

RESEARCH ARTICLE

PALEONTOLOGY AND PALEOGEOGRAPHY OF FORTY DIAGNOSTIC SOUTHERN TETHYAN CRETACEOUS-PALEOGENE GLOBIGERINID PLANKTIC FORAMINIFERA

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ABSTRACT

Forty planktic foraminiferal species were erected from ten localities in the Southern Tethys: Tunisia, Egypt, Angola, Tanzania, Iraq, Kuwait, UAE, Iran, Pakistan and India. Sixteen of the identified species were erected from Egypt, while 4 from each of Kuwait and India, 3 from UAE, 2 from each of Tunisia, Angola and Pakistan. Some of the recorded species were recorded also from many countries in the Northern and Southern Tethys: i.e. Austria, Denmark, Spain, Australia, New Zealand and USA. Three out of the identified species are believed here to be new: *Morozovella arabica*, *Morozovella hafitensis* and *Clavigerinella pakistanica*. The phylogenetic relationships of some of the recorded species are also presented. The high abundance of pelagic planktic foraminiferal assemblage indicate an open marine environment connection to the Tethys which predominantly mainly related to photic zone.

KEYWORDS

Paleontology, Paleogeography, Planktic Foraminifera, Southern Tethys

1. INTRODUCTION

The author has examined 40 species belonging to the 20 Globigerinid planktic foraminiferal genera, which were originally erected from 10 countries in the Southern Tethys (Figure 1), and some of them were recorded also from other countries in the Southern and Northern Tethys.

The present study aims at throwing light on many data scattered in the literature for the members of planktic foraminiferal taxa under a unifying them. Following the Code of Zoological Nomenclature, a taxonomic revision of three of the recorded species are re-described its morphological features, which considered here as a new species.



Figure 1: The geographic distribution of the planktic foraminifera in the different localities in the Southern Tethys (Angola, Tanzania, Tunisia, Egypt, Iraq, Kuwait, UAE, Iran, Pakistan, India).

2. MATERIAL OF STUDY

Rich and well-preserved 40 Globigerinid foraminiferal species of the 20 genera were erected by the present author and also others from many countries in the Southern Tethys (North and Central Africa, Southwest Asia, South Pacific (Australia and New Zealand), as well as some Northern Tethys countries (Spain, Austria, Denmark).

3. SYSTEMATIC PALEONTOLOGY

The taxonomy of Loeblich and Tappan (1988) and El-Nakhal (2010) are followed in this study for diagnostic forty Cretaceous-Paleogene planktic foraminiferal species belonging to 20 genera, which were erected, particularly from ten countries in the Southern Tethys. The new taxonomic considerations are used for the recorded species including three new species, and all of them are illustrated in Plate 1.

