay*, itself, was very dark to all the Members

* *See* page 70.

† Rev. T. E. R. Phillips suspected this appearance as early as 1898, November 13, when he noted that he thought "the *Sinus Sabæus* seemed "separated from the *Syrtis Major* by a lighter rift."

having sent in drawings of this region. The forks are admirably represented by Molesworth and Phillips (Figs. 3 and 4), and

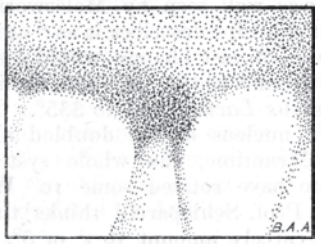

Fig. 3, November 3.
(*Molesworth.*)

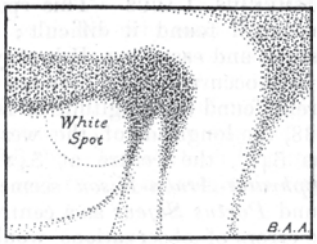

Fig. 4, January 24.
(*Phillips.*)

The *Sinus Sabæus* region of Mars in 1898–99.

appeared sharp to Antoniadi on February 27 (Plate III., 6). They were, as a rule, incomparably darker than the canals to which they give rise, possibly as dark as any other region of the planet in 1898–99.

The bright coast all along the N. boundary of the *Sinus* is shown by Attkins and Killip (Plate III., 5).

FASTIGIUM ARYN is drawn shaded (the shading extending all over the space between the *Hiddekel* and the *Gehon*), by Kempthorne, who is supported here by Corder and Molesworth.

EDOM PROMONTORIUM.—"Its whiteness," says Phillips, "has "been such as to cast a glimmer of light across the *Sinus*, thus "almost uniting *Edom* with *Deucalionis Regio* by a bright "bridge." This cape was also white in 1896–97.

EDOM, itself, was described as "very bright," under $\omega = 330°$, by Brown, and "bright on limb," by Stanley Williams. In August 1898, Molesworth found it very white, "whereas at the "next presentation it was unusually dull, except when near the "terminator."

EDEN was seen slightly shaded by Brown, Corder, Kempthorne, and Molesworth, but Stanley Williams found it white on the limb.

THYMIAMATA appeared white near the terminator to Kempthorne.

AERIA.—Remarkably bright to Brown, even when central; seen bright when rising or setting by Attkins, Corder, Molesworth, and Antoniadi.

ARABIA.—Shaded on January 27, according to Kempthorne.

DIOSCURIA.—Slightly shaded on drawings by Brown and Corder.

CYDONIA was observed shaded on January 27, by Kempthorne.

SIRBONIS PALUS.—Brown shows the swamp as an extensive but faint shading, while Antoniadi glimpsed it as a small round

dark spot on January 25, the cross canals *Typhonius* and *Phison** being invisible.

ISMENIUS LACUS.—This spot was well seen by Molesworth. Antoniadi found it difficult; but Phillips describes it as "quite distinct and easy," on February 24. A vast change would seem to have occurred here between 1886 and 1888. In 1886, Schiaparelli found the longitude of *Ismenius Lacus* equal to 335°. In 1888, the longitude of the western nucleus of the doubled lake was 345°, the centre at 342°. Meantime, the whole system *Euphrates-Arnon-Kison* seemed to have rotated some 10° W., round *Portus Sigeus* as a centre. Prof. Schiaparelli thinks that the errors of observations would scarcely amount to 2° or 3°, so that the evidence seems to be in favour of objective change on the planet. Considering the importance of the phenomenon, some measures of the longitude of *Ismenius Lacus*, as drawn by Members of the Section in 1898–99, would not be out of place here:—

Date.	Ω.	Observer.	Date.	Ω.	Observer.
1898.			1898.		
Aug. 22 -	335	Molesworth.	Nov. 11 -	322	Molesworth.
Sept. 30 -	332	Molesworth.			
Oct. 1 -	331	Molesworth.	1899.		
„ 2 -	338	Molesworth.	Jan. 24 -	339	Phillips.
Nov. 6 -	332	Molesworth.	„ 30 -	333	Phillips.
„ 9 -	333	Molesworth.	Feb. 27 -	337	Antoniadi.

It is obvious from these figures:—

(*a*) That the longitude of the lake did not go on increasing since 1888; and

(*b*) That, according to every probability, it rather decreased, so as to return to its original position.

ARETHUSA LACUS was seen by Molesworth on 1899, July 19, 20, 21, and 22, when the planet's disc was reduced to 4″·7; a very remarkable achievement indeed. Its longitude seemed to be towards 331°, or more than 10° less than in 1888. This confirms the idea of the return of the *Euphrates-Arnon-Kison* line to its primitive position.

SILOE FONS† was difficult to Antoniadi.

* The co-ordinates of *Sirbonis Palus* in 1879 were:—Ω = 327°, Φ = + 14°. Those of the marking called *Lacus Sirbonis*, by Schiaparelli, in 1888, were:—Ω = 333°, Φ = + 12°. The shift in longitude seems to have followed the change in the direction of the *Euphrates*, described in the next paragraph.

† This is different from *Dirce Fons*, drawn by Schiaparelli in 1883–84, on the intersection of *Deuteronilus*, *Iordanis*, *Xenius*, and *Oxus*, at Ω = 354°, Φ = + 36°. *Siloe Fons* (1888) lies on the intersection of *Deuteronilus*, *Gehon I.* and *II.*, *Xenius*, *Oxus*, and *Siris*, at Ω = 7°, Φ = + 34°.

DEUCALIONIS REGIO is shown with its usual cigar shape by Corder, Molesworth, Phillips, A. A. Williams, and Antoniadi. All agree in drawing it fainter and duskier than the N. continent when in transit. The passage to the S. not very marked. The straight between *Deucalion* and *Thymiamata* is very dark on Killip's drawing, while Phillips does not represent it at all; having, moreover, seen the island much brighter and narrower than on Schiaparelli's charts. Molesworth shows the channel to the N. diffuse. *Deucalion* is one of those lands which brighten with the obliquity of the solar rays, and this phenomenon is very well depicted by Attkins.

NOACHIS has been drawn white on S. limb by Phillips, January 24.

HELLESPONTUS was seen dark by Kempthorne.

MARE ERYTHRÆUM.—All Members of the Section agree in giving to this area a greyish tinge. Owing, however, to the tilt of the axis, it was impossible, in 1898–99, to reconnoitre the appearance of the various half-tones with which its surface is diversified.

NEW LAKES:—

i $\Omega = 312°$, $\Phi = +25°$; detected by Molesworth.
j $\Omega = 348°$, $\Phi = +18°$; detected by Molesworth.

CANALS.

ARNON.—Seen by Molesworth: diffuse (1899, July 20, D. = 4″·7).

"AROSIS" (Lowell).—Partly shown by Kempthorne: diffuse.

"CANTABRAS" (Lowell).—Shown by Brown: diffuse.

DEUTERONILUS.—Brown: narrow.—Molesworth: diffuse.—Phillips: narrow.—Antoniadi: faint and difficult.

"EULÆUS (Lowell).—Seen diffuse by Molesworth, but not in the same course as Lowell's canal.

EUPHRATES.—Brown: narrow.—Molesworth: diffuse.—Phillips: rather broad.—Antoniadi: diffuse; very hard to see properly.

GEHON.—Attkins: single, running into *Niliacus Lacus*, February 24, but very broad February 27.—Brown: single, curved into *Mare Acidalium*, and very narrow.—Corder: edge of shading between it and *Hiddekel*.—Kempthorne: edge of shading between this canal and *Hiddekel*.—Killip: single, narrow.—Molesworth: diffuse at first, then sharp and single (November 3), and running as a curved line into *Sinus Acidalius*.—Phillips: invariably single and narrow, curving into the *Mare Acidalium*.—Stanley Williams: "seen conspicuously and undoubtedly double on March 2. Two distinct "streaks ran parallel to one another in a straight line from either inlet of "*Dawes's Forked Bay* to the *Mare Acidalium*. The canal was also seen "double on March 1. Schiaparelli's early maps of Mars show the *Gehon* "running in a curve to the *Mare Acidalium*, but it is noteworthy that on "the present occasion both components of the double canal seemed to run "in a perfectly straight line from *Dawes's Forked Bay* to the *Mare* "*Acidalium*. Considered as a single object the double *Gehon* was very "conspicuous."* Antoniadi: diffuse.

* Signor Cerulli supports Mr. Williams here. In spite, therefore, of the negative evidence afforded by other Members of the Section, the Director is inclined to consider the *Gehon* as having been really double in 1899.

On the Chart (Pl. IV.) both the single (curved) and the double (straight) views of this canal are shown.

HIDDEKEL.—Attkins: very narrow.—Corder: edge of shade between it and *Gehon*.—Kempthorne: edge of shade between this canal and the *Gehon*.—Molesworth: diffuse.—Phillips: narrow.—Antoniadi: faint and narrow.

KISON.—Seen by Molesworth on 1899, July 22, when the planet's disc was reduced to 4″·7.

ORONTES.—Brown: narrow.—Kempthorne: edge of shade in *Eden*.—Molesworth: diffuse.—Phillips: narrow.—Antoniadi: narrow, though somewhat diffuse.

OXUS.—Seen by Molesworth as bounding a shade in *Cydonia*, when the breadth of the canal subtended $\frac{1}{10}''$.

PHISON.—Brown: faint.—Kempthorne: edge of shade in *Arabia*.—Molesworth: diffuse —Phillips: narrow.—Antoniadi: faint.

PIERIUS.—Brown: faint.—Molesworth: diffuse on 1899, June 16, D = 5″·4.—Antoniadi: diffuse.

"POROS."*—Shown by Brown: very narrow.

PROTONILUS.—Brown: well seen, narrow.—Kempthorne:—rather narrow, "edge of dusky area, quite sharp."—Molesworth: diffuse.—Phillips, narrow.—Antoniadi: narrow.

"SITACUS" (of Cerulli, not Lowell).—Corder: diffuse.—Antoniadi: very fine linear sensation; probably subjective.

TYPHONIUS.—Brown: narrow —Molesworth: diffuse.—Antoniadi: difficult. [Molesworth saw this canal produced into *Hadriacum Mare*.]

XENIUS.—Corder: very diffuse and indefinite.—Molesworth: edge of shading in S. *Cydonia*.

SECTION II.

Margaritifer Sinus, Auroræ Sinus, and Mare Acidalium.

$\Omega = 10°$ to $55°$; $\Phi = +60°$ to $-60°$.

MARGARITIFER SINUS.—This marking is drawn with its usual Schiaparellian outline by Brown. All Members agree in showing it much lighter in tint than the neighbouring dark *Sinus Sabæus*. Lowell's "Pearl" does not seem to have been seen.

AROMATUM PROMONTORIUM is shown bright by Molesworth. Attkins, Molesworth, Phillips, A. A. Williams, and Stanley Williams agree in drawing it a little more blunted than usual, while Brown, Kempthorne, and Antoniadi do not seem to corroborate this view. A light bridge was seen uniting this promontory to *Ogygis Regio* by Kempthorne (Pl. I., 3).

CHRYSE was found white when on transit by Brown; with a bright border by Attkins, February 21.

---

* *See ante* p. 70.

AURORÆ SINUS is described as "very dark" by Attkins and Phillips. Brown shows it rather faint, so also Corder and Crowley; Kempthorne very dark; Molesworth "abnormally "faint during the period of faintness,"* adding that from it, three great darker streaks have been seen crossing the *Mare*, two of which are apparently Lowell's "*Hipparis*" and "*Erannoboas*," the third being not identifiable, running, as it does, "in prolonga- "tion of *Iamuna* to a point W. of *Thaumasia* near the estuary "of *Nectar*." A. A. Williams depicts the *Sinus* as rather faint, whilst Stanley Williams describes it "not very dark," in perfect agreement with Antoniadi. Two bridges are seen crossing *Auroræ Sinus* on Attkins' drawings. One of them is Lowell's "*Caicus*," the other Cerulli's "*Ogyges*." The latter was also seen by Hall.

