LOWELL'S OBSERVATIONS OF THE PLANET MARS.[1]

IN the year 1893 the important volume on Mars, entitled "La Planète Mars et ses Conditions d'Habilabilité," was noticed in these columns (vol. xlvii., p. 553). This work, the outcome of an immense amount of labour on the part of M. Camille Flammarion, brought together every available observation and piece of information that could be gathered from published and unpublished works. In fact, the history of the observations made on this interesting planet was traced from the time of the earliest record (1636) down to the opposition of 1892.

Fourteen years have now elapsed, numerous workers have been busy studying his surface markings, and steady progress has been made in corroborating old and discovering new features. The time seems, therefore, ripe for a work supplementary to that above named which should bring together the mass of valuable material which is now scattered through many different pamphlets and journals.

Such an undertaking would undoubtedly consume much time and labour on the part of the compiler, but would prove a valuable addition to the literature of planetary astronomy.

Failing such a work at the present time, we have, however, a volume which will not only fill up the gap temporarily, but will reduce to a very considerable extent the labour of the future compiler to whom reference is made above.

This very handsome and valuable publication gives a detailed account of the observations made by Mr. Percival Lowell himself during the oppositions of 1894, 1896, and 1903; the supplement to the volume contains the observations of Mr. Douglass, assisted by Mr. Drew, at the opposition of 1898, owing to Mr. Lowell's absence through illness, and of Mr. Lowell and Mr. Douglass at the 1900 opposition.

In the arrangement of the subject-matter Mr. Lowell follows the classic memoirs of Schiaparelli, considering each opposition by itself, and adopting a chronological and topographical order for the observations themselves. In this way, during an opposition, the story runs "on in time while making meanwhile the circuit of the planet."

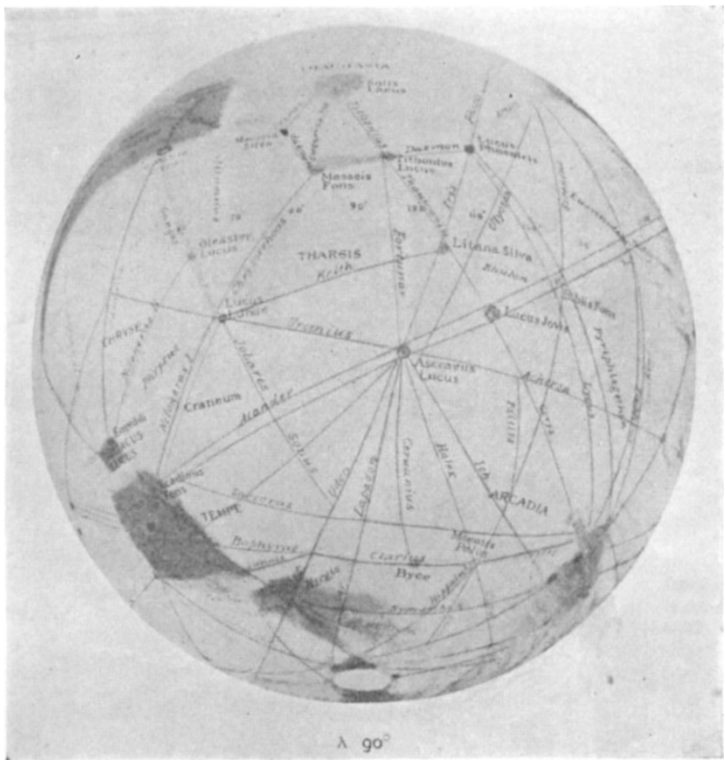

FIG. 1.—Lowell's drawing of Mars at longitude 90° at the opposition of 1903, showing Solis Lacus near the top.

As is well known, Mr. Lowell preserves Schiaparelli's nomenclature, which he refers to as an "at once appropriate and beautiful scheme." He makes, however, one important change, which is necessitated in the light of advance of our knowledge of the interpretation of the planet's markings. In the place of "Lacus" he adopts the word "Lucus," an alteration of a single letter, for markings which were previously considered to represent water are now looked upon as probably oases of land. It was Mr. W. H. Pickering's observations and deductions which first suggested this inversion of the then general idea of the dark and light shadings, and this knowledge was considerably extended by Mr. Lowell's observations.

In the observation of details on a planet's surface it is well to bear in mind that the power of the telescope is of less importance than steadiness and clearness of the air and keenness of the observer's vision. In fact, Schiaparelli's observations of the canals made with his 6-inch telescope were not corroborated at once by observers who were armed with very much more powerful instruments.

