

## Evaluation of the Maastrichtian-Priabonian benthic foraminiferal type species from the United Arab Emirates

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تقييم الأنواع من الفورامنيفرا القاعية لزمن الماستريختي - البريابوني في دولة الإمارات العربية المتحدة

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## Abstract:

The present study deals with evaluation and taxonomic consideration of twenty three species of the Maastrichtian-Priabonian small benthic foraminifera belonging to the three suborders. Textulariina (eight genera). Orbulinelloides, Psammolingulina, Repmanina, Spiroplectinella, Gaudryina, Tritaxia, Plectina and Marssonella; seven Lagenid genera. Chrysalogonium, Laevidentalina, Marginulinopsis, Hemirobulina, Marginulina, Procerolagena, Ramulina, and five Rotaliid genera. Turrilina, Transversigerina, Orthomorphina, Ornatanomalina, Elphidium from the United Arab Emirates (UAE). Seven species of these taxa are believed to be new. Gaudryina arabica, Chrysalogonium qarnelbarrensis, Laevidentalina ameerii, Procerolagena emiratensis, Transversigerina hamdani, Orthomorphina abdelghanyi and O. abusaimai .

**Keywords.** Benthic foraminifera, Maastrichtian, Paleogene, UAE, Tethys.

## ملخص:

تتناول الدراسة الحالية التقييم والوضع التصنيفي لثلاثة وعشرين نوعاً من المنخربات (الفورامينيفرا) القاعية الصغيرة لزمّن يمتد من الماستريختي-البريانوني والتي تنتمي إلى المجموعات الحفرية الثلاثة. Textulariina (ثمانية أجناس): Orbulinelloides و Psammolingulina و Repmanina و Spiroplectinella و Gaudryina و Tritaxia و Plectina و Marssonella ؛ ولمجموعة Lagenid (سبعة أجناس): Chrysalogonium و Laevidentalina و Marginulinopsis و Hemirobulina و Marginulina و Procerolagena و Ramulina. ولمجموعة Rotaliid (خمسة أجناس): Turrilina, Transversigerina, Orthomorphina, Ornatanomalina, Elphidium وجميعها من الإمارات العربية المتحدة. يُعتقد أن سبعة أنواع من هذه المجموعات جديدة: Gaudryina arabica و Chrysalogonium qarnelbarrensis و Laevidentalina ameerii و Procerolagena emiratensis و Transversigerina hamdani و Orthomorphina abdelghanyi و Orthomorphina abusaimai.

**الكلمات المفتاحية:** الفورامينيفرا القاعية، الماستريختي، الباليوجين، الإمارات العربية المتحدة، محيط التيثس.

## Introduction

Glennie et al. (1974) noted that the Maastrichtian-Paleogene neoautochthonous sedimentary rocks are the oldest strata deposited after the Oman nappes were emplaced during the Late Campanian-Early Maastrichtian and crop out in the UAE and Oman as a discontinuous belt of Jabals (mountains) and Qarns (hills) around the western flank of the Northern Oman Mountains. Among these, is the study four sections. Qarn El Barr of Sharjah Emirate (Lat. 25° 15' N - Long. 55° 50' E), Jabal Hafit (Lat. 24° 06' - 24° 9' N - Long. 55° 46' - 55° 49' E), J. Malaqet (Lat. 24° 07' N - Long. 55° 49' E), J. Mundassa, Al Ain area of Abu Dhabi Emirate (Lat. 24° 06' N - Long. 56° 00' E) (Fig. 1). An attempt has been made to study holotypes and paratypes of 23 benthic foraminiferal species of 20 Maastrichtian-Paleogene genera. Most of the recorded species are endemic to their original localities in the UAE, while some of them are also recorded in Egypt (Southern Tethys) and Spain (Northern Tethys) (Fig. 2).

The intent of this study is to bring together many data scattered in the literature under a unifying theme of these species, and to detect its paleontology and paleogeography.

## Stratigraphy

According to many authors, i. e. Hunting (1979), Warrak (1987), Nolan et al. (1986), Cherif et al. (1992), Anan et al. (1992), Anan (1995), the Maastrichtian-Priabonian succession in the UAE is subdivided into five formations arranged from the older, as follows:

5. Dammam Formation , Mazyad Member (Late Eocene)

4. Muthaymimah Formation (Paleocene-Early Eocene)

3. Fiqa Formation (Maastrichtian)

2. Simsima Formation (Maastrichtian)

1. Qahlah Formation (Maastrichtian)

Hamdan & Anan (1993) noted that the Oman Mountains and the Late Cretaceous syntectonic foredeep to the west are believed to have formed by the progressive movement of the Arabian continental margin toward this subduction zone as the Tethyan oceanic crust was subducted beneath it. Abdelghany (2003) noted that the post-obduction of the neoautochthonous Upper Cretaceous succession unconformably overlies the Late Cretaceous Semail Ophiolite. Nolan et al. (1986) noted that the Cenozoic history of the Arabian Gulf area began with regression at the K/P boundary, except for the basinal areas in the northern UAE (Ras Al Khaima Basin, including Qarn El Barr) and southern UAE (Mundassa Basin). Anan (1993a,b) noted that the deposition of the Paleocene Mundassa Member of the Muthaymimah Formation at both J. Mundassa and J. Malaqet reflect the effects of tectonic movements and sea-level changes. Anan (1993a, 2014, 2015) noted that the seawater covered the Malaqet section and rests on the shallow environment upper Maastrichtian limestone, and the deposition of the Danian exposed sediments took place with about 6 m thick (*Morozovella angulata* Zone), which represent continued subsidence below sea level. Anan (2017) noted that the duration of the hiatus at the K/P boundary in

