shoe. The total eclipse of the sun which will take place on June 29, 1973, belongs to a different series, and will be the third return of the one which will take place May 28-29, 1919. Here the moon's mean anomaly and argument of latitude will be very small, while the sun's mean anomaly will be large. These conditions will favor a long duration of totality on the central line, as long as $6^m\ 58^s$ at some places.

The significance of the symbols used in the computation are as follows:

T = Time
g = Moon's mean anomaly.
g' = Sun's " "
$u_0 - 180°$ = Moon's argument of latitude.
y°_2 = the ordinate of the point in which the axis of the shadow intersects the fundamental plane at conjunction.
x'_2 = hourly variation of the coördinate x_2 of the point in which the axis of the shadow intersects the fundamental plane.
l' = radius of the shadow cone on the fundamental plane.

REPORT ON MARS, No. 20.

WILLIAM H. PICKERING.

This Report will be devoted mainly to the discussion of the observations made last year and this up to March 16. The few made prior to October 1917 have been already described in Report No. 18. It was there noted that the dark meridional band lying between Nilosyrtis and Thoth, and which indicates without doubt the passage of large volumes of water from the northern polar cap into the southern hemisphere, remained visible fully four weeks later than at the two previous apparitions in 1913 and 1915. This clearly foreshadowed a late season on Mars, a result which has been amply verified since that time. The snow cap, while at first larger than in 1914 on the same Martian dates, diminished rapidly, so that by M. D. May 1 it was of practically the same size. This date corresponded to December 29, 1917, on the Earth. It followed apparently very much the same course as in 1916.

Snow Storms Observed.

While the decrease in size of the polar cap with the advance of the season is always readily observed, since the summer pole is then turned towards the Sun, and also towards the Earth, the various small increases in size which occur with successive Martian storms are much more difficult to detect. Three have been noted so far at this apparition. On October 4, M. D. March 30, the snow cap was drawn with great care under favourable conditions, and was described as satisfactory. It reached to latitude + 62°.8. Six days later it was seen to be clearly too small, and was found to reach latitude +57°.2, a difference of 5°.6. This was an unusually large storm as such storms go. If the change all occurred on one side of the cap, which is likely, the breadth of the addition was 11°.2 or 412 miles (663 km). The next storm, though more conspicuous on account of the greater proximity of the planet, was of less extent. On December 21, M.D. April 49, the snow cap reached latitude 72°.7, but six days later it had advanced 2°.4 to latitude 70°.3. It was evidently only a light fall of snow because six days later, January 2, it had again retreated to latitude 73°.6. The most interesting and conspicuous fall of the three, however, occurred on February 18 of the present year, M. D. May 51. This was due to four facts: in the first place the planet was quite near us, diameter 12″.6; secondly, the snow cap was much smaller than in the previous observations, varying from 1″.2 to 2″.3, so that the increase in size was readily observed; third, observations were made on four successive days; and, finally, the pole was turned towards us so far, and the phase was so small, that the whole of the snow cap was visible all the time. The results derived were as follows:—

February 12, M. D. May 45, longitude of central meridian ω 32°, latitude of center of disk + 21°.6, diameter of disk 12″.0, seeing 7; diameter of snow cap **17°.4**, latitude of southern edge of cap 81°.3. Brightness of snow 8 on scale of 10, color white.

February 16, ω 303°, seeing 6, 7, the diameter of the cap was reduced to 11°.4, but near the terminator, in longitude 210°±, a light cloud of brightness 7 was seen, extending 14°.2 to the south of the cap. The total breadth of the two was **25°.6**. The brightness of the snow itself was still 8.

February 17, ω 328°, seeing 9, 10. The diameter of the cap had increased to 13°.8, but the breadth of the cloud was now reduced to 8°.4. Total breadth **22°.2**. The brightness of the snow and cloud were still 8 and 7.

February 18, ω 293°, seeing 7, 8. The fainter region now surrounded the cap on all sides, and had brightened to 8, the cap itself being 9. It may be that the cloud had actually traveled across the cap, or perhaps, which is more likely, the white deposit was simply a thin layer of snow partially covering the ground, which had deposited from clouds constantly condensing on the night side of the planet. The diameter of the inner bright cap was 13°.6 or practically the same as before, that of the outer fainter one **23°.2** or about the same as the total breadth of snow and cloud on the previous night.

