Plate I.

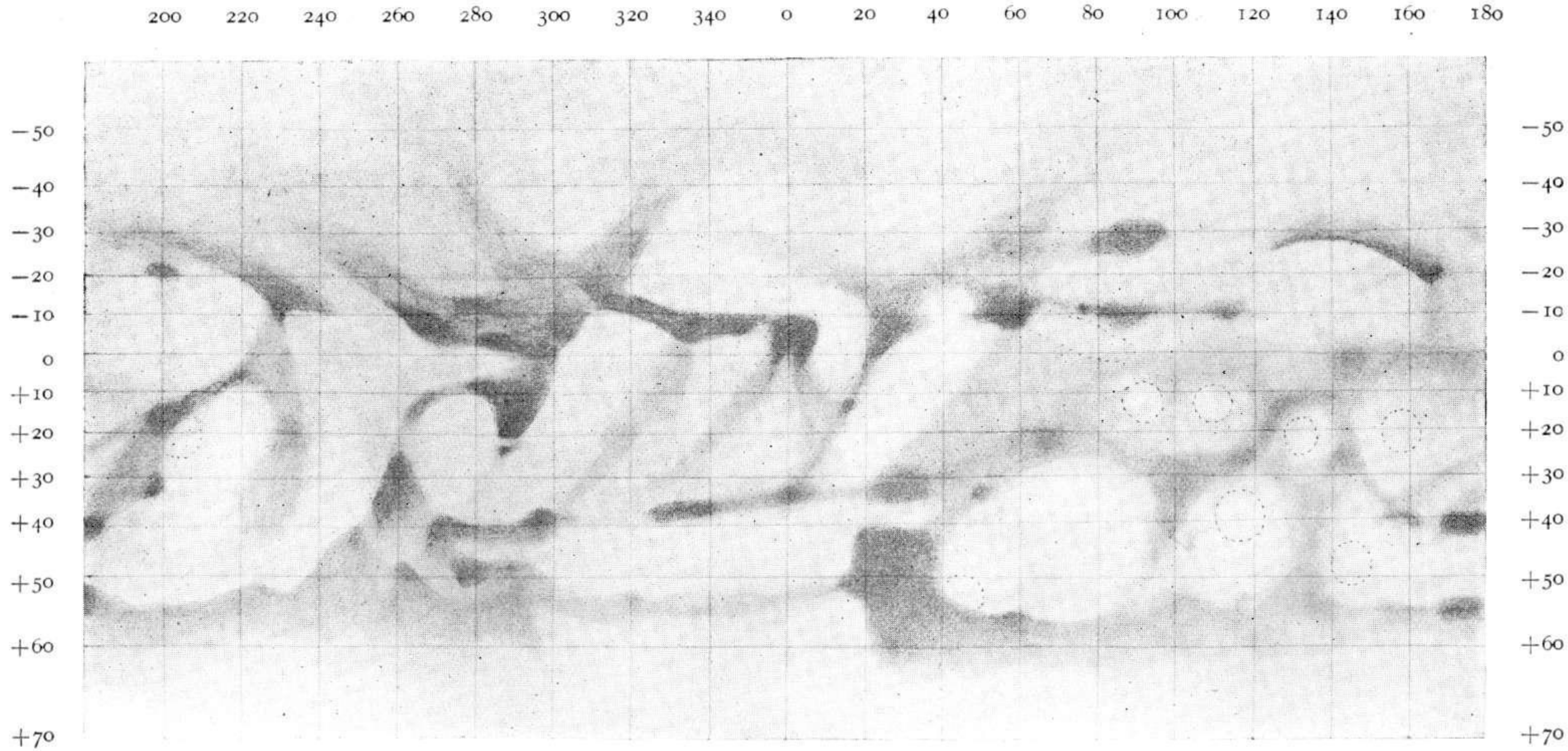

FIG. 1. Chart of MARS. From observations of The Section, 1935.

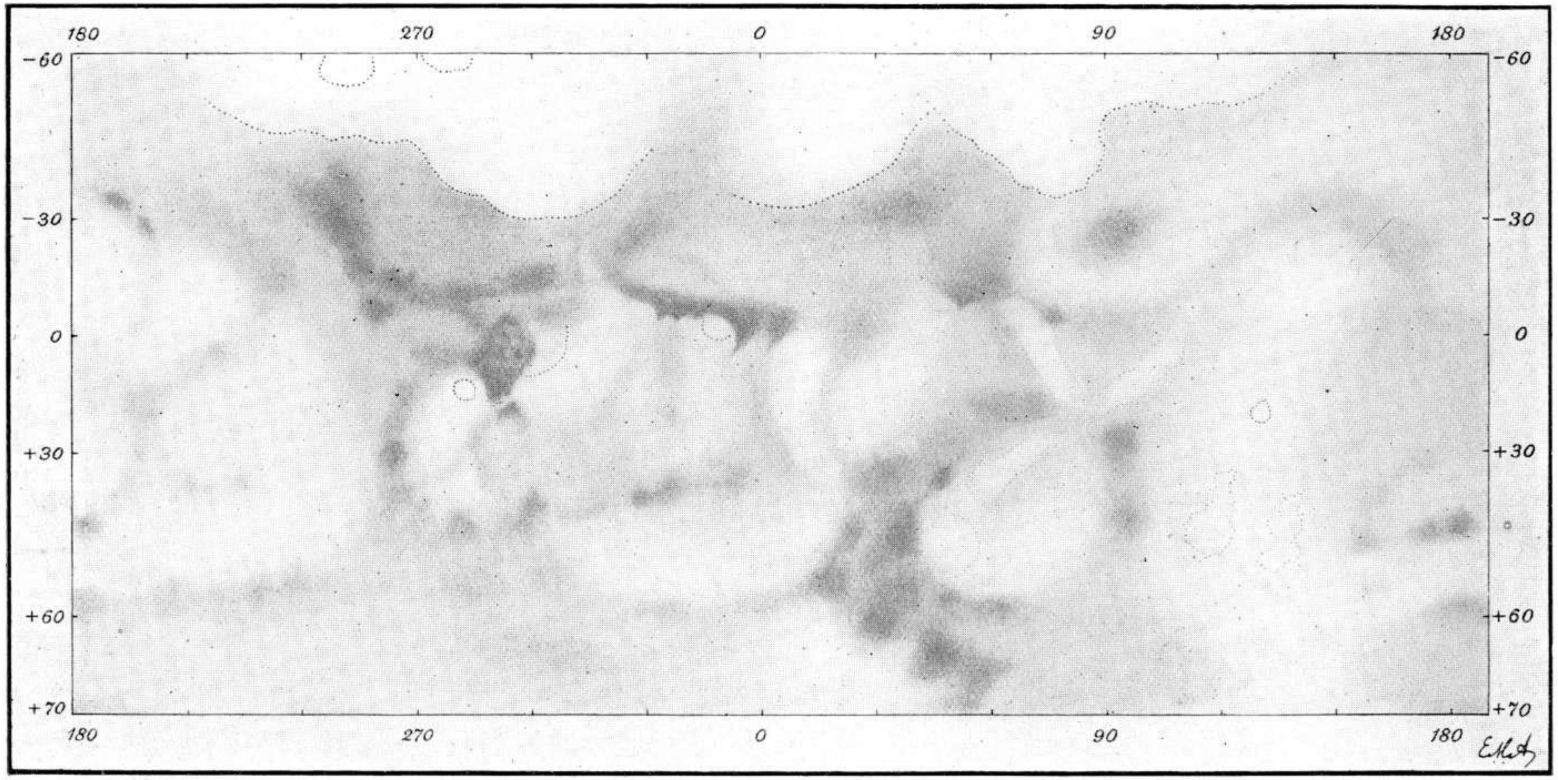

FIG. 2. Chart of MARS by E. M. ANTONIADI, 1935.