Mundassa includes the two earliest Danian biozones. P0 and P $\alpha$  (about 0.02 Ma), while at J. Malaqet a marked basal conglomerate bed (about 0.50 cm) between the obducted pre-Maastrichtian Semail Ophiolite and the Maastrichtian neoautochthonous limestone of the Simsim Formation is observed.

### Taxonomy

Taxonomy of Loeblich & Tappan (1988) is used here for 23 Maastrichtian-Priabonian small benthic foraminiferal species belonging to three suborders Textulariina (8 species), Lagenina (9 species) and Rotaliina (6 species) are identified from four outcrops in the UAE (Qarn El Barr, Jabal Haft, J. Malaqet, J. Mundassa, Fig. 1), and illustrated in Plates (1, 2). Some modern taxonomic consideration have been added to complete synonymies of the recorded species.

Order Foraminiferida Eichwald, 1830

Suborder Textulariina Delage & Hérouard, 1896

Genus *Orbulinelloides* Saidova, 1975

***Orbulinelloides arabicus* Anan, 2003**

(Pl. 1, fig. 1)

2003 *Orbulinelloides arabicus* Anan, p. 531, fig. 4. 1. ☹ [illustrated species]

Remarks. This Bartonian-Priabonian species was described from J. Hafit, UAE (Fig. 3). Anan (2021a) recorded six species of the genus *Orbulinelloides* from different part of the world. *O. agglutinus*, *O. arabicus*, *O. fusca*, *O. kaminskii*, *O. sztrakosae*, *O. testacea*.

Genus *Psammolingulina* Silvestri, 1904

***Psammolingulina bahri* Anan, 2021**

(Pl. 1, fig. 2)

2016 *Psammolingulina* sp. Anan, p. 244, fig. 4.8. ☹

2021b *Psammolingulina bahri* Anan, p. 85, pl. 1, fig. 6.

Remarks. This Danian species was recorded from J. Mundassa, UAE (Fig. 4).

Genus *Repmanina* Suleymanov, 1966

***Repmanina mazenii* Anan, 2021**

(Pl. 1, fig. 3)

2016 *Repmanina* sp. Anan, p. 244, fig. 4.7. ☹

2021b *Repmanina mazenii* Anan, p. 85, pl. 1, fig. 4.

Remarks. This Danian species was originally recorded from J. Mundassa.

Genus *Spiroplectinella* Kisel'man, 1972

***Spiroplectinella hamdani* (Anan, 1993)**

(Pl. 1, fig. 4)

1993b *Spiroplectammina hamdani* Anan, p. 652, pl. 1, fig. 14. ☹

2005 *Spiroplectinella hamdani* (Anan) - Anan, p. 79, pl. 1, fig. 2.

Remarks. This Maastrichtian species has larger test, coiled stage and highly raised sutures than *S. knebeli* (LeRoy, 1953). It was originally described from the Maastrichtian of Qarn El Barr, and, later on, from Wadi Ed Dakhel, Egypt.

Genus *Gaudryina* d'Orbigny, 1839

***Gaudryina arabica* Anan, 2022**

(Pl. 1, fig. 5)

2003 *Gaudryina pyramidata* Cushman - Abdelghany, p. 398, fig. 7.1. ☹

2022 *Gaudryina arabica* Anan, p. 28, pl. 1, fig. 11.

Remarks. This Late Maastrichtian species was described from the Maastrichtian of Qarn El Barr (Fig. 5).

Genus *Tritaxia* Reuss, 1860

***Tritaxia kaminskii* Anan, 2021**

(Pl. 1, fig. 6a-c)

1980 *Tritaxia* sp. Barr & Berggren, p. 183, pl.

1, fig. 3. ☹

1993 *Tritaxia* sp. Kuhnt & Kaminski, p. 78,

pl. 7, fig. 8. ☹

1996 *Tritaxia* sp. Anan, p. 150, fig. 3. 7. ☹

2021b *Tritaxia kaminskii* Anan, p. 86, pl. 1,  
fig. 12.

Remarks. The Early Eocene specimen *Tritaxia* sp. Anan (1996) from J. Hafit, UAE (the paratype of this species) is closely related to the Paleocene *Tritaxia* sp. of Kuhnt & Kaminski (1993) from Sopelana section, Spain (the holotype of this species), but has a shorter length, wider width and younger stratigraphic level. It is also resembles the *Tritaxia* sp. of Barr & Berggren (1980, another paratype) from the Early Eocene of Apollonia Limestone, NE Libya. It is recorded from Spain (N. Tethys) and UAE and Libya (S. Tethys).