February 19, ω 279°, seeing 10,8. The snow cap was now uniformly dense and white, brightness 9 to 10, diameter 21°.0. The deposit therefore now completely covered the ground. Its outline was distinctly hazy, however, as if surrounded by a narrow ring of cloud, or by ground only partly covered with snow. The size of the cap had not appreciably diminished by March 1, showing either that it consisted of deep snow which had not melted, or that another snowfall which had not been separately observed by the writer had taken place. It was now exposed to continual sunlight, though part of the time the Sun was at a very low altitude, 13°. It is doubtful if the clouds on Mars are ever brighter than 7, unless the snow shines through them.

Dense clouds, extending one-quarter to one-third way from the limb across the disk, were recorded on January 12, ω 335°, February 12, ω 32°, March 1, ω 267°. Smaller clouds were observed on other dates. A very small cloud over the south preceding side of Elysium has several times been recorded. In previous apparitions this has been noted as an exceptionally cloudy area of the planet. A moisture bearing wind from the melting polar cap, coming via Propontis, reaches Charontis at this point, according to the theory of aerial deposition, and sweeps along by Elysium through Cerberus. If Elysium is an elevated region, as has been suggested by some, we can well understand why clouds should form upon its slopes.

Color Changes.

An interesting fact that we have recorded is that at this season of the year the deserts distinctly change their color. Their usual reddish tint seems to have entirely disappeared. This fact had previously been noted by Molesworth in the sixth Report of the Mars Section (Mem. B. A. A. **16** 59), where he states "The general tone of the planet is bright corn color," and again "hardly any red tinge about the continents." His observations were made some seven and twelve weeks later in the Martian year, than those of the writer. A color sketch was made at the last apparition February 26, 1916, M. D. May 16, by the tungsten light, which gave a very satisfying representation of the color of the desert regions of the planet. This color was a trifle redder than that shown in the plate published in connection with the index to the first ten Reports, and coincided in tint almost exactly with No. 12 of the Color Scale published in "The Colors of the Stars and Planets, Part I" (Popular Astronomy **25**, 419). On January 18 of the present year, M. D. May 21, ω 280°, a comparison with this sketch was made, and the color pronounced "excellent". A 9 c. p. tungsten lamp at a distance of four inches, shining through blue glass, was employed to illumine the drawing. Six weeks later, on March 1, M. D. June 6, ω 250°, the drawing was pronounced "much too red", and the color of the planet was found to lie about halfway towards No. 11 on the Color Scale. That this change in color of the deserts is not due to cloud is shown by the fact that it is permanent even with the best of seeing, when minute detail and very faint canals are visible. It is therefore an actual surface change, implying that the deserts so-called are not wholly barren at this season, when there is so much moisture present in the atmosphere. It is clear that any material capable of wholly or in part neutralizing the red tinge of the soil by reflected light must be a greenish hue.

In order to measure the color more accurately, a color wedge five inches in length has been prepared, one end of which matches No. 12 on the Color Scale, and the other end No. 11. It is viewed through a round one-inch hole in a piece of black cardboard held against it. By means of it, it has been found possible to determine the color of the surface of the planet within one tenth of one division of the scale. Thus on March 5, ω 194°, the color was found to be 11.4, and later, at ω 222°, it was recorded as 11.5. March 6, ω 164°, it was 11.4, and March 13, ω 71°, 11.3.

The greens of the maria have not been very conspicuous this year, although detected on several occasions. With the tungsten light and blue glass the color effect is much less noticeable than with the direct carbon filament, such as was used during the apparition of 1914. Excepting for the reds and yellows, a yellow source of light is of little value for the determination of colors. When well seen this past year the color of the maria might properly be described as greenish, or greenish grey. It is like the color of our pine clad hills when seen at a distance of one or two miles. For a considerable portion of the time however no color at all was visible; the maria were simply grey.

An investigation has been undertaken to determine the least width that a colored stripe must possess in order that its color may be distinctly recognized as such. A piece of paper was tinted so as to match the various colors already recorded on Mars, and then cut into narrow strips two millimeters in width. These were then pasted upon another piece of paper colored to match the deserts of the planet, and viewed at night by the tungsten light, so placed as to give a brightness and color equal to that of the planet, when viewed in the telescope with a magnification of 660. No trace of color could be detected at 420 cm, breadth of strips 96″. At 300 cm, breadth 138″, a distinction could be seen between the brown and the blue, and at 240 cm, 168″, all the colors could be distinguished, but even at 120 cm, 336″, one could not be quite certain that the green was not a light blue. Even with a much brighter illumination only slightly narrower strips of color could be recognized, but as the illumination decreased the requirement of a greater width was much more marked. Dark tints were more readily recognized than lighter ones. It was concluded from these experiments that with a magnification of 660 a canal must be at least 0″.2 in width in order to determine whether its color was blue, brown, or grey.

