The Abundance of Benthic Foraminifera in Offshore Sediment Around Pulau Redang, Terengganu

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ABSTRACT

The study on the abundance of benthic foraminifera in offshore sediment was conducted based on twelve bottom samples from the coastal areas of Pulau Redang, Terengganu. Fifty nine species belonging to fifteen families were collected and had been identified. Foraminifera abundance and diversity appears to be principally controlled by sediment texture in the study area. The dominant species is Amphistegina cf. lessonii and the dominant family is Amphisteginidae. Family which have the most variety of species is Miliolidae with 20 species. Both of Hauerina sp. and Nonion sp. were found only 1 individual in the study area.

ABSTRAK


Keywords: abundance, benthic foraminifera, offshore sediment, Pulau Redang.
Introduction

Foraminifera are testate organisms, which mean that they have shells (tests). The protoplasm covers the exterior of the test. The simplest shapes are tubes or spheres. The tests are divided into chambers; more chambers are added as the cell grows. There are three basic test compositions: organic, agglutinated and secreted calcium carbonate. Foraminifera are single-celled organisms. A distinguishing structure in Foraminifera is the foramen, a hole that connects the wall (septa) between each chamber (Boersma 1980). Foraminifera are aquatic organisms, found in both freshwater and marine environments. For example, Amphistegina gibbosa inhabit coral reefs and carbonate shelves. Species diversity is highest in tropical areas. Foraminifera are the most prevalent benthic organisms in deep-sea fossil records, but some are planktic. There are many characteristics which influence foraminifera distribution, such as sediment type, food availability, oxygen levels and hydrostatic pressure. However, species can tolerate a wide range of unfavourable conditions. Low concentrations of foraminifera in benthic regions may indicate an environment under stress (Haynes 1981).

Study Area

Pulau Redang, Terengganu is located on the northern of South China Sea. A total of twelve sediment samples were collected from twelve sampling stations in Pulau Redang, Terengganu between 05°43'15" to 05°45'00"N and 102°59'00" to 103°03'05"E (Fig. 1). The range of salinity in the study area is between 25 to 34 ppt. The maximum value of dissolve oxygen is 7.03 mg/L at St 6 while the minimum value is 6.37 mg/L at St 2. In the study area, the highest temperature is noted at St 11 with 30.68°C and the lowest was 20.10°C at St 1. The sediment textures in the study area are classified as sand, loamy sand and sandy loam.

FIGURE 1: Map of Sampling Stations in Pulau Redang

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Materials and Methods

On July 2002, sediment samples were collected from twelve sampling stations in Pulau Redang, Terengganu with Petite Ponar type of grab sampler. The samples were used for identification process and physico-chemical analysis. The preparation of foraminifera samples was conducted by the method of wet filtration washings (Sohn et al. 1965). In the laboratory, each of the samples used for identification process was washed through a series of sieves (0.600, 0.180 and 0.063 mm). The samples were preserved in formalin and later stained with Rose Bengal for estimating the percentage of foraminifera species collected alive. Foraminifera specimens were classified as living specimen if they were judged to have been alive at the time of collection that had both strongly and slightly Rose Bengal coloured valves. Specimens were classified as dead if they had partly preserved. All specimens were picked up from the dried sediment. A number of systematic of quantitative analysis were applied to the faunal analysis including the simple species diversity (number of species in each sample), abundance (specimen number in each sample) and dominance (percentage of the most abundant species in each sample) have been ascertained in order to elucidate the nature of the various foraminifera communities and their relationship with the environmental factors. The species were identified with Scanning Electron Microscope (SEM) in SEM Unit, Faculty of Science and Technology, Universiti Kebangsaan Malaysia. Several in-situ physico-chemical parameters such as temperature, salinity, dissolve oxygen, percentage of organic matter and sediment texture were measured and had been determined in the laboratory.

