

Scientists can't agree on when the first animals evolved—research hopes to end the debate

October 16 2023, by Ross Anderson



Credit: AI-generated image ([disclaimer](#))

There are estimated to be nearly [8 million species of animals](#) living today, making up the majority of Earth's documented biodiversity and inhabiting almost all of its environments. However, for most of Earth's history animals were completely absent.

The date of the [first animals](#) marks a shift in the history of life on Earth. Of course, as animals ourselves, it's also the story of our origins. Without animals, our planet would have been a very different world.

The question of exactly when animals first evolved has puzzled scientists for centuries. [Even Charles Darwin](#) was stumped. He predicted a long history of evolution from simple single celled organisms to complex animals. However, the oldest [animal fossils](#) Darwin knew of, from around 500 million years ago, were large enough to be visible to the [naked eye](#) and often had shells and skeletons.

[My team's study](#) hopes to help settle the debate through a new approach to the question.

Why animal evolution is controversial

Scientists used to think animal fossils appeared suddenly in a time period around 500 million years ago called the [Cambrian Explosion](#), so named because the [fossil record](#) seems to show a sudden boom in complex life at this time. We know the first animals evolved in the oceans, and with their abilities to move and burrow, they fundamentally altered the [Earth's carbon cycle](#).

However, since Darwin, paleontologists have discovered thousands more fossils, some of them more ancient than the Cambrian Explosion. Impressions of strange-looking organisms, called the [Ediacara Biota](#), were discovered in the 1950s in rocks and have been dated to around 574–539 million years ago (the [Ediacaran Period](#)). Some of the Ediacara Biota fossils represent the [oldest animal fossils known](#).

Yet these recent advances have taken the animal [fossil](#) record back only so far. Reports of older and more simple animal-like fossils have been published. For example, [sponge-like fossils](#) from the Mackenzie

Mountains, Canada are around 800 million years old. But these older fossils [cannot yet be conclusively proven to be animals](#). They could be algae or perhaps not even fossils at all.

Also, the presence of fossils doesn't necessarily confirm the date for the evolutionary origin of animals. Only a fraction of life has ever been fossilized meaning the fossil record is [full of gaps](#).

With no definitive first animal fossils, paleontologists have turned to [molecular biology](#), using genetics to trace ancestry. This technique, called the [molecular clock](#), works by sampling the genetics of modern animals and comparing their DNA. The differences in DNA between species shows how much evolution has happened.

Although molecular clocks can only provide estimates for the timing of animal origins, [most converge on around 800–700 million years ago](#), long before the Ediacaran extent of the animal fossil record.



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This gives us two estimates for animal origins, more than 200 million years apart. On the one hand fossils extend to 574 million years ago, while on the other, molecular clocks suggest animals could be as old as 800 million years.

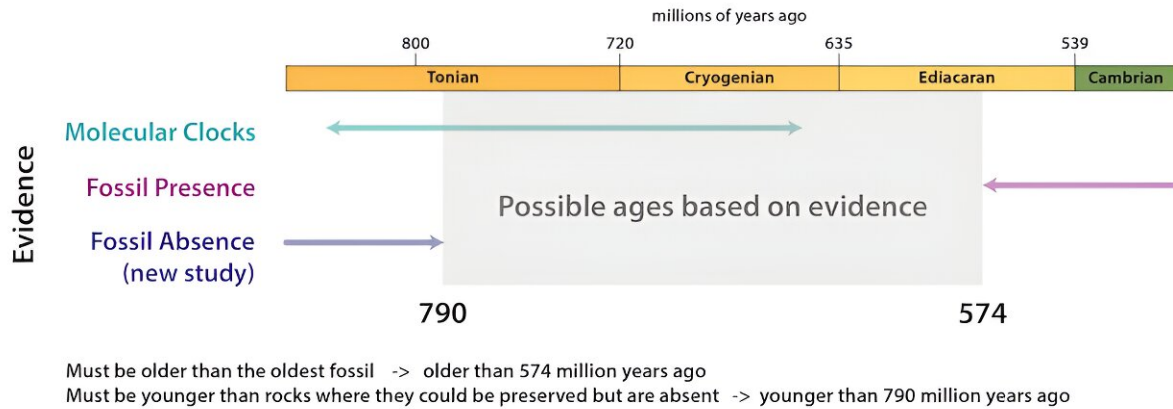
Turning back the clock

In our [recent paper](#), my colleagues and I suggest a new way to estimate the timing of animal origins. Instead of documenting the oldest animal fossils, we first considered which kind of rocks could preserve those animals.

An animal's body type determines what kind of rock can fossilize it. Many animals have shells and skeletons that can be preserved in most types of [sedimentary rocks](#)—such as sandstone—that start as sediments in rivers. However, the [first animals did not have shells or skeletons](#). Animals evolved these structures at a later time.

Studying deposits such as the [Burgess Shale](#) fossil bed in Canada, which is around 508 million years old, showed my team that fossils of animals lacking shells or skeletons, such as worms, are often [confined to rocks that are rich in clay minerals](#). Clays have [antibacterial properties](#) and can [stop the decay](#) of animal soft tissues.

When did animals evolve?



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We tested rocks from geological eras older than the Ediacaran period (635 million years ago) to work out which ones had the clay-rich composition necessary to fossilize the first animals. Rare rocks around [790 million years old from Canada, Norway and Russia](#) have the necessary clay-rich properties.

Although these rocks could preserve the first animals, none of them do. This suggests that animal fossils are absent at this point in time, not because they couldn't be preserved but perhaps because they weren't there—that animals hadn't evolved yet.

Paleontologists now need to search more geological sites across the planet to confirm the youngest clay-rich rocks that could have preserved the first animals, but where animal fossils are absent. This will help us to home in on the true timing of animal origins.

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