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RESEARCH ARTICLE

CONTRIBUTION TO ARABIAN BENTHIC AND PLANKTIC FORAMINIFERA OF ANAN

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ABSTRACT

This study deals with taxonomic consideration of one genus *Marginulinoides* and thirty six Arabian benthic and planktic foraminiferal species of Anan, which belongs to twenty six four genera from Saudi Arabia (SA), Qatar, United Arab Emirates (UAE) and Oman. The Arabian fauna made it possible to correlate them with those previously identified species in the coeval stratigraphic sequence in different Tethyan localities: Morocco, Egypt, UAE, and India. Twelve recorded species belong to Suborder Globigerinina, 11 to Lagenina, 7 to Textulariina, and 6 to Rotaliina. One genus and 26 species of them (~72%) are recorded from UAE, 8 species (~22%) from Oman, and one species (~3%) from each of Saudi Arabia and Qatar. Two of the recorded species are believed here to be new: *Tollmannia qatarica* and *Acarinina saudica.*

KEYWORDS

Benthic and planktic Foraminifera, stratigraphy, Cenomanian, Maastrichtian, Paleogene, Tethys, Arabia

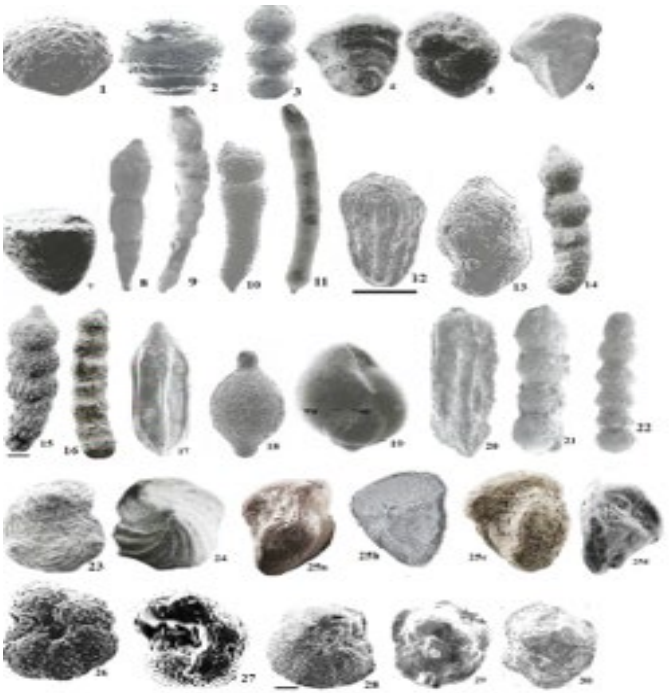
1. INTRODUCTION

Thirty-six diagnostic species of benthic and planktic foraminiferal species were recorded and described from four localities in the Arabia in the Southern Tethys: SA, Qatar, UAE and Oman (Figure 1). Most of the recorded species 26 species (23 benthic and 3 planktic) were recorded from UAE, followed by 8 species (planktic) from Oman, one only from each of SA (planktic) and Qatar (benthic foraminifera).

Figure 1: Location map of the study countries in Arabia: SA, Qatar, UAE and Oman.

2. TAXONOMY

The taxonomy followed here is that of Loeblich & Tappan (1988), with modern taxonomic consideration, thirty-six benthic and planktic foraminiferal species of the assemblage are presented and illustrated in Plate 1.



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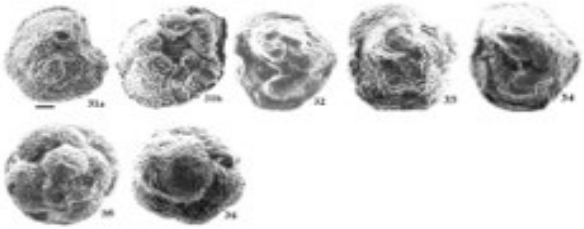