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Results and Discussion

Foraminifera Abundance

A total of 39082 individual from 15 families, 26 genera and 59 species were found and identified in offshore sediment around Pulau Redang, Terengganu from the entire set of 12 samples. The families are Miliolidae, Amphisteginidae, Calcarinidae, Discorbidae, Elphidiidae, Globigerinidae, Reophacidae, Nodosariidae, Nubeculariidae, Nummulitidae, Planorbulinidae, Rotaliidae, Soritidae, Cymbaloporoidae and Textulariidae. The faunal assemblage is dominated by Amphisteginidae family with 29966 individual (average abundance %). The second family is Miliolidae (14.70%), followed by Nummulitidae (9.19%), Rotaliidae (8.11%), Elphidiidae (3.94%), Calcarinidae (3.12%), Nubeculariidae (2.85%), Textulariidae (1.47%), Soritidae (1.27%), Planorbulinidae (0.85%), Reophacidae (0.14%), Cymbaloporoidae (0.02%), Discorbidae (0.005%), Globigerinidae (0.005%) and Nodosariidae (0.003%). Family with have the most variety of species is Miliolidae with 20 species. There are Quinqueloculina sp. (A), Quinqueloculina sp. (B), Quinqueloculina psuedoreticulata, Quinqueloculina parkeri, Quinqueloculina philippinensis, Quinqueloculina seminulum, Quinqueloculina simplex, Quinqueloculina tropicalis, Quinqueloculina curta, Quinqueloculina sulcata, Triloculina tricarinata, Triloculina trigomula, Triloculina cf. oblonga, Triloculina sp., Pyrgo cf. constricta, Pyrgo sp., Adelostina semistriata, Pseudomasstilina medioelata, Milolinella sp. and Hauerina sp. The dominant species is Amphistegina cf. lessonii with 16498 individuals. The abundance of foraminifera were maximum at St 2 (7120 individuals) and minimum at St 10 (413 individuals). Both Hauerina sp. and Nonion sp. were found only 1 individual. Most of foraminifera were found lived in sand sediment.

Taxonomy

All collection is stored at School of Environment and Natural Resource Sciences, Faculty of Science and Technology, Universiti Kebangsaan Malaysia. We refer to the taxonomy provided by Whittaker & Hodgkinson 1979, Haynes 1973 and Cushman 1969.

Family NUBECULARIDAE Jones 1875

Genus Spiriloculina d'Orbigny 1826
Spiriloculina communis Cushman & Todd 1944

1921 Spiriloculina grateloupii d'Orbigny, p. 397, pl. 78, fig. 5
1944 Spiriloculina communis Cushman & Todd, p. 64, pl. 9, figs 1-3, 6
1951 Spiriloculina communis incisa Cushman & Asano, p. 13, figs. 89, 90
1979 Spiriloculina communis Whittaker & Hodgkinson, p. 21, pl. 1, fig. 5

Remarks: The holotype appears to be a very large individual, about 3.7 mm long. This specimen are similar with S. communis from Togopi formation, eastern Sabah, Malaysia (Whittaker & Hodgkinson, 1979) and differs with S. communis (Cushman & Todd) in having the peripheral margins of the chambers raised above the succeeding chambers.
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**Spiroloculina eximia** Cushman 1922

*Pl. 1, fig. 20*

1922 **Spiroloculina eximia** Cushman, p. 61, pl. 11, fig. 2
1929 **Spiroloculina eximia** Cushman, p. 42, pl. 8, figs. 7a, b
1944 **Spiroloculina eximia** Cushman & Todd, p. 46, pl. 6, figs. 36a-38b
1956 **Spiroloculina eximia** Cushman & Bhatia, p. 18, pl. 1, figs. 14a, b
1979 **Spiroloculina eximia** Whittaker & Hodgkinson, p. 21, pl. 1, fig. 6

Remarks: This species was found in the recent tropical western Pacific, west coast of India. It was originally described from the Tortugas, off Florida, though further records from the Caribbean appear to be lacking. The Togopi specimens are believed to constitute the first fossil record.

