

APPENDIX.

I.—General Reference Map of Mars for the Minor Detail.

With a view to facilitating research, the Director deemed it desirable to give in this Report a detailed Chart of the planet (Plates VI. and VII.), embodying all well-authenticated areoscopic impressions, but whose objectivity has not been proved up to the present time. These maps, which were originally drawn for Paris, and since completed, give a synthesis of the results of Prof. Schiaparelli and of our Sectional Members, and they express a sort of "mean state" of the appearances observed on the planet during the last quarter of a century.

II.—Standard Chart of the Physical Condition of Mars embodying all Trustworthy Markings seen on the Planet.

Several circumstances conspire to cast a shade on the objectivity of the "canals". In the first place, we have the significant observation of subjective "canals" on other planets; then Mr. Maunder's and Mr. B. W. Lane's valuable experiments, which show the "canaliform illusion" to be a physiological phenomenon of at least some eyes; and, lastly, the fact that one half of the "canals" seen by careful observers are the boundaries of faint half-tones. Under the conventional name of "canal", we find, however, markings of unquestionable reality. Such are the *Cerberus*, the *Styx*, the *Casius*, *Ceraunius*, *Nilokeras*, &c., although it is fair to add that the broad and irregular structure of these spots has generally nothing "canaliform" in its appearance.

Still the hard line-likeness of the "canals" is almost sure to be experienced by all painstaking observers of the planet; and this circumstance cannot be treated lightly as illusive. But, the disappointment of seeing our representations of Mars profaned by doubt, led the Director to take a possibly backward step, and to include, in a rough approximation, only the solid data bequeathed to us by the labours of the last 125 years. These results are given in Plate VIII., based on an analysis of the drawings of W. Herschel, Schröter, J. Herschel, Mædler, Galle, De la Rue, Schmidt, Secchi, J. Phillips, Lockyer, Kaiser, Dawes, Burton, Dreyer, Green, Terby, Bæddicker, Lohse, Niesten, Trouvelot, Knobel, Maunder, Schiaparelli, W. H. Pickering, Hussey, Keeler, Gale, Denning, Stanley Williams, Cerulli, J. Rheden,* Millochau, Captain Molesworth, T. E. R.

* Herr J. Rheden, who took part in the Sectional work of 1896-1897, has published his observations of 1898-1899 in a fine memoir, entitled *Beobachtungen und Zeichnungen des Planeten Mars*, Vienna, 1901.

Phillips, Kempthorne, Cammell, Meares, Brown, W. J. Hall, Atkins, Kibbler, the other Members of the Section since 1892, and of the Director.

It appeared meantime necessary to give in Plate VIII., an adumbration of the physical phenomena of the Martian surface, such as the apparent changes in the outline of the *Maria*; and to differentiate the "seas" of changing intensity from those whose darkness seems but little affected by temporary, or seasonal, variations.

III.—On the part played by Contrast in the Martian Phenomena.

In the course of a series of experiments on artificial Mars disks, examined under very sharp and prolonged seeing, the Director came across the following physiological phenomena :—

- (a) The superior whiteness of the limb;
- (b) The canaliform darkening of the borders of all shadings generally, and of the "*Maria*" in particular;
- (c) The concomitant brightening of the "coasts";
- (d) The formation of subjective "canals," in accordance with the theories of Mr. Maunder and Mr. Lane;
- (e) The bridging of dusky spots by white "material".

Contrast seems to play an important part in the production of at least some of these appearances; and the phenomena presented, under perfectly focussed seeing, by small grey ellipses (Fig. 13) were remarkable, as tending to distinctly geminate the markings into two round spots (Fig. 14), exactly as seen on Mars.



Fig. 13.



Fig. 14.

Grey elliptical area and its doubled image, when seen from a distance under sharp seeing.

