III. *Observations of Mars, at Madeira, in August and September* 1877.

By N. E. Green, Esq.

The Instrument.—These observations were made with a reflecting telescope of the Newtonian form, furnished with a 13-inch speculum, figured by Mr. Geo. With, of Hereford. The frame was mounted as an altazimuth, open at the sides, thus giving free access to the external air. The powers employed were from 200 to 400, the one most frequently used giving an enlargement of 250 diameters. The instrument was first erected at an elevation of about 1,200 feet, and afterwards moved to a situation 2,200 feet above the sea. Particulars of its performance, and the opportunities for observation afforded by the climate and atmosphere of Madeira, may be seen in the *Monthly Notices*, vol. xxxviii., No. 1, November 1877.

The Drawings.—The twelve views which accompany this paper were selected from forty-one drawings, all of which were made direct from the telescope; the endeavour in the selection being to give a view of the planet at intervals of about two hours. The longitudes have been kindly supplied by Mr. Albert Marth. An earnest effort has been made to preserve the truth and character of the original drawings and to make the lithographic print a facsimile of those produced at Madeira. It may be remarked with regard to drawings of the planets generally, that they are necessarily exaggerations. When the eye has been taxed to the utmost to observe the form of some delicate marking, any shade which the hand could apply to a drawing, and which could be trusted to remain as a memento of the observation, would be far beyond the strength of the reality. But the value of the representation need not therefore be unduly depreciated; for if a proportionate amount of

force be given to all the details, it is still useful as expressing the general character of the object, and valuable as exhibiting a fair relation between its several parts.

A critical examination of the various views, and especially those which more immediately follow each other, will discover some discrepancies of form or position in the markings; but it was thought better to retain these errors, pointing out where they occur, than to correct them, especially as some valuable hints with regard to astronomical drawings generally may be derived from these imperfect operations of the eye and hand.

Nomenclature.—In the index to these drawings, and in references to them in this paper, the names employed are those used to designate the various markings in the maps of the planet published by Mr. Proctor from a series of drawings by Mr. Dawes. To these a few other names have been added where the forms appear to have been observed for the first time.

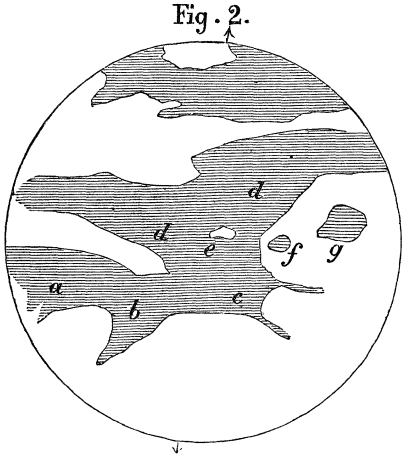
It has also been considered desirable that the name of the same observer should not be given to several markings, but that each definite form should have some name to distinguish it from all others; a change is therefore made in the name of the Lockyer Sea, which in the index bears the name of Dr. Terby, &c.

Figures 1, 2, and 3.—These drawings, the product of the night of September 1, were made under the most favourable atmospheric conditions; definition, good at the first, became magnificent as the night advanced, and it would be difficult to exaggerate the keen map-like appearance of the planet on this occasion. The views differ considerably from the previously accepted forms of this portion of the Martial surface; but they are fairly sustained by drawings made at Greenwich by Mr. Christie and Mr. Maunder, by those of Mr. Brett at the Land's End, by the observations and maps of Professor Schiaparelli at Milan, and also by the drawings of Dr. Terby at Louvain, and Professor Trouvelot at Cambridge, U.S.

In the first of these drawings part of the Kaiser Sea, *q*, is just disappearing at the western limb. Dawes Forked Bay, the "*a*" of Beer and Madler, from which their longitudes were reckoned, has just passed the meridian, and is followed by a long bay tending N.W., called Burton Bay in the index. To the east of Burton Bay there is a broader form extending towards the

north-east and terminating in a point, and it may be observed that in Fig. 2 this same mark is represented as having a square termination, called Christie Bay in the index, the alteration of form being due to the better definition produced by advance towards the centre of the disk. It may be remarked

Fig. 2.



in connection with this difference of form in these two drawings, that whenever an elongated dark form was imperfectly seen, there was a great tendency to prolong its shape into a point or a line. It is possible that this tendency of the eye to see, or suppose that it sees, a continuation to an indefinite shape, may account to some extent for the attenuated lines in some of Mr. DAWES' views of the planet, and also for the remarkable dark canals, extending into the lighter portion of the surface, so strongly depicted in the maps of Professor SCHIAPARELLI. These remarks acquire peculiar force when taken in connection with the effort to see and to draw the surroundings of the Lockyer Sea (now Terby Sea, *g*). This sea is usually represented as united to the De la Rue Ocean, *d*, by a dark canal, and it had exactly this appearance in momentary glimpses during the earlier portion of the night on which these three drawings were made; but as definition improved, this apparent strip contracted into a definite point, *f*, which was seen clearly and sharply separate from the surrounding markings. It is interesting to state that in a Greenwich drawing, by Mr. CHRISTIE, August 30, $12^{h}\cdot15$, this dark point* appears as a bay in connection with the De la Rue Ocean, and thus it would doubtless have been represented in the Madeira series but for the

* *See* the remarks of Dr. Dreyer, *post*, p. 136.

