

An Arthropod Lagerstätten from the Early Cambrian Mount Cap Formation (Northwest Territories, Canada)

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Summary

Exceptional carbonaceous microfossils from Canada uniquely reveal the fine-scale feeding anatomy of macroscopic Cambrian crustaceans, providing a new window onto early arthropod evolution.

Introduction

Canadian fossil-Lagerstätten play a central role in resolving the Cambrian evolutionary explosion. Most famously, the Burgess Shale of British Columbia yields carbonaceous compressions of soft-bodied organisms that are not otherwise preserved. It is now becoming clear that Cambrian mudstones from Canada contain an additional source of exceptional fossil data, in the form of microscopic carbonaceous compressions. Here we document an instance of “micro Burgess Shale” preservation that provides a unique view onto early arthropod evolution.

Method

The recovery of fossils from “micro-Burgess Shales” requires the laboratory maceration of undeformed mudrocks using hydrofluoric acid. We employ a technique that is based on standard palynological procedures, but which is specially modified to minimize damage to the exceptionally preserved but fragile microfossils. Specimens are rinsed into suspension and then individually transferred using a pipette onto glass coverslips. The fine details of the fossils can only be resolved using high-powered light and scanning electron microscopy.

Examples

A shale horizon in the early Cambrian Mount Cap Formation (subsurface Northwest Territories, Canada) yields an abundant and diverse array of crustacean-type mouthparts and appendages. These express exquisite, sub-micron-scale preservation yet are derived from centimeter-scale individuals, revealing for the first time the fine-scale feeding anatomy of macroscopic Cambrian arthropods. Identified as the earliest evidence for complex, crown-group crustaceans, the Mount Cap fossils expose the surprising extent to which Cambrian crustaceans had developed the sophisticated feeding mechanisms that were later to revolutionize the marine arthropod realm (Harvey and Butterfield 2008). We discuss the insights afforded by the Mount Cap assemblage in elucidating key events in the early history of arthropods, and consider the taphonomic processes responsible for the preservation of “micro-Burgess Shales”.

Conclusions

Exceptionally preserved arthropod cuticles from the Mount Cap Formation are identified as the mouthparts and appendages of a crown-group crustacean in possession of a sophisticated feeding apparatus. This sheds new light on early arthropod evolution, and reveals the palaeobiological potential—still largely untapped—of “micro Burgess Shales”.

References

Harvey, T. H. P. and Butterfield, N. J., 2008, Sophisticated particle-feeding in a large Early Cambrian crustacean: *Nature*, 452, 868-871.