

THE VIKING LABELED RELEASE EXPERIMENT CONTROVERSEY: WHY DOES IT EXIST AND WHEN WILL IT END?*

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Trying to understand why those in the NASA Mars Exploration program are intentionally side-stepping, ignoring and appear to have abandoned the most intriguing set of data about Mars ever obtained is a mystery in light of years of new evidence that seem to support its extraordinary findings – that there is life on Mars. It was in 1976 (35 years ago) that NASA sent the first and only true life detection experiments to Mars onboard the twin Viking Landers. One of these experiments, simply known as the Labeled Release experiment (LR) conducted a series of tests on samples of Martian soil nine times under different control conditions and got back strong evidence for microbial life. You would have thought when such evidence is found that every effort would be made to find out more about it by sending follow up missions with additional life science instruments. Yet no other life detection experiments have been sent and up to this day they have been forbidden or discouraged by the Mars Exploration program leaders. What possible explanation is there for this?

In July of 1997 I published a book trying to resolve this question titled “Mars The Living Planet” (1). It was in this book that Gilbert V. Levin first announced his conclusion after years of scientific study trying to reproduce his results using only chemistry that he discovered living microorganisms in the soil of Mars. In August Levin presented a scientific paper about his conclusion to an astrobiology conference held by The International Society for Optical Engineering held in San Diego, California later in August (2). Yet, none at the Mars Exploration program office or any of its scientists took much notice. Mars The Living Planet laid out in detail the behind the scenes workings of being an astrobiologist within the NASA Mars Exploration program and some of what was reported is disturbing. While writing the book it became apparent to me that at the conclusion of the Viking Mission to Mars that NASA had put Levin and his life detection data on a shelf and they were not to be mentioned again.

Since NASA has repeatedly published that one of its top goals is the search for life on other planets like Mars, how can one reconcile what happened with the Viking LR experiment on Mars? The discovery of life on Mars would constitute the greatest achievement in the history of science and is just too important to be ignored. Yet this is exactly what happened.

The big question is what motive would NASA have to suppress LR data about life on Mars? In this chapter I will show evidence that the LR data is being intentionally suppressed. However, I don't think it is NASA as a whole that is involved but rather

those left in charge of running the Mars Exploration program division. What could the motives be? Would the announcement of finding life on Mars kill future funding for additional missions? Or could it be something to do with religion, fearing that the reality of life on Mars would somehow topple society? Or perhaps the real reason is that NASA does not want to let Levin and his co-experimenter Patricia Ann Straat be recognized for the discovery of life on Mars and instead plan to “rediscover” it on another NASA Mars mission, so they can claim the discovery for themselves? Does this sound outrageous? Let us now continue to explore some fascinating facts.

SECOND GENESIS

Christopher McKay, an astrobiologist at the NASA/Ames Research Facility located at Moffet Field, California has also been the unofficial spokesperson for NASA’s Mars Exploration program since the 1990’s. He has appeared on dozens of television science documentaries about Mars. McKay is also a science team member on NASA's next big mission to Mars launching in the fall of 2011, called the Mars Science Laboratory (MSL). McKay will work with the Sample Analysis at Mars experiment (SAM) on MSL and it will look once again for organic molecules in the soil of Mars but has no life detection experiments. None of the Mars documentary programs that McKay is a guest on discuss the Viking LR biology results, but in a 2009 published book chapter McKay describes the importance of finding life on Mars this way:

“Philosophically, the discovery would directly address the question of life in the universe, and would strongly support the idea that life is a naturally emergent phenomenon and is widespread and diverse in the universe. Scientifically, having another example of life expands the scope of biology from one to two. There may well be significant advances in medicine, agriculture, pest control, and many other fields of biological inquiry, from having a second type of life to study. I would argue that if there is a second genesis of life on Mars, its enormous potential for practical benefit to humans in terms of knowledge should motivate us to preserve it and to enhance conditions for its growth” (3).

When not appearing as a guest on a Mars documentary and asked his views on the Levin’s conclusion of life on Mars McKay replies, “The main reason I favor a chemical over biological explanation for the Viking LR reactivity is the low water availability on Mars. It is certainly possible and even probable that at the Viking 2 Lander site snow melted to form thin transient films of liquid water in the soil. Whether these thin films can support life is still an open question. If they could then the question is still open as to if they do support life,” (personal communication McKay to DiGregorio).