exceptionally fine definition of the night of September 1. In a drawing by Professor Schiaparelli this dark spot is clearly separated from the De la Rue Ocean excepting on the south, where it is joined to the ocean by a short dark canal. As this dark spot has been observed for the first time in the opposition of 1877, and is therefore without a name, we would suggest Lake Schiaparilli as an appropriate designation. Should this spot be again visible during the opposition of 1879, it will serve admirably for a recalculation of the axial rotation, as it was observed at Madeira to be exactly at the centre of the disk on September 1, $14^{h}\cdot20$ G.M.T. Northwards from this dark spot there may be seen in Figs. 2 and 3 the squarish form we have named Christie Bay, and from each angle a faint tone of shade extends eastward. The one nearest to the dark spot Lake Schiaparelli is the only trace that could be observed of what appears in Mr. Proctor's maps as Dawes Sea. Westward from Lake Schiaparelli may be seen in Figs. 2 and 3 a white spot, *e*; this is doubtless the snow island of Mr. Proctor's map. It was observed by Mr. Maunder, of Greenwich, on October 2, $10^{h}\cdot4$, and also by Professor Schiaparelli on more than one occasion, but appeared to him to vary in its brightness. To the west of the polar cap there was seen on this evening, at $10^{h}\cdot40$, a separate point of light, *w*, Fig. 1, which in all probability was snow still resting on elevated ground after it had melted from the lower levels. This point shone like a star and could not have been overlooked by a careful observer. This light was afterwards seen on September 8, at $12^{h}\cdot30$, but it then presented the appearance of two separate points—*see* Fig. 12; and on September 10, at $11^{h}\cdot30$, a faint line of points was observed concentric with the zone of snow—*see* Fig. 11. These alterations of form were in all probability due to perspective; the single point of September 1 appearing as two when less foreshortened, and these still further separated and increased in number as they were seen nearer the central meridian of the disk. These points of light were not on any occasion observed on the eastern side of the polar cap, and this circumstance possesses peculiar interest in connection with the existence of snow on the planet. For this brilliant appearance of the spots when most to the west of the pole, and their decrease in brilliance when passing the meridian, together with the most significant fact that they were not seen at all on the eastern side, can best be explained by supposing the slopes of the hills that retained the snow

to have a south-westerly aspect; they would thus be sheltered from the Sun's rays during the greater part of a revolution, but fully exposed to its light, and therefore better seen, just as they were passing away towards the western limb. A larger drawing of the south pole is given in the centre of the plate, in which dark valleys breaking the outline may be observed; but the brilliant point is not so truly placed as in Fig. 1, where it appears nearer the outline of the disk. It is interesting to state that this point of light is most clearly and exactly figured in a drawing by MITCHEL, of Cincinnati, U.S., August 30, $4^{h}\cdot55$, 1845, and published by him in the *Sidereal Messenger*. It there occupies the same position on the western limb, and is doubtless connected with some special local configuration. It has been named in the index Mitchel Mount, in memory of that ardent lover of astronomy. Mr. BRETT was observing *Mars* at the Land's End on the night of September 1, and describes this light near the pole as an "auxiliary patch." There is a strange resemblance to the head of an animal in the forms to the east of the De la Rue Ocean. This would doubtless disappear under more favourable optical conditions; the hard lines would then be found to be indented and broken, and the crudities of form disappear as truth advanced. The whole of these parts in Fig. 3 were drawn a little too high on the disk. This is especially the case with the Terby Sea (the Occulus of the Italians); it should be fully its diameter further north.

Figure 4.—The principal interest in this drawing is the evidence that it affords of the presence of cloud on the planet, breaking the continuity of the outline of the De la Rue Ocean, *d*, and in other places obscuring the forms. The eastern edge of this ocean was drawn at Madeira sixteen times, and on each occasion was found to be clearly and even sharply defined; but on September 29 it appeared as in Fig. 4, broken by a mass of cloud, a second mass lying more to the south and within the outline of the sea. These obscurations of portions of the planet's surface are by no means unusual. In the series of drawings made in 1864 by Mr. LOCKYER a portion of the Dawes Ocean to the west of the Kaiser Sea is evidently hidden by cloud, and a similar appearance at the same spot was observed both by Mr. CHRISTIE and Mr. MAUNDER, at Greenwich, on October 16, 1877.

Figure 5.—The general forms of this view are thoroughly sustained in a drawing by Mr. MAUNDER, of Greenwich, on September 26, $10^{h}\cdot29$, and

the agreement of the details is so exact, that together they may be taken to establish the truth of the markings of this portion of the planet's surface, at least at the date on which the drawings were made. The Terby Sea or Occulus appears followed by and connected with a small dark spot tending north-east. This small spot was observed at Madeira, on August 23, to be surrounded with light. In the index this spot, *i*, is named Bessel Lake.

Above this dark spot, in a direction towards the south pole, is a definite dark line, and below it, towards the north-east, there is a faint line of shade, and as both these marks lie nearly in the direction of what was named by Mr. Proctor Bessel Inlet, it is highly probable they gave rise to this snake-like form in the drawings of Mr. Dawes. Towards the north pole in this drawing may be observed a series of delicate shades having a meridional direction, and as these lines do not belong to the permanent markings of the planet, they may be placed amongst the atmospheric effects, and possibly indicate the flow of currents of cold air from the pole towards the equator.

Fig 6.

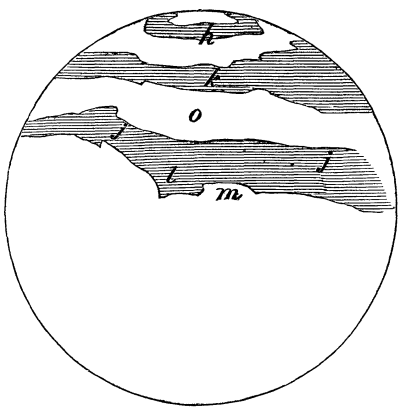


Figure 6.—This view introduces a peculiar series of zone-like markings which extend from longitude 130° to 250° and only cease at the Kaiser Sea. The forces which produce these alternate bands of land and water, if such they be, offer a field of conjecture to those inclined to theorise on such matters. The most prominent dark band in the drawing is that known as Maraldi Sea, *j*; Joynson Sea, *h*, being next the pole. Between these there is a sea, *k*, which may be observed in this and following two drawings, which does not

appear to have been figured before. It is clearly seen in a drawing by Mr. MAUNDER on September 21, $10^{h}\cdot54$, who also has this note attached: "The narrow sea round the polar snow seemed quite separated from the faint sea near it." In the index to these drawings it bears Mr. MAUNDER'S name. In connection with Fig. 6 there is an interesting note on the original drawing to this effect: that when the planet was partly obscured by thin cloud, the contrast between the orange tone of the central portions of the disk and the bluish light surrounding the limb became very evident, and it may be remarked in favour of the transparency of the Madeira air, that it required thin cloud to draw attention to an effect of contrast which was clearly seen and frequently observed under average atmospheric conditions in England. The most prominent mark on this portion of the planet's surface is a dark angle of the Maraldi Sea, *l*, which there forms a deep bay extending towards the equator. This bay is most admirably drawn in a view of *Mars* by Professor TROUVELOT, U.S., on September 30, $10^{h}\cdot10$ C.M.T., 1877, and in the index it is called Trouvelot Bay. There is in this and the following drawing a projection of the light portion of the disk into the northern edge of the Maraldi Sea, lettered *m* in the index. This was seen by Captain NOBLE and carefully drawn by him on September 21, $11^{h}\cdot25$. The land marked *o* in the index, between Maunder's Sea and the sea of Maraldi, has been named Webbs Land, in exchange for the narrow and somewhat doubtful isthmus called Webbs Land by Dr. Terby.