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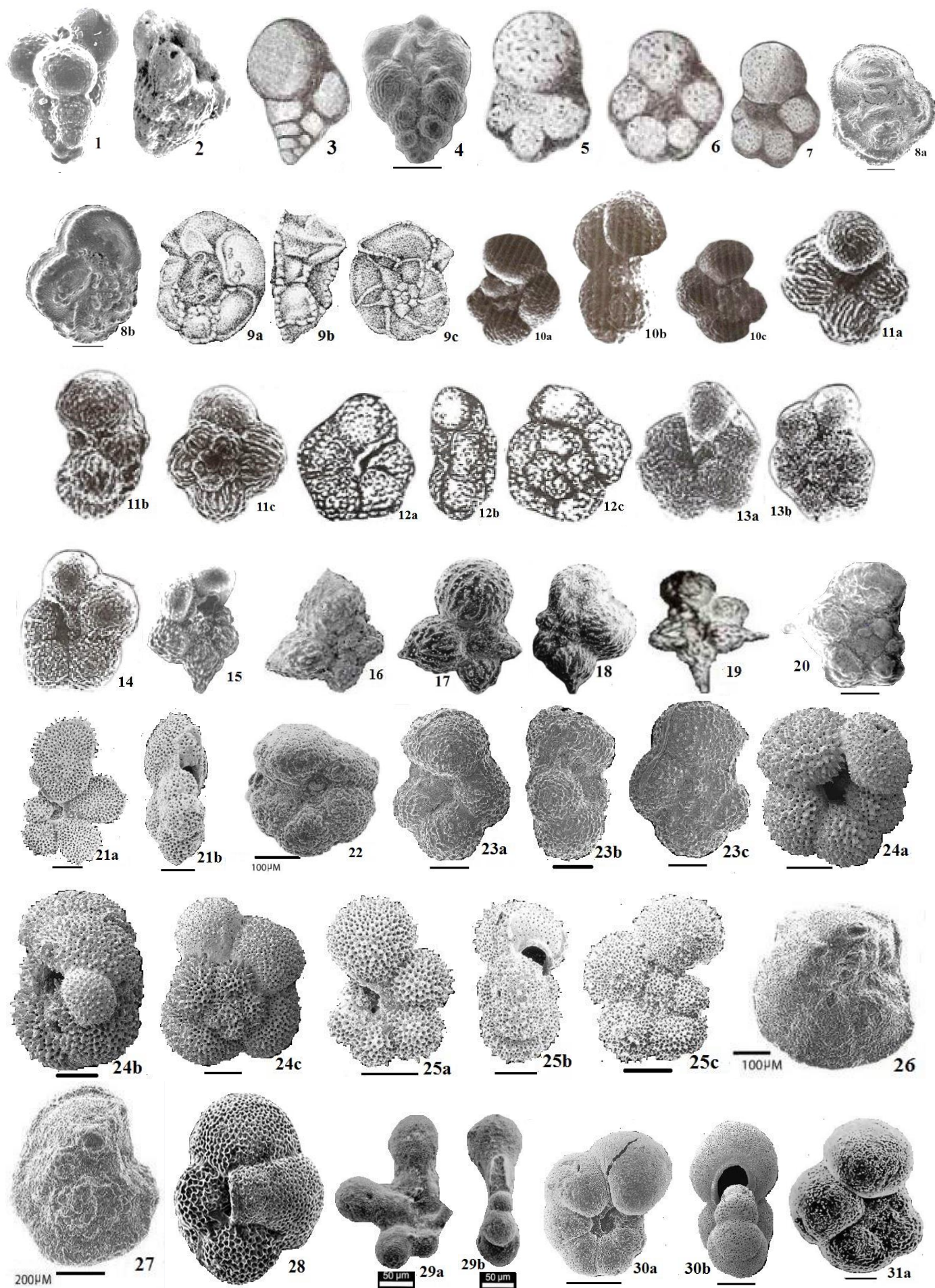
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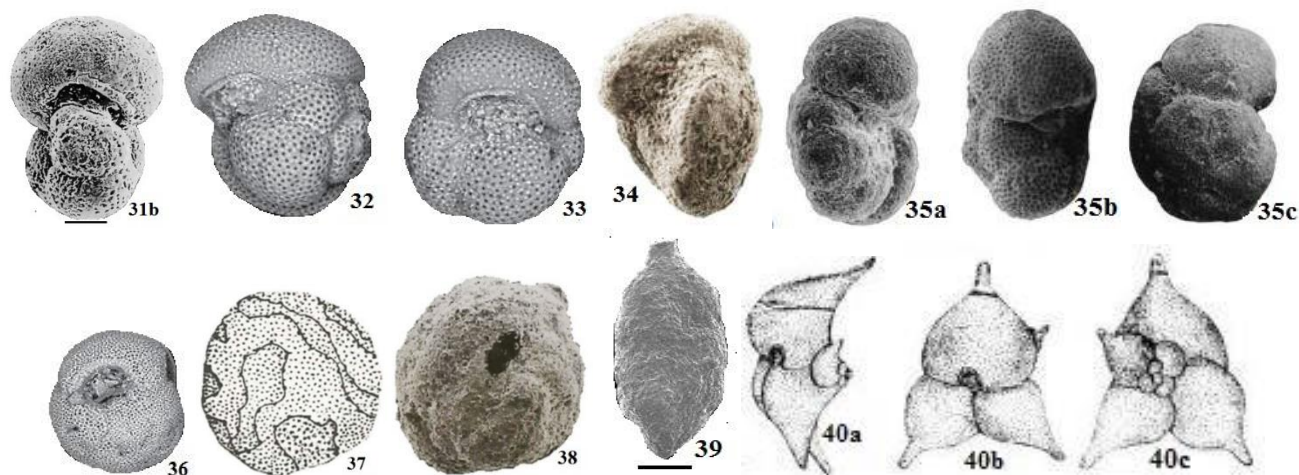