LACUS NILIACUS.—Considerable confusion would seem to reign in the representation of this most interesting dark area. Attkins and Corder show it united to *Mare Acidalium*, the whole constituting a very marked, intensely dark spot, running S.W. Also, Hall (Fig. 10), Killip, and Molesworth (Fig. 5) did not clearly separate it from the sombre area to the N.

But Brown (Fig. 7), Kempthorne, Stanley Williams (Fig. 9), and Antoniadi (Fig. 8) show *Achillis Pons* as a very conspicuous feature, thus completely isolating the lake from below. Brown describes the *Lacus* as "a long ellipse," Kempthorne calls it "very dark," and Stanley Williams "not so dark as *Mare Acidalium*."

Phillips saw a lake (Fig. 6) E. of *Niliacus Lacus*, as stated at the end of this Section.†

ACHILLIS PONS was "at times very bright" to Brown and Kempthorne, invisible to Phillips, February 24, "plain and pretty bright" to Stanley Williams (Plate I., 4), and "one of the easiest "and most striking features of the planet" to Antoniadi (Plate I., 2). These discordances between observers are interesting, and show how the varying conditions of atmospheric steadiness and vacillating sensibility of the retina make us now detect extremely delicate details, and then miss some comparatively obvious markings.‡

MARE ACIDALIUM.—"Most astonishing sight," says Attkins, "quite the darkest and most prominent object on the disc. [On "January 19] at 11^h it was noted that this latter appeared *black*." Brown shows this spot very dark, with *Scheria Insula*, "occa- "sionally very bright," occupying its centre. All Members of the Section, having returned drawings of this region, dwell on the great darkness of *Mare Acidalium*, and agree in representing it as the darkest area of Mars. It is thus shown on the drawings

* *See* p. 74.

† The Director is not quite sure that this is not *Siloe Fons*.

‡ On 1894, September 27, *Solis Lacus* was almost invisible to the Director when near the meridian for three consecutive hours, when, at last, upon nearing the *p* limb it suddenly appeared, for a fraction of a second, as an ink-black spot. Were the watch shorter, the latter appearance would not have been recorded, and the conclusion would be: "*Solis Lacus*, exceed- "ingly pale and indefinite."

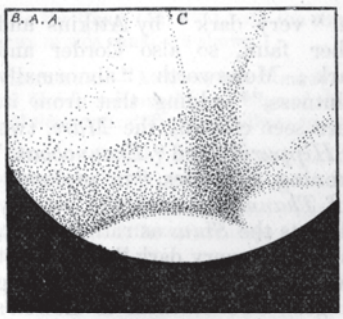

Fig. 5, 1898, November 3.
(*Molesworth.*)

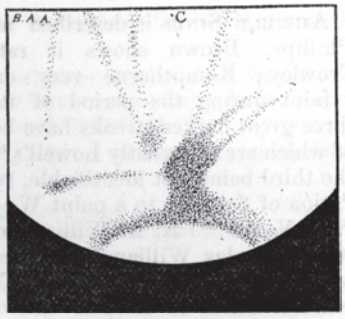

Fig. 6, 1899, March 1.
(*Phillips.*)

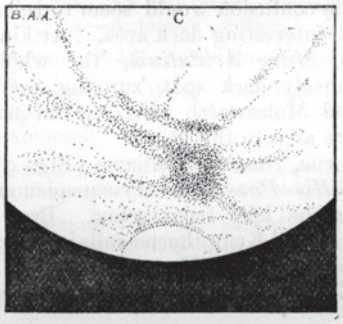

Fig. 7, January 16.
(*Brown.*)

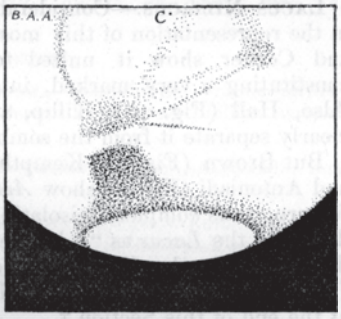

Fig. 8, February 24.
(*Antoniadi.*)

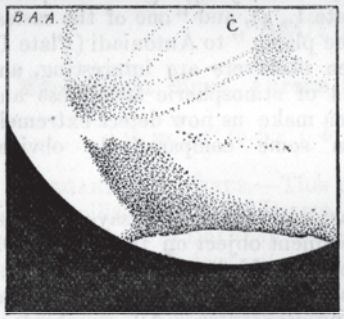

Fig. 9, February 23.
(*Stanley Williams.*)

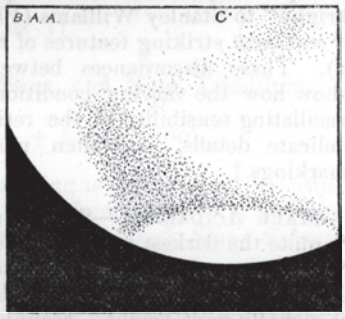

Fig. 10, January 4.
(*Hall.*)

The *Mare Acidalium* region of Mars in 1898–1899.

of Corder (Plate I., 1), Hall, Kempthorne, Killip, Molesworth, Phillips, A. A. Williams, and Stanley Williams. Among other particularities of this remarkable marking may be mentioned the accurate "bell-shaped" appearance given to it by Hall, and the fact that Stanley Williams saw it "very dark and definite on "the N. and preceding sides, but fainter towards the S. and "following sides," on February 23. When on the left of the

central meridian, Antoniadi found it resembling "a cat seated "on the polar cap." Possibly its darkness was less marked than in 1896–1897, though the change might not be objective, inasmuch as it was just grazing the N. cap three or four years ago —a juxtaposition certainly called to enhance contrast. It is noteworthy, however, that Prof. Schiaparelli's observations from 1883 to 1888 have shown the darkness of *Mare Acidalium* to decrease with the sun's increasing altitude over its horizon.

PYRRHÆ REGIO is well indicated, as a narrow and slightly shaded streak, by Phillips; and Kempthorne saw it united to *Aromatum Promontorium*. It is also vaguely shown by Molesworth.

PROTEI REGIO "seems indicated in several of the drawings" (Molesworth).

ARGYRE is drawn very white on the limb by Molesworth and Antoniadi. Phillips says that "on limb" it was "quite com- "parable to the polar snows in brightness."

MARE ERYTHRÆUM.—The W. part of this vast dusky area was "grey, with a faint indigo tinge," according to Molesworth, while Stanley Williams lays stress on the unevenness in its tint.

NEW LAKE:—

a $\Omega = 20°$, $\Phi = +30°$; detected by Phillips.

This is S.E. of *Mare Acidalium*, and E. of *Niliacus Lacus*; it seems to be different from Molesworth's lake *a* of 1896–97 (last "Report," page 66 and chart, Plate I.), and also different, it would appear, from *Siloe Fons*.

CANALS.

CALLIRRHOE.—Seen by Brown: diffuse.—Molesworth: diffuse (1899, June 10; D = 5″·5).—Antoniadi: merged into the sombre band encircling the N. Cap.

DARDANUS.—Brown: diffuse.—Kempthorne: narrow.—Molesworth diffuse; visible on disc of 5″·6.—Phillips: harsh, marked.—Stanley Williams: faint, narrow.—Antoniadi: sharp and easy.

HYDASPES.—Attkins: narrow.—Antoniadi: easy.

HYDRAOTES.—Brown: narrow.—Kempthorne: edge of shading N.—Molesworth: broad.—Phillips: verry narrow.

"HYPSAS" (Lowell). Shown by Kempthorne: harsh and dark.

IAMUNA.—Attkins: single, narrow.—Brown: single, exceedingly narrow. January 16.—Kempthorne: edge of shading between it and *Lunæ Lacus*.—Killip: diffuse.—Molesworth: diffuse.—Phillips: single; "on March 1, "in good air, it came out as a narrow and well-defined line."—Stanley Williams: "certainly double, both bands faint and diffuse, just like the other "canals, not sharply defined lines," February 23.—Antoniadi: vague and diffuse.

"IAMUNA II" (Molesworth).—Seen by Molesworth in the same position as in 1896–1897. This is the canal A of our last chart.

IAXARTES.—Molesworth: diffuse (1899, June 8; D = 5″·6).

INDUS.—Brown: narrow.—Kempthorne: narrow.—Killip: diffuse.—Molesworth: diffuse.—Phillips: narrow.—Stanley Williams: diffuse.—Antoniadi: diffuse.

IORDANIS.—Molesworth: diffuse (1899, June 7; D = 5″·6).—Phillips: narrow.

NILOKERAS.—Attkins: very dark and triangular in shape, point towards *Lunæ Lacus*, February 24; but narrow the day before.—Brown: diffuse.—Corder: very broad and extended.—Hall: broad and diffuse.—Molesworth: double, *parallel lines*, October 27.—Phillips: anomalously double.—Stanley Williams: "almost certain anomalously double."—Antoniadi: suspected anomalously double.

SECTION III.

Solis Lacus.

$\Omega = 55°$ to $120°$; $\Phi = +60°$ to $-60°$.

LUNÆ LACUS was seen by a considerable number of observers. Attkins draws it (Fig. 15) as a faint, small, round spot. Phillips shows it elongated E. to W., but also small and faint (Fig. 11). On the other hand, Hall (Fig. 12), Kempthorne (Fig. 13), Molesworth, and Stanley Williams (Fig. 14) agree in drawing it very large and diffuse. Antoniadi: "small and dark (Fig. 16); incomparably easier than *Solis Lacus*." On February 17, *Lunæ Lacus* was visible when the *Ganges* appeared diffused, but vanished during the geminated view of this canal.

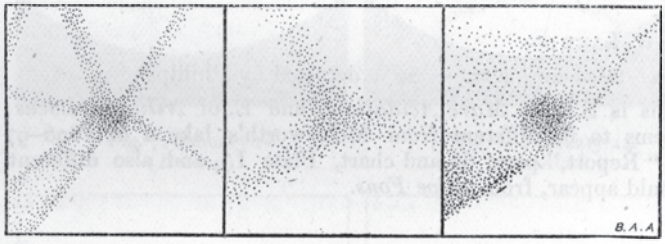

Fig. 11, January 14. (*Phillips.*) Fig. 12, January 14. (*Hall.*) Fig. 13, February 21. (*Kempthorne.*)

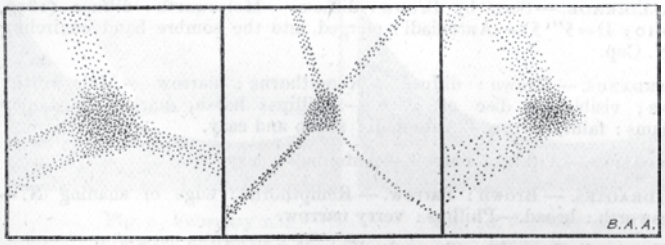

Fig. 14, February 23. (*Stanley Williams.*) Fig. 15, February 23. (*Attkins.*) Fig. 16, February 24. (*Antoniadi.*)

The *Lunæ Lacus* in 1899.

OPHIR is shown white by Attkins when midway between the centre and the limb, while Corder shades all the country from *Ganges* westwards.

TITHONIUS LACUS.—This is drawn as a small, round spot by Attkins on February 23, and described "as a widening of "*Agathodæmon*." Crowley gives it diffuse (Plate I., 5). Molesworth: double in 1898, July; gemination in round spots. Diameter of the disc at the time, 5″·4. This duplication, however, was not confirmed at the subsequent presentations of this region. The lake was seen, eliptical in shape and "fairly dark," by Phillips (Plate I., 6); faint and diffuse by Antoniadi.