However, McKay continued, “I remain of the opinion that we cannot rule out a biological explanation for the Viking LR results. However everything I’ve studied in the cold (Antarctic) and dry (Atacama) deserts of Earth suggests to me that the likely explanation is chemical and not biological. I base this on the low availability of liquid water. Having

said that I agree with Levin that we do not yet understand the chemical processes on Mars. This should not be too surprising given that we did not even know about the perchlorate until two years ago with the Phoenix Lander mission. However I disagree with Levin that the failure to produce a chemical explanation proves the biological one. The converse is also true: a complete and consistent chemical hypothesis that fits all the data does not prove that chemistry is the explanation, it just makes it seem more likely. The only way to prove anything in this field is to do further experiments on Mars. This is where Levin and I agree and we both agree that the best experiment is a chiral organic destruction experiment. At Levin's original suggestion I tried to do this experiment on MOx some years ago on the Russian Mars 96 mission". [A chapter about Levin's collaboration with McKay appears in the original 1997 version of Mars The Living Planet]

ORGANICS ON MARS REVISITED

For all those who are somewhat familiar with the story it was the negative findings of the Viking Lander GCMS organic analysis instrument that prompted the Viking team project scientist Gerald Soffen and others at NASA in 1997 to announce that life on Mars without organic molecules would be highly unlikely (4). It was at this point NASA turned its back on the Viking LR findings for the next 35 years and continues to do so today. Furthermore, no other organic analysis instruments would be sent to Mars to confirm whether the Viking GCMS results were in error until NASA's Phoenix Lander arrived on Mars in 2008. Although Phoenix carried a Thermal Evolved Gas Analysis (TEGA) mass spectrometer onboard it could find no evidence of organic molecules on Mars. However, Phoenix also had an ingeniously designed wet chemistry experiment to analyze the soil and discovered among other important facts that 1% perchlorate salts exist in the soil of Mars at the landing site. As it turns out, these perchlorate salts were later found to interfere with any type of organic analysis instrument that would use high heating steps like the Viking GCMS and Phoenix TEGA. This finding was incredibly important. It meant that if the Viking GCMS missed biologically significant quantities of organic that the Viking announcement of "No organics, no life" was based on possibly flawed data. You would think this finding alone would have NASA immediately reopen the case for the Viking LR experiment, but it did not.

In September 2010 Chris McKay and his colleagues published an important scientific research paper (5) about this finding in the Journal of Geophysical Research – Planets. However, McKay and his research team did not feel the finding was relevant to Levin's Viking LR data.

In the following summary (used by permission) McKay describes some of the findings he and his colleagues published in their paper regarding the Phoenix Lander perchlorate discovery and its implications for the Viking GCMS organic analysis conducted on Mars 35 years ago:

"The bottom line of this work is that the Viking landers did detect organics on Mars, we just did not realize it. The Viking lander GCMS operated by heating Martian soil and

then looking for organic fragments. There were two puzzling results from the Viking GCMS. First the detection of chlorinated methane compounds and secondly the absence of any other organics at the parts per billion level (ppb). At the time it was decided that the chlorinated methane compounds must have been terrestrial contamination and the lack of organics must be due to some very strong oxidant in the Martian soil.

In 2008 Phoenix landed on Mars and discovered that the main form of chlorine at the Phoenix landing site was not chloride as has been assumed but perchlorate. The difference is very significant. Chloride is normal salt. Perchlorate is the oxidized form of chlorine and a common ingredient in solid rocket fuels, firework, and other explosives.

We did some experiments in which we added perchlorate to soil from the Atacama Desert - one of the driest places on Earth and a place with the most Mars-like soils. We found that the perchlorate reacted with the organics in the Atacama soil completely destroying most of them and producing a small amount of chlorinated methane compounds. Suddenly the two seemingly independent results from the GCMS – the release of chlorinated methane compounds and the lack of other organics – come together to form a coherent picture.

Our results suggest that the best explanation for the Viking results is that the Martian soil contains a few ppm of organics. That is a thousand times more than the Viking limit believed previously and is comparable with the driest parts of the Atacama Desert.”

McKay continues:

“Does this mean that there is life on Mars. No, it just means that there are organics. We know that organics can be produced by non-biological processes. Meteorites are expected to be carrying organics to Mars. The presence of a few ppm organics on Mars is not inconsistent with our understanding of non-biological organics in the Solar System. Do our results suggest that the Viking Biology Experiments need to be reconsidered? In particular the Viking LR results have long sparked controversy because they seemed to indicate life in the Martian soil? It is certainly true that lack of detection of organics at the ppb levels by the GCMS result was an important argument against a biological interpretation of the Viking LR results. This has now been removed. But the real problem with postulating extant life at the Viking site is still, and always has been, the absence of liquid water. This remains an obstacle to a biological interpretation of the Viking LR result. The reactivity seen by the Viking LR results could be due to chemical reaction. We see such chemical reactivity in desert soils on Earth. I am optimistic that a confirmation of organics on Mars by the Mars Science Laboratory will open up the possibility of sending life detection experiments again.”

