Disponible en ligne sur
SciVerse ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en

Revue de micropaléontologie

Revue de micropaléontologie 56 (2013) 103–126

Original article

Cenomanian–Early Turonian Ostracoda of the shallow marine carbonate platform sequence at west central Sinai: Biostratigraphy, paleobathymetry and paleobiogeography

Ostracodes du Cénomanien – Turonien inférieur des séries de plate-forme carbonatée peu profonde du Sinai cental occidental : biostratigraphie, paléobathymétrie et paléobiogéographie

Abdalla Shahin [a,*], Sherif Elbaz [b]

[a] *Geology Department, Faculty of Science, Mansoura University, 35516 Mansoura, Egypt*
[b] *Geology Department, Faculty of Science, Damietta University, Damietta, Egypt*

Abstract

The Cenomanian–Lower Turonian succession exposed in west central Sinai is carefully studied for their ostracode content. The Raha and Abu Qada Formations were studied in 4 sections. Their ostracode content includes the recognition of 70 species belonging to 34 genera. One species is considered as new (*Spinoleberis grosdidieri* n. sp.). The vertical distribution of the ostracodes in the sections enables the detection of four local biostratigraphic zones with a Barren Interzone in between. In terms of paleobathymetry, each studied sequence reveals deposition on a shallow reefal carbonate platform of less than 100 m depth. The flourishing of cytherellids in repeated intervals refers to kenoxic events within the Cenomanian section. These events are enhanced just below the Cenomanian–Turonian boundary referring to the Oceanic Anoxic Event 2. The wide paleobiogeographic distribution of the recorded Cenomanian ostracodes reveals that there was a direct connection throughout the Southern Tethyan Realm countries. Also, there was a migration path between the Southern Tethyan bioprovince and the West African bioprovince during the Cenomanian via the Trans-Saharan Seaway and along the Atlantic coast of West Africa.

Keywords: Cenomanian–Turonian; Ostracodes; Biostratigraphy; Paleobathymetry; Anoxic events; Southern Tethyan bioprovince; Sinai; Egypt

Résumé

La série du Cénomanien - Turonien inférieur exposée dans le center-ouest du Sinaï est soigneusement étudiée pour son contenu en ostracodes. Les formations de Raha et d'Abou Qada ont été étudiées le long de 4 coupes. L'étude des ostracodes a conduit à la détermination de 70 espèces appartenant à 34 genres. Une espèce est considérée comme nouvelle (*Spinoleberis grosdidieri* n. sp.). La distribution verticale des ostracodes dans les coupes étudiée permet la reconnaissance de quatre biozones locales, avec une interzone stérile entre eux. En termes de paléobathymétrie chaque série étudiée révèle un dépôt sur une plate-forme carbonatée récifale inférieure à 100 m de profondeur. La prolifération des cytherellidés à des intervalles répétés atteste de la présence d'événements kenoxiques au sein de la série cénomanienne. Ces événements deviennent de plus en plus importants juste en dessous de la limite Cénomanien - Turonien se référant à l'événement d'anoxie océanique 2. La large distribution paléobiogéographique des ostracodes cénomaniens enregistrés suggère l'existence d'une connexion directe à travers les pays de la branche Sud de la Téthys. En outre, il y avait un chemin de migration entre le sud de la Téthys et la bioprovince ouest africaine au cours du Cénomanien via la voie transaharienne maritime et le long de la côte atlantique de l'Afrique occidentale.

Mots clés : Cénomanien-Turonien ; Ostracodes ; Biostratigraphie ; Paléobathymetrie ; Événements anoxiques ; Bioprovince sud-téthysienne ; Sinai ; Egypte

1. Introduction

Despite numerous stratigraphic studies in the Sinai, a detailed biostratigraphic subdivision of the Cenomanian–Lower

* Corresponding author.
E-mail addresses: abdallashahin@yahoo.com, shahin@mans.edu.eg (A. Shahin).

0035-1598/$ – see front matter © 2013 Elsevier Masson SAS. All rights reserved.
http://dx.doi.org/10.1016/j.revmic.2013.04.004

Turonian shallow-water platform carbonate sequences of central and southern Sinai is still missing. This is because of the long stratigraphic ranges and scarcity or absence of planktonic foraminiferal markers in some intervals and the abundance of benthonic foraminifera in others. Because of their sporadic occurrence, ammonites cannot be used in the biostratigraphic subdivision of the Cenomanian–Lower Turonian strata of the study area. Another tool is based on large and small benthic foraminifera, a study carried out by Shahin and Elbaz (in press). An attempt to use the ostracode fauna as a biostratigraphic tool is carried out here and compared with the foraminiferal biozones established by the same authors in the same area to obtain a maximum biostratigraphic resolution. The recorded ostracode ranges were compiled in new local range charts on which the attempt to introduce an ostracode biozonal scheme for the west central Sinai area is based. The paleobathymetry of each biostratigraphic unit and the kenoxic events referring to the Oceanic Anoxic Event 2 within the Cenomanian–Early Turonian sections are also discussed.

