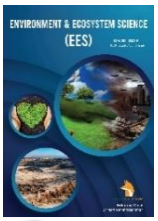
ZIBELINE INTERNATIONAL™ PUBLISHING

Environment and Ecosystem Science (EES)

DOI: http://doi.org/10.26480/ees.02.2026.87.91

ISSN: 2521-0882 (Print)
ISSN: 2521-0483 (Online)
CODEN: EESND2



RESEARCH ARTICLE

NEW LITTORAL BENTHIC FORAMINIFERAL DIVERSITY OF THE IRANIAN COAST, EAST ARABIAN GULF

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ARTICLE DETAILS

Article History:

Received 15 February 2026
Revised 25 March 2026
Accepted 20 April 2026
Available online 19 May 2026

ABSTRACT

This study includes the reinvestigation, modern taxonomical consideration, description and illustration for ten Holocene littoral benthic foraminiferal species belonging to ten genera of Suborders Textulariina (agglutinated form, includes 1 species), and three suborders constituting the calcareous forms: Miliolina (1 species), Lagenina (1 species) and Rotaliina (8 species). These ten taxa are recorded from the Iranian Coast of Eastern Arabian Gulf, which were previously noted in the literature, and believed here as new: *Spirotextularia kaminskii, Spiroloculina amaoi, Reussoolina iranica, Bolivinoidesella younesi, Cancris abdrabboi, Cibicides helmyi, Nonion maheri, Hanzawaia abbasi, Asterorotalia maheri, Challengerella solimani.*

KEYWORDS

Littoral benthic foraminifera, Holocene, Iran, Arabian Gulf.

1. INTRODUCTION

The littoral Iranian coast in the Eastern Arabian Gulf with elongated along of about 1000 km in length, was chosen for ten new species with modern paleontological approach, description and illustration in Figure 1.

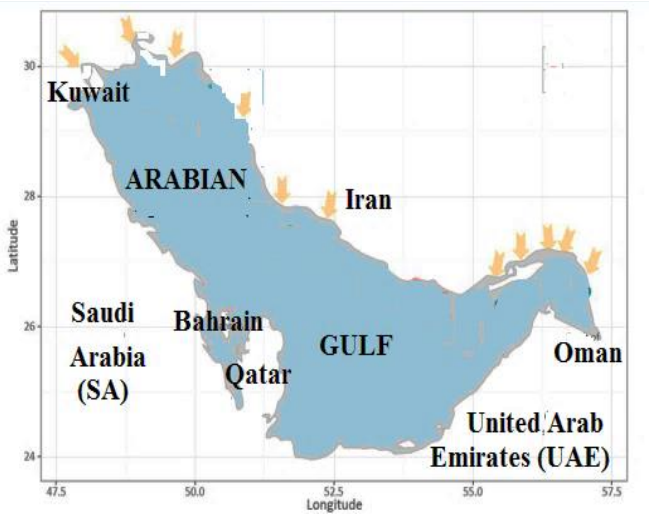


Figure 1: The distributiona of the different countries around the Arabian Gulf: estern side: Iran, weastern side: Kuwait, Saudi Arabin (SA), Bahrain, Qatar, United Arab Emirates (UAE), Oman. The arrows showing point of discharge of rain fall and rivers in the Iranian coast.

2. MATERIAL OF STUDY

New ten well preserved littoral benthic foraminiferal species belong to four suborders of agglutinated and calcareous walls are recorded and illustrated from the coast of Iran, eastern side of Arabian Gulf, which are treated here as new with modern taxonomical consideration.