That keen-eyed observer Dawes was accustomed to cut down the aperture of his telescope according to the kind of night experienced. Thus he termed his observing nights 6-inch night, 4-inch night, &c., according to the "seeing."

In considering Mr. Lowell's observations of Mars, the reader must bear in mind that, unlike most astronomers who make their observations from where the observatory is permanently situated, Mr. Lowell investigated the "seeing" conditions of a great number of regions in order to choose the most efficient spot for the observation of planetary details, and hence the position for his observatory. The steadiness of the air at Arizona thus allowed him to use larger apertures efficiently, and, coupled with his keen sight and expertness in this kind of observation, his observations are of the first importance. He, like Dawes, found that the aperture of the telescope had to be suited to the night. Thus of the opposition of 1900–1, using a 24-inch refractor, he writes (p. 101):—

"Observations were made with the 24-inch objective of the observatory and usually with the full aperture of the objective. On occasions, however, this was capped down to an aperture of 12 inches; an optical device which usually improved the seeing; . . . but because by so doing the harmful effects of the air currents were reduced. For the same reason at times even the 6-inch could be serviceably used."

[1] "Observations of the Planet Mars, during the Oppositions of 1894, 1896, 1898, 1901 and 1903, made at Flagstaff, Arizona." By Percival Lowell. ("Annals of the Lowell Observatory," vol. iii., 1905.)

At the opposition of 1894 an 18-inch glass made by Brashear was employed, but for the oppositions of 1896 and later the 24-inch objective mentioned above was made and mounted for the observatory by Alvan Clark and Sons, "the last glass, as it chanced, of that famous firm."

Even at Flagstaff Mr. Lowell was not content with the astronomical conditions of seeing all the year round. For this reason, at the opposition of 1896–7, he determined to try the conditions in Mexico for the winter months; observations were therefore terminated in November, 1896, and not resumed until December 30. In the meantime the dome and telescope were transported and set up at Tacubaya, near the city of Mexico, in latitude 19° 26′ N. This temporary change resulted in a long series of post-opposition observations.

With regard to the method of recording the observ-

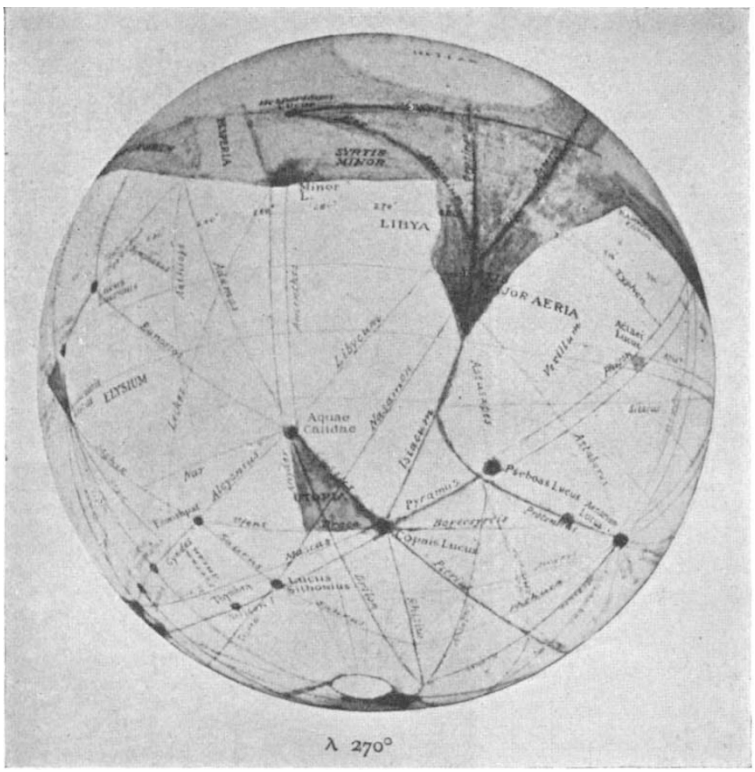

FIG. 2.—Longitude 270° at the opposition of 1901 with Syrtis Major near the centre of the disc (Lowell).

ations, drawings, notes, and micrometer measures formed the usual routine. The drawings were made on circles about 40 mm. in diameter, a convenient size for combining "most satisfactorily sufficient space with possibility of keeping proportions." As a rule, we are told, the drawings were of the complete disc, and were made as nearly instantaneously as possible.