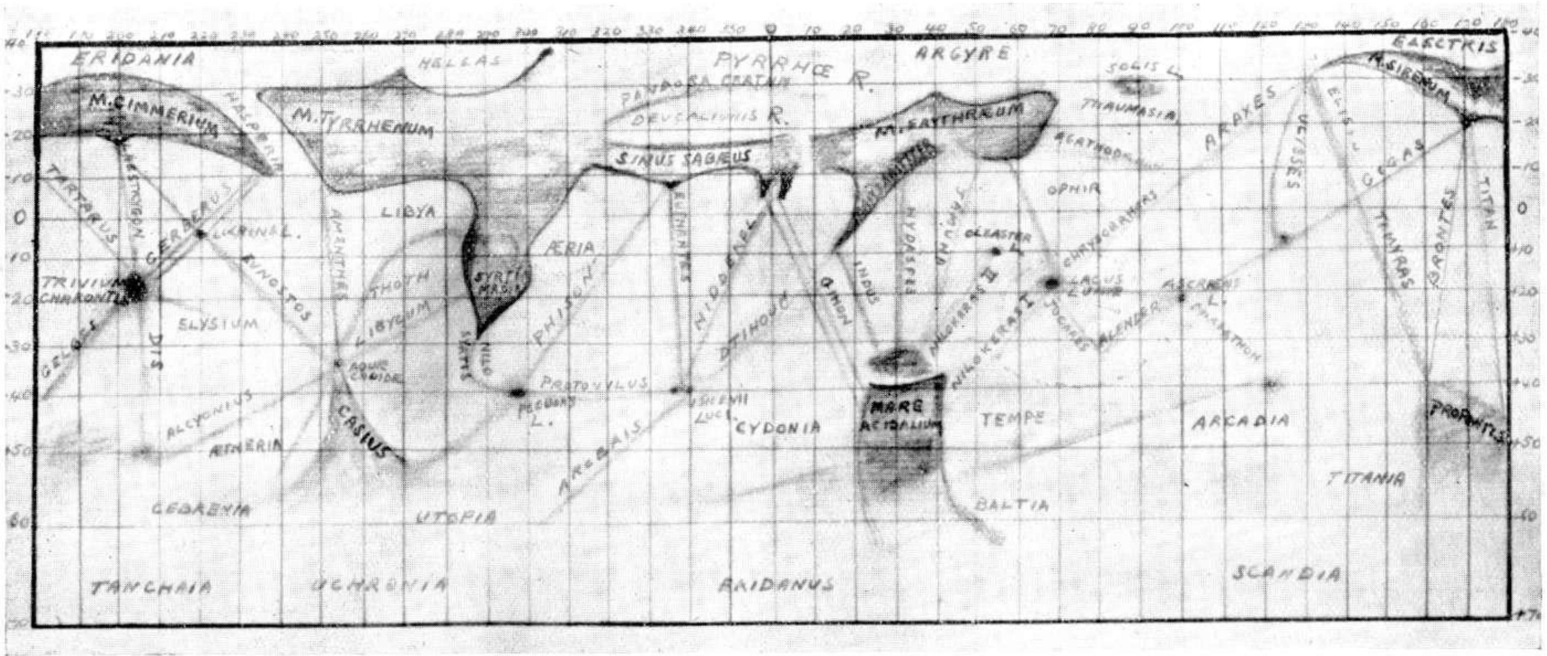

FIG. 3. Chart of MARS by R. BARKER, 1935.

Report of Section.

Interim Report of Mars Section.

The Apparition of 1935.

The last *B.A.A. Memoir* on Mars dealt with the apparition of 1920. The Director is now in process of bringing out a series of somewhat abridged *Memoirs* dealing with the apparition from 1922 up to 1935 inclusive, and hopes to have them ready for publication in the course of the next two years. Thereafter he intends to present each Mars *Memoir* within the two years immediately following the particular apparition to which it refers. He felt, however, it was desirable in the interval to prepare an interim report dealing with the recent apparition of 1935: the following pages contain this report.*

The apparition was a most unfavourable one both as regards the great distance of the planet from the earth and also as regards the weather conditions that prevailed.

The following table gives the names of the observers who contributed observations, their place of observation, and their instruments:—

Observer	*Locality*	*Aperture of Instrument in inches*
Antoniadi, E. M. ..	Meudon, Paris.. ..	32¾-in. O.G.
Attkins, E. A. L. ..	Squirrels Heath, nr. Romford	8½-in. Spec.
Ball, L. F.	Didsbury, Manchester	6½-in. and 10-in. Spec.
Barker, R.	Cheshunt, Herts ..	12½-in. Spec.
Burrell, B.	Doncaster	8½-in. Spec.
Collinson, E. H. ..	Felixstowe	10-in. Spec.
Diggles, R. E... ..	Stoke-on-Trent ..	4-in. O.G.
Fox, W. E.	Newark, Notts ..	6½-in. Spec.
Hargreaves, F. J. ..	Kingswood, Surrey ..	14-in. Spec.
Holborn, F. M. ..	Streatham Hill ..	8½-in. Spec.
Peek, B. M.	Solihul, nr. Birmingham	12½-in. Spec.
Phillips, Rev. T. E. R.	Headley, Surrey ..	8-in. O.G., 18-in. Spec.
Steavenson, W. H. ..	West Norwood ..	20-in. Spec.
Waterfield, R. L. ..	Headley, Surrey ..	8-in. O.G., 6-in. O.G., 18-in. Spec.
Waters, H. H. ..	Harrow, Middlesex ..	5-in. O.G.
Wooldridge, H. E. ..	Bromsgrove, Worcs. ..	6½-in. Spec.

The planet was in opposition to the sun on 1935 April 6. Its disc subtended a maximum diameter of 15″·07. The latitude of the centre of the disc was +22°·4 on Jan. 1; +19°·21 on March 1 (minimum); and +24°·55 on June 10 (maximum). The summer solstice of the northern hemisphere occurred about February 26; while the autumnal equinox occurs about August 27.

* Three charts of Mars are published (1) by the Director from the combined observations of the Section, (2) by M. Antoniadi and (3) by Mr. Barker. Since M. Antoniadi's observations were made with an aperture so much larger than any of the other observations, the Director felt it would be more interesting, for purposes of comparison, to construct the Section's chart independently of them. Mr. Barker's chart is given separately for the obvious reason that it is impossible in a single chart to both include and exclude geometrical features. (See Frontispiece.)

Region of Syrtis Major and Sinus Sabæus.

