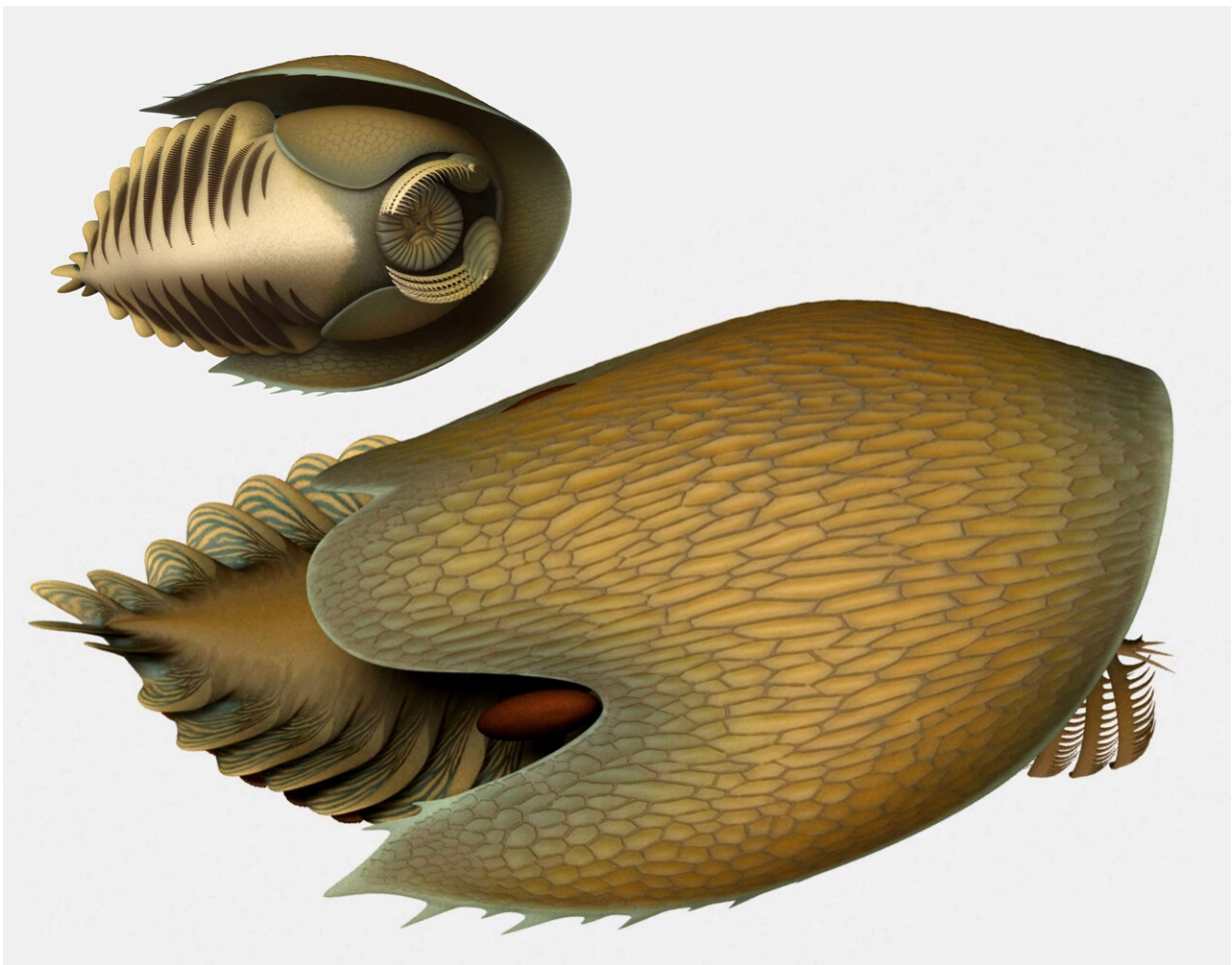


A voracious Cambrian predator, *Cambroraster*, is a new species from the Burgess Shale

