

IS MARS INHABITED?



DURING the favourable opposition of the planet Mars, in the autumn of 1892, there was a considerable amount of discussion as to the probability of that world being "inhabited." Letters appeared in the daily papers, and nearly every one had something to say on the subject, and there was even some talk of trying to engage the attention of our Martian neighbours by heliographic signals. What language was to be used, and whether the signals were to be according to the Morse, or some other code, was apparently left for astronomers to decide, but scientists declined to undertake this interesting work, and in the meantime Mars drifted away from us on his circumscribed journey through space.

Mars at the time of this favourable opposition was about thirty-five millions of miles from the earth, and at that distance it was of course impossible to trace with even our strongest telescopes the effects of man's handiwork, unless, indeed, the "canals" are artificial. But it was nevertheless quite easy to see that in many respects our neighbouring planet resembled the Earth, and for this reason many people thought they were justified in assuming that the probable inhabitants of Mars were in some respects like ourselves. It is certain that Mars has an atmosphere, that its surface is covered by something very like land and water, and that the north and south poles are enveloped in snow and ice; but here the similarity between the two planets ends, and the further we trace the difference in their actual physical conditions, and the effect those conditions would have on living organisms, the further are our minds carried from the belief that the inhabitants of Mars can partake of any of the more defined peculiarities of our race.

It is not the similarity between the Earth and Mars that we must look to in

attempting to argue this question, but the difference between the two planets; and in order to do this it is necessary to let our minds wander far back into the past, when the Solar System was yet in process of construction, and trace the origin of the formation of the worlds which course round the Sun. Let the grand theory formulated by Laplace be our starting-point.

The whole of the Solar System, including first the Sun himself, then Mercury, Venus, the Earth, Mars, the minor planets, Jupiter, Saturn, Uranus, Neptune, and possibly some of the meteor streams also, was at one time a vast moving nebula of incandescent gas, such as we see scattered about the heavens in rich profusion and endless variety at the present day.

Ages rolled by, during which the great nebula was constantly radiating heat into space; and it contracted—as other cooling bodies do—till at last a brilliant nucleus was formed, which was eventually destined to become our Sun. As the nucleus contracted and increased in density it formed an attractive power round which the outer portions of the nebula, already in motion, rotated. Still the radiation of heat went on, and with it the contraction of the outer zones of nebulous matter, and as these zones were—in relation to their distance from the nucleus—subjected to different forces of attraction, they separated one from another and became individual masses.

Still the cooling and contracting process continued, and in course of ages the detached portions of the nebula became miniature suns revolving round their primary in obedience to the laws of planetary motion. These minor suns were destined to become the planets of our Solar System—Venus, the Earth, Mars, Jupiter and others already mentioned—but before assuming their present form it was necessary that they should part with a great deal of the heat they possessed when in a nebulous condition, and that they should contract in dimensions as they gradually attained solidity.

From this hypothesis it may be fairly assumed that in point of years the Earth is of the same age as Mars and the rest of the members of our planetary system. But when we come to consider the state of animal development on Mars, as compared with the Earth, the actual age of the planet has nothing to do with the question. What we have to consider is the *time* during which the respective planets have been *capable* of harbouring and sustaining organic beings.

Now, it so happened that the portions of nebulous matter from which the planets were formed varied very considerably in volume, and consequently the larger portions have taken a very much longer time to cool down and form worlds than the smaller portions; in fact, it is most probable that Jupiter, whose diameter is about 85,000 miles, is still in a semi-molten condition, while the Earth, whose diameter is about 8000 miles, has for ages been covered by a hard crust of rock. The diameter of Mars is only about 4210 miles, little more than half the diameter of the earth, and its volume or cubical capacity only about one-seventh to one-eighth.* If we take two balls of iron, or any other substance, one six inches and the other three inches in diameter, and make them white hot in a furnace, it can be readily understood that the smaller ball will cool down very much more rapidly than the larger one, and so it has been with Mars and the Earth. The former planet must have obtained a hard covering of non-conducting substance on its surface untold ages before the Earth had become sufficiently cool to arrive at a similar condition. We may fairly assume—indeed, we may be quite sure—that the materials of which Mars is composed are similar to those with which geologists are so well acquainted on the Earth. Both planets were derived from the same mass of nebulous matter, and as the

* The contents of a sphere = Diameter³ × .5236.

nebulosity was due to the elementary substances of which the Earth is composed being in a state of incandescent vapour, that portion of the nebula which formed Mars would condense into the same elements as the portion which was destined to become the world on which we live.