Figures 7 and 8.—In these drawings the long dark form known as Maraldi Sea comes to an end, having extended through more than 100° of longitude. At its north-eastern end a faint winding shade, *n*, may be seen extending towards the north pole; this occurs very nearly in the position of Huggins Inlet and was the only form observed that could have been connected with that shape in the drawings of Mr. DAWES. Fig. 7 shows clearly the commencement of Hooke Sea, *p*, and the bearing of its western end on that of Maraldi, *j*. In this drawing may also be observed the continuation of Maunder's Sea, its extension towards the south pole being shown in Fig. 8. There is an interesting observation in connection with the polar cap in these two drawings. In Fig. 7 it is small and undefined, whereas in the next view, drawn less than two hours afterwards, it recovers its size and clearness of outline. The dark marks surrounding the pole

seem also to be similarly affected—faint and undefined in the earlier drawing, but dark and decisive in the later one. Both Mr. Maunder, at Greenwich, and Mr. Brett, at the Land's End, noticed the reduced and indefinite appearance of the south pole about this date; this appearance of the polar cap was also observed by Dr. Terby, at Louavin, on September 17, and on this occasion he remarks there was an increase of brightness between $8^h{\cdot}30$ and $10^h{\cdot}15$; from the Madeira drawings it would appear that a similar clearing up of the Martial atmosphere occurred on the night of September 18. It may be objected by some, that the reason for the better definition of the pole in Fig. 8 is to be found in the later hour and greater elevation of the planet; but the notes on the original drawing do not support this view, for the definition, at least as far as it was affected by terrestrial circumstances, had rather deteriorated, the air being more steady at the earlier hour.

Figure 9.—This drawing introduces the grandest mark on the surface of *Mars*, the Kaiser Sea, *q*, which is well within the eastern limb. Lockyer Land, *r*, the large orange patch between the Kaiser Sea and the south pole, becomes also a most important feature. It is difficult to account for the alterations in the form of this land in the three following drawings, yet they seem to be consistent with each other. It gradually decreases in size to Fig. 12; but why it should occupy a larger area in Fig. 9 than in Fig. 11, where it is on the meridian, is somewhat puzzling. The supposition that it is of an oval form, lying obliquely to the equator, will explain some of these changes; for in this case it would come on the disk with its longest axis presented to the eye; whereas, as it passed off towards the west, its shorter axis would in turn be visible.

Figure 10.—The forms represented in this view are fully supported by a drawing made by Mr. Maunder, at Greenwich, on October 15, $7^h{\cdot}12$, 1877. It is also in close agreement with the view of this phase in the grand series by Mr. Lockyer, published in the Society's *Memoirs* in 1862, and all its larger features are evident in a map-like drawing by Professor Schiaparelli; but in his view the light portions of the planet's disk are crossed by various dark canals, which certainly were invisible at Madeira. In justice to the learned and exact professor, it should be remarked that many of these dark canals were only visible to him during the months of February and March 1878. We are therefore presented with the following alternative: either that

vast physical changes had occurred in the atmosphere or on the surface of the planet between September 1877 and the early part of 1878, or that optical effects to which allusion has been already made had some influence in producing these appearances.

Figure 11.—This drawing was made only two hours after that of the previous figure, but definition had in that short interval become superb. The eye-piece employed was an achromatic by Mr. Browning, made especially for these drawings of *Mars*, and finished with the greatest care, its power giving an enlargement of 400 diameters. The atmospheric condition of *Mars* seemed also to be most favourable to the exhibition of minute forms and the most delicate tints of shading and colour. The edge of the polar snowcap was seen to be indented by several projections of the darker surrounding tone, and even in its general mass several delicate changes of tint were observed, indicating ridges and roughness on its surface; below it a series of minute points of light were clearly visible, being the result of the separation of those brighter points of light which had been frequently seen since September 1. Towards the western limb a junction was observed between Zollner Sea, and Hooke Sea, and to the west of the Kaiser Sea a most delicate shading, *s*, was visible somewhat in the position of the form known as Main Sea. This shading was faintly seen on the 15th—*see* Fig. 9—and appears in drawings by Mr. Pratt, of Brighton, and in those by Professor Schiaparelli. On the eastern side of the Kaiser Sea, and in the angle formed by it and Herschel II. Strait, a bay or sea was observed nearly separate from the Kaiser Sea. Immediately to the east of this dark sea there is a brilliant angle of light, *t*, on that part of the Dawes Continent which lies nearest the equator. This part was most carefully observed and drawn by Mr. Banks, at Ealing, in 1862, whose views of the planet were afterwards published in the *Astronomical Register*; to this kind and most amiable friend the writer owes his introduction to the noble science of astronomy, and in the index it is named Cape Banks, in grateful remembrance of his friendship and assistance. The most faint form observed on this occasion was the triangular space of light, *u*, which is seen half way between the Kaiser Sea and Lockyer Land; but as this figures very clearly in a drawing by Mr. Hirst, at Sydney, August 3, $10^{h}\cdot30$, there can be no doubt of its existence. It is also visible in a highly finished and accurate

drawing by Professor Trouvelot, Cambridge, U.S., September 16, $9^h \cdot 40$, Cambridge mean time. The singularly exact agreement between the details of the Professor's drawing of this date and the No. 11 of this series affords the strongest proof of the truth of this representation of the planet's surface.

Figure 12.—On this occasion the orange colour of the Martial continents was particularly evident, together with great refinement in details. The points of light called Mitchel Mountains, to the west of the polar snow, have already received a notice. These are located near longitudes 270° and 280°, and no small amount of interest will attend a search for them on some future favourable occasion.

Of all these views, that represented in Fig. 11 was without comparison the grandest obtained at Madeira. This drawing also, of all the series, most effectually recalls the impression received at the telescope; this sight of *Mars* was felt at the time to be a rich reward for every effort, and will remain, while memory lasts, a constant delight and satisfaction.

GENERAL REMARKS.

