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Recent Foraminifera from Socotra Island, Indian Ocean, Yemen

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ABSTRACT

Twenty five samples were collected from the beach sand of Socotra Island. These samples are covered the northern shoreline of the island. They were treated for extracting the foraminiferal content. Eighty Six foraminiferal species have been identified from the collected samples. These species belonging to 52 genera, 22 subfamilies, 35 families, 16 superfamilies and 6 suborders.

The systematic classification of the recorded species is mentioned and then they were compared with the type- species.

Key words: Key words: Recent foraminifera, Socotra Island, Indian Ocean, Yemen.

INTRODUCTION

Socotra island is the largest Yemeni Island, located between the longitudes 53° 19` and 54° 33` E, and latitudes 12° 18` and 12° 42` N (Fig.1). This island has been living in isolation with the three nearby small islands (Abd Al-Kouri, Samhah and Darsa) to form the Socotra Archipelago in the Indian Ocean off the Horn of Africa, some 380 km S-SE of Ras Fartaq, the nearest point on the south Arabian coast. The length of Socotra Island is about 135 km from east to west with a maximum N-S breadth of 42 km. This archipelago rests on a shelf platform that is attached to the horn of Africa, some 250 km E-NE of cape Gaurrdafui at the north-east tip of Somalia (Samuel et al., 1997).

The geography of the area is very interest and variable, there are mountains ground, littoral, fluvial and aeolian plains. Different sedimentary environments such as valleys, coasts, lagoons, brackish water lakes….etc. are widely distributed in the island. All of these environments are distinguished by their own particular environmental conditions which controlling the endemic faunal assemblages inhabiting them.

At the surface of the island, four kinds of relief can be distinguished, these including: (1) The central plateau: It occupies most of the island area

and is divided into two main parts: the eastern and the western plateaus, which overlooking gradually the coastal plains., (2) Coastal Plains: The coastal plains are situated in the northern and southern parts of the island and are non-existent in the eastern or western parts of the island due to the extension of drifts to the coast. The coastal plains are divided into two parts, the northern coastal plain named Hadibo plain and the southern plain named Nawgeed., (3) The Mountains: The most important of which are the mountainous range of Haggier Mountains, which are located at the eastern part of the island (Fig. 1). and (4) The Wadis (valleys): Wadis are interspersed and pour at the northern and southern parts of the island. Some of these valleys springing out from the Haggier mountainous range which are characterized by the running water all the year.

Geology and Stratigraphy of Socotra Island was introduced in detailed by Beydoun and Bichan, 1970, Morrison et al., 1997, Birse et al., 1997 and Samuel et al., 1997. Pre-Cambrian basement rocks are distributed at the eastern part of the island (Haggier Mountains) and in a narrow strip along much of the northern coastline at the base of the cliffs and in the west around Qalansiyah and Ras Shu'ab areas.

Thick sedimentary sequence rests on the Pre-Cambrian basement rocks and exposed in different areas of the island. This sedimentary sequence consists mainly of sandstone (Triassic) and carbonate rocks (Jurassic–Tertiary). The carbonate sequence is highly karstified and cliff-forming massive limestone varies considerably in thickness, from 30m up to 600m (Samuel et al., 1997). Pleistocene and Holocene sediments formed on older rocks in inland depressions, valleys and on coastal plains. The Quaternary deposits of the island include marine, fluvial and continental facies (Flettmaan et al., 2004).

In the studied areas marine deposits are generally horizontal terraces of sandy conglomeratic limestone and heterogeneous calcareous and cemented conglomerates with a variety of marine organisms. The most common amongst them being corals and bivalves. Other marine deposits include pebble banks, beaches, spits and bars giving rise to lagoons or damming up the mouths of streams and wadis to result in the formation of seasonal fresh and brackish water lakes. Marine deposition grades inland into continental and fluviatile conditions.

The island lies on the margins of sub-equatorial and northern tropical climate belts. Therefore; the climate is characterized by marked seasonal, spatial–altitudinal and inter-annual variability. The local climate is influenced by large-scale weather phenomena, particularly the seasonally reversing Monsoons, the El Nino-southern oscillation and the Indian Ocean Dipole, and the episodic passage of tropical cyclones.

The diverse topography of the islands creates various micro-climates which cause marked changes in Socotra weather patterns, sea and air temperatures and rainfall. The Nawgeed plains is typical of extremely arid conditions, while parts of the Haggier are in a humid cloudy zone and may experience substantial rainfall occasionally in excess of 100mm per day during the rainy season where the total annual rainfall on the north coast measured is 125-175mm. The annual average temperature in Hadibo attains 28-31°C and the average annual humidity is approximately 65-76%.

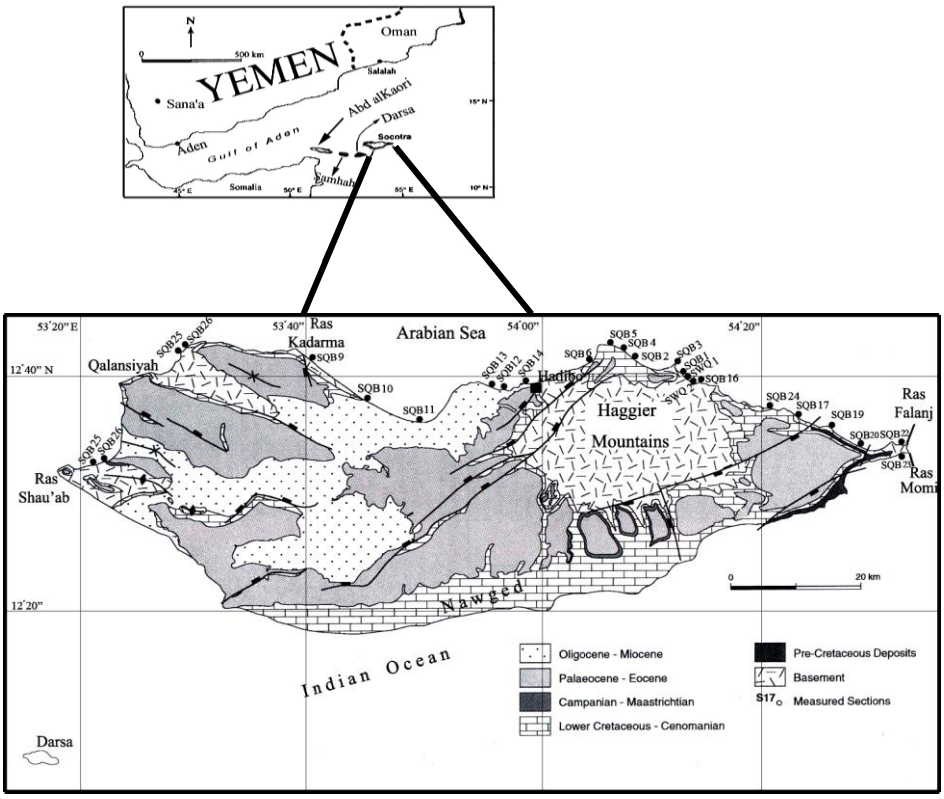


Figure 1: Geological map of Socotra Island including positions ofcollected samples

METHODOLOGY

Fieldwork was carried out along the northern coastline of Socotra Island during November 2007. Twenty five samples from the surface sediments of the selected area (Fig. 1) were collected for detail study and separation the foraminiferal tests from sediments which depends on the difference in density between saline water and the shells, which composed of calcium carbonate. The samples were washed by running distilled water using a (200-mesh) sieve. Shells of foraminifera were concentrated and extracted from the sediments by using turbulent movement to the salt water and the sediments inside a plastic container. The carbonate shells were separated and floated on the surface of water according to the low density of the calcium carbonate. The floating materials were separated from the saline solution and concentrated in a plastic sieve. Foraminiferal tests were picked by using double zero (00) size brush and arranged in micropaleotolgical slides. This fauna were studied and identified by using light binocular microscope. Photos of identified foraminiferal species were taken by Scanning Electronic Microscope (SEM) but some of them taken by 12 Mega Pixel digital camera.

Foraminiferal species from Socotra Island did not study before. Therefore, the present work is considered the first contribution on the foraminiferal assemblages from surface sediments of the Island.

