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Revue de micropaléontologie

Revue de micropaléontologie 56 (2013) 159–174

Article original

Les ostracodes et foraminifères associés des dépôts de l'Éocène moyen et supérieur de la coupe de Jebel Serj (Tunisie centrale). Intérêt biostratigraphique, paléoécologique et paléobiogéographique

Middle to Upper Eocene ostracods and associated foraminifera of the Jebel Serj section (central Tunisia). Biostratigraphical, paleoecological and paleobiogeographical significance

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Résumé

La faune d'ostracodes collectée dans la formation Chérahil qui affleure dans la coupe de Jebel Serj (Tunisie centrale) contient 24 espèces appartenant à 12 genres. Ces ostracodes sont associés à des foraminifères benthiques (dont 4 espèces de *Nummulites*) et des foraminifères planctoniques. L'étude biostratigraphique, basée sur l'examen des associations d'ostracodes a permis de détecter 6 biozones attribuées au Lutétien-Priabonien. Les indices de Shannon Weaver, de Margalef et d'équitabilité indiquent des conditions de dépôts néritiques de plateforme-interne avec de faibles fluctuations de l'oxygénation et de la profondeur. La distribution paléobiogéographique des espèces d'ostracodes étudiés révèle une bonne connexion avec les bassins développés en Afrique du Nord (Tunisie, Algérie, Libye et Mauritanie) et au Moyen Orient (Égypte, Jordanie).

Mots clés : Ostracodes ; Foraminifères ; Éocène moyen à supérieur ; Jebel Serj ; Tunisie Centrale ; Biostratigraphie ; Paléoécologie ; Paléobiogéographie

Abstract

The ostracod fauna collected from the Cherahil formation that crops out at the Jebel Serj section (central Tunisia) contains 24 species belonging to 12 genera. These ostracods are associated with 9 genera of benthic Foraminifera (including 4 *Nummulites* species) and 7 genera of planktonic Foraminifera. The biostratigraphic study of ostracod assemblages results to the recognition of 6 biozones which are correlated with Lutetian-Priabonian. The Shannon Weaver, Margalef and equitability indices point to internal platform netritic conditions, with minor fluctuations in depth and oxygenation. The palaeobiogeographic distribution of ostracod species found in the study area of Central of Tunisia establishes a good connexion with the basins developed in Northern Africa (Tunisia, Algeria, Libya and Mauritania) and the Middle East (Egypt and Jordan).

Keywords: Ostracoda; Foraminifera; Middle to Upper Eocene; Jebel Serj; Central Tunisia; Biostratigraphy; Paleoecology; Paleobiogeography

Abridged English version

This study presents new results and paleoenvironmental and paleogeographic interpretations of a detailed taxonomic, biostratigraphic and paleoecological analysis of the Middle to Upper Eocene ostracofauna obtained from sequences cropping out at the Jebel Serj anticline, central Tunisia (Fig. 1).

The micropaleontology of the Middle to Upper Eocene sedimentary succession of this area has been discussed in many previous papers (Oertli, 1976 ; Bismuth et al., 1978 ; Mechmeche, 1981 ; El Waer, 1992 ; Ben Ismail-Lattrache, 1996 and 2000). The sedimentary succession is composed mainly by shales intercalated with centimetric beds of marly limestones (Fig. 2) with abundant benthic fauna (ostracods and foraminifera) characteristic of a neritic depositional environment. Two

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http://dx.doi.org/10.1016/j.revmic.2013.10.002

main sequences can be recognised. The lower "Cherahil A" member is made of alternating laminated and gypseous clays and marly limestones that contain abundant, diverse and well preserved microfauna; the upper "Cherahil B" member is made of silty clays and sandstones and contains a well preserved microfauna.

Detailed investigation of the ostracod content from the 72 studied samples has led to the recognition of an ostracod assemblage that represents 75% of the total observed taxa. Bivalves (*Ostrea lamellosa*), rudists, Cephalopods, *Nummulites* spp. and other foraminifera represent only 25%. A total of 24 ostracod species have been recognized (Plates I and II) among which fifteen are restricted to the Lutetian and four others appear in the Bartonian-Priabonian interval. Finally, five other species are recorded in both the Lutetian and Bartonian-Priabonian intervals. These findings indicate that ostracods appear to have suffered by an extinction event across the Lutetian-Bartonian boundary.