It would be rash to assert that there are not any elements in Mars with which we are not familiar; but it is reasonable to suppose that if they do exist they hold a minor position to the known elements, and that they do not to any material extent affect the physical condition of that planet as compared with the Earth. Our only means of obtaining a knowledge of the substances of which the solar nebula was composed is by the spectrum analysis of the Sun, which is shown to contain more than thirty of the sixty-eight or seventy elements found on the Earth. There may be other substances existing in the Sun of which we know nothing; but they have not been identified, and their presence is purely conjectural; and there may be, for aught we know, elements in the Earth of which, at the present time, we have no knowledge.

Before going further, it may not be out of place to recall to the mind of the reader the exact nature of an elementary body. As already mentioned, there are about seventy known elements, and of these the whole universe is, so far as we know, built up. An *element* is a substance the molecules of which are composed of atoms of the same kind. In other words, it is matter which cannot by chemical analysis be divided into other substances. The elements combine chemically one with another in constant proportions, and thus form compound bodies. For example, the element carbon combined with the element oxygen forms carbonic acid. We shall have to refer again to this gas, which plays an important part in the economy of organic life.

And now let us return to the history of Mars and the Earth. We left them in the condition of minor suns revolving round their primary, constantly giving out heat and contracting in volume. In course of time the outer portion of Mars, exposed to the intense cold of stellar space, condensed, and a coating or crust of solid substance was formed over the surface of the planet. Now, although Mars had thus got a covering of solid rock material, the cooling of the interior would proceed as before, but more slowly, and the solid crust would constantly increase in thickness from within. But as the planet continued to cool, so it would contract, and the solid outer covering shrink, in order that it might adapt its dimensions to the internal bulk. If the coat of a large man is put on the shoulders of a smaller man, it will appear ill-fitting and wrinkled, and so it has been with the coating over Mars: it became too large for the curtailed dimensions of the body it had to cover, and therefore shrank into folds and wrinkles, thus forming hills and valleys and sea beds, such as now exist on the Earth, and on Mars in a probably somewhat modified form. In course of ages an atmosphere, in many respects similar to our own, surrounded the planet, the sea-basins became filled with water, evaporation and condensation resulted in clouds, rain and snow, and the time at last arrived when this newly formed world first became capable of sustaining the most simple forms of animal and vegetable life. From that time up to the present it is more than probable that Mars has been an "inhabited" world.

It has already been mentioned that our planet is seven or eight times larger than Mars, and would therefore take a very much longer time to cool and obtain a solid covering of rock. And it follows that when Mars as a new world first became capable of sustaining organic life, the Earth was still in a semi-molten condition; in other words, thousands of generations of organic beings must have lived and died on Mars untold ages before the Earth was capable of harbouring even the most rudimentary forms of animal or vegetable life.

That part of the crust of the Earth which throws any light on the process of animal development is composed of a vast thickness of sedimentary rocks, formed under water, the materials of which were originally derived from the denudation of the primary rock covering of our planet. Within these sedimentary rocks are found embedded many forms of animals and plants quite unknown in the living world; and, speaking generally, the lower down we explore the strata the simpler do the forms of organisms become, and we are thus led to the belief that the first living things placed on the earth were of an exceedingly simple nature, and that as the world grew older they varied, according to their surroundings, and developed a more and more complicated structure, till at last man, the most highly endowed form of animal with which we are acquainted, took his place in the living world.

It is a mistake to suppose that a belief in the theory of evolution in any way detracts from our admiration of the system on which the universe has been formed. Instantaneous creation—although it involves miraculous power—is surely infinitely inferior in conception to the principle of natural development of organic life under the influence of those physical laws which were conceived and set in motion, not for this world alone, but for the benefit of the whole Universe.

Let us now briefly consider the physical features of Mars, and endeavour to trace their probable effect on animal life. In the first place it has been ascertained that our neighbouring planet is surrounded by an atmosphere in which clouds much less dense than those covering the earth have been seen to float. The north and south poles of Mars are covered by large patches of a white substance which contract in area during the summer and extend during the winter, and in fact closely resemble the polar ice-caps of the Earth. It is true that the expansion and contraction of these varies to a greater extent than is the case on our globe; but this may be easily accounted for by the fact that the seasons on Mars are about twice as long as they are on the Earth. It takes Mars six hundred and eighty-seven days to complete his journey round the Sun—which, unlike that of the Earth, is performed in a highly elliptical orbit, so that at one part of the year the planet is a great distance from the sun, and at another comparatively near to it—and it will readily be understood that these conditions must of necessity have a very marked influence on the climate.