The foraminiferal species are recorded and assessed in the present study The classification of recorded foraminifera based primarily on characters of the shells. The differences between the type species and our identified species are mentioned and the unknown species will describe here.

Based on the classification of foraminiferal genera by Loeblich and Tappan, 1988, an assemblage of 86 foraminiferal species is recorded. These recorded species belong to 52 genera, 22 subfamilies, 35 families, 16 superfamilies and 6 suborders. The described specimens are deposited in the Department of Earth and Environmental Sciences, Faculty of Science, University of Sana'a.

TAXONOMY AND SYSTEMATIC PALEONTOLOGY

Order : Foraminiferida EICHWALD, 1830

Suborder: Textularina EHRENBERG, 1839

Superfamily: Textulariacea EHRENBERG, 1838

Family: Eggerellidae CUSHMAN, 1937

Subfamily: Eggerellinae CUSHMAN, 1937

Genus: *Martinottiella* CUSHMAN, 1933

Martinottiella communis D'ORBIGNY, 1846

Pl. I, Fig. 1

Remarks: This species was recorded from Maldives Ridge and south eastern Arabian Sea (Sarkar *et al*., 2009). In this study, *Martinottiella communis* D'orbigny was found as a rare form in SQB12 (Table 1).

Martinottiella sp.

Pl. I, Figs. 2-3

Description: Test free, elongate, uniserial, ovate; periphery lobulate, sub-angular; suture flash, curved; wall finely agglutinated, aperture arcuate slit-like, terminal.

Remarks: in this study, *Martinottiella sp.* was found as rare form in SQB12 (Table 1).

Subfamily: Textulariinae EHRENBERG, 1838

Genus: *Textularia* DEFRANCE, 1824

Textularia agglutinans D'ORBIGNY, 1839

Pl. I, Figs. 4-9

Remarks: This species was recorded from several areas such as southern Thailand (Jumnongthai, 1980) and East Coast of India (Gandhi *et al*., 2002). In this study, it recorded as a common and rare form from several samples (Table 1).

Textularia conica D'ORBIGNY, 1839

Pl. I, Figs. 10-11.

Remarks: Chambers of this species are increasing gradually in size. This species was recorded from different regions such as south Maldives Ridge, Arabian Sea and from the north-west Indian coastline by Srinath, 2002 and Sarkar *et al*., 2009. In this study, this species was found with a huge numbers of up to more than 500 specimens in many samples (Table 1).

Textularia foliacea HERON-ALLEN and EARLAND, 1915

Pl. I, Fig. 12.

Remarks: This species was distinguished from recent deposits of the Red Sea and the Gulf of Aqaba (Hottinger *et al*., 1993). In the present study, this form is distinguished from SQB26 as an abundant and as frequent form in SQB25 and rarely form in SQB3 (Table 1).

Suborder: Spirillinina HOHENEGGER and PILLER, 1975
Family: Spirillinidae REUSS and FRITSCH, 1861
Genus: *Sejunctella* LOEBLICH and TAPPAN, 1957
Sejunctella sp.
Pl. I, Figs. 13-14.

Description: Test discoidal to enrolled tubular, globular to ovate; complete and rounded Periphery; wall hyaline, numerous prominent perforations on one side, and opposite side imperforate; aperture terminal, rounded at the end of the tube.
Remarks: In this study, this form is distinguished from SQB25, SQB26 as a rare form (Table 1).

Suborder: Miliolina DELAGE and HEROUARD, 1896
Superfamily: Cornuspiracea SCHULTZE, 1854
Genus: *Vertebralina* D'ORBIGNY, 1826
Vertebralina striata D'ORBIGNY, 1826
Pl. I, Figs. 15-18.

Remarks: *Vertebralina striata* D'orbigny was recorded from different regions such as East Coast of India (Gandhi *et al*., 2002), Maldives Ridge and south eastern Arabian Sea (Sarkar *et al*., 2009) and from Turkey (Meriç *et al*., 2009).
In this study, this form is distinguished from SQB25 as a frequent and as a rare form in SQB3, SQB13 and SQB26 (Table 1).

Superfamily: Miliolacea EHRENBERG, 1839
Family: Spiroloculinidae WIESNER, 1920
Genus: *Spiroloculina* D'ORBIGNY, 1826
Spiroloculina aequa CUSHMAN, 1917
Pl. II, Figs. 2-3.

Remarks: This species was recorded from the beach sands along Saurashtra coast in north-west India (Rao and Srinath, 2002) and Indian coast (Devi and Rajashekhar, 2009). In the present study, this form was found as a common form in SQB25 and SQB26 (Table 1).

Spiroloculina depressa D'ORBIGNY, 1826
Pl. I, Fig. 19.

Remarks: This species is very similar to the type species which was described by D'orbigny, 1826. It was recorded several regions such as Florida (Buzas and Severin, 1982), France (Debenay *et al*., 2001), Thailand Gulf (Melis and Violanti, 2006) and Turkey (Meriç *et al*., 2009).
In this study, it was recorded as rare form in SQB3, SQB13, SQB25 and SQB26 (Table 1).

Spiroloculina laevigata CUSHMAN and TODD, 1944
Pl. I, Fig. 20.

Remarks: This species was recorded in beach sands along Saurashtra coast in north-west India (Rao and Srinath, 2002). This form was recorded as a rare form from the Red Sea coastline (Hudaydah, Mukha and Zabeed) by El-Nakhal, 1980. In this study, *Spiroloculina laevigata* Cushman and Todd was recorded as rare form in SQB25 (Table 1).

Spiroloculina ornate D'ORBIGNY, 1839
Pl. II, Fig. 1.

Remarks: In this study, *Spiroloculina ornate* D'orbigny has been recorded as a rare form in SQB12 and SQB25 (Table 1).

Spiroloculina sp.

Pl. II, Figs. 4-5.

Description: Test ovate in outline, biconvex; tube-shaped; milioline; complete and semi-rounded periphery; suture lines curved, depressed; surface smooth; wall porcelaneous, imperforate; aperture terminal, rounded at the end of the final chamber with simple tooth.

Remarks: In this study, *Spiroloculina sp*. has been recorded as rare form in SQB12 and SQB26 (Table 1).

Family: Haueriniдae SCHWAGER, 1876

Subfamily: Haueriniae SCHWAGER, 1876

Genus: *Hauerina* D'ORBIGNY, 1839

Hauerina bradyi CUSHMAN, 1917

Pl. II Figs. 6-10.

Remarks: This species is similar to the type species. It was recorded in southern Thailand (Jumnongthai, 1980). In the study samples *Hauerina bradyi* Cushman was recorded as an abundant form in SQB25 and SQB26 and rarely from SQB3 and SQB13 (Table 1).

Genus: *Massilina* SCHLUMBERGER, 1893

Massilina granulocostata GERMERAAD, 1946

Pl. II, Figs. 11-12.

Remarks: *Massilina granulocostata* was recorded from different regions such as Challenger Station in Papua New Guinea, Gulf of Mexico, Mediterranean Sea, New Zealand and from USA. In the present study, this species was distinguished as a frequent form in samples SQB3, SQB25 and SQB26 (Table 1).

Genus: *Quinqueloculina* D'ORBIGNY, 1826

Quinqueloculina flavescens D'ORBIGNY, 1826

Pl. II, Fig. 13.

Remarks: *Quinqueloculina flavescens* was originally described from Madagascar (D'Orbigny, 1826). It was recorded from the coastline of Yemen by El-Nakhal, 1984. In this study, this species was recorded from samples SQB2, SQB19 and SQB25 (Table 1).

Quinqueloculina poeyana D'ORBIGNY, 1839

Pl. II, Figs. 14-15.

Remarks: The present species was described from the recent deposits of Cuba and Jamaica (D'Orbigny, 1839). In Yemen, this species was recorded by El-Nakhal, 1980. Also, it was recorded in different regions such as Florida (Buzas and Severin, 1982), Western Australia (Glover *et al.,* 2003) from Thailand (Melis and Violanti, 2006). In this study, it occurs in samples SQB10, SQB12, SWQ1 and SWQ2 as a common form (Table 1).

