

# Zooming in on the GOBE

## 2020 Virtual Annual Meeting of IGCP 653

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International Geoscience Programme Project 653:  
The onset of the Great Ordovician Biodiversification Event

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## Marine substrate change and biodiversity in the Ordovician

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The Ordovician was a time of tremendous evolutionary and environmental upheaval, incorporating both the unprecedented marine diversification of the GOBE, and substantial changes in shallow marine environments at both local and global scales, mediated by a complex interplay between biotic and abiotic processes.

Understanding how early Palaeozoic environments constrained biotic evolution is a major topic of palaeoenvironmental research, though knowledge of the magnitude and nature of the feedbacks between proliferating macroscopic life and global environments is less completely developed.

Among the regional-scale environmental changes of the Ordovician were the development of extensive shallow marine carbonate shelf environments, together with the expansion of novel habitats generated by metazoan ecosystem engineers. Drawing on data from both Baltica and Laurentia palaeocontinents, we evaluate the impact of regional substrate changes on diversity at a variety of spatial and temporal scales.

We used the Ordovician-Silurian record of the Baltic palaeobasin as a case study, using hierarchical diversity partitioning to evaluate the impacts of environmental heterogeneity and temporal turnover on brachiopod diversity patterns, using data from the Paleobiology Database and the database of the Geoscience Collections of Estonia. We find that the development of an extensive carbonate shelf in the Baltic palaeobasin during the Sandbian-Katian had a major influence over regional diversity patterns because of the relatively high heterogeneity (beta diversity) of assemblages in these carbonate-dominated environments.

The development of widespread metazoan reefs in the Baltic paleobasin occurred alongside this diversification, and imposed small-scale habitat heterogeneity on marine seascapes. The Middle Ordovician rise of metazoan reefs enhanced complexity in shallow marine environments, which can be investigated in areas of exceptional exposure. With reference to metazoan reefs of the Mingan Archipelago, Quebec, we explore the forms of seascape heterogeneity generated by this change in carbonate deposition at community scale.

Developing understanding of the interactions between environmental and faunal heterogeneity is required for a mechanistic picture the long-term development of marine ecosystems. The early Palaeozoic marks the inception of major metazoan impacts on marine environments, and developing knowledge of these links could have general implications for our understanding of the feedbacks between macroscopic life and global environmental change.