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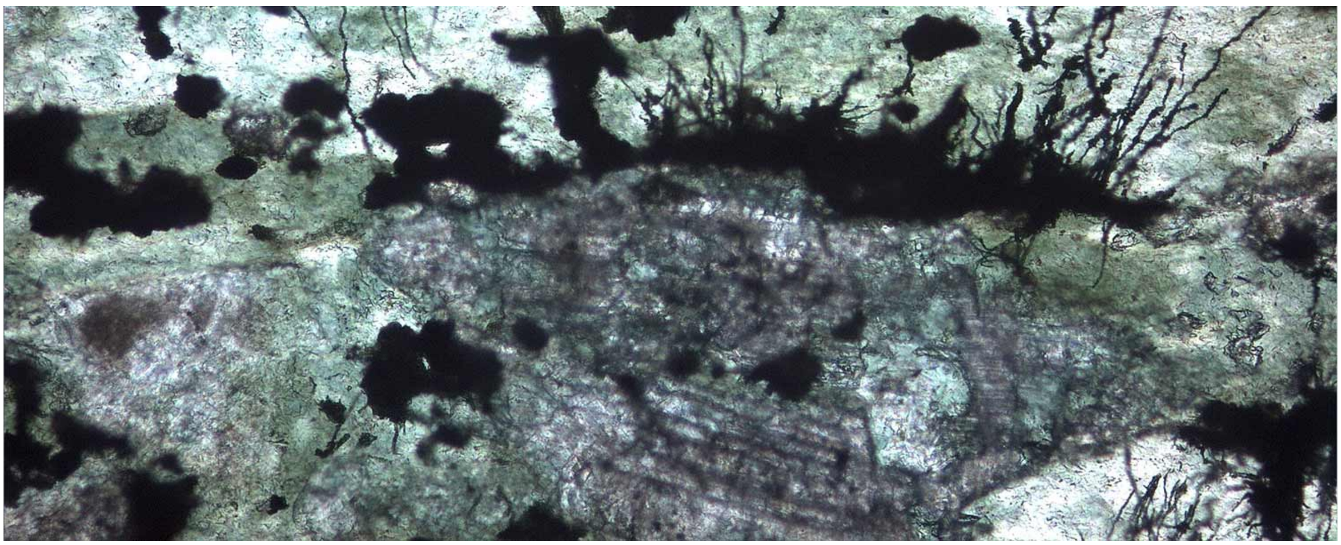
New Studies of Rocks Show Earliest Forms of Life in Antarctic Ice Caves and in South African Lava

Discovery of physical fossils validated in new science papers



Microscopic structures in rock are believed to be the fossilized remains of organisms more than 3 billion years old.

Hubert Staudigel, a geophysicist at Scripps Institution of Oceanography, UC San Diego, and his collaborators have completed two studies about fossils in volcanic rocks, and the biological activity in some of the earth's harshest environments.

These studies are helping researchers understand how life may have emerged under the physical and chemical conditions that existed on Earth billions of years ago.

In a paper appearing in the journal *Proceedings of the National Academy of Sciences* (PNAS) on May 18, Staudigel and other researchers report on data collected from samples of 3.5 billion-year-old basalts from Australia and South Africa. They compared those samples to newer basalts from the Pacific and Atlantic oceans. The research focused on critical physical attributes rather than the chemical makeup of the trace fossils. Reliance on such chemical data was the basis of a previous study that had suggested that what Staudigel considered fossilized remains were actually structures within rocks made by non-biological means.

The PNAS study confirms earlier conclusions that microscopic tubular structures in the rock were fossilized remains of the earliest forms of life on Earth and that corrosion occurred when organic acids came in contact with the branching filaments that can extend from microbes such as fungi and bacteria.

“The [previous] study gave us a little ‘bump in the road’, but in our paper, we could show that these earliest trace fossils are very likely to be real and offer a great opportunity to help us understand the earliest life on Earth,” he said.

In March, Staudigel’s study about microbes from ice caves in Antarctica was published in *Frontiers in Microbiology.* Researchers collected sediment samples from the bottom of ice caves on Mt. Erebus, Antarctica, in November 2010 and November 2012 to investigate life in the absence of sunlight. The study found that the gas emissions from volcanic activity could support simple forms of life, giving another clue about the characteristics of the planet’s earliest organisms.

“The results suggest that microbial communities can be supported by the small amounts of chemical energy from [volcanic] emissions and from dissolution of volcanic materials,” said co-author and former Scripps Oceanography researcher Bradley Tebo, now associate director of the Institute of Health at the Oregon Health and Science University.

Staudigel hopes to continue his research in the field by comparing naturally occurring microbes and their patterns of rock dissolution in the laboratory to the fossils created in natural rocks millions to billions of years ago.

“If you look at it from the positive side, we hope in the long term to identify microbes from the ice caves that are capable of creating trace fossils,” he said. “We can finally connect the biological investigations with the geological studies if we can match up specific shapes of corrosion textures and their biochemical residues in natural systems with the shapes generated in the lab.”

Besides Staudigel, the PNAS study is co-authored by Harald Furnes from the Department of Earth Science and the Centre for Geobiology, University of Bergen, Bergen, Norway, and Maarten deWit from the Africa Earth Observatory Network and Earth Stewardship Science Research Institute, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa.

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