Is Life on Mars a Danger to Life on Earth? NASA's Mars Sample Return

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Abstract

It has been known since the 1976 Viking Labeled Release Experiments that there may be life on Mars. In 1996 fossilized biological and chemical residue discovered in Martian Meteorite ALH 80041, provided evidence of past life between 3.8 to 4.2 billion years ago. Structures resembling fossilized microbialites, microbial mats, stromatolites, algae and what may be metazoan invertebrates have been observed. Organics have also been discovered. There is controversial evidence supporting the possibility that algae, fungi, and lichens may be flourishing in Eagle and Gale Crater and other select areas of Mars. NASA has refused to acknowledge this evidence and is preparing to harvest samples of Martian soil and air and return these substances to Earth in the absence of strict protocols to protect Earth from putative Martian pathogens. To avoid contamination, it is proposed that samples be deposited in the ISS or orbiting or lunar laboratories for investigation.

Key Words: Life on Mars, Bacteria, Viruses, Martian Pathogens, NASA's Mars Sample Return

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1. Will NASA's Mars Sample Retrieval Return Life from Mars?

NASA plans to obtain samples of Martian air and soil and return this material to Earth. There is now a collective body of evidence supporting the likelihood of current and past life on Mars; findings that NASA ignores. If NASA's Mars Sample Return mission captures Martian bacteria, viruses, fungi, and other organisms, might these life-forms pose a danger to Earth?

In this article, the evidence for life on Mars will be briefly reviewed. If these putative life forms poses a danger to life on Earth is unknown.

2. Viking Labeled Release Experiment

Viking 1 landed on Mars on July 20, 1976 and contained a biology package with three experiments--including the Labeled Release Experiment (LR)--designed to test for the possibility of life. The LR was not based on static chemical or physical properties but the detection of on-going biological metabolism. After 8 sols (Martian days) the LR was performed, radioactive nutrients were added to the soil, strong positive response was obtained, and the results met the pre-mission criteria for the detection of life (Levin & Straat 1977). As described by Levin (2010): "In a further effort to distinguish between biological and non-biological agents, additional, more defining controls were executed by commands from Earth. It was shown that the causative agent was inactivated by temperatures as low as 51.C, and when previously active soils were sequestered at 10.C for sometime before approximately three months. Finally, to test the possibility raised that the LR reaction had been caused by soil energized by exposure to the virtually unattenuated ultra violet light reaching the surface of Mars, another experiment was improvised. At dawn, a rock was pushed aside by the Viking sampling arm, and a sample taken from where the rock had protected the soil from ultraviolet light over geological time. The LR test was run on the sample. The results were positive, with the response being very similar to those of the other active runs."

Viking 2, landed on Mars after some months, 4,000 miles away. LR tests were repeated, all data satisfied or were consistent with the established criteria for life.

The failure to detect organics by the Gas Chromatograph Mass-Spectrometer (GCMS) aboard to the Vikings convinced NASA administrators that the LR results were false positive tests, perhaps do to salts in the soil; a claim Levin (2011) has vigorously disputed. Moreover, there is now considerable evidence of organics on Mars as discovered by Eigenbrode et al. (2018) and detected by others (Bieman et al. 1976; Ming et al. 2009; Sutter et al. 2016).

Subsequently, Gilbert Levin, the principal investigator of LR experiment, and G. Bianciardi and colleagues (Bianciardi et al 2012) performed a computerized mathematical complexity deep analysis of the Viking LR data, employing seven complexity variables. It was determined that the Viking LR positive responses demonstrated a different pattern from control responses which resembled near-random noise. By contrast, the active experiments exhibited statistically significant ($p < 0.001$) highly organized responses typical of terrestrial biology.

3. Fungus, Algae and Lichens on Mars?

The Viking LR experiment (Bianciardi et al 2012, Levin & Straat 1977; Levin 2010) was capable of detecting the biological activity of bacteria, algae, fungi, lichens, and other organisms. Although NASA refuses to equip any subsequent mission with life-detection technology, additional support for the LR experiment was subsequently found in photographs of the Martian surface, beginning in 2006 when structures described as "Martian mushrooms" and "lichens" were tentatively identified in images captured by the rover Opportunity in Eagle Crater (Joseph 2006). Subsequently, nearly thirty experts in fungi and lichens formed a consensus agreeing to a high probability that these organisms have colonized Mars (Joseph 2016); observations endorsed by independent scientists and teams of experts (Dass, 2017; Joseph et al. 2019, 2021a; Rabb, 2018) and substantiated via quantitative statistical comparisons with terrestrial specimens (Armstrong, 2021). Investigators also observed what resembles algae (Krupa 2017; Joseph et al. 2020a; Latif et al. 2021). Furthermore, sequential photos have documented what appears to be the growth of fungi on Mars (Joseph et al. 2021a).

