

Pushing the Frontier of Earth' s Deep-Time CO₂ Reconstructions

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Atmospheric CO₂ and ocean pH records derived from the boron isotope composition of foraminifers' shells have, over the last couple of decades, revolutionised our understanding of the Cenozoic (~66 million years) carbon cycle. However, deeper-time reconstructions have generally been regarded as controversial due to difficulties in interpreting the rock record, including disentangling secondary influences and the lack of constraints on ancillary parameters required to calculate CO₂ from boron isotopes. Here, we will summarise recent advances in boron isotope analysis and their application to brachiopods, which now allow robust CO₂ and climate reconstructions to be extended further back in time to the emergence of complex multicellular life on Earth (~500 million years ago). By showcasing new Palaeozoic and Mesozoic boron isotope records, we will explore the role of CO₂ in driving Earth' s major climate transitions and mass extinctions. These advances push the frontier of Earth' s deep-time CO₂ reconstructions, providing unprecedented insight into the role of CO₂ in environmental, biotic, and climatic change - past, present, and future.

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