Plate 1: (all figures x 100, except some of them, a=ventral view, b= side view, c=dorsal view) Fig. 1. *Guembelitra oveyi* Ansary (1955), 2. *Heterohelix aegyptiaca* (Ansary and Tewfik, 1966), 3. *Heterohelix inflata* El-Nakhal (1983) 4. *Pseudoguembelina hariaensis* Nederbragt (1991), 5. *Hedbergella macrocephala* El-Nakhal (1983), 6. *Hedbergella submacrocephala* El-Nakhal (1983), 7. *Hedbergella trocoideaformis* El-Nakhal (1983), 8. *Globotruncana aegyptiaca* Nakkady (1950), 9. *Kassabiana falsocalcarata* (Kerdany and Abdelsalam, 1969), 10. *Kassabella carteri* (Kassab, 1976) El-Nakhal (1984), 11. *Meridionella pilula* (Belford, 1960)-El-Nakhal (2002), 12. *Badriella mouradi* El-Nakhal (2002), 13. *Anania caronae* El-Nakhal (2010), 14. *Anania shobairi* El-Nakhal (2010), 15. *Plummerita caribbeanica* Anan (2023), 16. *Plummerita elkefensis* Anan and Orabi (2022), 17. *Plummerita haggagae* Anan (2008), 18. *Plummerita hodae* Anan (2022), 19. *Plummerita kelleriae* Anan and Orabi (2022), 20. *Plummerita* sp. - Beiranvand et al. (2014), 21. *Acarinina africana* (El Naggar, 1966), 22. *Acarinina berwaliana* Mohan and Soodan (1969), 23. *Acarinina esnaensis* (LeRoy, 1953), 24. *Acarinina esnehensis* (Nakkady, 1950), 25. *Acarinina sibaiyaensis* (El Naggar, 1966), 26. *Morozovella arabica* Anan, n. sp., 27. *Morozovella hafitensis* Anan, n. sp., 28. *Catapsydrax africanus* Blow and Banner (1962), 29. *Clavigerinella pakistana* Anan, n. sp., 30. *Globanomalina luxorensis* (Nakkady, 1950), 31. *Globanomalina ovalis* Haque (1956), 32. *Turborotalia nukhulensis* Haggag and Luterbacher (1995), 33. *Turbotalia semicunialensis* Anan (2023), 34. *Turborotalia sinaiensis* Haggag and Luterbacher (1995), 35. *Turborotalia vagalkhodensis* Mukhopadhyay (2005), 36. *Globigerinatheka aegyptiaca* Haggag and Bolli (1995), 37. *Inordinatosphaera indica* Mohan and Soodan (1967), 38. *Inordinatosphaera* aff. *indica* Mohan and Soodan-Anan (2017), 39. *Zeauvigerina aegyptiaca* Said and Kenawy (1956), 40. *Schackoinella tricamerata* Mohan and Soodan (1969).

Suborder Globigerinina Delage and Hérourard, 1896

Guembelitra oveyi Ansary, 1955, p. 79, pl. 2, fig. 31. It is recorded from Egypt.

Heterohelix aegyptiaca Ansary and Tewfik, 1966, p. 10, pl. 5, fig. 5. Egypt.