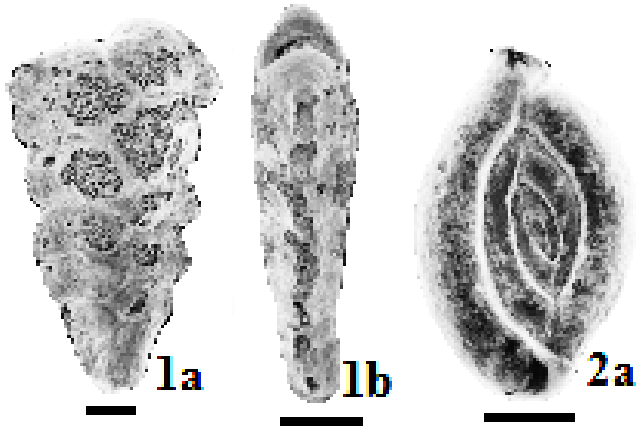
3. SYSTEMATIC PALEONTOLOGY

The taxonomy of Loeblich & Tappan (1988) is followed here for ten littoral Holocene benthic foraminiferal species, which belonging to ten genera: *Spirotextularia* Saidova (1975), *Spiroloculina* d'Orbigny (1826), *Reussoolina* Colom (1956), *Bolivinoidesella* Anan (2025), *Cancris* Montfort (1808), *Cibicides* Montfort (1808), *Nonion* Montfort (1808), *Hanzawaia* Asano (1944), *Asterorotalia* Hofker (1950), and *Challengerella* Billman, Hottinger & Oesterle (1980). The recorded species are illustrated in Plate 1, and Table 1.

Plate 1

(Scale bars are 100 µm, a. lateral or ventral view, b. apertural view, c. dorsal view)

Fig. 1a, b. *Spirotextularia kaminskii*, **2a, b**. *Spiroloculina amaoi*, **3a, b.** *Reussoolina iranica*, **4a, b.** *Bolivinoidesella younesi,* **5a-c.** *Cancris abdrabboi*, **6a-c.** *Cibicides helmyi*, **7a-c.** *Nonion maheri*, **8a-c.** *Hanzawaia abbasi*, **9a-c.** *Asterorotalia maheri,* **10a-c.** *Challengerella solimani*.