July 30 2019



Reconstruction by Lars Fields. Credit: Lars Fields© Royal Ontario Museum

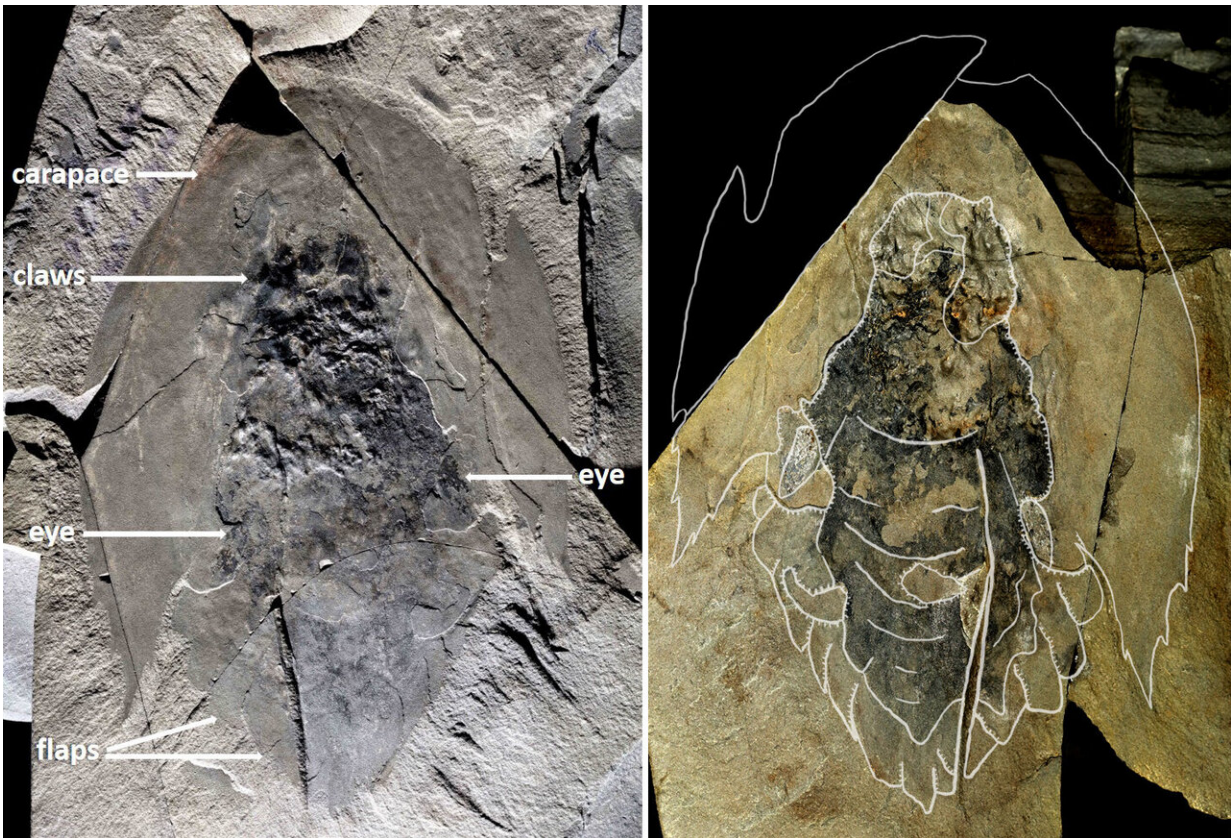
Palaeontologists at the Royal Ontario Museum and University of Toronto have uncovered fossils of a large new predatory species in half-a-billion-year-old rocks from Kootenay National Park in the Canadian Rockies. This new species has rake-like claws and a pineapple-slice-shaped mouth at the front of an enormous head, and it sheds light on the diversity of the earliest relatives of insects, crabs, spiders, and their kin. The findings were announced July 31, 2019, in a study published in *Proceedings of the Royal Society B*.

Reaching up to a foot in length, the new species, named *Cambroraster falcatus*, comes from the famous 506-million-year-old Burgess Shale. "Its size would have been even more impressive at the time it was alive, as most animals living during the Cambrian Period were smaller than your little finger," said Joe Moysiuk, a graduate student based at the Royal Ontario Museum who led the study as part of his Ph.D. research in Ecology & Evolutionary Biology at the University of Toronto. *Cambroraster* was a distant cousin of the iconic *Anomalocaris*, the top predator living in the seas at that time, but it seems to have been feeding in a radically different way," continued Moysiuk.

