

# Trilobite diversity in Avalonia prior to the end Ordovician extinction — the peak before the trough

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## Abstract

The trilobite biodiversity curve for Avalonia differs markedly from the global and other regional patterns in having the peak of diversity immediately prior to the Hirnantian extinction event rather than in the Caradoc or even earlier. This reflects both the very wide spectrum of biofacies represented in this part of the succession in Avalonia and the immigration of taxa resulting from the closure of the Iapetus and Tornquist oceans. Detailed analysis of the faunas demonstrates that Avalonia exemplifies the many factors involved in provincial breakdown and their influence on biodiversity. Furthermore, it emphasises the need to understand the palaeo-environmental context within which such changes took place.

Over 90 trilobite genera are known from the mid-Ashgill (Cautleyan and Rawtheyan stages) of Avalonia with half of these making their first appearance on this microcontinent in that interval. The wide environmental spectrum reflected in the rock record not only includes the return of the deepest water (cyclopygid–atheloptic) biofacies but also marks the first recorded development in Avalonia of the pure carbonate illaenid–cheirurid association which was first established in low latitude Laurentia much earlier in the Ordovician. Its appearance in Avalonia may reflect a combination of the drift of the microcontinent towards tropical latitudes and a possible warming event. Recruitment into this and other environments was overwhelmingly from low latitudes with the largest cohort having its earlier history in Laurentia. Setting aside the ‘new’ pure carbonate environment, the marked rise in diversity and concomitant provincial breakdown resulted from the insinuation of immigrant taxa into existing communities across the shelf and upper slope rather than from any substantial replacement of the established incumbents. The peak of diversity in the mid-Ashgill made the climatically triggered Hirnantian extinction all the more dramatic in Avalonia.

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## 1. Introduction

Clades within the Trilobita underwent a major increase in taxonomic diversity as part of what has become known as the ‘Great Ordovician Biodiversification Event’ (see [Webby, 2004](#)). A recent benchmark volume ([Webby et al., 2004](#)) documented the global and

some regional patterns of biodiversity change within all the major groups of organisms during the Ordovician. These support the contention by [Miller \(1997, 1998\)](#) that global patterns are aggregates of the patterns that differ between and even within the major clades and vary both spatially and temporally. The trilobites, one of the most intensively studied Ordovician groups, are clear exemplars of this and so provide an opportunity to assess the complex palaeobiogeographical and palaeoecological factors that influenced biodiversity change.

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The global pattern of trilobite biodiversity change (Adrain, Westrop and Fortey in Adrain et al., 2004) essentially shows a rise to a peak of some 280 genera during the Darriwilian stage (approximately uppermost

Arenig and Llanvirn in terms of the Anglo-Welsh chronostratigraphy) and a fall thereafter to about 170 genera in the later part of the late Ordovician (approximately Ashgill). This trajectory from the global peak was

