Study casts doubts about chemical process thought to support subterranean microbial life

By Elizabeth Luciano
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Scientists from the University and the U. S. Geological Survey (USGS) have a c discovered that a critical chemical reaction previously thought to support microbial life deep below the Earth's surface, and possibly on Mars, is in fact highly unlikely. The findings were reported in the Aug. 14 issue of the journal Science.

It had been generally accepted by scientists that hydrogen gas produced from rock could provide energy to support the growth of microorganisms living below the Earth's surface, says Derek Lovley, who chairs the Department of Microbiology. The hydrogen was thought to be produced when basalt, a common form of rock in the Earth's subsurface, reacts with water.

However, a research team led by Lovley has found that this concept is incorrect. They found that although hydrogen gas can be produced from basalt under artificial laboratory conditions, there is no hydrogen production under the conditions actually found in the Earth's subsurface.

The research was funded with a three-year, $325,000 grant from the National Science Foundation's Life in Extreme Environments (LeXeN) program.

Lovley and his colleagues found that hydrogen could only be produced from the basalt when the rock was exposed to acidic conditions but environments containing basalt are never acidic.

"The idea that hydrogen produced from rocks could support large subsurface microbial ecosystems on Earth and possibly other planets was fascinating and was accepted by most microbiologists," Lovley says. "Unfortunately, this concept can not be supported by the available data."

Based on an analysis of chemical and microbiological data by Lovley and collaborators Robert Anderson, a UMass graduate student, and Francis Chapelle. a hydrologists at the USGS in South Carolina the study suggests that microorganisms in the Farth's subsurface are probably living on organic matter associated with the rock, not hydrogen. This is similar to the way that microorganisms grow in soil on the surface of Earth.

The scientists emphasized that even though the microorganisms living deep in the Earth have the ability to survive in a manner similar to surface microorganisms, they may have other unique characteristics. For example. Lovley's recent research has demonstrated that microorganisms from the Earth's subsurface can be used to remove radioactive metals and hydrocarbons from polluted groundwater.

The study suggests that microorganisms in the Earth's subsurface are probably living on organic matter, not hydrogen, as previously believed.

"This **is an important step forward in our continuing efforts to udnerstand the processes that sustain life deep beneath the Earth's surface," said Mike Purdy, director of NSF's LeXeN program. "Negative findings like this** are as **important as positive ones in their importance to our understanding of the processes that determine the limits to life."**