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Press release

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Research results, Scientific Publications
Biology, Environment / ecology, Geosciences, History / archaeology, Oceanology / climate
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Unknown microorganisms used marble and limestone as a habitat

Unusual structures of unknown origin found in rocks of desert areas / Publication in the "Geomicrobiology Journal"

In the desert areas of Namibia, Oman, and Saudi Arabia, research work has revealed unusual structures that are probably due to the activity of an unknown microbiological life form. Unusually small burrows, i.e., tiny tubes that run through the rock in a parallel arrangement from top to bottom, were discovered in marble and limestone of these desert regions. "We were surprised because these tubes are clearly not the result of a geological process," said Professor Cees Passchier from Johannes Gutenberg University Mainz (JGU), who first came across the phenomenon during geological field work in Namibia. During subsequent sample investigations, evidence of biological material was found. Evidently, microorganisms had perforated the rock. "We don't currently know whether this is a life form that has become extinct or is still alive somewhere," added Passchier.

Puzzling discovery in Namibia

Geologist Cees Passchier has been working in Namibia for 25 years, among other places. His research focuses on the geological reconstruction of Precambrian terranes. "We look at the structure of the rocks to find out how continents came together to form the supercontinent Gondwana 500 to 600 million years ago," explained Passchier. At that time, carbonate deposits formed in the ancient oceans and turned into marble due to pressure and heat. "We noticed strange structures in this marble that were not the result of geological events." Instead of smooth erosion surfaces, tubes could be seen that were about half a millimeter wide and up to three centimeters long, lined up parallel to one another and forming bands up to ten meters long. Some calcrete crusts had formed on the edges.

The first observations of this kind in the Namibian desert were made 15 years ago. In the meantime, Professor Cees Passchier, together with colleagues from the Institute of Geosciences at Mainz University, and Dr. Trudy Wassenaar, head of the consulting company Molecular Microbiology and Genomics Consultants, have continued to investigate the phenomenon. "We think that it must have been a microorganism that formed these tubes." The tubes were not empty but filled with a fine powder of clean calcium carbonate. It is assumed that microorganisms may have bored the tunnels to use nutrients present in the calcium carbonate, the main component of marble. The fine powder remained behind. Passchier also found very similar structures during field work in Oman and in Saudi Arabia – in Oman in limestone, while in the Saudi Arabian desert they were in marble.

"In any case, these are old structures, perhaps one or two million years old," said Passchier. "We assume that they were formed in a slightly more humid climate, not in the dry desert climate that prevails today." However, the organism that caused these structures remains a mystery.

Endolithic microorganisms use rock as a basis for life

Microorganisms such as bacteria, fungi, or lichen are found even in inhospitable or remote corners of the Earth. So-called endolithic microorganisms are not uncommon in desert areas as they can obtain their energy and nutrients from the rocks they live in. "What is so exciting about our discovery is that we do not know which endolithic microorganism this is. Is it a known form of life or a completely unknown organism?" According to Cees Passchier, it must be an organism that can survive without light because the tubes have formed deep inside the rock. The researchers found biological material, but no DNA or proteins that could provide further insights.

Passchier hopes that specialists on endolithic organisms will look into this phenomenon in the future. "This form of life, of which we do not know whether it still exists, could be important for the global carbon cycle. It is therefore essential that the scientific community becomes aware of it." The release of carbon through the biological activity of microorganisms could also play a major role in the Earth's CO_2 balance.

Publication in the "Geomicrobiology Journal"

Cees Passchier was Professor of Tectonophysics and Structural Geology at the Institute of Geosciences of Johannes Gutenberg University Mainz from 1993 to 2019. He has been Senior Research Professor in Geoarchaeology at JGU since 2019. The current research paper "Subfossil Fracture-Related Euendolithic Micro-burrows in Marble and Limestone" was published in the "Geomicrobiology Journal".

Images:
https://download.uni-mainz.de/presse/09_geowiss_geomikrobio_mikroorganismen_01.jpg
Marble from Namibia in which micro-burrows have grown in parallel arrangement downwards from a fracture filled with white calcium carbonate
photo/©: Cees Passchier

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Band of heavily eroded micro-burrows that had been exposed to the surface
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https://download.uni-mainz.de/presse/09_geowiss_geomikrobio_mikroorganismen_03.jpg
Top view of an outcrop in Namibia showing the marble penetrated by a group of micro-burrows
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https://download.uni-mainz.de/presse/09_geowiss_geomikrobio_mikroorganismen_04.jpg
Marble from Namibia in which micro-burrows have grown in parallel arrangement downwards from two fractures filled with calcrete
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https://download.uni-mainz.de/presse/09_geowiss_geomikrobio_mikroorganismen_05.jpg
Landscape in Namibia with marble outcrops where the bands of micro-burrow were found
photo/©: Cees Passchier

Related links:
- https://www.geowiss.uni-mainz.de/geoarchaeologie/ – Geoarchaeology group at the JGU Institute of Geosciences
- https://www.geosciences.uni-mainz.de/ – Institute of Geosciences at JGU

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Marble from Namibia in which micro-burrows have grown in parallel arrangement downwards from a fracture filled with white calcium carbonate
photo/©: Cees Passchier

Landscape in Namibia with marble outcrops where the bands of micro-burrow were found
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