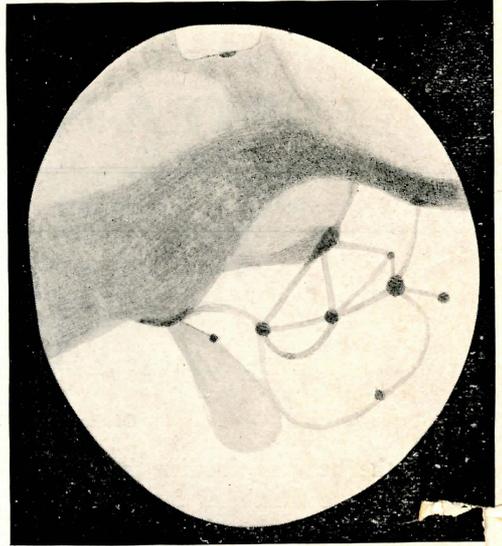


the total surface. They are dark colored in the summer time, but in high latitudes are green in the spring and yellow in the autumn. The rest of the surface is a desert crossed by numerous so-called canals. These canals are in reality narrow strips of vegetation, joining darker spots, called lakes, or sometimes oases. These spots are also probably due to vegetation. We find similar lakes and canals upon the moon, and also in the Hawaiian Islands, where narrow strips of vegetation cross the deserts, the vegetation growing on both sides of volcanic cracks in the soil, whence small quantities of steam are constantly escaping into the atmosphere.

The canals of Mars are much larger than those of the moon, and those of the moon are much larger than those of Hawaii. It has been suggested by some writers that the Martian canals, unlike the lunar and terrestrial ones, are artificial, being constructed by supposed intelligent inhabitants of the planet. This



Canals on Mars.

is to most people a very interesting idea but there is as yet little evidence to support it, and what evidence there is seems rather to point in the opposite direction.

## IS MARS INHABITED?

BY ANDREW ELLICOTT DOUGLASS,

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Is Mars inhabited? Shall we not some day have an instrument capable of answering this? I have often dreamed of some contrivance which would do this, just as the spectroscope tells us that certain stars are double, whose distance apart is so small that they will never be seen as separate entities.

The only evidence we have on this question is circumstantial. Many details of physical conditions we are reasonably sure of. For instance, we know the

year, the day, the measure of the heat received from the sun, the seasons and seasonal differences between the hemispheres. Astronomers agree as to the polar caps and the general absence of water. A few have observed temporary white patches in the warm latitudes of the planet, which certainly suggest clouds or snow. All agree upon the existence of large, general, permanent dark markings, and most agree that these markings are due to vegetation.

It is from the changes in these that one comes to believe in their vegetative origin. In 1888 I made my first drawing of the planet. In the oppositions of 1892, 1894, 1896-97, 1903 and 1905 the southern markings were dark and conspicuous, following the melting of the south polar cap. In the oppositions of 1898-99 and 1901 the northern markings were dark following the melting of the northern cap. In this variation these markings act like desert vegetation I have seen on the coast of Peru, which in dry years is apparently non-existent, and in wet years grows higher than a horse's head. A photographic record of the planet will settle this matter with finality.

Here, astronomers begin to disagree. There is no doubt that there is a complicated plexus of markings on the planet; but as to the general canal interpretation, I have much doubt. In investigating visual work done on the limit of vision, from the view-point of experimental psychology, I have found several

peculiarities that, under similar conditions, produce just such lines, whose sole existence is in the eye, and is due to the well-known phenomenon of rays. Black rays appear around a black spot, just as white rays around a star, and are due to the same cause,—irregular refraction in the lense of the eye. They may be seen by holding a small round paper screen in front of the eye, so that the only light admitted comes through the outer margin of the pupil. We do not commonly see them because they are drowned in the white background, and habit assists us in disregarding them. These rays are actually present around every small dark marking; and when one is looking for such markings on the limit of vision, he is more apt to see rays, the more care, patience and industry he uses.

In this ray phenomenon we have the explanation of the multitude of radiating canals, which to a number of observers characterize the "lakes" and "oases" of Mars. The exhaustless puzzle of those radiating canals, partially agreeing, often disagreeing, is only realized by one who has tried to compile a consistent map from large numbers of such drawings.

Another class of canals is due to a halo phenomenon. To illustrate this, I have devised the following experiment: Make a small spot of ink on a blank card and place it at a distance of six to twelve feet from the eye. Around it appears a white area surrounded by a dark ring, which presents the appearance of a halo around the spot. This halo explains at once canals parallel to the limb\* or to large dark markings. Since white spots may produce a ring, or secondary image, as well as dark, light areas within dark markings may



Canals on the Moon.

\*Limb: the outer edge of any view of the planet.

merely be the secondary image of adjacent light areas. Here we have an explanation of those curious results of Schiaparelli in his map of 1888, where he shows not only a considerable number of canals, but also some of the seas, as double.

Another class of canals really exist, but derive their form through misinterpretation. From various causes, irregular areas appear to the eye to be canal-like in form, when on or near the limit of vision. This I have studied extensively by means of naked-eye views of the moon. I find that such errors apply only to markings so large and conspicuous that there is no doubt of their reality.

And lastly, the study of artificial planets reveals the fact that on a perfectly blank globe rays sometimes appear radiating from near the centre. These rays have, I believe, some direct relation to the above-referred-to irregular refraction in the eye.

From the foregoing, it will be seen that what I have to add to the literature of this subject, by supplying a psychologic origin, destroys most of those canals upon whose artificial appearance rests the strongest habitation argument. But it shows that the investigation of the canals has been done in a conscientious belief in their genuineness, and that work in the future should be free from such errors.

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## WHAT THE MARTIANS MIGHT SAY OF US.

BY EDWARD SYLVESTER MORSE, A.M., PH.D.



FOR every single perplexity of interpretation we encounter in our study of the surface markings of Mars, the Martian would encounter a dozen perplexities in interpreting the various features on the surface of the earth. What must be the Martian interpretation of the surface features of this world? It is a perfectly fair inquiry, for by such means we may appreciate the attitude of some of our interpreters of Mars.

In examining the earth, then, as we have examined Mars, the Martian would find large yellow and reddish areas, extensive greenish areas, and besides, large regions of varying shades of blue, possibly occupying three-fourths of the

earth's surface. The yellow areas he would interpret as desert land, the greenish areas he might consider vegetation, but what would he make out of the larger regions of blue? This would certainly puzzle him, because, unfamiliar with oceans, he could not believe that such vast tracts could really be water. He would easily interpret the polar snow caps and the waters at their edges, but the oceans would be impossible to solve. The suggestion by some audacious interpreter, that this vast blue area was water, would be answered by showing that these so-called bodies of water bordered vast tracts of sandy deserts with no canals running into them for irrigation or navigation purposes. Even the polar snow caps would be doubted, because they would seem to extend far down into temperate latitudes; and on their recedence