Compliments of the Author.

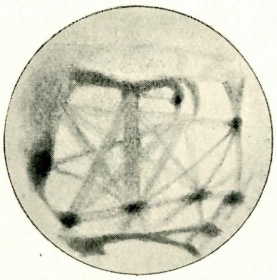
Feb. 11.99

Mars.

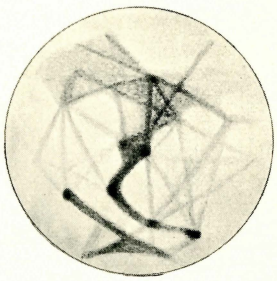
A. E. DOUGLASS.

Reprint from POPULAR ASTRONOMY.

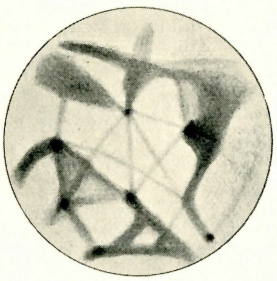
PLATE IV.



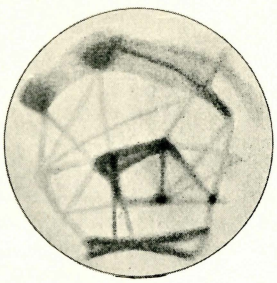
Dec. 31. $20^h\ 52^m$—$22^h\ 10^m$
Seeing 5 and 6
Powers 370 and 500
$\lambda = 342$



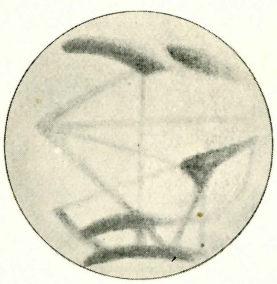
Jan. 4. $20^h\ 24^m$—$21^h\ 12^m$
Seeing 3 to 7.
Power 500
$\lambda = 298$



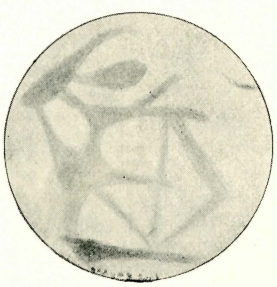
Jan. 5. $18^h\ 42^m$—$19^h\ 10^m$
Seeing 2 to 5.
Power 370
$\lambda = 260$



Jan. 9. $17^h\ 27^m$—$18^h\ 55^m$
Seeing 2 to 4
Powers 370 and 500
$\lambda = 208$



Jan, 18. $20^h\ 30^m$—$20^h\ 52^m$
Seeing 2 to 4.
Power 370
(Aperture reduced to 7 inches.)
$\lambda = 173$



Jan. 21. $16^h\ 30^m$—52^m
Seeing 0 to 2.
Power 370
$\lambda = 87$

DRAWINGS OF MARS

January, 1899.

(G. M. T)

MARS.

January, 1899.

A. E. DOUGLASS.

For Popular Astronomy

During a recent trip East, the writer visited the Chamberlain, Yerkes, Naval, Flower and Harvard Observatories (at Denver, William's Bay, Washington, Philadelphia and Cambridge) and at each point made observations of Mars in the early morning. Of all these, the view at Washington was the best. The detail visible was the Syrtis Major and the regions following it. A number of canals were very distinct and so well seen that they presented a doubled appearance such as has since been seen at times. Upon obtaining this view, it seemed as if, after all, our claim for remarkably good seeing at Flagstaff might not be well made; for, at a point in the East where there was no pretension of seeing fine planetary markings, it was possible to trace with ease a number of canals. But not long after returning to this Observatory, a good night appeared, notwithstanding the winter weather, and the view of Mars was so vastly superior to the best that was visible in Washington that the seeing seemed to be not merely improved quantitatively but to be of an entirely different quality. The Planet stood out before its dark background like a beautiful colored print in which there was a vast amount of detail and a beautiful blending of soft hazy greens, light grays, pronounced yellows and pure white. Work on such an object is a pleasure from an artistic point of view.

