Researchers identify oldest known species of swimming jellyfish

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Artistic reconstruction of a group of Burgessomedusa phasmiformis swimming in the Cambrian sea. Credit: Reconstruction by Christian McCall.

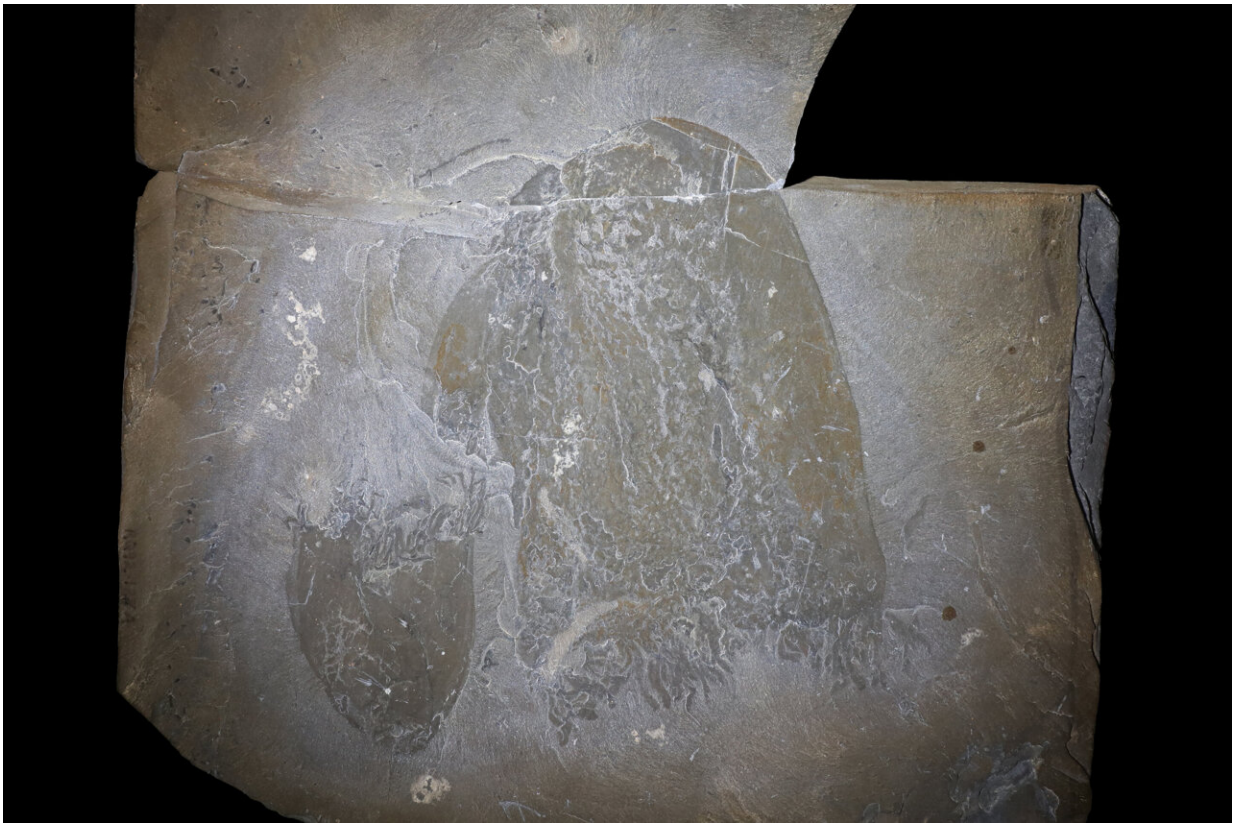
The Royal Ontario Museum (ROM) announces the oldest swimming jellyfish in the fossil record with the newly named Burgessomedusa phasmiformis. These findings are announced in the journal *Proceedings of the Royal Society B*.

Jellyfish belong to medusozoans, or animals producing medusae, and include today's box jellies, hydroids, stalked jellyfish and true jellyfish. Medusozoans are part of one of the oldest groups of animals to have existed, called Cnidaria, a group which also includes corals and sea anemones. Burgessomedusa unambiguously shows that large, swimming jellyfish with a typical saucer or bell-shaped body had already evolved more than 500 million years ago.

Burgessomedusa fossils are exceptionally well preserved at the Burgess Shale considering jellyfish are roughly 95% composed of water. ROM holds close to 200 specimens from which remarkable details of internal anatomy and tentacles can be observed, with some specimens reaching more than 20 centimeters in length. These details enable classifying Burgessomedusa as a medusozoan. By comparison with modern jellyfish, Burgessomedusa would also have been capable of free-swimming and the presence of tentacles would have enabled capturing sizeable prey.