At the present opposition this would imply a width of at least 60 miles, which would eliminate all of the finer canals. On February 18, ω 303°, seeing 7 to 8, it was recorded that Thoth and Nilosyrtis were neither blue nor grey, but both of them brown, and of the same color as the polar marsh. At that time their widths were each 150 miles, and there was no question as to their color, which distinctly differed from that of the grey maria.

Hourly Changes in Brightness.

A noticeable phenomenon this year was that in certain longitudes, especially in the region south and preceding Boreosyrtis, stretching from the Syrtis major to Elysium, the deserts tend to darken as the Sun rises higher and higher upon them, the darkening first becoming conspicuous about Martian noon. By the Martian afternoon they are often very dark indeed. The same phenomenon is observed, though less strikingly, on the deserts south of Acidalium and south of Propontis. The first two are the regions where the meridional band had been recorded earlier in the season. The effect is clearly due to the action of the Sun, since the shading is not seen at all in the morning hours in the region preceding the Syrtis, nor in that south of Propontis preceding Charontis. We can only attribute it to a gradual warming and thawing of the ground, which leads to the interesting result that on Mars it freezes at night even in the equatorial regions of the planet. Frosts are seldom visible there, however, although on March 3, M. D. June 8, ω 245°, it was recorded that there was a white area on the limb following the Syrtis of brightness 9, while the brightness of the polar cap itself was only 8. Since it was white as well as very brilliant, it appeared that the frost or snow completely covered the ground. With its rare atmosphere and greater distance from the Sun than our earth, perhaps the surprising feature is that tropical frosts are not more frequently recorded there. We shall presently see that at least one other such has been noted this year.

The darkening observed occurs on both sides of Thoth, but never following, or to the west of Nilosyrtis. The moisture appears to stop there in the great marsh, and from that point to be distributed only through the maria to the south of it. A striking result of the darkening of this region is that Thoth, although always a conspicuous object in the Martian mornings, is occasionally detected with some difficulty in the Martian afternoons at this season of the year, being confused with the swampy or muddy regions on either side of it. Thus we find that during the past two apparitions of the planet and a portion of this one considering only the interval when Mars was within two months of oppsition, that Thoth was visible in the Martian afternoons after passing the central meridian between 2^h and 3^h, eight times, and was invisible three times. On the other hand in the Martian mornings between 3^h and 2^h previous to passing the central meridian, Thoth was visible every time that the planet was observed, or six in all. It was never concealed during the morning hours. In this investigation the longitude of Thoth was taken at 261°, and the values of ω considered lay between 216° and 231°, and between 291° and 306°. On watching it disappear the canal would seem to gradually fade out into the darkness of the surrounding regions.

It is very certain, however, that the canal itself is not visible at all seasons of the year, even in the Martian mornings.

In 1913 it was first detected at ⊙ 328°.2, diameter of the planet 8″.4.
In 1914 it was last seen at ⊙ 72°.0, diameter 5″.9.
In 1915 it was first detected at ⊙ 0°.4, diameter 6″.7.
In 1916 it was last seen at ⊙ 82°.0, diameter 8″.6.
In 1917 it was first detected at ⊙ 29°.1, diameter 5″.6.

It thus seems to have appeared later in the Martian year at each apparition, although the diameter of the planet in each case was smaller. While this may have been due in part to the relative positions of the Earth and Mars in their orbits, this is not thought to be the complete explanation. In 1915 October 18, ⊙ 359°.9, when Thoth should have been within 10° of the central meridian, ω 271°, it certainly was not visible, though there was no meridional band to conceal it. The next night, ω 258°, seeing 10, it was very faintly seen and three nights later, ω 228°, it was quite distinct. It is believed to have really formed at this time. In 1917 September 29, ω 268°, it was concealed by the wide meridional band traversing the planet. On November 3, ω 285°, the band persisted, but was narrower. This band is believed to have been an extensive swampy area. Thoth was probably concealed by the bordering swamps, but two nights later, ω 265°, it was conspicuous, the swamps being less developed so early in the day. In 1914 it and its neighbouring swamps gradually faded out. In 1916 the writer was absent from the Observatory when it should have disappeared, and so cannot say what happened.

Flooding of the Syrtis Marsh.