Morphological evidence of specimens resembling terrestrial organisms and fungal growth should therefore be seen as additional evidence that the LR experiment carried out by the Viking did in fact detect biological activity in Martian soil samples (Levin 2010; Levin & Straat 1977; Bianciardi et al 2012). In further support is evidence that living organisms dwelled on Mars at least 4 billion years ago (McKay et al. 1996, 2009; Thomas-Keprta et al. 2002, 2009); and that these initial organisms subsequently fashioned bacteria mats, microbialites, stromatolites (Bianciardi et al 2014, 2015; Small, 2015; Joseph et al. 2019; Latif et al. 2021; Elewa, 2021; Rabb, 2018); and that life evolved as there is evidence of fossilized algae, acritarchs, and metazoan invertebrates (Bianciardi et al 2021; Armstrong 2021b; Elewa, 2021; Joseph et al. 2021b; Kaźmierczak 2016, 2020; Suamanarathna et al. 2021). Lichens are also a highly evolved eukaryotic organisms as they consist of a symbiotic consortium of algae, fungus, and bacteria; and, as noted what may be colonies of lichen-like specimens have been repeatedly observed on Mars.

4. Martian Meteorite ALH 84001

Detailed analysis of Martian meteorite ALH 84001--which may be from 3.8 to 4.2 billion years in age--has documented the presence of biological residue, carbonates, magnetite crystals, and fossilized polycyclic aromatic hydrocarbons (Thomas-Keprta et al. 2002, 2009; McKay et al. 2009; Thomas-Keprta et al. 2009). The magnetotactic residue was found to have the characteristic chain-like organization associated with biological activity (Clement et al. 1998; McKay et al. 1996, 2009) whereas the highest concentration of Martian polycyclic aromatic hydrocarbons--a possible byproduct of cellular decay--was embedded within carbonates (Clement et al. 1998). The evidence indicates that this biological residue may have been produced by carbonate and iron-eating bacteria, magnetotactic bacteria, algae, or fungi around four billion years ago (Thomas-Keprta et al. 2009).

5. Fossilized Algae, Microbialites, Stromatolites

Algae may have left their biological signature within ALH 84001 four billion years ago. Specimens that significantly resemble fossilized algae and cyanobacteria have also been photographed on the surface by the Martian Rovers, Spirit, Opportunity, and Curiosity (Bianciardi et al., 2021; Kaźmierczak 2016, 2020; Rizzo & Cantasano 2009; Rizzo et al. 2015).

Algae and cyanobacteria are known to fashion bacterial mats and microbialites; and specimens that resemble these biological formations have also been photographed on Mars (Bianciardi et al., 2014, 2015; Small 2015; Noffke, 2015; Joseph et al. 2019; Rabb 2018). Bianciardi et al., (2014, 2015) conducted an extensive fractal statistical analysis of sedimentary microstructures photographed by Opportunity and Spirit Martian Rovers and compared them with terrestrial microbialites. Morphometric indexes of the textural patterns indicated a highly significant statistical probability ($p < 0.01$) that the specimens on Mars are similar to terrestrial microbialites. Noffke (2015) has come to similar conclusions: microbialites may have been fashioned on Mars by algae and cyanobacteria (Bianciardi et al., 2014, 2015; Rizzo et al. 2021).

Not only is there a highly statistically significant similarities at the level of micro-structure (Bianciardi et al., 2014, 2015) but complex concentric domical structures, similar to the stromatolites of Lake Thetis, Australia, have been photographed in Gale Crater (Joseph et al. 2020b; Latif et al. 2021; Elewa 2021).

6. Do Martian Organisms Pose a Danger to Earth?

Joseph, Bianciardi, and colleagues (Joseph et al. 2019) have summarized a considerable body of evidence that supports the hypothesis that viable organisms may have been repeatedly transferred to and fro, back and forth, between Earth and Mars over the course of the last four billion years. If this hypothesis is correct, this may explain why Martian specimens resembling fossilized and living organisms closely resemble those on Earth. Likewise, if this hypothesis is correct, then Earth has been repeatedly contaminated with Martian viruses and living organisms and vice versa; and Martian life-forms may be genetically similar or identical to those on Earth.

If any putative Martian organisms and viruses transferred between planets have caused diseases, plague, or effected the biosphere or the evolutionary trajectory of life on Earth, is unknown. However, if the interplanetary transfer hypothesis is correct, then it can be argued that life on Earth has already been exposed to Martian organisms and viruses, and NASA's plan to transfer samples to Earth, might pose no danger, even if viable organisms are accidentally released into our environment. On the other hand, if life on Earth has never before been exposed to Martian organisms, then the risks are unknown.

7. Conclusions: NASA's Mars Sample Return and Life on Mars.

There is now a mass of data that collectively strongly supports, but does not prove, the likelihood of life on Mars in the ancient past and in the present day (Becker 2021; Rizzo et al. 2021). Dozens of scientists have reported evidence of fossils and what may be living organisms. Even scientists who at first expressed skepticism (e.g., Armstrong, 2019; Kidron 2019) now believe the evidence of current and past life is compelling (Armstrong 2021a,b; Joseph et al. 2021ab).

A ten-year project for NASA Mars Sample Return missions has already begun (a joint NASA/ESA initiative). Samples have already been cached by the Mars 2020 Perseverance Rover. These samples will be returned to Earth in the coming years, perhaps 2031. Recently, some other proposals, such as low-cost Mars sample return missions may be able to return the Mars sample even earlier and provide protection against contamination (Bertolini et al., 2021; Kouduka et al. 2020).

The dangers, as I have pointed out, are unknown. However, the benefits to the advancement of science will be priceless. To avoid contamination perhaps the best strategy is to deliver samples from Mars to the International Space Station, or orbiting or lunar laboratories.

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