Multinational Team Of Scientists Finds Early Life In Volcanic Lava

Science paper describes geological setting favorable for the origin of life Scripps Institution of Oceanography, UCSD

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Scientists from the United States, Norway, Canada, and South Africa have identified what is believed to be evidence of one of Earth's earliest forms of life, a finding that could factor heavily into discussions of the origins of life.

The team, which includes a scientist from Scripps Institution of Oceanography at the University of California, San Diego, found microscopic life colonized in ancient volcanic lava dating nearly 3.5 billion years old, during a time known as the Archean.

The findings are reported in the April 23 issue of the journal *Science*. The team includes Harald Furnes and Neil Banerjee of the University of Bergen, Norway; Karlis Muehlenbachs of the University of Alberta, Canada; Hubert Staudigel of Scripps Institution; and Maarten de Wit of the University of Cape Town, South Africa.

In 2001, Staudigel and his colleagues documented how microscopic organisms, smaller than the width of a human hair, are able to eat their way into volcanic rock to form long, worm-like tubes (see http://scrippsnews.ucsd.edu/pressreleases/staudigel_rockeaters.cfm).

The new study, which describes a similar finding in the Barberton Greenstone Belt, a location several hundred miles east of Johannesburg, South Africa, near Swaziland, proves that microbial processes that can be seen today also occurred during the earliest stages of the planet's history at the roots of life's origins. The Barberton

Greenstone Belt was formed in an underwater setting in the planet's oceanic crust but is now uplifted and accessible to land-based field work. Until the team's expedition last June, this area had not been extensively explored for signs of early life.

"Our evidence is amongst the oldest evidence for life found so far," said Staudigel, a research geophysicist at the Cecil H. and Ida M. Green Institute of Geophysics and Planetary Physics at Scripps. "This area within the oceanic crust is a favorable place for the origin of life. It offers relatively easy access to seawater and volcanic environments such as deep-sea hydrothermal systems-including a wide range of catalysts that are required in the origin of life."

Staudigel also argues that the region's previous geographic position in a submarine environment below the ocean floor may have provided protection from the life-stunting effects of meteorites that bombarded Earth's surface billions of years ago.

"This finding may allow us to cross-reference the visual clues of these microbial fossils with their chemical fingerprints," said Staudigel. "They may help us understand biological and chemical processes that occurred 3.5 billion years ago, which is only one billion years after the accretion of Earth from the solar nebula."

The scientists identified the microbes in an area of Barberton with ample volcanic eruptions called "pillow lavas." These are formed when undersea volcanoes erupt and spew lava, which cools quickly to form tube-like structures. Over time these tubes harden and, when dissected by erosion, form pillow-like formations.

"When the planet was three-and-a-half billion years old there were no plants or animals to eat," said Staudigel. "So to make a living these microbes adapted to eating volcanic rock. That's all there was."

The scientists now plan to carefully analyze the microbes with sensitive instruments to characterize their ancient activities within the pillow lava.

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