Axis.—In No. 1 of the outlines which serve as an index to the drawings an attempt has been made to give the direction of the axis of rotation. This cannot claim in any way to be the result of calculation, but simply that direction which best accords with the movement of the markings across the surface of the planet's disk. The markings seemed always to come on the disk lower towards the east, and to leave it higher on the west, than was consistent with an axis concentric with the polar cap. It is also Mr. Proctor's opinion, from various observations, that the axis of rotation lies just within the eastern edge of the south polar snow as it appeared in September 1877.

Atmosphere.—The principal evidence of atmosphere is the constant fading of the markings and colours as they approach the limb, and it has been remarked by Captain Noble that this fading was more evident on the western than on the eastern limb, indicating that sunrise on *Mars* was generally more clear than sunset. The most decisive evidence of this atmospheric ring within the limb of the planet was observed on September 20,

when the bluish white of this portion was most strongly contrasted with the orange tone of the centre, a contrast which was much increased when observed through thin passing clouds. The northern hemisphere was singularly free from markings, and although on one or two favourable occasions the stronger darks could be traced into it, the general effect was that of atmosphere rather than of surface details. The most remarkable appearance in this hemisphere is shown in Fig. 5, where the meridional lines occur to which reference has already been made. It is far from improbable that the north polar region, which in the opposition of 1877 lay beyond the visible portion of the limb, was not only in darkness but covered by cloud, from which the snow of a future opposition might be condensed and deposited.

Clouds.—The clouds of *Mars* are evidently much less dense than those of the Earth, indeed so much so that no cloud proper can be said to exist in the equatoreal regions. This has been clearly argued by Mr. Brett, though he has been led to consider the snowcaps as cloud formations, a theory which appears to be strongly opposed by the behaviour of those caps, and especially by the sharp definite and fixed points of light left behind by their contraction, which have been seen after many years to occupy the same places, and which points during the opposition of 1877 preserved a fair relative position amongst each other; this at least is not how clouds usually behave. But though of cloud proper there seems but little evidence, of vapour sufficiently like cloud to hide, and that completely, portions of the darkest markings, there is evidence in abundance. In Fig. 4 the outline of the De la Rue Ocean is not only obscured, but a portion of it hidden, by cloud. In drawings 7 and 8 there is evidence of the clearing up of the zone about the south pole, the indistinctness of the polar patch about this time having been noticed by Mr. Maunder, Mr. Brett, and Dr. Terby. In the Greenwich drawings of 1877, and those in 1862 by Mr. Lockyer, parts of Dawes Ocean were hidden occasionally by a light which was not always observed in that position. In addition to these facts may be mentioned the occasional appearance of white masses, almost rivalling the pole in brightness, which have been observed on the limb near the northern pole, and especially on the eastern side; one of these is figured in a drawing by the writer, published in the *Astronomical Register*, vol. iii., March 1865. These masses of light

were observed upon the limb only, and did not advance within it; they were not therefore attached to the surface, and the only solution we can propose is that they were volumes of cloud or mist, which were dissipated by the rising Sun. Such effects of the Sun's rays frequently occur in our own climate, especially in mountain districts.

Snow.—The argument in favour of the polar cap being composed of snow has in great part been anticipated in the remarks upon Fig. 1. But there is further evidence if it be required. In the drawing of *Mars*, April 20, 1856, published by Mr. De la Rue, the whole of the continent to the south of of the Kaiser Sea is evidently under snow; for at this time the south pole was out of sight, and the form of the white portion is just that of Lockyer Land seen foreshortened. This appearance is also clearly shown in Figs. 3 and 4 of a series of drawings by the author of this paper, published in the *Astronomical Register* in 1873; in these also the south polar cap is out of sight, but the snow extends in an angular form exactly over the position of Lockyer Land. There is also a strong indication of the presence of snow on the line of light that forms the edge of Beer Continent, *v*, near the equator; and it is no extravagant supposition to consider that this continent may be bounded by mountain ranges of great height, as the continents of North and South America, on the western coast, by the Andes. These lines of light are not confined to the edge of Beer Continent, but may be seen on other portions of the surface of the planet, such as Kepler Land to the south of Terby Sea; Hind Peninsula, *x*; and the so-called snow island of Mr. Dawes.

Colour.—An attempt has been made to illustrate this subject in the drawings. The general tone of the central portions of the disk may be described as a warm yellow, heightening into orange on some of the continents, especially on Lockyer Land and Beer and Herschel Continents. The darker portions, supposed to be water, were a greenish grey, partly due to contrast with the orange; but it varied so much in depth and tone, that much of its colour must have been the result of local changes. It was very interesting to observe the delicate alterations in depth of the darker portions, and if depth of tone means depth of water, deep indeed must be some parts

of the Sea of Kaiser. The Terby Sea, or Occulus, was a very dark spot, much darker in proportion than is represented in the drawings; it always caught the eye before any other mark, especially when near the meridian. The atmospheric ring, which generally surrounded the interior edge of the disk, has been already described as a bluish white, but this did not attract so much attention at Madeira as in the English observations.

The thanks of the Author are heartily given to those who have so kindly placed their drawings at his service, for examination and comparison with his own. These are first due to Sir GEORGE AIRY, for his kindness in allowing the use of the Greenwich series by Mr. CHRISTIE and Mr. MAUNDER; and to Mr. CHRISTIE, for his earnest co-operation in the effort to procure other views or information connected with the subject. The drawings of Mr. BRETT have been most serviceable in confirming and supporting the truth of the general forms; and those by Dr. TERBY, Capt. NOBLE, and Mr. PRATT have greatly assisted the investigation. To Professor SCHIAPARELLI the writer is particularly indebted for his prompt reply to the request for drawings, and also to Professor TROUVELOT, between whose views of the planet and those made at Madeira there exists such serviceable agreement.

The thanks of the Author would be most incomplete without a reference to the valuable assistance received from friends at Madeira, especially from Mr. WM. HINTON and family, by whose efficient help the observations were greatly facilitated, while the mind and body of the artist were refreshed and strengthened by constant sympathy and kindness. To Mr. CHARLES R. BLANDY also most sincere thanks are due, for the great interest shown by him in telescopic matters, every help in his power being most generously and kindly given.

One decisive advantage has been gained by this united effort to produce drawings of the planet. There is an evident advance in the knowledge of fixed markings, and the doubts and difficulties which in former years have attended the effort to harmonise conflicting views have in a great measure disappeared—a fairly consistent *Mars* being the product of the memorable opposition of 1877.

ADDENDA.