LIQUID WATER, METHANE AND HABITABLE SOIL

Newly acquired data gleaned from orbital spacecraft missions since Viking suggest Mars currently has liquid water emanating from crater wall gullies (6). Liquid water droplets were observed forming and clinging to the Phoenix Lander struts (7). Methane emissions

where the highest concentrations are associated with the warmest seasons, and at locations where favorable conditions, such as residual geothermal activity (Tharsis and Elysium) and water ice (Arabia Terra), are expected on Mars. Authors Fonti and Marzo found that the lifetime of this methane in the Martian atmosphere is only one year suggesting something is consuming it at a fantastic rate (8). Taken together, the above results could strongly support that the Viking LR data are biological in origin.

Perhaps the most stunning new announcement of all was from another 2010 paper published in the Journal of Geophysical Research – Planets, by Carol Stoker et al (9) with the title “Habitability of the Phoenix Landing Site”. In this paper the authors state:

“Energy to drive metabolism is available from sunlight, when semitransparent soil grains provide shielding from UV radiation and chemical energy from the redox couple of perchlorate and reduced iron. Nutrient sources including C, H, N, O, P, and S compounds are supplied by known atmospheric sources or global dust. Environmental conditions are within growth tolerance for terrestrial microbes. Surface soil temperatures currently reach 260 K and are periodically much higher, the pH is 7.8 and is well buffered, and the water activity is high enough to allow growth when sufficient water is available”.

According to Stoker and her research team the Phoenix landing site could be a habitat for some terrestrial microorganisms let alone any alien microorganisms that might have evolved to the harsh conditions there. Clearly there seemed to be a division among NASA astrobiologists about the habitability of Mars as Stoker also works at the same NASA/Ames Research Center that Chris McKay does.

PUTTING THE VIKING LR FINDINGS ON ICE

You would think that the new findings mentioned above would move NASA or the European Space Agency to convene a special scientific conference to reexamine in detail the findings of the Viking LR but it seems just the opposite has occurred. Instead there seems to be a concentrated effort on the part of NASA to move away from or completely ignore the Viking LR findings altogether. One recent example of this is apparent in a 2010 meeting sponsored by the NASA Astrobiology Program: “Seeking Signs of Life: A Symposium Celebrating 50 Years of Exobiology and Astrobiology at NASA”. This meeting was held on Thursday October 14, 2010, 8 am-5 pm at the Lockheed Global Vision Center in Arlington, Virginia. Ironically the meeting invitation says:

“In 1959, NASA funded its first exobiology investigation, a life-detection experiment for a Viking mission to Mars. In 1960, the agency established an exobiology program, whose early managers adopted an approach to advancing this field of study by funding forward-thinking, boundary-bending, multidisciplinary research projects that other funding sources tended to judge as too risky. NASA Viking mission included three exobiology experiments designed to look for evidence of life on Mars. By the 1980s, NASA expanded its exobiology program to encompass studies of evolutionary biology. In the 1990s, NASA again expanded the breadth and depth of this program, broadening the boundaries of

“exobiology” to establish “astrobiology” as a program encompassing studies of chemical evolution in interstellar space, the formation and evolution of planets, and the natural history of Earth in addition to exobiology and evolutionary biology. Today NASA’s Astrobiology Program addresses three fundamental questions: How does life begin and evolve? Is there life beyond Earth and, if so, how can we detect it? What is the future of life on Earth and in the universe? In striving to answer these questions and improve understanding of biological, planetary and cosmic phenomena and relationships among them, experts in a range of relevant disciplines are participating in astrobiology research and helping to advance the enterprise of space exploration.”

Considering that Levin and Straat were among the first NASA funded astrobiologists who worked on both NASA's Mariner 9 and the Viking Lander missions you would think they would have been invited as honored guests to this meeting. However, they were not even considered or was it more likely they were deliberately overlooked?

When Levin heard about the meeting he wondered why he and Straat were not invited and called the people setting up the symposium to offer to give a free talk on the Viking search for life on Mars. Levin’s offer to speak was flatly rejected with the only explanation that the speakers for the meeting had already been selected. Thus there would be no mention of the Viking LR search for life on Mars. This was obviously a deliberate exclusion, how could the last two surviving experimenters of the Viking biology team not be invited? To Levin and Straat this seemed like a big slap in the face at a meeting boasting the title “Seeking Signs of Life: A Symposium Celebrating 50 Years of Exobiology and Astrobiology at NASA”. Is this how NASA treats its astrobiology royalty?

