Systematics and palaeoecology of Cambrian problematic dinomischids

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The rapid radiation of metazoan body plans during the Ediacaran-Cambrian period includes many problematic fossils that normally have morphologies disparate from modern animals. These problematic fossils, in the best cases, can be assigned to the total group of a particular living phylum, or, in some cases, are interpreted as extinct, evolutionary dead-end clades. Dinomischidae is one of these problematic fossil groups, which is argued to provide crucial information on the morphology and palaeoecology of early basal metazoans. Dinomischids were previously treated as a paraphyletic group, with the three genera Xianguangia, Daihua and Dinomischus arranged along the stem of the ctenophore clade (Zhao et al., 2019). Here, we present an updated interpretation of the morphology of Xianguangia and assign an additional problematic taxon, Calathites spinalis, as a new member of the Dinomischidae based on newly collected soft-bodied fossils. Now, four genera are recovered as a monophyletic group in our phylogenetic analysis (Figure 1). Dinomischids possess similar architectures in their tentacle-sheath complex that features a sclerotized tentacle fringed with pinnules and enveloped with the smooth sheath externally. Functional comparison of the ciliated pinnules suggests that dinomischids were suspension-feeders that likely sieved organic matters down to 21 µm, corresponding well to the size range of micro-plankton (Zhao et al., 2023). However, members of Dinomischidae have different attachment structures with varying shape and size, which allow them to occupy lower and middle epifaunal tiers. We suggest that dinomischids might stabilize their body upright on the seafloor by embedding the base into the firm Proterozoic-style substrate, an attachment strategy widely employed by co-occurring basal metazoans. The substrate changes and the rising ecological competition during this period probably have shaped the taxonomic diversity pattern and the mode of life of dinomischids.
Figure 1. The updated in-group relationship of Dinomischidae. Scale bars: 5 mm

REFERENCES