**Spiroloculina lucida** Cushman & Todd 1944

*Pl. 9, figs. 30-31b*

1944 **Spiroloculina lucida** Cushman & Todd, p. 70, pl. 9, figs. 30-31b
1951 **Spiroloculina lucida** Cushman et al., p. 15, figs. 99, 100
1956b **Spiroloculina lucida** Cushman et al., p. 68, pl. 7, figs. 5a, b
1979 **Spiroloculina lucida** Whittaker & Hodgkinson, p. 21, pl. 1, fig. 7

Remarks: The peripheral margins of the older chambers always project to form weak ridges. The main difference between *S. lucida* and *S. communis* is that in typical members of the latter group the periphery is flat or more commonly concave, while in the former is convex.

**Spiroloculina manifesta** Cushman & Todd 1944

*Pl. 8, figs. 26a-28*

1921 **Spiroloculina canaliculata** d’Orbigny, Cushman, p. 395, pl. 80, figs. 3a, b
1944 **Spiroloculina manifesta** Cushman & Todd, p. 62, pl. 8, figs. 26a-28
1951 **Spiroloculina manifesta** Cushman et al., p. 15, figs. 101, 102
1979 **Spiroloculina manifesta** Whittaker & Hodgkinson, p. 21, pl. 1, figs. 8, 9

Remarks: Considerable morphological variation exists within the Togopi specimens. The microspheric form tends to be subcircular in side view with the chambers nearly flush; the megalospheric form, on the other hand, is much narrower and often strongly concave in the central portion of the test.

Family **MILIOLIDAE** Ehrenberg 1839
Genus **Quinqueloculina** d’Orbigny 1826

**Quinqueloculina curta** Cushman 1921

1921 **Quinqueloculina curta** Cushman, p. 426, pl. 100, figs. 1, 2
1931 **Quinqueloculina curta** Cushman & Hadla, p. 80, figs. 33a-c
1937 **Quinqueloculina curta** Cushman et al., p. 114, pl. 17, figs. 1, 4
1941 **Quinqueloculina curta** Cushman & Le Roy, p. 113, pl. 1, figs. 1-5
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**Notes:**
- The table represents the distribution of benthic foraminifera species in Pulau Redang, Terengganu.
- Family names are listed in italics.
- Species names are listed in regular text.
- The table includes a total of 174 species.
THE ABUNDANCE OF BENTHIC FORAMINIFERA IN OFFSHORE SEDIMENT AROUND PULAU REDANG

1959  *Quinqueloculina curta* Cushman et al., p. 44, pl. 5, figs. 9a-c
1963  *Quinqueloculina curta* Cushman & Matsunaga, pl. 26, figs. 16a-c
Remarks: The specimens is smooth with rounded chambers, carinate being only poorly developed on the chamber peripheries, to forms with truncate, strongly carinate peripheries and even secondary reticulate ornament.

1917  *Quinqueloculina parkeri* Brady 1917
Pl. 1, fig. 13

1917  *Quinqueloculina parkeri* Brady & Cushman, p. 50, pl. 15, figs. 3a-c
1932  *Quinqueloculina parkeri* Brady & Cushman, p. 25, pl. 6, figs. 3, 4
1957  *Quinqueloculina parkeri* Brady & Todd, p. 286, pl. 85, figs. 13a-14b
1961  *Quinqueloculina parkeri* Brady & Huang, p. 85, pl. 1, fig. 24
1963  *Quinqueloculina parkeri* Brady & Matsunaga, pl. 28, figs. 7a-c
1965  *Quinqueloculina parkeri* Brady & Moura, p. 17, pl. 1, fig. 13
1968  *Quinqueloculina parkeri* Brady et al., p. 110, pl. 9, figs. 4a-b
Remarks: The chamber peripheries are angled and truncate. The ornament is generally well developed on the earlier visible chambers but is often sparse or absent over the last chamber, particularly in the apertural region.

