

Neoichnological evidence of predatory behavior in soil arthropods and its application to continental trace fossils

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Abstract:

Predatory arthropods are known from terrestrial environments since the Silurian. Many of these animals have acquired specialized behavioral adaptations including various burrowing styles and even permanently fossorial habits. Our knowledge of arthropod predators in Paleozoic soil ecosystems, however, is limited. Ichnofossils are abundant in Paleozoic paleosols and may record a hidden diversity of predatory arthropods. Laboratory experiments were conducted with various species of predatory soil arthropods to better understand the morphology and use of their burrows. Specimens were placed in sediment-filled terrariums and observed for 10-30 days. Open burrows were cast and ichnofabric was observed through serial sections. The morphology of the traces was described qualitatively and quantitatively and compared using statistical methods. The animals burrowed through intrusion, excavation, and backfilling. Burrow morphology ranged from simple vertical shafts to complex boxworks that served as temporary to permanent dwellings. Burrows also served a role in hunting and were used as sites for concealment for ambush or as prey traps. While complexity of burrows was not related to their use, distinct morphologies could be linked to predatory behaviors. Data collected from these experiments can be applied to ichnofossils found in Paleozoic paleosols to improve our understanding of the evolution of predatory arthropods, their geographic distribution through time, and their response to changes in soil environments, as well as improve interpretations of the paleoecology of ancient soil ecosystems. This knowledge is especially important given the relatively poor preservation potential of predatory soil arthropods in the environments they inhabit.

Keywords: neoichnology, arthropod, paleosol, burrow, predator