Since the Memoir on *Mars* was written, the Earl of Ross has kindly forwarded a copy of Dr. Dreyer's views of the planet, made in 1877, at his Lordship's Observatory at Parsonstown. The drawings are accompanied with a few remarks upon the definition of the surface markings.

There is a fair agreement between the drawings by Dr. Dreyer and those produced at Madeira, especially between No. 6 of the Parsonstown series, September 16, $10^h\ 55^m$, and No. 8 of the Madeira views, drawn on September 18, $11^h\ 45^m$.

Amongst the remarks there is one of peculiar interest, showing that similar optical illusions may present themselves to observers separated by great distances, and using instruments of very different light-grasping powers:—

Dr. Dreyer, observing with the three-foot mirror, writes: "Lockyer Sea was always seen of a very regular shape, slightly oval east and west. It appeared to be joined to the De la Rue Sea by an extremely faint and diffused band, but this was considered rather doubtful." This is exactly the character of definition to which allusion is made at page 125 of this Memoir, and refers to the same portion of the planet's surface. Dr. Dreyer would have been justified in connecting the Lockyer Sea with the De la Rue Ocean by a faint band in his drawings, although he might have added a note expressing his doubt as to the exactness of the observation; and, had it not been for the singularly good definition of the night of September 1, at Madeira, this series would have exhibited the imaginary faint band also.

But the small sea called "Schiaparelli" receives a confirmation from Parsonstown. In a letter to the author, Dr. Dreyer remarks: "On my drawing No. 9 there is a small spot nearly midway between Lockyer Sea and De la Rue Sea, and when I read your note in the *Monthly Notices* for December 1877, I thought at once that I had seen and shown on Fig. 9 what you call a very small sea." The special interest connected with these statements is this: that, both at Parsonstown and Madeira, each observer sees at one time a faint band, connecting the Lockyer Sea with the De la Rue Ocean, which band resolves itself, afterwards, into a small spot.

INDEX TO THE MAP OF MARS.

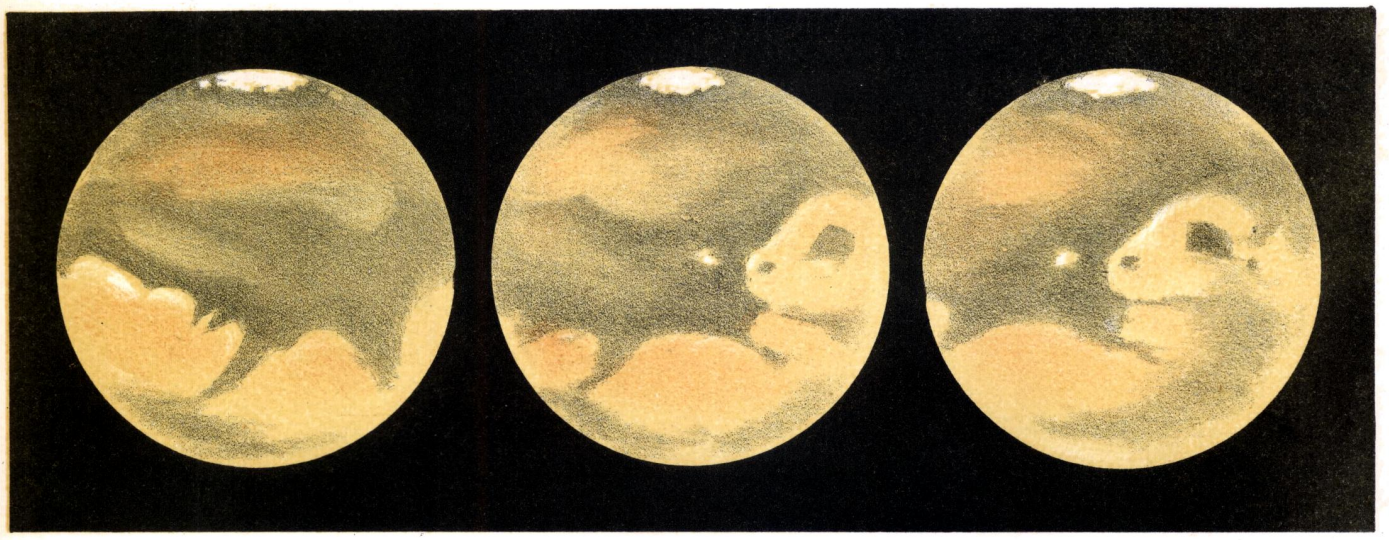
Names.	Approximate Centre.		Remarks.
	Lat.	Long.	
	°	°	
Airy Sea	45 N.	80	
Arago Strait...	25 S.	350	Form indefinite on planet.
*Banks Cape	10 S.	312	De La Rue; Lockyer; Banks.
Beer Continent	20 N.	320	
Bessel Lake	18 S.	98	As the inlet is doubtful.
Browning Land	3 N.	75	
Burchardt Land	25 S.	230	
Burton Bay	5 N.	5	Changed, as Beer has Continent.
Campani Sea	65 N.	80	
Cassini Land	47 S.	245	Indefinite outline on planet.
*Christie Bay	5 S.	60	Kaiser; Lockyer; Christie.
Copernicus Land	12 S.	80	
Dawes Forked Bay	0	352	Named as desired by Dawes.
Dawes Ocean	10 S.	290	Includes several seas (Proctor).
De Tottingnez Sea	65 S.	80	
De Lambre Sea	55 N.	270	The Beer Sea of Proctor.
De La Rue Ocean	20 S.	40	
*Dreyer Island	25 S.	265	Trouvelot; Dreyer; Green.
*Flammarion Sea	15 S.	270	All observers.
Fontana Land	35 N.	210	Very definite in 1873 (Knobel).
*Gill Land	65 S.	180	Maunder; Trouvelot; Green.
*Gruithuisen Bay	9 S.	253	All observers.
*Hall Island	23 S.	48	Dawes; Maunder; Schiaparelli.
Herschel I Continent ...	15 N.	240	
Herschel II Strait	10 S.	340	Very dark and definite.
Hind Peninsula	8 S.	265	
*Hirst Island	20 S.	295	Trouvelot; Hirst; Green.
Hooke Sea	30 S.	245	
Huggins Bay	8 S.	225	The inlet being doubtful.
Jacob Land	50 S.	40	Outlines on planet indefinite.

* Where new names have been introduced the observers are given under remarks.

