Quantitative biochronology by unitary associations of late Albian ammonites from Europe and their biodiversity

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Abstract

The chronostratigraphic subdivision into an Early and Late Cretaceous is preceded by a global turnover in marine faunas, called the middle–late Albian Boundary Bio-Event. Thus, the late Albian is a critical time interval, especially with respect to the evolution and radiation of ammonites, which are by far the most abundant nektic organisms at that time. In this context, achieving the best possible biochronological resolution has direct implications on the various geological, geochemical, palaeoclimatic and biotic hypotheses related to this period. Over the past decades, several quantitative biochronological methods have been developed to achieve more accurate biozonations and correlations. Using strict and well-defined algorithms allow for the processing of large datasets and ensure a rigorous, exhaustive, and consistent treatment of the biostratigraphic data. Here, by means of the Unitary Association Method (UAM), we perform a quantitative biochronological analysis on a substantial dataset of late Albian ammonite occurrences from western Europe (comprising 175 species among 13 sections). This led to the construction of a sequence of 23 UAs for the whole late Albian that corresponds to a higher resolution than the standard empirical interval-based zonations for northwestern and southwestern Europe (7 zones and 9 subzones, respectively). These UAs can also be merged into 9 more geographically reproducible association zones, which correlates very well with these two standard zonations. Based on our results, the UAM enables accounting for and highlighting the range of actually all taxa, and not just a few selected index taxa whose ranges very often extend before and/or after their eponymous interval zone. Finally, the UA quantitative biochronology enables us to measure western European ammonite diversity throughout the whole Albian in detail. Consequently, we identified a major and sharp diversity decrease during the uppermost Albian (UAZ 8/9 boundary; = *M. perinflatum*/*A. briacensis* zones boundary), concomitant with the well-known Oceanic Anoxic Event OAE1d.

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