

Mars: The Living Planet, Chapter 9 Revisited

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*“The Moving Finger writes; and, having writ,
Moves on: nor all thy Piety nor Wit
Shall lure it back to cancel half a Line,
Nor all thy Tears wash out a Word of it.” Omar Khayyam*

In the thirteen years since I wrote Chapter 9, “Life after Viking: The Evidence Mounts” in Mars: The Living Planet, it is remarkable that nothing has happened to make me want to “wash out a word of it.” Even more remarkable, the evidence for the claim that the Viking LR detected life on Mars has continued to mount, all in all enough to meet Carl Sagan’s rigid requirement of “extraordinary evidence.” What’s more, the “extraordinary claim” requiring such evidence has now become ordinary, as will be shown below. While the paradigm shift from a lifeless Mars (“Biological experiments on the Viking landers did not detect signs of life or any of the organic compounds that are abundant on Earth” inscription on the Viking Mission exhibit plaque at the Smithsonian Institution) to a living planet has not yet occurred, the consensus against life on Mars is diminishing. A score of prominent scientists have stated publicly or communicated to me their current belief that the Viking LR detected life on Mars; with an additional two dozen stating they think it possible.

This October, I received an email broadcast to the scientific community announcing a NASA symposium, “Seeking Signs of Life,” in celebration of the 50th Anniversary of its astrobiology program. In reviewing the list of speakers, I was taken aback to find my name absent, nor to find any presentation discussing the Viking LR, the only life detection experiment ever to obtain a sign of life! This unwriting of history occurred even though the first paper was entitled “Exobiology in the Beginning,” followed by a talk entitled “The Origins and Evolution of Exobiology.” When I questioned this vital omission and offered to make such a presentation, I was told that the symposium was of a general nature, and not given to specific experiments!

Unlike the fate of many experiments, the original Viking LR data remain unchallenged. To my knowledge, there has been no report or statement to the effect that the instrument or its software operated incorrectly. Nor, has anyone challenged our published statement that the many hundreds of terrestrial field and laboratory LR tests performed before and after Viking never produced a false positive or a false negative. And, despite many initial claims by researchers to have duplicated the Mars LR results, none has duplicated the thermal controls of those experiments, which controls are simply not addressed by those reporting. To this day, no non-biological replication or near-replication of the complete Viking LR data has been achieved, or, at least, none has been reported or published. Yet, even though the Viking LR data are completely consistent with characteristics of known

species of terrestrial microorganisms, the consensus favoring life has not yet reached the tipping point.

It is a well-accepted fact that living organisms can distinguish between the mirror images, or “isomer” forms of such chemicals they can metabolize. However, chemical reactants do not make such a distinction, reacting equally with both isomers of a mirror image compound. A refinement based on this distinction had been proposed for the Viking LR, but, because of instrument costs to implement it, we had to settle with including such isomers in the single LR nutrient solution. A few years after Viking, I proposed a “Chiral LR” (CLR) experiment to resolve the issue of what had been detected in the Martian soil. Using the proven technology of the LR, the new experiment would dose duplicate soil samples with only the “left-handed” and “right-handed” isomers, respectively, of those LR nutrients possessing mirror images. Thus, it could readily be established whether the active agent on Mars favored one isomer over its twin. If so, this would be strong evidence for biology likely accepted by astrobiologists, many of whom have already embraced the principle. The CLR might even determine whether any Martian life found were related to Earth life or were of a separate origin, addressing another major problem in biology. However, none of my many proposals for the CLR experiment was accepted, either by NASA or ESA. I still believe it is an easy and reliable way that can settle the important issue of what the Viking LR detected, and I will continue to urge its use.

Most of the life-pertinent data obtained by post-Viking Mars landers duplicate and confirm Viking findings. This includes the “follow-the-water” and habitat data to which Mars landers have been strangely constrained and dedicated since Viking. The 1997 statement in my Chapter 9, that no life detection test has been sent to Mars since Viking (or to any other extraterrestrial target), unfortunately, remains true, and may remain so for years to come. However, there have been some new and important data that have been reported, but, somehow, not generally acknowledged for their impact on the life issue. Shortly after Viking, methane was reported (1) to have been observed in the Martian atmosphere by terrestrial telescopes. Most of the methane in the Earth’s atmosphere is of biological origin (2), but no reference was made to any biological implication on Mars until subsequent papers (3, 4), refining the reports of methane, casually mentioned that possibility as an alternative to the presumed chemical origin. It seems strange that such a significant possibility, especially in light of the Viking LR data, was not elaborated upon. In fact, the Viking LR was not even referred to. This, despite one report (5) stating that the methane’s persistence required constant replenishment, as it does on Earth where it is provided largely by living organisms. No mention was made that thermal mappings of Mars have shown no geologic hot spot, thus making volcanism an improbable source of the methane. Moreover, the report of methane said that the methane disappeared at a rate requiring a “sink” for the gas, with no mechanism for that sink suggested.