Syrtis Major was one of the darkest markings on the planet, and its general form was much the same as in 1933. The portion of it due west of *Libya* was definitely fainter than its more northerly parts—that was so in 1933, but not so in 1931. This apparition, however, *Nili Pons,* was visible as a bridge cutting off the extreme northern tip of *Syrtis*. *Nili Pons* was observed in England in 1931, cutting off rather more of the tip than in 1935, but was not observed in England in 1933,* when the *Syrtis* apparently ran unbroken to a tapering point. *Nili Pons* and the little lake north of it were first seen by Phillips in 1935 on March 19; to him *Nili Pons* appeared directed E.-W., while the little lake appeared elongated and curving southwards at its western extremity. Antoniadi in May saw *Nili Pons* cutting across the tip in a direction N.E.-S.W. with the little lake thus lying north and slightly west of the extremity of the main part of the *Syrtis*.

To the majority of the observers *Lacus Mœris* was simply a widening and darkening of *Nepenthes* at its entrance to *Syrtis Major*. In May Antoniadi saw it large and faintish, with the 32¾ inch, and projecting into *Libya*. He also found *Libya,* with the large refractor, deeply shaded.

Deltoton Sinus was well seen by Phillips in March gently projecting into *Aeria* and limited to the N.E. by *Œnotria* and to the S.W. by *Hammonis Cornu* and *Ara*. In April, however, the same observer and the Director could see no sign of it under good conditions, the coast line running unbroken in a smooth curve from *Syrtis Major* to *Sinus Sabæus*. In May Antoniadi saw the region very well: *Deltoton Sinus* fainter than *Syrtis,* irregularly shaded and limited by *Œnotria,* by *Incurva Insula,* and by *Hammonis Cornu* and *Ara*.

Hellas was often intensely white, occasionally rivalling the brilliance of the pole-cap. It was always brightest rising and setting, and generally seemed brighter at sunset than at sunrise. In March *Mare Hadriacum* was faint or invisible in England perhaps due to an extension over it of the *Hellas* cloud. In April, however, *Mare Hadriacum* stood out dark in contrast to the whiteness of *Hellas,* while Phillips reported that *Hellas* looked smaller than before. On April 21 the western portions of *Hellas* were noted by Phillips to be shaded,† and this was confirmed by the Director. Antoniadi on May 22 and 25 found *Yaonis Regio* covered by the *Hellas* cloud.

Another example of cloud or haze also occurred in this region of the planet; this took the form of a comparatively bright tongue extending W.S.W. from *Libya,* covering the southern part of *Syrtis, Crocea,* and *Œnotria*. This cloud was observed at different times as *Syrtis* was rising by Attkins (April 22, 23, June 3), by Phillips and the Director (Mar. 20); but on several other occasions it was *not* visible when *Syrtis* was rising. When

* *Nili Pons* was however detected by Antoniadi in 1933.

† See Plate II, Fig. 9.

Plate II.

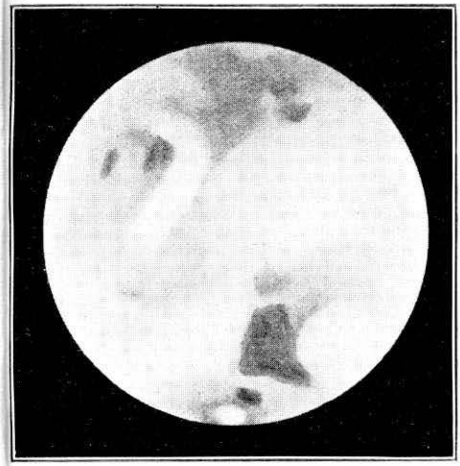

Fig. 1. B. M. Peek. 12½-in. Spec.
March 14. $\omega = 20°$. $\phi = 19°.5$.

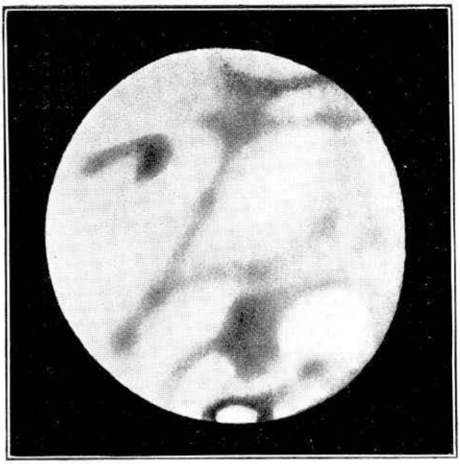

Fig. 2. F. J. Hargreaves. 14¼-in. Spec.
May 17. $\omega = 25°$. $\phi = 24°.0$.

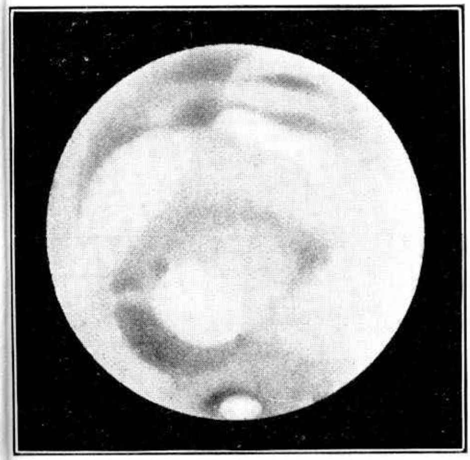

Fig. 3. T. E. R. Phillips. 18-in. Spec.
April 14. $\omega = 65°$. $\phi = 21°.8$.

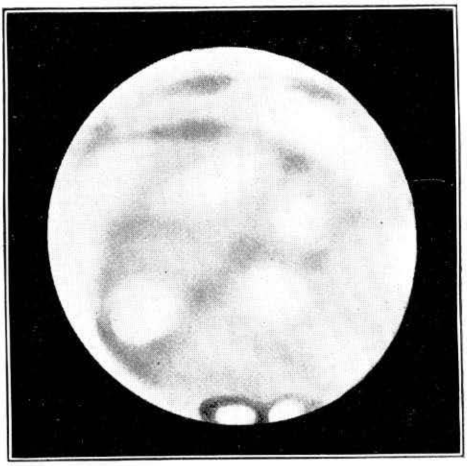

Fig. 4. F. J. Hargreaves. 14¼-in. Spec.
May 9. $\omega = 100°$. $\phi = 23°.6$.

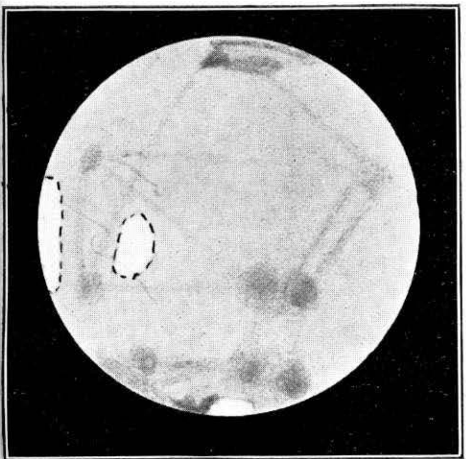

Fig. 5. B. Burrell. 8½-in. Spec.
May 4. $\omega = 170°$. $\phi = 23°.3$.