Quinqueloculina parkeri BRADY, 1881

Pl. II, Figs. 16-17

Remarks: This form was described by Brady, 1881. It was identified from different regions such as southern Thailand (Jumnongthai, 1980) and East Coast of India (Gandhi *et al*., 2002), beach sands along Saurashtra coast in north-west India (Rao and Srinath, 2002) and from Indian coast (Devi and Rajashekhar, 2009). In this study, *Quinqueloculina parkeri*

Brady was occurred as rare form in samples SQB1, SQB4, frequently from samples SQB25 and SQB26 (Table 1).

Quinqueloculina subdecorata CUSHMAN, 1918

Pl. II, Fig. 18.

Remarks: This species was recorded by El-Nakhal, 1984 From the Red Sea coastline of Yemen. In this study, *Quinqueloculina subdecorata* was recorded as a rare form in sample SWQ2 (Table 1).

Quinqueloculina sp.

Pl. II, Fig. 19.

Description: Test ovate in outline, biconvex; chambers shape tube, milioline; complete and sub-rounded periphery; suture lines curved, slightly depressed; wall porcelaneous, imperforate; surface striated lines; aperture terminal, rounded with a bifid tooth.

This species has recorded here as a commonly from sample SQB26, as a frequent form in sample SQB3, and as rare form in sample SQB19 (Table 1).

Subfamily: Miliolinellinae VELLA, 1957

Genus: *Biloculinella* WIESNER, 1931

Biloculina labiata SCHLUMBERGER, 1891

Pl. II, Fig. 20.

Remarks: *Biloculina labiata* Schlumberger was recorded from Turkey (Meriç *et al*., 2009). In this study, it has been recorded as a frequent form in samples SQB25 and SQB26 and as a rare form in samples SQB3 and SWQ2 (Table 1).

Genus: *Triloculina* D'ORBIGNY, 1826

Triloculina bertheliana BRADY, 1884

Pl. III, Figs. 14-15.

Remarks: In this study, *Triloculina bertheliana* was identified rarely form in sample SQB2 and frequently from sample SQB25 (Table 1).

Triloculina longidentata BANDY, 1953

Pl. III, Figs. 3-5.

Remarks: El-Nakhal, 1993 recorded *Triloculina longidentata* Bandy from Hudaydah and Zabeed, Salif and Mukha areas. In this study, it was identified as an abundant form in sample SQB26, as a common form in sample SQB25 and as a rare form in samples SQB13, SQB14, SQB23 and SQB27 (Table 1).

Triloculina mindenensis HOWE, 1939

Pl. III, Figs. 6-7.

Remarks: Howe, 1939 described *Triloculina mindenensis* from the Eocene of Louisiana, U.S.A. It was identified by El-Nakhal, 1980, 1984 and 1993 from Yemen (Hudaydah, Zabeed and Mukha). In this study, this species was recorded form as an abundant form in sample SWQ2 and as a frequent form in samples SQB3 and SQB13 (Table 1).

Triloculina oblonga MONTAGU, 1*803*

Pl. III, Figs. 8-10.

Genus: *Coscinospira* EHRENBERG, 1839

Coscinospira hemprichii EHRENBERG, 1839

Pl. IV, Figs. 1-3.

Remarks: This species was recorded by El-Nakhal, 1984 from Mukha area. In this study it was recorded as a rare form in sample SQB1 and SQW 1 (Table 1).

Plate I

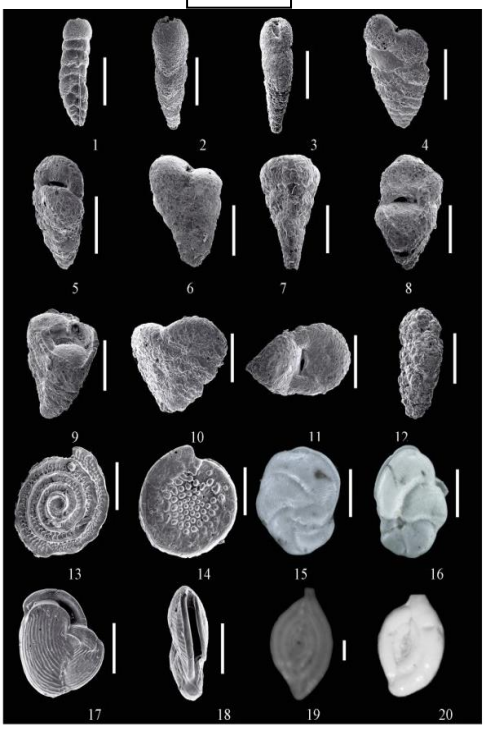


Plate II

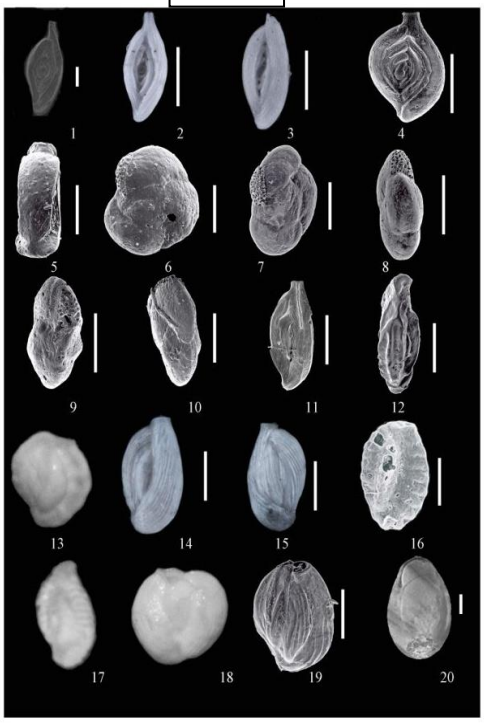


Plate I

1- *Martinottiella communis* D'orbigny, side view, scale bar 320µm., 2- *Martinottiella* sp., side view, scale bar 220µm., 3-*Martinottiella* sp., apertural view, scale bar 315µm., 4- *Textularia agglutinans* D'orbigny, side view, scale bar 510µm. 5- *Textularia agglutinans* D'orbigny, apertural view, scale bar 485µm., 6- *Textularia agglutinans* D'orbigny, side view, scale bar 420µm. 7- *Textularia agglutinans* D'orbigny, edge view, Scale bar 175µm., 8- *Textularia agglutinans* D'orbigny, apertural view, scale bar 120 µm., 9- *Textularia agglutinans* D'orbigny, edge view, scale bar 290µm., 10- *Textularia conica* D'ORBIGNY, side view, scale bar 160µm., 11- *Textularia conica* D'orbigny, apertural view, scale bar 135µm., 12- *Textularia foliacea* Heron-Allen and Earland, edge view, scale bar 680µm., 13- *Sejunctella* sp., spiral side, scale bar 230µm., 14- *Sejunctella* sp., umbilical view, scale bar 255µm., 15- *Vertebralina striata* D'orbigny, spiral side, scale bar 325µm., 16- *Vertebralina striata* D'orbigny, spiral side, scale bar 395µm., 17- *Vertebralina striata* D'orbigny, umbilical view, scale bar 165µm., 18- *Vertebralina striata* D'orbigny, apertural view, scale bar 173µm., 19- *Spiroloculina depressa* D'orbigny, side view, scale bar 100µm., and 20- *Spiroloculina laevigata* Cushman and Todd, side view, X60.

Plate II

1- *Spiroloculina ornate* D'orbigny, side view, scale bar 100µm., 2- *Spiroloculina aequa* Cushman, side view, scale bar 460µm., 3- *Spiroloculina aequa* Cushman, side view, scale bar 405µm., 4- *Spiroloculina sp.*, side view, scale bar 190µm., 5- *Spiroloculina* sp., edge view, Scale bar 185µm., 6- *Hauerina bradyi* Cushman, spiral side, scale bar 260µm., 7- *Hauerina bradyi* Cushman, 1917, scale bar 285µm., 8- *Hauerina bradyi* Cushman, edge view, scale bar 260µm., 9- *Hauerina bradyi* Cushman, apertural view, scale bar 270µm., 10- *Hauerina bradyi* Cushman, edge view, scale bar 295µm., 11- *Massilina granulocostata* Germeraad, side view, scale bar 370µm., 12- *Massilina granulocostata* Germeraad, apertural view, scale bar 310µm., 13- *Quinqueloculina flavescens* D'orbigny, side view, X*60*, *14- Quinqueloculina poeyana* D'orbigny, side view, scale bar 230µm. 15- *Quinqueloculina poeyana* D'orbigny, side view, scale bar 265µm., 16- *Quinqueloculina parkeri* Brady, side view, scale bar 100µm., 17- *Quinqueloculina parkeri* Brady, side view, X*60*, 18- *Quinqueloculina subdecorata* Cushman, side view, X*60*, *19- Quinqueloculina* sp., side view, scale bar 155µm. and 20- *Biloculina labiata* Schlumberger, side view, scale bar 50µm.