I and my Viking LR Co-Experimenter, Dr. Patricia A. Straat, then published an article (6) citing one type of microorganisms on Earth that generate methane, and another type that consumes it. We pointed out how that situation might pertain to Mars, and that it would be in complete harmony with our LR results. In 2010, additional reports (7, 8) of methane on Mars strongly confirmed its presence and found a peak of about 80 ppbv. Moreover, a pattern in its concentration is indicative or, at least, supportive of biological activity, which possibility is mentioned, but not pursued despite its overriding scientific importance. No reference is made to the Viking LR or any of the articles supporting its detection of life. The new reports confirm the requirement for a methane sink (not mentioning our above-cited paper on this). Over a measurement period of three Martian years, spanning wide areas including both Viking lander sites, methane was observed in the atmosphere by exceptionally sensitive measurements. Of even greater importance, the atmospheric methane concentration was found to vary seasonally, being heaviest in the summers and autumns, and to vary appreciable from year to year. Furthermore, the methane was more concentrated at the extremes of the observed latitudinal bounds, 60 S to 60 N. In winters, the methane was “almost exclusively concentrated roughly between 40- and 50-N.” To me, this resonates against a geological source. I am unaware of any volcanic source of methane increasing in the colder months. Were the methane being released from entrapment in near-surface water ice, as has been proposed, it would be expected to increase, not decrease, with warmer temperatures.

The authors of another highly significant report (9) in 2010 analyze the isotopic ratios of stable carbon and oxygen in the carbon dioxide and carbonate sampled at the Phoenix Mission landing site on Mars and in the Martian meteorites. The paper proposes that the combined data from Phoenix and the meteorites provides insight into the history of water. It also finds that carbonate formation is ongoing. Its final paragraph cites the well-known fractionation of carbon isotopes by biology, and says “This process is one of many that may be operating on Mars; thus, the atmospheric measurement does not provide an unambiguous detection of biological processes (underscoring added by me).” The authors thus belatedly recognize that their conclusions are at least consistent with the presence of biology. However, like the authors of the paper cited in the paragraph above, these do not pursue this overriding scientific issue, life. Again, they do not mention or reference the Viking LR experiment.

The findings cited above: 1) that there is methane in the Martian atmosphere, 2) that it requires an on-going source and sink, and 3) that its concentration varies seasonally, satisfy the requirements for detection of extraterrestrial life as proposed (10) many years ago: disequilibrium of the gases in a planetary atmosphere. However, while this life detection method was accorded credence by many scientists in the past, none, including its author, has claimed the actual findings as proof of life.

Since Viking, our concept of life has changed radically. No longer do we think of life as a frail layer on the surface of Earth. We now know it to be extraordinarily robust, populating not only the surface of Earth, but the outermost atmospheric heights, the extreme penetrations on land, the depths of the ocean and miles below its surface. Many species inhabit environments fully as “extreme” as those on Mars. Martian environment, long cited as a bar to life, is now viewed as tolerant if not friendly.

On top of all this new evidence, it is now acknowledged that Mars and Earth have been exchanging rocks and surface materials since the formation of the two planets. Meteoric impacts on both planets eject matter, a very small percentage of which eventually falls onto its neighbor. It has been reported (11) that living microorganisms inside ejected matter from one planet can land on the other in viable form. Known terrestrial extremeophile species could grow on Mars, and, if there are, indeed, microorganisms on Mars, vice versa. This raises the question of whether microorganisms on one planet may have come from the other, or whether some third source is responsible. In any event, it is now much harder to postulate a sterile Mars than one supporting life.

So, a lot has developed since Viking! And all of it supports, or is consistent with, life existing on Mars. Contrariwise, no single finding militates against that possibility. This includes Phoenix’s finding of perchlorates (12) in the Martian soil. Also, perchlorates cannot be the long-sought oxidant putatively responsible for the LR response, because they are very resistant thermally and would have easily survived the 160° C heating which destroyed the LR agent. Not only do perchlorates not address the LR data, they are in no way inimical to life, many terrestrial species include perchlorates in their metabolism (13). A paper (14), adding to others that have explained why the Viking GCMS failed to find organics, says that perchlorates in the Viking samples would have violently destroyed any organics present in the soil when the GCMS was raising the temperature of the sample to 500° C.

