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Study indicates Earth's earliest sea creatures drove evolution by stirring the water

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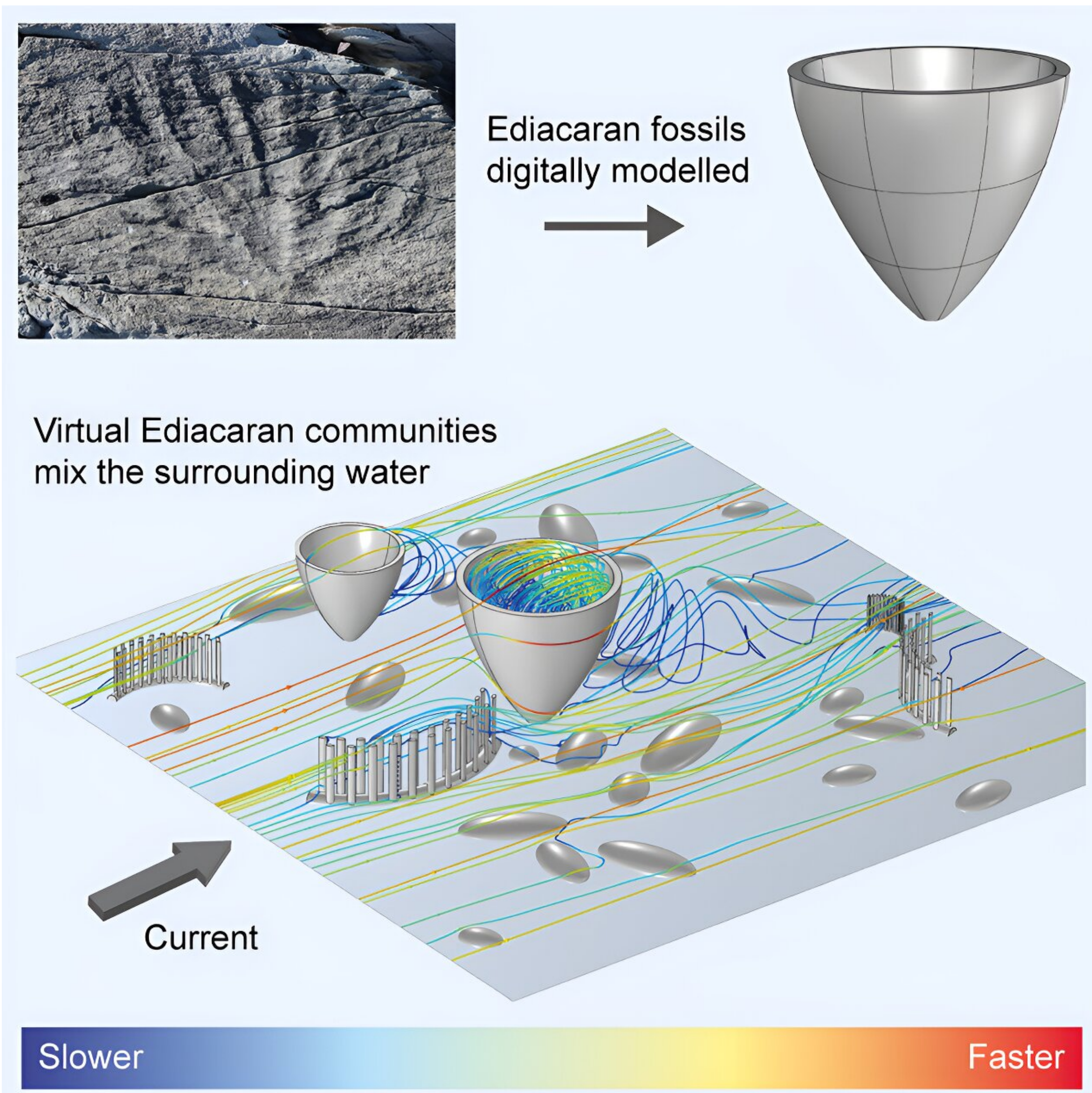

Graphical abstract. Credit: *Current Biology* (2024). DOI: 10.1016/j.cub.2024.04.059

A study involving the University of Cambridge has used virtual recreations of the earliest animal ecosystems, known as marine animal forests, to demonstrate the part they played in the evolution of our planet.

Using state-of-the-art computer simulations of fossils from the Ediacaran time period—approximately 565 million years ago—scientists discovered how these animals mixed the surrounding seawater. This may have affected the distribution of important resources such as food particles and could have increased local oxygen levels.

Through this process, the scientists think these early communities could have played a crucial role in shaping the initial emergence of large and complex organisms prior to a major evolutionary radiation of different forms of animal life, the so-called Cambrian "explosion."

Over long periods of time, these changes might have allowed life forms to perform more complicated functions, like those associated with the evolution of new feeding and movement styles.

The study was led by the Natural History Museum and is published today in the journal *Current Biology*.

Dr. Emily Mitchell at the University of Cambridge's Department of Zoology, a co-author of the report, said, "It's exciting to learn that the very first animals from 580 million years ago had a significant impact on their environment, despite not being able to move or swim. We've found they mixed up the water and enabled resources to spread more widely—potentially encouraging more evolution."

Scientists know from modern marine environments that nutrients like food and oxygen are carried in seawater, and that animals can affect water flow in ways that influence the distribution of these resources.

To test how far back this process goes in Earth's history, the team looked at some of the earliest examples of marine animal communities, known from rocks at Mistaken Point, Newfoundland, Canada. This world-famous fossil site perfectly preserves early life forms thanks to a cover of volcanic ash (sometimes referred to as an "Ediacaran Pompeii").

Although some of these life forms look like plants, analysis of their anatomy and growth strongly suggests they are animals. Owing to the exceptional preservation of the fossils, the scientists could recreate digital models of key species, which were used as a basis for further computational analyses.

First author Dr. Susana Gutarra, a Scientific Associate at the Natural History Museum, said, "We used ecological modeling and computer simulations to investigate how 3D virtual assemblages of Ediacaran life forms affected water flow. Our results showed that these communities were capable of ecological functions similar to those seen in present-day marine ecosystems."

The study showed that one of the most important Ediacaran organisms for disrupting the flow of water was the cabbage-shaped animal Bradgatia, named after Bradgate Park in England. The Bradgatia from Mistaken Point are among some of the largest fossils known from this site, reaching diameters of over 50 centimeters.

Through their influence on the water around them, the scientists believe these Ediacaran organisms might have been capable of enhancing local oxygen concentrations. This biological mixing might also have had repercussions for the wider environment, possibly making other areas of the sea floor more habitable and perhaps even driving evolutionary innovation.

Dr. Imran Rahman, lead author and Principal Researcher at the Natural History Museum, said, "The approach we've developed to study Ediacaran fossil communities is entirely new in paleontology, providing us with a powerful tool for studying how past and present marine ecosystems might shape and influence their environment."

More information: Susana Gutarra et al, Ediacaran marine animal forests and the ventilation of the oceans, *Current Biology* (2024). DOI: 10.1016/j.cub.2024.04.059

Provided by University of Cambridge