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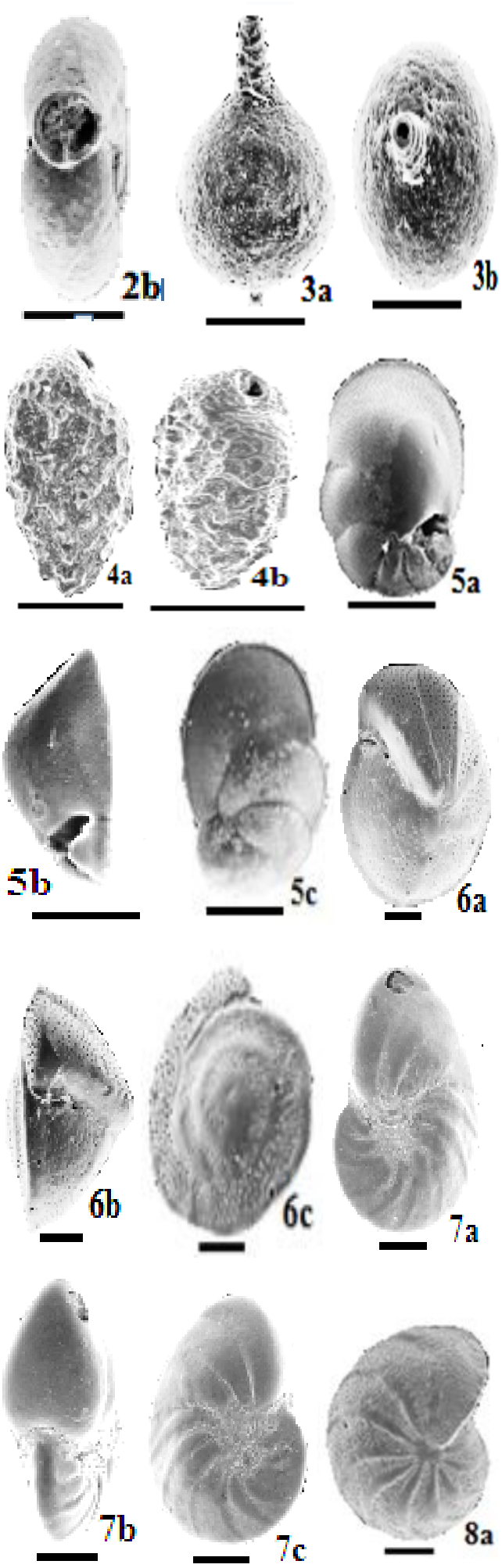
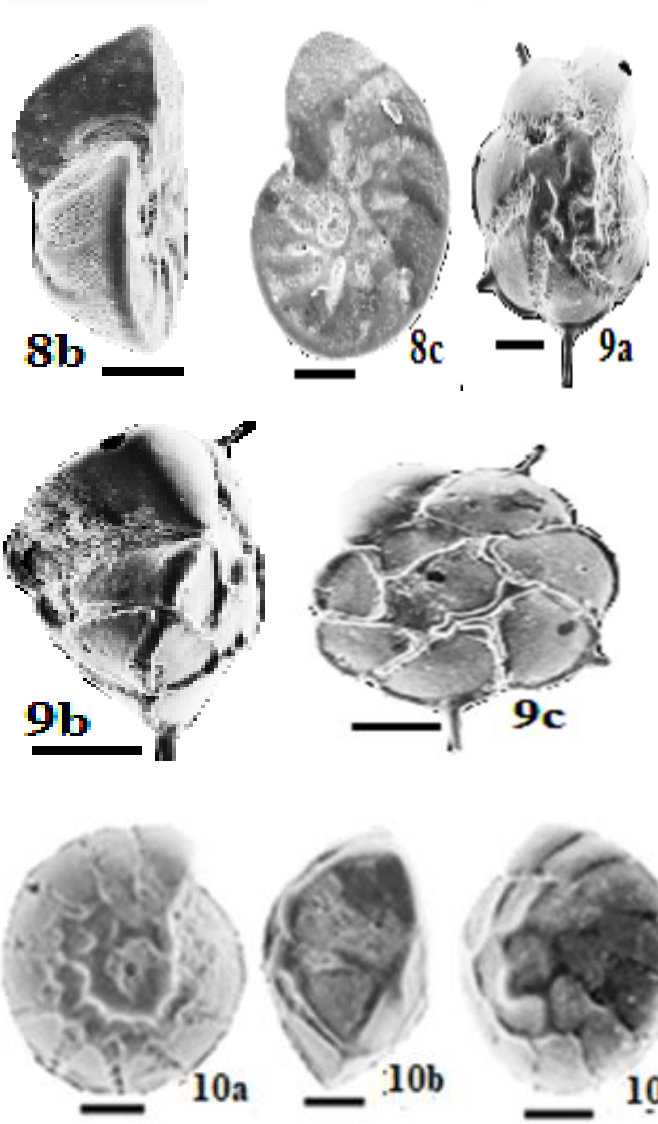
Cite the Article: Haidar Salim Anan (2026). New Littoral Benthic Foraminiferal Diversity of The Iranian Coast, East Arabian Gulf. *Environment and Ecosystem Science* (EES), 10(2): 87-91.





Order Foraminiferida Eichwald, 1830

I. Suborder Textulariina Delage & Hérouard, 1896

***1. Spirotextularia kaminskii* Anan, n. sp.** (=*Spirotextularia* cf. *S. floridana* - Amao et al, 2018, fig. 3j-l)- Pl.1, fig.1a, b.

Etymology: after Prof. Michael A. Kaminski, The Geosciences Department, College of Petroleum Engineering and

Geosciences, King Fahd University of Petroleum and Minerals (KFUPM), Dhahran 31261, Saudi Arabia.

Diagnosis: It is a species of the genus *Spirotextularia* Saidova (1975) with its biserial rough test throughout, but with minute spirospiral initial portion. It has an additional aperture along the peripheral margin, which represents the principal difference from the other genus *Textularia*.

Remarks: The new Iranian *Spirotextularia kaminskii* differs from *S. floridana* (Cushman, 1922) in its rougher test, and less acute periphery.