Heterohelix inflata El-Nakhal, 1983, p. 16, pl. 1, figs. 1, 2. Kuwait.

Pseudoguembelina hariaensis Nederbragt, 1991, p. 358, pl. 8, fig. 6, 7. Tunisia.

Hedbergella macrocephala El-Nakhal, 1983, p. 12, pl. 1, figs. 6-8. Kuwait.

Hedbergella submacrocephala El-Nakhal, 1983, p. 13, pl. 1, figs. 9-11. Kuwait.

Hedbergella trocoideaformis El-Nakhal, 1983, p. 14, pl. 1, figs. 3-5. Kuwait.

Globotruncana aegyptiaca Nakkady, 1950, p. 690, pl. 90, figs. 20-22. Cosmopolitan species.

Kassabiana falsocalcarata (Kerdany and Abdelsalam, 1969) (= *Globotruncana falsocalcarata*), p. 261, pl. 1, figs. 1, 2. Loeblich and Tappan (1988) reported that the lip in *Kassabella* is not shown in the original figures, although the umbilicus appears to show remnants of a tegillum, for that they regarded *Kassabella* El-Nakhal (1984), and the other genus *Fissoarchaeoglobigerina* Abdel-Kireem (1978) as synonyms of *Archaeoglobigerina*, pending description of better preserved material.

Egypt, Iraq, Tunisia and Pakistan.

Kassabella carteri (Kassab, 1976) - El-Nakhal (1984), p.140, fig.1. Iraq.

Meridionella pilula (Belford, 1960) - El-Nakhal, 2002, p. 5, pl. 2, figs. 5-7. El-Nakhal (2002) noted that the Cenomanian-Coniacian genus *Badriella* belongs to Abathomphalidae with compressed later chambers, two faint keels, meridional arranged rugosity on the umbilical side and an aperture bordered by a porticus.

Badriella mouradi El-Nakhal, 2002, p. 6, pl. 2, figs. 8-10. The phylogeny and stratigraphic ranges of the genera related to Rugoglobigerinacea are presented in Figure 2.

Anania caronae El-Nakhal, 2010, p. 406, pl. 408, pl. 1, figs. 1-3. It is distinguished by its six inflated almost equal chambers of the last whorl. The holotype from site 364, Angola Basin (Southern Tethys).

Anania shobairi El-Nakhal (2010), p. 408, pl. 408, pl. 1, figs. 4-9. It is distinguished by its five inflated chambers, rapidly increasing in size of the last whorl. The holotype from site 364, Angola Basin, S. Tethys.