Remarks: This species was recorded from the beach sands along Saurashtra coast in north-

west India (Rao and Srinath, 2002) and Indian coast (Devi and Rajashekhar, 2009). It was recorded by El-Nakhal, 1980 and 1993 from sea shores of Yemen. In this study, *Triloculina oblonga* was occurred as an abundent form in sample SQB12, as frequent form in samples SQB3, SQB14 and SQB25 and as a rare form in samples SQB1 and SQB19 (Table 1).

Triloculina peroblonga CUSHMAN, 1922

Pl. III, Fig. 11.

Remarks: This form was recorded by El-Nakhal, 1980 and 1993 from sea shores of Yemen. In this study, *Triloculina peroblonga* Cushman was distinguished as a common form in samples SQB3, SQB13 and SQB25, as a frequent form in sample SQB25 and as a rare form in sample SQB14 (Table 1).

Triloculina quadrata COLLINS, 1958

Pl. III, Figs. 12-13.

Remarks: Collins, 1958 described *Triloculina quadrata* from the recent deposits of the Great Barrier Reef of Australia. This species was recorded by El-Nakhal, 1980 and 1993 from sea shores of Yemen. In this study, it was recorded as a common form in sample SQB3, as a frequent form in samples SQB25 and SQB26 and as a rare form in samples SQB13 and SQB19 (Table 1).

Triloculina trihedra LOEBLICH and TAPPAN, 1953

Pl. III, Figs. 1-2.

Remarks: This species was recorded by Michelsen, 1967 from island of Læsø in Denmark. *Triloculina trihedra* Loeblich and Tappan was recorded by El-Nakhal, 1980 and1984 from the Red sea coastline of Yemen. In this study, It was found as an abundant form in samples SQB26 and SWQ2, as a common form in samples SQB1 and SQB13, as a frequent form in sample SQB3 and as rare form in samples SQB12, SQB25 and SWQ1 (Table 1).

Triloculina sp.

Pl. III, Fig. 16.

Description: Test ovate in outline, biconvex; chambers shape tube; milioline, three chambers visible from the exterior; complete and sub-rounded periphery; suture lines curved, depressed; wall porcelaneous, imperforate; surface smooth; aperture terminal, rounded at the end of the final chamber with a short bifid tooth.

Remarks: This species was found as rare form in SQB25 (Table1).

Subfamily: Tubinellinae RHUMBLER, 1906

Genus: *Articulina* D'ORBIGNY, 1826

Articulina antillarum CUSHMAN, 1922

Pl. III, Fig. 17.

Remarks: This species was recorded in Gulf of Mexico. In this study, *Articulina antillarum* was occurred as rare form (two shells only) in SQB3.

Articulina carinata WIESNER, 1923

Pl. III, Figs. 18-20.

Remarks: *Articulina carinata* Cushman was recorded from the recent sediments of Queensland, Australia. In this study it was recorded frequently from SQB25 and rarely from SQB26 (Table 1). It is very similar to the type species but the ornamentation is more clear in our specimens.

Superfamily: Soritacea EHRENBERG, 1839

Family: Peneroplidae SCHULTZE, 1854

Genus: *Peneroplis* DE MONTFORT, 1808

Peneroplis planatus FICHTEL and MOLL, 1798

Pl. IV, Figs. 4-6.

Remarks: This species is very similar to the type species that was described by Fichtel and Moll, 1798, but our specimens characterized that their chambers are increasing slowly in size. It was recorded from southern Thailand (Jumnongthai, 1980), East Coast of India (Gandhi *et al*., 2002) and from Turkey (Meriç *et al*., 2009). In this study, it was recorded frequently from samples SQB2 and SQB26 and and as a rare form in samples SQB1, SQB13, SQB19 and SQB25 (Table 1).

Peneroplis pertusus D'ORBIGNY, 1839

Pl. IV, Figs. 7-8.

Remarks: This species is similar to the species *Dendritina ambigua* Fichtel and Moll, but it has different in the aperture type. It was recorded in Florida (Buzas and Severin, 1982) and Turkey (Meriç *et al*., 2009). In this study, this species was recorded as an abundant form in samples SQB13 and SQB25, frequently form in samples SQB2 and SQB7 and as a rare form in samples SQB1, SQB4, SQB8, SQB14, SQB19 and SQB26 (Table 1).

Family: Soritidae EHRENBERG, 1839

Subfamily: Soritinae EHRENBERG, 1839

Genus: *Sorites* EHRENBERG, 1839

Sorites orbiculus FORSKAL, 1775

Pl. IV, Figs. 9-10.

Remarks: In Yemen *Sorites orbiculus* Forskal recorded as an abundant form at the Yemeni Red Sea coastline by El-Nakhal, 1980 and 1993. In this study, this form was distinguished abundantly from many samples (Table 1). This species was recorded in East Coast of India (Gandhi *et al*., 2002) and Turkey (Meriç *et al*., 2009).

Suborder: Lagenina DELAGE and HEROUARD, 1896

Superfamily: Nodosariacea EHRENBERG, 1838

Family: Nodosariidae EHRENBERG, 1838

Subfamily: Nodosariinae EHRENBERG, 1838

Genus: *Dentalina* RISSO, 1826

Dentalina inornata D'ORBIGNY, 1846

Pl. IV, Fig. 11.

Remarks: This species was recorded in Maldives Ridge in south eastern Arabian Sea (Sarkar *et al*., 2009). It is similar to the *laevidentalina aphelis* which was described in Loeblich and Tappan, 1986; but the surface of our specimens smooth. In this study, this species was found as a rare form in sample SQB26 (Table 1).

Genus: *Amphimorphina* NEGEBOREN, 1850

Amphimorphina butonensis KEYZER, 1953

Pl. IV, Fig. 12.

Remarks: This species is too similar to the type species of *Amphimorphina haueriana* Negeboren, 1850, but it differs by its rounded aperture. In this study, it was recorded as a rare form in sample SQB25 (Table 1).

Family: Vaginulinidae REUSS, 1860

Subfamily: Marginulininae WEDEKIND, 1937

Genus: *Amphicoryna* SCHLUMBERGER, 1893

Amphicoryna sp. 1971

Pl. IV, Fig. 13.

Plate III

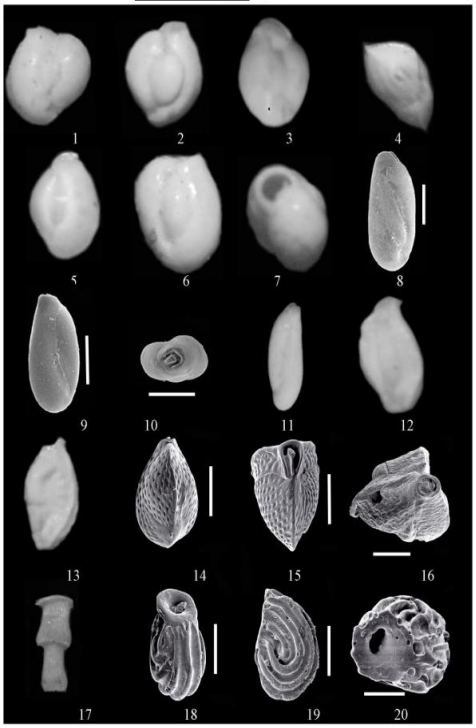


Plate III

1- Triloculina trihedra Loeblich and Tappan, side view, X60., 2- *Triloculina trihedra* Loeblich and Tappan, side view, X60., 3- *Triloculina longidentata* Bandy, side view, X*60, 4- Triloculina longidentata* Bandy, apertural view, X*60., 5- Triloculina longidentata* Bandy, side view, X*60., 6- Triloculina mindenensis* Howe,, side view, X*60., 7- Triloculina mindenensis* Howe, apertural view, X*60., 8- Triloculina oblonga* Montagu, side view, scale bar 100µm., 9- *Triloculina oblonga* Montagu, side view, scale bar 100µm., 10- *Triloculina oblonga* Montagu, apertural view, scale bar 100µm., 11- *Triloculina peroblonga* Cushman, side view, X60., 12- *Triloculina quadrata* Collins, side view, X60., 13- *Triloculina quadrata* Collins, side view, X60., 14- *Triloculina bertheliana* Brady, side view, scale bar 230µm., 15- *Triloculina bertheliana* Brady, apertural view, scale bar 205µm., 16- *Triloculina* sp., apertural view, scale bar 170µm., 17- *Articulina antillarum* Cushman, side view, X60., 18- *Articulina carinata* Wiesner, edge view, scale bar 170µm., 19- *Articulina carinata* Wiesner, side view, scale bar 160µm., 20- *Articulina carinata* Wiesner, apertural view, scale bar 120µm.