II. Suborder Miliolina Delage & Hérouard, 1896

***2. Spiroloculina amaoi* Anan, n. sp.** (=*Spiroloculina* sp. 1 - Amao et al, 2018, fig. 3v-x) - Pl. 1, fig. 2a, b.

Etymology: after Dr. Abdulhakim O. Amao, the Geosciences Department, College of Petroleum Engineering and

Geosciences, King Fahd University of Petroleum and Minerals (KFUPM), Dhahran 31261, Saudi Arabia.

Diagnosis: It has one-half coil chambers in length added in a single plane, rounded periphery, aperture terminal, circular with short elongate and slightly protruding bifid tooth at the tip.

Remarks: The new species *Spiroloculina amaoi* is characterized by its rounded periphery and large circular terminal aperture with short bifid tooth.

III. Suborder Lagenina Delage & Hérouard, 1896

***3. Reussoolina iranica* Anan, n. sp. (**=*Lagena* sp. 1- Amao et al, 2018, fig. 5v-x) - Pl. 1, fig. 3a, b.

Etymology: after the Islamic Republick of Iran, Arabian Gulf.

Diagnosis: It has an apiculate smooth unilocular globular test at the base, and round opening aperture at the end of an elongate neck.

Remarks: The new species *Reussoolina arabica* is characterized by its globular smooth test with an apiculate base, which represents the principal difference from the other genus *Lagena*.

IV. Suborder Rotaliina Delage & Hérouard, 1896

***4. Bolivinoidesella younisi* Anan, n. sp.** (=*Bolivina* cf. *B. persiensis* - Amao et al, 2018, fig. 5d-f) - Pl. 1, fig. 4a, b.

Etymology: after my uncle Advocate Younis Ahmad Aljaro, Chairman of Palestinian Red Crescentic Society-Gaza.

Diagnosis: It is a species of the genus *Bolivinoidesella* Anan (2025) with large biserial and tapering initial test, nearly triangular in outline, and ornamented surface with wrinkles or irregularly anastomosing costae in the all parts of the test, aperture basal opening extending from the base of the last chamber.

Remarks: It has an irregularly anastomosing costae in the most part of the test, which represents the principal difference from the other genus *Bolivina* d'Orbigny (1839). It differs from the *B. karimae* by its irregularly anastomosing costae extending to all parts of the test.

***5. Cancris abdraboui* Anan, n. sp.** (=*Cancris* cf. *C. auricula* - Amao et al, 2018, fig. 4o-q) - Pl. 1, fig. 5a-c.

Etymology: after Prof. Abdel Fattah Abd Rabou, Biology Department, Islamic University-Gaza, Palestine.

Diagnosis: It has a smooth trochospiral elongate ovate test in outline, lenticular in section, periphery with faint keel, chambers increasing rapidly in length and breadth as added, sutures depressed and arched on the both sides, aperture a high interiomarginal opening on the umbilical side.

Remarks: It differs mainly from *Cancris auricula* (Fichtel & Moll, 1798) by lacks imperforate umbilical apertural flap, and larger aperture.

***6. Cibicides helmyi* Anan, n. sp.** (=*Cibicides cf. C. refulgens* - Amao et al, 2018, fig. 4r-t) - Pl. 1, fig. 6a-c.

Etymology: after the late Prof. E. Helmy, Geology Department, Ain Shams University, Egypt.

Diagnosis: It has nearly planoconvex test, sutures convex and slightly raised both sides, angular apertural face, smooth with finely perforate surface, imperforated peripheral keel, low and small interiomarginal equatorial aperture extends a short distance on the spiral side.

Remarks: Remarks: It differs from *Cibicides refulgens* Montfort (1808) in its slightly raised sutures than depressed, shorter extends distance of the aperture on spiral side, finer peripheral keel, and finer perforated surface.

***7. Cibicides maheri* Anan, n. sp.** (=*Nonion* sp. 2 - Amao et al, 2018, fig. 4u-w) - Pl. 1, fig. 7a-c.

Etymology: after my cousin Dr. Maher R. Ajjour, Gaza, Palestine.

