

# Sponges identified as oldest animal life

Scientists say Australian fossils date back 650 million years



Adam Maloof

Sponge fossils were found between layers in this stromatolite column of bacterial mats in Australia. The marking pen is included in the picture to provide a sense of scale.

**By Jennifer Viegas**

[Discovery News](#)

MSNBC

8-17-10

Recently found primitive sponge fossils from South Australia suggest that animals have been on Earth for at least 650 million years.

This discovery pushes back the fossil record for animals by about 70 million years, according to a new study published in the journal *Nature Geoscience*.

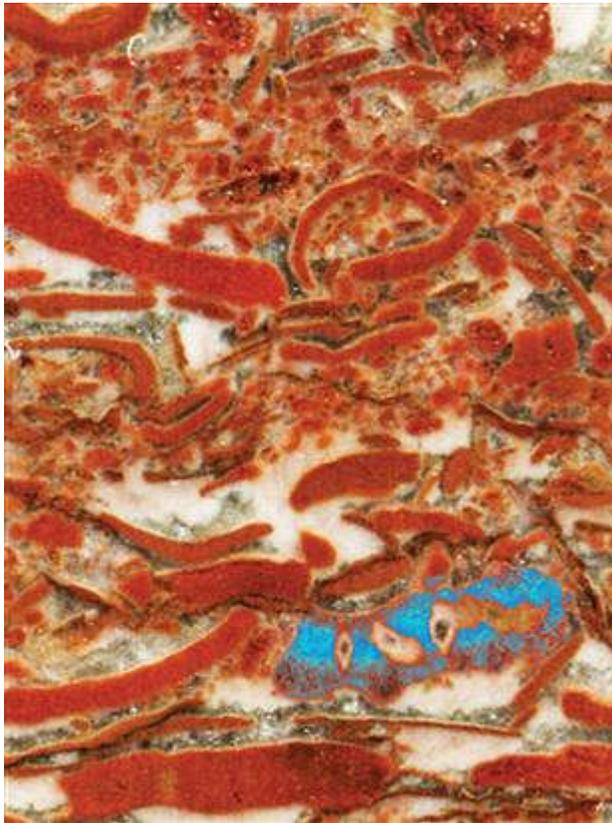
Previously, the oldest known hard-bodied animals were reef-dwelling organisms called *Namacalathus*, which date to approximately 550 million years ago. Disputed remains for other possible soft-bodied animals date to between 577 and 542 million years ago. The even more advanced age of the newly found sponge fossils provides direct evidence that animal life existed before the severe "Snowball Earth" event. The episode marked the end of Cryogenian Period 635 million years ago and left much of the globe covered in ice.

The early sponges somehow managed to survive, perhaps in watery refuges around volcanic islands.

"The sponges were about one centimeter (0.4 inches) tall and probably lived on hard stromatolite reefs made by bacteria," lead author Adam Maloof told Discovery News. "The sponges probably swayed in the ocean currents in less than 20 meters (65.6 feet) of water filtering organic carbon out of the water for food," added Maloof, a geosciences professor at Princeton University.

He and his colleagues found the fossils in the Trezona Formation of Flinders Ranges, South Australia.

The composition and location of the fossils meant they couldn't be removed from the surrounding rock using conventional techniques. Imaging with X-ray scanners also wasn't possible, since X-rays can only distinguish between materials with different densities. In this case, the fossils are made of calcite, the same material that makes up the rock matrix in which they are embedded.



Maloof Lab / Situ Studio

Sponge fossils are highlighted in blue amid layers of limestone. The serial grinding process created nearly 500 such images that scientists stacked and autotraced to create a 3-D model.

To get around this problem, the researchers used what Maloof called a "serial grinder and imager." One of 32 collected block samples from the formation was shaved off 50 microns at a time — about half the width of a human hair — and then photographed

after each minute shaving. The images were then stacked to create complete three-dimensional models of two of the sponge fossils.

"We hypothesize that the fossils are sponges because they are large (not bacteria), asymmetric (not any other animal group), and contain a network of 1-millimeter-diameter tunnels inside that may have served as the 'water canal system' used by sponges to circulate water and food," he said.

The scientists ruled out that the tunnels were dug by worms, an even more complex organism than sponges.

Since sponges are now the most basal animals on the evolutionary tree of life, this latest find hints at how animals first arose on Earth.

"Perhaps rising oxygen, elevated dissolved organic carbon and the initial climate perturbation before the snowball glaciation all made it possible for the first animals to emerge," Maloof explained.

In an accompanying piece in the same journal, postdoctoral associate Marc Laflamme of Yale University's Department of Geology and Geophysics points out that prior studies support the age of the sponges and suggest that the world's first animals could date to an even earlier time.

"Molecular clocks, which reflect rates of molecular change in DNA, and biomarker studies of sponge-specific organic compounds both strongly indicate that sponges were present in the Cryogenian interval between approximately 850 and 635 million years ago," Laflamme wrote.

Biologist Andrew Knoll of Harvard University further believes that the researchers have "built a reasonable case for interpreting the structures as spongelike animals."  
"At the very least, this should drive paleontologists back to the field to seek similar or better evidence in other rocks of comparable age," Knoll added.

Maloof and his team are already planning to do just that. He and his students perform three to four months of fieldwork each year.

"As we do so, we continue to uncover strange ancient fossils," he said. "Hopefully some will prove to be as interesting as these sponges."

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