Genus *Plectina* Marsson, 1878

***Plectina emiratensis* Anan, 2003**

(Pl. 1, fig. 7)

2003 *Plectina emiratensis* Anan, p. 534, fig.

4. 2. ☹

Remarks. This Bartonian species *P. emiratensis* was described from the J. Hafit, UAE.

Genus *Marssonella* Cushman, 1933

***Marssonella hafitensis* Anan, 2003**

(Pl. 1, fig. 8)

2003 *Marssonella hafitensis* Anan, p. 535,

fig. 4. 3. ☹

Remarks. This Bartonian-Priabonian species *M. hafitensis* was described from J. Hafit, UAE.

Suborder Lagenina Delage & Hérouard,  
1896

Genus *Chrysalogonium* Schubert, 1908

***Chrysalogonium qarnelbarrensis* Anan, n. sp.**

(Pl. 1, fig. 9)

2003 *Dentalina manifesta* Reuss -

Abdelghany, p. 398, fig. 7.5. ☹

Holotype. Illustrated specimen in Pl. 1, fig. 9.

Diameter. Length 0.87 mm, width 0.13 mm.

Etymology. After Qarn El Barr section, sample 28, Simsim Formation, Sharjah Emirate, UAE.

Age. Late Maastrichtian  
*Abathomphalus mayaroensis* Zone.

Remarks. Progressively more elongate smooth test, small proloculus, 3-4 uniserial rectilinear cylindrical to pyriform gradually added chambers, slowly in breadth, straight horizontal incised sutures, aperture terminal on neck. The gradually increased chambers as added of this species, less numbers of chambers and older stratigraphic level than *C. polystoma* Schwager (1866).

Genus *Laevidentalina* Loeblich & Tappan,  
1986

***Laevidentalina ameerii* Anan, n. sp.**

(Pl. 1, fig. 10)

2003 *Dentalina megalopolitana* Reuss -

Abdelghany, p. 398, fig. 7.6. ☹

Holotype. Illustrated specimen in Pl. 1, fig. 10.

Diameter. Length 2.10 mm, width 0.17 mm.

Etymology. In the memory of my late son Ameer Anan.

Type locality of the holotype. Qarn El Barr section, Sharjah Emirate, UAE.

Type sample. sample 28, Simsim Formation.

Age. Late Maastrichtian *A. mayaroensis* Zone.

Remarks. This Maastrichtian species has large proloculus with apiculate, elongate test with 8 uniserial arcuate globular-semiglobular circular in section chambers, straight horizontal limbate sutures, smooth surface, terminal with large rounded aperture. It is most probably the ancestor of the Danian *Laevidentalina hudaе* Anan (2015), which may developed to the Middle-Late Eocene *L. salimi* Anan (2009).

***Laevidentalina hudaе* Anan, 2015**

(Pl. 1, fig. 11)

2015 *Laevidentalina hudaе* Anan, p. 65, pl. 1, fig. 1. ☺

Remarks. It was recorded from the Danian of J. Mundassa.

***Laevidentalina salimi* Anan, 2009**

(Pl. 1, fig. 12)

2009 *Laevidentalina salimi* Anan, p. 3, pl. 1, fig. 2. ☺

Remarks. This Middle-Late Eocene species has more elongated test and less number of globular last two chambers than the Paleocene *L. hudaе*.

Genus *Marginulinopsis* Silvestri, 1904

***Marginulinopsis emiratensis* Anan, 1993**

(Pl. 1, fig. 13)

1993b *Marginulinopsis emiratensis* Anan, p. 657, pl. 2, fig. 12. ☺

Remarks. This Late Maastrichtian species was described from Qarn El Barr section, UAE.

Genus *Hemirobulina* Stache, 1864

***Hemirobulina olaе* Anan, 2015**

(Pl. 2, fig. 14)

2015 *Hemirobulina olaе* Anan, p. 71, pl. 1, fig. 8. ☺

Remarks. This Danian species differs from the Middle-Late Eocene *H. bassiounii* Anan (2009) by its more inflated circular test, more rounded periphery, and younger stratigraphic level. It was described from J. Mundassa, UAE.

Genus *Marginulina* d'Orbigny, 1826

***Marginulina karimae* (Anan, 2009)**

(Pl. 2, fig. 15)

2009 *Marginulinopsis karimae* Anan, p. 6, pl. 1, fig. 8. ☺

Remarks. This Bartonian-Priabonian species was recorded from J. Hafit, UAE.

Genus *Procerolagena* Puri, 1954

***Procerolagena emiratensis* Anan, n. sp.**

(Pl. 2, fig. 16)

2003 *Pyramidulina* sp. Abdelghany, p. 399, fig. 8.7. ☺

Holotype. Illustrated specimen in Pl. 1, fig. 16.

Dimension. Length 0. 80 mm, width 0. 27 mm.

Etymology and type locality of the holotype. After Qarn El Barr, UAE.