1936  *Quinqueloculina reticulata* Cushman, p. 55, pl. 16, fig. 1
1959  *Quinqueloculina thalmanni* Vroman, p. 422, figs. 1-5
1968  *Quinqueloculina kerimbatica* (Heron-Allen & Earland) var. philippinensis (Cushman), p. 112, pl. 1, figs. 20-22
1974  *Quinqueloculina philippinensis* Cushman, Ponder, p. 244, pl. 13, figs. 22, 23
Remarks: The early chambers of this species are very prominent and well developed apertural neck is very characteristic. Ornament is relatively coarse reticulum and there is some degree of ribbing.

1941  *Quinqueloculina psuedoreticulata* Parr, 1941
Pl. 1, fig. 28

1941  *Quinqueloculina psuedoreticulata* (d’Orbigny), Le Roy, p. 22, pl. 3, figs. 1-3
1958  *Quinqueloculina psuedoreticulata* (d’Orbigny), Ganapathi & Satyavathi, pl. 2, fig. 32
1964  *Quinqueloculina psuedoreticulata* Parr, Rocha & Ubaldo, p. 38, pl. 2, fig. 7
1967  *Quinqueloculina psuedoreticulata* Parr, Lloyd, p. 88, pl. 13, figs. 5a-c
1968  *Quinqueloculina psuedoreticulata* (d’Orbigny), Chiji & Lopez, p. 110, pl. 9, figs. 5a-c
Remarks: The reticulate ornament is confined predominantly to the peripheral surface of each chamber, the central part of each face being smooth. In larger specimen the chamber

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edges are broadly rounded, while in smaller specimens they are more acute. It produced apertural neck and coarser ornamentation of *Q. philippinensis*.

**Quinqueloculina sulcata** d’Orbigny, 1826

1826 Quinqueloculina sulcata d’Orbigny, p. 301, no. 17
1900 Quinqueloculina sulcata d’Orbigny, Fornasini, p. 364, fig. 9
1932 Quinqueloculina sulcata d’Orbigny, Cushman, p. 28, pl. 7, figs. 5-8c
1954 Quinqueloculina sulcata d’Orbigny, Cushman, Todd & Post, p.334, pl. 84, figs. 1,2
1968 Quinqueloculina sulcata d’Orbigny, Chiji & Lopez, p. 110, pl. 9, figs. 7a, b
1979 Quinqueloculina sulcata Whittaker & Hodgkinson, p. 29, pl. 2, fig. 7

**Remarks:** It has been recorded in the Recent of the Red Sea (d’Orbigny, 1826), Fiji (Cushman, 1932), Marshall Islands, west Pacific (Cushman, Todd & Post, 1954), Japan (Chiji & Lopez, 1968) and eastern Sabah, Malaysia (Whittaker & Hodgkinson, 1979).

**Genus** Psuedomassilina Lacroix, 1983

**Psuedomassilina medioelata** Whittaker & Hodgkinson, 1979

Pl. 1, fig. 6

1979 Psuedomassilina medioelata Whittaker & Hodgkinson, p. 29, pl. 2, figs. 15, 16

**Remarks:** This specimens had fully developed show the typical flattened planispiral chambers of a *Psuedomassilina*. It have stronger, thicker tests and are ornamented by well developed costae.

**Genus** Triloculina d’Orbigny, 1826

**Triloculina trigonula** Lamrack, 1826

Pl. 1, fig. 23

1826 Triloculina trigonula (Lamrack), d’Orbigny, p. 299, pl. 16, figs. 5-9
1941 Triloculina trigonula (Lamrack), Le Roy, p. 22, pl. 3, figs. 26-28
1955 Triloculina trigonula (Lamrack), Takayanagi, pl. 1, fig. 14
1963 Triloculina trigonula (Lamrack), Matsunaga, pl. 30, figs. 2a, b
1968 Triloculina trigonula (Lamrack), Bhalla, p. 382, pl. 1, figs. 2a, b
1970 Triloculina trigonula (Lamrack), Matoba, p. 62, pl. 3, figs. 3a, b

**Remarks:** The fossil of this species was originally described from the Eocene of France. In Recent, a cosmopolitan species frequently found throughout the Indo-Pacific region at the present day.