Beside the fact of the clouds which are occasionally seen floating above Mars being so much less dense and numerous than those of the Earth, it is only reasonable to assume from other data that the atmosphere is more rarefied than our own. It has already been mentioned that the diameter of Mars is only about one-half that of the Earth, and it therefore follows that the attractive power of the two planets is widely different. This lesser attractive force must have a very important influence on the density of the atmosphere of Mars, for the density or the weight of the air on Earth, as shown by our mercurial barometers, is simply the result of gravitation. The higher we rise above the surface of the Earth, or, in other words, the farther we get away from the source of attraction, the more rarefied and lighter does the atmosphere become; and as *weight* is simply the effect of *gravitation* it follows that the density of fluid substances on Mars, such as air and water, must be considerably less than it is on the Earth.

Of course the existence of water on Mars is more or less conjectural, yet we may safely infer from analogy, and for another reason which will presently be given, that it does exist in one form or another.

There is another point which must not be overlooked in relation to the rarefied atmosphere of Mars. During the day-time the rays of the sun will fall with intense

brilliancy on the surface of the planet, but at night the thin light air exposed to the intense frigidity of space must rapidly part with the warmth it has absorbed, and thus cause the variation of temperature during the twenty-four and a half hours to be very much greater than that we experience on the Earth.

There is only one other dissimilarity between the Earth and Mars which need be mentioned, and that is the greater inclination of the polar axis of the latter planet to the plane of its orbit. The climatic effect of this peculiarity must be very marked on either hemisphere during the summer and winter, and to a greater or lesser extent affect the conditions favourable or unfavourable to animal life. This is, however, a detail of such difficulty that it may be passed by here with only the above acknowledgment of its existence.

One of our strongest and most direct proofs of the existence of water in the great sea basins of Mars is that astronomers have seen indications of large tracts of land being at certain times inundated. But how is this phenomenon to be accounted for? The rarefied atmosphere of Mars is incapable of holding a large amount of water in the form of vapour, and the comparatively few clouds floating above the surface of the planet show that this is actually the case; the inundations cannot, therefore, be due to excessive rainfall, and we must look to some other cause for their explanation.

It has already been mentioned how in point of solidity Mars is a much older planet than the Earth, and how the crust of the former planet must now be of much greater thickness—in comparison to the diameters of the respective globes—than the crust of the Earth, and consequently of much greater rigidity. The alternations of sea and land on Mars probably ceased long ago, and for countless ages the geographical features of the planet remained the same as we now have them mapped out. During those ages the effects of sub-aerial denudation would greatly reduce the height of the mountain chains and tend to level down the surface of the land into extensive plains towards the coast. Now, the effect of the axial rotation of any planet is to make fluid substances lying on its surface accumulate round about the centre of gravity; and here, possibly, is the explanation of the inundations. It is observed, owing to the extreme eccentricity of the orbit of Mars, and the climatic effects thus produced on the different hemispheres, that the polar ice-caps contract and extend in dimensions in a remarkable manner. Billions of tons of ice must in this way be taken up by evaporation from the north pole, and transferred to the south pole, or *vice versa*, with the result that the centre of gravity of the planet will, when this occurs, be shifted to a considerable distance either to the north or south of the equator, and the sea-water, accumulating round the centre of gravity, will rise and flood the low-lying land adjoining the coast.

Now, if we are to look on the theory of evolution as explaining to some extent the method adopted by the Creator in stocking the earth with an infinite variety of highly organised and endowed beings, we must ask ourselves how it is that the variety is so great, and yet each so perfectly adapted to its surroundings. The theory, of course, teaches us that all animals are derived from a common and very lowly stock, and that the great diversity of form and organisation in all the different classes of the animal world originated from very slight variations of species brought about by the natural adaptation of those species to the constantly varying physical conditions of our planet. A variation of species which eventually became perfectly stable may, indeed, have been brought about by "accident," or the effect of a purely local cause; and if we try to guide our minds over that intensely intricate chain, or rather network of animal development, broken in many places by whole genera becoming extinct, it seems doubtful, extremely doubtful, if our World had to live

her life over again, whether her offspring would in any but the most general aspects resemble those creatures with which she is now inhabited.

If there is the slightest ground for these suppositions, how can we reasonably suppose that Mars is inhabited by beings holding the most remote resemblance to ourselves? We have tried to show that the physical conditions of Mars as they would affect animal development are, as regards atmosphere, gravitation, seasons, climate, and age, entirely different to those which are suitable to our organisation. For aught we know, the highest race of beings on Mars may be infinitely superior to ourselves, both as regards mental and physical development; they may be endowed with senses of which we have no conception, powers of penetrating into the mysteries of the unseen universe which would terrify the most ardent spiritualist; they may even have solved the problems of life and death. On the other hand, the zenith of prosperity in Mars may long since have been passed, and as a dying planet he may be gradually assuming that cold and lifeless state which characterises our moon, and is eventually to be the fate, not only of the Sun's planetary system, but of the Sun himself.