Age. Late Maastrichtian *A. mayaroensis* Zone.

Remarks. This species has cylindrical elongate unilocular test, parallel sides periphery, 4 longitudinal costate along surface, radial on neck with phialine lip aperture. It differs from *Lagena paucicosta* of Sliter (1968) in its more cylindrical than fusiform test and in its tapering apical apertural end, and lesser length. It was recorded, from Qarn El Barr, UAE.

Genus *Ramulina* Jones, 1875

***Ramulina futyani* Anan, 2015**

(Pl. 2, fig. 17)

2015 *Ramulina futyani* Anan, p. 72, pl. 1, fig. 11. ☺

Remarks. This Paleocene species differs from *R. elkhoudaryi* Anan (2002) by its

hispid surface than smooth, one stout arm than 4 perpendicular arms and younger stratigraphic level. It was recorded, so far, from J. Mundassa, UAE.

Suborder Rotaliina Delage & Hérouard,  
1896

Genus *Turrilina* Andreae, 1884

***Turrilina hassani* Anan, 2010**

(Pl. 2, fig. 18)

2010 *Turrilina hassani* Anan, p. 160, pl. 1,  
fig. 3. ☺

Remarks. This Middle-Late Eocene species *T. hassani* differs from other *Turrilina* spp. by its opposite v-shaped aperture at the interiomarginal of the last chamber. It was originally recorded from J. Hafit, UAE.

Genus *Transversigerina* Mathews, 1954

***Transversigerina hamdani* Anan, n. sp.**

(Pl. 2, fig. 19)

2003 *Transversigerina* sp. - Abdelghany, p.  
399, fig. 8.6. ☺

Holotype. Illustrated specimen of Pl. 1,  
fig. 19.

Dimension. Length 0.70 mm, width 0.  
20 mm.

Etymology. After the  
micropaleontologist Prof. Abdel Rahim  
Hamdan, UAE University.

Type locality of the holotype. Sample  
31, Simsima Formation of Qarn El Barr  
section, Sharjah Emirate.

Age. Late Maastrichtian *A. mayaroensis*  
Zone.

Remarks. Early stage of test triserial  
followed by later uniserial, sutures  
horizontal, surface with 4 parallel  
longitudinal continuous costae, terminal  
rounded aperture on neck. It was recorded  
from Qarn El Barr, UAE.

Genus *Orthomorphina* Stainforth, 1952

***Orthomorphina abusaimai* Anan, n. sp.**

(Pl. 2, fig. 20)

2003 *Stilostomella spinae* Cushman -

Abdelghany, p. 399, fig. 8.9. ☹

Holotype. Illustrated specimen in Pl. 1,  
fig. 20.

Dimension. Length 0.50 mm, width 0.10  
mm.

Etymology. After the  
micropaleontologist Dr. Mahmoud Abu  
Saima, UAE University.

Type locality and sample of holotype.  
sample 28, Simsima Formation, Qarn El  
Barr, Sharjah Emirate, UAE.

Age. Late Maastrichtian *A. mayaroensis*  
Zone.

Remarks. Elongate uniserial rectilinear  
to slightly curved smooth test, proloculus  
globular, followed by 6 ovoid-discoidal  
chambers increasing rapidly in height,  
slowly decreased in breadth, sutures  
straight depressed, terminal rounded  
aperture. It differs from the Eocene *O. sp.*  
of Barr & Berggren (1980) from Libya in its  
semi globular chambers and gradually  
increased as added.

***Orthomorphina abdelghany* Anan, n. sp.**

(Pl. 2, fig. 21)

2003 *Nodosarella gracillima* Cushman -

Abdelghany, p. 399, fig. 8.8. ☹

Holotype. Illustrated specimen in Pl. 1,  
fig. 21.

Dimension. Length 2.0 mm, width 0.27  
mm.

Depository. Collection of Prof. O.  
Abdelghany, Geology Department, UAE  
University.

Etymology. After the  
micropaleontologist Prof. Osman  
Abdelghany.

Type locality and sample of holotype. Qarn El Barr, Sharjah Emirate, sample 28, Simsima Formation

Age. Late Maastrichtian *A. mayaroensis* Zone.

Remarks. Elongate uniserial rectilinear smooth test, proloculus globular, followed by 3 chambers increasing slowly in height, sutures straight limbate, terminal rounded aperture. It differs from *O. abusaimai* in its larger test, globular chambers than slightly inclined, limbate than normal sutures.

Genus *Ornatanomalina* Haque, 1956

***Ornatanomalina ennakhali* Anan, 1996**

(Pl. 2, fig. 22)

1996 *Ornatanomalina* sp. Anan, p. 154, fig.

4. 10. ☺

2011 *Ornatanomalina ennakhali* Anan, p.

63, pl. 3, fig. 34.

Remarks. This Ypresian species differs from the type species *O. geei* of Haque (1956, 1960) from Pakistan by its discontinuous ribs, not rounded periphery, and lacking the radial median ridges across the chamber surface. Loeblich & Tappan (1988) considered the genus *Ornatanomalina* Haque as a senior synonym of *Saudella* Hasson (1985) from Saudi Arabia, and considered *O. hafeezi* as a junior synonym of *O. geei*, which not accepted here.

