Scientists discover evolutionary link to modern-day sea echinoderms

May 2 2019, by Laura Arenschield

Credit: The Ohio State University

Scientists at The Ohio State University have discovered a new species that lived more than 500 million years ago—a form of ancient echinoderm that was ancestral to modern-day groups such as sea cucumbers, sea urchins, sea stars, brittle stars and crinoids. The fossil shows a crucial evolutionary step by echinoderms that parallels the most important ecological change to have taken place in marine sediments.

The discovery, nearly 30 years in the making, was published recently in the *Bulletin of Geosciences* and provides a clue as to how creatures were able to make the evolutionary leap from living stuck to marine sediment grains—which were held together by gooey algae-like colonies, the original way that echinoderms lived—to living attached to hard, shelly surfaces, which is the way their modern-day descendants live now on the bottom of the ocean.

"It throws light on a critical time, not just in the evolution of organisms, but also in the evolution of marine ecosystems," said Loren Babcock, co-author of the study and professor of earth sciences at Ohio State. "This represents a creature that clearly was making the leap from the old style of marine ecosystems in which sediments were stabilized by cyanobacterial mats, to what ultimately became the present system, with more fluidized sediment surfaces."

The creature, a species of edrioasteroid echinoderm that Babcock and his researchers named Totiglobus spencensis, lived in the Cambrian Period—about 507 million years ago. (The Earth, for the record, is about 4.5 billion years old.) A family of fossil hunters discovered the fossil in shale of Spence Gulch, in the eastern part of Idaho, in 1992, and donated it to Richard Robison, a researcher at the University of Kansas and Babcock's doctoral adviser. That part of the country is rich with fossils from the Cambrian period, Babcock said.

For years, the fossil puzzled both Babcock and Robison. But the mystery was solved a few years ago, when Robison's fossil collection passed to Babcock after Robison's retirement.

Once Babcock had the fossil in his lab, he and a visiting doctoral student, Rongqin Wen, removed layers of rock, exposing a small, rust-colored circle with numerous tiny plates and distinct arm-like structures, called ambulcra. Further study showed them that the animal attached itself to a small, conical shell of a mysterious, now-extinct animal called a hyolith using a basal disk—a short, funnel-like structure composed of numerous small calcite plates.

The discovery was a type of scientific poetry—years earlier, Babcock and Robison discovered the type of shell that this animal appeared to be attached to, and named it Haplophrentis reesei.

The edrioasteroid that Babcock and Wen discovered apparently lived attached to the upper side of the elongate-triangular hyolith shell, even as the hyolith was alive. They think a sudden storm buried the animals in a thick layer of mud, preserving them in their original ecological condition.

Echinoderms and hyoliths first appeared during the Cambrian Period, a time in Earth's history when life exploded and the world became more biodiverse than it had ever been before. The earliest echinoderms, including the earliest edrioasteroids, lived by sticking to cyanobacterial mats—thick, algae-like substances that covered the Earth's waters. And until the time of Totiglobus spencensis, echinoderms had not yet figured out how to attach to a hard surface.

"In all of Earth's history, the Cambrian is probably the most important in the evolution of both animals and marine ecosystems, because this was a time when a more modern style of ecosystem was first starting to take hold," Babcock said. "This genus of the species we discovered shows the evolutionary transition from being a 'mat-sticker' to the more advanced condition of attaching to a shelly substrate, which became a successful model for later species, including some that live today."

In the early part of the Cambrian Period—which started about 538 million years ago—echinoderms likely lived on that algae-like substance in shallow seas that covered many areas of the planet. The algae, Babcock said, probably was not unlike the cyanobacterial mats that appear in certain lakes, including Lake Erie, each summer. But at some point, those algae-like substances became appealing food for other creatures, including prehistoric snails. During the Cambrian, as the population of snails and other herbivores exploded, the algae-like cyanobacterial mats began to disappear from shallow seas, and sediments became too physically unstable to support the animals—including echinoderms—that had come to rely on them.

Once their algae-like homes became food for other animals, Babcock said, echinoderms either had to find new places to live or perish.

Paleontologists knew that the creatures had somehow managed to survive, but until the Ohio State researchers' discovery, they hadn't seen much evidence that an echinoderm that lived this long ago had made the move from living stuck to cyanobacterial-covered sediment to living attached to hard surfaces.

"This evolutionary choice—to move from mat-sticker to hard shelly substrate—ultimately is responsible for giving rise to attached animals such as crinoids," Babcock said. "This new species represents the link between the old lifestyle and the new lifestyle that became successful for this echinoderm lineage."

More information: New edrioasteroid (Echinodermata) from the Spence Shale (Cambrian), Idaho, USA: further evidence of attachment in the early evolutionary history of edrioasteroids, *Bulletin of Geosciences* (2019). DOI: 10.3140/bull.geosci.1730

Provided by The Ohio State University

Citation: Scientists discover evolutionary link to modern-day sea echinoderms (2019, May 2) retrieved 22 June 2024 from https://phys.org/news/2019-05-scientists-evolutionary-link-modern-day-sea.html