The name *Cambroraster* refers to the remarkable claws of this animal, which bear a parallel series of outgrowths, looking like forward-directed rakes. "We think *Cambroraster* may have used these claws to sift through sediment, trapping buried prey in the net-like array of hooked spines," added Jean-Bernard Caron, Moysiuk's supervisor and the Richard M. Ivey Curator of Invertebrate Palaeontology at the Royal Ontario Museum.

With the interspace between the spines on the claws at typically less than a millimeter, this would have enabled *Cambroraster* to feed on very small organisms, although larger prey could also likely be captured, and ingested into the circular tooth-lined mouth. This specialized mouth apparatus is the namesake of the extinct group Radiodonta, which

includes both *Cambroraster* and *Anomalocaris*. Radiodonta is considered to be one of the earliest offshoots of the arthropod lineage (today including all animals with an exoskeleton, a segmented body and jointed limbs).



Complete fossil (Holotype ROMIP 65078) of *Cambroraster falcatus*, showing the eyes and the body with paired swimming flaps below the large head carapace. The shale in which the fossil was entombed was split open, leaving parts of the body on both sides (right and left). Credit: Jean-Bernard Caron© Royal Ontario Museum

The second part of the species name *falcatus* was given in tribute to another of *Cambroraster*'s distinctive features: the large shield-like

carapace covering its head, which is shaped like the Millennium Falcon spaceship from the Star Wars films. "With its broad head carapace with deep notches accommodating the upward facing eyes, *Cambroraster* resembles modern living bottom-dwelling animals like horseshoe crabs. This represents a remarkable case of evolutionary convergence in these radiodonts," Moysiuk explained. Such convergence is likely reflective of a similar environment and mode of life—like modern horseshoe crabs, *Cambroraster* may have used its carapace to plough through sediment as it fed.

Perhaps even more astonishing is the large number of specimens recovered. "The sheer abundance of this animal is extraordinary," added Dr. Caron, who is also an Assistant Professor in Ecology & Evolutionary Biology and Earth Sciences at the University of Toronto, and the leader of the field expeditions that unearthed the new fossils. "Over the past few summers we found hundreds of specimens, sometimes with dozens of individuals covering single rock slabs."

Based on over a hundred exceptionally well-preserved fossils now housed at the Museum, researchers were able to reconstruct *Cambroraster* in unprecedented detail, revealing characteristics that had not been seen before in related species.

"The radiodont fossil record is very sparse; typically, we only find scattered bits and pieces. The large number of parts and unusually complete fossils preserved at the same place are a real coup, as they help us to better understand what these animals looked like and how they lived," said Dr. Caron. "We are really excited about this discovery. *Cambroraster* clearly illustrates that predation was a big deal at that time with many kinds of surprising morphological adaptations."

Fossils from the Cambrian period, particularly from sites like the Burgess Shale, record a dramatic "explosion" of biodiversity at this time,

culminating in the evolution of most of the major groups of animals that survive today. But, the story has far more intricacy than a straight line leading from simple ancestors to the vast diversity of modern species. "Far from being primitive, radiodonts show us that at the very outset of complex ecosystems on Earth, early representatives of the arthropod lineage rapidly radiated to play a wide array of ecological roles," remarked Moysiuk.

The fossils were found at several sites in the Marble Canyon area in Kootenay National Park, British Columbia, which have been discovered by ROM-led field teams since 2012, with some of the key specimens unearthed just last summer. These sites are about 40 kilometers away from the original Burgess Shale fossil site in Yoho National Park that was first discovered in 1909. What is also exciting for researchers is the realization that there is a large new area in northern Kootenay National Park worth scientific exploration, holding the potential for the discovery of many more new species.

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 our 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.

More information: A new hurdiid radiodont from the Burgess Shale evinces the exploitation of Cambrian infaunal food sources, *Proceedings of the Royal Society B*, [rspb.royalsocietypublishing.org1098/rspb.2019.1079](https://rspb.royalsocietypublishing.org/doi/10.1098/rspb.2019.1079)

Provided by Royal Ontario Museum

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