Genus *Elphidium* de Montfort, 1808

***Elphidium cherifi* Anan, 2010**

(Pl. 2, fig. 23)

2010 *Elphidium cherifi* Anan, p. 172, pl. 2, fig. 8. ☺

Remarks. This Middle-Late Eocene species differs from the Priabonian *E. leave* of Cherif et al. (1992) from J. Hafit by its

backward extensions of the chambers. It was recorded, so far, from J. Hafit.

**Stratigraphic value of the benthic foraminiferal species and its distribution in the UAE**

Nine species of the above 23 recorded species are recorded from the Maastrichtian Simsima Formation of Qarn El Barr section. These are *Spiroplectinella hamdani*, *Gaudryina arabica*, *Chrysalogonium qarnelbarrensis*, *Laevidentalina ameeri*, *Marginulinopsis emiratensis*, *Procerolagena emiratensis*, *Transversigerina hamdani*, *Orthomorphina abusaimai* and *O. abdelghanyi*.

Five species of the above 23 described species are recorded from the Danian J. Mundassa section. These are *Psammolingulina bahri*, *Repmanina mazenii*, *Laevidentalina hudaie*, *Hemirobulina olae* and *Ramulina futyani*.

Nine species of the above 23 described species are recorded from the Ypresian-Priabonian of J. Hafit section. *Orbulinelloides arabicus*, *Plectina emiratensis*, *Tritaxia kaminskii*, *Marssonella hafitensis*, *Laevidentalina salimi*, *Marginulina karimae*, *Turrilina hassani*, *Ornatanomalina ennakhali* and *Elphidium cherifi* (Fig. 6).

**Paleogeography**

Adams et al. (1983) noted that the continuous marine Paleogene connection between the area of present-day Mediterranean and the Indian Ocean had been lost by mid Burdigalian time (early Oligocene) when a land bridge connected

southwest Asia to Arabia. The wide geographic distribution of UAE benthic foraminifera emphasizes the interpretations that have been presented by some authors (i.e. Anan, 1995; Adams et al., 1983) about the extended realms of the Indo-Pacific with the Atlantic via Tethys during the Maastrichtian-Eocene time.

### Paleoenvironment

Anan (1993b) concluded that the type of substrate is not the fundamental environmental factor (like the water temperature, light penetration, depth, salinity, food supply, dissolved oxygen) plays the control in the distribution of the benthic foraminiferal taxa in UAE. This study concluded that the distribution of the identified species from the UAE and surrounding area in the Tethys represent tropical-subtropical faunas (20–25°) and is indicative of an open sea shelf environment (50-200 m water depth) not restricted basins and indicative to the Midway Fauna Type (MFT), middle-outer shelf environment.

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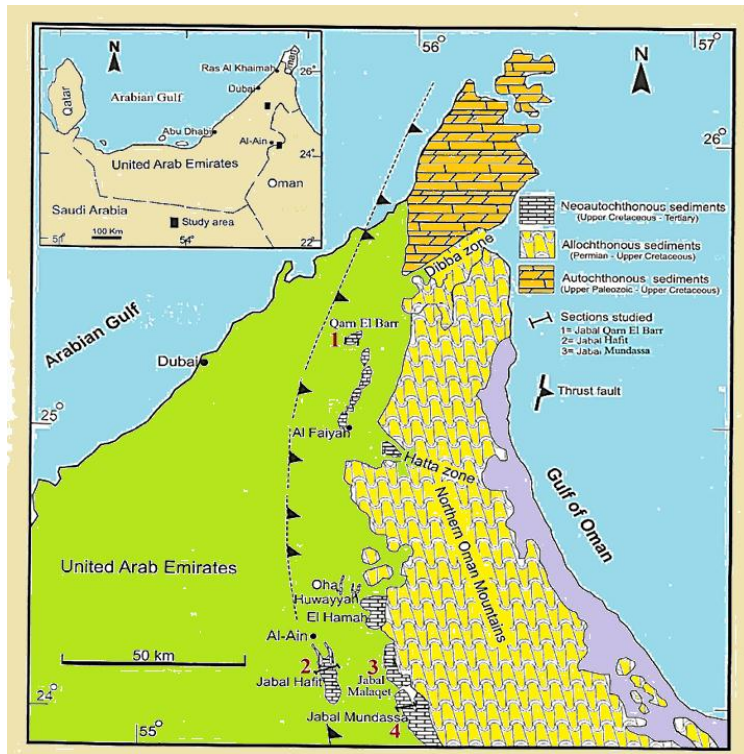


Fig. 1. The location map of the studied sections in the UAE . 1.Qarn El Barr, 2. Jabal Hafit, 3. J. Malaqet, 4. J. Mundassa (Abdelghany, 2003).



Fig. 2. The present location of the UAE, Egypt, Libya (Southern Tethys) and Spain (Northern Tethys).