**Triloculina tricarinata** d’Orbigny, 1865

1865 Triloculina tricarinata d’Orbigny, Parker, Jones & Brady, p. 34, pl. 1, fig. 8
1932 Triloculina tricarinata d’Orbigny, Cushman, p. 59, pl. 13, figs. 3a, b
1956 Triloculina tricarinata d’Orbigny, Bhatia, p. 19, pl. 1, figs. 16a, b
1961 Triloculina tricarinata d’Orbigny, Braga, p. 77, pl. 7, figs. 3, 4
THE ABUNDANCE OF BENTHIC FORAMINIFERA IN OFFSHORE SEDIMENT AROUND PULAU REDANG

1965 Triloculina tricarinata d’Orbigny, Moura, p. 26, pl. 3, fig. 2
1969 Triloculina tricarinata d’Orbigny, Rao, p. 592, pl. 3, fig. 22

Remarks: The chamber sides of this species are rarely straight to gently concave. It has been reported on a number of occasions from both the west and east coasts of the Indian subcontinent and Sri Lanka. Other records in the region comprise the Red Sea and Mozambique.

Family SORITIDAE Ehrenberg, 1839
Genus Peneroplis de Montfort, 1808
Peneroplis planatus Fichtel & Moll, 1898
1959 Peneroplis discoideus Flint, Graham & Militente, p. 62, pl. 9, fig. 22
1979 Peneroplis planatus Whittaker, Hadgkinson, p. 75, pl. 8, fig. 8

Remarks: The specimens have a striate ornament and don’t developed subepidermal partitions even in the final chambers. This species had previously recorded in Recent of north central Philippines and of the Togopi formation, eastern Sabah, Malaysia.

Family ROTALIIDAE Ehrenberg, 1839
Genus Ammonia Brunnich, 1772
Ammonia beccarii Cushman, 1963
Pl. 1, fig. 4
1963 Ammonia cf. beccarii Cushman, Ujie, pl. 2, figs. 7a-c
1964 Ammonia hozanensis Nakamura, Huang, p. 53, pl. 1, figs. 4a-c
1967 Ammonia beccarii tepida Cushman, Konda, p. 33, pl. 4, figs. 9a, b
1968 Ammonia beccarii tepida Cushman, Chihi, p. 58, pl. 3, figs. 4a, b

Remarks: This species show varying degrees of chamber inflation in the final whorl. The earlier sutures, however are limbate and flush. The umbilical depression is usually somewhat in filled with secondary material but is not plugged. It distributed in the tropical waters of the Indo-Pacific.

Genus Asterorotalia Hofker, 1951
Asterorotalia pulchella d’Orbigny, 1951
Pl. 1, figs. 9, 33
1927 Rotalia pulchella d’Orbigny, Hofker, p. 37, pl. 16, figs. 7-10
1937 Rotalia trispinosa Thalman, Yabe & Asano, p. 103, pl. 18, fig. 11
1951 Asterorotalia pulchella d’Orbigny, Hofker, p. 305, figs. 343, 344
1958 Asterorotalia pulchella d’Orbigny, Reuss & Merling, pl. 2, figs. 2, 3; pl. 5, figs. 12, 13
1964 Asterorotalia trispinosa Thalman, Le Roy, p. F39, pl. 6, figs. 18, 19

Remarks: Asterorotalia pulchella becomes plentiful and the ornament on the dorsal surface varies from very sparse to heavy on both chambers and sutures. It appears to be confined in eastern Sabah to Indonesia and the coasts of India.
Genus *Pararotalia* Le Calvez, 1949