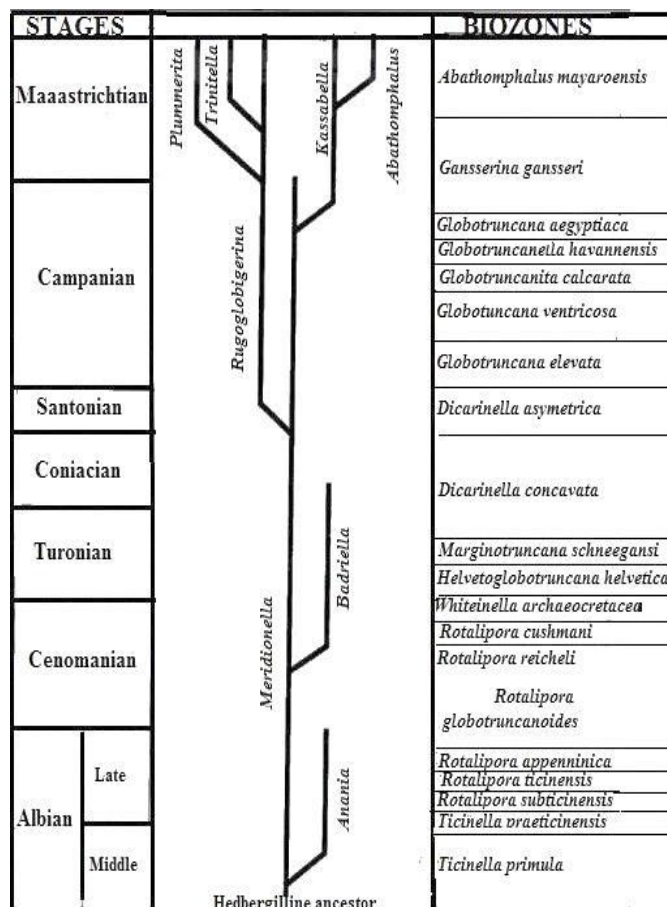


Figure 2: Phylogeny and stratigraphic ranges of the Superfamily Rugoglobigerinacea at a generic level (after El-Nakhal, 2010).

***Plummerita caribbeana* Anan (2023)**, p. 26, pl.1, fig. 5 (= *Rugoglobigerina* cf. *reicheli* or *Plummerita* cf. *hantkeninoides* - Robaszynski et al., 1983/4, p. 187, p. 286, pl. 50, fig. 6). It is recorded from Puerto Rico, Caribbean region, Southern Tethys.

***Plummerita elkefensis* Anan and Orabi (2022)**, p. 183, figs. 4D, E. (*Plummerita hantkeninoides* (Brönnimann). Keller, 2005, p. 741, pl. 16.4). It is recorded from Tunisia and Egypt.

***Plummerita haggagae* Anan, 2008**, p. 249, pl. 1, figs. 2, 3. It is recorded from Egypt and Iraq.

***Plummerita hodaie* Anan, 2022**, p. 183, fig. 4A. (= *Plummerita inflata* (Brönnimann). Anan, 2012, p. 594, pl. 1, fig. 3; Anan and Orabi, 2022). It is, so far, confined to Egypt.

***Plummerita kelleræ* Anan and Orabi (2022)**, p. 279, pl. 2, fig.14 (= *Plummerita hantkeninoides* Keller et al, 2003, p. 279, pl. 2, fig. 14). It is, so far, confined to Egypt

***Plummerita* sp.** (*Plummerita hantkeninoides* of Beiranvand et al, 2014), p. 247, fig.6.6). The Iranian *Plummerita* sp. doesn't has an axially spine-like prolongation for all five chambers in the last whorl (as in *P. hantkeninoides*), except the fourth peni-ultimate chamber. For that it is considered here as a separate species, and needs more detailed treatment in the future.

***Acarinina africana* (El Naggar, 1966)** (= *Globorotalia africana* El Naggar, 1966), p.193, pl.23, fig.4) Egypt.

***Acarinina berwaliana* Mohan and Soodan, 1969** (= *Globorotalia berwaliana* Mohan and Soodan, 1969, p. 9, text-fig. 1 A-F). It is recorded from India, Pakistan and UAE.

***Acarinina esnaensis* (LeRoy, 1953)** (= *Globorotalia esnaensis*, LeRoy, 1953), p. 31, pl. 6, figs. 8-10. Egypt, Tanzania, Austria, Australia, Denmark, Spain, Iran, India and New Zealand.

***Acarinina esnehensis* (Nakkady, 1950)** (= *Globigerina cretacea* d'Orbigny var. *esnehensis* Nakkady, 1950), p. 689, pl. 90: figs. 14-16. Egypt, Iran.

***Acarinina sibaiyaensis* (El Naggar, 1966)** (= *Globorotalia sibaiyaensis* El Naggar, 1966), p. 235, pl. 23, fig.6. It is recorded from Egypt, Iran, Spain, Atlantic Ocean and USA.

***Morozovella arabica* Anan, n. sp.** (= *Morozovella* sp. 1- Anan, 2015, p. 24, pl. 1, fig. 8).

Holotype: Plate 1, Figure 28. (=Transitional form between *M. aragonensis* and *M. caucasica*-Anan, 1996, p. 154, fig. 6.1; *Morozovella* aff. *aragonensis* (Nuttall) - Haggag et al., 2010, p. 181, fig. 18.25-26).