"Although jellyfish and their relatives are thought to be one of the earliest animal groups to have evolved, they have been remarkably hard to pin down in the Cambrian fossil record. This discovery leaves no doubt they were swimming about at that time," said co-author Joe Moysiuk, a Ph.D. candidate in Ecology & Evolutionary Biology at the University of Toronto, who is based at ROM.

This study, identifying Burgessomedusa, is based on fossil specimens discovered at the Burgess Shale and mostly found in the late 1980s and 1990s under former ROM Curator of Invertebrate Paleontology Desmond Collins. They show that the Cambrian food chain was far more complex than previously thought, and that predation was not limited to large swimming arthropods like Anomalocaris (see field image showing Burgessomedusa and Anomalocaris preserved on the same rock surface).

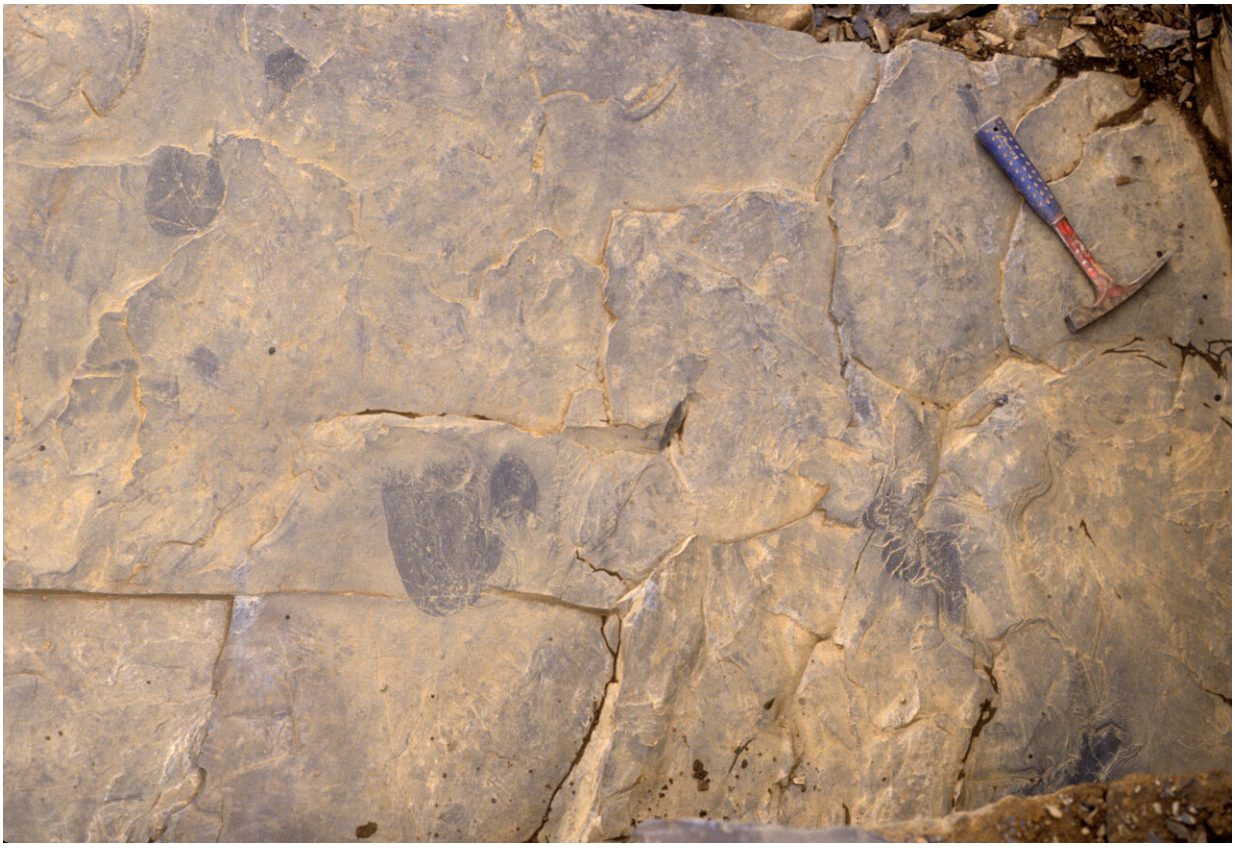


Slab showing one large and one small (rotated 180 degree) bell-shaped specimens with preservation of tentacles. ROMIP 65789. Credit: Jean-Bernard Caron © Royal Ontario Museum

"Finding such incredibly delicate animals preserved in rock layers on top of these mountains is such a wonderous discovery. Burgessomedusa adds to the complexity of Cambrian foodwebs, and like Anomalocaris which lived in the same environment, these jellyfish were efficient swimming predators," said co-author, Dr. Jean-Bernard Caron, ROM's Richard Ivey Curator of Invertebrate Paleontology. "This adds yet another remarkable lineage of animals that the Burgess Shale has preserved chronicling the evolution of life on Earth."

