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University of Buckingham Astrobiologists Endorsed by UK Space Agency to Look for Life on Mars

The UK Space Agency has endorsed an experiment proposal submitted to the NASA ROSES-2015: The Mars Science Laboratory Participating Scientist Program by a group of scientists including two members of the University of Buckingham's Centre for Astrobiology (BCAB), BACB's Barry E. DiGregorio and Gilbert V. Levin. Ronald I. Dorn a Professor of Geography of Arizona State University, in Tempe, Arizona, Giorgio Bianciardi a Researcher and Adjunct Professor at the Dept. of Medical Biotechnologies, at Siena University, Italy, and Robert Lodder, Professor of Pharmaceutical Sciences at the University of Kentucky Medical Center in Lexington Kentucky, are also participants. The proposal, titled "A search for extant endolithic and hypolithic microbial communities," if selected by NASA and the UK Space Agency, would be the first effort to look for evidence of current life on Mars since Viking in 1976. Already endorsed but awaiting funding approval by the UK Space Agency, the new proposal would be a part of Curiosity's Extended Mission objectives from October 2015-2019 as the rover makes the long climb to the top of the 8-kilometer Mount Sharp. The Buckingham proposal seeks to use the frequencies of special spectroscopic filters on the Mast Camera and MAHLI microscopic imager camera on the Curiosity to look for evidence of microorganisms. Photosynthetic pigments, portions of or intact microorganisms (endolithic microbes) that might be alive inside freshly broken or those living under rocks (hypolithic microbes) would be sought. The rover wheels sometimes break open or turn over rocks providing fresh surfaces.

DiGregorio says, "Looking for evidence of current life on Mars by Curiosity despite its lack of a dedicated life detection experiment is possible because endolithic and hypolithic microbial communities can easily be seen by the naked eye because of their photosynthetic pigments and textures. Once a suspect endolithic or hypolithic microbial community has been identified using spectroscopic filters on the Mast Camera, other instruments on the rover can be brought to bear, including ChemCam and SAM. Many endolithic communities on Earth have been found to emit methane, a key biosignature gas. In addition, by positioning the rover's tunable laser spectrometer inlets over rocks with endolithic colonies it might be possible to detect faint traces of methane gas from any endolithic colonies present."

The team also hopes to look more closely at the manganese rock coatings that have been discovered early on by Curiosity. Barry E. DiGregorio, the Principal Investigator for the proposal says "Manganese rock varnish coatings on Earth in many cases are mediated by manganese-oxidizing microorganisms. The coatings can preserve fossils and detectable traces of organic molecules from both dead and living cells. As the rover climbs Mount Sharp as part of its extended mission, it will go through four distinct geological units identified from orbit with each representing perhaps a different ancient habitable environment. To explore them all will require Curiosity to climb up Mount Sharp a distance of 8 kilometers over a two to four year period.

A second opportunity to look for life?

It was Gilbert Levin and his Co-Experimenter Patricia Ann Straat who in 1976 were part of NASA's first and only mission to look for life on Mars with the twin Viking Landers. Levin designed one of three small biology detection laboratories that were placed on both Viking Landers sent to two different landing sites separated on Mars by about 6500 kilometers. Levin has argued since Viking 38 years ago that his findings, that were conducted a total of seven times on Martian soil samples under a variety of environmental conditions, were consistent with biology. However, the results were considered inconclusive by others on Viking team because of data from two miniaturized organic analysis instruments also on Viking. Known to organic chemists as a gas chromatograph mass-spectrometer (GCMS), each GCMS was designed to look for organic molecules at the parts per billion level, but, according to the GCMS Experimenter, MIT organic chemist Klaus Biemann, neither GCMS found any. Since that time, Levin has designed and proposed a number of life detection instruments to be flown to Mars, but none has been accepted. In 1996, Levin was part of a NASA/JPL effort on the Russian Mars 96 mission to look for oxidants on Mars that might be causing the destruction of organic molecules. However, the Russian vehicle never made it out of Earth orbit and was destroyed as it reentered Earth's atmosphere.

New possibilities with MSL in phase 2

Monumental discoveries already made by Curiosity during its first two years on Mars have shown not only does Mars have organic molecules, but that they are of the same type of long-chain organic molecules composing microbial cell walls on Earth. Other efforts to look for current microbial life include the sampling of sporadic methane gas emissions believed to be emanating somewhere within Curiosity's Gale Crater landing site. Could it be coming from communities of microbes living within certain rocks? The MSL rover has also determined that the rocks and soil at Gale Carter are or once were a habitable environment for some types of hardy microorganisms. DiGregorio says, "Combine this with the strong evidence that Gale Crater was once home to a large fresh water lake, makes it almost too irresistible not to look for life in the protected niches we hope to search."

Most recently, new evidence for a current liquid water cycle at the rover landing site makes it possible that small amounts of liquid water exist in the pores of some rocks and soil, perhaps just enough to keep microbial colonies alive.

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