The paleogeographic relevance of the recorded ostracodes is another major target of our study. During the Late Cretaceous, northern and southern Tethyan provinces can be distinguished in the Tethyan Realm (Babinot and Colin, 1988). The Late Cenomanian–Early Turonian transgression flooded the shallow marine Trans-Saharan Seaway and established a connection between the southern Tethyan province and West Africa.

The substantially increased numbers of publications on the Egyptian Cenomanian ostracodes are of interest. The publications dealing with other areas in North Africa, West Africa and the Middle East are also important references due to the direct connection between all countries of the South Tethyan palaeobiogeographic province during the Cenomanian.

Two groups of ostracode species are already present. The main first group includes species well known in the southern Tethyan province and is investigated in detail. The second includes some species which do not belong to the southern Tethys margin. This later group which is recorded in this study and other Egyptian areas as well as Jordan (Morsi and Wendler, 2010) includes some smooth ostracodes such as *Cytherella ovata* (Roemer), *Cytherella parallela* (Reuss), *Bairdia alexanderi* Blake, and *Bairdoppilata pseudorseptentrionalis* Mertens. The occurrence of these ostracodes is confusing for palaeobiogeographic analysis and therefore they are temporarily excluded from this study.

All identified ostracode species are illustrated in Plates 1–4. The vertical distribution of the recorded ostracodes in the four studied sections is shown in Figs. 3–6. In our collection, reference number (SMS 89) is given only to the newly described species.

2. Geologic and lithostratigraphic setting

The Sinai Peninsula lies in the northeastern part of Egypt and it is situated between the African and Arabian Plates. The Egyptian shelf was part of the Levant Platform, extending from Syria in the northeast to Egypt in the southwest (Alsharhan and Salah, 1996). After the Early Cretaceous regression, a mid-Cretaceous carbonate platform covered most of the Sinai Peninsula and adjacent areas (Lewy, 1990; Kuss, 1992). This carbonate platform which is situated on the southern passive margin of the Neo-Tethys belonged to the pericratonic Arabo-African carbonate platform, which extended from Morocco to Oman along the southern margin of Tethys (Bauer et al., 2001, 2003).

The study area lies within the Egyptian stable shelf of Said (1962). It extends on the western Sinai in nearly north to south alignment including the Essila section (lat. 29°10′04″ N and long. 33°13′17″ E), the Musaba Salama section (lat. 29°06′06″ N and long. 33°14′30″ E), the Farsh El Ghozlan section (lat. 28°54′46″ N and long. 33°19′4″ E) and Mukattab section to the south (lat. 28°48′20″ N and long. 33°27′23″ E) (Fig. 1). The Cenomanian–Turonian sediments are mainly composed of near shore silt-sandstones with carbonates and dark shale intercalations in the studied sections grading to thicker carbonate units intercalated with marls, shale and few sandstones.

Following the classification of Ghorab (1961), the Cenomanian–Lower Turonian succession is represented herein by two lithostratigraphic units (Fig. 2). They are arranged from base to top as follows:

2.1. Raha Formation: It unconformably overlies the Lower Cretaceous Malha Formation and underlies the Abu Qada Formation. It is subdivided into two formal members arranged from base to top as follows:
   2.1.1. The Abu Had Member constitutes the major part of the Raha Formation. The lower part of this member is composed of green glauconitic siltstone, sandstone, varicolored dark shale with some limestone intercalations. The middle part consists essentially of hard cliff forming limestone while the upper part is composed mainly of calcareous shale.
   2.1.2. The Mellaha Sand Member represents the upper part of the Raha Formation. It is composed of yellow, medium to fine sandstone devoid of micro and macrofossils.

2.2. Abu Qada Formation: It is composed mainly of characteristic green shale, calcareous shale and argillaceous limestone intercalation.

The age determination of these units is based mainly on the investigated foraminiferal content. All the studied materials are housed in our micropaleontological collections, Faculty of Science, Mansoura University, Egypt.

3. Ostracode content

Detailed investigation of the ostracode content has led to the recognition of 70 species belonging to 34 genera. Out of them, one species is considered here as new, namely *Spinoleberis grosdidieri* Shahin n. sp., which is described below in detail.

The species recorded during our study are listed below in a Taxonomic appendix; they are illustrated in Plates 1–4 and their stratigraphic ranges are provided in Figs. 3–6.

Subclass OSTRACODA Latreille 1806