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Mass extinctions, recovery and resilience

The impact of the end-Permian mass extinction on the global distribution of marine invertebrates

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While mass extinction events represent times of hardship for most of Earth's ecosystems, shallow marine reef communities have often been hardest hit during periods of extreme environmental change. This is particularly true of the end-Permian mass extinction (∼250 Ma), the most severe in Earth history, when up to 96% of marine species became extinct. High rates of taxonomic turnover across this event represent the transition between Sepkoski's 'Palaeozoic' and 'Modern' marine faunas.
However, the environmental changes which occurred during the Late Permian–Middle Triassic (∼260 – 237 Ma) are complex. Large-scale volcanic episodes drove extreme greenhouse temperatures, peaking in the late Early Triassic, alongside widespread ocean acidification and anoxia, compounded by feedbacks associated with the presence of the supercontinent Pangea. As such, the variation of climate with latitude may have driven spatially heterogeneous patterns of extinction severity and selectivity. Several recent studies have suggested that high latitude faunas suffered higher extinction rates during the end-Permian mass extinction than their counterparts at lower latitudes.
To examine the spatial nuances of the end-Permian mass extinction and recovery for marine invertebrates, we downloaded and reviewed Late Permian to Middle Triassic occurrence data for brachiopods and bivalves from the Paleobiology Database. We then calculated changes in origination, extinction and extirpation rates with latitude, and reconstructed the latitudinal diversity gradients (LDGs) of brachiopods and bivalves, with shareholder quorum subsampling (SQS) applied to compare richness between latitudinal bands. These results highlight the role of extreme climate change and continental configuration in driving Permo-Triassic spatial biodiversity patterns.