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Palaeozoogeography of Western European Lower Jurassic (Pliensbachian and Toarcian) Ostracoda

Paléozoogéographie des ostracodes du Jurassique inférieur (Pliensbachien et Toarcien) de l'Ouest de l'Europe

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Abstract

The palaeozoogeography of Lower Jurassic (Pliensbachian-Toarcian) Ostracoda is studied in terms of faunal similarity between 13 geographical areas. A list of 270 marine ostracod species from Europe, North Africa and North America has been compiled and subjected to quantitative analysis (using multivariate methods) in order to ascertain the degree of similarity between Spanish assemblages and those described from these areas. The cluster analysis demonstrates that degree of similarity generally reflects proximity in palaeogeographical position. The results indicate extensive intercommunication of taxa between the basins, and also the absence of clear differentiation between Tethyan and Boreal faunas.

Résumé

La paléozoogéographie des ostracodes du Jurassique inférieur (Pliensbachien-Toarcien) est étudiée en termes de similitudes fauniques entre 13 zones géographiques. Une liste de 270 espèces d'ostracodes marins de l'Europe du Nord de l'Afrique et d'Amérique du Nord a été compilée et soumise à l'analyse quantitative (méthodes d'analyse multivariée) de façon à déterminer le degré de similitude entre les assemblages d'Espagne et ceux décrits à partir de ces régions. Les classifications hiérarchiques démontrent que le degré de similitude reflète généralement la proximité paléogéographique. Les résultats indiquent une communication très importante des taxons entre les basins et aussi une différentiation claire entre les faunes téthysiennes et boréales.

Resumen

Este estudio analiza la paleozoografía de los ostrácodos del Jurásico inferior (Pliensbachiense-Toarciense), teniendo en consideración el grado de semejanza faunística entre 13 áreas geográficas. Se ha compilado una lista de 270 especies de ostrácodos marinos descritos en Europa, Africa y Norte América. El resultado ha sido sometido a un ánalisis cuantitativo (usando métodos de análisis multivariante) con el fín de conocer el grado de semejanza entre las asociaciones de ostrácodos españolas y aquellas descritas en dichas áreas. El análisis de tipo cluster demuestra que el grado de semejanza es mayor entre áreas paleogeograficamente próximas. Los resultados muestran una intercomunicación muy amplia de taxones entre las cuencas estudiadas. Además, los resultados de este estudio indican la inesistencia de una clara diferenciación entre fanuas típicas del Tethys y faunas boreales.

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Mots clés : Ostracodes ; Paléobiogéographie ; Jurassique inférieur (Pliensbachien-Toarcien) ; Classifications hiérarchiques

Palabras claves: Ostrácodos; Palaeobiogeografía; Jurásico Inferior (Pliensbaquiense-Toarciense); Análisis de tipo Cluster

1. Introduction

Palaeozoogeography is the study of the distribution of animal taxa in space and time, which in most cases is largely a consequence of their ecological requirements. Thus, zoogeography transcends the classical study of the geographical distribution of organisms, involving as it does a range of other factors, including ecological processes, which limit the distribution of species. In an ecological context, zoogeographers have used geographical patterns of distribution to infer the role of such physico-chemical factors as temperature, water depth, O2 concentration, pH, light, etc. Biotic factors, although more difficult to quantify are, notwithstanding, of equal importance. However, in the study of fossils, it is also necessary to embrace an evolutionary dynamic with respect to the phylogenetic history of the taxa concerned, together with evolving palaeogeographies and their consequences in terms of palaeoenvironmental successions; the whole, of course, being complicated by hiatuses and taphonomic processes. The intermittent nature of preservation of strata and outcrop, the wide distribution of Lower Jurassic sediments over the European continent, together with the occurrence of some lithologies highly prejudicial to the preservation or the recovery of Ostracoda, will naturally bias the results of this study to an unknown degree.

The number of papers concerning the general distribution of Jurassic marine Ostracoda (Bate, 1977; Lord, 1978, 1982, 1988; Herrig, 1988) is less than for other groups of fossils invertebrates, such as ammonites, brachiopods, bivalves or foraminifers, etc. The present paper has been compiled from a comprehensive literature of ostracod studies for each of the 13 selected geographical areas across Europe. It considers the main composition of their Pliensbachian and Toarcian ostracod assemblages and also their faunal interrelationships in that both similarities and differences are analysed.

2. Provinciality and faunal provinces during the Lower Jurassic

In spite of the abundant literature on Jurassic Ostracoda, rather little attention has been paid to their spatial occurrence. This has been not the case with other invertebrate groups. The distribution patterns of such groups as ammonites, brachiopods and bivalves have been used to propose the existence of two major provinces the Northern Hemisphere Lower Jurassic. These are the Boreal and Tethyan provinces (Neumayr, 1882, 1883; Uhlig, 1911; Arkell, 1956; Hallam, 1975, 1983; Enay, 1980; Taylor et al., 1984; Cariou et al, 1985; Damborenea, 1993, etc.).

However, in those studies based on microfossils such provinces have not been so readily recognised. This is the case, for example, with foraminiferal assemblages. Gordon (1970) distinguished five types of foraminiferal assemblages (Gordon, 1970; Exton and Gradstein, 1984). Three are characteristic of shelf seas (composed mainly of Nodosaridae), while the other two are characteristic of the Tethys and its margins (which included planktonic and arenaceous foraminifera). In addition to differences in their geographical distribution (in relation to Boreal and Tethyan ammonite provinces these types of foraminiferal assemblages alternate with each other the same localities and are obviously local ecofacies.

The study of the distribution of Northern Hemisphere Mesozoic Ostracoda has allowed the identification of five provinces: European, Tethyan, North African, American and East African (Bate, 1977). Bate indicates that only the first two provinces can be clearly recognised in the Lower Jurassic. The European Province extends from Newfoundland in the west, to the Ukraine in the east and from Greenland in the north to the northern margin of the Tethys in the south. Although, its total inclusion is open to doubt, the Iberian Peninsula is also usually included in this province (Bate, 1977). The Tethyan Province (Bate, 1977; Lord, 1988) extends from the eastern coast of Canada to Northwest Africa (Tunisia, Morocco, Algeria, etc.).

For this study the palaeogeographical framework of Ziegler (1988, 1991, 1992) and Bassoullet et al. (1992) has been adopted (Fig. 1). The Lower Jurassic was marked by the development of an extensive epicontinental sea that covered the entire present western European continent. Ziegler (1988) recognized three North European provinces based on facies: Baltic and Polish, North Sea-North Germany and southwestern Europe. The first one is a continental and estuarine, clastic facies province, situated between the Fenno-Scandian High and the Bohemian Massif. The second was an open, colder water marine shale dominated area, which extended from the Norwegian-Greenland Sea into the Netherlands and from the Scottish Highlands into northern Germany. The Southwestern Europe province was a warmer water, carbonate-shale depositional area that extended from the southwest of the Bohemian-Rhenish-London-Brabant massifs to the Irish Massif axis.

In the Tethys area, Bassoullet et al. (1992) distinguished carbonate platforms of North Africa (Moroccan High Atlas, Algerian Sahara and Atlas), basinal environment argillaceous sedimentation (Subbetic and Tellian basins) and the pelagic or hemipelagic deposits of the Ammonitico Rosso limestones in the western Tethys.