SOLIS LACUS was generally a very faint and difficult feature during the past apparition, so that it was sought in vain by most observers. "Careful search," says Attkins, "under good con- "ditions, on seven consecutive nights, failed to show the slightest "trace of the object." It was also unsuccessfully that Crowley looked for it on February 17. Molesworth, however, although remarking that it was "faint throughout," and that it appeared "more distinct near the edge of the disc than when on the "central meridian," drew it nevertheless as far back as 1898, May 31, when the planet's disc subtended 4″·8 only, having, moreover, reobserved it at all subsequent presentations (Plate II., 1). Less fortunate, Phillips and Antoniadi could scarcely make it out when the planet was near opposition, and his diameter subtended 14″·7.

THAUMASIA was found "very white, nearly equal to polar cap," on March 27, by Attkins, while Molesworth records it as being "very dull, especially to S.E."

AUREA CHERSONESUS is not shown by any of the Members of the Section.*

AONIUS SINUS also has not been seen in 1898–99.†

PHŒNICIS LACUS was found "small, round, and distinct throughout," by Molesworth.

DÆDALIA.—Seen white on limb by Attkins.

THARSIS.—Corder shows this part of the planet shaded, the shading beginning from the *Ganges* and *Nilokeras* in order to extend W.

---

* In 1894 the Director found this peninsula missing, and the observations from America and elsewhere gave full support to this view. *Solis Lacus* was thus very near the E. coast of *Thaumasia* (*see* 2nd "Report" of this Section by Mr. Cammell, p. 113). But it is interesting to find that M. Brenner drew, at the time, *Aurea Chersonesus* exactly as found on Schiaparelli's early maps!

† The same remarks apply to this marking, which was replaced since 1892 or 1894 by a nearly bright area. And yet M. Brenner shows it in his 1894 map exactly as Schiaparelli in 1877, viz., a sharp, black bay, long penetrating into the continent N.! That prepossession may go so far as to make one see black what is white will be new to many people. Planets should not be drawn "as they ought to be," but as they are.

TEMPE was found "extremely white" when central, on January 14, by Phillips—a phenomenon of condensation of some vapour. *Tempe* is often white. In 1864, Kaiser, in his map of the planet's N. hemisphere, showed four protuberances in the outline of the polar cap, the most remarkable of which, extending down to $\Phi = +36°$, was in *Tempe*. Again, in 1879, a white streak seen crossing the *Nilus* by Schiaparelli, was coming from *Tempe*. Lastly, in 1894, the N. polar cap presented a protuberance in *Tempe*, exactly as drawn by Kaiser 30 years previously. Probably, this region is a tableland on which facilitated radiation of heat into space favours condensation.

MÆOTIS PALUS is shown as a faint protuberance to the band encircling the N. polar cap, by Attkins and Antoniadi.

OGYGIS REGIO was seen united by a bridge to *Aromatum Promontorium* by Kempthorne. Attkins and Phillips show this land white on S. limb.

"DIA." *—A land discovered apparently by Dawes in 1864, and called "*Mist Land*" by Proctor in 1888. On February 14, under $\omega = 91°$, Phillips saw the S. limb bright, doubtless owing to the presence of this island on the central meridian, and the same phenomenon was seen by Antoniadi, under $\omega = 101°$, three days later. This island is too far S. to be shown on the Chart. but it can be seen above *Thaumasia* on our 1896–97 map.

NEW LAKE *b*.—$\Omega = 100°$, $\Phi = +29°$; seen by Molesworth and Phillips somewhere on *Ceraunius;* and an intensification of *Ceraunius* there where it meets Lowell's "*Gigas*"; probably double.

CANALS.

AGATHODÆMON.—Seen by Attkins: very narrow.—Crowley: very diffuse —Molesworth: diffuse.—Phillips: narrow; "not difficult by any means."

CERAUNIUS.—Attkins: single, though "faint and broad."—Molesworth: double, bands diffuse.—Phillips: broad, "seen broad in moments of comparative steadiness."—Antoniadi: anomalously double, as in Schiaparelli's charts; both bands very faint and diffuse. [Intensifications of *Ceraunius* there where it is met by other canals, are shown by Molesworth and Phillips.]

CHRYSORRHOAS.—Attkins: narrow.—Kempthorne: narrow.—Molesworth: diffuse.—Phillips: moderately broad.

CLARIUS.—Attkins, Molesworth, Phillips, and Antoniadi, all agree in showing this canal as part of the polar band.

EOSPHOROS.—Drawn by Molesworth: diffuse.

GANGES.—Attkins: usually narrow, but "very broad," February 17.—Corder: very diffuse.—Hall: very diffuse.—Kempthorne: not indicated; a vague shading covering the triangular region *Ganges—Iamuna—Nilokeras*.—Molesworth: double, 1898, April 27, with a disc of Mars not greater than 4″·6; sharply double, October 27.—Phillips: broad; "less prominent than in 1896–97."—Stanley Williams: "broad, but faint and diffuse."—Antoniadi:

* Name given by the Director. Δία was the old name of Naxos; also that of an island a few miles N. of Crete.

usually broad and diffuse; but on February 17^{d} 8^{h} 23^{m} distinctly double (Fig. 17) with *Nilus*. (*See* "Journal," Vol. IX., p. 371.) The appearance lasted for about one third of a second. The planet's limb appeared, mean-

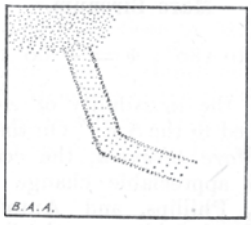

Fig. 17. Gemination of the *Ganges* and *Nilus*, as seen for one third of a second, on 1899, February 17. (*Antoniadi.*)

time diffuse. But this does not invalidate the idea of objective gemination, inasmuch as the eye cannot, at a given moment, see distinctly over more than a very small fraction of the planet's disc. It will be seen that in this case the broad and diffuse appearance given to the *Ganges* by other observers corresponds very satisfactorily to an imperfect view of the two lines, the distance separating which is practically equal to the breadth of the broad band. If we consider, moreover, that Capt. Molesworth and Signor Cerulli have also seen the *Ganges* doubled, we think that there can be little doubt of the objective reality of this gemination, and that the fugitive appearance seen on February 17, was, as suspected at the time by the Director, a neater perception of the amorphous *Ganges* seen under unfavourable definition.

Attkins saw an indentation in *Auroræ Sinus* at the estuary of the *Ganges*.

FORTUNA.—Molesworth and Phillips: diffuse.

IRIS.—Seen by Phillips: diffuse.

ISSEDON was seen by Molesworth diffuse, when the planet's disc measured 5″·7.

NECTAR.—Molesworth: diffuse; "usually fairly easy." There is a prolongation of *Nectar* into the *Mare Erythræum*.—Phillips: diffuse.

NILUS.—Attkins: narrow and faint.—Hall: broad and diffuse.—Molesworth: diffuse.—Phillips: "not difficult . . . seen to terminate in a dusky spot on *Ceraunius*. It was less broad than the *Ganges*, but was *not* seen as a narrow, sharply defined line."—Stanley Williams: "broad, very faint, diffuse."—Antoniadi: distinctly double on February 17. The breadth separating the two streaks was equal to that of the faint line seen by Stanley Williams. Hence the probable objectivity of this doubling also.

PHASIS.—Crowley: indefinite.—Molesworth: diffuse.

PHLEGETHON.—Molesworth: diffuse; seen on 1899, July 6, on a disc of 5″·0.—Phillips: faint and moderately narrow.—Antoniadi: easy; dark and narrow streak, on January 8.

TANAIS.—Seen by Attkins, Brown, Molesworth, Phillips, Stanley Williams, and Antoniadi, as part of the dark boundary of the N. cap.

URANIUS.—Seen by Kempthorne: narrow.

NEW CANAL, **A**.—From $\Omega = 42°$, $\Phi = +43°$, to $\Omega = 98°$, $\Phi = +30°$. Detected by Molesworth.

SECTION IV.

Mare Sirenum.

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

ICARIA.—Owing to the invisibility of *Aonius Sinus* (p. 85) this land was not defined to the S.E. On the other side, however, to the N.W., along *Mare Sirenum*, the coast did not seem to have undergone any appreciable change since former years. Attkins, Molesworth, Phillips, and Antoniadi agree on this point. Attkins saw *Icaria* white near the limb.

PHAETHONTIS is described as a "brilliant white spot on limb," March 14, by Attkins. Phillips says that it was "very brilliant, appearing at times to indent the *Mare Sirenum*." A. A. Williams and Antoniadi also show it white near the limb.

MARE SIRENUM.—Attkins, Crowley, Molesworth, and Phillips (Plate II., 3) give to this marking its usual Schiaparelli outline. Attkins shows it fairly dark, and so also Kempthorne, particularly towards *Titanum Sinus*. "The beak of the *Sirens*," says Molesworth, "remained fairly dark throughout." (Plate II., 2.) The same observer noted, on 1898, October 17, "a delicate blue grey, the blue tinge being most obvious at *Titanum Sinus*." Phillips found this *Mare* rather faint, probably fainter than in 1896–97. The estuary of the canal *Gorgon* was seen as a dark knot by Molesworth.

ATLANTIS I. is shown as a bright bridge by Attkins ("plain"), Brown (marked near limb), Kempthorne (very marked indeed), Molesworth ("fairly distinct at times, most distinct near terminator"), Phillips ("distinctly seen in moments of best image"); and Antoniadi (slightly shaded).

ATLANTIS II.—Not shown by any of the Members of the Section.

MEMNONIA was seen white near the limb by Attkins.

AMAZONIS.—"Duller than *Memnonia* or *Zephyria*" (Molesworth).

ARCADIA does not seem to have shown any shading in 1898–99.

NODUS GORDII is drawn as a large, faint, round marking by Attkins. Hall shows it very diffuse, very faint, and very extended. Molesworth: "diffuse, but having, when the definition was first-class, a streaky aspect, as if including numerous faint canals." Phillips shows it also exceedingly diffuse.

"NODUS GORDII" (Lowell*).—This small "bead" on *Eumenides-Orcus* was seen by Molesworth.

---

* For the differentiation between the two *Nodi*, *see ante*, p. 72.

"LUCUS MARICÆ" (Lowell). — Seen by Molesworth and Phillips.

"AMMONIUM" (Lowell).—Seen by Molesworth and Phillips.

"CASTALIA FONS" (Lowell).—Seen by Molesworth.

PROPONTIS.—This large lake is shown on the drawings of a considerable number of Members of the Section. Hall draws it very accurately, and not quite separated from the polar "marshes." It is dark on Kempthorne's drawing. Killip shows it vaguely.

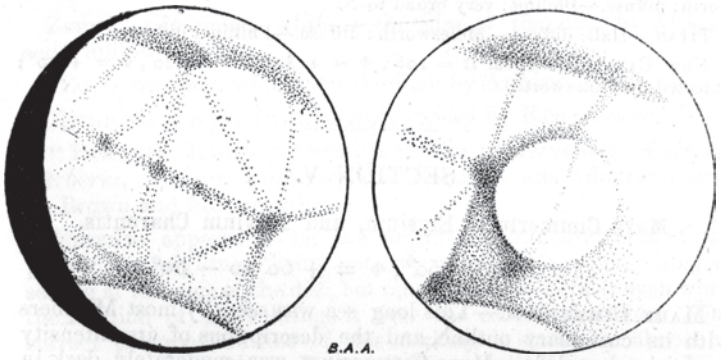

Fig. 18, 1898, Oct. 17. (*Molesworth.*)

Fig. 19, 1899, Feb. 1. (*Phillips.*)

Recent views of the *Propontis* region of Mars.