The consequences resulting from the late Mr. Green's theory that the canals are the edges of shadings are obvious and far-reaching. If, as has been observed, contrast is instrumental in so incredibly exaggerating the boundary of an imperceptible half-tone into a perfectly definite line, it is also sure to render the *Maria* darker at their borders; and this, as we have just seen, is in perfect harmony with trials on artificial disks, as well as with the Martian experience.* But the amorphous, elongated, duski-

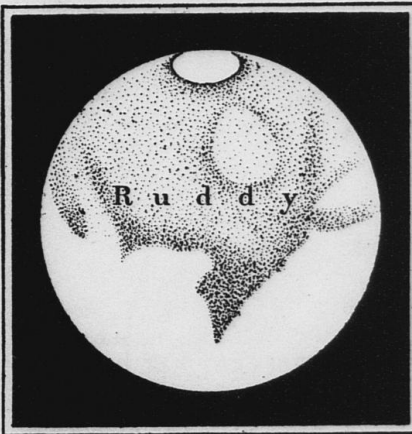
* In 1888 Schiaparelli saw the majority of the *Maria* bounded by black "canals," and as it is impossible to admit the reality of such markings, we have here a striking vindication of the late lamented Mr. Green's edge to shade theory of the "canals."

nesses of the planet ought also to be affected by contrast, their borders deriving strength from opposition. A natural explanation of gemination, based on the purely physiological grounds of contrast, is thus presented to the mind; and it is noteworthy that all double "canals" observed by the Section in 1900-1901, although they may have been objective, are readily accounted for on the basis of that simple, but rational, interpretation.

The important points to be retained from the above remarks are the facts; the phenomena of the Martian "canals" and their gemination being too complex to warrant any statements made on their nature without the strictest, and most guarded, diffidence.

IV.—On the Naked-Eye Changes of Colour of Mars.

These have been already traced to the longitude and latitude of the centre of the disk,* although the Director did not see that idea expressed in print before. Disclaiming, therefore, any originality from the interpretation, he now wishes to say that Mars ought to appear the ruddiest during oppositions occurring in September, about the summer solstice of the planet's S. hemisphere, and under $\omega = 280^\circ$ (Fig. 15); and that it would assume its maximum yellowness in oppositions taking place in March, towards the summer solstice of the N. hemisphere, and $\omega = 120^\circ$ (Fig. 16).



(1907.1)

Fig. 15.

The disk of Mars showing us a maximum of ruddiness.

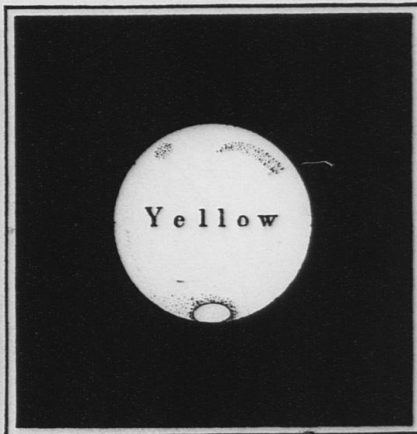


Fig. 16.

The disk of Mars showing us a maximum of yellowness.

* Given on the evidence of a friend, who could not say when or by whom the theory was enunciated.

V.—The Appearance of the Full Moon with the Naked Eye.

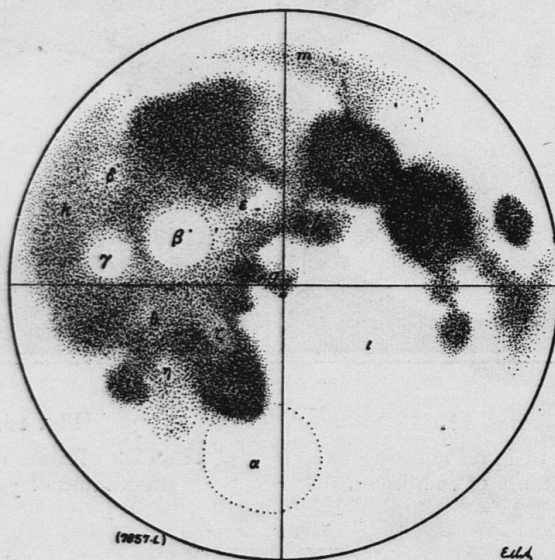
A careful delineation of the naked-eye appearance of the full moon has, as suggested by the late Herr Marth, a direct comparative bearing on telescopic drawings of Mars. The latest attempt at such a representation of the lunar surface by the Director is given in Fig. 17; while Fig. 18, made at Mr. Maunder's suggestion, is a key-map of the chief markings on our satellite revealed by the unaided eye.



