abstract

SKIMMING THE SURFACE WITH BURGESS SHALE ARTHROPOD LOCOMOTION

The notion that animal behaviour is fossilised in the geological record may seem implausible. Behavioural interactions between animals and substrates leave behind physical structures such as trackways, trails, burrows, bite marks and faeces. These are readily preserved in ancient environments even when the animals themselves are not; collectively these structures are known as trace fossils. As Sherlock Holmes proffered in A Study in Scarlet, “there is no branch of detective science which is so important and so much neglected as the art of tracing footsteps”. Trace fossils are a little studied branch of science in comparison to body fossils. Their full analysis requires a holistic integration of palaeontology, sedimentology and behavioural ecology. In combination with some detective work, they can be used to reconstruct and provide unparalleled insights into animal behaviour and environments from the geological record.

The 500 million year old Burgess Shale of Canada is famed for its weird and wonderful fossils of marine animals and the information that they provide on evolution during the Cambrian explosion. Some of these animals also left behind more than just their bodies. Here, the first arthropod trackways from the Burgess Shale Formation are presented. Trackway dimensions and the requisite number of limbs are matched with the body plan of a tegopeltid. Tegopelte is over twice the size of all other known benthic Burgess Shale arthropods and is considered to have been a predator or scavenger. Trackway analysis demonstrates the producers were capable of very high-geared gaits, rapidly skimming across the seafloor with short propulsive backstroke phases and metachronal waves of eight limbs moving along the body. Re-examination of body fossils has also identified the presence of gut diverticulae, confirming a carnivorous mode of life. Integrated trace and body fossil evidence therefore supports previous hypotheses on the locomotory capabilities and mode of life of such arthropods.

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