

Finding of Microbial Colony in U.S. Suggests Life Could Live on Mars

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for National Geographic News
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Scientists have found a place on Earth that they believe is analogous to conditions on Mars and the Jovian moon Europa, and the site is teeming with a group of microbes that far outnumber bacteria.

The discovery supports the idea that life may exist on other planets and moons.

The site is Lidy Hot Springs, located in the Beaverhead Mountains in Idaho. Living in hydrothermal waters 660 feet (200 meters) below the surface are microscopic organisms called methanogens, which derive their energy from geothermal hydrogen and produce methane as a byproduct.



Scientists have discovered microbes thriving in an ecosystem on Earth that closely resembles the conditions thought to exist on Mars.

*Photograph by
NASA/Roger
Resmeyer/CORBIS*

Many scientists have agreed that if extraterrestrial life does exist elsewhere in the solar system, it is probably in the form of organisms at the bottom of the food chain, which have a simple metabolism and need only hydrogen and carbon dioxide to survive.

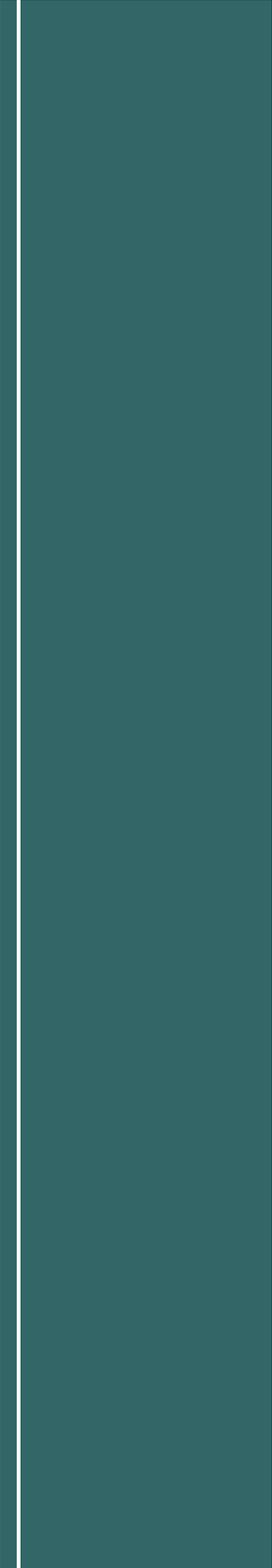
"Those two things are very common in the universe," said Francis Chappelle of the U.S. Geological Survey in Columbia, South Carolina. "It is a kind of metabolism that can happen independent of photosynthesis."

Chappelle is co-author of a paper on the microbial community in Idaho published in the January 17 issue of *Nature*.

Unique Community

Methanogens are a part of the domain of life known as Archaea. Discovered in the 1970s, Archaea inhabit environments with harsh conditions, such as hydrothermal vents, petroleum deposits, and the digestive tracts of cows.

Archaea are genetically different from seemingly similar bacteria. Bacteria, which dominate the ecosystem, live where there is organic matter and photosynthesis. Archaea, in contrast, can live in environments lacking organic carbon.



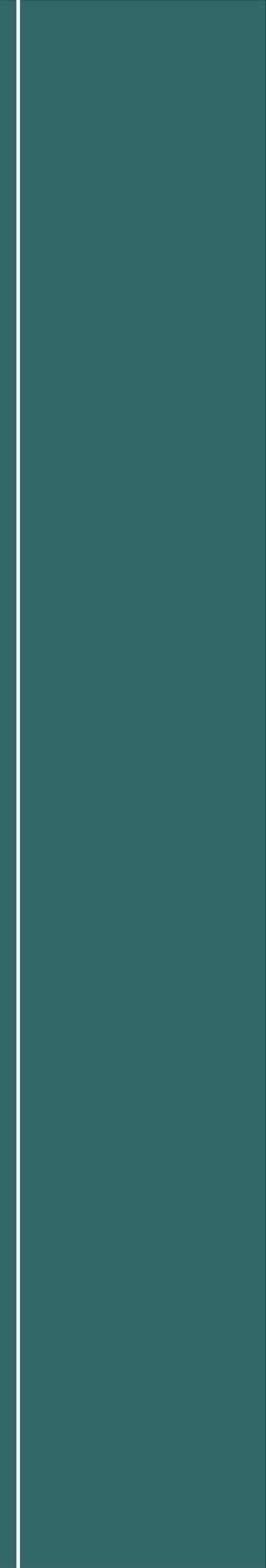
Scientists had theorized that methanogens could exist on Earth and other planets and moons. But no place dominated by the hydrogen-loving microorganisms had ever been found on Earth.