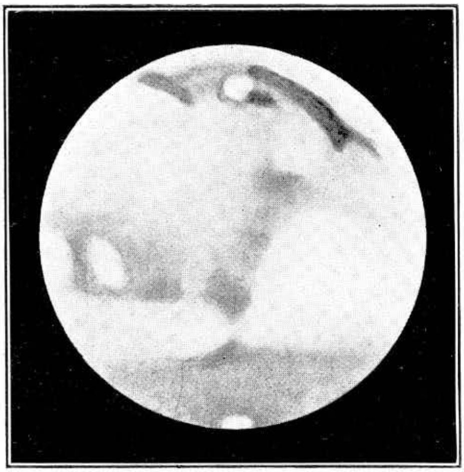

Fig. 6. B. M. Peek. 12½-in. Spec.
March 27. $\omega = 185°$. $\phi = 20°.3$.

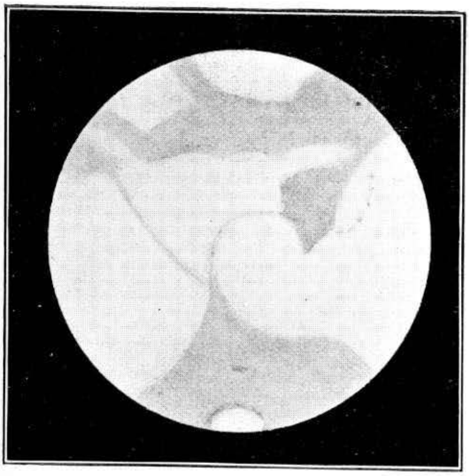

Fig. 7. E. A. L. Attkins. $8\frac{1}{2}$-in. Spec.
April 23. $\omega = 250°$. $\phi = 22°{\cdot}6$.

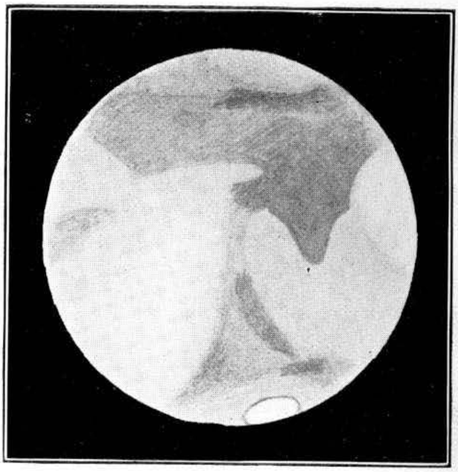

Fig. 8. E. H. Collinson. 10-in. Spec.
March 18. $\omega = 255°$. $\phi = 19°{\cdot}6$.

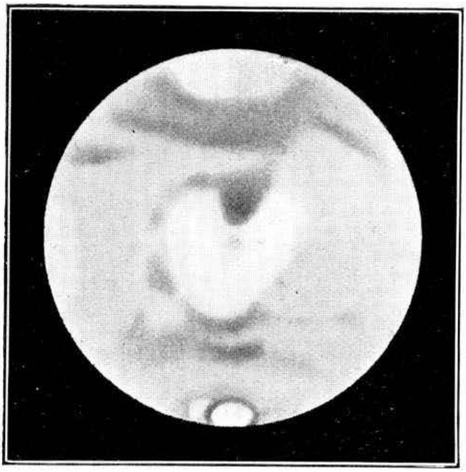

Fig. 9. T. E. R. Phillips. 18-in. Spec.
April 22. $\omega = 285$. $\phi = 22°{\cdot}5$.

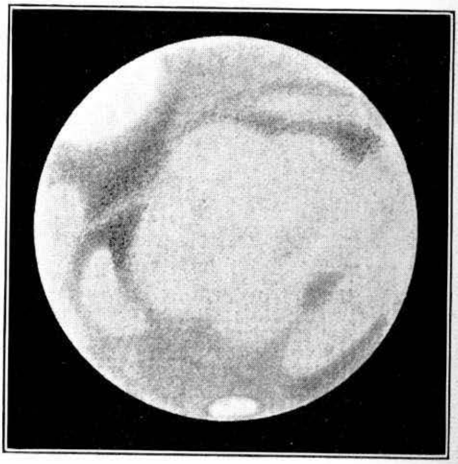

Fig. 10. F. M. Holborn. $8\frac{1}{2}$-in. Spec.
April 19. $\omega = 315$. $\phi = 22°{\cdot}2$.

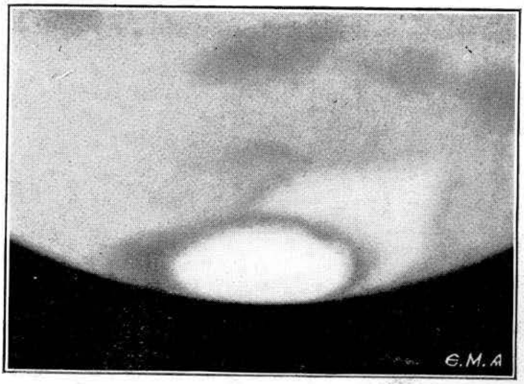

Fig. 11. E. M. Antoniadi. $32\frac{3}{4}$-in. O.G.
May 1. $\omega = 185°$. $\phi = 23°{\cdot}2$.

seen it invariably became less conspicuous as *Syrtis* approached the central meridian. [This same phenomenon was observed in 1933.] On one occasion, April 19, a practically identical appearance was recorded by Holborn as *Syrtis* was setting.*

M. Tyrrhenum showed gross condensations in its midst to several observers, and these were still further resolved by Antoniadi—see his chart. Ball reports that good conditions of seeing invariably revealed complex lighter streaks and darker patches in this as well as in all the other *Maria* south of the equator.

Sinus Sabæus and *Furca* were probably the darkest markings on the planet. *Edom Promontorium* was seen fairly bright by several observers. *Pandoræ Fretum* was mostly invisible, though its western portion was sometimes seen in March and April excessively faintly. In May Antoniadi could detect no sign of it. *Deucalionis Regio* was uninterrupted at its junction with *Thymiamata, Jani Fretum* being invisible. In May Antoniadi detected a faint streak curving across *Deucalionis Regio* south of *Portus Sigæus*.

Nepenthes-Thoth, though still prominent, appeared to Antoniadi, Collinson, and the Director to have continued since 1933 the fading that has now been in progress for some years. *Tritonis Lacus* was a definite swelling at the junction of *Nepenthes* and *Thoth*. Hargreaves, Phillips, and the Director in March and April found *Thoth* much less strong than *Nepenthes*, and almost invisible just south of its junction with *Casius;* while, to the same observers, as well as to Attkins and Collinson, *Casius* itself appeared gently tapering without its usual swelling. *Alcyonius Lacus*, however, is shown by Barker, Ball and Burrell as an intense condensation. In May it was seen by Antoniadi as a definite swelling at the tip of *Casius*. Early in the apparition Steavenson and Holborn found *Eunostos* very broad and conspicuous connecting the tip of *Casius* with the tip of *Cerberus I*. Later, however, this streak ceased to be visible.