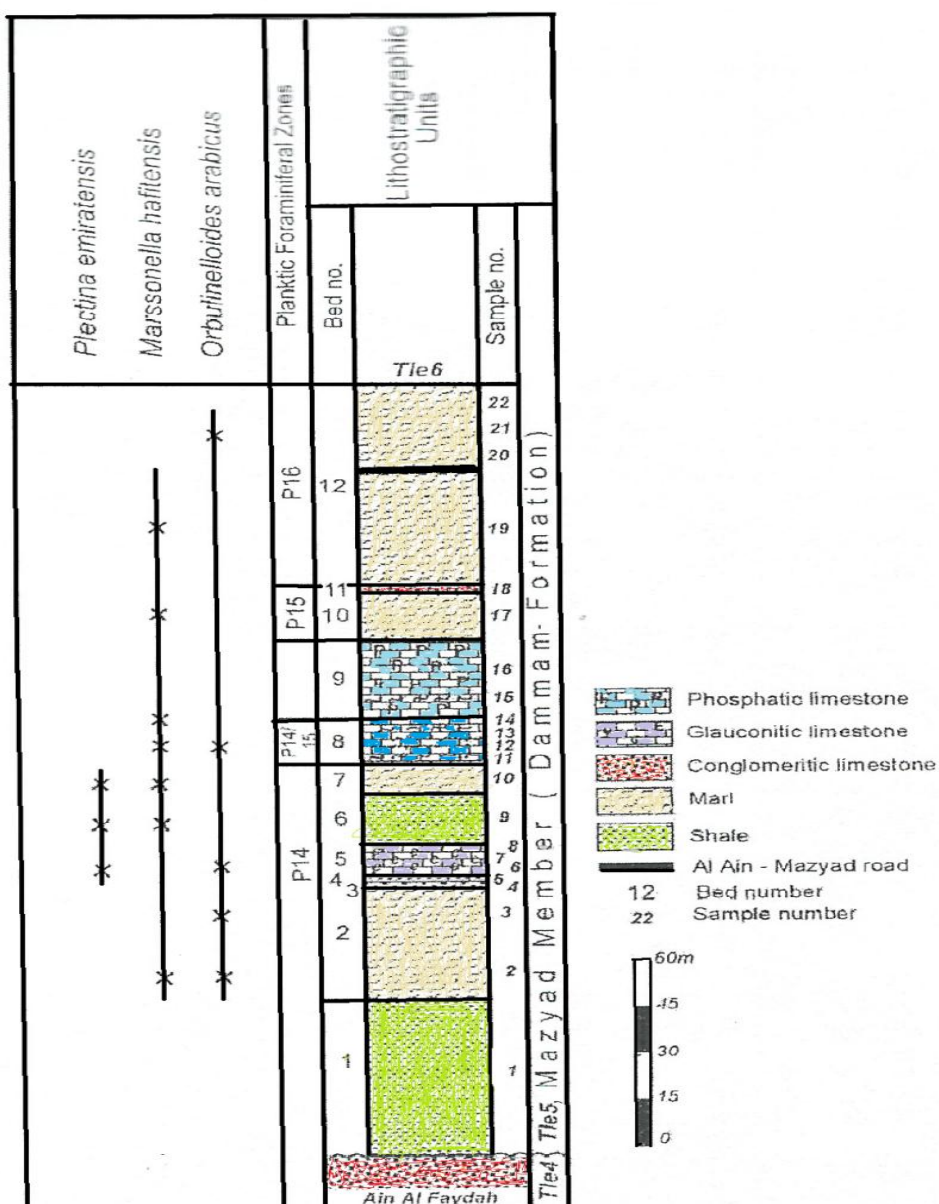


Fig. 3. Stratigraphic ranges of the three identified species (*Orbulinelloides arabicus*, *Plectina emirates*, *Marssonella hafitensis*) in the Middle-Upper Eocene in the western limb of J. Hafit (Anan, 2003)

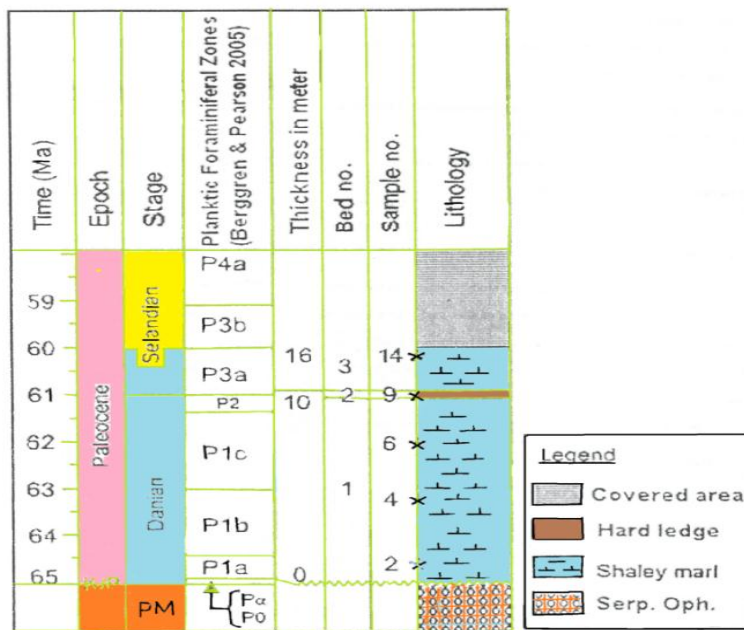


Fig. 4. The stratigraphic log of the Danian of the eastern limb of J. Mundassa, Al Ain, UAE (after Anan, 2021a).

