

Post-Ordovician dynamics of trilobites as exemplified by evolutionary faunas

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Trilobites appeared with the Cambrian explosion with several other clades. They became quickly abundant and successfully invaded different environments. They reached their maximum diversity during the Ordovician but the Hirnantian glaciation severely affected this emblematic early Palaeozoic fauna leading to the disappearance of many orders and families. However, trilobites remained diversified after the crisis and other important diversity changes occurred later in the Palaeozoic. Using the factor analysis approach of Sepkoski, we identified the different evolutionary faunas of post-Ordovician trilobites to highlight the different key periods in their late history and the impact of ecological changes. During the Silurian, the Ordovician families that survived the Hirnantian extinction dominated the trilobite fauna. This evolutionary fauna prospered until the Devonian but was progressively replaced by another one. Indeed, the development of vast epicontinental seas during the Early Devonian led to the most important diversification of trilobites since the Ordovician with the radiation of several families. The Middle and the Late Devonian events strongly affected trilobites both ecologically and taxonomically. During this critical period, another fauna developed, the only one linked to a decrease of diversity and not to a diversification. In response to environmental stresses, Late Devonian trilobites showed morphological and ecological particularities such as eye reduction and deep living behaviour. Finally, a latest evolutionary fauna occurred during the Carboniferous and the Permian but it did not recover an important taxonomic diversity, despite a diversification in the Mississippian before disappearing at the end of the Permian.

Throughout their evolutionary history, trilobites suffered from environmental changes such as sea-level changes, anoxic events, or temperature changes, but also ecological changes with the development of other clades. These changes shaped their diversity both positively with several diversifications but also negatively with extinction events.

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