The view in Washington seemed of a different quality from this. The colors were not clearly defined and distinct one from another but rather there seemed a general yellowish tint over the whole planet. Perhaps this was due to the special quality of the seeing. Curiously enough, Mr. Anderson described the night as a poor one while at the Flower Observatory, where planetary markings were not easily seen, the night was called somewhat superior. This disagreement occurred because the atmospheric requirements for seeing fine planetary markings are not the same as for micrometer measures of double stars or measures of diameters of planets, and are invariably more difficult to obtain.

The accompanying drawings give the present appearance of the planet.* They have been made at various times since the last day of December and are reproduced as exactly as possible from the originals. It will be noticed that the planet is practically circular. This, of course, is on account of its nearness to opposition, which took place on the 18th of January. On each observation up to that of January 9th, it was apparent that the terminator appeared slightly darker than the limb. On that day the terminator appeared fully as bright as the limb or brighter, but of a different color, namely, yellow instead of white. I have associated this yellowish tint of the terminator with the fact that the afternoon regions of the planet in general appear hazy and lack contrast in their detail, and by the analogy of our own equatorial regions, in which the air is calm in the morning but in violent motion in the afternoons, conclude that it is the same on Mars as with us, the haziness being due to dust in the air and its color to the fact that it is dust and not moisture. The white in the morning portions of Mars comes from the purer air of that hour and perhaps from the deposition of frost.

The North Pole of the planet is now turned well towards us for the first time since so great interest has been displayed in this planet by Americans and therefore the detail becomes specially interesting. The season corresponds to our April and the polar cap is of great size extending almost to latitude 60 degrees as judged by comparison with Schiaparelli's map. All the detail in the Northern hemisphere is well developed and the markings in the vicinity of the polar cap show very dark. In the opposition which succeeds this or in the later part of this opposition we may expect the polar cap to have receded to a marked degree and to disclose much detail nearer the poles than that which is now apparent.

Upon comparing the present appearance of the planet with the maps and drawings presented in Flammarian's great work on Mars, we find that we now see as far north on the planet as was seen in the opposition of 1881 and '82 but more canals appear in the region between the equatorial seas and the north polar cap than are shown in the drawings of that period. The configuration, however, is much the same. In the configuration of the large canals or markings near the polar cap there are now

* The seeing at this season is usually very bad although the nights may be very clear. Practically no time has been given to observations of the satellites but Deimos was easily seen by the writer on Dec. 22nd and Phobos was probably seen by Mr. Cogshall on that same night, that is; stars were seen of the proper brightness and in the proper places as given in the ephemeris.

many points of striking similarity to the drawings of Perrotin and Thollon made in 1886 and also to Schiaparelli's general map of his observations from 1877 to 1888.

However, some changes of much importance are evident, of which the most conspicuous is in the (Martian) eastern outline of Syrtis Major. The changes in this region seem to be secular rather than seasonal, that is, while probably varying with the season, there is a marked difference between the same season in different years. Such changes in this region were noticed long ago. Flammarian calls attention to the difference between the drawings of Dawes in 1864 and those of Schiaparelli in 1879 to 1888. The oppositions of 1864 and '79 were similar as regards season and the appearance of markings should have been the same in each. Schiaparelli himself remarks upon the changes in this outline which occurred during his long series of observations. (See diagram in "Mars," p. 439) He shows that in 1877 the sea was very narrow in an East and West direction in the latitude of Lacus Moeris. In 1879 to '82 the width has doubled. In 1884 to '88 it was nearly tripled. From personal observations, I can continue by saying that in 1892 to 1896 in that same region, the width was quadrupled. This, be it noticed, was in an opposition presenting the same seasons as in '77 to '81 when the sea was nearly its narrowest. In the present opposition of 1898 to '99 it seems to have returned to almost the same configuration that it had in 1879 to '82. As an inference from these facts, we can state in general that the seasonal change of the Syrtis Major at the vernal equinox is a drying out but in the years 1894 to '96 the drying out came very late; that is, during those years there was an extra abundance of moisture in that region, and therefore a persistent dark tint to the vegetation. This supposition of abundance of water in those years is corroborated by the fact that in 1894, at least, the projections on the terminator due to clouds were extremely numerous.