Cnidarians have complex life cycles with one or two body forms, a vase-shaped body, called a polyp, and in medusozoans, a bell or saucer-shaped body, called a medusa or jellyfish, which can be free-swimming or not. While fossilized polyps are known in ca. 560-million-year-old rocks, the origin of the free-swimming medusa or jellyfish is not well understood.

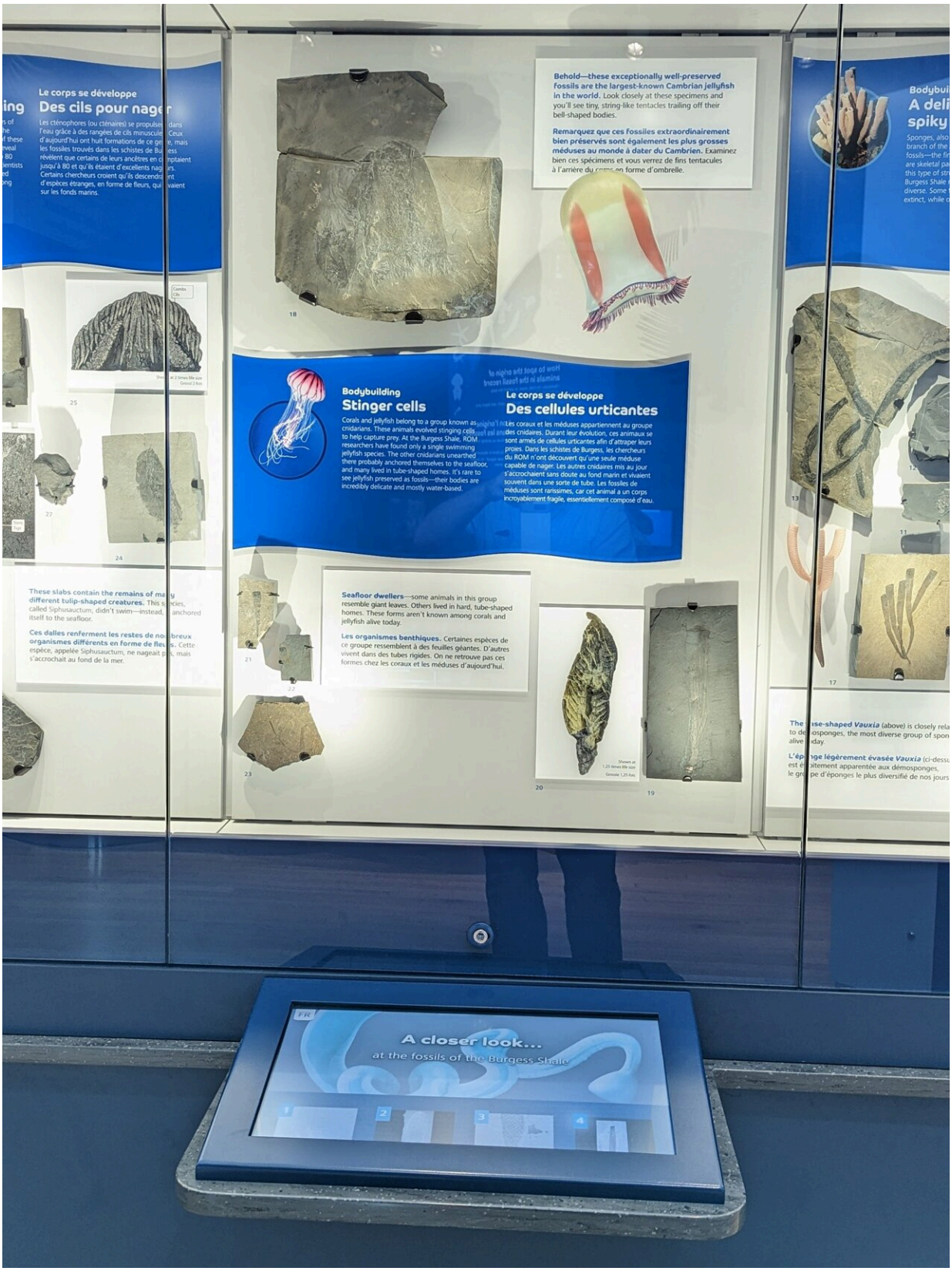
Fossils of any type of jellyfish are extremely rare. As a consequence, their evolutionary history is based on microscopic fossilized larval stages and the results of molecular studies from living species (modeling of divergence times of DNA sequences). Though some fossils of comb-jellies have also been found at the Burgess Shale and in other Cambrian deposits, and may superficially resemble medusozoan jellyfish from the phylum Cnidaria, comb-jellies are actually from a quite separate phylum of animals called Ctenophora. Previous reports of Cambrian swimming jellyfish are reinterpreted as ctenophores.