"There is this idea that there might be these communities," said Derek Lovley, a microbiologist at the University of Massachusetts in Amherst and co-author of the paper in *Nature*. "People have looked for a while, but the problem is that almost everywhere there is a significant amount of organic matter."

To find an environment in which Archaea were likely to dominate, the researchers went in search of a place lacking organic carbon. They focused on the hot springs in eastern Idaho because volcanic activity had burned away most of the organic carbon that could serve as an energy source for microorganisms but the water contained high concentrations of geologically produced hydrogen.

"Lidy Hot Springs does not have organic matter," said Lovley. "The only thing there is hydrogen percolating up."

The owner of the hot springs, Charles Wilson, had drilled a bore hole into the hot springs to get a regular flow of hot water to heat his home and generate electricity. The researchers asked him to



modify his plumbing so that they could get an uncontaminated sample of the subsurface water, and he complied.

To determine what type of microbes was most prevalent in the hydrothermal waters circulating around the deeply buried igneous rocks, the scientists analyzed DNA sequences of the organisms. The results indicated that the microbial population consisted of more than 95 percent Archaea.

Further analysis revealed that most of the microorganisms seemed to be methanogens, which make methane from hydrogen gas.

This methanogen-dominated community of microbes at Lidy Hot Springs "is unlike anything previously described on Earth," and "is consistent with geochemical scenarios proposed for microbial communities that may inhabit the subsurface of Mars and Europa," the scientists reported in their paper.

"What it shows is that the kind of ecosystem that is hypothesized to be on Europa is in fact possible," said Chapelle. "It is like Einstein making relativity predictions, but until he went out and measured deflection of stars, he didn't know he was right."

Extraterrestrial Life?

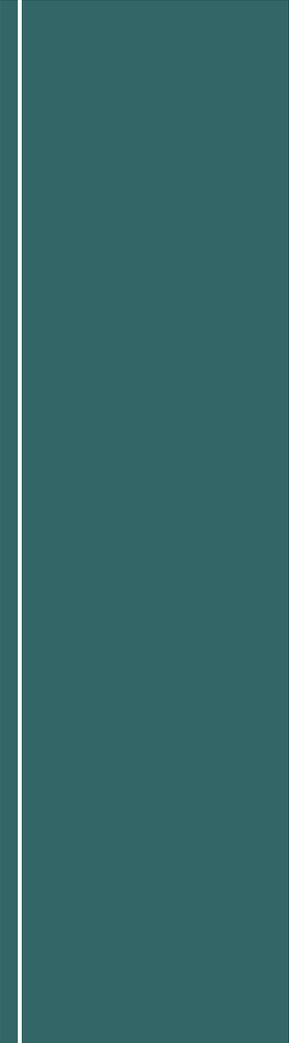
Jack Farmer, chair of the NASA Astrobiology Institute's Mars Focus Group and a professor of geology and astrobiology at Arizona State University in Phoenix, supports the connection that Chapelle, Lovley, and their colleagues make between the microbial community in Idaho and possible life on Mars and Europa.

"Because there is evidence that Mars once had—and probably still does have—a widespread subsurface groundwater system, and, in the past, at least, widespread volcanic activity that could drive hydrothermal systems, hydrogen-eating microbes could have developed and persist there deep beneath the surface," said Farmer.

Evidence, as yet unproven, also suggests Europa may have microbial life, Farmer said. Europa has a subsurface ocean and hydrothermal heating as a result of a gravitational tug-of-war between Jupiter and other large moons.

Are Archaea out there?

In search of an answer, NASA has a Mars-exploration program. It will culminate in 2007 with the launch of a robotic probe that will dig near the surface of the planet in search of life, past



or present, said Farmer.

"What we would really like to do to answer this question is deep-drill to depths of hundreds to thousands of meters," said Farmer. "The technology for intermediate and deep drilling from a robotic platform does not yet exist, although there are active efforts within the community and NASA to develop these capabilities," he noted.

Although Farmer, Chapelle, and their colleagues say they have no scientific basis to prove the existence of life on other planets, findings like those at Lidy Hot Springs give them the gut feeling that extraterrestrial life will one day be found.

Chapelle said: "I think it is inconceivable that there is not this kind of metabolism in other places."