Table 1 : Scale bars 100 µm

Figure 1 : Orbulinelloides arabicus Anan, 2003, (2) Repmanina mazeni Anan, 2021, (3) Psammolingulina bahri Anan, 2021, (4) Spiroplectinella hamdani (Anan, 1993), (5) Plectina emiratensis Anan, 2003, (6) Gaudryina arabica Anan, 2022a, (7) Marssonella hafitensis Anan, 2003, (8) Chrysalogonium qarnelbarrensis Anan, 2022b, (9) Laevidentalina ameeri Anan, 2022b, (10) L. hudae Anan, 2015, (11) L. salimi Anan, 2009, (12) Tollmannia qatarica Anan, n. sp., (13) Hemirobulina olae Anan, 2015, (14) Marginulina karimae (Anan, 2009), (15) Marginulinoides arabica Anan, 2024a, (16) Vaginulinopsis emiratensis (Anan, 1993), (17) Procerolagena emiratensis Anan, 2022b, (18) Ramulina futyani Anan, 2015, (19) Turrilina hassani Anan, 2010, (20) Transversigerina hamdani Anan, 2022b, (21) Orthomorphina abdelghanyi Anan, 2022b, (22) O. abusaimai Anan, 2022b, (23) Ornatanomalina ennakhali Anan, 2011, (24) Elphidium cherifi Anan, 2010, (25a-d) Turborotalia semicunialensis Anan, 2023, a. (from Morocco), b. (from Egypt), c. (from UAE), d. (from India), (26) Acarinina saudica Anan, n. sp., (27) A. umbilicata Anan, 2024b, (28) Morozovella arabica Anan, 2024c, (29) M. elbadrii Anan, 2024b, (30), M. elsayighi Anan, 2024b, (31a, b), M. hafitensis Anan, 2024c, a. (from UAE), b. (from Oman), (32) M. omanica Anan, 2024b, (33) M. surensis Anan, 2024b, (34) M. wadimusawaensis Anan, 2024b, (35) Globigerinatheka arabica Anan, 2024b, (36) G. omanica Anan, 2024b.

Order Foraminiferida Eichwald, 1830

- Suborder Textulariina Delage & Hérouard, 1896

(1) *Orbulinelloides arabicus* Anan, 2003, p. 531, fig. 4. 1. Bartonian-Priabonian. UAE.

(2) *Repmanina mazeni* Anan, 2021, p. 85, pl. 1, fig. 4. Danian. UAE.

Remarks: This species differs from R. charoides by its regular trochoid test, sharply edges chambers. It also differs from Glomospira gordialis by regular and depressed crown coiled in outline.

(3) *Psammolingulina bahri* Anan, 2021, p. 85, pl. 1, fig. 6. Danian. UAE.

(4) *Spiroplectinella hamdani* (Anan, 1993). Maastrichtian. UAE and Egypt.

Remarks: This species differs from *S. knebeli* (LeRoy, 1953) by its more height test (length/width of *S. hamdani* is 1.5 than 1.12 of *S. knebeli*), larger coiled portion and more highly raised sutures.

(5) *Plectina emiratensis* Anan, 2003, p. 534, fig. 4. 2. Bartonian. UAE.

(6) *Gaudryina arabica* Anan, 2022a, p. 28, pl. 1, fig. 11. Maastrichtian. UAE.

(7) *Marssonella hafitensis* Anan, 2003, p. 535, fig. 4. 3. Bartonian-Priabonian. UAE

- Suborder Lagenina Delage & Hérouard, 1896

(8) *Chrysalogonium qarnelbarrensis* Anan, 2022b, p. 40, pl. 1, fig. 9. Maastrichtian. UAE.

Remarks: It differs from *C. polystoma Schwager* by gradually increased chambers, and less numbers of chambers.

(9) *Laevidentalina ameeri* Anan, 2022b, p. 40, pl. 1, fig. 10. Maastrichtian. UAE.

Remarks. This species presents a good example for benthic foraminiferal lineage: *Maastrichtian Laevidentalina ameeri* (Anan) > *Danian Laevidentalina hudae Anan* (2015) > Middle-Late *Eocene L. salimi* Anan (2009) lineage.

(10) *Laevidentalina hudae* Anan, 2015, p. 65, pl. 1, fig. 1. Selandian. UAE.

(11) *Laevidentalina salimi* Anan, 2009, p. 3, pl. 1, fig. 2. Bartonian-Priabonian. UAE.