Three interesting illustrated reports, a portion of which relate to this region, have been received from our associate Mr. McEwen, of Glasgow, Scotland. On December 2, M. D. April 31, ω 292°, he reports the Syrtis as very faint, while that portion of Boreosyrtis known as Caloe Palus was described and drawn as almost black (Figure 1). Large quantities of water had evidently collected at that point, while the Syrtis appears to have been partially hidden by cloud. The region following it towards Sabaeus was recorded as white. The writer observed this region December 6, ω 302° (Figure 2). Caloe was not then noticeable, and the Syrtis was only moderately dark, number 4 on the scale of 10.

On December 9, ω 238° (Figure 3), Mr. McEwen shows no notable darkening in Caloe, but the Syrtis region was partially concealed by a meridional cloud, brightest over Libya. Three hours later on the same night, ω 285° (Figure 4), this region was observed by the writer, but the cloud had then disappeared, and the Syrtis was beginning to darken perceptibly in the vicinity of the marsh. Brightness now only 3. Thoth was concealed although Casius was visible. It was recorded that preceding the Syrtis towards the terminator there was a whitish region indicating wide spread cloud. This was unusual.

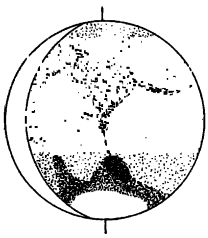

FIG. 1. Dec. 2 192°

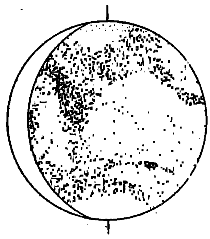

FIG. 2. Dec. 6 302°

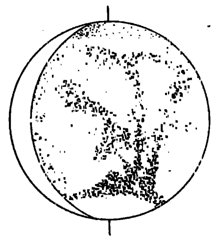

FIG. 3. Dec. 9 238°

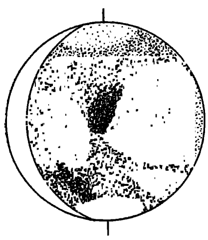

FIG. 4. Dec. 9 258°

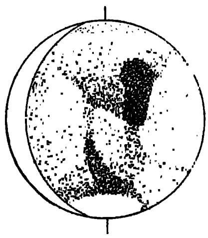

FIG. 5. Dec. 11 267°

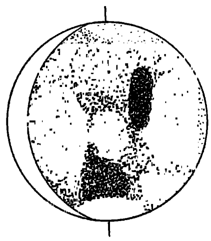

FIG. 6. Dec. 12 267°

December 11, ω 267° (Figure 5), the southern border of the marsh in the Syrtis had now become fairly defined, its color had turned bluish, and its brightness was reduced to 2. The region of Libya had also turned dark, the northern border of the "mare" advancing notably, fully 300 miles (500 km) within two days at this point.

December 12, ω 267° (Figure 6), the marsh narrowed somewhat, was clearly blue, and of brightness 2. Very faint clouds were still seen towards the terminator. The northern marsh in Boreosyrtis now increased conspicuously in size, and was presumably getting ready for another transfer of its waters to the south. But this we were not to see, since it could only be recorded by observers well to the west of us, if any such existed, who were observing the planet during the early morning hours, when alone it was visible.

This set of drawings shows very clearly how the work of two observers located in different longitudes may be combined so as to supplement one another, thus giving results which are much more instructive and valuable than the work of either taken by itself. It also shows how an enthusiastic amateur, although working only with a small telescope, if he has grit enough to observe systematically, under the rather discouraging circumstances involved in rising on many cold winter mornings before sunrise, sometimes finding only inferior seeing, may yet achieve interesting results, leading to advances in our knowledge of the heavenly bodies. These particular results if it had not been for Mr. McEwen would certainly have been lost to science.

At the next presentation of the planet, on January 12, the marsh in the Syrtis was bluish, and extended to the southwest as far as the preceding end of Sabaeus. Six days later it had retreated 600 miles to the north, and was then clearly blue. January 22 this was confirmed, and the change since January 12 pronounced marked. On February 9 a dark area extending as far as Margaritifer had formed in Aurorae. Its brightness was only 3, while that of the rest of the "mare" was 4. Three days earlier it was not visible. Three days later it had quadrupled its area. It was evidently analogous to the Syrtis marsh, but had less depth of water, and showed no blue color. It bore the same relation to Acidalium that the Syrtis marsh did to Boreosyrtis. Of the three outlets to the northern polar cap, it is clear that more than one-third of the water goes by way of the Syrtis marsh. It appears to feed the maria all the way from Tyrrhenium to Hellespontus inclusive. Acidalium although presenting the largest free liquid surface on the planet does not seem to be of any greater importance. It would appear to feed the maria from Sabaeus to Solis Lacus and Aonius. The Castorius-Propontis discharge is evidently a minor matter, merely feeding Sirenum and Cimmerium. Cerberus itself as a storage reservoir corresponds to the Syrtis marsh and to Aurorae.