Names.	Approximate Centre.		Remarks.
	Lat.	Long.	
	°	°	
*Joynson Sea	73 S.	180	Joynson; Maunder; Trouvelot.
Kaiser Sea	5 N.	288	
Kepler Land	28 S.	80	Occasionally very light.
*Knobel Sea	40 N.	10	Burton; Knobel; Green.
Kunowski Land	50 S.	350	Marking on planet indefinite.
Lagrange Peninsula ...	40 S.	120	Lagrange Land of Proctor.
Lambert Sea	50 S.	333	Continues to S. Polar Snow.
Laplace Land	45 N.	305	Formerly Mädler Land.
Lassell Sea	35 N.	335	Very distinct in 1873.
Leverrier Land	35 N.	345	Seen crossed by dark lines (Knobel).
Lockyer Land	50 S.	300	
Mädler Continent	10 N.	40	
Main Sea	0	270	Very faint shade on planet.
Maraldi Sea	28 S.	175	Outlines bold and definite.
*Maunder Sea	55 S.	180	Maunder; Niesten; Trouvelot.
*Mitchel Mountains	73 S.	275	Mitchel; Green; Brett.
Nasmyth Inlet	40 N.	310	
Newton Sea	55 S.	10	Marking on planet indefinite.
*Niesten Isthmus	36 S.	210	Niesten; Trouvelot; Terby.
*Noble Cape	25 S.	185	Noble; Pratt; Green.
Oudeman Sea	40 N.	180	In place of Oudeman Inlet; doubtful.
Phillips Island	15 S.	345	Form on planet indefinite.
*Pratt Bay	28 S.	110	Pratt; Maunder; Green.
Proctor Cape	3 S.	343	Named by Dr. Terby.
Rosse Land	50 N.	40	Rosse Strait being doubtful.
Schiaparelli Lake	16 S.	67	Schiaparelli; Dreyer; Green.
Schmidt Bay...	7 S.	328	Named by Dr. Terby.
Schröter Sea...	55 N.	210	
Secchi Continent	10 N.	135	
Terby Sea	22 S.	84	Changed, as Lockyer has Continent.
*Trouvelot Bay	20 S.	168	Trouvelot; Niesten; Terby.
Tycho Sea	38 N.	50	
*Webb Land	42 S.	180	Terby's Webb Isthmus being doubtful.
Zollner Sea	40 S.	270	Continues to S. Polar Snow.

* Where new names have been introduced the observers are given under remarks.

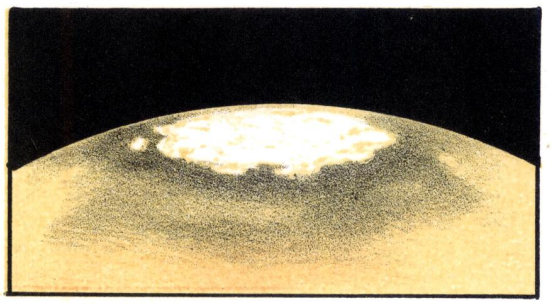
Fig. 1. Fig. 2. Fig. 3.



E

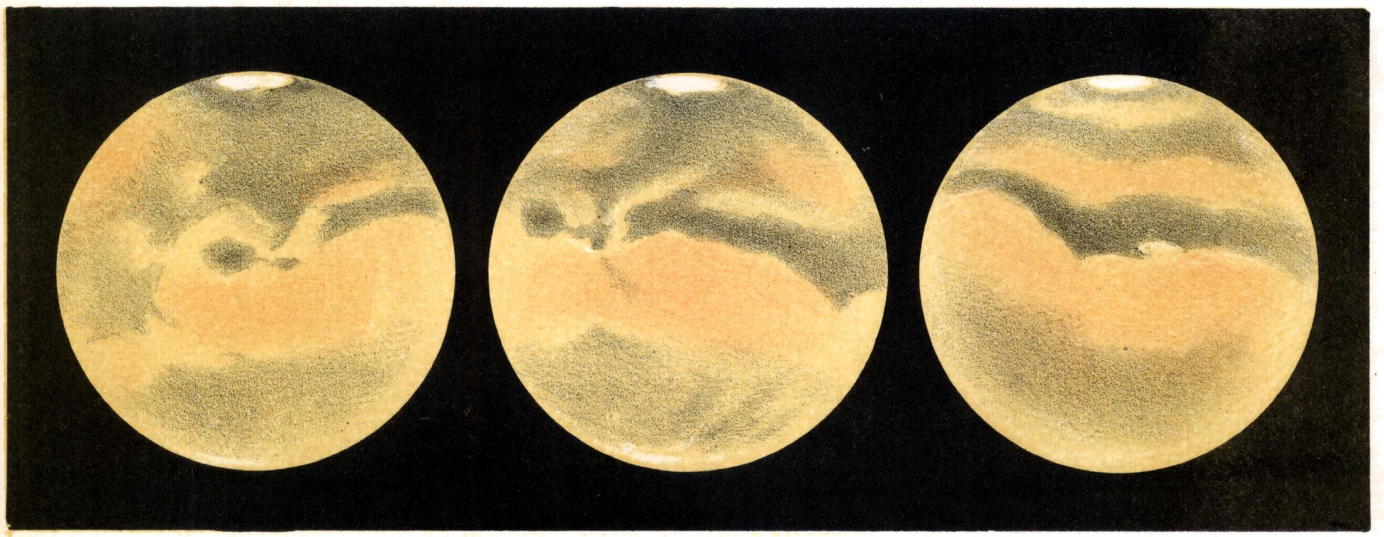
Sep. 1–10h 40m G.M.T. Long. 7°. Sep. 1–13h 10m Long. 43°. Sep. 1–14h 20m Long. 60°.

SOUTH POLE.



Sep. 1–10h 40m.

Fig. 4. Fig. 5. Fig. 6.

