

Exceptional fossils may need a breath of air to form

November 6 2019



A fossilized mantle of a vampyropod, a relative to the vampire squid. The ink sac is the raised structure in the center, and muscles have a striated appearance. Credit: Rowan Martindale/The University of Texas at Austin Jackson School of Geosciences.

Some of the world's most exquisite fossil beds were formed millions of years ago during time periods when the Earth's oceans were largely without oxygen.

That association has led paleontologists to believe that the world's best-preserved fossil collections come from choked oceans. But research led by The University of Texas at Austin has found that while [low oxygen environments](#) set the stage, it takes a breath of air to catalyze the fossilization process.

"The traditional thinking about these exceptionally preserved [fossil sites](#) is wrong," said lead author Drew Muscente. "It is not the absence of [oxygen](#) that allows them to be preserved and fossilized. It is the presence of oxygen under the right circumstances."

The research was published in the journal *Palaios* on November 5.

Muscente conducted the research during a postdoctoral research fellowship at the UT Jackson School of Geosciences. He is currently an assistant professor at Cornell College in Mount Vernon, Iowa. The research co-authors are Jackson School Assistant Professor Rowan Martindale, Jackson School undergraduate students Brooke Bogan and Abby Creighton and University of Missouri Associate Professor James Schiffbauer.

The best-preserved fossil deposits are called "Konservat-lagerstätten." They are rare and scientifically valuable because they preserve soft tissues along with hard ones—which in turn, preserves a greater variety of life from ancient ecosystems.



Lead author Drew Muscente at Ya Ha Tinda Ranch in Alberta, Canada. The exceptional fossil deposit is located on the property. Credit: Rowan Martindale/The University of Texas at Austin Jackson School of Geosciences.

"When you look at lagerstätten, what's so interesting about them is everybody is there," said Bogan. "You get a more complete picture of the animal and the environment, and those living in it."

The research examined the fossilization history of an exceptional fossil site located at Ya Ha Tinda Ranch in Canada's Banff National Park. The site, which Martindale described in a 2017 paper, is known for its cache of delicate marine specimens from the Early Jurassic—such as lobsters

and vampire squids with their ink sacks still intact—preserved in slabs of black shale.

During the time of fossilization, about 183 million years ago, high global temperatures sapped oxygen from the oceans. To determine if the fossils did indeed form in an oxygen-deprived environment, the team analyzed minerals in the fossils. Since different minerals form under different chemical conditions, the research could determine if oxygen was present or not.

"The cool thing about this work is that we can now understand the modes of formation of these different minerals as this organism fossilizes," Martindale said. "A particular pathway can tell you about the oxygen conditions."

The analysis involved using a scanning electron microscope to detect the mineral makeup.

"You pick points of interest that you think might tell you something about the composition," said Creighton, who analyzed a number of specimens. "From there you can correlate to the specific minerals."



A fossilized lobster claw that may belong to a new species. Credit: Rowan Martindale/The University of Texas at Austin Jackson School of Geosciences.

The workup revealed that the vast majority of the fossils are made of apatite—a phosphate-based mineral that needs oxygen to form. However, the research also found that the climatic conditions of a low-oxygen environment helped set the stage for fossilization once oxygen became available.

That's because periods of low ocean oxygen are linked to high global temperatures that raise sea levels and erode rock, which is a rich source of phosphate to help form fossils. If the low oxygen environment persisted, this sediment would simply release its phosphate into the ocean. But with oxygen around, the phosphate stays in the sediment

where it could start the fossilization process.

Muscente said that the apatite fossils of Ya Ha Tinda point to this mechanism.

The research team does not know the source of the oxygen. But Muscente wasn't surprised to find evidence for it because the organisms that were fossilized would have needed to breathe oxygen when they were alive.

The researchers plan to continue their work by analyzing specimens from exceptional fossil sites in Germany and the United Kingdom that were preserved around the same time as the Ya Ha Tinda specimens and compare their fossilization histories.

More information: A.D. Muscente Et Al, Taphonomy Of The Lower Jurassic Konservat-Lagerstätte At Ya Ha Tinda (Alberta, Canada) And Its Significance For Exceptional Fossil Preservation During Oceanic Anoxic Events, *Palaos* (2019). [DOI: 10.2110/Palo.2019.050](https://doi.org/10.2110/Palo.2019.050)

Provided by University of Texas at Austin

Citation: Exceptional fossils may need a breath of air to form (2019, November 6) retrieved 10 April 2024 from <https://phys.org/news/2019-11-exceptional-fossils-air.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--