Plate IV

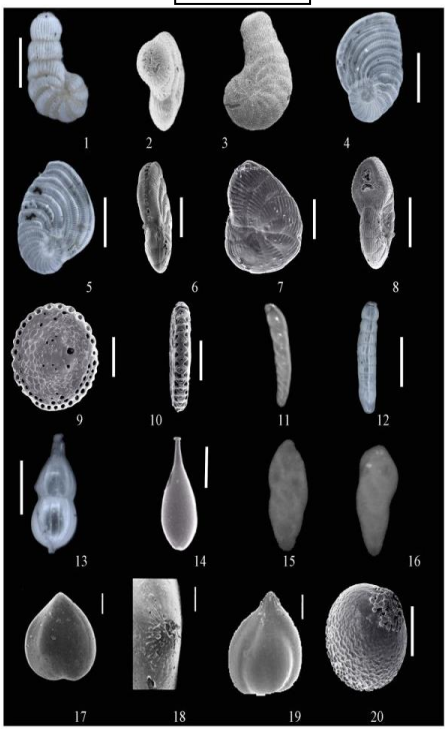


Plate IV

1- *Coscinospira hemprichii* Ehrenberg, spiral view, scale bar 375µm., 2- *Coscinospira hemprichii* Ehrenberg, apertural view, X100., 3- *Coscinospira hemprichii* Ehrenberg, spiral side, X60., 4- *Peneroplis planatus* Fichtel and Moll, spiral side, scale bar 665µm., 5- *Peneroplis planatus* Fichtel and Moll, spiral side, scale bar 575µm., 6- *Peneroplis planatus* Fichtel and Moll, apertural view, scale bar 430µm., 7- *Peneroplis pertusus* D'orbigny, spiral side, scale bar 325µm., 8- *Peneroplis pertusus* D'orbigny, *apertural view,* scale bar 340µm., 9- *Sorites orbiculus* Forskal, spiral side, scale bar 280µm., 10- *Sorites orbiculus* Forskal, edge view, scale bar 260µm., 11- *Dentalina inornata* D'orbigny, side view, X60., 12- *Amphimorphina butonensis* Keyzer, side view, scale bar 560µm., 13- *Amphicoryna* sp. side view, scale bar 190µm., 14- *Procerolagena clavata* D'orbigny, side view, 300µm. 15- *Pseudopolymorphina hanzawai* Cushman and Ozawa, side view, X60., 16- *Pseudopolymorphina hanzawai* Cushman and Ozawa, side view, X60., 17- *Sigmoidella elegantissima* Parker and Jones, side view, scale bar 100µm., 18- *Sigmoidella elegantissima* Parker and Jones, apertural view, scale bar 100µm., 19- *Sigmoidella elegantissima* Parker and Jones, side view, scale bar 100µm. and 20- *Oolina* sp., apertural view, scale bar 105µm.

Description: Test elongate, uniserial and rectilinear, consist of two global chambers, base commonly apiculate; semi-lobulate and angular periphery; suture lines curved, depressed; wall hyaline, perforate; surface longitudinally striate; aperture terminal, rounded at the end of neck.

Remarks: In this study, it was recorded as a rare form in SQB25 (Table 1).

Family: Lagenidae REUSS, 1862

Genus: *Procerolagena* R. W. JONES, 1984

Procerolagena clavata D'ORBIGNY, 1826

Pl. IV, Fig.14.

Remarks: This species was identified by D'orbigny, 1826, from The Hebridean shelf, west of Scotland (Murray, 2003). In this study, it was distinguished as a rare form in SQB25 (Table 1).

Family: Polymorphinidae D'ORBIGNY, 1839

Subfamily: Falsoguttulininae LOEBLICH and TAPPAN, 1986

Genus: *Pseudopolymorphinoides* VAN BELLEN, 1946

Pseudopolymorphina hanzawai CUSHMAN and OZAWA, 1928

Pl. IV, Figs. 15-16.

Remarks: *Pseudopolymorphina hanzawai* Cushman and Ozawa was originally described from Sado Island, Japan (Loeblich and Tappan,1988). In this study, it was recorded as a rare form in QB3 and SQB12 (Table 1).

Subfamily: Polymorphininae D'ORBIGNY, 1839

Genus: *Sigmoidella* CUSHMAN and OZAWA, 1928

Sigmoidella elegantissima PARKER and JONES, 1865

Pl. IV, Figs. 17-19.

Remarks: In this study, *Sigmoidella elegantissima* Parker and Jones was found as a common form in SQB25 and SQB26 (Table 1).

Family: Ellipsolagenidae SILVESTRI, 1923

Sub Family: Oolininae LOEBLICH and TAPPAN, 1961

Genus: *Oolina* D'ORBIGNY, 1839

Oolina sp.

Pl. IV, Fig. 20.

Description: Test unilocular; chamber shape globular to ovate; complete, sub-rounded periphery; wall calcareous, hyaline, radial, surface with very fine longitudinal striate; aperture terminal, rounded.

Remarks: In this study, it was found two shells only. *Oolina sp*. was found as a rare form in SQB25 (Table 1).

Subfamily: Ellipsolageninae A. SILVESTRI, 1923

Genus: *Fissurina* REUSS, 1850

Fissurina lacunata BURROWS and HOLLAND, 1895

Pl. V, Figs.1-2.

Remarks: *Fissurina lacunata* Burrows and Holland was recorded from different regions such as Gulf of Mexico, and New Zealand. In this study, it was recorded frequently from sample SQB25 and as a rare form in SQB26 (Table 1).

Fissurina sp.

Pl. V, Fig. 3.

Description: Test ovate in outline with short neck, unilocular; complete and sub-angular periphery; wall calcareous, hyaline, finely perforate; surface smooth, with random or regularly aligned punctae; aperture terminal, ovate.
Remarks: In this study, this species was found as a rare form in SQB26 and frequently from in SQB25 (Table 1).

Genus: *Palliolatella* PATTERSON and RICHARDSON, 1987
Palliolatella bradii SILVESTRI, 1902
Pl. V, Fig. 4.

Remarks: *Palliolatella bradii* Silvestri was identified from the Gulf of Aqaba. In this study, this species was recorded as an abundant form in sample SQB25, as a common form in sample SQB26, as a frequent form in sample SQB13 and as a rare form in sample SQB12 (Table 1).

Palliolatella sp.
Pl. V, Figs. 5-6.

Description: Test elongate ovate, unilocular; complete and subangular periphery; wall calcareous, hyaline, surface smooth, surrounded with three costae; aperture terminal, rounded on a small neck.
Remarks: In this study, this present species was recorded as a rare form in SQB25 and SQB26 (Table 1).

Suborder: Globigerinina DELAGE and HEROUARD, 1896
Superfamily: Globorotaliacea CUSHMAN, 1927
Family: Globorotaliidae CUSHMAN, 1927
Genus: *Globorotalia* CUSHMAN, 1927
Globorotalia mendardii PARKER, JONES and BRADY, 1865
Pl. V, Figs. 7-9.

Remarks: In umbilical view, the suture lines are depressed and curved, but they are flush and curved in spiral view. This species was distinguished as an abundant form in sample SQB26, as a frequent form in samples SQB3 and SQB25 and as a rare form in samples SQB12 and SWQ2 (Table 1).