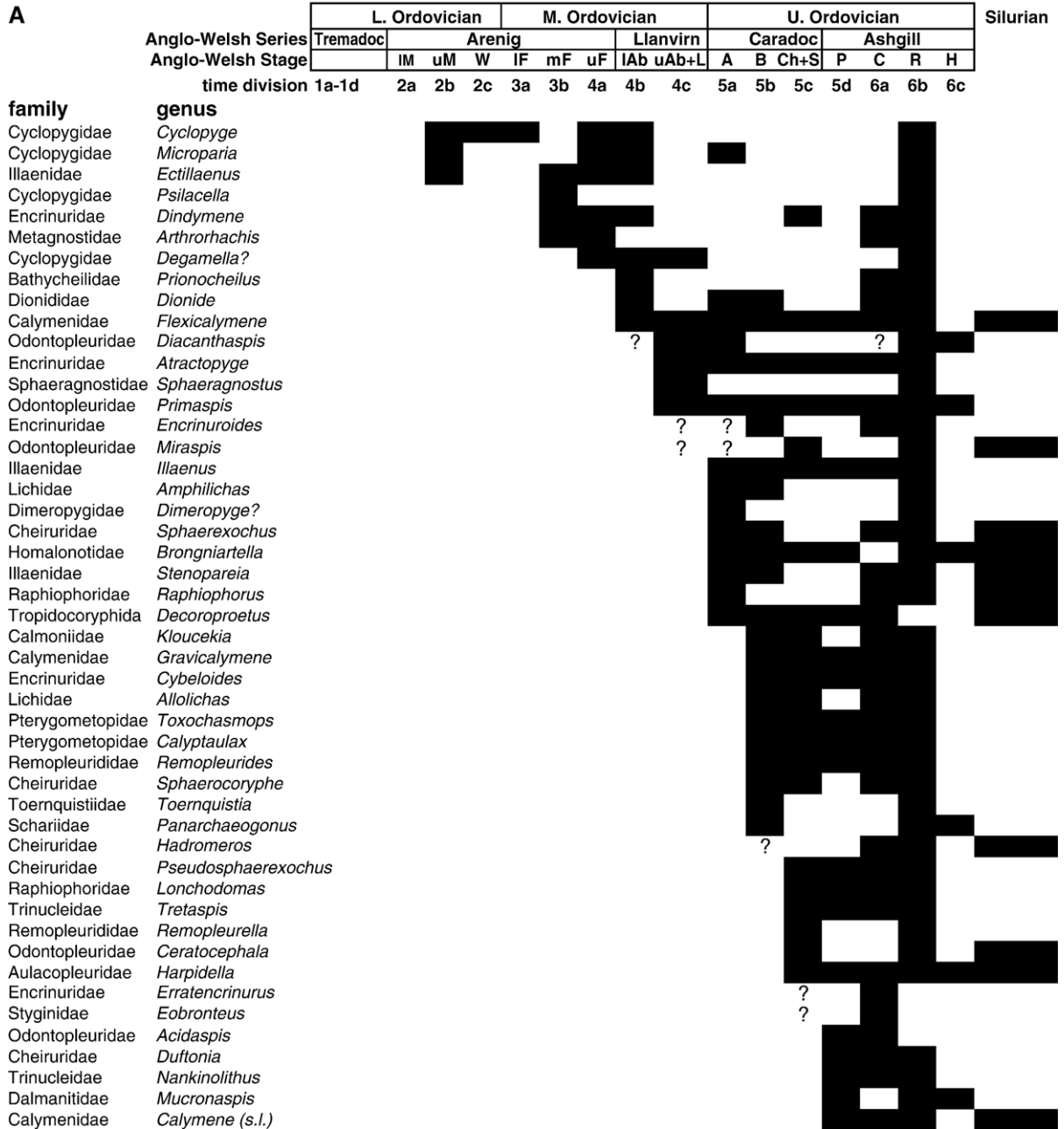


Fig. 1. A. Range chart of occurrences of those trilobite genera in the Anglo-Welsh area and southern Ireland that occur in the mid-Ashgill (Cautleyan and Rawtheyan stages) and have an earlier history in the region. Abbreviations of stage names: M — Moridunian, W — Whitlandian, F — Fennian, Ab — Aberdeiddian, L — Llandeilian, A — Aurelucian, B — Burrellian, Ch — Cheneyan, S — Streffordian, P — Pusgillian, C — Cautleyan, R — Rawtheyan, H — Hirnantian. Lower (l), middle (m) and upper (u) indicated where appropriate. Approximate equivalence of stages to the time divisions (1a–1d, 2a etc) recommended in Webby et al. (2004) also indicated (see also Owen and McCormick in Adrain et al., 2004). B. Range chart of occurrences of those trilobite genera in the Anglo-Welsh area and southern Ireland that occur in the mid-Ashgill (Cautleyan and Rawtheyan stages) and do not have earlier history in the region. Abbreviations as on A.

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