So the question is: Why do Levin and Straat appear to be shut out by the NASA Mars Exploration community? Why is the Viking LR data such a threat? Why do Levin and Straat have their papers and letters constantly rejected by peer-reviewed journals such as Science, PNAS and others? Why have Levin’s many proposals to send additional life detection experiments to Mars all been rejected by NASA?

One of the true stories in my book Mars The Living Planet in the chapter titled Russian Roulette, tells how the Russian Space Agency recognized the significance of the Viking LR findings and invited Levin to put an advanced chiral version of it onboard their Russian Mars 96 probe. NASA convinced the Russians not to fly it by paying them millions of dollars to fly their own experiment in its place. Levin’s LR was replaced with the NASA Jet Propulsion Laboratory Mars Oxidant Experiment (MOx). Levin was invited to participate, but MOx was not a life detection experiment so Levin altered it slightly putting in two chiral fiber optic sensors that could have yielded more information about what the LR found on Mars. Unfortunately the Russian Mars 96 spacecraft never made it to Earth orbit and plunged into the Pacific with parts of it landing in Chile. It was clear from this moment on that the NASA Mars Exploration program did not want any further life detection experiments going to Mars. Instead the focus was changed to follow the water, a program designed to look for traces of ancient water activity although Mars had plenty of current water ice, huge polar ice caps and snow.

The media also share a hand in perpetuating this situation. It seems that these days journalists are only too happy to go along with whatever NASA says rather than do some good investigative journalism themselves and ask the tough questions. For example I didn't read one newspaper or magazine article asking why Levin and Straat were so obviously overlooked at the NASA meeting celebrating 50 years of exobiology.

OCTOBER 1ST 2010 ARTICLE IN SCIENCE

On October 1st, 2010 I read with astonishment the "News Focus" article published in Science with the title "Growing Prospects For Life on Mars Divide Astrobiologists" (10). The article in Science has a caption under a photograph of the Viking Lander that reads "Stymied. The Viking landers found no signs of life". This is the same dogma shown in virtually every television science documentary about looking for life on Mars. For such a prestigious journal as Science to publish this caption was both factually and scientifically inaccurate because peer-reviewed papers for the Viking LR evidence for life on Mars have been published by Levin and Straat – with one of them appearing in a 1977 issue of Science (11).

There is good reason for those in the astrobiology community to be concerned about all this. If the one life detection instrument aboard Viking that really might have found life is simply ignored today then what is the point of sending additional life detection instruments to the surface of Mars? Will they fair any better with NASA than the Viking Labeled Release experiment?

MY WORK SUPPORTING THE VIKING LR

In December of 2010 I asked astrobiologists Gilbert Levin, Patricia Ann Straat, Joseph D. Miller and Chandra Wickramasinghe if they would consider writing all new chapters supporting the Viking LR data for a 2011 Addendum to Mars The Living Planet. All agreed and it is now published (along with this chapter) as an eBook on Kindle and other such electronic book outlets. Each author tries to surmise why those in the NASA Mars Exploration division have avoided the Viking LR results in light of the new findings from Mars.

Over the years almost all of the television science documentaries about Mars and looking for life on Mars fail to mention the Viking LR biology findings other than the typical NASA Mars Exploration program mantra that "Viking searched but found no evidence for life on Mars". Yet all any writer or producer for any of these documentaries had to do was read a few peer-reviewed published papers by Levin and Straat to know this is not true. These lazy television journalists do not even seem interested to interview these surviving experimenters of the Viking biology team. It seems almost too contrived and doesn't make sense. Evidence for life on Mars was found by both Viking Landers and history will surely show that. I know I have done my share to straighten the record out. It is interesting to consider how the people responsible for blackballing the Viking LR data will appear in the context of history in the near future.

In an effort to fill out all the misinformation in popular Mars science documentaries, I decided to make a film of my own. In April of 2010 I flew out to Levin's home to film a documentary with him relaxed in his office and discussing in extreme detail the findings of the Viking Labeled Release experiment. This DVD documentary with the title, THE UNTOLD TRUTH: HOW THE NASA VIKING MISSION FOUND LIFE ON MARS is proudly available on Amazon.com and other venues (12). I think anyone interested in planetary science should hear what he has to say.