The region of *Casius, Umbra, Boreosyrtis, Utopia* has preserved the same general configuration that it had in 1933—so very different from that of earlier years (compare chart *B.A.A. Memoir*, Mars 1917-18). The northern part of *Casius* is now shifted further south into *Umbra*. The complexity of this region —its dark knots and lightly shaded rifts—appears to have increased since 1933. The drawings of it by Burrell, Collinson, Hargreaves, Phillips, and the Director with moderate apertures are in very satisfactory general agreement with Antoniadi's observations of it with the great Meudon refractor. It should however be remarked that a few of the drawings received of it represent it as it appeared in earlier years—a good example of the danger of subconsciously perpetuating previous impressions and thus overlooking a very gross change. Nevertheless, most of the drawings, though they may fail to show the more delicate complexities of this region, have represented the general nature of the change quite correctly.

* See Plate II, Figs. 7 and 10.

Nilosyrtis, so conspicuous some years ago, was excessively faint, emanating as a curved streak from the lake at the tip of *Syrtis.*

Coloe Palus was large and conspicuous, while *Protonilus* running west from it was a diffuse and faint shading. *Ismenius Lacus* was dark and conspicuous, large, and elongated. Its duplicity was noted by Antoniadi, Barker, Burrell, and Peek, Antoniadi finding the E. component small and darkish, and the W. component pointed to S., large and faintish, exactly as he found it in 1933. *Deuteronilus* in striking contrast to *Protonilus* was intense and broad; it swelled into *Dirce Fons,* which also was strikingly conspicuous. Beyond *Dirce Fons* several observers detected *Deuteronilus,* running westwards, excessively faint in March and April; but in May Antoniadi found it quite invisible in this part of its course.

Region of Margaritifer Sinus, Auroræ Sinus, &c.

Margaritifer Sinus as usual was pale in contrast with *Furca.* From its tip *Oxus* was traced to *Dirce Fons* as quite a dense and comparatively narrow shading with *Oxia Palus* dark and quite small in its course. Several observers noted how clearly the *Oxus* stood out in good seeing, in striking contrast with the indefiniteness of the other streaks seen during the apparition on the planet.

Eos was fairly bright; *Auroræ Futum* appeared incomplete in its middle part, and thus only partially severed *Eos* from the lands to the north of it. A lightly shaded area extended west from *Eos* and divided *Auroræ Sinus* from *Mare Erythræum.* There appears to have been some variation in the depth of this shaded area: the division between *Auroræ Sinus* and *Mare Erythræum* being sometimes conspicuous and sometimes barely visible. A very fine view of this region was obtained in June by Antoniadi; the irregular outline of *Auroræ Sinus* with the sharp projection of *Jamunæ Sinus,* and further south the dark and elongated *Depressio Erythræa.*

Solis Lacus, all agreed, retained its classical form. *Tithonius Lacus* appeared to the Director more diffuse, and broader in a N.-S. direction than usual. *Agathodæmon* was also diffuse. *Lacus Melas* was seen by the Director on April 14 small and dark in contrast with *Tithonius Lacus.* It was seen by Hargreaves on May 10, and noted as " blackish " by Antoniadi on June 21.

From *Tithonius Lacus* a faint shading stretched westwards. According to Attkins, Burrell, Hargreaves, Peek, and Phillips it ended in a diffuse but very conspicuous rounded shading. The observations of this marking are very few; and because of its nearness to the S. limb and its comparative isolation from other markings, there is a good deal of doubt as to its precise position. It seems to have been too far north for *Lacus Phœnicis*: Hargreaves in fact put it still further north than did the others, practically on the equator. In May Antionadi noted that *Lacus Phœnicis* was invisible.

Mare Acidalium was extremely dark though definitely less so than *Furca* and *Sinus Sabæus*. Its outlines, except to the north, were the same as in recent years. *Callirrhoe Sinus* was a conspicuous and dense projection to the E. Considerable detail was made out in the *Mare Acidalium* by Antoniadi under excellent conditions on June 21 and 22.

One of the most striking differences between the apparitions of 1933 and 1935 was the relation of *Baltia* to *Tempe*. In 1933 *Baltia* cut right through *Tanais* into *Tempe* and thus isolated from *Mare Acidalium* the conspicuous *Acidalius Fons*. In 1935 *Tanais* was strong and broad, running continuously from *Mare Acidalium* to *Acidalius Fons*, and thus completely separated *Baltia* from *Tempe*.

This state of affairs was, however, apparently interrupted by a temporary reversion, between May 13 and May 20, to the configuration of 1933.* On May 13 Phillips saw *Tanais* unbroken. On May 15 Hargreaves saw *Tanais* severed as in 1933; and the same appearance was seen by Attkins on May 16 and again by Hargreaves on May 17, while on May 16 Holborn found *Tanais* very lightly shaded. On May 20, however, Hargreaves found *Tanais* again dark, separating *Baltia* from *Tempe*. There seems to be very little doubt that this temporary disappearance of *Tanais* was due to obscuration by cloud. Antoniadi's observations of June 22 and 23 showed that the *Mare Acidalium* had considerably encroached upon *Baltia* (Heliocentric longitude 233°). A similar phenomenon was suspected by Kellaway and the Director in 1933 round heliocentric longitude 185°.

Niliacus Lacus was faint and diffuse and was separated from the south border of *M. Acidalium* by *Achillis Pons*. Collinson noted *Achillis Pons* more deeply shaded than in 1933, and the same impression was recorded by the Director.

Nilokeras was extremely broad and diffuse: to the south and east there was no definite boundary to it; but to the north-west its edge was much more definite, and sometimes seen condensed into a definite streak. Here *Idæus Fons* was quite small and dark. *Lacus Lunæ* was extremely vague—more so, considerably, than in 1933; but here again there seems to have been definite variation, for occasionally *Lacus Lunæ* appeared more definite than at other times even to the same observer under similarly good conditions.

Beyond *Lacus Lunæ* the shading of *Niloheras* continued as the *Nilus* to *Ceraunius*, which was an extremely conspicuous object. The topography of this part of the planet—*Ceraunius* and the districts west and south-west of it—was extremely difficult to make certain about. The detail here requires excellent conditions of seeing; and unfortunately the seeing was exceptionally bad during most of the apparition. There is, therefore, considerable disagreement between the drawings of different observers and even between different drawings of the same observer. This region of the planet has well been referred

* *Cf.* Plate II, Figs. 1 and 3 with Fig. 2.

to as "the difficult side of Mars." To Phillips and the Director *Ceraunius* always appeared as in 1933 shaped rather like a carrot with its point directed N.N.E. and reaching almost to the shading of *Nerigos*. Holborn represents it very similarly. Attkins, Burrell, and Collinson also see it inclined slightly eastwards. Antoniadi shows it running due north with a slight curve in its eastern border towards the east. Hargreaves and Peek show it as a diffuse and wide shading without definite form separating *Tempe* from *Arcadia*.

The Section's chart, which, as explained above, is independent of Antoniadi's observations, depends as regards this difficult region (between $\omega=90^\circ$ and $\omega=160^\circ$) mainly on the drawings of Attkins, Burrell, Collinson, Hargreaves, Holborn, Peek, Phillips, and the Director. It is the result of a careful consideration of all the evidence available from their drawings.