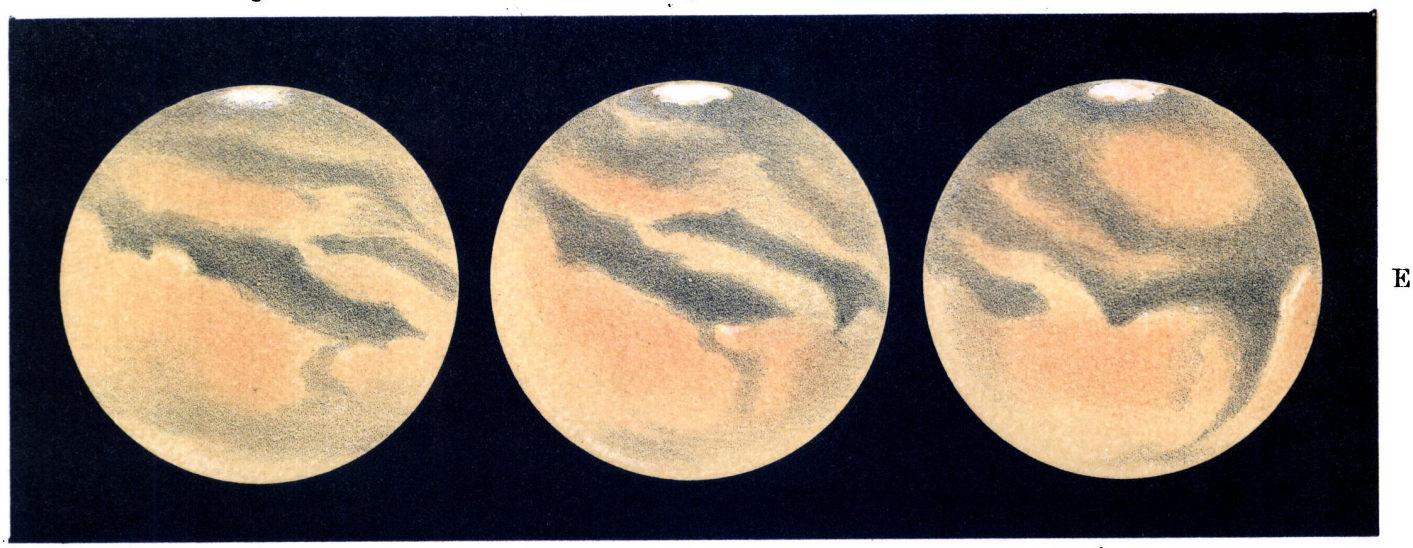


E

Sep. 29–9h Long. 94°. Aug. 21–12h 30m Long. 131°. Sep. 20–9h 5m Long. 175°.

N.E. Green del. et lith. 13 in. Speculum by Geo. With. powers 200 to 400. Hanhart imp.

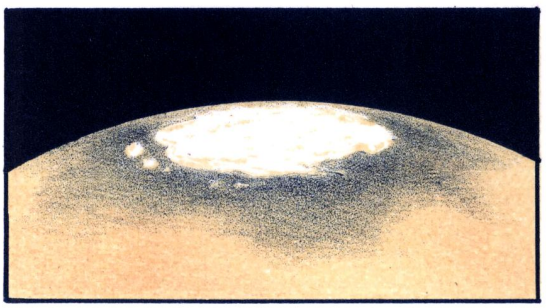
Fig. 7. Fig. 8. Fig. 9.



W E

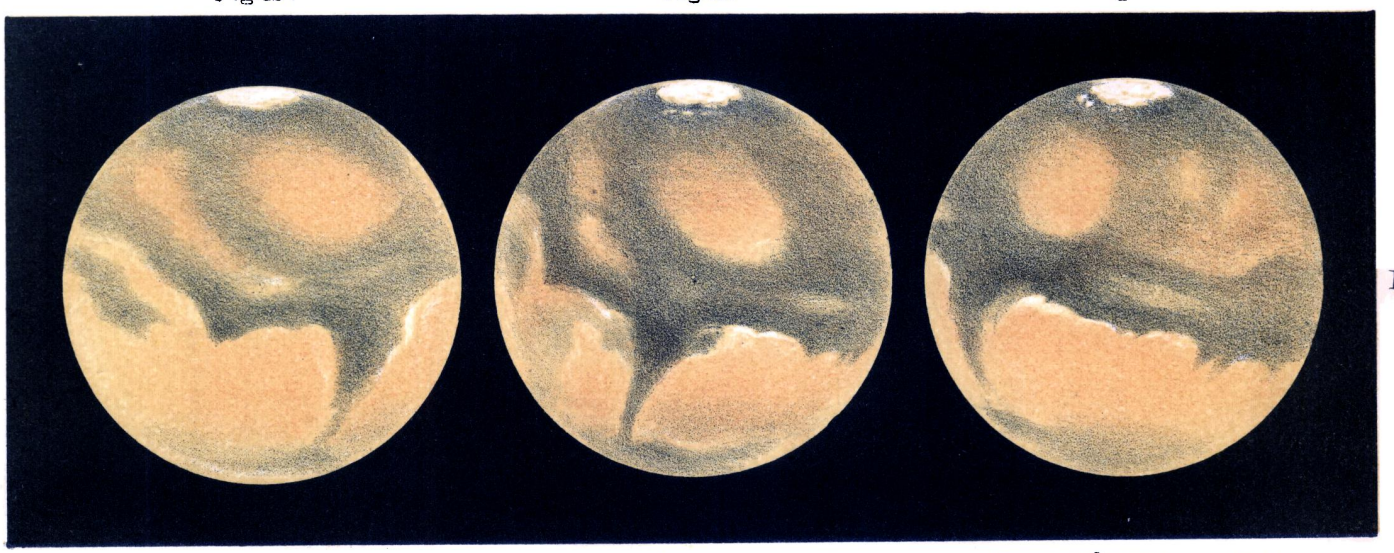
Sep. 18 - 10h 10m Long. 209°. Sep. 18 - 11h 45m Long. 232°. Sep. 15 - 11h 10m Long. 250°.

SOUTH POLE.



Sep. 8 - 12h 30m

Fig. 10. Fig. 11. Fig. 12.



W E

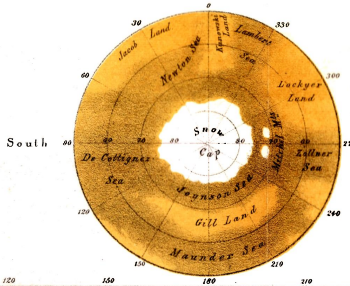
Sep. 10 - 9h 15m Long. 267°. Sep. 10 - 11h 20m Long. 297°. Sep. 8 - 12h 30m Long. 332°.