ASTROENVIRONMENTALISM

In the intervening years since I wrote Mars The Living Planet, I have become active in the areas of astroenvironmentalism with issues involving planetary protection. Although NASA today has a planetary protection program they try and paint the Mars Sample Return scenario as a low risk mission – with them considering the risk of harmful contamination from Mars to be near zero but not zero (13). What kind of risk assessment states there is “a near zero risk, but not zero” chance of contaminating the Earth?

It is very interesting to note that Levin's Company Biospherics Incorporated was funded by NASA in 1975 to submit a full Mars Sample Return concept (14). Levin and his co-workers published a 300-page report detailing such a mission but warned at NASA held meetings that he didn't think bringing samples back to Earth was without substantial risk (15). Is this a reason why NASA has blackballed Levin and the Viking Labeled Release data – because he wouldn't play ball with early plans to return Martian soil samples? If so, Levin's ethical and thoughtful cautioning to protect Earth's biosphere should be applauded.

After the Viking mission concluded, NASA continued on without Levin, making serious plans to return soil and rock samples from Mars to Earth with the first samples arriving by 2003 and 2005 (16). This was before any type of appropriate biohazard facility had been built to handle such samples (17). However in 2004 the NASA Genesis sample return capsule crashed and broke open in the Utah desert spilling its contents of solar wind particles (18). The symbolism of this tragic event was obvious, what might have happened if this capsule was returning from Mars and contained pathogenic bacteria, viruses and toxins that became released into Earth's soil and atmosphere?

By 1998 it seemed like no one in the scientific community or media was asking any tough questions about the Mars Sample Return mission. So I thought I would begin raising public awareness about it (19). I went on to write dozens of articles about this for various publications, journals and any radio or television programs that would listen. It occurred to me that Levin and Straat's LR data from Mars was a warning and that we had better settle the life on Mars issue with life detection instruments sent to Mars before bringing back any potentially deadly forms of Martian microbes that might wreak havoc on Earth's biosphere. By 1999 I set up an organization called ICAMSR, an acronym for the International Committee Against Mars Sample Return (20) and asked both Levin and Straat to be science advisors for ICAMSR and both agreed. Chandra Wickramasinghe,

Director of the Cardiff Centre for Astrobiology in Wales also volunteered to lend his voice (21). Since then ICAMSR's message has reached out to thousands of people and media all over the world. Furthermore, ICAMSR stands as testament to the work of Levin and Straat who are in my humble opinion (formed from years of studying their data and all the data gleaned from Mars spacecraft received since Viking), are the discoverers of life on Mars.

EPILOGUE

The 35-year Viking LR data suppression (let us call it what it is) by certain factions within the NASA Mars Exploration community and those peer-reviewed journals that will only allow NASA-authorized scientific papers to be published should be a major concern to all thinking people, especially those among us in the astrobiology community. It is not good science to discard any scientific data 35-years old or otherwise that has left behind a set of unsolved mysteries. This is especially in light of all the new information about Mars that is in support of this data. Real science builds on the foundations of data left behind by pioneering instrumentation that have obtained an interesting result. A recent example of this is the 2010 re-examination of the 35-year old Viking GCMS data by Navarro-Gonzalez et al (22). Because of this new information we now know the Viking GCMS failed in its mission to detect organic molecules on Mars, not because they weren't there, but rather because the Viking GCMS was simply not equipped to deal with the perchlorate salts. This leaves the door wide open as to what the Viking LR found. What Navarro-Gonzalez et al have done for the Viking GCMS should now be done for the Viking LR – a complete re-examination of the evidence.

For all of those in the scientific community proclaiming to be planetary scientists or astrobiologists, you have a responsibility to review the Viking Labeled Release experiment to determine if the new supporting data are in agreement with Levin and Straat's conclusion or not. If the results do favor a biological explanation, then another dedicated life detection mission to Mars should be sent to confirm these results at the first opportunity. For any scientist to refrain from such work is in essence to agree with those who would abandon the very principles on which science is based – the search for the truth about nature.

[Authors Note: After this paper had been published in the ebook THE MICROBES OF MARS, NASA/ASU researchers published in the August 5th 2011 issue of the journal Science that observations from NASA's Mars Reconnaissance Orbiter (MRO) have revealed possible flowing water during the warmest months on Mars. What further doubts can now exist in the scientific community that the Viking Labeled Release experiment results should not be fully re-examined under this extraordinary finding?]

HOW TO VOICE YOUR VIEWS ON THE VIKING LR

MEPAG is NASA's community-based forum designed to provide science input for planning and prioritizing Mars exploration activities for the next several decades. It is

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