Coming now to the observations themselves, and the numerous clear drawings which accompany them, it seems extremely difficult to refer to any particular set of them, as they are all so full of interest. The observations bring out, however, very clearly the apparent discrepancies which have arisen between observations taken of the same region, but at different times, by well-known Martian observers. Thus, to take a case in point, in the opposition of 1894 Mr. Lowell relates how, in observing the region about Syrtis Major, which was central on the disc, the most prominent features were tongues of shade which lay between Hellas and Naochis, and nearly joined the Syrtis to the blue band bordering the cap. "For the rest no detail could be made out upon the disc, except for two dark spots where the coast-line dipped to enter the Great and Little Syrtes respectively; the only salient points these of an otherwise featureless face. Not only was there no sign of a canal, but even the main markings showed dishearteningly indefinite."

Such an apparent lack of markings was, as Mr. Lowell points out, a matter of the Martian date. It was, as he says, "the very nick of time to see nothing. For the part of the planet most presented to the earth was then at the height of its dead season." Mr. Lowell states, further, "when we consider that such is always the face the planet shows when at its nearest to the earth, and that till lately such time was commonly chosen for examining its disc, it is small wonder that previous to Schiaparelli the strange canal-system should have escaped detection."

The above extracts will, we think, convey to the reader the pitfalls into which the Martian observer can stumble in consequence of the seasonal changes on the planet.

Again, Mr. Lowell gives instances of markings which undergo a secular variation covering many years. Thus a conspicuous single canal, called by Lowell Sitacus, connecting the eastern fork of the Sabaeus Sinus with the north-east corner of Aeria, was not seen by Schiaparelli. It was such a salient feature in 1894 that he could not have missed it had it been there. Cerulli noticed it in 1896, and it has been seen at all subsequent oppositions as a fairly conspicuous canal. This canal exemplifies, as Mr. Lowell says, "the truth of a deduction of Schiaparelli that the canals were curiously subject to secular wax and wane."

Another canal, Ulysses, unrecorded by Schiaparelli, which in 1894 was comparable in strength with the Gigas or the Titan, is a further instance of secular change.

It is interesting to note that Mr. Lowell gracefully explains the great difference between the number, 183, of canals seen at Flagstaff at the opposition of 1894 and that recorded by Schiaparelli, 79, as "due solely in consequence of better observational conditions of one sort and another."

Among other results of this opposition was the clear detection of the seasonal change; an increase in the number of the oases which lie at the intersection of the canals; an extension of the canals in the dark regions which conclusively showed that the dark areas were not "seas"; observations on the changes of shades of the dark areas showing that they were not bodies of water; and, finally, peculiar markings, termed "nicks," were observed where the canals entered the light regions.

Space does not permit one to enter into anything like detail with reference to the observations made at the succeeding oppositions. In that of 1896 there was sufficient evidence to show that, as Schiaparelli had pointed out, the doubling of the canals was not wholly a seasonal effect. Another observation of

importance was the identification of a rift in the snow-cap with the subsequent canal called Jaxartes.

In the opposition of 1900 the Phosin and Euphrates were always seen double, as in 1896. Mr. Lowell suggests that probably the two epochs of gemination of the canals on Mars as laid down by Schiaparelli may not be epochs of gemination, but epochs of greater conspicuousness of the gemination at one time than at another; this would bring apparently discordant facts into line.

During this opposition Solis Lacus was not seen with its usual distinctness, and it is inferred that as it was at its dead season it had turned sear and yellow. White equatorial spots of long duration were an important feature at this time.

The observations of 1903 were very fruitful with results, and special reference should be made to the relationship between the oases and the double canals.