Another interesting observation of Mr. McEwen's was made on December 16, M. D. April 44, ω 153°. He described and drew a very bright streak located in latitude 10° south, and stretching from the limb to the central meridian. He represents it as white, and he states that it was brighter than the polar cap. It was clearly another case of tropical frost, which remained unmelted throughout the morning, and lasted well into the afternoon until about half past two o'clock Martian local time, before it finally disappeared.

It is well known that at the time of the summer solstice the north pole of the Earth receives from the Sun over 36 per cent more heat in the course of the twenty-four hours than reaches the equator. The reason that the pole is colder in spite of this fact is in part due to our dense atmosphere, which absorbs and reflects away the heat, in part to the clouds in our polar regions, and especially to our melting polar cap. All of these conditions prevail to a far less extent on Mars than on the Earth, and it is very likely that at the summer solstice the mean daily temperature at his pole is comparable to that at his equator. Nevertheless a minute north polar cap, not less than 400 miles in diameter, is a permanent feature of the planet, so we may argue that the mean daily temperature of his equator throughout the year cannot be far from the freezing point. Since his days are certainly much warmer than his nights, we may therefore expect to detect an occasional early morning equatorial frost at any season of his year when there is a sufficient amount of moisture in his atmosphere to deposit it. The fact that these tropical frosts have been detected at the season just preceding the summer solstice would lead us to believe that there was then an unusual amount of moisture in the Martian atmosphere, a conclusion which the recent melting of the northern polar cap seems to fully justify.

In Report No. 18 attention was called to the fact that Mars could be profitably observed this year until the time of "Transit Meridian of Greenwich" as given in the almanac dropped to 4^h, or until August 24. It was also pointed out that the Physical Ephemeris of the planet in the American, and in all the European Almanacs, was unfortunately only computed as far as July 2. Application was made to Professor Eichelberger, and he very kindly forwarded me all the blanks, formulae, and constants necessary to continue the computation. This has now been done by Miss C. M. Hall, under the supervision of Mr. Maxwell Hall, the well known astronomer and meteorologist of Jamaica, and the writer has pleasure in presenting the results herewith to the readers of these Reports, hoping that they may find them useful.

Table I contains the usual data of the drawings up to date.

EPHEMERIS FOR PHYSICAL OBSERVATIONS OF MARS, 1918.
FOR GREENWICH MEAN NOON.

Noon		Light Time	Stellar Magnitude	P	A⊕+180°	D⊕	A⊙−A⊕	D⊙	⊙♂
		m	+	°	°	°	°	°	°
July.	2	10.69	0.8	27.55	277.01	24.96	+42.33	+16.16	136.78
	4	10.81	0.8	27.99	278.12	24.92	42.22	15.85	137.78
	6	10.92	0.8	28.43	279.24	24.87	42.09	15.54	138.78
	8	11.04	0.9	28.86	280.37	24.82	41.94	15.21	139.78
	10	11.16	0.9	29.29	281.52	24.75	41.78	14.89	140.79
	12	11.27	0.9	29.72	282.68	24.67	41.61	14.56	141.80
	14	11.38	0.9	30.14	283.85	24.58	41.42	14.22	142.81
	16	11.50	0.9	30.55	285.03	24.48	41.23	13.88	143.83
	18	11.61	1.0	30.96	286.22	24.37	41.02	13.53	144.85
	20	11.72	1.0	31.37	287.43	24.24	40.80	13.18	145.87
	22	11.83	1.0	31.76	288.65	24.10	40.58	12.82	146.90
	24	11.94	1.0	32.15	289.87	23.96	40.34	12.46	147.93
	26	12.04	1.0	32.52	291.10	23.80	40.10	12.09	148.96
	28	12.15	1.0	32.89	292.34	23.62	39.85	11.72	150.00
	30	12.26	1.0	33.25	293.58	23.44	39.59	11.35	151.04
Aug.	1	12.36	1.1	33.59	294.84	23.24	39.33	10.97	152.09
	3	12.47	1.1	33.92	296.10	23.03	39.06	10.58	153.13
	5	12.57	1.1	34.24	297.37	22.81	38.79	10.19	154.19
	7	12.67	1.1	34.55	298.64	22.58	38.51	9.80	155.24
	9	12.77	1.1	34.84	299.92	22.33	38.23	9.40	156.30
	11	12.87	1.1	35.12	301.20	22.07	37.94	9.00	157.36
	13	12.97	1.1	35.38	302.49	21.80	37.65	8.59	158.43
	15	13.07	1.1	35.63	303.78	21.51	37.36	8.18	159.50
	17	13.16	1.2	35.86	305.08	21.21	37.06	7.77	160.57
	19	13.26	1.2	36.07	306.38	20.90	36.76	7.35	161.65
	21	13.35	1.2	36.26	307.68	20.58	36.47	6.93	162.73
	23	13.45	1.2	36.44	308.98	20.25	36.17	6.50	163.82
	25	13.54	1.2	36.60	310.28	19.90	35.87	6.08	164.90
	27	13.63	1.2	36.74	311.59	19.55	35.57	5.64	166.00
	29	13.72	1.2	36.86	312.90	19.18	35.27	5.21	167.09
	31	13.81	1.2	36.95	314.22	18.80	34.97	4.77	168.19
Sept.	2	13.90	1.2	37.03	315.53	18.40	34.68	4.33	169.30
	4	13.98	1.2	37.09	316.84	18.00	34.38	3.88	170.40
	6	14.07	1.2	37.12	318.16	17.58	34.08	3.44	171.52
	8	14.16	1.2	37.13	319.47	17.15	33.79	2.99	172.63
	10	14.24	1.2	37.13	320.79	16.72	33.50	2.54	173.75

