Researchers find evidence of cavity-dwelling microbial life from 3 billion years ago

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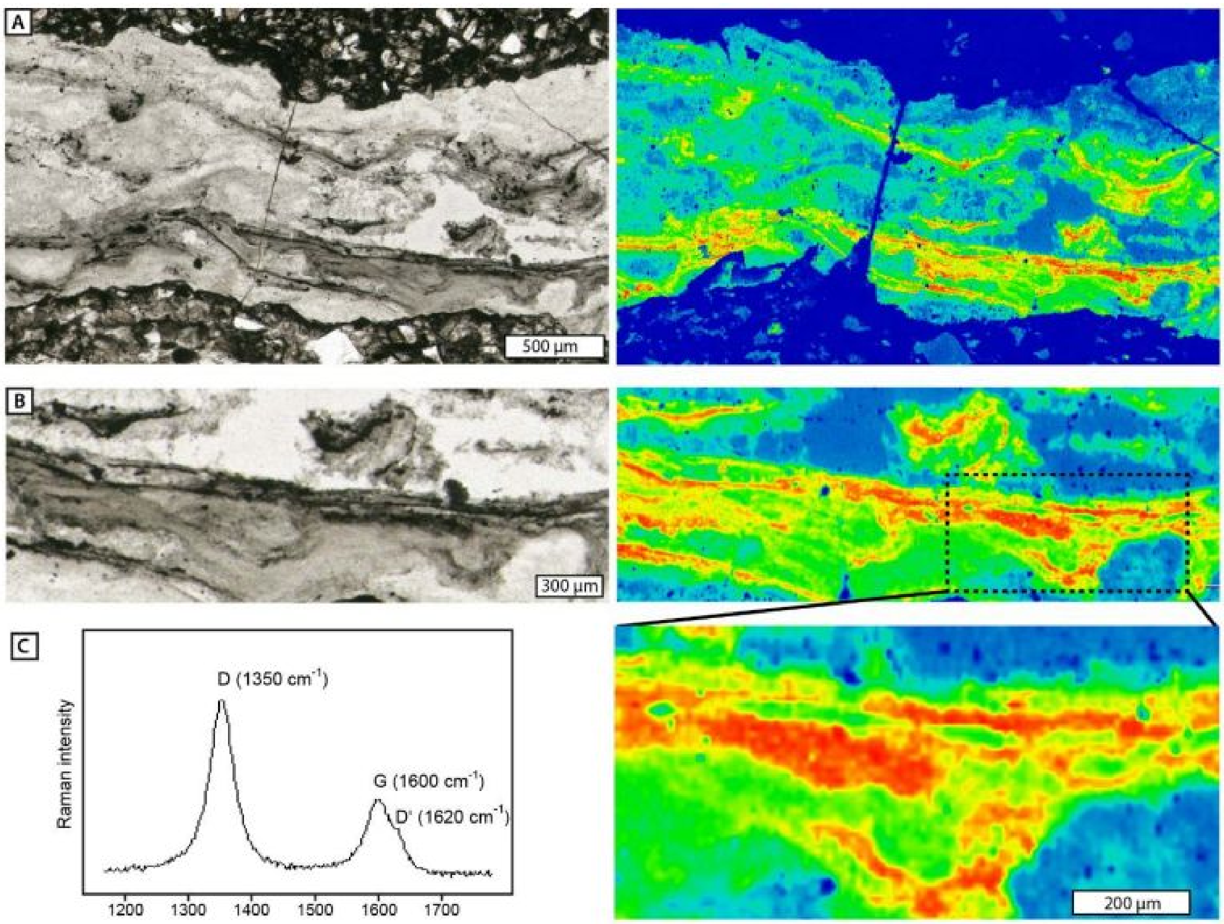

Raman micro-spectroscopy. A, B: Thin section photomicrographs (left) and corresponding Raman intensity maps (right) of the silicified cavities showing the downward-oriented accretion and the kerogenous composition of the dark laminae. Red colors indicate kerogen-rich areas. C: Representative first-order Raman spectrum of the kerogen with the characteristic disordered peaks for amorphous carbon (D and D') and the graphite peak (G). Credit: *Geology* (2016).

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(Phys.org)—A team of researchers from Germany and Switzerland has found examples of microbial life from over 3 billion years ago, that appeared to have evaded UV radiation by hiding in subsurface cavities. In their paper published in the journal *Geology*, the team describes where the fossilized cells were found, their testing techniques and why their finding is important.

Scientists believe that life first came to exist on planet Earth approximately three and a half to four billion years ago, a time called the Archaean aeon, when there was not yet an ozone layer to filer out UV radiation, or oxygen in the atmosphere to breathe—that meant that microbes that developed would have had to do so in a protected place. In this new effort, the researchers report that they believe they have found just such a haven.

Newly found fossils in South Africa's Baberton greenstone belt offer evidence that ancient microbes found refuge in cavities in tidal sediment, formed by air bubbles. The fossilized cells have been dated to 3.2 billion years ago and were found under a microbial mat that was believed to have been pushed to the surface by volcanic activity. The team conducted multiple tests on the mats and the microbes found hidden under them, including bulk carbon and SEM analysis and Raman micro-spectroscopy and report that the microbes were shaped like rods, growing in train like filaments, similar to many bacteria alive today. They note also that the microbes were quite uniform in shape and that they were able to control their diameter and length as modern microbes do. The fossils are also approximately 500 million years older than any other previous fossil found in a habitat, and thus represent some of the earliest forms of life ever found (the very earliest date back to approximately 3.43 billion years ago.)

Interestingly, the researchers also note that most scientists agree that during the time that life was first coming about on Earth, the planet was very much like Mars is today, suggesting that the new find might offer some clues as to the best way to search for life on the Red planet, as new probes are designed and sent.

More information: Martin Homann et al. Evidence for cavity-dwelling microbial life in 3.22 Ga tidal deposits, *Geology* (2016). DOI: 10.1130/G37272.1 , geology.gsapubs.org/content/ea … 04/G37272.1.abstract

Abstract
Cavities are considered plausible and favorable habitats for life on early Earth. In such microenvironments, organisms may have found an adequate protection against the intense ultraviolet radiation that characterized the Archean ozone-free atmosphere. However, while there is clear evidence that benthic life existed in the Paleoarchean, the oldest traces of cavity-dwelling microbes (coelobionts) have been found in Neoarchean rocks. Here we present the results of a detailed investigation of early silicified cavities occurring in the oldest well-preserved siliciclastic tidal deposits, the 3.22 Ga Moodies Group of the Barberton Greenstone Belt (South Africa). Downward-growing microstromatolitic columns composed of kerogenous laminae are commonly present in planar, bedding-parallel, now silica-filled cavities that formed in sediments of the peritidal zone. In-situ δ13CPDB (PDB—Peedee belemnite) measurements of the kerogen range from –32.3‰ to –21.3‰ and are consistent with a biogenic origin. Scanning electron microscopy analysis of the silicified cavities shows well-preserved chains of cell-sized molds that are interpreted as fossil filamentous microorganisms. The geological context, the morphology of the microstromatolites, the δ13C composition of the kerogen, and the presence of microfossils all

suggest that a microbial community inhabited the cavities. These results extend the geological record of coelobionts by ~500 m.y., supporting the view that cavities were among the first ecological niches to have been occupied by early microorganisms.