Family: Candeinidae CUSHMAN, 1927
Subfamily: Globigerinitinae BERMUDEZ, 1961
Genus: *Globigerinita* BRÖNNIMANN, 1951
Globigerinita sp.
Pl. V, Figs. 10-11.

Description: Test coiled, subglobular, trochospiral; chambers globular to ovate; sutures curved, depressed; rounded lobulate and sub-rounded periphery; wall calcareous, microperforate; surface pitted; aperture in the early stage a low interiomarginal, extraumbilical-umbilical arch.
Remarks: In this study, this species was recorded as a frequently form in SQB13 and SQB25 (Table 1).

Family: Globigerinidae CARPENTER, PARKER, and JONES, 1862
Subfamily: Globigeriniae CARPENTER, PARKER, and JONES, 1862
Genus: *Globigerina* D'ORBIGNY, 1826
Globigerina bulloides D'ORBIGNY, 1826
Pl. V, Figs. 12-13.

Remarks: The initial chamber larger than the subsequent chambers. It was recorded from different regions such as East Coast of India (Gandhi *et al*., 2002) and Indian coast (Devi and Rajashekhar, 2009). In this study, this species was found as a common form in samples SQB3 and SQB25 and as a frequent form in samples SQB26 and SWQ2 (Table 1).

Globigerinoides rubber D'ORBIGNY, 1839

Pl. V, Figs. 14- 15

Remarks: *Globigerinoides rubber* D'orbigny, was recorded from different regions such as South Africa, Gulf of Mexico, Kenya, Mediterranean Sea, west and east coasts of India, New Zealand Exclusive Economic Zone and European waters (Devi and Rajashekhar, 2009). In this study, this species was distinguished as a common form in samples SQB3 and SQB26, as a frequent form in sample SWQ2 and as a rare form in sample SQB25 (Table 1).

Globigerinoides sacculifer BRADY, 1884

Pl. V, Figs. 16-17.

Remarks: chambers of this form is increasing gradually in size. *Globigerinoides sacculifer* Brady, was recorded from Indian coast (Devi and Rajashekhar, 2009). In this study, this form was recorded abundantly from samples SQB25 and SQB26, as a common form in sample SWQ2, as a frequent form in sample SQB3 and as a rare form in samples SQB1 and SQB27 (Table 1).

Suborder: Rotalina DELAGE and HEROUARD, 1896

Superfamily: Bolivinacea GLAESSNER, 1937

Family: Bolivinidae GLAESSNER, 1937

Genus: *Bolivinellina* SAIDOVA, 1975

Bolivina pseudopunctata HÖGLUND, 1947

Pl. V, Figs. 18-19.

Remarks: This species was recorded in Hebridean Shelf west of Scotland (Murray, 2003), Island of Læsø in Denmark (Michelsen, 1967) and Disko Bugt, West Greenland (Lioyd, 2006). In this study, this species form was recorded abundantly from samples SQB25 and SQB26, as a common form in sample SWQ2, as a frequent form in samples SQB3 and SQB12 and as a rare form in samples SQB1 and SQB27 (Table 1).

Bolivina seminuda CUSHMAN, 1911

Pl. V, Fig. 20.

Remarks: This species was recorded in shelf of Congo in tropical west Africa (Mojtahid *et al*., 2006). In this study, *Bolivina seminuda* Cushman was recorded as an abundant form in sample SQB10, as a frequent form in samples SQB3, SQB7, SQB8 and SQB25 and as a rare form in samples SQB9 and SQB26 (Table 1).

Bolivinella folia PARKER and JONES, 1865

Pl. VI, Fig. 1.

Remarks: *Bolivinella folia* Parker and Jones was originally described from South Australia by Parker and Jones, 1865. In this study, this species was found as a rare form in study area, in SQB25 and SQB26 (Table 1).

Superfamily: Bolivinitacea CUSHMAN, 1927

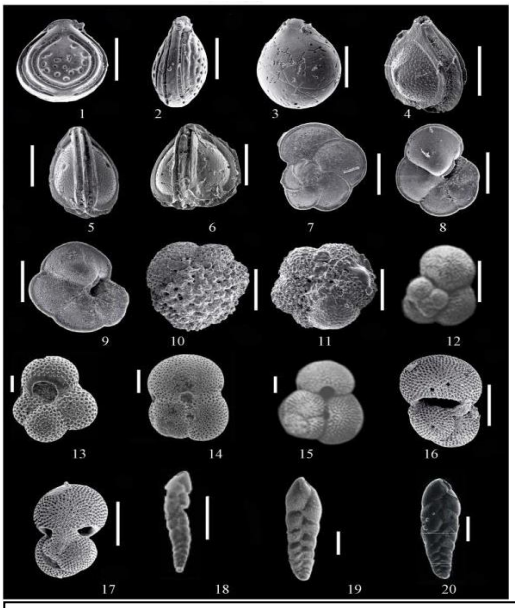
Family: Bolivinitidae CUSHMAN, 1927

Genus: Abbditodentrix PATTERSON, 1985

Abditodentrix rhomboidalis MILLETT, 1899

Pl. VI, Figs. 2-4.

Plate V



Plate

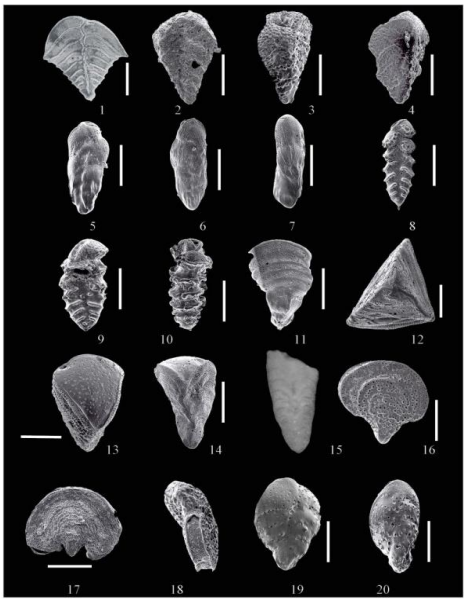


Plate V

1-Fissurina lacunata BURROWS and HOLLAND, side view, Scale bar= 155µm., 2- *Fissurina lacunata* BURROWS and HOLLAND, edge view, Scale bar= 145µm., 3- *Fissurina* sp., side view, Scale bar= 115µm., 4- *Palliolatella bradii* SILVESTRI, edge view, Scale bar= 180µm., 5- *Palliolatella* sp., side view, Scale bar= 160µm., 6- *Palliolatella* sp., side view, Scale bar= 160µm., 7- *Globorotalia mendardii* Parker, JONES and BRADY, spiral side, Scale bar= 290µm., 8- *Globorotalia mendardii* Parker, JONES and BRADY, umbilical view, Scale bar= 265µm., 9- *Globorotalia mendardii* Parker, JONES and BRADY, apertural view, Scale bar= 220µm., 10- *Globigerinita* sp., spiral side, Scale bar= 130µm., 11- *Globigerinita* sp., umbilical view, Scale bar= 128µm., 12- *Globigerina bulloides* D'ORBIGNY, spiral side, Scale bar= 100µm., 13- *Globigerina bulloides* D'ORBIGNY, apertural view, Scale bar= 100µm., 13- *Globigerina bulloides* D'ORBIGNY, apertural view, Scale bar= 100µm., 14- *Globigerinoides rubber* D'ORBIGNY, spiral side, Scale bar= 190µm., 15- *Globigerinoides sacculifer* BRADY, aperture view, Scale bar= 290µm., 15- *Globigerinoides sacculifer* BRADY, edge view, Scale bar= 275µm., 16- *Bolivina pseudopunctata* HÖGLUND, side view, Scale bar= 200µm., 17- *Bolivina pseudopunctata* HÖGLUND, side view, Scale bar= 100µm., 18- *Bolivina seminuda* Cushman, edge view, Scale bar= 100µm, 19-20, side views, Scale bar= 100µm.