Antoniadi found it vague and diffuse. Molesworth and Phillips depict *Propontis* so beautifully that we subjoin their whole disc drawings of these regions (Figs. 18 and 19). "This lake," says Phillips, "was quite dark, even when close to the terminator."

NEW LAKES:—

c $\Omega = 122°, \Phi = -\ 9°$; detected by Molesworth.
d $\Omega = 167°, \Phi = +\ 28°$; detected by Molesworth.

CANALS.

"BRONTES" (Lowell).—Seen by Molesworth, diffuse.

"ELISON" (Lowell).—Seen by Molesworth, diffuse.

EUMENIDES-ORCUS.—Attkins: narrow.—Corder: very diffuse.—Hall: diffuse.—Kempthorne: narrow.—Molesworth: diffuse, broad; S. edge distinct; N. diffuse. Inasmuch as this observer notes *Amazonis* duller than *Memnonia*, the canal *Eumenides-Orcus* becomes the edge of a shade.—Phillips: "not so dark as during last apparition" (Dec. 31)—"*Orcus* seen "as a faint, broad streak, but no lakes on it" (January 4). "Seemed darker than of late," (February 21). "On one occasion," says Phillips, "the *Eumenides-Orcus* was for a moment or two doubled, together with the "*Trivium Charontis*. The effect, however, was very transitory, and was "evidently an optical illusion caused, perhaps, by the passing of air-waves "or by a temporary alteration of the focus of the eye."—Stanley Williams: "seemed single."—Antoniadi: broad and indefinite.

EUROTAS.—Seen by Molesworth, diffuse.

FEVOS.—Seen by Molesworth, diffuse.

GIGAS.—Hall: very indefinite.—Molesworth: directed on drawings more N., possibly Lowell's "*Gigas*" and not Schiaparelli's. The change of direction is a frequent phenomenon with canals, according to Schiaparelli.

GORGON.—Molesworth: diffuse.—Antoniadi: confuse; at one time a very hazy impression of doubling; doubtful.

HEBRUS.—Seen by Molesworth, diffuse.

PYRIPHLEGETHON.—Attkins: narrow.—Killip: harsh; moderately broad.—Molesworth: diffuse.—Phillips: diffuse.

SIRENIUS.—Attkins: narrow.—Killip: harsh; moderately broad.—Molesworth: diffuse.—Phillips: very broad to N.

TITAN.—Hall: diffuse.—Molesworth: diffuse.—Phillips: diffuse.

NEW CANAL **B**.—From $\Omega = 106°$, $\Phi = +30°$ to $\Omega = 150°$, $\Phi = +20°$; detected by Molesworth.

SECTION V.

Mare Cimmerium, Elysium, and Trivium Charontis.

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

MARE CIMMERIUM.—This long sea was seen by most Members with its customary outline, and the descriptions of its intensity are fairly accordant: *Mare Cimmerium* was moderately dark in 1898–99. Attkins, Brown, Corder, Crowley, Hall, A. A. Williams and Antoniadi confirm each other here. However, Killip, Mee, and Phillips depict this area a little darker and narrower than on Schiaparelli's maps. Phillips adds: "strange to say, the *Mare* "*Cimmerium* has appeared to me considerably darker than *Mare* "*Sirenum*. Exactly the reverse was the case last apparition." Kempthorne shows it a little darker still, while Molesworth found the colour of the *Mare* "dark bluish grey. Only traces of "*Cimmeria* have been seen between *Sinus Læstrygonum* and "*Cyclops*."

HESPERIA is drawn exceedingly narrow by Attkins, who describes it "distinct." Corder saw it very bright, but apparently severed from the land to the N. Hall: "so faint as to be doubtful," February 2. Kempthorne shows it shaded, February 3. Mee depicts it distinctly white, and, like Corder, severed from the mainland (*Triton*). Molesworth remarked that the N. portion of this peninsula was shaded. Phillips: "well seen," December 23, "*Hesperia* narrow, but very distinct," but on March 7 "no trace of *Hesperia*, though carefully looked for." The peninsula is further distinctly drawn by A. A. Williams (Plate III., 2). Antoniadi found nothing abnormal in these regions. The plurality of inclined peninsulæ or islands bending round at right angles to join the mainland to the N. is a striking feature of the planet's S. hemisphere. *Pyrrhæ Regio*, *Deucalionis Regio*, *Œnotria*, *Hesperia* and, perhaps, *Atlantis*, all present more than one point of similitude.

TYRRHENUM MARE (E.).—Attkins depicts this sea of the same tone as the *Mare Cimmerium*; Corder, less dark. So also

Molesworth, A. A. Williams, and Antoniadi; Mee and Phillips show it very dark; Kempthorne, still darker.

ELECTRIS has been drawn white on the limb by Molesworth, Phillips, and Antoniadi. Phillips says that it was "very white at the terminator;" also very white on S. limb, December 31.

ERIDANIA is described "as white as polar cap," March 14, by Attkins. Molesworth also shows it white. Phillips notes it "very white at the terminator." *Eridania* was invariably bright on the limb to Antoniadi.

ZEPHYRIA is shown white at the edge of the disc by Attkins and Phillips.

ÆOLIS was seen white near the limb by Attkins.

ÆTHIOPIS is represented slightly shaded by Kempthorne.

"PAMBOTIS LACUS" (Cerulli), on the rendezvous of *Cyclops*, *Cerberus*, *Antæus*, *Pactolus*, and *Eunostos* was admirably seen by Brown and Molesworth.

ELYSIUM appears to be the brightest continental area of the planet; its brightness being not only remarkable when rising or setting at the edge of the disc, but remaining considerable even when the rotation of Mars brings it over the central meridian. The correct polygonal outline of this marking is shown by almost all the Members:—Attkins, Brown, Corder, Hall, Kempthorne, Mee, Molesworth, Phillips, Stanley Williams, and Antoniadi. The latter found the canals bounding this area sharp inside, diffuse outside. As in 1896–97, the brightest part of *Elysium* was its E. angle. At this point an intensely white spot was drawn by Attkins, Brown, Kempthorne, Molesworth, Phillips, and Antoniadi. Phillips, moreover, draws all the E. half of *Elysium* brighter than the W. half; the line of demarcation between the two tints being the *Galaxias*. Brown confirms this; but, inasmuch, as he sees the polygon cut into three (Plate II., 6) by the new canal **C** as well as by the curved line discovered in 1896 by Molesworth, his W. boundary of the bright area is different from that of Phillips. Molesworth gives a smaller surface to the bright patch; he again saw *Elysium* broken up by his 1896 canal (**E** on our last chart), and seems to have also detected part of *Galaxias*. The brightness of Elysium would seem to have decreased with the shrinking of the disc. On March 10, Attkins found the white spot invisible, a statement which received full corroboration at the hands of Phillips and Antoniadi. The change, however, might not necessarily be objective, the increasing distance of Mars having, perhaps, something to do with it.

TRIVIUM CHARONTIS.—This remarkable dark spot was described by Attkins as "oblong in shape, running, roughly, N. and S. (Plate II., 5); darker than seas; *f* side very dark and definite, *p* indefinite," and, lastly, "crescentic" on March 14. On March 15, the same observer found that "*Trivium Charontis* seemed to be nearly "divided by the white spot following it." Brown notes that the lake seemed composed of "two very dark markings," which he could not see round. Corder and Crowley show the spot very diffuse, and in this they are confirmed by Hall,

who, however, draws it darker at the S.W. end. Kempthorne shows it as a black equilateral triangle, one point of which is directed towards the *Orcus*, the other towards the *Cerberus*, and the last one along the *Styx*. Stanley Williams corroborates this statement: "*Trivium Charontis* itself," he says, "is not double "at the present time, but seems of a triangular shape, with "lighter interior, as though it were formed by several crossing or "interlacing canals, as represented in the diagram." (Fig. 20.)*

Fig. 20.—The *Trivium Charontis* in March 1899.
(*Stanley Williams.*)

Molesworth, Phillips, and Antoniadi show the lake dark in the centre, but with diffused edges, whilst A. A. Williams gives it a remarkable extension.

HEPHÆSTUS is shown as a very faint and diffuse marking by Brown, Hall, Molesworth, and Phillips. The latter depicts it as the S.E. boundary of the great shading near *Boreosyrtis*.

HECATES LACUS.—A dark spot on the N.E. angle of *Elysium*, at the meeting point of *Styx*, *Chaos*, *Plutus*, *Boreas*, and *Æsacus*; seen by Brown (very dark), Molesworth, Phillips (very dark), and Antoniadi.

STYMPHALIUS LACUS.—This is the name given by Schiaparelli, in 1888, to the dusky area at the rendezvous of *Æsacus*, *Granicus*, *Choaspes*, *Adonis*, and *Gyndes*. The marking is shown by Brown and Phillips ("large dark lake between *Styx* and *Hades*," December 29).

PHLEGRA.—Shown shaded by Corder, Kempthorne, Molesworth, Phillips (Plate II., 4), and Antoniadi.

CEBRENIA.—Shaded: Corder, Mee, Molesworth, Phillips, and Antoniadi.

ÆTHERIA. — Shaded: Corder, Kempthorne, Molesworth, Phillips, and Antoniadi.

It would appear that the shading of these regions was an extension of the great *Boreosyrtis* intensification, dealt with in the next Section.

NEW LAKES:—

e $\Omega = 217^\circ$, $\Phi = +39^\circ$; detected by Brown.
f $\Omega = 225^\circ$, $\Phi = +39^\circ$; detected by Brown.

* Mr. Stanley Williams remarks that "an intensification of two such spots "at the N. and S. angles of the triangle might cause the *Trivium Charontis* "to appear under the form of two round black spots," as seen in 1896.

CANALS.

ADAMAS.—This is the name given by Schiaparelli to a double canal observed by him in 1888 uniting *Boreosyrtis* to *Hephæstus*. The same canal, but single, and continued to *Mare Cimmerium* ("*Pseudoæthiops*" of Signor Cerulli), was observed by the following Members of the Section in 1898–99 :—Kempthorne : single, narrow, "clear and sharp."—Molesworth : single, diffuse (not following the same course as Kempthorne's line).—Antoniadi : single, easy, and narrow.

ÆSACUS. — Brown : diffuse. — Molesworth : seen on 1899, June 26; D = 5″·2.—Antoniadi : diffuse.

ÆTHIOPS.—Seen by Molesworth only : diffuse.

ANTÆUS.—Seen by Kempthorne : narrow.—Molesworth : diffuse.

BOREAS.—Seen by Molesworth only : diffuse.

CERBERUS.—Attkins : rather narrow.—Brown : broad and marked.—Corder : diffuse.—Hall : faint, diffuse.—Kempthorne : rather narrow.—Killip : broad, harsh.—Mee : diffuse.—Molesworth : double, on 1898, November 17 ; gemination extending to *Cyclops*, after which the canal is single to *Mare Cimmerium*.—Phillips : exceedingly broad ; "surely it is a quite "misnomer to speak of the *Cerberus* as a '*canal*.' I think it would be more "correct to term it a '*sea*,' if, indeed, the broad dark areas are aquatic "at all."—Stanley Williams : double. On March 15, "definition was pretty "good at times, and the canal appeared most distinctly double with 450. "Owing to the small size of the image (apparent diameter of planet = 10″), "the duplicity was only suspected with 320, but with the higher power "it was undoubted. The canal, in fact, was seen double with as much "certainty and distinctness as a double star near the limit of separation for "the aperture employed."—Antoniadi : very broad and dark ; as dark, indeed, as *Mare Cimmerium*.

CHAOS.—Brown : diffuse.—Corder : diffuse.—Hall : indefinite.—Molesworth : diffuse.—Phillips : dark and broad.—Antoniadi : very marked.