EPHEMERIS FOR PHYSICAL OBSERVATIONS OF MARS, 1918.—CONT.
FOR GREENWICH MEAN NOON.

Noon		*k*	Diameter	*i*	*q*	*Q*	Central Meridian	Mean Time of Transit of Zero Meridian: of date		of intermediate date	
			″	°	″	°	°	h	m	h	m
July	2	0.881	7.85	40.44	0.94	113.38	258.15	6	58.6	7	38.4
	4	0.881	7.76	40.43	0.93	113.35	238.81	8	18.2	8	58.0
	6	0.881	7.68	40.42	0.92	113.32	219.44	9	37.8	10	17.6
	8	0.881	7.60	40.39	0.91	113.28	200.06	10	57.4	11	37.3
	10	0.881	7.52	40.36	0.90	113.23	180.67	12	17.2	12	57.0
	12	0.881	7.45	40.31	0.88	113.18	161.27	13	36.9	14	16.8
	14	0.882	7.37	40.25	0.87	113.12	141.86	14	56.8	15	36.7
	16	0.882	7.30	40.19	0.86	113.05	122.43	16	16.6	16	56.6
	18	0.882	7.23	40.12	0.85	112.98	102.99	17	36.6	18	16.5
	20	0.883	7.16	40.03	0.84	112.90	83.54	18	56.5	19	36.5

EPHEMERIS FOR PHYSICAL OBSERVATIONS OF MARS.—CONTINUED.

Noon		k	Diam.	i	q	Q	Central Meridian	Mean Time of Transit of Zero Meridian of date		Mean Time of Transit of Zero Meridian of intermediate date	
July	22	0.883	7.09	39.94	0.83	112.81	64.08	20	16.5	20	56.6
	24	0.884	7.03	39.85	0.82	112.72	44.62	21	36.6	22	16.6
	26	0.884	6.97	39.74	0.80	112.61	25.15	22	56.6	23	36.7
	28	0.885	6.91	39.63	0.79	112.50	5.67	..	....	0	16.8
	30	0.886	6.85	39.52	0.78	112.38	346.18	0	56.8	1	36.9
Aug.	1	0.886	6.79	39.39	0.77	112.25	326.68	2	17.0	2	57.1
	3	0.887	6.73	39.26	0.76	112.10	307.18	3	37.2	4	17.3
	5	0.888	6.68	39.12	0.75	111.95	287.67	4	57.4	5	37.5
	7	0.889	6.62	38.98	0.74	111.80	268.16	6	17.6	6	57.7
	9	0.890	6.57	38.83	0.73	111.63	248.64	7	37.8	8	18.0
	11	0.890	6.52	38.68	0.72	111.45	229.12	8	58.1	9	38.3
	13	0.891	6.47	38.52	0.70	111.26	209.59	10	18.4	10	58.6
	15	0.892	6.42	38.36	0.69	111.06	190.06	11	38.7	12	18.9
	17	0.893	6.38	38.19	0.68	110.85	170.52	12	59.0	13	39.2
	19	0.894	6.33	38.01	0.67	110.63	150.98	14	19.4	14	59.6
	21	0.895	6.28	37.84	0.66	110.39	131.44	15	39.7	16	19.9
	23	0.896	6.24	37.65	0.65	110.15	111.90	17	0.1	17	40.3
	25	0.897	6.20	37.47	0.64	109.90	92.36	18	20.4	19	0.6
	27	0.898	6.16	37.28	0.63	109.63	72.81	19	40.8	20	21.0
	29	0.889	6.12	37.08	0.62	109.35	53.26	21	1.2	21	41.4
	31	0.900	6.08	36.88	0.61	109.06	33.72	22	21.6	23	1.8
Sept.	2	0.901	6.04	36.68	0.60	108.76	14.16	23	42.0	..	....
	4	0.902	6.00	36.48	0.59	108.45	354.61	0	22.1	1	2.3
	6	0.903	5.96	36.27	0.58	108.13	335.06	1	42.5	2	22.7
	8	0.904	5.93	36.06	0.57	107.79	315.51	3	2.9	3	43.1
	10	0.905	5.89	35.84	0.56	107.45	295.95	4	23.3	5	3.5