Etymology: after the United Arab Emirates.

Type locality: Western Limb of Jabal Hafit, UAE, sample 9b (Figure 3).

Stratigraphic level: Ypresian.

Diagnosis: Distinguished by its more pronouncedly plano-convex test with semi-circular outline, 5 chambers in the last whorl added gradually in size, sutures slightly depressed, umbilicus deep and relatively wide, aperture a low interiomarginal, umbilical-extraumbilical slit.

Remarks: It is located between *Morozovella lensiformis* and *M. crater* in the *M. lensiformis* → *M. arabica* → *M. crater* → *M. aragonensis* → *M. caucasica* lineage. It is recorded from UAE and Egypt.

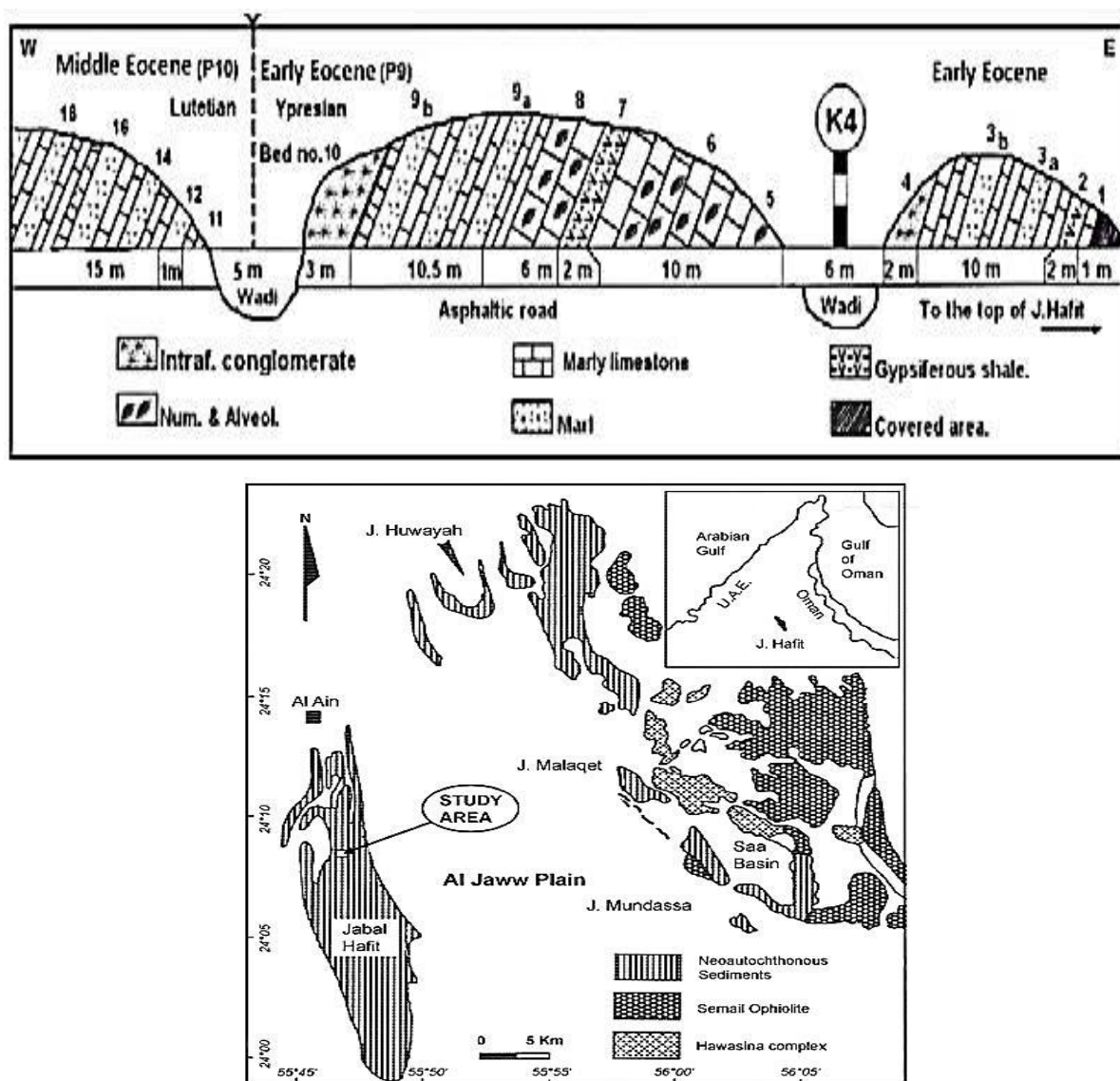


Figure 3: Schematic section of the EME succession at K4 of J. Hafit, UAE (after Anan, 2015).

***Morozovella hafitensis* Anan, n. sp.**

Holotype: Plate 1, Figure 29.

Etymology: after Jabal Hafit, UAE.

Stratigraphic level: Ypresian, sample 3a (see Figure 3).

Diagnosis: Plano-convex test with slightly lobulate outline, 4½ mainly equidimensional chambers in last whorl, sutures slightly depressed to radial, heavily beaded ornamented, umbilicus deep and relatively wide, aperture a low, interiomarginal, umbilical-extraumbilical slit.