(12) *Tollmannia qatarica* Anan, n. sp. (=*Pyramidulina costata* Hewaidy & Al-Hitmi, 1994, p. 16, fig. 5. 13, 14). Cenomanian., Well B, west Qatar (Figure 2).

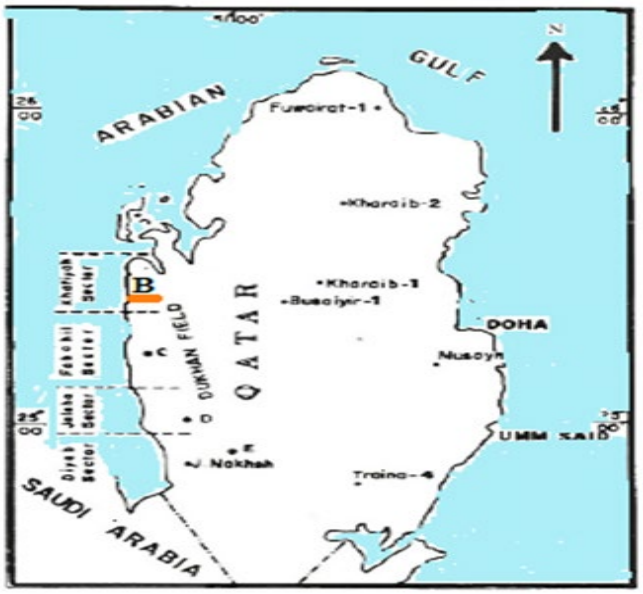

Figure 2: Location map of Well B, west Qatar, which yields *T. qatarica* n. sp. (after Hewaidy & Al-Hitmi, 1994).

Remarks: This species belongs here to the genus *Tollmannia* due to its rapidly increasing uniserial chambers (than gradually), and the last chamber represent about (~⅓) size of the test. It is resemble *T. costata* (d'Orbigny) from Tertiary Basin of Vienna, but differs by less number of the longitudinal ribs, more rapidly increasing chambers, without apical early stage and apertural neck.

(13) *Hemirobulina olae* Anan, 2015, p. 71, pl. 1, fig. 8. Selandian. UAE.

Remarks: It differs from the Paleocene-Early Eocene H. *hamuloides* (Brotzen) by its more inflated test, circular in cross section and rounded periphery.

(14) *Marginulina karimae* (Anan, 2009), Anan, 2021, p. 91, pl. 1, fig. 46. Priabonian. UAE.

Remarks: This species and the Pleistocene *M. coarctata* Silvestri represent another example of homeomorphy.

Genus Marginulinoides Anan, 2024

(15) *Marginulinoides arabica* Anan, 2024a, p. 96, pl. 1, fig. 5. Priabonian. UAE.

Remarks: The new genus *Marginulinoides* Anan differs from the other Lagenid fauna by its closed coiled early stage, followed by uniserial chambers, and spinose and knobs ornamented surface.

(16) *Vaginulinopsis emiratensis* (Anan, 1993). Maastrichtian. UAE.

Remarks: This species belongs here to the genus *Vaginulinopsis* mainly due to its smooth surface than numerous longitudinal costae ornamented surface in *Marginulinopsis.*

(17) *Procerolagena emiratensis* Anan, 2022b, p. 41, pl. 2, fig. 16. Maastrichtian. UAE.

(18) *Ramulina futyani* Anan, 2015, p. 72, pl. 1, fig. 11. Paleocene. UAE.

Remarks: It differs from American *R. pseudoaculeata* (Olsson) by more globular and hispid test.

(19) *Turrilina hassani* Anan, 2010, p. 160, pl. 1, fig. 3. Bartonian-Priabonian. UAE.

- Suborder Rotaliina Delage & Hérouard, 1896

Remarks: This species differs from other *Turrilina* spp. by its opposite v-shaped aperture at the interiomarginal of the last chamber, and the last three chambers consists about 9/10 time of the whole test.

(20) *Transversigerina hamdani* Anan, 2022b, p. 42, pl. 2, fig. 19.

Maastrichtian. UAE.