To the west of *Ceraunius, Arcadia* was apparently divided by a very faint shading, *Sirenius II*. On either side of this lay a brightish area, corresponding to those indicated by dotted lines in Antoniadi's chart. These areas were particularly bright on the limbs. Running S.W. from the southern part of *Ceraunius* was a broad and conspicuous zig-zag streak with indefinite condensations at its angles. To the west of the zig-zag was *Nix Olympica*; while to the east of the zig-zag and south of *Cerannius* were two other light areas, which near the limbs appeared identical with *Nix Olympica* in shape and brightness though slightly larger. S.W. and W.N.W. of *Nix Olympica* were two large diffuse rounded shadings both near $\omega=145^\circ$, one in $\phi=+3^\circ$ and one in $\phi=+26^\circ$. The more southerly of these two was probably *Nodus Gordii*. The whole of this region seems to be closely similar to what it was in 1933.

On April 2 and April 4 the Director found *Ceraunius* apparently invisible. On April 2 the brightness of *Tempe* near its setting was continuous with that of *Arcadia*: for *Ceraunius* was not there to separate them. On April 4 *Ceraunius* was near the central meridian, yet only its broader southern portion (*Lacus Ascræus*) was visible, while an elongated brightish area covered the region where the rest of it should have been. Unfortunately no other drawings are available to confirm this. On April 12 the Director saw *Ceraunius* clearly defined again.

The Region of Mare Sirenum and Mare Cimmerium.

Mare Cimmerium.—Near *Læstrygonum Sinus* Antoniadi saw in May two blackish spots. They were seen by Hargreaves on May 4 as a single elongated blob. This blob was also observed by Peek on March 27, who saw immediately E. of it *Simplegades Insulæ* very white. Antoniadi found on May 31 the beak of *Mare Cimmerium* truncated as in 1926; "W. of *Cerberi Sinus* the beak was missing! There was a slight shading all over the part which was not there."

Hesperia was noted by Antoniadi as very strongly shaded in May. Phillips was of the opinion that the shading of *Hesperia* was variable: on Mar. 20 and Apr. 22 *Hesperia* stood out clearly to him; on Mar. 19 and Apr. 21 he could see no sign of it.

Antoniadi found *Trivium Charontis* large, roughly circular, but very faint, and *Cerberus* broad, faintish, and diffuse. Attkins also noted the faintness of *Trivium Charontis*. Hargreaves was of the opinion that the inclination of *Cerberus* to the equator was less than usual.

Elysium was noted by Antoniadi as very slightly whitish; to Phillips and the Director it was only whitish in the angle of it which abutted on *Trivium Charontis*. When rising or setting however it was frequently seen bright. Hargreaves, Phillips, Steavenson, and the Director in March and April were able to make out faintly the western and north-western boundaries of *Elysium*: a faint shading from *Cyclopum Sinus* joined another from the tip of *Cerberus I;* it curved northwards, swelled into *Hephæstas* (very diffuse) and continued more faintly to *Hecates Lacus*. The eastern and southern boundaries were much stronger. Phillips noted *Elysium* elliptical as in 1933. During May Antoniadi could find no trace of the western and north-western boundaries of *Elysium;* he found *Morpheos Lacus* small and fairly intense. *Hades I* was seen well by Antoniadi on May 1: convex to N.-W. and containing two dark spots. To other observers it was simply a broad, diffuse shading.

Amazonis: a fairly large spot brighter than its surroundings was seen here by Hargreaves and the Director when near the meridian; it was, however, much whiter when seen near the limbs. What was probably the same spot was seen bright and large near the terminator on May 10 and 11 by Antoniadi. This spot is somewhat W. of *Nix Olympica;* in longitude 150°-160°, in the judgment of the Director.

The *Propontides* were widely separated as in 1933 by *Herculis Pons*. Phillips even suspected that this "bridge" was still wider than in 1933—after making full allowance for the greater axial tilt. *Propontis I* was more conspicuous than *Propontis II*. Antoniadi saw in *Propontis I* a resemblance to *Ismenius Lacus:* it was definitely double with the W. component larger than the E. component. Again it must be noticed that a few drawings received show the two *Propontides* as a single large shading, just like it was years ago. This is another example of the danger that the memory of past impressions may blind one to gross changes. East of the *Propontides, Euxinus Lacus* and *Castorius Lacus* were seen by most observers. Hargreaves alone of the observers in England made out a faint shading curving over from *Euxinus Lacus* towards *Trivium Charontis;* while Antoniadi succeeded in resolving this into *Aphritis Fons* and *Ascania Palus* with a faint shading connecting them with *Euxinus Lacus*.

Gyndes broad and dark ran westwards from *Propontis II*. *Stymphalius Lacus* and *Sithonius Lacus* were seen by several observers as irregularities on the border of this shading; while in addition *Thymbræ Fons* and *Mnemosynes Fons* were visible to Antoniadi.

North Pole Cap.

In January the North Pole Cap was large: Heath estimated it to be 35° across on January 6. During February it appeared to Barker and the Director less brilliant as though veiled by cloud. A sudden shrinkage in size—presumably due to disappearance of the cloud—occurred at the beginning of March: the region of the cap was last seen large and dullish by the Director on Feb. 23 and by Collinson on Feb. 25; on March 4 the Director noticed a great reduction in size with a marked increase in brilliance and sharpness of outline, while the same thing was noticed by Collinson on March 6 and by Burrell on March 7. The cap continued diminishing till the end of March.

Antoniadi found the cap to be larger than it is normally at a corresponding heliocentric longitude, and pointed out that this is in complete agreement with his discovery of the relation between solar activity and the melting of the polar snows. His paper announcing this important observation, received on 1935 May 20, is appended below.

Several observers were of the opinion that towards the end of March or later the cap apparently increased instead of diminishing in size. Phillips found a slight increase through April and May, Holborn between March 26 and April 11, Collinson during April, Barker during May, Heath on May 8, and Burrell on May 12. It is possible that this effect was the result of some such phenomenon as is described in the penultimate paragraph of Antoniadi's paper.

Olympia was first seen by Phillips on April 22 (heliocentric longitude = 203°). It was then separated from the cap by quite a wide gap, and its earlier detection was doubtless prevented by the bad-seeing conditions. In 1933 the same observer first noted *Olympia* detached in heliocentric longitude 165°·7. Observations of *Olympia* were also made by Antoniadi, Attkins, Burrell, Collinson, Hargreaves, Peek, and the Director. At this period the cap was surrounded by a very dark and broad band; *Olympia* appeared paler than the cap and crescentic in shape with its concave border towards the cap. To Antoniadi, Phillips, and the Director the convex border of *Olympia* was only faintly shaded; but Hargreaves saw it darkly outlined. Antoniadi found the convex border of *Olympia* drawn out somewhat to a point away from the cap.* Phillips' observation of *Olympia* on May 13 is the last one reported; but it was still of considerable size. That the breaking off of *Olympia* is a constant seasonal event was first recognized by Antoniadi, and his discovery was published in *B.A.A. Memoir*, Mars, 1903.

Lacus Hyperboreas was a conspicuous object during the apparition, intensely dark bordering on the polar snows. Antoniadi found it definitely less dark than in 1933.

* See Plate II, Fig. 11.