Remarks: The writer considered *M. hafitensis* has been the direct ancestor of *M. caucasica*. It is located between *M. crater* and *M. caucasica* in the *M. crater* → *M. hafitensis* → *M. caucasica* lineage. It is, so far, confined to UAE. It means that *M. crater* has evolved in two directions: to *M. aragonensis*, ends with *M. caucasica*, while the other to *M. hafitensis* ends with *M. caucasica*.

***Catapsydrax africanus* Blow and Banner, 1962, p. 105, pl. 15, figs. A-C.**

Tanzania, Egypt, Pakistan.

***Clavigerinella pakistanica* Anan, n. sp. (*Clavigerinella* sp. – Naz, 2013, pl. 14, fig. 4).**

Holotype: Plate 1, Figure 30.

Etymology: after the Islamic Republic of Pakistan.

Stratigraphic level: Lutetian (P10, P11), Tiyon Formation, of Mari Nai section (Figure 4A, B).

Diagnosis: Test planispirally enrolled, involute and biumbilicate, early chambers globular and inflated, later 5 chambers radially elongate and clavate, peripheral outline strongly lobulate to digitate, aperture a high narrow equatorial arch extending up the apertural face, bordered laterally by a narrow lip at the upper margin.

Remarks: This Pakistanian new species differs from the type species *Clavigerinella akersi* from Trinidad by its radially elongate chambers, not terminally bulbous, and more chambers in the whorl.