TABLE I.

DATA OF THE DRAWINGS.

No.	1917, 8		⊙	M. D.		Long.	Lat.	Sun	Diam.	Seeing
4	Oct.	4	14°3	Mar.	30	214°	+17°6	+ 5°8	4″9	7
5	"	"	"	"	"	229	"	"	"	7
6	"	10	17.1	"	35	159	18.4	6.9	5.0	7, 8
7	"	22	22.7	"	47	43	20.2	9.0	5.3	9
8	"	26	24.5	"	51	8	20.6	9.7	5.4	7
9	Nov.	3	28.2	Apr.	2	285	21.4	11.1	5.6	7
10	"	5	29.1	"	5	265	21.6	11.4	"	10
11	"	28	39.5	"	27	52	22.8	15.0	6.5	5
12	Dec.	2	41.4	"	31	1	22.9	15.6	6.6	5
13	"	5	42.6	"	34	332	23.0	16.0	6.7	9
14	"	6	43.1	"	35	330	"	16.1	6.8	11
15	"	"	"	"	"	302	"	"	"	10, 11
16	"	9	44.4	"	38	285	"	16.5	6.9	9, 8
17	"	11	45.3	"	40	267	"	16.8	7.0	8, 10
18	"	12	45.8	"	41	267	"	16.9	7.1	9
19	"	14	46.7	"	43	237	"	17.2	7.2	7, 5
20	"	15	47.1	"	44	252	"	17.3	"	7, 5
21	"	17	48.0	"	46	212	"	17.6	7.4	7, 10
22	"	21	49.7	"	49	178	22.9	18.3	7.6	11, 8
23	"	27	52.3	"	55	108	22.8	18.8	7.9	5
24	Jan.	2	55.0	May	5	63	22.7	19.4	8.3	6, 7
25	"	11	59.0	"	14	356	22.4	20.4	9.0	6, 4
26	"	12	59.3	"	15	300	"	20.5	9.1	11
27	"	"	59.4	"	"	335	"	"	"	6, 7
28	"	14	60.3	"	17	331	22.3	20.7	9.2	11, 9
29	"	22	63.8	"	25	236	22.0	21.4	10.0	8, 6
30	"	"	"	"	"	261	"	"	"	8, 7

TABLE I.—CONTINUED.

No.	1917, 8		⊙	M. D.		Long.	Lat.	Sun	Diam.	Seeing
31	Jan.	26	65.5	May	28	176	21.9	21.7	10.4	8, 7
32	Feb.	1	68.1	"	34	125	21.8	22.2	10.8	7, 6
33	"	"	"	"	"	150	"	"	"	7
34	"	6	70.3	"	39	64	21.6	22.5	11.4	6
35	"	9	71.5	"	42	60	"	22.7	11.8	11, 9
36	"	"	"	"	"	91	"	"	"	11, 9
37	"	12	72.9	"	45	354	"	22.9	12.0	6, 5
38	"	"	"	"	"	32	"	"	"	7
39	"	16	74.7	"	49	303	21.5	23.1	12.4	6, 7
40	"	17	75.0	"	50	328	"	"	12.6	9, 10
41	"	"	"	"	"	347	"	"	"	9
42	"	18	75.5	"	51	293	"	23.2	"	7, 8
43	"	19	75.9	"	52	279	"	"	12.8	10, 8
44	"	27	79.4	June	4	264	"	23.6	13.4	5, 4
45	Mar.	1	80.4	"	6	241	21.5	23.6	13.5	6, 4
46	"	3	81.2	"	8	241	"	23.7	13.7	6, 5
47	"	5	82.1	"	10	181	"	"	13.8	9, 8
48	"	"	"	"	"	212	"	"	"	8, 7
49	"	6	82.5	"	11	130	"	23.8	13.9	10
50	"	"	"	"	"	155	"	"	"	10, 9
51	"	13	85.5	"	17	60	21.6	23.9	14.1	7, 8
52	"	14	86.0	"	18	88	"	"	"	11, 10
53	"	16	86.8	"	20	34	21.7	"	14.2	9

