Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.29024

Benthic diel oxygen variability and stress as drivers for animal diversification in the Neoproterozoic-Palaeozoic

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Animal diversification mirrors an expansion in marine shelf area during the early Cambrian and occurs under a warming climate. The extent to which these environmental conditions directly influenced physiology and early organismal ecology remains unclear. Here we used biogeochemical modelling of day-night (diel) cycles of oxygen at the sunlit sediment-water interface under warm and cold conditions to demonstrate that increased physiologically stressful conditions occurred with benthic oxic-anoxic shifts over the nutrient-rich shelf. Under these conditions, a population-and-phenotype model further showed that the benefits of efficient cellular oxygen sensing offer adaptations to stress that outweighs the costs. Since diurnal benthic redox variability would have expanded as continents were flooded in the end-Neoproterozoic and early Palaeozoic, we propose that a combination of physiological stress and ample resources in expanding shallow shelf benthic environments may have impacted the adaptive radiation of animals tolerant to oxygen fluctuations.