7557 K.

Fig. 17.

An elementary view of the Moon, as seen with the Naked Eye.



(7557-L)

E.H.

Fig. 18.

Chart of the most prominent Markings seen on the Moon without a Telescope.

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DARK SPOTS.

- a* = *Mare Crisium*.
b = *Mare Fœcunditatis*.
c = *Mare Nectaris*.
d = *Mare Tranquillitatis*.
e = *Mare Serenitatis*.
f = *Mare Vaporum*.
g = *Sinus Medii*.
h = *Mare Nubium*.
i = *Mare Humorum*.
k = *Oceanus Procellarum*.
l = *Mare Imbrium*.
m = *Mare Frigoris*.

BRIGHT SPOTS.

- a* = *Tycho* (it is only the bright mass that is visible, but not the crater).
β = *Copernicus*, ditto.
γ = *Kepler*, ditto.
δ = *Aristarchus* (very difficult).
ε = *Apennines*.
ζ = Bright mass formed by *Guerike*, *Parry*, and *Bonpland*.
η = Brightness between *Maria Nubium* and *Humorum*.
θ = Faint whiteness of *Riphæan Mountains*.
ι = Bright region N.W. of *Tycho*.

The dark areas, whose combinations give rise to two human faces,* are not uniform in colour as seen with the naked eye. The sombre grey tint is most intense, apparently, in *Mare Tranquillitatis* and in *Mare Nubium*, although the darkness of the latter seems enhanced by contrast with the neighbouring brightness of *Tycho*. It is curious that *Mare Serenitatis* shows already its lighter interior without optical assistance. *Maria Imbrium* and *Fœcunditatis* are distinctly fainter than any of the preceding grey expanses, whereas the vicinity of the bright limb interferes with the darkness of the gloomy wilderness of *Oceanus Procellarum*.

The scientific interest of this delineation of the moon with the naked eye lies in the natural tendency of our sight to suppress irregularities of outline in objects subtending a very small angle, and to give to the markings of our satellite that unpleasant geometrical regularity of form with which some representations of Mars have rendered us so familiar.

In concluding the present Report, and in thanking the gentlemen who have so kindly accorded him their invaluable collaboration, the Director wishes to say a word or two on the way in which the Section may still more forcibly increase our knowledge of the planet. Judging from personal experience,

* The first of these, which wildly fixes the observer, consists in supposing *Mare Imbrium* to represent the right eye, *Maria Serenitatis* and *Tranquillitatis* the left, and *Mare Nubium* the mouth; while Signor Filippo Zamboni, of Vienna, has discovered an otherwise elegant and poetical figure. Assuming *Maria Serenitatis* and *Tranquillitatis* to represent the hair, he sees, in profile, a left eye in *Mare Vaporum*, the nose in the bright masses to S.E., the moustache in *Sinus Medii*; all the W. coast of *Mare Nubium* sketching the chin and neck of that remarkably truthful imitation of our lineaments.

Signor Zamboni's lunar figure is much more distinct than the ordinary one; and the discovery, on the moon, of such a robust and detailed human profile, to which a slight magnification adds a secondary chin, a thyroid cartilage, and a sparkling decoration (*Tycho*) on the chest, is most interesting, and one that gives credit to the Italian poet.

he would not recommend the choice of refractors from 4 to 5 inches, which would scarcely enable Members of the Association to master the more prominent markings of the planet; but he would rather back, in preference, the otherwise powerful, though less expensive, reflectors of between $6\frac{1}{2}$ and 10 inches aperture. He would also like to see that instrument which, devised by Newton, and immortalised by Herschel, has become a national glory of the British nation, more readily diffused in the tropical latitudes and brighter skies of the Colonies. And thus, by a wider geographical distribution, a greater increase in numbers, and a more general amelioration of the instrumental equipment of its workers, the Section may enjoy, some day, the satisfaction of accomplished duty, in bringing forward a powerful contribution to the solution of the Martian mystery.

Paris, 74, Rue Jouffroy,
1903, May 26.

E. M. ANTONIADI,
Director of the Section.