*Pararotalia calcar* d’Orbigny, 1970

1884 *Rotalia calcar* d’Orbigny, Brady, p. 709, pl. 108, figs. 3a-c
1927 *Rotalia calcar* d’Orbigny, Hofker, p. 37, pl. 17, figs. 1-13
1946 *Calcarina calcar* d’Orbigny, Germeraad, p. 70, pl. 4, fig. 1
1954 *Rotalia calcar* d’Orbigny, Kleinpell, p. 61, pl. 7, figs. 5, 6
1964 *Calcarina calcar* d’Orbigny, Rocha & Ubaldo, p. 153, pl. 19, figs. 5-7
1970 *Pararotalia calcar* d’Orbigny, Hofker, p. 55, pl. 41, figs. 1-5

Remarks: These specimens are placed in *Pararotalia* as they have laterally elongated chambers, a plugged umbilicus and an interiomarginal and curved intercameral aperture. Ornament is variable and consists of pustules, particularly over the umbilical area, hyaline ridges along the chambers and hispid spines.

Genus *Psuedorotalia* Reiss & Merling, 1958

*Psuedorotalia schroeteriana* Parker & Jones, 1958

Pl. 1, fig. 32

1937 *Rotalia schroeteriana* Parker & Jones, Yabe & Asano, p. 104, pl. 19, fig. 10
1958 *Psuedorotalia schroeteriana* Parker & Jones, Reiss & Merling, p. 13, pl. 1, figs. 15-17
1968 *Psuedorotalia schroeteriana* Parker & Jones, Hofker, p. 30, pl. 10, figs. 4-18
1971 *Psuedorotalia schroeteriana* Parker & Jones, Hofker, p. 31, pl. 73, figs. 1-6

Remarks: Microspheric form of this specimens have a flat spiral and a high conical umbilical side with single or double rows of beading along the sutures. The umbilical plug is added to the apex of the newest chamber but because of the high conical test shape the plug development on earlier chambers remains prominent, simulating a lateral displacement, whereas it is in reality terminal in relation to each chamber.

Family CALCARINIDAE Schwager, 1876

Genus *Calcarina* d’Orbigny, 1826

*Calcarina hispida* Brady, 1884

Pl. 1, fig. 5

1884 *Calcarina hispida* Brady, p. 713, pl. 108, figs. 8, 9
1921 *Calcarina hispida* Brady, Cushman, p. 356, pl. 75, fig. 4
1954 *Calcarina hispida* Brady, Cushman, Todd & Post, p. 363, pl. 90, figs. 9-12
1961 *Calcarina hispida* Brady, Huang, p. 88, pl. 5, figs. 1-4
1970 *Calcarina hispida* Brady, Hofker, p. 63, pl. 43, figs. 5-13
1979 *Calcarina hispida* Brady, Whittaker & Hodgkinson, p. 73, pl. 7, figs. 1, 2

Remarks: The chambers in the last whorl are prominent or obscure, while in across section the test varies in its biconvexity, the chamber peripheries being either rounded or acute. The spines never more than nine, arise at any angle along a suture and are always hispid. The strongly biconvex forms are usually heavily postulate and very hispid but
THE ABUNDANCE OF BENTHIC FORAMINIFERA IN OFFSHORE SEDIMENT AROUND PULAU REDANG

Flatter specimens with prominent chambers in the last whorl have reduced ornament, what pustules there are being confined to the umbilical region.

Family **ELPHIDIIDAE** Galloway, 1933  
Genus *Cellanthus* de Montfort, 1808  
*Cellanthus biperforatus* Whittaker & Hodgkinson, 1979  
Pl. 1, fig. 22

1979 *Cellanthus biperforatus* Whittaker & Hodgkinson, p. 73, pl. 7, figs 3a, b  
Remarks: Test calcareous, perforate, biconvex and plugged. Plug raised, translucent, occupying a third of the test diameter and perforated by many canals. Periphery round in side view. On the later-formed sutures the anterior pores are larger than the posterior row, but for the most part are of the same size. Test inflated in apertural view, peripheries subrounded.