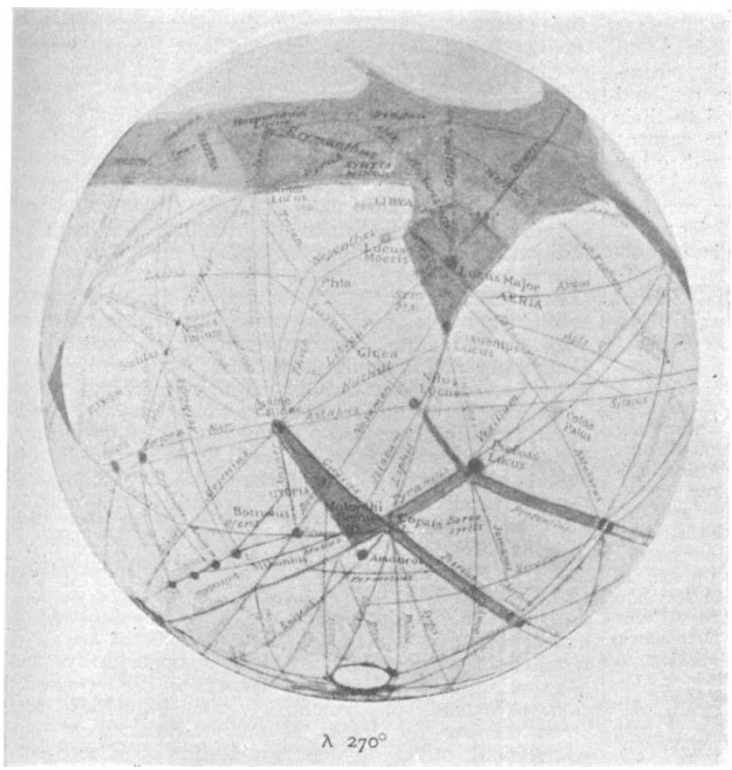

FIG. 3.—The same longitude (270°) as in Fig. 2 from observations made at the opposition of 1903 (Lowell).

The reader should also direct his attention to the semi-annual flux in the development of the canals which was revealed, showing that two waves of development sweep alternately over the planet's surface in the course of one of its years, this being clearly illustrated in Lowell's cartouches.

Regarding the appearance of cloud on the planet's surface, Mr. Lowell is inclined to think that the large, whitish marking named Hellas to the north of Syrtis Major represents either mist or cloud. In the opposition of 1901 it was never seen as white as the polar cap, although it approximated to it more than to all the regions outside of it. He was thus led to believe that it was not formed of snow, but of "something which would thus hold an intermediate position between snow and ground, namely, cloud or mist."

Another, among other references to cloud, is mentioned at the opposition of 1903, in relation to the region about the Mare Acidalium and the pole, this region being obscurely semi-white. On January 23 Mr. Lowell wrote:—"No sharp limit to polar cap. Think it surrounded by spring cloud."

Many other points of interest in connection with these and similar observations might be dwelt on at some length, but the reader must be referred to the volume itself for a more intimate study.

In addition to a good index to the volume, there is a special index of the names on the maps and globes. In the latter there are fifty-four regions, 392 canals, and 172 oases mentioned, which will give the reader some idea of the number of Martian markings seen at Flagstaff.

In addition to the frontispiece, which is a reproduction from a photograph of the 24-inch equatorial, there are thirteen plates and seventy-six illustrations in the text, all of which are of first-class quality.

Printed in large, clear type on smooth, stout paper, and occupying about 350 pages, the volume contains a valuable increase to our knowledge of Mars, and forms a handsome addition to the astronomical library.

On the production of this volume Mr. Lowell and his staff are to be sincerely congratulated, the more so that since its publication success has rewarded their endeavours in recording the canals of Mars on a photographic plate (Roy. Soc. Proc., Ser. A, vol. lxxvii., p. 132).

WILLIAM J. S. LOCKYER.

THE PLACE OF THE MODERN UNIVERSITY IN THE STATE.

THE recent quatercentenary celebrations of the University of Aberdeen, and especially the speeches of the venerable Chancellor of the University on that occasion, again direct the attention of thoughtful men to the vital connection between national efficiency and well-being and the provision made by a State for the higher education of its people in modernised universities. The presence of the King and Queen to open the new buildings at Marischal College serves admirably to accentuate the fortunate fact that in their endeavours to provide this country with institutions adequately equipped to supply instruction of the highest grade and with facilities for research in all departments of knowledge, our statesmen, our men of science, and our men of wealth are receiving some of that encouragement of their efforts which it is the power of our Sovereigns to bestow.

The brilliant gathering of learned men eminent in every sphere of human endeavour, and representative alike of science, art, and letters, may be taken as a happy augury of the unanimity that prevails to spare no effort in the pressing work of supplementing and extending the supply of seats of the highest learning in every part of the country, with a view to place Great Britain on terms of equality with other great nations in the keen competition which is the outstanding characteristic of international relations at the beginning of the twentieth century.

With these evidences of educational enthusiasm and endeavour before us, it seems a fitting opportunity to consider briefly what appears to be the current