Field images of Burgessomedusa phasmiformis jellyfish specimens (middle right ROMIP 65789 – see close up images) and of the top arthropod predator Anomalocaris canadensis preserved on the same rock surface. Hammer for scale. Credit: Desmond Collins. © Royal Ontario Museum

Detail of previous image showing Burgessomedusa phasmiformis jellyfish specimens (middle right ROMIP 65789) and of the top arthropod predator Anomalocaris canadensis. Credit: Desmond Collins. © Royal Ontario Museum

ROM Burgess Shale fieldwork site in Yoho National Park, Raymond Quarry, in 1992. Credit: Desmond Collins. © Royal Ontario Museum


Behold—these exceptionally well-preserved fossils are the largest-known Cambrian jellyfish in the world. Look closely at these specimens and you'll see tiny, string-like tentacles trailing off their bell-shaped bodies.
Remarquez que ces fossiles extraordinairement bien préservés sont également les plus grosses méduses au monde à dater du Cambrien. Examinez bien ces spécimens et vous verrez de fins tentacules à l'arrière du corps en forme d'ombrelle.
Bodybuilding
Stinger cells
Corals and jellyfish belong to a group known as cnidarians. These animals evolved stinging cells to help capture prey. At the Burgess Shale, ROM researchers have found only a single swimming jellyfish species. The other cnidarians unearthed there probably anchored themselves to the seafloor, and many lived in tube-shaped homes. It's rare to see jellyfish preserved as fossils—their bodies are incredibly delicate and mostly water-based.
Le corps se développe
Des cellules urticantes
Les coraux et les méduses appartiennent au groupe des cnidaires. Durant leur évolution, ces animaux se sont armés de cellules urticantes afin d'attraper leurs proies. Dans les schistes de Burgess, les chercheurs du ROM n'ont découvert qu'une seule méduse capable de nager. Les autres cnidaires mis au jour s'accrochaient sans doute au fond marin et vivaient souvent dans une sorte de tube. Les fossiles de méduses sont rarissimes, car cet animal a un corps incroyablement fragile, essentiellement composé d'eau.
Seafloor dwellers—some animals in this group resemble giant leaves. Others lived in hard, tube-shaped homes. These forms aren't known among corals and jellyfish alive today.
Les organismes benthiques. Certaines espèces de ce groupe ressemblent à des feuilles géantes. D'autres vivent dans des tubes rigides. On ne retrouve pas ces formes chez les coraux et les méduses d'aujourd'hui.
A closer look...
at the fossils of the Burgess Shale

Display of Burgessomedusa phasmiformis in the Burgess Shale section of ROM Willner Madge Gallery, Dawn of Life. Credit: David McKay. © Royal Ontario Museum

The Burgess Shale fossil sites are located within Yoho and Kootenay National Parks and are managed by Parks Canada. Parks Canada is proud to work with leading scientific researchers to expand knowledge and understanding of this key period of Earth history and to share these sites with the world through award-winning guided hikes. The Burgess Shale was designated a UNESCO World Heritage Site in 1980 due to its outstanding universal value and is now part of the larger Canadian Rocky Mountain Parks World Heritage Site.

Visitors to ROM can see fossils of Burgessomedusa phasmiformis on display in the Burgess Shale section of the Willner Madge Gallery, Dawn of Life.

More information: A macroscopic free-swimming medusa from the middle Cambrian Burgess Shale, *Proceedings of the Royal Society B: Biological Sciences* (2023). DOI: 10.1098/rspb.2022.2490. royalsocietypublishing.org/doi … .1098/rspb.2022.2490

Provided by Royal Ontario Museum