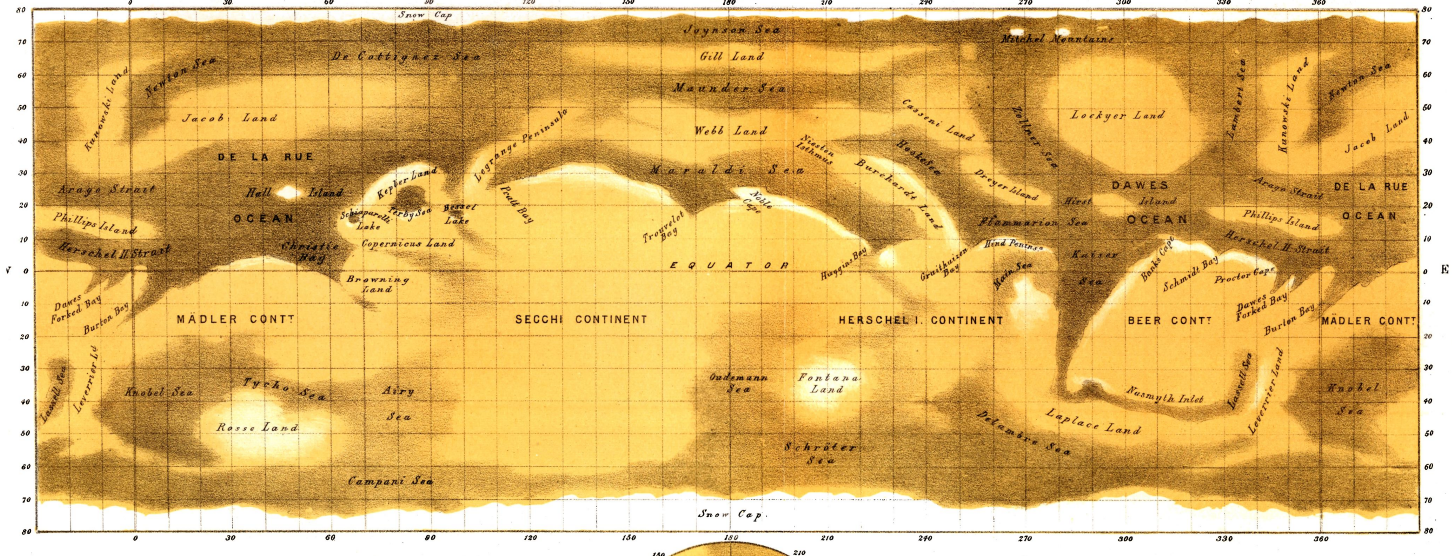
N.E. Green. del. et. lith. 13 IN. SPECULUM BY GEO. WITH. POWERS 200 TO 400. Hanhart imp.

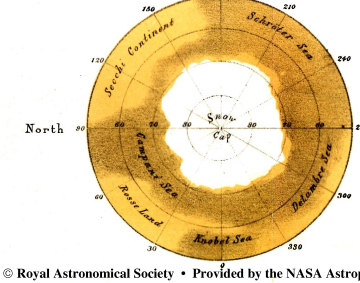
CHART OF MARS.

From drawings at Madeira in 1877,

by N.E.Green.







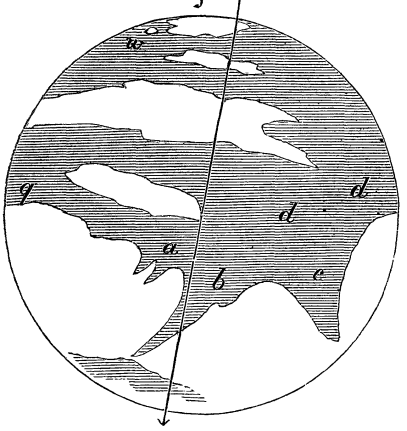
The details of this chart have been compared with views of the planet by Schiaparelli, Trouvelot, Terby, De la Rue, Lockyer, Knobel, Christie, Maunder, Brett, Dreyer, and others. No form is introduced that has not been confirmed by the drawings of at least three observers.

The northern portion of the chart is supplied from drawings made in 1873, and may be considered provisional. The names with a few exceptions are those employed by Mr. Proctor in his chart of Mars, adapted as far as possible to the recent observations. New names have been added by the Author where required.

HANHART IMP.

INDEX TO PLATE I.

Fig. 1.



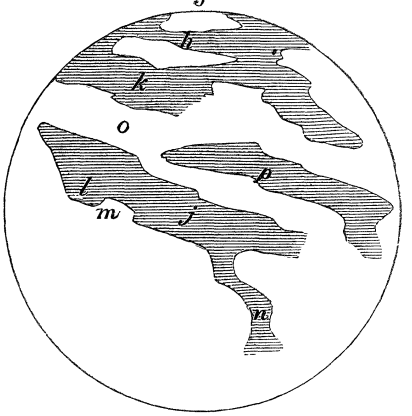
a	Dawes Forked Bay.	*g*	Terby Sea.
b	Burton Bay.	*i*	Bessel Lake.
c	Christie Bay.	*j*	Maraldi Sea.
d	De la Rue Ocean.	*l*	Trouvelot Bay.
q	Part of Kaiser Sea.	*w*	Mitchel Mountain.

Fig. 5.

The above names are those to which reference is made in the Memoir. For fuller particulars see the Map of *Mars*.

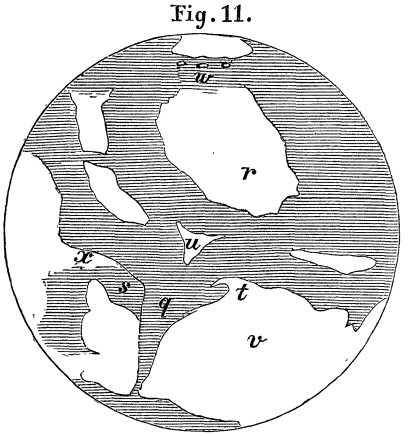
INDEX TO PLATE II.

Fig. 8.



h JOYNSON SEA.
j MARALDI SEA.
k MAUNDER SEA.
l TROUVELOT BAY.
m NOBLE CAPE.
n HUGGINS INLET.
o WEBBS LAND.
p HOOKE SEA.
q KAISER SEA.
r LOCKYER LAND.
s MAIN SEA.
t BANKS CAPE.
u HIRST ISLAND.
v BEER CONTINENT.
w MITCHEL MOUNTAINS.
x HIND PENINSULA.

Fig. 11.



The above names are those to which reference is made in the Memoir. For fuller particulars see the Map of *Mars*.