American Museum of Natural History

Media Inquiries:
Kendra Snyder
Department of Communications
212-496-3419
ksnyder@amnh.org
amnh.org

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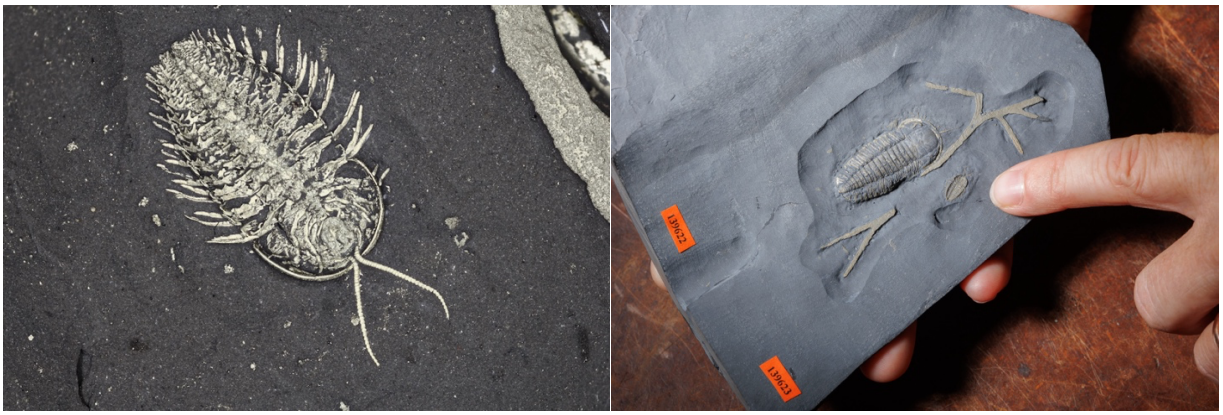
Trilobite Fossils from Upstate New York Reveal "Extra" Set of Legs

Discovery of fifth pair of head appendages helps researchers solve trilobite segmentation puzzle



A new study finds that a trilobite species with exceptionally well-preserved fossils from upstate New York has an additional set of legs underneath its head. The research, led by the American Museum of Natural History and Nanjing University in China, suggests that having a fifth pair of head appendages might be more widespread among trilobites than once thought. Published today in the journal *Palaeontology,* the study helps researchers better understand how trilobite heads are segmented.

Trilobites are a group of extinct arthropods whose living relatives include lobsters and spiders. Like other arthropods, the bodies of trilobites are made up of many segments, with the head region comprised of several fused segments. As with other parts of the trilobite body (the thorax and tail), these segments were associated with appendages, which ranged in function from sensing to feeding to locomotion.

"The number of these segments and how they are associated with other important traits, like eyes and legs, is important for understanding how arthropods are related to one another, and therefore, how they evolved," said Melanie Hopkins, curator and chair of the Museum's Division of Paleontology.

The segments in the trilobite head can be counted in two different ways: by looking at the grooves (called furrows) on the upper side of the trilobite fossil's hard exoskeleton, or by counting the pairs of preserved antennae and legs on the underside of the fossil. The soft appendages of trilobites are rarely preserved, though, and when looking at the segments in the trilobite head, researchers regularly find a mismatch between these two methods.

In the new study, Hopkins and colleague Jin-Bo Hou from Nanjing University examined newly recovered specimens of the exceptionally preserved trilobite *Triarthrus eatoni* from upstate New York. These fossils, known for the gold shine of the pyrite replacement preserving them, show an additional, previously undescribed leg underneath the head.

“This fantastic preservation style allows us to observe 3D appendages in hundreds of specimens directly from the ventral side of the animals, just like looking at the appendages of horseshoe crabs on a beach by grabbing them and turning them upside down,” said Hou.

By making comparisons with another trilobite species, the exceptionally preserved *Olenoides serratus* from the Burgess Shale in British Columbia, Hopkins and Hou propose a model for how appendages were attached to the head in relation to the grooves in the exoskeleton. This model resolves the apparent mismatch and indicates that the trilobite head included six segments: an anterior segment associated with the developmental origin of the eyes and five additional segments, associated with one pair of antennae and four pairs of walking legs, respectively.

This study expands on the analysis that Hou and Hopkins have done on *Triarthrus eatoni*, which showed that the walking legs carry micron-sized respiratory structures (gills) and that the function of some of the spines on the walking legs was to keep these gills clean.

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Images: *An extremely well-preserved fossil of* Triarthrus eatoni *from upstate New York. Left: A magnified photo, © M. Hopkins and J-B Hou. Right: A photo at scale, Daniel Kim/ ©AMNH*