CYCLOPS. — Attkins : narrow. — Brown : very narrow. — Corder : very broad.—Kempthorne : edge of shading on Æthiopis.—Molesworth : at first diffuse, but then double, 1898, November 17.—Phillips : "broad" ; inclined to meridian ; trend from N.N.E. to S.S.W., February 1.—Stanley Williams : diffuse.—Antoniadi : very faint, difficult, and diffuse.

EREBUS.—Attkins : narrow.—Molesworth : diffuse.—Phillips : faint.

EUNOSTOS. — Attkins : narrow. — Brown : narrow ; then, possibly, anomalously double ?—Corder : diffuse.—Kempthorne : broad, diffused.—Mee : diffuse.—Molesworth : diffuse.—Phillips : moderately broad.—Stanley Williams : broad.—Antoniadi : diffuse, but very easy.

GALAXIAS.—Brown : narrow.—Phillips : extremely narrow.

GRANICUS.*—Seen by Brown : diffuse.

GYNDES.—Seen by Brown : diffuse.

HADES.—Hall : faint, diffuse.—Kempthorne : broad ; edge of shading between it and *Styx*.—Killip : harsh and broad.—Molesworth : diffuse ; edge of shading between it and *Styx*.—Phillips : dark ; edge of shading between it and *Styx*.—Stanley Williams : well marked ; "suspected double."—Antoniadi : diffuse ; edge of shading between it and *Styx*.

HYBLÆUS.—Brown : broad.—Corder : diffuse.—Molesworth : diffuse.—Phillips : moderately broad.—Antoniadi : obvious, but diffuse.

"HYBLÆUS II." (Molesworth).—Seen by Brown and Molesworth in about the same position as drawn by the latter in 1896–97. This is the canal **E.** of our last chart. Diffuse and curved.

---

* Prof. Schiaparelli draws attention to the fact that in his map, published in 1889 in "Himmel und Erde" (Flammarion, "Mars," p. 440), the *Granicus* is erroneously called *Gyndes*, and that the name for the true *Gyndes* is missing. The *Granicus* unites *Propontis* to *Stymphalius Lacus* ; the *Gyndes*, *Stymphalius Lacus* to *Sithonius Lacus*.

LÆSTRYGON. — Brown : narrow. — Kempthorne : narrow. — Molesworth : diffuse.—Phillips : narrow.—Antoniadi : narrow and difficult.

PACTOLUS.—Seen by Brown : narrow.—Molesworth : diffuse.

PLUTUS.—Brown : diffuse.—Molesworth : diffuse ; seen on a disc of 5″·2. The angular breadth of the canal ought not thus to have exceeded $\frac{1}{10}$″.

STYX.—Brown : dark and very broad.—Corder : exceedingly broad, melting into shading towards *Hades*.—Kempthorne : broad ; edge of shading between it and *Hades*.—Killip : broad.—Mee : diffuse.—Molesworth : double ; 1898, November 9, space between it and *Hades* shaded.—Phillips : almost black ; space between it and *Hades* shaded.—Stanley Williams : broad to N., narrow to S. ; this makes it triangular in appearance.—Antoniadi : very dark and broad ; double (?) February 4 ; edge of shading between it and *Hades*.

TARTARUS. — Kempthorne : narrow. — Molesworth : diffuse. — Stanley Williams : diffuse.—Antoniadi : very faint and diffuse.

TRITON.—Corder : broad and black.—Mee : harsh and black.—Molesworth : diffuse.

XANTHUS.—Drawn by Molesworth early in 1898, when the planet showed us its S. pole.

NEW CANAL, C.—From $\Omega = 220°$, $\Phi = +19°$, to $\Omega = 232°$, $\Phi = +14°$. Detected by Brown.

SECTION VI.

Syrtis Major.

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

TYRRHENUM MARE (W.).—This, the W. portion of *Mare Tyrrhenum*, was much darker than the E. portion. It has been seen quite dark up to the limb.

SYRTIS PARVA did not present any remarkable features. It was not a very dark marking. Kempthorne shows it of the same tint as *Maria Cimmerium* and *Tyrrhenum*, and somewhat harshly marked. Mee, Molesworth, and Phillips corroborate this view. On the other hand, however, Brown, Corder, Hall, A. A. Williams, and Antoniadi agree in showing it a little fainter and somewhat more confused.

AUSONIA.—Seen white near S. limb by Hall, Mee, Phillips, and Antoniadi. The whitening does not seem to have been very intense. Townshend saw, in addition, a bluish tinge to the white colour of this ill-defined land.

HADRIACUM MARE is shown dark by Attkins, and very dark by Corder. Molesworth also draws it very dark, and with a darker knot on the W. coast of *Hellas*, somewhere about the *f* embouchure of *Peneus*. Phillips and Antoniadi draw it fainter. Only the lower half of the boundary of *Hellas* was well seen in 1898–99.

HELLAS.—Owing to the tilt of the axis, this land was never orange red when on the central meridian. On March 9, Attkins found it "nearly as white as polar cap."* Also, Hall, Mee,

* *Hellas* has often been mistaken for a polar cap. Thus, on 1777, April 17, Sir William Herschel drew two caps, one N. the other S., the line uniting which, however, did not pass through the centre of the planet's disc (Flammarion, "Mars," p. 51, Fig. 17 of Herschel's series). The longitude of the centre was 324° and its latitude positive. Hence there can be no doubt that "cap *a*" was not a true cap, but white *Hellas* on S. limb.

Molesworth, Phillips, Townshend (Plate III., 3), and Antoniadi insist on its remarkable brightness.

"LUNÆ PONS" (Lowell) is represented by Attkins ("very distinct"), Brown, Hall (Plate III., 1), Phillips, Molesworth, and Antoniadi.

"SOLIS PONS" (Lowell) is shown by Attkins, Hall, Molesworth, Phillips, and Antoniadi.

IAPYGIA is indicated by Brown; it was seen by Hall, and described "very distinct" by Phillips.

ŒNOTRIA.—An easier marking than the preceding. Attkins shows it disfiguring *Syrtis Major* by transforming into a "shoal" a considerable part of its W. half; the shoal seeming bounded to E. by a strong black line.* Brown and A. A. Williams depict it as a slight fading of the *Syrtis*. Kempthorne gives it an E. extension—almost near *Mœris Lacus*, while Molesworth, Phillips, and Antoniadi saw it as given in Schiaparelli's charts.

SYRTIS MAIOR.—No important change in the general outline of this grand object since 1896–97. As at the last apparition, the *Syrtis* showed very decidedly the form given to it by Lowell in 1894, with a sharp point to the N. The numerous drawings by Attkins, Brown, Corder, Hall, Kempthorne, Killip, Mee, Phillips, Townshend, A. A. Williams, and Antoniadi are all in excellent agreement as to this. But Molesworth shows the N. end distinctly blunted, as on the annexed diagram (Fig. 21). A very large

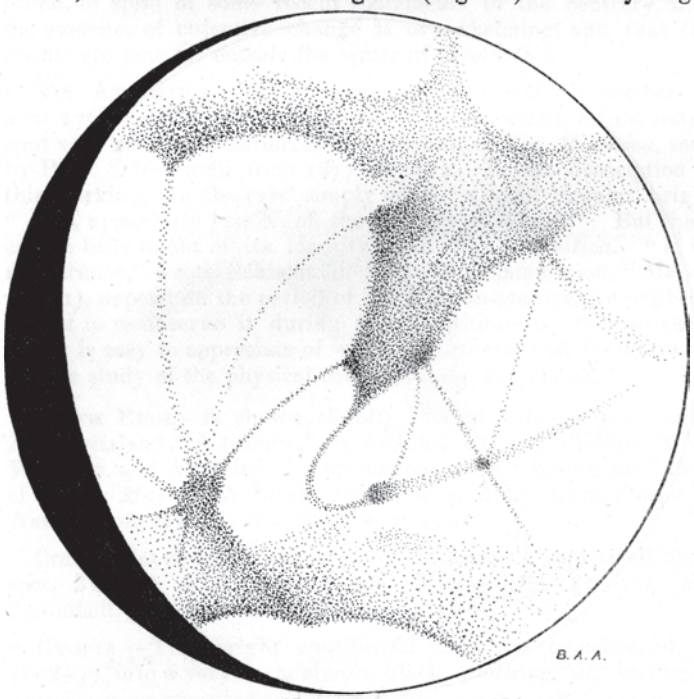

Fig. 21. The *Syrtis Major* region on 1898, November 11. (*Molesworth.*)

* Probably Lowell's "*Dosaron.*" This canal in a dark area is shown on Prof. Schiaparelli's drawings in 1888.

majority of the drawings sent show further the N. end as the darkest part of the *Syrtis*. The colouring of this immense dark area did not seem uniform. Allusion has already been made to Attkins's remarkable observation of what seems to be Lowell's "*Dosaron*," vague traces of which are found on the Ceylon drawings, but in his description of Fig. 21, Molesworth draws attention to the "much veined" appearance of *Syrtis Major*, which was "very dark and distinct, with darker nuclei at the "estuaries of *Typhon*, *Thoth*, *Astapus*, and *Astusapes*," Colour: "a distinctly greenish grey" (Molesworth). According to the same observer, the "following side of *Syrtis Major* was very dark —more so than the preceding side." Townshend lays stress on the fact that the duplication of the N. point observed by him in 1896–97 (*vide* last "Report," p. 94) had been confirmed by M. Comas Sola in Spain. On one of his drawings A. A. Williams unites *Libya* to *Hammonis Cornu* by a straight bridge, parallel to the Martian equator, and recalling to memory a drawing taken by Mr. Gledhill on 1871, April 4 (Flammarion, "Mars," p. 208, Fig. 129), and Lohse, 1873, May 25 (*Ibid.*, p. 227, Fig. 146).

As in 1896–97, Phillips was fortunate in detecting a bright bridge in $\Phi = +22^\circ$ completely separating the *Syrtis Major* from the *Nilosyrtis* (Fig. 22). "I have noticed this," he says, "distinctly on several occasions when the air had been good enough, "and feel quite convinced of its objective existence." Attkins fully endorsed this statement when saying that on March 10,

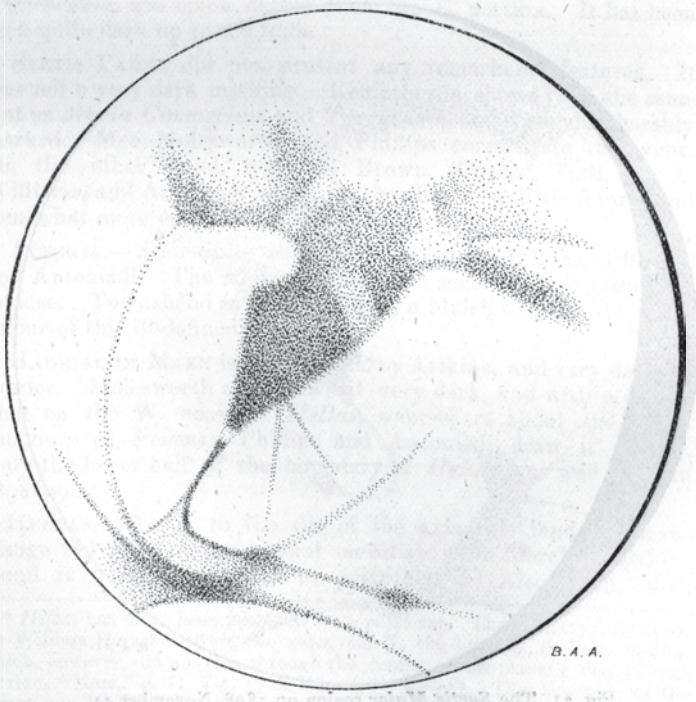

Fig. 22. Bridge severing the *Syrtis Major* from the *Nilosyrtis*. 1899, January 30. (*Phillips*).