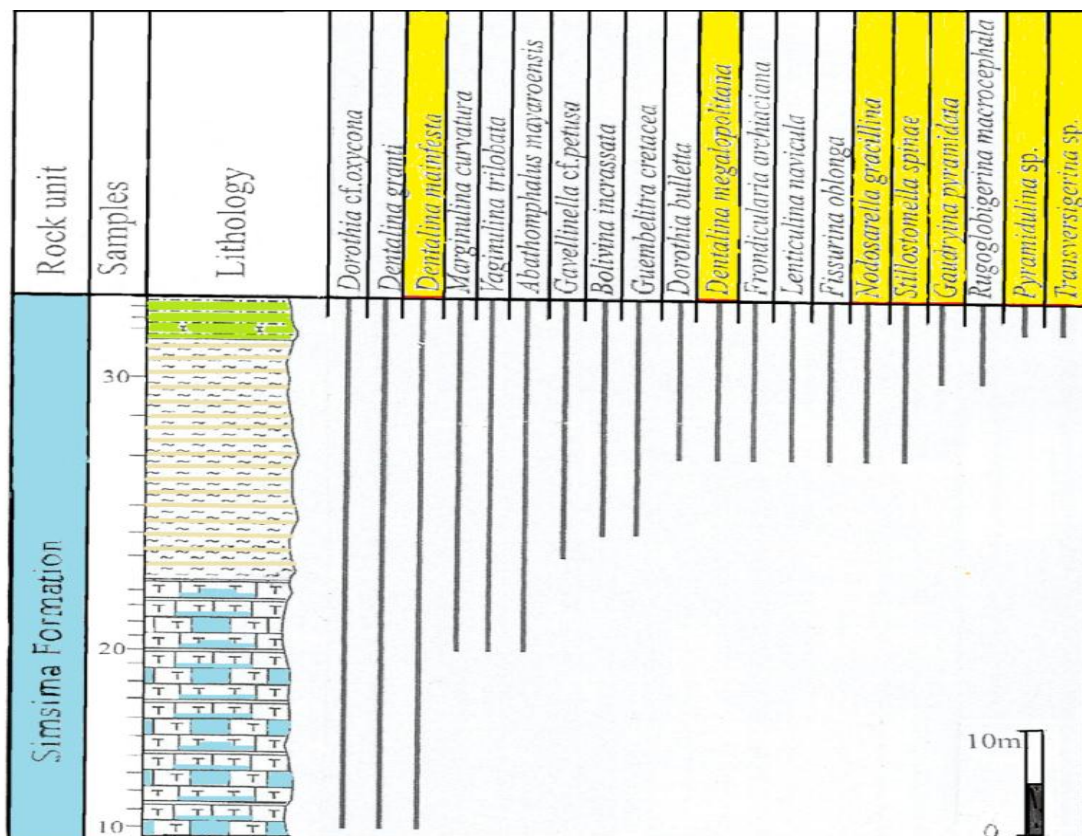


Fig. 5. Stratigraphic ranges of the identified Maastrichtian species of Qarn El Barr section, UAE. *Transversigerina* sp. (= *Transversigerina hamdani* in this study), *Pyramidulina* sp. (= *Procerolagena emiratensis*), *Gaudryina pyramidata* (= *Gaudryina arabica*), *Stilostomella*

*spinae* (= *Orthomorphina abusaimai*), *Nodosarella gracillima* (= *Orthomorphina abdelghanyi*), *Dentalina megalopolitana* (= *Laevidentalina ameeri*), *Dentalina manifesta* (= *Chrysalogonium qarnelbarrensis*) (after Abdelghany, 2003).