Diagnosis: It has a smooth evolute biumbilicate laterally compressed plaispiral test, sutures curved slightly raised, but depressed in the last three chambers, aperture a low interiomarginal and equatorial slit at the base of the triangular apertmal face.

Remarks: It is characterized by its nearly ovate test in outline, triangular apertural face, and well rounded periphery.

***8. Hanzawaia abbasi* Anan, n. sp.** (=*Hanzawaia* sp. 3, - Amao et al, 2018, fig. 4l-n) - Pl. 1, fig. 8a-c.

Etymology: after the late Prof H. L. Abbas, Geology Department, Ain Shams University, Egypt.

Diagnosis: It has semicircular planoconvex test, numerous chambers gradually increased as added with small umbilical boss, smooth with finely perforate surface, sutures thickened raised curved back at the subangular periphery, aperture interiomarginal and equatorial at the base of the apertural face.

Remarks: It is characterized by its thickened raised curved sutures back at the subangular periphery.

***9. Asterorotalia maheri* Anan, n. sp.** (=*Asterorotalia* sp. 3- Amao et al, 2018, fig. 4a-c) - Pl. 1, fig. 9a-c.

Etymology: after my cousin Eng. Maher M. Anan, Gaza, Palestine.

Diagnosis: It has trochospiral to nearly planispiral coil, seven chambers gradually increased as added, diagnostic imperforate keel interrupted by deep limbate sutural incisions, umbilical plug is filled with a central pillar, three large solid spines arise as extensions from the imperforate keel in the last third whorl, aperture nearly equatorial ovate at the base of the apertural face.

Remarks: It is distinguished by filled umbilical plug with central pillar, and three large solid spines in the last third whorl.

***10. Challengerella solimani* Anan, n. sp.** (=*Challengerella* sp. 3, - Amao et al, 2018, fig. 4g-i) - Pl. 1, fig. 10a-c.

Etymology: after the late Prof. S.M. Soliman, Geology Department, Ain Shams University, Egypt.

Diagnosis: It has smooth trochospiral, nearly equally biconvex test, fourteen chambers gradually increased in the third last whorl, sutures deeply incised with elevated margins and finely pustulose, umbilicus with large umbilical plug, periphery rounded with faint keel, aperture a small interiomarginal slit bordered by an imperforate lip.

Remarks: This species is characterized by its large biconvex test with numerous chambers, large umbilical plug, and faint peripheral keel.

Table 1: The distribution of the different foraminiferal groups in the study area of the Iranian coast.

Sp. No.		Textulariid	Miliolid	Lagenid	Rotaliid
1	*Spirotextularia kaminskii*	x			
2	*Spiroloculina amaoi*		x		
3	*Reussoolina iranica*			x	
4	*Bolivinoidesella younesi*				x
5	*Cancris abdrabboi*				x
6	*Cibicides hilmyi*				x
7	*Nonion maheri*				x
8	*Hanzawaia abbasi*				x
9	*Asterorotalia maheri*				x
10	*Challengerella solimani*				x

The Comparative Recent benthic foraminiferal species between the Iranian coast (east Arabian Gulf) and south Yaman coast (Arabian Sea) are shown in Figure 2, and Table 2.

Figure 2: Location map of Yaman (Arabian Sea) and Iran (east Arabian Gulf).

Table 2: Comparative Recent benthic foraminiferal species between the Iranian coast (I) and south Yaman coast (Y).

Sp. No.	Recent benthic foraminiferal species of Iranian coast and south Yaman coast	I	Y
1	*Spiroplectinella yamanensis* Anan, 2025		x
2	*Spirotextularia kaminskii* Anan, n. sp.	x	
3	*Textularia* arabica Anan, 2025		x
4	*Textularia biraliensis* Anan, 2025		x
5	*Spiroloculina amaoi* Anan, n. sp.	x	
6	*Spiroloculina biraliensis* Anan, 2025		x
7	*Quinqueloculina alwosabii* Anan, 2025		x
8	*Quinqueloculina biraliensis* Anan, 2025		x
9	*Quinqueloculina munefi* Anan, 2025		x
10	*Miliolinella biraliensis* Anan, 2025		x
11	*Pyrgo basardahi* Anan, 2025		x
12	*Reussoolina iranica* Anan, n. sp.	x	
13	*Bolivinoidesella younesi* Anan, n. sp.	x	
14	*Cancris abdrabboi* Anan, n. sp.	x	

Table 2 (Cont): Comparative Recent benthic foraminiferal species between the Iranian coast (I) and south Yaman coast (Y).

