The palaeobiogeography of Late Devonian and Early Carboniferous marine ostracods

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Introduction

Over geological time, life experienced many periods of significant biodiversity variations. Among the declines during the Phanerozoic, five events are considered as major crises. One of them, the Kellwasser event, marked the Frasnian-Famennian boundary (-372 Myr) and was followed by another extinction close to the Devonian-Carboniferous boundary (-359 Myr) named the Hangenberg event. The aim of this work is to study the palaeogeographical distribution of ostracods in this particular context.

Material & method

Data from publications documenting Frasnian, Famennian and Tournaisian ostracods have been gathered. Entomozoidae (mostly pelagic) and deep-water faunas (i.e. Thuringian Mega-assemblage) are not considered because too few data are available so far. Moreover, Entomozoidae have a wide spatial distribution during the Late Devonian. Data have been distributed within 19 operational geographical units (OGU, list on Fig. 1) in order to consider faunas living in the same palaeogeographical area, although they may have lived under different environmental settings. This method minimizes the impact of local palaeoenvironmental conditions on large-scale palaeobiogeographical studies. Three different analyses has been carried out: unweighted pair method with arithmetic mean (UPGMA) and non-metric multidimensional scaling (NMDS), both performed with similarity Jaccard and Dice indices, and network analysis.

Results

Different clusters have been identified for each stages (Fig. 1). During the Frasnian, Laurussia and Siberia formed a unique cluster. It is splitted into 2 clusters during the Famennian: Laurussia and Siberia-Russian Platform. They are also present during the Tournaisian but the Central American Platform seems more isolated. The Northeastern Palaeotethys cluster also splitted in 2 clusters between the Frasnian and the Famennian. There are no major changes between the Famennian and the Tournaisian but data are scarce about Tournaisian faunas, particularly from Gondwana.