Plate VI

1-Bolivinella folia PARKER and JONES, Side View, scale bar= 100µm., 2- *Abditodentrix rhomboidalis* MILLETT, side view, Scale bar= 130µm., 3- *Abditodentrix rhomboidalis* MILLETT, apertural view, Scale bar = 120µm., 4- *Abditodentrix rhomboidalis* MILLETT, edge view, Scale bar= 140µm., 5- *Loxostomina limbata* BRADY, side view, Scale bar = 215µm., 6- *Loxostomina limbata* BRADY, side view, Scale bar = 290µm., 7- *Loxostomina limbata* BRADY, side view, Scale bar= 190µm., 8- *Sagrinella lobata* BRADY, side view, Scale bar=165µm., 9- *Sagrinella lobata* BRADY, side view, Scale bar= 175µm., 10- *Sagrinella lobata* BRADY, side view, Scale bar= 190µm., 11- *Chrysalidinella dimorpha* BRADY, side view, Scale bar= 255 µm., 12- *Chrysalidinella dimorpha* BRADY, side view, Scale bar = 180 µm., 13- *Chrysalidinella dimorpha* BRADY, apertural view, Scale bar = 190 µm., 14- *Chrysalidinella dimorpha* BRADY, edge view, Scale bar = 355 µm., 15- *Chrysalidina pacific* UCHIO, side view, *x60, 16- Pavonina flabelliformis* D'ORBIGNY, side view, Scale bar = 225µm., 17- *Pavonina flabelliformis* D'ORBIGNY, side view, Scale bar= 420µm., 18- *Pavonina flabelliformis* D'ORBIGNY, apertural view, Scale bar= 210µm., 19- *Sigmavirgulina tortuosa* BRADY, side view, Scale bar= 155µm., 20- *Sigmavirgulina tortuosa* BRADY, side view, Scale bar = 165µm.

Remarks: This species was recorded from different regions such as European waters and Mediterranean Sea. In this study, *Abditodentrix rhomboidalis* Millett was found as a rare form in samples SQB3, SQB12 and SQB13 (Table 1).

Superfamily: Buliminacea JONES, 1875
Family: Siphogenerinoididae SAIDOVA, 1981
Subfamily: Siphogenerinoidinae SAIDOVA, 1981
Genus: *Loxostomina* SELLIER DE CIVRIEUX, 1969
Loxostomina limbata BRADY, 1881
Pl. VI, Figs. 6-7

Remarks: This species was recorded from beach sands along Saurashtra coast in north-west India (Rao and Srinath, 2002) and East Coast of India (Gandhi *et al*., 2002). In this study, this species was found as a frequent form in samples SQB10 and SQB12 and as a rare form in samples SQB3 and SQB13 (Table 1).

Genus: *Sagrinella* SAIDOVA, 1975
Sagrinella lobata BRADY, 1881
Pl. VI, Figs. 8-10.

Remarks: In Yemen, El-Nakhal, 1984 recorded this species from Salif area. In this study, *Sagrinella lobata* Brady was distinguished as an abundant form in sample SQB12, as a frequent form in sample SQB13 and as a rare form in samples SQB14 and SQB25 (Table 1).

Family: Reusseeidae CUSHMAN, 1933
Subfamily: Angulogerininae GALLOWAY, 1933
Genus: *Chrysalidinella* SCHUBERT, 1908
Chrysalidinella dimorpha BRADY, 1881
Pl. VI, Figs. 11-14.

Remarks: This species was recorded from southern Thailand (Jumnongthai, 1980). In this study, this species was recorded as an abundant form in samples SQB25 and SQB26 and as a rare form in samples SQB13 and SWQ2 (Table 1).

Chrysalidina pacific UCHIO, 1952
Pl. VI, Fig. 15.

Remarks: : *Chrysalidina pacific* Uchio seems as *Chrysalidinella dimorpha* Brady, 1881, but it is taller. In this study, it was recorded in samples SQB25 and SQB26 as a rare form (Table 1).

Family: Pavoninidae EIMER and FICKERT, 1899
Genus: *Pavonina* D'ORBIGNY, 1826
Pavonina flabelliformis D'ORBIGNY, 1826
Pl. VI, Figs. 16- 18.

Remarks: In this study, *Pavonina flabelliformis* D'Orbigny was recorded as an abundant form in samples SQB25 and SQB26 (Table 1).

Superfamily: Fursenkoinacea LOEBLICH and TAPPAN, 1961
Family: Fursenkoinidae LOEBLICH and TAPPAN, 1961
Genus: *Sigmavirgulina* LOEBLICH and TAPPAN, 1957
Sigmavirgulina tortuosa BRADY, 1881
Pl. VI, Figs. 19-20 and Pl. VII, Figs. 1-2.

Remarks: This species was recorded from Florida (Buzas and Severin, 1982), Maldives Ridg in south eastern Arabian Sea (Sarkar *et al*., 2009). In Yemen, it was recorded by El-Nakhal, 1993 from Hudaydah, Mukha and Zabeed Sea shores. In this study, it was found

frequently from samples SQB3, SQB12 and SQB25 and a rare form in samples SQB13 and SQB14 (Table 1).

Superfamily: Discorbacea EHRENBERG, 1838
Family: Eponididae HOFKER, 1951
Subfamily: Eponidinae HOFKER, 1951
Genus: *Eponides* DE MONTFORT, 1808
Eponides cribrorepandus ASANO and UCHIO, 1951
Pl. VII, Figs. 3-4.

Remarks: In initial stages, this species is trochospiral. The aperture extends from the umbilicus to the outer edge on the umbilical side and may be cribrate (Nobes and Uthicke, 2008). In this study, it was found as a frequent form in samples SQB25 and SQB26 and as a rare form in samples SQB1, SQB2 and SQB13 (Table 1).

Eponides repandus FICHTEL and MOLL, 1798
Pl. VII, Fig. 5.

Remarks: It was recorded from different regions such as southern Thailand (Jumnongthai, 1980), Florida (Buzas and Severin, 1982), beach sands along Saurashtra coast in north-west India (Rao and Srinath, 2002) and from Indian coast (Devi and Rajashekhar,2009). In this study, it was recorded as a common form in sample SQB25 and as a rare form in samples SQB5 and SQB13 (Table 1).

Family: Pegidiidae HORN-ALLEN and EARLAND, 1928
Genus: *Neoeponides* REISS, 1960
Neoeponides schreibersii D'ORBIGNY, 1846
Pl. VII, Figs. 6-7.

Remarks: In this study, this species was distinguished as a common form in sample SQB13, as a frequent form in samples SQB20, SQB26 and SWQ2 and as a rare form in samples SQB2, SQB14 and SQB25 (Table 1).

Genus: *Schaferina* MC CULLOCH, 1977
Schaferina annamaryae MC CULLOCH, 1977
Pl. 7, Fig. 8.

Remarks: In this study, *Schaferina annamaryae* McCulloch was recorded as a rare form in samples SQB3, SQB25, SQB26 and SWQ2 (Table 1).

Family: Rosalinidae REISS, 1963
Genus: *Rosalina* D'ORBIGNY, 1826
Rosalina bradyi CUSHMAN, 1915
Pl. VII, Figs. 9-13.

Remarks: This species was recorded in several regions such as France (Debenay *et al*., 2001), Marmara Sea (Kaminski *et al*., 2002), Australia marines (Nobes and Uthicke, 2008), Turkey (Meriç *et al*., 2009), and Indian coast (Devi and Rajashekhar, 2009). In this study, this species was found as an abundant form im samples SQB25 and SQB26, as a common form in sample SQB3, as a frequent form in sample SQB10 and as a rare form in samples SQB12 and SWQ2 (Table 1).

Superfamily: Glabratellacea LOEBLICH and TAPPAN, 1964
Family: Glabratellidae LOEBLICH and TAPPAN, 1964
Genus: *Discorbinoides* SAIDOVA, 1975
Discorbinoides minogasiformis UJIIÉ, 1992
Pl. VII, Figs.14-17.

Remarks: In this study, this species was occurred as an abundant form in samples SQB13, SQB25 and SQB26 and as a rare form in samples SQB20 and SWQ2 (Table 1).

Family: Buliminoididae SEIGLIE, 1970

Genus: *Buliminoides* CUSHMAN, 1911

Buliminoides williamsoniana BRADY, 1881

Pl. VII, Fig. 18.

Remarks: It was recorded from Maldives Ridge in south eastern Arabian Sea (Sarkar *et al*., 2009). In this study, this species was found as a rare form in sample SQB26 (Table 1).

