Portion of ancient Australian chert microstructures definitively pseudo-fossils

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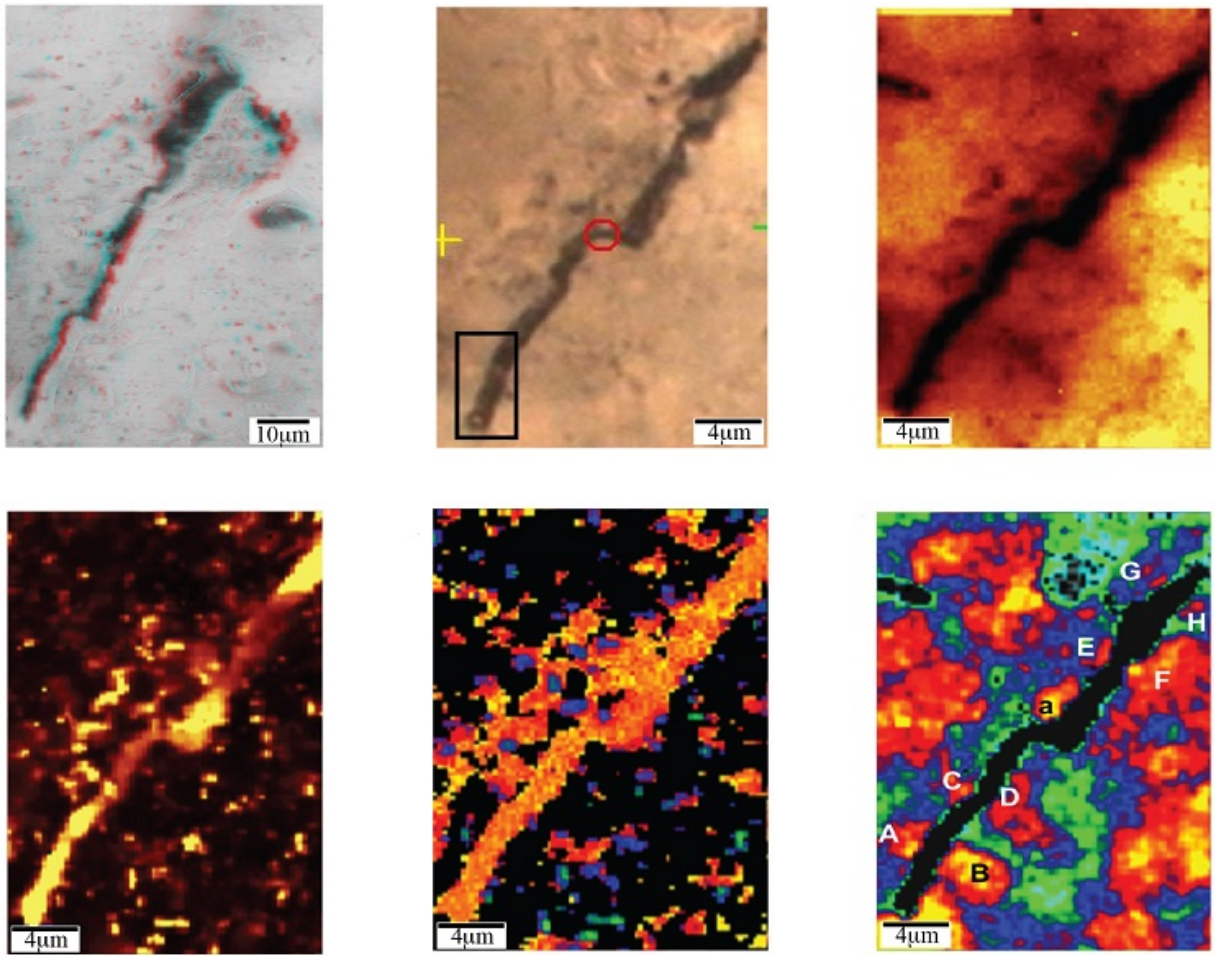

Different types of imaging show the microstructure that was originally designated as the fossil Eoleptonema apex. Credit: Dina Bower and Andrew Steele

A team of scientists including Carnegie's Dina Bower and Andrew Steele weigh in on whether microstructures found in 3.46 billion-year-old samples of a silica-rich rock called chert found in Western Australia are the planet's oldest fossils. The purported fossils have been a heated scientific controversy for many years. The team asserts that at least a portion of the microstructures are actually pseudo-fossils. Their findings are published in *Astrobiology*.

More than two decades ago, microscopic filamentary structures, less than two dozen micrometers in length, found in Australia's Apex chert formation were declared to be fossils of photosynthetic bacteria from the Archean eon. These alleged microfossils were obviously of great interest to scientists interested in the origins of life on Earth as well as those trying to determine the best way to look for life on other planets.

But since then, subsequent research involving Owen Green at Oxford University (who is also a co-author on this study) has called these claims into question, putting forward the idea that the structures are fossil-like mineral formations, but not actually the remains of life. Debate about the authenticity of the Apex chert microfossils has raged over the last several years.

The research team—which also included Marc Fries of the NASA Johnson Space Center and John Lindsay (now deceased) of the Lunar and Planetary Science Institute—analyzed the orientation of the quartz crystals (quartz is a form of silica, which makes up chert) surrounding the alleged microfossils in order to determine whether the crystals and microstructures were both formed as part of the same geological processes.

"Based on our findings, we think that the Apex fossil that was designated as Eoleptonema apex in the originally described samples that we re-studied here was actually formed when a series of quartz grains cracked

and was filled in with carbon-rich material to create a sheet-shaped structure within the larger crystal," Steele explains.

The source of the carbon could have been biological, or abiotic, but this structure itself is not a fossil, the team asserts.

"Studies have shown that 60 percent of the originally described alleged microfossils were found in material that is younger than its host rock, E. apex being one such example. This study further develops a new technique in order to study the indigeneity of the microfossils in the rock and shows without a doubt that this particular example is a pseudo-fossil. The other microstructures in the primary rock (i.e. the oldest part of the rock) should now be analyzed critically in order to prove that similar processes have not been responsible for the formation of those features," said Bower.

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