

Study on the Patterns of Trilobite Richness Changes in the South China from the Late Cambrian to the Early Ordovician

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Abstract

This project aims to delve deeply into the patterns of trilobite richness changes in the late Cambrian to early Ordovician of the South China. It strives to reveal the patterns and characteristics of trilobite richness during significant transitional periods, summarizing the species composition features of trilobite in the late Cambrian and Early Ordovician of the region. This will help us restore the significance of this period as a crucial transitional era for Early Paleozoic life evolution and climate changes, enhancing our understanding of deep-time Earth evolution. To address this, CONOP (Constrained Optimization) was used to synthesize data from 1,603 marine fossil species collected from over 700 stratigraphic sections. This approach generated high-temporal-resolution richness curves for trilobites at the millennial scale in South China, with an imputed temporal resolution of 50 thousand years, leveraging databases such as GBDB and OneStratigraphy. The result shows that from the Gushan to Guzhangian of the late Cambrian, species richness gradually increased, indicating a minor life explosion. Trilobites flourished, while conodonts and graptolites had yet to appear. During the Paibian stage to the end of the Cambrian, species richness fluctuated but remained stable overall. Conodonts first appeared during the Paibian stage, quickly increasing in richness and eventually matching trilobites, whose richness sharply declined despite occasional recoveries. In the Tremadocian stage of the Early Ordovician, species richness rapidly increased, signaling a minor biotic radiation. Graptolites emerged, causing a gradual decline in conodont richness, while trilobites further declined to a low point. Graptolite richness surged, becoming dominant in this period. During the Floian stage of the Middle Ordovician, species richness slowly rose, followed by explosive growth in the Darriwilian stage, indicating a major Ordovician radiation with an initial slow phase followed by rapid expansion. trilobite richness varied throughout the study period, notably so. In the Late Ordovician Darriwilian stage, species richness decreased. Graptolite richness peaked and then declined, while trilobites rapidly rebounded. The changes in trilobite richness from 510 to 460 Ma provide valuable clues for identifying key historical events.

Keywords

Trilobite, Late Cambrian to Early Ordovician, South China, Database, Constrained Optimization, Supercomputing