" at times it appeared that *Syrtis Major* was separated from " *Nilosyrtis* by a whitish marking—probably owing to irradiation " from a whitish, round spot following N. end of *Syrtis Major*" —an observation which he repeated on April 11.* This occasional bridging of the *Maria* is not a rare occurrence on Mars. In 1890 it was *Solis Lacus* which was thus cut in two, in 1892 *Mare Sirenum* (near the " beak "), according to Schiaparelli; while the narrow white marking seen by the Flagstaff observers in 1894 to issue from *Fastigium Aryn* southwards, across *Dawes's Forked Bay*, probably belongs to the same class of phenomena.

MŒRIS LACUS is shown as a mere bight of the *Syrtis Major* by Attkins, Brown, Mee (Plate III., 4), Molesworth (" still merged in the eastern coast of the *Syrtis Major* "), Phillips, Stanley Williams, and Antoniadi. On February 1, however, Phillips saw a faint lake a short distance inland, E. of *Mœris*, while Stanley Williams notes that " *Lacus Mœris* appeared as a round, " very dark, in fact, almost black-looking spot, open on the " following side to the *Syrtis Major*, though once or twice a " narrow bright border separating it from the latter was " suspected."†

LIBYA.—Observed bright by all the Members of the Section, and further brightening near the terminator or limb. Comparing the observations of 1888 or 1890 with those of 1898–99, it will be found, in spite of some recent statements to the contrary, that the evidence of objective change is overwhelming, and that the results are here far outside the errors of observation.

NIX ATLANTICA.—On a drawing dated 1898, November 9, $\omega = 276°$, $\phi = +16°$, Molesworth depicts a small, bright round spot very near the position of the celebrated *Nix Atlantica*, seen by Prof. Schiaparelli from 1877 to 1882. In his description of this marking, the observer simply notes " a small circular bright " spot, apparently just N. of the estuary of Thoth." But there can be little doubt of its identity with *Nix Atlantica*. " If its appearance," wrote Schiaparelli in 1888 (Flammarion, " Mars," p. 441), depend on the period of the Martian seasons, we ought to expect to re-observe it during the oppositions of 1892 to 1897, and it is easy to appreciate of what importance will be its return for the study of the physical constitution of the planet."

NEITH REGIO is shown slightly shaded between the canals *Nilosyrtis* and " *Nasamon*," by Attkins, Corder, Phillips, A. A. Williams, and Antoniadi. This completes the " hour-glass " form of *Syrtis Major*. A bright spot was seen by Kempthorne in *Neith Regio* towards $\Omega = 268°$, $\Phi = +34°$.

COLOE PALUS is well depicted by Brown, as a very small black spot, January 26. Kempthorne, Molesworth, Phillips, and Antoniadi, give it a more diffused appearance.

UTOPIA.—This bright continental area was transformed, in 1898–99, into a very dark, almost black, marking, the blackness

* Signor Cerulli further confirms the reality of this marking in his 1898–99 map.

† The laky character of *Mœris* is clearly shown by Cerulli.

remaining unchanged even when rotation brought it on the limb. Attkins, Corder, Hall, Kempthorne, Mee, Molesworth, Phillips, and Antoniadi, thus show the country marked by an extraordinary mass of dark material. The latter would seem to be furnished by the intensification of the great canal *Boreosyrtis*, and it is probable that the partial concomitant shading of *Ætheria*, *Cebrenia*, and *Phlegra*, described in Section V., was due to the same cause. In this case also, the evidence in favour of objective change since 1888 is very strong.*

NEW LAKES :—

g $\Omega = 262°$, $\Phi = +34°$; detected independently by Brown and Kempthorne.

h $\Omega = 280°$, $\Phi = +54°$; detected by Phillips in 1896–97 (when the canal *Boreosyrtis* was seen "swollen into a lake-like aspect," *vide* last Report, p. 94); and re-observed now by Attkins, Brown, Corder, Hall, Kempthorne, Mee, Molesworth, Phillips, and Antoniadi.

CANALS.

ALCYONIUS.—Seen by Molesworth on 1899, June 21, D = 5″·2.

AMENTHES.—Attkins : very narrow. — Brown : faint. — Kempthorne : very narrow; edge of shading in *Æthiopis*.—Mee: diffuse.—Molesworth: diffuse.—Phillips: moderately broad.—Stanley Williams : faint.—Antoniadi: very easy, though broad and diffuse.

ANUBIS.—Seen by Molesworth diffuse.

ASCLEPIUS.—Mee : in part only.—Molesworth : diffuse.—Antoniadi : faint and diffuse.

ASTABORAS.—Molesworth : diffuse.—Phillips: narrow.

ASTAPUS.—Brown: narrow.—Kempthorne : very narrow.—Molesworth: diffuse.

ASTUSAPES. — Brown : narrow.—Molesworth: diffuse. — Phillips : very narrow.

ATHYR.—Seen by Molesworth diffuse.

"AXON" (Cerulli).—Molesworth: diffuse and extending E. and W. of Cerulli's "*Nuba*."—Antoniadi: diffuse and broad.

BOREOSYRTIS.—Attkins: very dark; darker than *Mare Cimmerium*, March 14, W. limit of shade in *Utopia*.—Brown: broad.—Corder: diffuse. —Hall: dark and broad.—Kempthorne : extremely dark and definite; W. end of *Utopia* shade.—Mee: very dark; W. limit of *Utopia* shade.—Molesworth: very dark.—Phillips: exceedingly dark; W. limit of shade in *Utopia*.—Antoniadi: dark and broad; W. limit of shade in *Utopia*.

EURIPUS.—Seen by Molesworth diffuse.

HELICONIUS.—Seen by Molesworth ; diffuse on a disc of 5″·2.

LETHES.—Seen by Antoniadi very faint.

"NASAMON."†—Attkins : narrow.—Hall : diffuse.—Molesworth: diffuse.—Phillips : faint; edge of shading in *Neith Regio*.—Townshend: diffuse.—

* The darkness of the *Boreosyrtis* region has been detected long ago. It is shown on drawings by Hooke, 1666; W. Herschel, 1777; De la Rue, 1856; Secchi, 1858; Burton, 1871; Flammarion, Green, Lohse, Schmidt, and Terby, 1873; Burton, 1882; Knobel and Lohse, 1884; Denning, 1886; Perrotin and Wislicenus, 1888, &c. It is, meantime, interesting to point out that whereas the last two observers were seeing shaded the region in question in 1888, Schiaparelli did not see any shading at all.

† *See* p. 70.

A. A. Williams: diffuse; edge of shading in *Neith Regio*.—Antoniadi: diffuse; edge of shading in *Neith Regio*.

NEPENTHES.—Kempthorne: "very faint"; narrow.—Molesworth: almost straight from *Mœris Lacus* to *Hephæstus*; diffuse.—Phillips: narrow.—Antoniadi: faint, not in its Schiaparellian course.

NILOSYRTIS.—Attkins: narrow.—Brown: narrow, dark.—Corder: diffuse.—Kempthorne: very narrow, gracefully curved.—Killip: narrow.—Molesworth: narrow.—Phillips: narrow and dark; edge of shade in *Neith Regio*.—A. A. Williams: diffuse, edge of shade in *Neith Regio*.—Stanley Williams: "remarkable for its faintness in March."—Antoniadi: difficult. Certainly not the easiest of canals in 1898–99.

"RHESUS" (Cerulli).—Seen by Molesworth di use.

THOTH.—Brown: faint.—Antoniadi: indefinite.

SECTION VII.

The South Polar Region.

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

Mars was too far from the earth when the south polar cap was visible, early in 1898. Hence, no returns of the diminution of the white material came to hand, with the exception of the following Table, due to Molesworth, and in which ω is the longitude of the centre of the disc during observation, α the areocentric arc subtended by the cap, and d the number of days separating the determination from the summer solstice of the S. hemisphere (— before, + after):—

Date.	ω	α	d.	Date.	ω	α	d.
1898.	°	°		1898.	°	°	
April 25 -	86	42	−36	June 8 -	357	17	+ 8
„ 27 -	63	42	−34	„ 9 -	348	17	+ 9
May 1 -	27	41	−30	„ 11 -	332	13	+11
„ 3 -	4	38	−28	„ 17 -	270	11	+17
„ 7 -	325	34	−24	„ 18 -	263	11	+18
„ 8 -	317	32	−23	„ 21	233	invis.	+21
„ 11 -	289	28	−20	„ 25 -	194	invis.	+25
„ 12 -	272	29	−19	„ 26 -	187	10	+26
„ 13 -	265	28	−18	„ 27 -	170	9	+27
„ 16 -	232	26	−15	„ 29 -	151	11	+29
„ 18 -	216	27	−13	„ 30 -	148	9	+30
„ 20 -	196	26	−11	July 1 -	131	10	+31
„ 21 -	184	26	−10	„ 2 -	118	7	+32
„ 23 -	164	24	− 8	„ 3 -	118	invis.	+33
„ 24 -	149	24	− 7	„ 4 -	105	invis.	+34
„ 25 -	143	22	− 6	„ 6 -	85	8	+36
„ 31 -	80	20	0	„ 7 -	71	9	+37
June 1 -	72	19	+ 1	„ 9	54	6	+39
„ 2 -	60	20	+ 2	„ 10 -	44	invis.	+40
„ 4 -	37	20	+ 4	„ 11 -	38	9	+41
„ 5 -	38	17	+ 5	„ 12 -	28	invis.	+42

After July 11, the S. cap was seen no more in Ceylon. Soon after its disappearance, whitish glimmers were visible in the S. polar regions, as in 1896–97.

SECTION VIII.

The North Polar Region.

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

"Throughout August and September, the N. polar region was "generally a dull white, with none of the characteristics of a true "polar cap. . . . . Towards the middle of September this "became a dull, not very white, patch, bounded, as a rule, by a "very faint streak of shade, diffuse towards the S. It was not "till September 28, that the cap was really well seen, shining "with a pale, almost greenish lustre, brightest to E., the bounding "marsh being distinct and dark" (Molesworth). Traces of the cap were also caught by Phillips on 1898, September 16, and by Stanley Williams a week later.

The change in the area of the white material went on as follows:—

d is here the number of days before (−) or after (+), the summer solstice of N. hemisphere.

Date.	ω	α	*d*	Observer.	Date.	ω	α	*d*	Observer.
1898.	°				1898.				
Sept. 16	197	50	−250	Phillips.	Nov. 18	217	56	−187	Antoniadi.
„ 24	95	8?	−242	Stanley Williams.	„ 19	{196 / 219}	56	−186	Molesworth.
„ 28	{340 / 352}	43	−238	Molesworth.	„ 21	194	65	−184	Phillips.
„ 30	324	43	−236	Molesworth.	Dec. 7	52	54	−168	Phillips.
Oct. 1	{309 / 321}	52	−235	Molesworth.	„ 17	309	55	−158	Phillips.
„ 2	{298 / 308}	61	−234	Molesworth.	„ 20	{269 / 284}	42	−155	Antoniadi.
„ 6	{262 / 272}	54	−230	Molesworth.	„ 20	276	50	−155	Phillips.
„ 9	{235 / 257}	50	−227	Molesworth.	„ 21	{249 / 268}	42	−154	Antoniadi.
„ 11	223	50	−225	Molesworth.	„ 22	{270 / 277}	43	−153	Antoniadi.
„ 12	{207 / 218}	53	−224	Molesworth.	„ 25	245	45	−150	Phillips.
„ 13	204	57	−223	Molesworth.	„ 26	262	37	−149	A. A. Williams.
„ 17	163	56	−219	Molesworth.	„ 27	253	27	−148	Corder.
„ 18	{147 / 159}	56	−218	Molesworth.	„ 31	180	47	−144	Phillips.
„ 19	{140 / 152}	59	−217	Molesworth.	1899. Jan. 4	153	43	−140	Phillips.
„ 22	{123 / 131}	60	−214	Antoniadi.	„ 4	167	35	−140	A. A. Williams.
„ 27	{70 / 82}	54	−209	Molesworth.	„ 4	171	42	−140	Hall.
Nov. 3	{356 / 8}	53	−202	Molesworth.	„ 8	{101 / 116}	42	−136	Antoniadi.
„ 4	359	75	−201	Phillips.	„ 8	118	43	−136	Phillips.
„ 6	{315 / 336}	51	−199	Molesworth.	„ 9	{85 / 92}	56	−135	Antoniadi.
„ 9	{276 / 306}	50	−196	Molesworth.	„ 9	87	56	−135	Crowley.
„ 11	{271 / 295}	55	−194	Molesworth.	„ 13	{48 / 63}	30	−131	Corder.
„ 11	{297 / 306}	55	−194	Antoniadi.	„ 13	59	50	−131	Phillips.
„ 13	{258 / 267}	54	−192	Molesworth.	„ 14	32	30	−130	Corder.
„ 17	{211 / 237}	56	−188	Molesworth.	„ 14	59	50	−130	Hall.