The following canals and lakes have been identified:—

Oct. 4 **E** Cerberus.
" 10 **D** Charontis.
" 22 **B** Lunae lacus.
Nov. 3 **F** Nilosyrtis.
" 5 **E** Thoth, Casius, Nilosyrtis.
Dec. 5 **A** Protonilus, Deuteronilus, Oxus, Gehon, Siris.
" 6 **F** Protonilus, Deuteronilus, Oxus, Gehon, Siris, and Ismenius.
" 9 **F** Casius, Nilosyrtis, Protonilus.
" 11 **E** Thoth, Casius, Nilosyrtis, Protonilus.
" 12 **E** Thoth, Casius, Nilosyrtis, Protonilus.
" 14 **E** Thoth, Casius, Nilosyrtis, and Nuba.
" 15 **E** Thoth, Casius, Nilosyrtis.
" 17 **E** Hades, Cerberus, Cyclops, Eunostos, Hyblaeus, Chaos, Styx, Hephaestus, Casius, Thoth, Nepenthes.
Dec. 21 **D** Hades, Cerberus, Eunostos, and Charontis.
Jan. 2 **B** Nilokeras, Ganges, Uranius, Ophir, Daemon, and Lunae.
" 11 **A** Indus.
" 12 **F** Casius, Thoth, Nilosyrtis, Phison, Protonilus, Deuteronilus, Arnon, and Ismenius.
" 12 **FA** Protonilus, Deuteronilus, Siris, Gehon, and Ismenius,
" 14 **A** Protonilus, Deuteronilus, Gehon, and Ismenius.
" 22 **E** Cerberus, Cyclops, Eunostos, Hyblaeus, Chaos, Styx, Hephaestus, Thoth, Casius, Nilosyrtis.
" 26 **D** Orcus, Cerberus, Styx, Chaos.

Feb.	1	**C**	Gigas, Pyriphlegethon.
"	6	**B**	Nilokeras, Ganges, Nectar, Ophir, Daemon, Fortuna, Tanais, Ceraunius, Clarius, and Lunae, Tithonius, Solis.
"	9	**BC**	Nilokeras, Ganges, Uranius, Ceraunius, Fortuna, Nectar, Ophir, Daemon, Tithonius, Phasis, Eumenides, Gigas, Pyriphlegethon, and Lunae, Solis, Tithonius, Ascraeus.
"	12	**B**	Deuteronilus, Indus, Ophir, and Ismenius, Lunae.
"	16	**F**	Nilosyrtis, Protonilus, Deuteronilus, and Ismenius.
"	17	**FA**	Nilosyrtis, Protonilus, Deuteronilus, Pierias, Callirrhoe, Iaxartes, Astaboras, Phison, Asopus, Typhonius, Orontes, Gehon, Oxus, Indus, and Caloe, Ismenius, Arethusa, Sirbonis.
"	18	**F**	Casius, Thoth, Nepenthes, Nilosyrtis, Astusapes, Protonilus.
"	19	**F**	Casius, Thoth, Nepenthes, Nilosyrtis, Astusapes, Protonilus, Pierias.
"	27	**E**	Thoth, Nilosyrtis.
Mar.	1	**E**	Cerberus, Thoth, Nilosyrtis.
"	3	**E**	Hades, Cerberus, Eunostos, Hyblaeus, Chaos, Styx, Cyclops, Hephaestus, Thoth, Nilosyrtis.
"	5	**DE**	Acheron, Erebus, Pyriphlegethon, Hades, Cerberus, Cyclops, Eunostos, Hyblaeus, Chaos, Styx, and Propontis I.
"	6	**CD**	Gigas, Eurotas, Brontes, Hebrus, Hades, Granicus, Cerberus, Styx, and Castorius, Propontis I, Arsenius, Stymphallus.
"	13	**B**	Nectar, Ophir, Hyperboreus, and Solis, Tithonius.
"	14	**B**	Nectar, Ophir, Daemon, Fortuna, Phasis, and Solis, Tithonius.
"	16	**B**	Calirrhoe, Deuteronilus, Hyperboreus, Nectar, Ophir, Daemon, Dardanus, Tanais.