Libya, which in past times has been so noted for its brightness, has this time also been seen highly illuminated. A bright, nearly continuous band has been seen stretching from Libya through the region of Schiaparelli's Nix Atlantica shown in his map of 1877 to '86 and thence passing for a long distance along the northern side of Nilosyrtis. At one point near the northern end of this canal a bright spot appeared on its southern side. Edom Promontory also shows with it customary conspicuousness. On one occasion a long, very narrow, brilliant line appeared on the extreme southern edge of the polar cap, in the longitudes of Syrtis Major and Sinus Sabaeus.

Elysium shows as in the old drawings of twenty years ago as surrounded by a circle of dark markings but these are soluble into individual canals and oases. Instead of the double canals on the (Martian) south and east side I get the impression of systems of canals inclined at small angles to each other forming triangles; for instance, Cerberus appears as a narrow isosceles triangle with its fine vertex towards the southwest and the Hades appears as a similar area with its vertex towards the south.

Besides showing canals in the light region, the drawings show some in the dark parts of the planet, which agree in general with drawings made here in 1894 and 1896 (for 1894 see Annals of the Lowell Observatory, Vol. I. For 1896 compare Cerulli's observations). Owing to the marked lightening or drying up of the Syrtis Major region new details of great interest have appeared, especially near its darkest parts. Of course the study of those regions is under the disadvantage of the extra tilt of the south pole away from us, thus making them appear at a considerable inclination. Seas still further to the south than the Syrtis Major present in their canal system a very close agreement with the records of the last two oppositions.

On the other hand the regions well in the northern hemisphere such as Mare Acidalium, Lacus Niliacus, Ceraunius, etc., show to advantage and exhibit a canal structure similar to the southern dark regions.

In connection with this subject some historical points are worth noting. In 1862 Lockyer and others made some drawings which show ill-defined and meaningless streaks in the dark regions. In 1877 Von Ertborn having used an instrument of a little over 4 inches aperture, represents canal-like marks emerging from the Syrtis Major in south and southwest (Martian) directions. The former very probably is the canal afterwards seen by Professor W. H. Pickering in 1892 and to which he gave the generic name of "River System." The seas represented in Perrotin and Thollon's map of 1886, are very canal-like in their narrowness but were yet regarded as seas; and the same remarks apply to some of Schiaparelli's work. *

Professor Pickering's first drawing of a canal in the dark regions was on June 24, 1892. On the 16th and 17th of the following month, he drew the canal above referred to, stretching from the Syrtis Major up towards the south polar cap, and branches

* These data are from Flammarian's "Mars."

to it, and called the whole a river system. This was published in the Autumn of that same year and in the description, under date of August 1, he even applies the name of canal to it. (*Astronomy and Astro-Physics*, Vol. XI, pp. 668-849.) Altogether six drawings by Professor Pickering and eleven by the writer showing these canals were made between July 16 and September 22. Professor J. M. Schaeberle at the Lick Observatory drew a number of these canals and recognized them as a distinct feature of the planet, by calling attention to the "streaks" in the dark region. (Pub. A. S. P., IV, 197; V, 127.)

It was in 1894 that the writer's chief work was done and in the following opposition. During the present opposition the winter weather has thus far prevented micronometer observations of the dark region canals.

No observations of any consequence have yet been made at this opposition upon irregularities of the terminator. In 1892 a fair number were seen; in 1894 they were extremely numerous; in 1896 a fair number were observed, while at present they seem to be very scarce. These are of interest and importance in studying the meteorology of the planet. One class of them however seem difficult of explanation, namely the "cusp-knobs" or high projections near the cusps. These were seen both in 1892 and 1894 and frequently appeared to project many miles beyond the true limb, (from 30 to 60 miles). Of course cloud height could be greater on Mars as the atmosphere decreases in density on ascent much more slowly than with us. I mention them now chiefly to call attention to the fact hitherto almost unnoticed, that they were seen in 1892 as well as in 1894.

LOWELL OBSERVATORY, Flagstaff, Arizona.

February 11, 1899.