*The Seasonal Diminution of the Snow Caps of Mars and Solar Radiation.**

By E. M. Antoniadi.

In 1913, Shajn suggested that the polar snows of Mars were melting quicker during a solar maximum than during a minimum, and found almost parallel curves from 1877 to 1907. But my examination of the problem did not show at all parallel curves for the two phenomena, although a rough relation between them seemed probable.

Now, the N. polar cap was distinctly larger early in the present apparition than its mean size in my permanent ephemeris: it subtended 16°, instead of 12°; and this coincided with a period of minimum solar activity. I observed a similar coincidence for the S. cap in 1924, and for the N. one in 1913-14, when sunspots were also at a minimum in both cases. On the other hand, in 1903, two years only before a solar maximum, the N. cap subtended 10° instead of 15°. Such phenomena seem to confirm the idea of Langley that the calorific radiation of the Sun must be greater at maximum than at minimum; and, as shown by the admirable researches of Prof. Abbot, the difference is only but a very small percentage indeed of the whole.

Now Mars yields the most precious and sensitive means available for the detection of such slight changes in solar heat: this is what our late lamented mentor, E. W. Maunder, saw at a glance when I drew his attention to the probability of such variations, which seemed to result from my examination of the size of the snow-caps on drawings made from 1856 to 1916. Thus, on a post-card dated 1916 May 5, the founder of this Association expressed his opinion on the subject as follows:— "The meteorology of Mars must be far simpler than that of the earth, and therefore it will respond more obviously to changes in solar radiation than will the earth."

Some difficulty is inseparable from this inquiry through the frequent presence of cloud over, or near, the caps. The white clouds are almost invariably duller than the bright snows; and, when extending beyond the latter, they tend to increase the apparent size of the caps, while the yellow clouds tend to bring about their seeming diminution.

The general conclusion to be drawn from the above phenomena is that they are probably not the outcome of mere coincidences and unquestionable local meteorological causes, and that the necessarily very slight changes in the intensity of solar heat would seem detectable by the varying size of the polar snow-caps of Mars.

Colour Notes.

Antoniadi has sent a very complete and valuable report on the colours of the various parts of the planet during the apparition. In this interim report are included his notes on only a

* This note was received by the Secretaries for publication on 1935 May 20; it was held over in order that it might be included in this Report.

few of the more prominent regions, set side by side with colour estimates of other observers:—

Region	*Antoniadi*	*Other Observers*
Syrtis Major ..	Dark. Indigo grey	Grey (Attkins); Grey green (Burrell); Sage green (Heath); Blue green (Collinson); Green blue near limb, with some brown in it when near C.M. (Phillips); Greenish blue (Director)
Sinus Sabæus ..	V. dark. Chocolate (as in 1933)	Dark brown (Hargreaves); Sage green (Heath)
Utopia	Moderately shaded. Dingy brown	Brownish (Attkins); Grey green (Heath); Muddy brown (Phillips); Light grey brown (Director)
Casius	Brownish grey	
Nepenthes Thoth ..	Distinctly brown	
Margaritifer Sinus	Greenish grey (as always since 1909)	
Auroræ Sinus ..	Darkish. Grey	
Lacus Lunæ ..	V. faint. Pale brown	
Nilokeras and Ceraunius	Pale. Striking vermilion brown	Brownish green (Burrell); Reddish brown, as in 1933 (Director)
Mare Cimmerium	Ochre to east	
Trivium Charontis	Faint. Grey	
Propontis I ..	Darkish brown or sepia	
Propontis II ..	Never brown: grey, possibly indigo, slightly	
Hades I	Brown vermilion	
Baltia	Pale indigo	
Mare Acidalium ..	Dark (less so than Furca). A bit greenish	Dark green (Attkins); Grey green (Burrell and Heath); Green (Phillips); Brown green (Director)
Niliacus Lacus ..	Grey	

Phillips often noticed *Syrtis Major* blue-green to blue when coming round the limb, but green with a little brown in it when nearing the central meridian. Antoniadi saw a pale bluish tint in *Mare Acidalium* on May 22 when the marking was near the terminator, and this colour was confirmed by M. Baldet. Yet on June 21 and 22 he saw it dark and grey with a tinge of green. He points out that it is impossible for light *yellow* cloud, lying over a grey marking with a green tinge, to produce in the appearance of the latter a bluish tint, and suggests that it may have been due to overlying *whitish* cloud. Barker found all the *Maria* south of the equator often a brilliant blue-green.

Colour estimates are always very difficult: they depend on the differential colour sensitiveness of different eyes; on the apparent brightness of the planet as influenced by different apertures and magnifications; and, if a refractor, on the colour correction of the lens; and they are also dependent on the words used to describe them. Undoubtedly a large telescope is far superior to a small one for colour judgments, because of the greater light-grasp and the possibility of obtaining a large image of great brightness. A glance, however, at the table given shows that there is on the whole very satisfactory agreement between the different observers. For example, *Syrtis Major,* indigo to Antoniadi, is noted by other observers as ranging generally from blue, to blue-green, to light green; *Casius,* brownish-grey to Antoniadi, was seen by the other observers generally to have a brownish tinge. Again there was general agreement as to the green of *Mare Acidalium,* the chocolate or dark brown of *Sinus Sabæus,* and the ruddy or vermilion-brown of *Nilokeras* and *Ceraunius.*

Bright Areas.

Observations of bright areas and spots, either seen only at the limb or seen brightest at the limb, were contributed by Antoniadi, Attkins, Ball, Barker, Burrell, Collinson, Diggles, Fox, Hargreaves, Heath, Holborn, Peek, Phillips, Waters, and the Director. These can be divided into two classes; large diffuse areas, and comparatively small and more or less sharply demarcated spots. The more important of the larger areas sometimes seen bright at the limb included: *Libya, Isidis Regio, Neith Regio, Aeria, Thymiamata, Cydonia, Chryse, Argyre I, Tempe, Arcadia, Elysium.* The smaller spots include two spots in *Chersonesus* (Antoniadi), *Nix Atlantica* (Antoniadi and Holborn), *Edom, Nix Tanaica,* the two spots C. of *Ceraunius, Nix Olympica,* the two spots in *Arcadia,* and the spot in *Amazonis.**

The spots in *Arcadia* and *Amazonis, Nix Olympica,* and the spots S. of *Ceraunius* can readily be identified with those photographed at the Lick Observatory in March and described as "unusually bright clouds." As has already been pointed out by the Director in the *Journal,* these spots, although they probably owe their brilliance on the terminator to atmospheric causes (as long ago shown by Antoniadi), are quite permanent in position. They were observed all through the recent apparition and during the apparitions of 1933 and 1931, and they appear on drawings and charts of Mars made many years ago. Their brightness at the limb may, however, be variable; and the Director was of the opinion that when they were seen in April and May they were less brilliant than they were in March. If it is necessary to refer to them as "clouds" they should be carefully distinguished from the normal white clouds, which are very rare, and which are *not* fixed in their positions.

Longitude of Markings.

A number of observations of the time of central meridian passage of various markings was made by Peek, Phillips, and the Director. Owing to bad seeing conditions and the distance of the planet the number of these observations is small.

* These smaller spots are indicated in Charts 1 and 2 by dotted lines.