Date.	ω	α	δ	Observer.
1899.				
Jan. 14	73	53	−130	Phillips.
„ 16	36	25	−128	Brown.
„ 19	{331 0}	38	−125	Corder.
„ 22	319	32	−122	Corder.
„ 23	330	25	−121	Brown.
„ 23	332	35	−121	A. A. Williams.
„ 24	321	25	−120	Killip.
„ 24	357	54	−120	Phillips.
„ 25	285	27	−119	Brown.
„ 25	{309 328}	50	−119	Antoniadi.
„ 25	292	38	−119	Mee.
„ 26	273	30	−118	Corder.
„ 26	280	27	−118	Brown.
„ 26	288	48	−118	Attkins.
„ 26	306	37	−118	Killip.
„ 26	314	34	−118	A. A. Williams.
„ 27	268	32	−117	Mee.
„ 27	330	40	−117	Kempthorne
„ 28	{228 236}	43	−116	Antoniadi.
„ 30	301	50	−114	Phillips.
Feb. 1	{210 272}	55	−112	Phillips.
„ 1	224	35	−112	Corder.
„ 1	225	28	−112	Brown.
„ 1	264	24	−112	Townshend.
„ 2	205	33	−111	Kempthorne
„ 2	235	34	−111	Mee.
„ 2	{242 257}	46	−111	Antoniadi.
„ 2	251	36	−111	Hall.
„ 2	259	37	−111	A. A. Williams.
„ 3	206	36	−110	Hall.
„ 3	234	43	−110	Attkins.
„ 3	255	38	−110	Kempthorne.
„ 4	{214 225}	46	−109	Antoniadi.
„ 7	196	35	−106	Corder.
„ 10	{153 201}	41	−103	Antoniadi.
„ 10	{158 203}	46	−103	Crowley.
„ 12	156	36	−101	Hall.
„ 14	91	52	− 99	Phillips.
„ 16	72	28	− 97	Corder.
„ 17	{79 109}	42	− 96	Antoniadi.
„ 17	86	46	− 96	Crowley.
1899.				
Feb. 17	{106 130}	30	− 96	Attkins.
„ 20	{28 38}	48	− 93	Antoniadi.
„ 21	35	38	− 92	Kempthorne.
„ 22	58	35	− 91	Killip.
„ 23	57	48	− 90	Stanley Williams.
„ 23	60	37	− 90	Kempthorne.
„ 23	71	35	− 90	Attkins.
„ 24	{42 60}	42	− 89	Antoniadi.
„ 24	42	27	− 89	Attkins.
„ 25	{24 39}	40	− 88	Antoniadi.
„ 26	29	44	− 87	Phillips.
„ 26	44	37	− 87	A. A. Williams.
„ 27	{320 16}	40	− 86	Antoniadi.
„ 27	345	25	− 86	Attkins.
Mar. 1	32	38	− 84	Phillips.
„ 2	309	30	− 83	Attkins.
„ 5	325	26	− 80	A. A. Williams.
„ 10	290	48	− 75	Phillips.
„ 13	266	26	− 72	Killip.
„ 14	189	35	− 71	Antoniadi.
„ 14	{207 255}	26	− 71	Attkins.
„ 14	249	40	− 71	Phillips.
„ 15	178	30	− 70	Killip.
Mar. 16	178	36	− 69	Antoniadi.
„ 27	124	30	− 60	Attkins.
Apr. 3	70	32	− 53	Phillips.
„ 9	337	32	− 47	Phillips.
„ 19	{254 261}	30	− 37	Antoniadi.
„ 21	245	26	− 35	Phillips.
May 27	257	26	+ 3	Antoniadi.
„ 30	{217 228}	25	+ 6	Antoniadi.
June 1	194	27	+ 8	Antoniadi.
	189	36?	+ 9	Antoniadi.
„	72	22	+ 10	Molesworth.
„ 7	{30 40}	29	+ 14	Molesworth.
„ 8	23	28	+ 15	Molesworth.
„ 10	4	25	+ 17	Molesworth.
„ 11	356	25	+ 18	Molesworth.
„ 12	345	23	+ 19	Molesworth.
„ 13	332	23	+ 20	Molesworth.

Date.	ω	α	d	Observer.	Date.	ω	α	d	Observer.
1899. June 16	300	21	+ 23	Molesworth.	1899. July 9	78	25	+ 46	Molesworth.
„ 20	265	24	+ 27	Molesworth.	„ 10	70	21	+ 47	Molesworth.
„ 21	256	24	+ 28	Molesworth.	„ 15	25	20	+ 52	Molesworth.
„ 22	247	23	+ 29	Molesworth.	„ 16	11	20	+ 53	Molesworth.
„ 24	225	26	+ 31	Molesworth.	„ 17	1	20	+ 54	Molesworth.
„ 26	206	22	+ 33	Molesworth.	„ 18	354	20	+ 55	Molesworth.
„ 27	200	20	+ 34	Molesworth.	„ 19	341	19	+ 56	Molesworth.
July 6	109	19	+ 43	Molesworth.	„ 20	336	20	+ 57	Molesworth.
„ 7	95	20	+ 44	Molesworth.	„ 21	324	20	+ 58	Molesworth.
„ 8	88	21	+ 45	Molesworth.	„ 22	314	19	+ 59	Molesworth.

These data are very instructive. It is interesting to see that the N. polar cap was still considerable two months after the summer solstice.

With reference to the early veiling of this cap, Molesworth adds the following considerations:—

"A study of the September drawings at once brings us to the "conclusion that the N. polar cap, during September . . . was "partially veiled from us by some obscuring medium; dense early "in September, thinner later, and finally clearing away at the "beginning of October (rather more than a month before the "spring equinox of the N. hemisphere). This obscuring medium, "I think we may assume to have been the clouds and mists of "the winter of the Martian N. pole, which covered the latter "during the process of formation, and remained covering it until "the melting of the edge of the polar cap had begun in the early "spring. If this assumption is correct, we have a strong analogy "between Mars and the earth in this respect.

"Referring to the 1896 'Report' we find that a fog-like ap- "pearance covered the edge of the N. polar cap from November "18th to early in December, about a month before the spring "equinox of the N. hemisphere.

"It will also be noticed that this year the *Maria* began to "darken again eight days before the first unveiling of the polar "cap, which would appear to point to an intimate connexion "between the two phenomena. If the irrigation theory is correct, "this might be due to the springing-up of vegetation fertilised "by the earliest flow of water from the incipient melting of the "polar cap."

The cap was seen "slightly indented at $\Omega = 310 - 315$," on December 19 by Phillips, and "flattened on *f* side," February 17, $\omega = 78^\circ$ by Attkins. Its colour was, according to the former observer, an intense bluish white, like Vega.

Lastly, with reference to the dark band encircling the cap, Attkins and Townshend write that it was seen of "a very dark blue" at first, and that the colour faded with the season. This statement is confirmed by Hall when writing that "on February "21, while *Mare Acidalium* was dark, the 'sea' surrounding the "polar cap was considerably lighter than it was a month before."

PART III.

CONCLUSION.

Chart of Mars in 1898–1899.

The Chart at the end of the present "Report" is 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 arbitrary character of the task, the Director believes that the present Chart of Mars constitutes, by the mutual corroboration of most of its data, the most solid and trustworthy delineation of the planet made during the last apparition.

The Section tenders its warmest thanks 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, 1898–1899," published in Vol. LVIII. of the "Monthly Notices" of the Royal Astronomical Society, without which our work would have been assailed by formidable difficulties. The last column of the Ephemeris, the one concerning the passage of the Zero Meridian, was found in fair agreement with the appearance of the planet, and its difference was smaller than the errors of observation. Hence the justification for taking *Fastigium Aryn* as the Martian Greenwich on the Chart. Meantime, the measures of position taken by the Director on the most striking markings (*Sinus Sabæus*, *Mare Acidalium*, *Titanum Sinus*, *Trivium Charontis*, N. point of *Syrtis Major*, &c.) have shown (*a*) the accuracy of Prof. Schiaparelli's charts, and (*b*) the absence of any appreciable changes in the position of the dark areas. The backbone of the Chart is thus as accurate as could reasonably be expected.

It was thought advantageous to depart from the system followed in previous years, by drawing the Chart on a large scale, and printing it in such a manner that the reader might, by unfolding it, have at the same time text and map before him. This avoids turning pages, and enables to find the markings described at a glance.

The Chart contains the following abbreviations:—I. = *Insula*; *L.* = *Lacus*; *Prom.* = *Promontorium*. White spots are indicated by dotted circles. Markings conveying the idea of "land" are generally written in *upright* letters, those interpreted as meaning "water" in *inclined* letters. The names of important objects, not visible in 1898–1899, are given in brackets, while names belonging to Lowell's (1894) and Cerulli's (1899) maps, are indicated in inverted commas. The same is the case with names introduced by the Director. Overcrowding has been avoided by the use of *part* only of Schiaparelli's nomenclature, namely, those names which have been judged indispensable to the features presented by the last apparition.

The 1898–1899 Changes on Mars.

As shown in the exposition of the observations, these were—

(1) The incontestable intensification of the *Boreosyrtis*, invading, with a dark material, all the country to the E., until *Phlegra*;
(2) The separation between the *Syrtis* and *Nilosyrtis*, visible since 1896–1897;
(3) The development of "*Solis Pons*," resulting in a separation between the *Syrtis Major* and the *Sinus Sabæus*;
(4) The reappearance of *Nix Atlantica*;
(5) The remarkable "hour-glass" form of the "*Hour-glass Sea*."

On some Points connected with the Physical Constitution of Mars.

With a few exceptions, the following considerations lay no claims to originality :—

(1.) The question of the age of Mars is beyond our present grasp. Were the planet young, and its surface still warm, there would be no condensation caps at the poles, while, on the other hand, observation is reluctant to making of Mars a glacier.

(2.) The atmosphere is much more transparent than it is generally supposed to be, allowing, at times, markings on the limb to be seen quite as sharp and dark as when on the central meridian. Probably its density is also very small. It is not certain that clouds do float in such a medium. But superficial condensations (like hoar frost) are highly probable.

(3.) Should Dr. Johnstone Stoney's theory of the absence of aqueous vapour be correct, then the mean temperature of the planet would be low, harmonising, indeed, more readily with the demands of the law of inverse squares. If the theory be incorrect, and the polar caps be due to ordinary snow, then the mean temperature would not seem to be far from the 0° Centigrade. To ensure, however, such a result, the Martian atmosphere ought to contain some gas, fairly diathermanous to the luminous heat of the sun, but strongly athermanous to the reflected dark radiation from the surface. In that case only could the planet be habitable in the sense we are giving to that term.