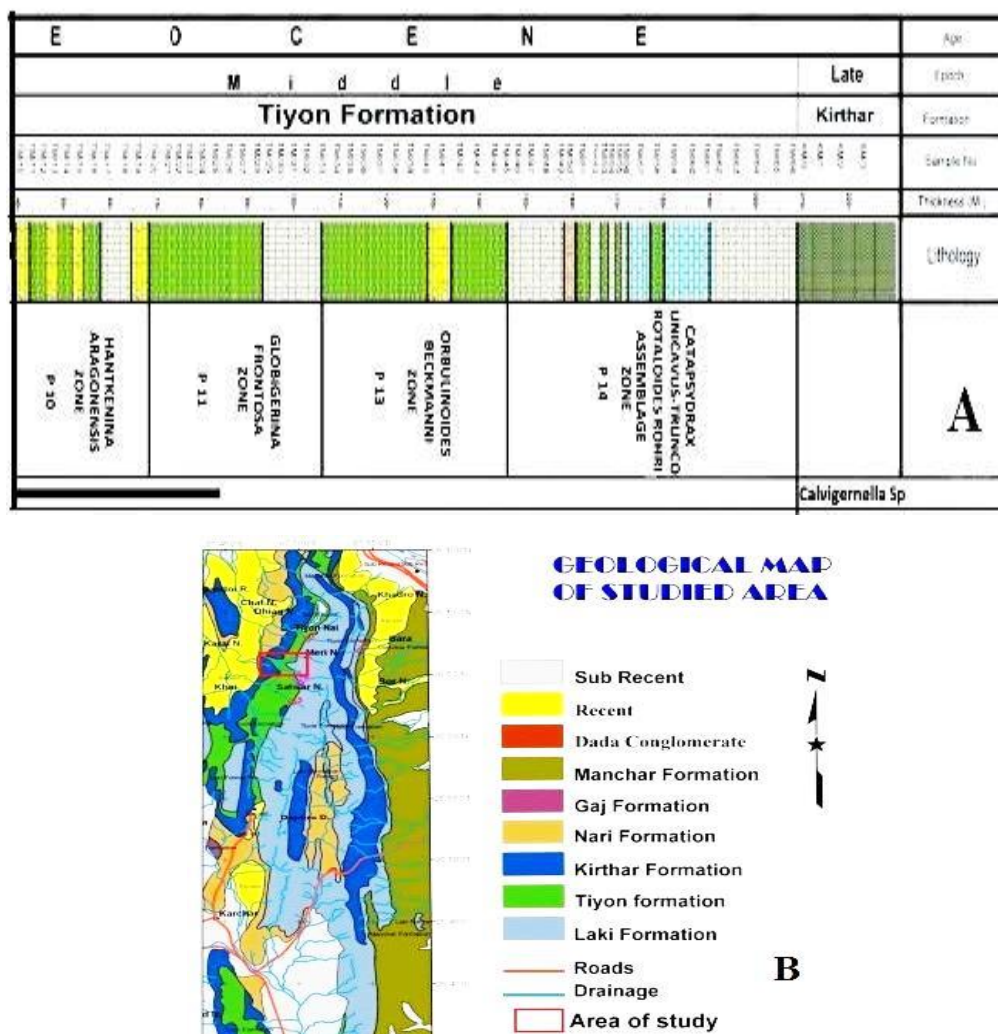


Figure 4: (A) Stratigraphic level of the *C. pakistanica* of the Tiyon Formation, and geological map of Northern Pakistan (B).

***Globanomalina luxorensis* (Nakkady, 1950) (= *Anomalina luxorensis* Nakkady, 1950, p. 691, pl. 90, figs. 39-41).** The Ypresian *Globanomalina luxorensis* most probably evolved from the Paleocene-Ypresian *G. ovalis* by an increase of number of chambers in the final whorl. It is, so far, confined to Egypt.

***Globanomalina ovalis* Haque, 1956, p. 147, pl. 14, fig. 3.** It is recorded from Pakistan and India.

***Turborotalia nukhulensis* Haggag and Luterbacher (1995) (= *T. pseudoampliapertura nukhulensis*, pl. 2, figs. 5-9).** It is, so far, confined to Egypt.

***Turbototalia semicunialensis* Anan, 2023, p. 36, pl. 1, fig. 9.** It is recorded from Egypt, UAE and India

***Turborotalia sinaiensis* Haggag and Luterbacher (1995) (= *T. pseudoampliapertura sinaiensis* Haggag and Luterbacher, p. 41, pl. 3, figs. 1-4).** It is recorded from Egypt and UAE.

***Turborotalia vagalkhodensis* Mukhopadhyay, 2005, p. 38, pl. 1, figs. 8-14.** It is, so far, confined to India.

***Globigerinatheka aegyptiaca* Haggag and Bolli, 1996.** It is, so far, confined to Egypt.

***Inordinatosphaera indica* Mohan and Soodan, 1967, p. 24, fig. 1. 1-7.** It is recorded from India.

***Inordinatosphaera* aff. *indica* Mohan and Soodan-Anan, 2017, p. 128, fig. 3b.** It is recorded from UAE.

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