Object	ω Phillips	ω Peek	ω Director
Fastigium Aryn		$357{\cdot}0_1$	$356{\cdot}5_1$
Margaritifer S. (N. tip) ..			$20{\cdot}7_1$
Callirrhoe S.			$20{\cdot}7_1$
M. Acidalium (centre)	$34{\cdot}1_1$		$33{\cdot}5_2$
Auroræ S.			$57{\cdot}0_2$
Tithonius L.			$84{\cdot}0_1$
Propontis I	$174{\cdot}8_2$	$178{\cdot}6_1$	$177{\cdot}1_1$
Trivium Charontis	$197{\cdot}5_2$		$196{\cdot}3_1$
Alcyonius L.	$255{\cdot}5_1$	$255{\cdot}2_1$	
Syrtis Major (middle of northern part)	$286{\cdot}3_6$	$287{\cdot}7_3$	$289{\cdot}0_2$
Syrtis Major (N. tip)			$283{\cdot}9_3$
Coloe P.			$298{\cdot}8_1$
Portus Sigæus		$330{\cdot}7_1$	
Ismenius L.	$335{\cdot}1_1$	$337{\cdot}2_2$	$341{\cdot}1_3$

(The numbers below the line indicate the *number* of observations of which the figure is the mean.)

"Canals" and "Streaks."

The term "canals" will be used to mean those practically linear markings drawn by some observers, and the term "streaks" to mean those diffuse shadings drawn by other observers. Both terms refer to the *representation* of a marking in a drawing or chart. It follows, as is often the case, that a given marking on the planet may be represented sometimes as a canal, sometimes as a streak.

It is clear that canals as thus defined must fall into one of three categories: (1) canals that actually appear as such upon the planet; (2) canals that are simply a misinterpretation by the eye, or a formal or diagrammatic representation (due to poor draughtsmanship), of detail of a different sort upon the planet—shadings, streaks, or delicate and faint detail; and (3) canals that are purely illusory and have no actual counterpart upon the planet.

It is the Director's opinion that very few, if any, of the canals fall into the first category, and that none drawn at the recent apparition—with Mars so far away and seeing conditions so poor—do so. The *Oxus* was the nearest approach to this type of canal. He feels that by far the greater majority of all canals, and of those drawn this year, fall into the second category: they represent the course of the streaks or the edges of the shadings which were seen by the observers who did not interpret them as canals. The more important markings in this category seen in 1935 included: *Nepenthes-Thoth, Nilo-Syrtis, Protonilus, Deuteronilus, Pierius, Callirrhœ, Euphrates, Gehon, Phison, Hiddekel, Oxus, Nilokeras, Jamuna, Ganges, Indus, Agathodæmon, Nectar, Ceraunius, Nilus, Sirenius II, Titan, Hades I, Styx, Læstrygon, Cerberus I, Cerberus II, Cyclops,* and *Tartarus*. There were probably other markings as well, which were sometimes interpreted as canals.

In addition, however, the Director is convinced that a certain number of the canals represented at this apparition fall into the third category, and were illusory in the sense that there was no underlying detail really visible which could give rise to the impression of them. His reasons for believing this are (1) a canal has sometimes been drawn across a brightish region which in actual fact is filled with a densely shaded marking, *e.g.*, the region of *Boreosyrtis* since its change some years ago. (2) Some drawings contain canals not seen by other observers, and at the same time completely misrepresent—beyond the errors accounted for by poor draughtsmanship—the larger markings: if the coarse detail is illusory, little significance can be attached to the fine detail. (3) Some drawings show very fine canals not observed by others, yet omit such excessively coarse streaks as *Deuteronilus*.

It must be realised that the eye is often untrustworthy; and objects suspected, or even repeatedly suspected, should never be recorded as definitely present. Only when the seeing so improves that they "well up" quite definitely into view—sometimes to be held steadily, more often to be held momentarily but repeatedly—should they be regarded as definite. The inclusion in a drawing for publication of a suspected object is far more dangerous to the advancement of our knowledge than the omission of an object that really could have been seen definitely.

But the Director does not wish to suggest that more than a small minority of the canals drawn by the section are illusory in this sense. Practically all of them he would regard as canals of the second kind, canals through interpretation or representation; and in so far as such canals represent real underlying detail—its presence and often its general configuration—they are extremely valuable as contributions to the observations. The Director is himself a horrible draughtsman, and often has to represent what he sees diagrammatically. In poor seeing he often sees the margins of faint shadings as apparently narrow lines, but in good seeing their true nature becomes apparent. Finally, when seeing is bad and the planet is small through distance, he frequently suspects streaks connecting up the darker markings in regions where later, under good conditions and when the planet is nearer, no streaks or other underlying detail can be seen at all. This last effect, which is *pure illusion*, is like seeing a horse when there is *nothing* there; the other effect, of seeing canals where there *is* underlying diffuse shading, is more like seeing a horse when there is actually a donkey—an error which on many occasions is not really very serious.

The Director finally would urge members of the Section to concentrate attention mainly on the grosser markings of the planet, dusky and bright, which come well within the limits of their instruments. There is still an enormous amount to be learned about these markings. It is entirely wrong to use the large markings simply as pegs on which to hang the canals. It is, the Director feels, very largely a waste of time to confine attention to very faint details, such as the majority of the so-called canals, which must be close to, or even below, the limits of the capabilities of the instruments available. At the best such observations cannot possess that degree of certainty which scientific knowledge requires.

In conclusion the Director wishes to express his thanks to all the members of the Section for their collaboration in this work. To M. Antoniadi he is particularly indebted for his valuable observations made with the great telescope at Meudon. He also wishes to acknowledge with gratitude the kind assistance of Mr. Phillips in the preparation of the chart.—R. L. WATERFIELD, *Director.*

Papers Communicated to the Association.

Solar Activity during the Second Quarter of 1935.

By F. J. SELLERS, M.I.Mech.E., F.R.A.S.

General solar activity has again increased, and the pronounced activity in the southern hemisphere, which was remarked in the report for the first quarter, has continued during April, May, and June. As before, this not only refers to *frequency*, as shown by the table, but also to the *importance* of the outbreaks of sunspots and prominences.

1935	Prominences						Sunspots			
Month	Observations	Mean daily frequency	North	South	East	West	Observations	Mean daily frequency	North	South
April	18	8·50	62	91	72	81	25	1·16	8	21
May	23	9·65	102	120	113	109	28	2·28	25	39
June	16	8·38	58	76	65	69	28	2·86	31	49
Totals	57	8·93	222	287	250	259	81	2·13	64	109

Sunspots.

April started quietly, no spots being seen until the 8th, when a double spot appeared at lat. N. 24° and about 14° east of the C.M. There were some six other small spot groups observed in April, but the only one which calls for special remark appeared on the 12th as two small spots at the high latitude of S. 35° to 36° and some 45° east of the C.M., and had developed by the next day into an important group. It continued to increase until about the 17th, and then gradually gathered up into a single spot passing the west limb about the 23rd. It returned and was glimpsed again on May 9 after passing the east limb, but quickly disappeared.

On April 29 some small spots were seen near the east limb at S. 22° which developed rapidly, and on May 3 a sudden fresh