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large distances may be measured. It is like the heliometer in this respect, with the added advantage that in fine weather a large amount of material may be stored away to be worked up at leisure.

UNIVERSITY OF MINNESOTA, July, 1894.

CAN ORGANIC LIFE EXIST IN THE SOLAR SYSTEM ANYWHERE BUT ON THE PLANET *MARS?*

[A letter from a citizen of *Mars*, found in a meteorite which fell in the rooms of the A. S. P.]

Communicated by M. CAMILLE FLAMMARION.

In the following discussion I hold to the principle that, in explaining any phenomena taking place elsewhere than in *Mars*, we must not assume the existence of new and unknown forces and properties of matter. The more our knowledge of the universe progresses the more we become convinced that the phenomena observed on *Mars* are only repeated, on a smaller or a grander scale, in every nook and corner of infinite space.

One of the very first points to be examined in considering the conditions of habitability of a world, is evidently the question of the stability of beings and of things, and at the same time the allied question of their freedom to move about. It is essential that a man must not be too heavy, nor yet too light. Too great levity would prevent all fixity in the work of his hands—and perhaps all stability in his character, even. Too great gravity would chain him to the soil. It is essential that all useful or agreeable things, dwellings, furniture—everything, in short—should be in harmony with the muscular force of a man, with his stature, his weight, etc. Here, for example, an object falling from the top of an edifice traverses 1.84 mètres during the first second of its fall.* This is a necessity of the first importance. Suppose, for instance, that bodies, instead of falling with this safe slowness, were attracted by a violent force and were precipitated in a brutal descent two or three times more rapid! In such a case it would be impossible to build houses without

* The editor has translated the Martian measures into terrestrial ones.

danger to life, and men could no longer risk the navigation of the atmosphere! Our astronomers have taught us that on the Earth, for example, gravity is so intense that bodies fall with a velocity of 4.90 mètres during the first second of their descent. This perpetual menace of death to whomsoever would attempt to quit the soil, from a desire to elevate himself towards some superiority, alone suffices to prove to us that the Earth is uninhabitable by an intelligent race. At the best, some vile and crawling creatures may exist there. A Martian man who weighs 100 kilogrammes, would there weigh 266. Life would be impracticable. He could not move.

A second condition for the habitability of a world, not less important, is, assuredly, its distance from the Sun, that source of all light, heat and life. When one reflects on the narrow limits within which life manifests itself, when one knows that all beings are benumbed by a little too much cold, and suffocated by a little too much heat, one cannot be too careful to keep Nature enclosed within her bounds. *Mars* is exactly at the providential distance. Here it is never too warm nor too cold. The snow-fields of our polar regions melt in summer, as is proper, and are formed once more in winter to feed our water-courses. If *Mars* could be removed to the distance of *Jupiter* we should all be instantly frozen to death. If, on the other hand, our planet were to approach the Sun to the regions where the Earth revolves, it would then receive more than twice the heat that is now received, and our fields would be parched. Every one knows how intolerable and dangerous are, even now, certain summer heats. Think what it would be were you exposed to a Sun more than twice as hot as our own! Wretched Earth! If, by mischance, it is inhabited, it can only be by salamanders* or by passionate creatures of some sort. The most elementary common sense shows that the other planets are either too near or too far from the Sun and that our own is alone at the golden mean.

Since we are discussing the question of the habitability of other worlds by intelligent beings—the only kind of beings of any interest to us—let us also consider the density of the substances which enter into the constitution of bodies. No one can think of denying that the Martian human form is the only perfect one, and that intelligence could not choose its domicile in any heads

* The editor has translated the Martian words into their terrestrial equivalents.

except ours. We are supremely complete, even to the point that artists, wishing to represent God in our sanctuaries, have figured Him in the image of a Martian man. Well—this elegant form, this elevated stature, these aerial wings, these eyes which respond to the ultra-violet radiations, all of these could not exist on other globes, on account of their different conditions. Consider, for example, the Earth. Its density is a full third too great. Everything on it is much too heavy. Terrestrial organisms could not resemble ours, and would be species of monsters. Moreover, the eye, that essential organ, if developed in a too intense light, would be incapacitated to respond to the ultra-violet rays, and would be blind to more than half of the multitude of things. Under whatever aspect we look at it, the Earth is, then, an uninhabitable world. The same is true of the other planets, for they differ too greatly from ourselves.

Moreover how could one live usefully in a world where the years pass so quickly? During the period in which one of us attains the middle age of fifty years, those on the Earth have become decrepit old men of ninety-four; if indeed they are not already dead. What time would there be for good or useful things in a rapid whirlpool like that? Their days are also shorter than ours, though only by 39 minutes—hardly worth mentioning. But the matter of the years is much more serious, for the average duration of a human life is a considerable factor in the history of progress. If then the Earth might possibly be inhabited, this would be relatively useless, for it would revolve indefinitely in the same circle of prejudices. There would be no time to acquire the experience which would be so useful to succeeding generations.

How gross must be the alimentation of living beings on the Earth. Celestial chemistry teaches us that the terrestrial atmosphere is not nutritive. Are we obliged to degrade the men on the Earth by supposing them to have alimentary canals, like our inferior animals? and to suppose that they must continually slaughter beasts that they may feed on their corpses? No—we will stop short of that. But, assuredly, the mode of alimentation, whatever it be, cannot be compatible with the requirements of an advanced intellectual state; so that if the Earth be inhabited at all, it can only be by animals of a distinctly low order.

Moreover with what senses may we dare to endow organisms immersed in such surroundings? Touch, smell, hearing, perhaps vision of the most brilliant of the spectral rays. What

would they make of our seventeen senses? The sense of magnetic direction will certainly be wanting; and their dull intelligences will surely be incapable of communicating by psychic force alone. Unquestionably they can enjoy no more than five or six senses. A trifle! What a wretched condition!

Thus, from whatever side we consider the question, we find conditions opposed to our own. Even the simplest cosmographic arrangements are lacking. For instance, we have two Moons whose motions are so marvellously combined that the first rises in the west, while the second rises in the east; and both of them move so rapidly across the sky that they serve us as a perpetual time-piece in every circumstance of life, and even enable our sailors to calculate instantly the positions of their ships. Well—the Earth has but a single satellite which turns with ridiculous slowness and which can serve no useful purpose.

And again, why speak of the stars to the supposititious inhabitants of the Earth? Here we have nearly continual fine weather, while there the sky is constantly covered with clouds scattered here and there. Where shall the inhabitants live? Upon these clouds? That would be a fragile foundation. Beneath them? But there they could see nothing of the sky. And, furthermore, the terrestrial atmosphere is of an excessive density. It is a veritable sea, in whose depths we can only imagine fishes to exist. All these reasons, and a million others which might readily be added, agree in establishing the conclusion that the Earth is uninhabitable, and that the same is true for the other planets, for all of them differ from our admirable dwelling-place. The extravagant idea of a plurality of worlds is a pure chimera, unworthy the attention of a Martian.

In concluding this investigation we cannot help admiring the inductive acumen of the theologians who considered our *Mars* to be the most important of the planets and the center of creation. Although their opinions were not based upon scientific facts, they arrived at the truth, nevertheless.*

ATTEST: a true copy.

CAMILLE FLAMMARION.

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* Translated by EDWARD S. HOLDEN.