Let’s tally the evidence. First, direct evidence: 1) the LR data, based on a strong, unblemished legacy of laboratory and field tests provided direct evidence for life, 2) isotopic fractionation of carbon is broadly attributed to biology and not chemistry on Earth, so to ignore consideration of this new finding on Mars is tantamount to saying that chemistry is different on Mars, 3) disequilibrium in the atmospheric gases proposed as a life detection experiment has now been established. Next, circumstantial evidence: 1) the presence of all needed ingredients and conditions that could support some terrestrial extremeophiles, 2) the absence of any life-prohibitive factor in the plethora of Martian data on all of the many aspects reported of its composition and environment is supportive of biology, 3) the failure of all attempts to explain away the VLR data non-biologically, 4) the likely transfer of viable microorganisms between planets relieves the necessity for an unlikely, independent origin of life on neighboring planets; 5) long neglected, the changing pattern of greenish patches on rocks at the Viking lander sites should no longer be ignored: the original paper (15) presented not only true color images of the patches,

but a spectroscopic analysis showing their color, hue and saturation to be the same as those of lichen on terrestrial rocks viewed and analyzed similarly under the Viking Imaging System at JPL. All of this is now recalled to mind by a recent report (16) showing greenish spots on rocks in the Mars-like Atacama Desert which are photosynthetic micro-organisms which the authors say “have successfully colonized the interior of halite crusts, which are widespread in the Atacama Desert. These endoevaporitic colonies are an example of life that has adapted to the extreme dryness by colonizing the interior of rocks (my comment: but, as the images show, are visible at the surface) that provide enhanced moisture conditions. As such, these colonies represent a novel example of potential life on Mars.”

With strong direct evidence buttressed by significant circumstantial evidence, and no contrary evidence whatsoever, why has the scientific method and common logic not prevailed?

What to do now in pursuit of, as NASA proclaimed prior to the launch of Viking, “Perhaps, the greatest experiment in the history of science?” Incredibly, a third of a century after the Viking LR, there is still no direct life detection experiment planned for Mars – or any other celestial body. The Mars Science Laboratory (MSL) will land powerful organic matter analyzers on Mars. But the finding of amino acids or even more advanced “biomarkers,” by the MSL will not likely withstand incision by Occam’s razor (17). Such evidence will fail to be accepted in that it is far easier for amino acids, or any organic molecule, to occur by chance than by having to invoke that ultimate complexity, life.

Space budgets are suffering postponements and cuts in these difficult economic times, so, even should life detection missions be planned, they are unlikely to be flown in the near or mid-term future. However, there is a way that the life issue may be settled short of a new mission. The Viking LR data have not been examined by an independent board since 1977, and then under the pall of the negative consensus based on evidence since impugned. All of the above evidence should warrant a new evaluation. I propose that a panel of experts be set to make such an examination. It is possible that the totality of the evidence might lead the panel to a conclusion. Of course, I hope the LR data would prevail. In this way, the U.S. government might redeem the \$1 billion (in 1976 dollars!) spent on Viking, the principal objective of which was to search for life. Even if the decision failed to support the claim of life, there is no downside to such an investigation. Our knowledge on the subject would be vastly improved, making for better missions in the future.

Meanwhile, how is it possible to rationalize NASA’s reluctance to have sent any mission to Mars to investigate the extraordinary agent, extraordinary whether biological or chemical, the Viking LR found in the Martian soil? In my view, any such rationale is beyond science. There can be no scientific justification for the deliberate path taken to: 1) avoid seeking confirmation of the VLR data, 2) avoid seeking the nature of the response, 3) forbid any life detection experiments since

Viking, 4) denigrate the VLR experiment against all evidence, 4) re-write history to exclude the VLR (an example: the recent paper (18) saying that prospects for life on Mars are greatly improved, quoting a NASA astrobiologist as saying, "The probability of identifying life is higher for modern than for ancient life," but the article does not mention the VLR), 5) convince scientific and lay media editors and writers not to anything relating to the VLR or the foregoing described scientifically irrational acts.

Shortly before he died, Sir Fred Hoyle visited me for the purpose of warning me that there was deep political motivation behind government efforts to suppress information about life on Mars. He said the matter ran so deep that I should take personal precautions. In our discussions, he raised the possibility that, not only had the VLR detected life on Mars, but that, in a clandestine return sample mission to Mars, the U.S. Government had obtained living microorganisms which were now under cultivation for potential applications mandated secret for now. Since then, several others have similarly cautioned me. Now, most recently, Professor Chandra Wickramasinghe, a disciple and successor to Nobel laureate Fred Hoyle at Cardiff University, is quoted as saying (19) "I think there could be political and sociological considerations at work." I, personally, do not embrace such conspiracy theories. But I do believe the suppression of the LR finding and the re-writing of history to exclude it are deliberate. My best guess for it is that no NASA bureaucrat since Viking has been willing to tarnish NASA's image by saying that NASA had been wrong in deciding against the VLR evidence in 1976. And the legions of scientists who are dependant on NASA support hesitate to invite disfavor from their funding source by publishing otherwise. Whatever the truth may be, I am certain that history will finally be written to acknowledge that the Viking Labeled Release experiment did, indeed, discover life on Mars in 1976. The purpose of my website, <gillevin.com>, is to keep the matter alive until then.

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