

Tracing the ecological footprint of late Ediacaran animals with molecular fossils

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Body fossils of the first animals, both macroscopic and microscopic, appear in the late Ediacaran across a wide range of marine environments [1,2]. However, fossils are subject to preservation biases, making it unclear whether surfaces with Ediacara biota impressions accurately represent the long-term ecology of the earliest animal communities.

In recent years, analyses of individual Ediacara biota fossils have shown that Ediacaran animals possess a recognizable molecular signature of steroid biomarkers, shaped by a distinct microbial consortium that alters sterols within their decomposing carcasses [3,4]. By examining steroid biomarker distributions in geological samples from tide-dominated, wave-dominated, and storm-dominated Ediacaran environments, we identified a molecular signal of animals in the rock record, enabling an assessment of the abundance of animals across ancient ecosystems independent of physical preservation.

At the scale of major depositional settings, molecular data confirm that fossils accurately reflect the preferred animal habitats, at least for the White Sea Assemblage of the Ediacara biota. However, at a finer scale, within these preferred habitats, animals consistently constituted a significant portion of the total biomass, even in sedimentary intervals where no fossils are preserved.

[1] Grazhdankin, D. *Journal of Paleontology* **88**, 269-283 (2014).

[2] McMahon, W. J. et al. *Journal of Sedimentary Research* **90**, 1463-1499 (2021).

[3] Bobrovskiy, I. et al. *Science* **361**, 1246-1249 (2018).

[4] Bobrovskiy, I. et al. *Current Biology* **32**, 5382-5389.e5383 (2022).