

## Host-specific infestation in early Cambrian worms

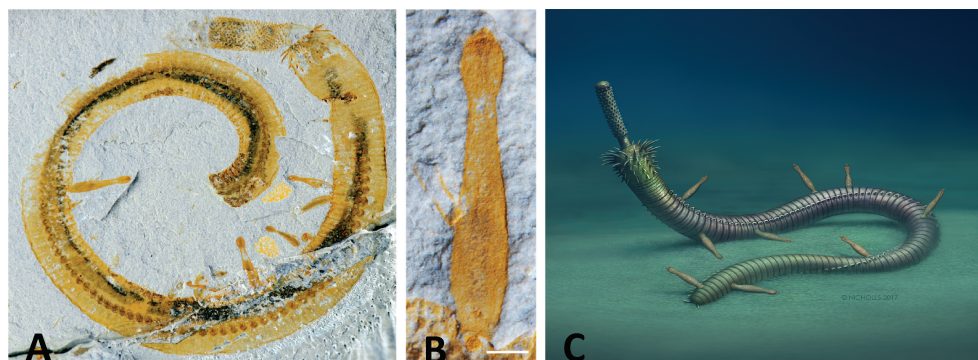
With the support of the National Natural Science Foundation of China, an international collaborative study, led by Professors Cong PeiYun (丛培允), Ma XiaoYa (马晓娅), Hou XianGuang (侯先光) and Zhai DaYou (翟大有) from the Yunnan Key Laboratory for Palaeobiology at Yunnan University, demonstrates the earliest example of host-specific infestation in metazoans, which was published in *Nature Ecology & Evolution* (2017, DOI: 10.1038/s41559-017-0278-4).

Symbiotic interactions such as commensalism and parasitism are extremely common in modern terrestrial and aquatic ecosystems, but their origins in the fossil record have been poorly understood and biased towards geologically young associations. The Cambrian radiation of animals is increasingly seen as an ecological phenomenon, but evidence for symbiosis between Cambrian species is often indirect. The Chengjiang Biota from Yunnan Province, Southwest China, records a diverse range of extraordinarily preserved animal fossils dated around 520 million year ago, representing the earliest record of a complex ‘animal-rich’ marine ecosystem and a unique window into the structure of early Cambrian communities.

Their study is based on an exceptional snapshot of biotic interactions from the Chengjiang Biota. They discovered aggregates of a new species of tiny worm infesting two known species of larger, priapulid-like worms *Cricocosmia jinningensis* and *Mafangsciolex sinensis*, providing multiple examples of hosts and symbionts fossilized *in situ*. The new species of tiny worm, named *Inquicus fellatus* gen. et sp. nov., is about 3 mm long and ‘bowling-pin’ shaped, with an elongate bulb-shaped head, a sub-circular-shaped attachment disc at the posterior end of the body and a through gut that is funnel-shaped anteriorly. *I. fellatus* is attached to the host at its posterior end that does not penetrate the cuticle of either hosts.

Further studies show that *I. fellatus* forms aggregates of six or more on each host, with all individuals of a similar size, providing the earliest known record of aggregate infestation on a soft-bodied bilaterian. *I. fellatus* also represents the earliest probable example of host specificity in the fossil record. Of 16 other priapulid-like worm species in the Chengjiang biota, none has *I. fellatus* associates, despite searching through a collection of several thousands of specimens. The relationship of *I. fellatus* with two host species also indicates a capacity for host shift—the colonization of a new host species from an original host—and suggests that this type of ecology was already developed in early Cambrian ecosystems.

This study demonstrated a compelling case of symbiosis with the earliest evidence of aggregate infestation, host specificity and host shift, and thus fills a gap in our knowledge of the complexity of Cambrian ecosystems. Therefore, the complex ecosystem might have evolved over a protracted interval of late Precambrian and early Cambrian time, the main burst of ecological diversification of animals being during the Cambrian explosion.



**Figure** A, Cluster of *I. fellatus* attached to *C. jinningensis*; B, morphology of *I. fellatus*; C, artist's reconstruction of *I. fellatus* infesting *C. jinningensis*.