Our attempt to draw a biozonal scheme for the Middle to Late Eocene in jebel Serj area is based on the biostratigraphic distribution of the ostracod genus *Loculicytheretta*. This scheme shows six local biozones (Fig. 3) which can be correlated with their equivalents in and outside Tunisia, as well as with the Shallow Benthic Zones (SBZ) of Serra Kiel et al. (1998) and the planktonic foraminifera biozonal scheme established by Wade et al. (2011). The biozonation suggested for central Tunisia is similar to the one established for the Southern Tethyan realm (Oertli, 1976 ; Apostolescu et Magne, 1956 ; Apostolescu, 1961 ; El Waer, 1992). The lower four zones are assigned to the Lutetian (*Loculicytheretta semipunctata*, *Loculicytheretta harshae, Loculicytheretta semirugosa, Loculicytheretta minuta*), one to the Bartonian (*Loculicytheretta cavernosa*) and the upper most one to the Priabonian (*Loculicytheretta* aff. *gortanii*.).

Based on co-occuring planktonic and benthic foraminifera, the above ostracod zones are correlated with coeval planktonic foraminiferal and *Nummulites* biozones; more specifically, the two ostracods assemblage zones of Early Lutetian (*L. semipunctata* and *L. harshae*) are coeval with *T. frontosa* Zone (E7b) of Wade et al. (2011). Consequently, an Early Lutetian age has been corroborated. Also, *L. semirugosa* Zone is correlated with the Middle Lutetian foraminiferal zone: *Guembelitrioides nutalli* Zone (E8) of Wade et al. (2011). Moreover, the lower part of *L. cavernosa* Zone nearly coincides with the biozone SBZ 17 described by Serra-Kiel et al., 1998. Accordingly, a Lower Bartonian age is assigned to this biozone. The *Loculicytheretta* aff. *gortanii* assemblage zone is partly coeval with the Priabonian biozone SBZ 19.

The paleobathymetric discussion of these assemblages reveals a restricted habitat ranging from the inner neritic to circalittoral environment. During the Lutetian, the ostracod assemblage is dominated by forms that display reticulated and ornamented carapaces such as the genera *Loculicytheretta, Leguminocythereis* and *Buntonia* genera (Fig. 4), suggestive of a shallow marine environment from inner shelf with low energy. This was confirmed by average values of plankton/benthos ratio. The Bartonian time is characterized by a decrease of bathymetry coupled with a high frequency of benthonic foraminifera, ostracoda and *Nummulites* species from a closed shallow water environment. Throughout the Priabonian deposition, the upper stratigraphic levels expose a facies of a marine circalittoral environment documented by diversified planktonic foraminifera in association with frequent ostracod taxa and scarce benthic foraminifera.

Three community structure indices were calculated for each sample: these are the Margalef (richness), Shannon (diversity) and equitability indices (Fig. 5). The samples show in general average values of richness coupled with rather high values of equitability, particularly in the upper part of the section. These parameters reflect a rather stable environment, which lead to the establishment of several diverse ostracod communities.

In any case, it is possible to recognize some changes between the ostracod communities of the lower and the upper part of the section. In the lower part, the community structure analysis gives high values of Margalef and Shannon indices, pointing to rather stable environments. On the contrary, in the upper part there are several samples with low values of richness and diversity, which indicate a degrading environment, influenced by a high-energy hydrodynamic regime (Gliozzi et Grossi, 2004).

The ostracofauna, recognized in the studied section, displays many similarities with those of the Northern Africa and the Middle East regions as Libya, Algeria, Mauritania and Egypt (Fig. 6). The similarity with assemblages from Senegal and Ivory Coast is low (Table 1) and totally absent with those of European margin despite some cosmopolitan forms. Accordingly during the Middle to Late Eocene, a marine connection is evident between Northern Africa and the Middle East, probably between Northern Africa and Western Africa and totally absent between Northern Africa and European margin.

1. Introduction

En raison de leur faculté à répondre rapidement aux variations des paramètres du milieu (disparition et renouvellement rapide des faunes ou adaptation marquée par des différences morphologiques), l'étude des ostracodes fossiles permet des reconstitutions paléoenvironnementales (Zaïbi et al., 2012). En effet, la densité faunique et la diversité spécifique apportent des renseignements précieux sur les caractéristiques du milieu.

Les dépôts éocènes de la région du Jebel Serj, en Tunisie centrale (Fig. 1) offrent l'opportunité d'étudier les variations paléoenvironnementales d'une période charnière dans l'histoire climatique du Paléogène.

Un des meilleurs affleurements de la série éocène de la région se trouve au niveau de la coupe de Jebel Serj. De nombreux travaux y ont été effectués ; on citera une étude détaillée précisant les structures générales du massif (Turki, 1985), ainsi qu'une étude micropaléontologique et biostratigraphique des dépôts de l'Éocène inférieur (Ben Ismail-Lattrache et Bobier, 1996) et du passage Lutétien-Bartonien (Ben Ismail-Lattrache, 2000).

Dans ce travail une attention particulière est portée aux passages Lutétien-Bartonien et Bartonien-Priabonien marqués à l'échelle mondiale par une chute eustatique du niveau marin (Haq et al., 1987) responsable du grand renouvellement faunique par rapport à l'Éocène inférieur.