

Reproduction of Eurypterid Trace Fossils via Neoichnological Experiments Using Robotic Models of Eurypterids and Cephalaspis

*Narumi Ikusue¹, Toshiyasu Kondo²

1. Institute of Science Tokyo High School, 2. AFK Research and Development LTD

During the Devonian period, Eurypterids are thought to have been major predators that preyed upon Cephalaspis. However, trace fossils directly indicating predation between these taxa have rarely been reported. Therefore, clarifying the types of traces left by a Eurypterid attack is key to interpreting predator–prey relationships from the fossil record.

To investigate this, we conducted experiments in which the chelicerae of robotic eurypterids were used to attack a model of Cephalaspis under various experimental options: Eurypterids attacking (head or tail) and Cephalaspis defending (head position: up or down; part facing the chelicerae: head, tail, or body sideways). Similar experimental verifications were also performed using robotic models of Cephalaspis magnifica and Cephalaspis. These experiments produced two types of traces: a single groove from each chelicera, arranged in a V-shaped pattern, and two parallel grooves formed by the left and right chelicerae, respectively, also in a V-shaped configuration. However, neither type matched the ichnofossils described by Olivia A. (2016). Therefore, a second set of experiments was conducted to examine the role of the postcheliceral appendages. In Condition 2-1, the appendages moved parallel to the direction of travel; in Condition 2-2, they moved inward toward the mouth. Condition 2-2 produced traces with sharper, scratch-like margins that most closely resembled the ichnofossils in the reference. Furthermore, the five to eight parallel grooves characteristic of the fossil record are consistent with the number of postcheliceral appendages in Eurypterids.

These results indicate that reproducing these ichnofossils using only the chelicerae is difficult, suggesting that Eurypterids likely utilized their postcheliceral appendages in an inward motion, in addition to their chelicerae, when preying on Cephalaspis.

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