

**Neoichnological experiments with masked chafer beetles (Coleoptera:
Scarabaeidae): Implications for backfilled continental trace fossils**

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ABSTRACT

Laboratory experiments conducted with larvae and adults of the northern or southern masked chafer beetle (Scarabaeidae: *Cyclocephala lurida* or *C. borealis*) tested hypotheses that beetle larvae construct meniscate, backfilled burrows and that they are distinct from backfilled burrows constructed by marine organisms. Beetle larvae were placed in narrow enclosures with laminated moist, fine-to-medium-grained sand and allowed to burrow for several weeks. Beetle larvae did not create open burrow systems but instead excavated single open cells approximately twice their body width and roughly equal to their body length. Burrowing was accomplished by scraping sediment with the head and mandibles, consolidating excavated sediment into a ball, rotating 180° with the ball to the back of the cell, and packing the ball onto the posterior end of the cell. The beetle larvae produced vertical-to-horizontal traces that were straight to tortuous and composed of discrete packets of meniscate backfill. Adult chafer beetles moved through the media using a sand-swimming motion, that is, by passing sand around their bodies with the legs. Traces produced by adults are characterized by straighter axes and mixed passive and active fill resulting from sediment collapse and sediment transported backward. When vertical, adult burrows contain chevron-shaped fill. Traces produced by these beetles are similar to adhesive meniscate burrows found in many ancient continental deposits as old as the Permian and can be assigned to *Naktodemasis* isp. We propose that *Naktodemasis* with this kind of burrow morphology were soil-dwelling insect larvae that used burrowing mechanisms similar to chafer beetle larvae. These experiments demonstrate that this kind of burrow morphology is terrestrial in origin, suggesting that previous interpretations that the burrows are subaqueous in origin need to be reevaluated.