15	*Cibicides hilmyi* Anan, n. sp.	x	
16	*Nonion maheri* Anan, n. sp.	x	
17	*Hanzawaia abbasi* Anan, n. sp.	x	
18	*Asterorotalia maheri* Anan, n. sp.	x	
19	*Challengerella solimani* Anan, n. sp.	x	

4. ENVIRONMENT

The coastal areas around the Arabian Peninsula are characterized by a relatively confined shallow shelf (Fig. 3), which slopes gently to deeper water environments. Anan (1984) noted that the greater abundance of the foraminiferal assemblage in the Egyptian Red Sea and also the other studied areas in the Arabian Gulf, favor precipitation of organic binding material for the sand grains of the arenaceous tests, which favor the forms thriving in shallow and warm environment and used as indicator for environmental changes. Minor differences in morphology of test, wall structure, size, ornamentation, and type of periphery are recognized as being of decisive generic or specific value. The genus and species are facies-linked, and migrated from elsewhere as the favorable habitat expanded due to alternation in the environmental parameters.

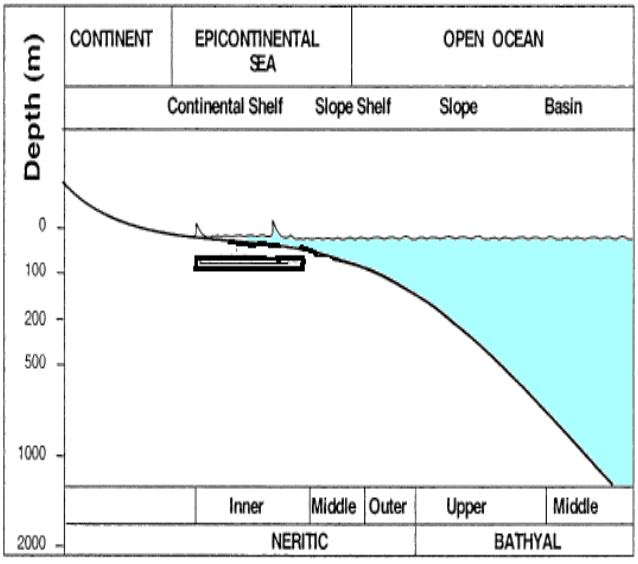


Figure 3: The environmental settings of shallow littoral (inner neritic) of recorded foraminiferal species.

5. SUMMARY AND CONCLUSIONS

The study of the spatial distributions of foraminiferal fauna in the littoral Iranian coast, eastern Arabian Gulf, with about 1000 km in length, enables to reach the following conclusions:

- The studied area represents a classical example of a mixed carbonate-siliciclastic ramp system.
- The most abundant wall type in the study area (Amao et al, 2018), calculated based on the number of the all identified species is porcelaneous, followed by hyaline wall, and lesser by agglutinated species.
- Littoral foraminiferal faunas in the Iranian coast are reported some species in open nomenclature or are only tentatively identified. For that, identification of ten new foraminiferal species of ten genera belonging to the agglutinated and calcareous wall types are presented.

- Rotaliid foraminifera are the most diversified order of modern benthic foraminifera in this study, and show the highest diversity (7 of 10 species).
- The studied area is generally dynamically active, and characterized by its endemic fauna that adapted to extremes of salinity (about 40 - 36.5 ‰, due to dilution from freshwater input), high temperature and nutrients terrigenous sedimentation.
- The recorded foraminiferal assemblage suggests that there is a similarity of the tropical Indo-Pacific fauna.
- A comparative study between the Recent benthic foraminiferal species of Anan is also presented.

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