Family **NUMMULITIDAE** de Blainville, 1825  
Genus *Operculina* d’Orbigny, 1826  
*Operculina ammonoides* Schroter, 1783  
Pl. 1, fig. 2

1783 *Nautilus ammonoides* Schroter, p. 21  
1839 *Operculina ammonoides* (Gronovius), Egger, p. 242, pl. 20, figs. 38, 39  
1939 *Operculina ammonoides* (Gronovius), Hanzawa, p. 229, pl. 15, figs. 1a-2b  
1959 *Operculina ammonoides* (Gronovius), Graham & Militante, p. 76, pl. 12, figs. 1, 2  
1961 *Operculina ammonoides* (Gronovius), Huang, p. 86, pl. 3, figs. 22, 23  
1964 *Operculina ammonoides* (Gronovius), Rocha & Ubaldo, p. 156, pl. 19, fig. 13  
Remarks: This specimens show gradation from thin, almost evolute test with a strong marginal cord, to thick, nearly in volute immature tests but never completely involute. The megalospheric generation remains close-coiled but the microspheric has a flared last whorl, have a coarsely postulate umbilical area with a large central umbonal pustule.

Family **GLOBIGERINIDAE** Carpenter, Parker & Jones, 1862  
Genus *Globigerinita* Bronnmann, 1951  
*Globigerinita glutinata* Egger, 1893

1893 *Globigerinita glutinata* Egger, p. 371, pl. 13, figs. 19-21  
1979 *Globigerinita glutinata* (Egger), Whittaker & Hodgkinson, p. 75, pl. 8, fig. 13  
Remarks: This species was recorded by F. L. Parker (1967) as G glutinata (Egger) with range of late Miocene to Recent and Togopi formation, eastern Sabah, Malaysia.
EKOSISTEM MARIN MALA: PELUANG & PENYELIDIKAN TERKINI

Family **AMPHISTEGINIDAE** Cushman, 1927

Genus *Amphistegina* d'Orbigny, 1826

*Amphistegina cf. lessonii* d'Orbigny, 1826

Pl. 1, fig. 11

1826 *Amphistegina cf. lessonii* d'Orbigny, p. 304, pl. 17, figs. 1-4

1979 *Amphistegina cf. lessonii* (d'Orbigny), Whittaker & Hodgkinson, p. 75, pl. 8, fig. 2

Remarks: This species occurs in all but the highest samples in the Pulau Redang, Terengganu. *A. cf. lessonii* was recorded in Togopi formation, eastern Sabah, Malaysia.

Family **PLANORBULINIDAE** Schwager, 1877

Genus *Planorbulinella* Cushman, 1927

*Planorbulinella larvata* Parker & Jones, 1865

1865 *Planorbulinella larvata* Parker & Jones, pp. 379, 380, pl. 19, figs. 3a, b

1969 *Planorbulinella larvata* (Parker & Jones), Freudenthal, p. 82, pl. 4, figs. 3, 4

1979 *Planorbulinella larvata* (Parker & Jones), Whittaker & Hodgkinson, p.101, figs. 65a-b

Remarks: This species is commonly occurring in the Indian and Pacific Oceans and in the Red Sea. There appear to be several reliable records as early as the Miocene and was recorded in Togopi formation, eastern Sabah, Malaysia.

**Conclusion**

From this study, it showed that the benthic foraminifera are abundance and have a variety of species. A total of 39,082 specimens had been identified as 59 species from 15 families. *Amphistegina cf. lessonii* is the most dominant species with 16,498 individuals. While the most dominant family is Amphisteginidae with 20,966 individuals. Family with have the most variety of species is Miliolidae with 20 species. Both of *Hauerina* sp. and *Nonion* sp. were found only 1 individual in the study area. The abundance of foraminifera were maximum at Station 2 (7120 individuals) and minimum at Station 10 (413 individuals). Most of foraminifera were found in sand dominated sediment.

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**References**

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Plate 1