(4.) Inasmuch as contrast ought necessarily to brighten regions approaching the limb (which, on Mars, entails an apparent change of colour from ochre to white), the phenomenon of the lands whitening with the obliquity of the visual (or solar) rays, must, to some extent at least, be subjective. If essentially objective, we have in it evidence of a considerable absorption of the solar rays by the Martian atmosphere, since, under an

increasing thickness of the gaseous envelope, the solar beam is too enfeebled to prevent precipitation.

(5.) The valuable results secured by the Section can now throw some light on the points raised by our late lamented past President, Mr. Green, at the December 1890 Meeting of the Association. There is no questioning the splendid accuracy of Prof. Schiaparelli's *outlines* of the *Maria*, but Mr. Green was right in stating that the Italian astronomer had a slight tendency to turn "soft and indefinite pieces of shading into clear, sharp, "lines." We know, at present, that the continental regions of Mars, and the N. hemisphere especially, are diversified by extensive, though exceedingly faint shadings, of almost all degrees of delicacy, visible to some observers, invisible to others, but on whose objective reality no reasonable doubts could be entertained.

(6.) From an analysis of past work, but chiefly from Rev. P. H. Kempthorne's valuable observations given in this "Report," we now know for certain that a considerable number of the so-called "canals" coincide with the boundaries of adjacent areas of different *albedos*. The fact is significant.* Generalising, however, on this point, by considering *all* the canals to be edges of shades, would be dangerous at present. But great credit is due to Mr. Maunder for having suggested this explanation for *some* canals almost 20 years ago.

(7.) The evidence in favour of objective change on Mars, beyond the obvious melting of the snows, is strong. A single instance, drawn from the present "Memoir" will suffice to illustrate this. In 1883–1884 the *Boreosyrtis* was a narrow dark band, surrounded by a bright area. In the comparable opposition of 1898–1899, a prodigious mass of dark material covered at least 10 times the area of the 1883–1884 band. Obviously, such discrepancies, seem far outside observational errors. And if change occur on such a gigantic scale on a given point of the planet, it is likely to affect, in a more or less attenuated form, all other parts of the Martian surface.

(8.) But little aquatic is the deportment of the *Maria*. Variability of intensity and outline are not the characteristics of water areas.

(9.) "Lakes" forming on the intersection of widening canals are not necessarily real, but might be superposition images ("Journal," Vol. XI., No. 1). Of course, this interpretation does not apply to real, permanent markings, but simply to some exceedingly small dots, invisible when the canals are narrow, but visible only when the breadth of the latter is increasing.

* In this connexion, the following extract from the report of the Meeting above alluded to is eloquent:—"Mr. Green added that he had himself been "deceived sometimes by the edges of large faint tones, and had drawn them "with a single line, only to find out his mistake when the form came to the "meridian, and its whole shape was made evident."—"Journal," Vol. I., p. 113.

(10.) As shown by Mr. Stanley Williams, the doubling of the markings cannot be accounted for by M. de Boë's hypothesis of out-of-focus vision, which the Director advocated in 1898, but in order to abandon early in 1899, when his experiments on very fine lines which it was impossible to "double," led him to fatal objections. In Vol. VIII., p. 309 of the "Journal," the Director wrote that "if a canal is at the limit of visibility when "at focus, its doubled and weakened image would not "impress the retina," and, since that time, he often asked himself whether *all* the canals being at the limit of visibility, their doubled images would not be invisible. He published, however, nothing on this point, but simply sought another explanation of the phenomenon.* The credit, therefore, of first drawing attention to this objection in print belongs entirely to Mr. Williams, who, in a series of valuable papers published in 1900 in the "Journal," completely overthrew the optical theory of M. de Boë. Viewed in a powerful telescope, the double markings have the appearance of objective realities, but, whether the canals are actually doubling, as affirmed by Prof. Schiaparelli, or are grouped into more or less permanent pairs—like some of the bright streaks radiating from Tycho and other large walled plains on the moon —is what future observation only will decide.

In concluding the present "Report," the Director wishes to express his sense of gratitude for the valuable collaboration given by the gentlemen who worked with such perseverance and skill under the uninviting conditions of out-door nightwork in mid-winter; and to congratulate them on the success which crowned their efforts in increasing our knowledge of our neighbour in space.

E. M. ANTONIADI,
Director of the Section.

Observatoire Flammarion,
Juvisy (S.-et-O.), France,
1901, January 2.

* "English Mechanic," Vol. LXIX., No. 1770, p. 37.

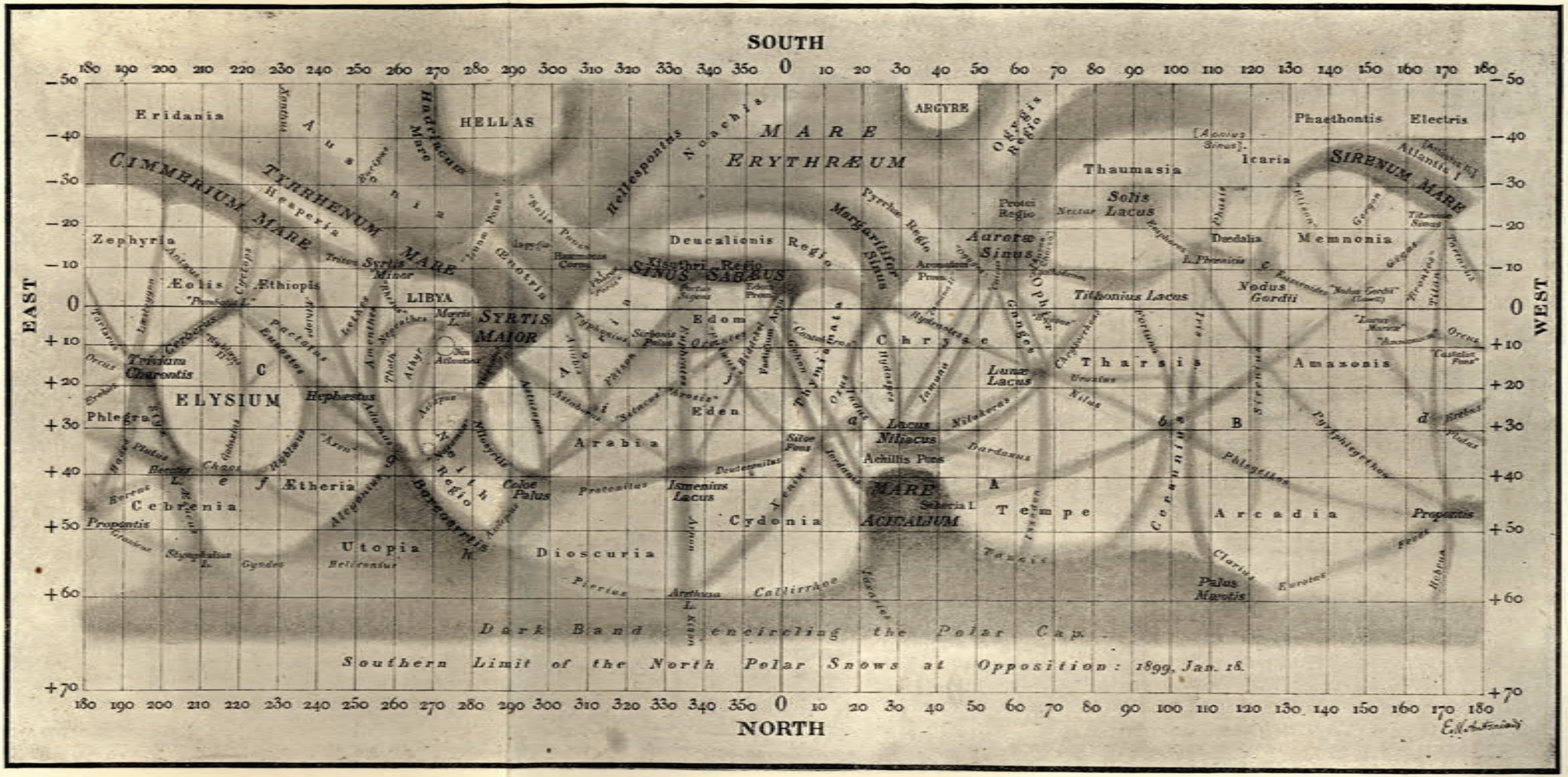

CHART OF MARS, ON MERCATOR'S PROJECTION.

Prepared from Observations of the Section in 1898–99.

MARS 1898–99. Plate 1.

Fig. 1. H. Corder. $6\frac{1}{2}$ in Spec.
1899. Jan. $19^d\ 9^h 30^m$. $\omega = 0°$. $\phi = -11°5$

Fig. 2. E. M. Antoniadi. $10\frac{1}{2}$ in O.G.
1899. Feb. $20^d\ 6^h 11^m$. $\omega = 28°$. $\phi = +8°5$

Fig. 3. P. H. Kempthorne $12\frac{1}{2}$ in Spec.
1899. Feb. $21^d\ 7^h 15^m$. $\omega = 35°$. $\phi = +8°5$.

Fig. 4. A. S. Williams. $6\frac{1}{2}$ in Spec.
1899. Feb. $23^d\ 10^h\ 0^m$. $\omega = 57°$. $\phi = +8°6$.

Fig. 5. L. A. Crowley 7 in O.G.
1899. Feb. $17^d\ 8^h 20^m$. $\omega = 86°$. $\phi = +8°6$

Fig. 6. T. E. R. Phillips. $9\frac{1}{4}$ in Spec.
1899. Feb. $14^d\ 6^h 15^m$. $\omega = 91°$. $\phi = +8°7$.

MARS 1898–99. Plate 2.

Fig.1. P. B. Molesworth. 12½ in. Spec.
1898. Oct. 22^{d} 10^{h} 46^{m} ω-121° φ--13°9

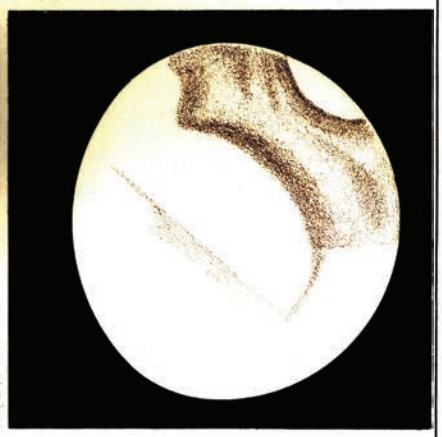

Fig.2. P. B. Molesworth. 12½ in. Spec.
1898. May. 25^{d} 11^{h} 50^{m} ω-143° φ--20°

Fig.3. T. E. R. Phillips. 9½ in. Spec.
1899. Jan. 4^{d} 11^{h} 0^{m} ω-153° φ-+13°8.

Fig. 4. T. E. R. Phillips. 9½ in. Spec.
1898. Dec. 31^{d} 10^{h} 15^{m} ω-180° φ--14°4

Fig. 5. E. Attkins. 6½ in. Spec.
1899. March 14^{d} 7^{h} 35^{m} ω-207° φ-+9°6.

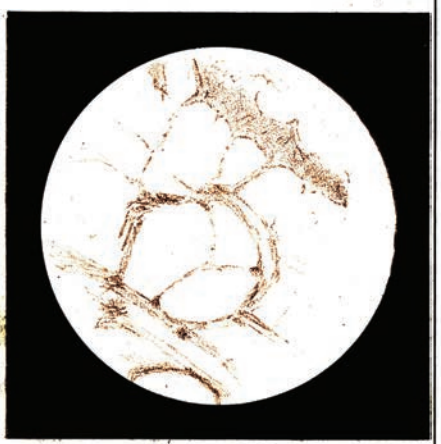

Fig. 6. G. L. Brown. 10¼ in. Spec.
1899. Feb. 1^{d} 7^{h} 59^{m} ω-225° φ--9°7