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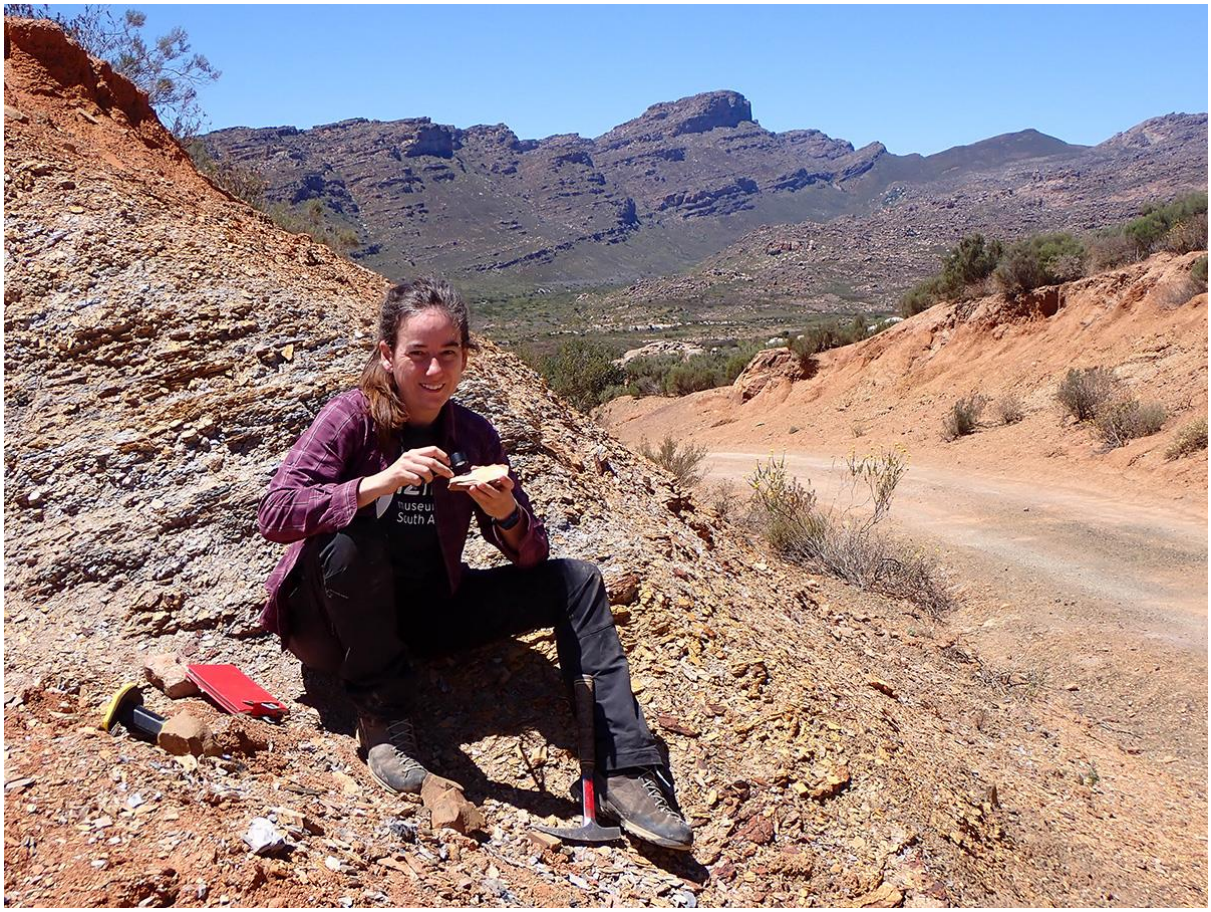
UCT-led study uncovers fossil ecosystem that helped kick-start life after global catastrophe



Dr Claire Browning, lead author, in the Cedarberg mountains digging for fossils.

Photo: Supplied

An international team of scientists from South Africa, Canada, France and the United Kingdom (UK) has uncovered fossil evidence of a tiny ecosystem that helped kick-start the recovery of Earth's oceans after a global mass extinction.

The team, led by Dr Claire Browning, an Honorary Research Associate at the University of Cape Town (UCT), found fossilised burrows and droppings left by creatures so small they lived between grains of sand, revealing an ancient community that probably played a critical role in reviving marine life after the end-Ordovician ice age and mass extinction event. The discovery places the UCT at the centre of groundbreaking research that is reshaping how scientists understand early marine resilience.

The findings are published in *Nature Ecology & Evolution*.

Using micro-CT scanning, an advanced X-ray imaging technique that allows scientists to visualise the interior of rocks in three dimensions, the team examined 444-million-year-old mudrock from the Cederberg mountains. Scans revealed tell-tale traces of life, just a fraction of a millimetre wide. Burrows and droppings left by nematodes (tiny, unsegmented worms) and foraminifera (single-celled protists with intricate shells) that lived in ancient seafloor sediments. The study highlights UCT's growing role in deploying cutting-edge technology to illuminate ancient biological processes.

"This was an unexpected find because the Cederberg rocks formed on a seafloor thought to be intermittently devoid of oxygen and toxic to life," said Dr Browning.

"Although some amazing fossils have been found in the Cedarberg rocks in the past, these are from creatures that swam in the surface waters. We did not expect to find fossils of creatures living on the harsh seafloor, especially from a period immediately following a mass extinction when 85% of marine species vanished. Remarkably, these tiny creatures were able to withstand those conditions, and even thrive."

These tiny animals formed a resilient "small food web," similar to ecosystems that sustain oceans today, where they recycle nutrients and carbon to support larger marine life. By examining the mudrocks layer by layer, the researchers uncovered evidence that pulses of organic matter, produced by phytoplankton in the sunlit surface waters, regularly sank to the seafloor and fed this hidden community. This work provides some of the earliest evidence that sea-floor ecosystems stabilised quickly after catastrophic change, a finding that strengthens UCT's reputation in transformative Earth science research.

The research also adds to global conversations about how ecosystems respond to climate shocks, offering ancient parallels for challenges facing today's oceans.

The research team aims to determine the extent to which this tiny ecosystem was widespread in ancient seas, both in South Africa and beyond.

"Geology does not respect modern borders. For example, rocks of the same age in South America were once connected to those in the Cederberg mountains and may also hold hidden evidence of marine snow, dust and meiofauna. Mapping the extent of these ecosystems will help us understand their broader role in regulating ancient oceans' carbon and nutrient cycles," said Browning.

This work forms part of UCT's commitment to advancing research that links Earth's deep past to its environmental future. Insights from this project could also inform models and strategies for addressing today's human-driven climate change.

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