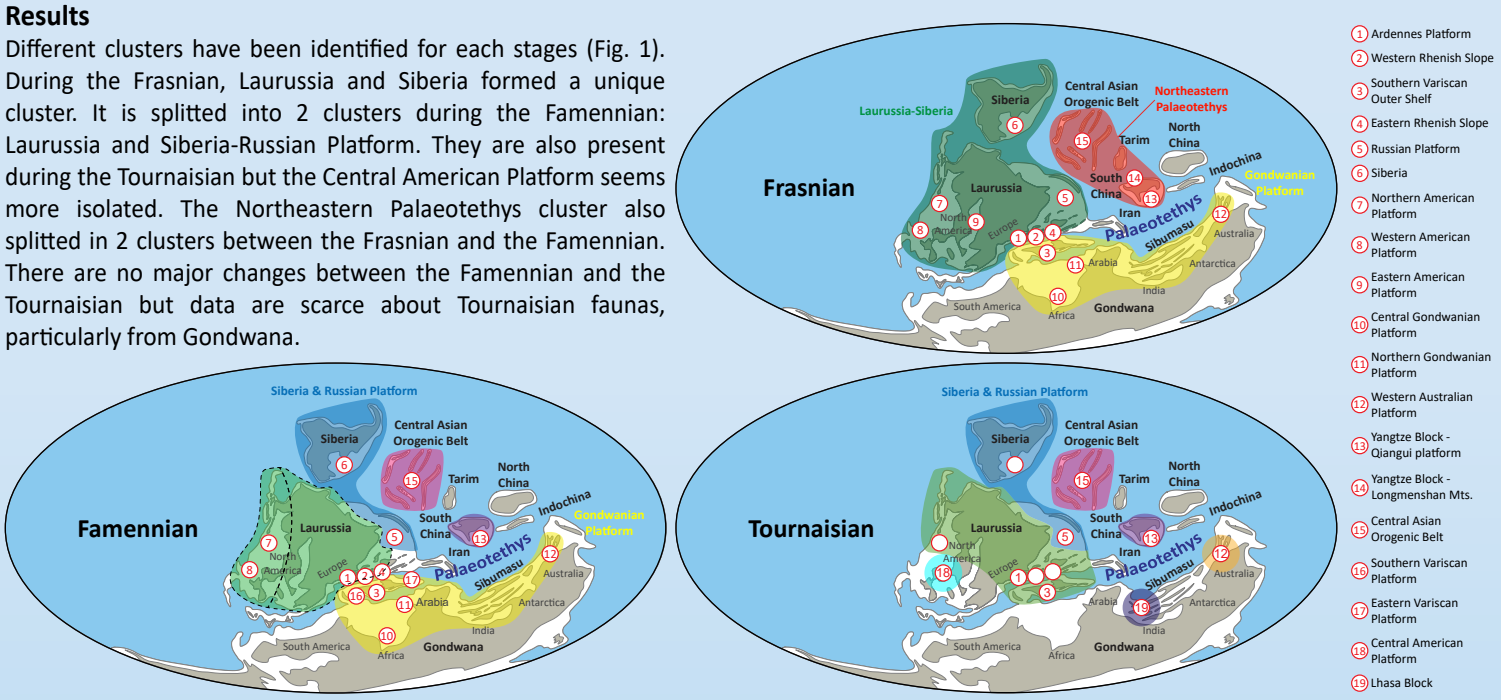

Figure 1. Clusters identified during the Late Devonian-Early Carboniferous. They are symbolized by different colours. Map modified from Carmichael *et al*. 2019.

Discussion & conclusion

The clusters roughly follow the climatic zonation so the distribution of ostracods in the interval was possibly constrained by the climate (Fig. 2). Similarities between faunas from distant OGU and clusters suggest that connections existed between them, potentially by surface currents (Fig. 2). The most important change happened at the Frasnian-Famennian transition, with faunas appearing more isolated from each other during the Famennian. However, the variations are possibly more related to climatic and tectonic changes than to extinction events.

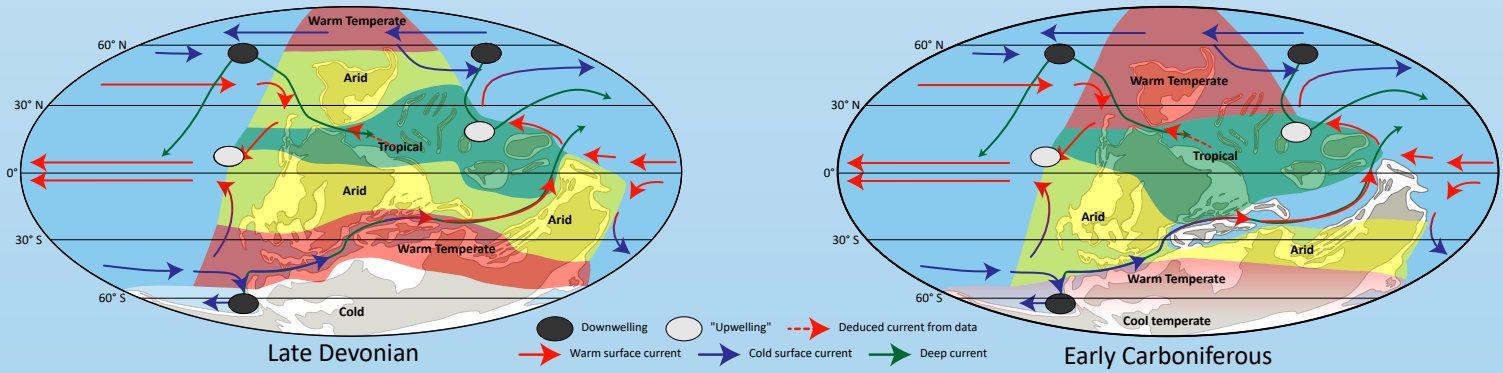

Figure 2. Climatic zonation (after Boucot *et al*. 2013) and ocean circulation (after Scotese & Moore 2014 and Crasquin & Horne 2018) during the Late Devonian & the Early Carboniferous.

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References
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