There is another feature of Mars, the most striking of all to the ordinary observer, which may or may not have some effect on organic life on the planet. To the naked eye Mars usually appears as a star of the first magnitude and of an exceedingly ruddy hue. This colour is a very marked characteristic, and forms a most striking contrast to the yellowish white of Jupiter, and the intense silvery lustre of Venus.

Why Mars is red no one has been able to tell; but it has been suggested that the colour may be due to extensive masses of red earth and rock similar to the New Red Sandstone of our world. This hardly seems a satisfactory explanation, for if we view red sandstone cliffs, or a quarry, at the distance of a mile or two, the rock appears to be brownish, and very different to the lustrous Indian-red of our neighbouring planet. Another suggestion, which appeared to gain some favour during the opposition of August 1892, was that Mars is covered by a luxuriant vegetation, not of a green colour like our own, but bright red. As this is a question of importance in connection with our subject, we may be excused for referring to certain details regarding plant life, which are doubtless already well known to the reader.

Our atmosphere is constantly being charged with carbonic-acid gas formed during the process of combustion and decomposition of organic substances; in fact, our method of living is to abstract oxygen from the atmosphere, combine that oxygen with the burnt-up tissues of our bodies, and return the carbonic acid thus formed to the air with each exhalation of our breath. As this carbonic-acid gas, which is of a highly poisonous nature, does not combine chemically with the air, but remains in a free state, it would, if allowed to accumulate, soon render the atmosphere quite unfit for the use of air-breathing animals. Nature has, however, organised a process by which this poisonous gas is not only removed from the air we breathe, but is actually in its decomposed form rendered beneficial to the animal and vegetable world.

The green leaves of plants are for this purpose furnished with a great number of minute mouths, called stomata, the function of which is to absorb or breathe the air surrounding them together with the small portion of carbonic acid it contains. But this is not all, for when the carbonic acid comes in contact with the chlorophyll, or green colouring matter in the plant, that substance has the power, during daytime, of breaking up the carbonic acid into the elements of which it is composed, of retaining the carbon for the purpose of adding to the woody fibre of the plant, and of returning the oxygen to the atmosphere for the benefit of the animal world.

We do not mean to say that plants live entirely on carbonic acid, for, like animals, it is a necessity of life that they should inhale oxygen in small quantities.

Although the great proportion of active chlorophyll on the earth is green, it also exists of a red colour, and there is probably no reason why red chlorophyll should not perform the same purifying offices to the atmosphere as the green. But the question is this: Would the Earth viewed from Mars appear to be green in colour? We think not; nor would a luxuriant vegetation of copper beeches on Mars, which we view from a distance of thirty-five millions of miles, account for its ruddy appearance as seen from the Earth.

We see the surface of Mars through a considerable thickness of atmosphere which surrounds that planet, and it has been suggested that the ruddy colour may in some way be due to the filtration of the rays of sunlight through this atmospheric envelope.

The reader will clearly remember the wonderful atmospheric effects produced in the autumn of 1883, shortly after the great volcanic eruption of Krakatoa. It was shown that the colours, especially red, then seen were due to minute particles of volcanic dust floating in certain parts of the atmosphere.

A similar effect can be produced on a small scale in a very simple manner. If we take a transparent vessel containing a solution of hyposulphite of soda, and transmit through it by means of the lens of a lantern a powerful ray of light, the colour of the ray will not be altered. If, however, a drop or two of strong acid is put into the solution, it causes minute crystals of sulphur to be formed, which, being held in suspension, partially intercept or filter some of the rays of light, and those which pass through the solution now appear, not white as before, but red.

A close examination of the planet with powerful telescopes shows that the above theory cannot be satisfactorily established; for Schiaparelli, the greatest authority on the subject, has noted that the ruddy tint of Mars is confined to certain areas of the planet. Thus the seas vary in colour from grey to brown, and the polar ice-caps, though viewed obliquely through a maximum thickness of Martian atmosphere, are of intense whiteness. It is the continents alone which appear to be red and yellow, but why they are so remains a mystery.

The next most favourable opposition of Mars will be in August 1909; and can we hope then to learn more than we now know, or rather surmise, regarding life on our neighbouring planet? Alas! there is little chance of it. We are cut off by one of those lines which bound the penetration of the human mind, and we are compelled to acknowledge that there are mysteries as unfathomable in the seen as there are in the unseen worlds.

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