New Analysis of Viking Mission Results Indicates Presence of Life on Mars

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We may already have 'met' Martian organisms, according to a paper presented Sunday (Jan. 7) at the meeting of the American Astronomical Society in Seattle.

Dirk Schulze-Makuch of Washington State University and Joop Houtkooper of Justus-Liebig-University, Giessen, Germany, argue that even as new missions to Mars seek evidence that the planet might once have supported life, we already have data showing that life exists there now—data from experiments done by the Viking Mars landers in the late 1970s.

"I think the Viking results have been a little bit neglected in the last 10 years or more," said Schulze-Makuch. "But actually, we got a lot of data there." He said recent findings about Earth organisms that live in extreme environments and improvements in our understanding of conditions on Mars give astrobiologists new ways of looking at the 30-year-old data.

The researchers hypothesize that Mars is home to microbe-like organisms that use a mixture of water and hydrogen peroxide as their internal fluid. Such a mixture would provide at least three clear benefits to organisms in the cold, dry Martian environment, said Schulze-Makuch. Its freezing point is as low as -56.5^{o} C (depending on the concentration of H_2O_2); below that temperature it becomes firm but does not form cell-destroying crystals, as water ice does; and H_2O_2 is hygroscopic, which means it attracts water vapor from the atmosphere—a valuable trait on a planet where liquid water is rare.

Schulze-Makuch said that despite hydrogen peroxide's reputation as a powerful disinfectant, the fluid is also compatible with biological processes if it is accompanied by stabilizing compounds that protect cells from its harmful effects. It performs useful functions inside cells of many terrestrial organisms, including mammals. Some soil microbes tolerate high levels of H_2O_2 in their surroundings, and the species Acetobacter peroxidans uses hydrogen peroxide in its metabolism.

Possibly the most vivid use of hydrogen peroxide by an Earth organism is performed by the bombardier beetle (Brachinus), which produces a solution of 25 percent hydrogen peroxide in water as a defensive spray. The noxious liquid shoots from a special chamber at the beetle's rear end when the beetle is threatened.

He said scientists working on the Viking projects weren't looking for organisms that rely on hydrogen peroxide, because at the time nobody was aware that such organisms could exist. The study of extremophiles, organisms that thrive in conditions of extreme temperatures or chemical environments, has just taken off since the 90s, well after the Viking experiments were conducted.

The researchers argue that hydrogen peroxide-containing organisms could have produced almost all of the results observed in the Viking experiments.

• Hydrogen peroxide is a powerful oxidant. When released from dying cells, it would sharply lower the amount of organic material in their surroundings. This would help explain why Viking's gas chromatograph-mass spectrometer detected no organic compounds on the surface of Mars. This result has also been questioned recently by Rafael Navarro-Gonzalez of the University of Mexico, who reported that similar instruments and methodology are unable to detect organic compounds in places on Earth, such as Antarctic dry valleys, where we know soil microorganisms exist.

• The Labeled Release experiment, in which samples of Martian soil (and putative soil organisms) were exposed to water and a nutrient source including radiolabeled carbon, showed rapid production of radiolabeled CO_2 which then leveled off. Schulze-Makuch said the initial increase could have been due to metabolism by hydrogen peroxide-containing organisms, and the leveling off could have been due to the organisms dying from exposure to the experimental conditions. He said that point has been argued for years by Gilbert Levin, who was a primary investigator on the original Viking team. The new hypothesis explains why the experimental conditions would have been fatal: microbes using a water-hydrogen peroxide mixture would either “drown” or burst due to water absorption, if suddenly exposed to liquid water.

• The possibility that the tests killed the organisms they were looking for is also consistent with the results of the Pyrolytic Release experiment, in which radiolabeled CO_2 was converted to organic compounds by samples of Martian soil. Of the seven tests done, three showed significant production of organic substances and one showed much higher production. The variation could simply be due to patchy distribution of microbes, said Schulze-Makuch. Perhaps most interesting was that the sample with the lowest production—lower even than the control—had been treated with liquid water.

The researchers acknowledge that their hypothesis requires further exploration. “We can be absolutely wrong, and there might not be organisms like that at all,” said Schulze-Makuch. “But it’s a consistent explanation that would explain the Viking results.”

He said the Phoenix mission to Mars, which is scheduled for launch in August, 2007, offers a good chance to further explore their hypothesis. Although the mission’s experiments were not designed with peroxide -containing organisms in mind, Phoenix will land in a sub-polar area, whose low temperatures and relatively high atmospheric water vapor (from the nearby polar ice caps) should provide better growing conditions for such microbes than the more “tropical” region visited by Viking. Schulze-Makuch said the tests planned for the mission, including the use of two microscopes to examine samples at high magnification, could reveal whether we had the answer all along—and if we’ve already introduced ourselves to our Martian neighbors in a harsher way than we intended.

“If the hypothesis is true, it would mean that we killed the Martian microbes during our first extraterrestrial contact, by drowning—due to ignorance,” said Schulze-Makuch.

Source: Washington State University

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