(21) *Orthomorphina abdelghanyi* Anan, 2022b, p. 42, pl. 2, fig. 21. Maastrichtian. UAE.

(22) *Orthomorphina abusaimai* Anan, 2022b, p. 42, pl. 2, fig. 20. Maastrichtian. UAE.

Remarks: It differs from *O. abdelghanyi* by smaller test, thicker sutures, and less globular chambers.

(23) *Ornatanomalina ennakhali* Anan, 2011, p. 90, pl. 3, fig. 68. Ypresian. UAE.

Remarks: It differs from the type species *O. geei* and other six species of Haque (1956, 1960) from Pakistan by its discontinuous ribs, not rounded periphery and lacking the radial median ridges across the chamber surface.

(24) *Elphidium cherifi* Anan, 2010, p. 172, pl. 2, fig. 8. Bartonian-Priabonian. UAE.

Remarks: It differs from the Priabonian E. leave of Cherif et al. (1992) from Jabal Hafit (UAE) by its backward extensions of the chambers.

- Suborder Globigerinina Delage & Hérouard, 1896

(25) *Turborotalia semicunialensis* Anan, 2023, p. 36, pl. 1, fig. 9. Priabonian. Morocco, Egypt, UAE, India. (Figure. 3).

Figure 3: Geographic distribution of Late Eocene Turborotalia semicunialensis Anan: Morocco, Egypt, UAE, India.

Remarks: After the original record of this species from UAE (Anan, 2023a), Anan (2023b) present more added record of it in India (Mukhopadhyay, 2005) and Egypt (Strougo et al, 2013). In this study, a new record of this species is documented from Morocco (=*Turborotalia cunialensis* (Cushman) of Djeya et al, 2016, p. 101, pl. 1, fig. 10).

(26) *Acarinina saudica* Anan, n. sp. (=Globorotalia cf. *pentacamerata* - Hasson, p. 362, pl. 8, fig. 10). Ypresian. SA.

Etymology: after the Saudi Arabia.

Stratigraphic level: Ypresian, Umm er Radhuma Formation, Well B, 3070ft (Figure 4).

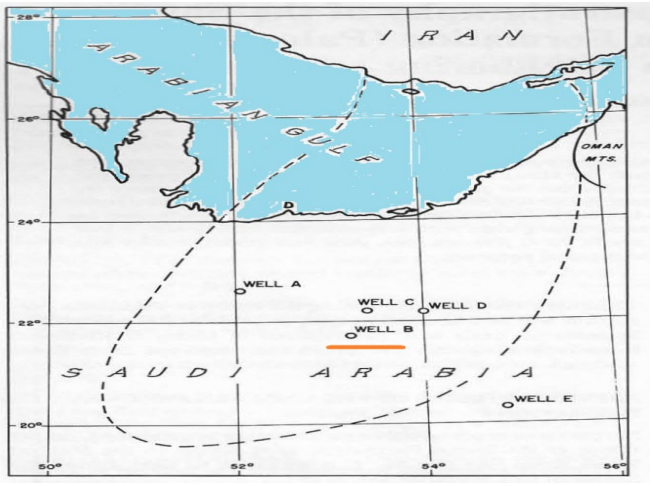

Figure 4: Location map of Well B, east Saudi Arabia, which yields Acarinina saudica n. sp. (after Hasson, 1985).

Diagnosis: This species is distinguished by its low trochospiral test, large and widely open umbilicus, 6 chambers in the last whorl, round periphery, umbilical-extraumbilical aperture.

Remarks: It differs from Acarinina pentacamerata with only 5 compact chambers in the last whorl, generally deep small umbilicus, and low umbilical-extraumbilical slit aperture.

(27) *Acarinina umbilicata* Anan, 2024b, p. 49, pl. 1, fig. 26. Ypresian. Oman.

(28) *Morozovella arabica* Anan, 2024c, p. 96, pl. 1, fig. 26. Ypresian. UAE and Egypt.

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

(29) *Morozovella elbadrii* Anan, 2024b, p. 49, pl. 1, fig. 35. Lutetian. Oman.

Remarks: It differs from all other known *Morozovella* species in having raised curved spiral sutures, depressed shallow wide open umbilicus, and low arch umbilical-extraumbilical aperture.

