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DEPARTMENT OF BIOLOGY

August 28, 1969

Hon. Clinton P. Anderson
Chairman, Committee on Aeronautical and Space Sciences
United States Senate Office Building
Washington, D.C. 20510

Dear Mr. Senator:

It was very kind of you to send me an excerpt from the Congressional Record in which you rectified the accusations that had been leveled against the ICBC. I am happy that this brief excitement subsided so rapidly and that it did not interfere with the schedule for our successful Apollo 11 mission.

I would like to take this opportunity to comment on some public reaction to the results of the recent Mariner VI and Mariner VII encounters with Mars. While it had been stated in advance that the missions were not intended to convey any direct biological information, it was of course inevitable that the data obtained by these two Mariner flights were immediately considered from a biological point of view. In particular, I heard numerous comments to the effect that the presence of meteoritic craters suggested a "moon-like" environment, and that the failure to observe free gaseous nitrogen was sufficient to indicate the absence of living organisms and hence the futility of conducting any biological exploration of Mars. Allow me to comment on the observation of numerous craters, the role of nitrogen, and the purpose of the biological exploration of Mars as I see it.

Vishniac

The existence of craters alone may evoke in many people's minds a vision of the lunar surface, purely by association. Yet the Earth has its share of meteoritic craters, albeit in much smaller numbers, the most spectacular example being the great Arizona crater. It can be argued that craters contribute to a diversification of the environment, with the creation of ecological niches favorable to colonization by living organisms by giving access to deeper geological formations, protection from radiation in the shadows, and providing opportunity for the accumulation of essential elements.

On Earth we are acquainted with a complex nitrogen cycle, one in which nitrogen occurs in a variety of reduced and oxidized states. These include nitrogen in its most reduced form, ammonia, in its most oxidized form, nitrate, and in several intermediate forms such as gaseous nitrogen, various oxides of nitrogen, and nitrite. While microorganisms in particular are active in the interconversion of these various nitrogen compounds, the one form of nitrogen which is important for the life that we know is ammonia, which is utilized immediately for the formation of amino groups in amino acids. It is entirely conceivable, as I wrote in the volume on "Biology and the Exploration of Mars" which the Academy published in 1965, for life to exist without such an elaborate nitrogen cycle which, incidentally, in part is also dependent on the existence of free oxygen. One may well envisage an environment in which all biologically significant nitrogen is found either in the amino groups of amino acids or in ammonium salts. The preliminary report that free ammonia has been observed in the Martian atmosphere may or may not be confirmed by more extensive analysis of the data, but the above argument applies even if no free ammonia were detected in the Martian atmosphere.

Perhaps more significant is the purpose of the biological exploration of Mars. Such exploration has at times been characterized as a "search for life". This is an unfortunate formulation, since it suggest that the failure to find living organisms is a failure of the exploration, and that nothing remains but to go home and stay there. To me the biological exploration of Mars is merely a part of the systematic study of the planetary surface. The discovery of life or the determination that no life exists are equally exciting to me. Naturally, the discovery of living organisms would open a host of exciting problems in comparative biochemistry. However, the definite establishment that no life exists on Mars, would for the first time place at our disposal a planetary surface which has not been turned topsy-turvy by living organisms. We would undoubtedly be strongly influenced in our views concerning the origin of life and its evolution, and learn more about the conditions under which life can and under which it cannot evolve. It would be important, in the absence of life on Mars, to determine which limiting factor prevented the development of such a complex chemistry as leads to the evolution of life. Is it the lack of water? Is it the lack of nitrogen? Is it the excessive radiation? I might go so far as to say that were I a biologist from another galaxy, sent to this solar system for the purpose of studying biology, I could wish for nothing better than to find two comparable planets, one with and one without life, one experimental planet and one control. It is for this reason that I am convinced that we must use our greatest ingenuity in devising instruments which are capable of establishing the presence of living organisms on Mars or excluding such a possibility. Clearly, this cannot be done in a single mission. Our first and most naive approach must be an attempt to detect organisms similar to those on Earth. Should such organisms be absent there are alternative approaches possible which would search out complicated molecular structures which conceivably might support life of some other type than the one with which we are acquainted.

I apologize for this long-winded dissertation, but I believe that they represent more accurately the biologist's point of view when the purpose of the biological study of Mars is discussed. I admit that it is not an easy point of view to explain to uninformed laymen, but I am sure that you will appreciate it. I have even found it possible to present successfully this attitude to local civic groups, such as our local Kiwani chapter, members of our police department, and other local luncheon groups.

Sincerely yours,

Wolf Vishniac
Biology Team Leader - Viking Project

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