

Deep-water incised valley deposits at the Ediacaran-Cambrian boundary in southern Namibia contain abundant *Treptichnus pedum*

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ABSTRACT

Valley-filling deposits of the Nama Group, southern Namibia, record two episodes of erosional downcutting and backfill, developed close together in time near the Ediacaran-Cambrian boundary. Geochronological constraints indicate that the older valley fill began 539.4 ± 1 Ma or later; the younger of these deposits contains unusually well-preserved populations of the basal Cambrian trace fossil *Treptichnus pedum*. Facies analysis shows that *T. pedum* is closely linked to a nearshore sandstone deposit, indicating a close environmental or taphonomic connection to very shallow, mud-draped sandy seafloor swept by tidal currents. Facies restriction may limit the biostratigraphic potential of *T. pedum* in Namibia and elsewhere, but it also illuminates functional and ecological interpretation. The *T. pedum* tracemaker was a motile bilaterian animal that lived below the sediment-water interface—propelling itself forward in upward-curving projections that breached the sediment surface. The *T. pedum* animal, therefore, lived infaunally, perhaps to avoid predation, surfacing regularly to feed and take in oxygen. Alternatively, the *T. pedum* animal may have been a deposit feeder that surfaced largely for purposes of

gas exchange, an interpretation that has some support in the observed association of *T. pedum* with mud drapes. *Treptichnus pedum* provides our oldest record of animals that combined anatomical and behavioral complexity. Insights from comparative biology suggest that basal Cambrian *T. pedum* animals already possessed the anatomical, neurological, and genetic complexity needed to enable the body plan and behavioral diversification recorded by younger Cambrian fossils.