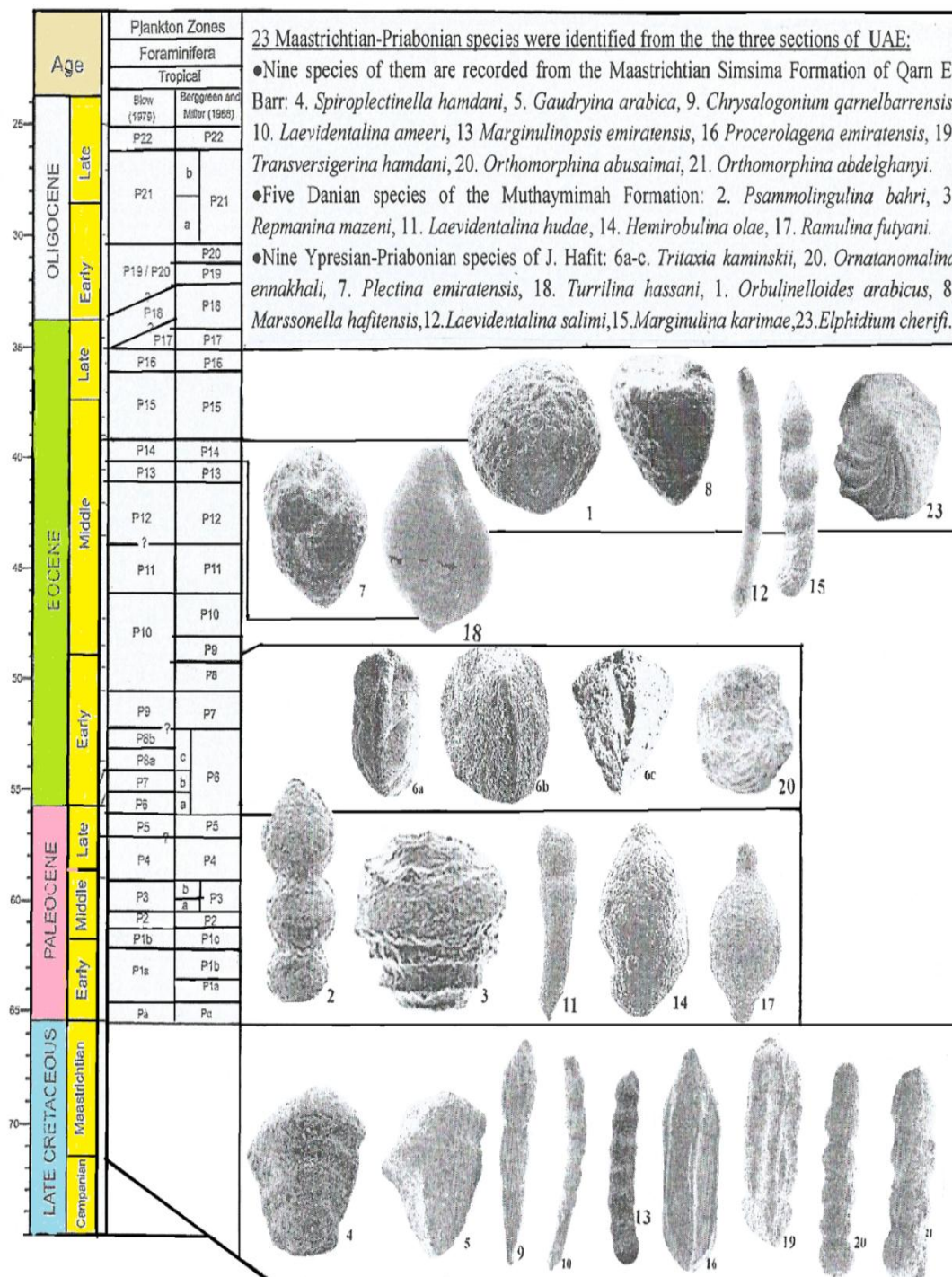


Fig. 6. The stratigraphic level of the identified Maastrichtian-Priabonian species from the three studied section in the UAE (This study).

## PLATE 1

**Fig. 1.** *Orbulinoides arabicus* Anan, 1995 x 135, **2.** *Psammolingulina bahri* Anan, 2021b x 100, **3.** *Repmanina mazenii* Anan, 2021b x 150, **4.** *Spiroplectinella hamdani* (Anan, 1993b) x 20, **5.** *Gaudryina arabica* Anan, 2022 x 25, **6a.** *Tritaxia kaminskii* Anan, 2021a x 40, **6b.** *Tritaxia kaminskii* Anan, 2021b x 20, **6c.** *Tritaxia kaminskii* Anan, 2021b x 45, **7.** *Plectina emiratensis* Anan, 2003 x 45, **8.** *Marssonella hafitensis* Anan, 2003x 40, **9.** *Chrysalogonium qarnelbarrensis* Anan, n. sp. x 70, **10.** *Laevidentalina ameerii* Anan, n. sp. x 85, **11.** *Laevidentalina hudaie* Anan, 2015 x 50, **12.** *Laevidentalina salimi* Anan, 2009 x 80, **13.** *Marginulinopsis emiratensis* Anan, 1993b x 45.



PLATE 2

**Fig. 14.** *Hemirobulina olae* Anan, 2015 x 65, **15.** *Marginulina karimae* (Anan, 2009) x 130, **16.** *Procerolagena emiratensis* Anan, n. sp. x 90, **17.** *Ramulina futyani* Anan, 2015 x 95, **18.** *Turrilina hassani* Anan, 2010 x 100, **19.** *Transversigerina hamdani* Anan, n. sp. x 100, **20.** *Orthomorphina abusaimai* Anan, n. sp. x 70, **21.** *O. abdelghanyi* Anan, n. sp. x 25, **22.** *Ornatanomalina ennakhali* Anan, 1996 x 50, **23.** *Elphidium cherifi* Anan, 2010 x 100.

