# Palaeozoic Reefs and Bioaccumulations: Climatic and Evolutionary Controls

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# Palaeozoic Reefs and Bioaccumulations: Climatic and Evolutionary Controls

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# Foreword

The difficulty of studying reefs and shell accumulations rests primarily on its multidisciplinary position crossing numerous disciplines, such as biostratigraphy, geochemistry, palaeobiology, palaeoecology, petrology, sedimentology and taphonomy. The facies characterization of these bioclastic-bearing strata is, like many other biosedimentary structures, a process that requires the acquisition and integration of a wide and multiscale diversity of observations, which include field (global geometries), sample (fabrics) and thin-section (textures) scales.

When we organized an international meeting focused on 'Climatic and Evolutionary Controls on Palaeozoic Reefs and Bioaccumulations' (7–9 September 2005, Paris, France), it was our intention to provide a forum for discussing the evolution of reefs, shell accumulations and their transitional deposits. We invited specialists on a wide range of taxonomic groups, siliciclastic–mixed carbonate platforms and Palaeozoic ages to introduce a number of topics that are the focus of current research in the world of Palaeozoic benthic communities. The result of their contributions is presented in this Special Publication, which shows the complexity of intrareef synecological relationships and the diversity of concepts used to characterize both reefs and bioaccumulations. The editors offer, in the introductory paper (**Álvaro *et al.***), a discussion about concepts and definitions related to reefs and bioaccumulations. The transition between the concepts of reef and shell accumulation is gradual, as illustrated by some Palaeozoic examples, where reworked coquinas were episodically stabilized by encrusting communities and/or early diagenetic cements, in some cases forming the sole for future frame-building fabrics. Three Cambrian works are focused on shell-rich phosphorites from the Montagne Noire, France (**Clausen & Álvaro**), and microbial and archaeocyathan–microbial reef complexes from Sardinia, Italy (**Gandin *et al.***) and the High Atlas, Morocco (**Álvaro & Clausen**), the latter directly controlled by volcanogenic turbidity. The increase in biodiversity recorded in Ordovician bioaccumulations is illustrated by the characterization of a distinct echinoderm assemblage rich in ophiuroids and stylophorans (**Hunter *et al.***). **Kershaw *et al.*** show that some Silurian reefs from Gotland and the UK have sharp boundaries, with the surrounding sediments terminating abruptly against the reef edge, and the sharp margins made up of automicrites; the sharp reef edges indicate coherence of the micritic fabric, interpreted as a lithified wall against which bedded limestones were deposited. **Hubmann & Suttner** provide a review of Alpine Late Silurian–Late Devonian reefs and pavements, spanning a wide range of different autochthonous carbonates (e.g. brachiopod pavements, algal reefs, stromatoporoid–coral patch reefs) as well as allochthonous accumulations (e.g. serpulid accumulations). Two related papers offer an updated synthesis of the establishment of a carbonate platform (**Mabille & Boulvain**) and the sea-level-controlled evolution of Devonian mounds and atolls in the Dinant Synclinorium from Belgium (**Boulvain**). Examples for the youngest reefs of the Middle Palaeozoic reef community of stromatoporoids and corals are described from the latest Frasnian of Belgium (**Poty & Chevalier**). The struggle to establish a successful reef assemblage in the aftermath of the Kellwasser events and the importance of microbial communities in Famennian and Carboniferous reefs is described from Belgium (**Aretz & Chevalier**). The influence of palaeobathymetry and local synsedimentary tectonics in the establishment of carbonate factories is discussed in two papers focused on the development of Carboniferous chaetetid 'reefs' (**Almazán-Vazquez *et al.***) and neighbouring crinoidal thickets (**Buitrón-Sánchez *et al.***) in Sonora, Mexico, whereas the documentation of sea-floor instability related to the evolution of the Permian foreland basin recorded in the southern Urals is characterized by **Vennin**. The input of cool waters within tropical Permo-Carboniferous seas is analysed in Oman by **Weidlich**, and opens a large field of future discussions. **Théry *et al.*** provide new insights into the latest Permian reefs and bioaccumulations from eastern Europe and the Caucasus. And, finally, **Zapalski *et al.*** offer an estimation of palaeoenvironmental changes based on the distribution of late Middle Devonian tabulae in tabulate corals from northern France.

One of the messages of this collection of papers is the wide diversity of sedimentary geometries and facies displayed by reefs, shell accumulations and transitional composite deposits. Readers will find that the papers in this Special Publication cover specific nomenclatural problems, evidenced by the widespread terminology used to describe skeletal assemblages. Rather than attempt a complete revision of terms, we have touched on some of the major issues at this stage of development in the field: the major

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climatic, environmental and evolutionary factors that controlled the Palaeozoic development of shell accumulations and reefs. We hope that this volume attracts the attention of everyone interested in the fascinating diversity of Palaeozoic reefs and shell accumulation. It will be useful to senior undergraduate and postgraduate students of Earth Sciences and engineering. We also hope that it may prove useful to professionals who explore and economically exploit Palaeozoic skeletal-rich strata.

The editors would like to thank all contributors and referees for their rapid and stimulating collaboration. Thanks also for their suggestions, discussions, editorial work and constructive reviews.

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