(30) *Morozovella elsayighi* Anan, 2024b, p. 49, pl. 1, fig. 36. Paleocene. Oman.

Remarks: It differs from *M. acuta* by rhomboidal low trochospiral test, than semi-rounded test of the latter.

(31) *Morozovella hafitensis* Anan, 2024c, p. 97, pl. 1, fig. 27. Ypresian. UAE and SA.

Remarks: It has been the direct ancestor of *M. caucasica*, and located between *M. crater* and *M. caucasica* in the *M. crater* →*M. hafitensis* → *M. caucasica* lineage. The figure specimen *Globorotalia formosa formosa* (of Hasson, 1985, p. 350, pl. 7, figs. 7-9) is closely resembles to the *Morozovella hafitensis* Anan.

(32) *Morozovella omanica* Anan, 2024b, p. 49, pl. 1, fig. 42. Paleocene. Oman.

Remarks: It differs from *M. parva* Rey in having more conical circular test, more chambers in the last whorl.

(33) *Morozovella surensis* Anan, 2024b, p. 49, pl. 1, fig. 45. Ypresian. Oman.

(34) *Morozovella wadimusawaensis* Anan, 2024b, p. 50, pl. 1, fig. 47. Ypersian. Oman.

(35) *Globigerinatheka arabica* Anan, 2024b, p. 47, pl. 1, fig. 11. Lutetian. Oman.

Remarks: It resembles *G. barri* but lacks bulla.

(36) *Globigerinatheka omanica* Anan, 2024b, p. 47, pl. 1, fig. 14. Lutetian. Oman.

Remarks: It differs from *G. euganea* in having more strongly incised sutures, more strongly inflated chambers, and consequently less spherical test shape.

3. PALEOGEOGRAPHY

The Paleogene paleogeographic maps of many authors (i.e. Salahi, 2021) show that the Tethyan realm had been connected with the Indo-Pacific Ocean from east to Atla ntic Ocean to the west (Figure 5).

Figure 5: Paleogene paleogeography of the Tethys Ocean (Salahi, 2021).

4. Paleoenvironment

The faunal benthic and planktic foraminiferal assemblage of the study area is not completely recorded and distributed in the most different localities, which controlled mainly by different water depths (the paleorelief highs and lows), lack of available literatures, different stratigraphical levels of species, and/or misidentification of some species by different authors (Figure 6).

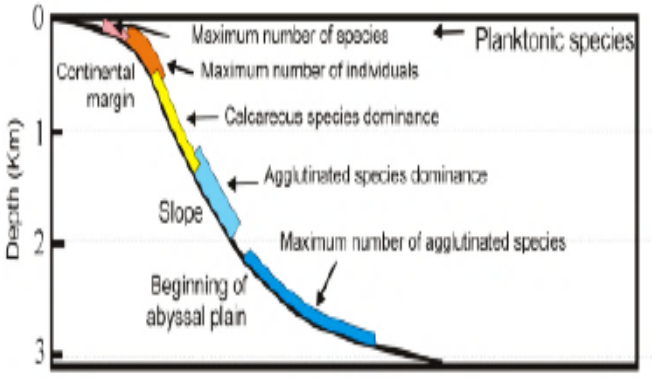

Figure 6: Depth distribution of planktic and benthic foraminifera

5. Summary And Conclusions

The study of the spatial distributions of foraminiferal fauna in the Arabia, enables to reach the following conclusions:

- The studied area represents a classical example of a mixed carbonate-silicate ramp system.
- The most abundant wall type in the study area calculated based on the number of the all identified species is hyaline, followed by agglutinated arenaceous wall.
- The identification of two new foraminiferal species of two genera belonging to one benthic and one planktic calcareous wall types.
- Globigerinid planktic foraminifera is the most diversified order in this study (12 of 36 species).
- Lagenid foraminifera is the most diversified order of benthic foraminifera (11 of 36 species), followed by Textulariid (7 of 36 species), and (6 of 36) to Rotaliid, which shows the lowest diversity.
- The studied area is generally characterized by its endemic fauna that adapted to extremes lack of literatures, and/or different stratigraphic levels.

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