Superfamily: Siphoninacea CUSHMAN, 1927

Family: Siphoninidae CUSHMAN, 1927

Subfamily: Siphoninoidinae LOEBLICH and TAPPAN, 1984

Genus: *Siphoninoides* CUSHMAN. 1927

Siphoninoides cf. *laevigatus* HOWCHIN, 1889

Pl. VII, Fig. 19.

Remarks: In this study, this species was found as abundant form in samples SQB25 and SQB26 (Table 1).

Siphoninoides echinatus BRADY, 1879

Pl. VII, Fig. 20 and Pl. 8, Figs.1- 2.

Remarks: This species was recorded from Yemen (Hudaydah, Salif, Zabeed and Mukha) by El-Nakhal, 1993. In this study, *Siphoninoides echinatus* Brady was found as abundant form in samples SQB25 and SQB26 and as a rare form in samples SQB13 and SWQ2 (Table 1).

Siphoninoides sp.

Pl. IIX, Figs. 3-4.

Description: Test sub-globular, irregularly trochospiral; periphery sub-lobulate, sub-rounded; wall calcareous, hyaline, thin in the early stage, later much thickened and coarsely perforate; surface pustulose; aperture elevated on a short neck, rounded.

Remarks: In this study, this species was occurred as a common form in samples SQB25 and SQB26 (Table 1).

Family: Cibicididae CUSHMAN, 1927

Subfamily: Cibicidinae CUSHMAN, 1927

Genus: *Cibicides* DE MONTFORT, 1808

Cibicides refulgens MONTFORT, 1808

Pl. IIX, Fig. 5-8.

Remarks: *Cibicides refulgens* Montfort, 1808 was recorded from different regions such as France (Debenay *et al*., 2001), Marmara Sea (Kaminski *et al*., 2002), beach sands along Saurashtra coast in north-west India (Rao and Srinath, 2002), Hebridean Shelf in west of Scotland (Murray, 2003), Maldives Ridge in south eastern Arabian Sea (Sarkar *et al*., 2009), Indian coast (Devi and Rajashekhar, 2009), and Mediterranean Sea in Italy (Dias *et al*., 2010). In this study, It was found as an abundant form in samples SQB13, SQB25, SQB26 and SWQ2, as a common form in sample SQB20, as a frequent form in sample SQB1 and as a rare form in samples SQB2, SQB10, SQB12, SQB19 and SQB24 (Table 1).

Genus: *Montfortella* LOEBLICH and TAPPAN, 1963

Montfortella bramlettei LOEBLICH and TAPPAN, 1963

Pl. IIX, Fig. 9.

Remarks: In this study, this species was found as a rare form in samples SQB25, SQB6, SQB27 and SWQ2 (Table 1).

Plate VII

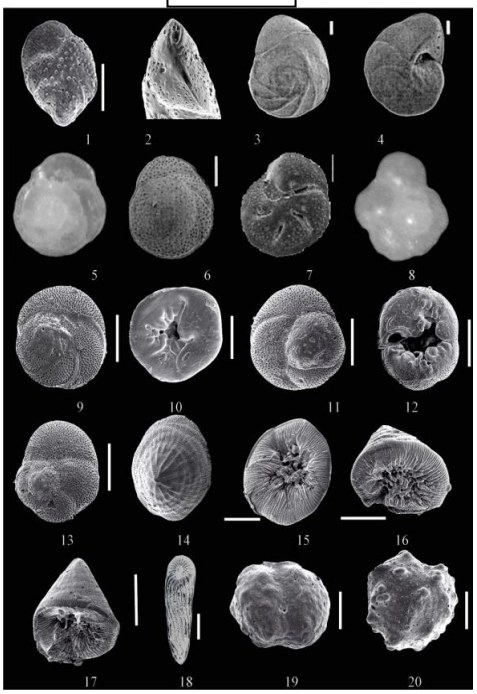


Plate VII

1- *Sigmavirgulina tortuosa* Brady, side view, scale bar 115µm., 2- *Sigmavirgulina tortuosa* Brady, apertural view, scale bar 135µm., 3- *Eponides cribrorepandus* Asano and Uchio, spiral view, scale bar 100µm., *4- Eponides cribrorepandus* Asano and Uchio, umbilical view, scale bar 100µm., 5- *Eponides repandus* Fichtel and Moll, spiral view, X*60.*, 6- *Neoeponides schreibersii* D'orbigny, spiral view, scale bar 100µm., 7- *Neoeponides schreibersii* D'orbigny, umbilical view, scale bar 100µm., 8- *Schaferina annamaryae* Mc Culloch, spiral view, X60., 9- *Rosalina bradyi* Cushman, spiral view, scale bar 130µm., 10- *Rosalina bradyi* Cushman, umbilical view, scale bar 135µm., 11- *Rosalina bradyi* Cushman, spiral view, scale bar 170µm., 12- *Rosalina bradyi* Cushman, umbilical view, scale bar 185µm., 13- *Rosalina bradyi* Cushman, spiral view, scale bar 215µm., 14- *Discorbinoides minogasiformis* Ujiié, spiral view, scale bar 145µm., 15- *Discorbinoides minogasiformis* Ujiié, umbilical view, scale bar 140µm., 16- *Discorbinoides minogasiformis* Ujiié, side view, scale bar 135µm., 17- *Discorbinoides minogasiformis* Ujiié, scale bar 160µm., 18- *Buliminoides williamsoniana* Brady, apertural view, scale bar 100µm., 19- *Siphoninoides* cf. *laevigatus* Howchin, scale bar 155µm. and 20- *Siphoninoides echinatus* Brady, scale bar 125µm.

Plate IIX

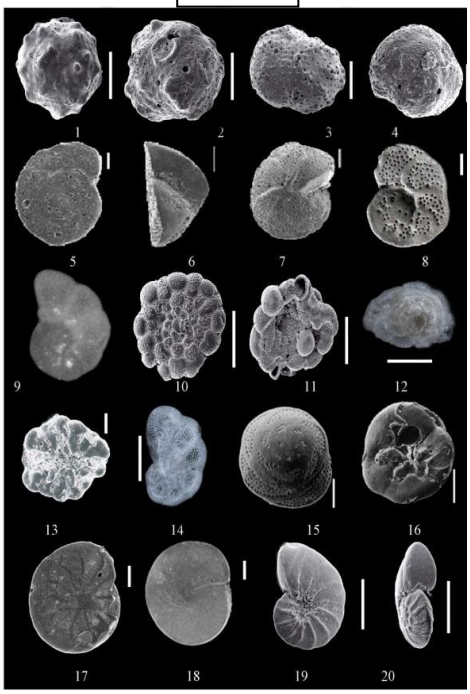


Plate IIX

1- *Siphoninoides echinatus* Brady, side view, scale bar 160µm., 2- *Siphoninoides echinatus* Brady, side view, scale bar 123µm., 3- *Siphoninoides* sp., side view, scale bar 120µm., 4- *Siphoninoides* sp., side view, scale bar 120µm., 5- *Cibicides refulgens* Montfort, spiral view, scale bar 100µm., 6- *Cibicides refulgens* Montfort, edge view, scale bar 100µm., 7- *Cibicides refulgens* Montfort, spiral view, scale bar 100µm., 8- *Cibicides refulgens* Montfort, spiral view, scale bar 100µm., 9- *Montfortella bramlettei* Loeblich and Tappan, spiral view, X60., 10- *Planorbulina mediterranensis* D'orbigny, spiral view, scale bar 435µm., 11- *Planorbulina mediterranensis* D'orbigny, umbilical view, scale bar 380µm., 12- *Cymbaloporella tabellaeformis* Brady, spiral view, scale bar 320µm., 13- *Cymbaloporella tabellaeformis* Brady, apertural view, scale bar 100µm., 14- *Epistomaroides punctulatus* Parker and Jones, spiral view, scale bar 230µm., 15- *Asterigerinata mamila* Williamson, spiral view , scale bar 50µm., 16- *Asterigerinata mamila* Williamson, umbilical view, scale bar 50µm., 17- *Amphistegina vulgaris* D'orbigny, spiral view, scale bar 100µm., 18- *Amphistegina radiata* Fichtel and Moll, spiral view, scale bar 100µm., 19- *Nonion tennerbankense* Mc Culioch, spiral view, scale bar 220µm. and 20- *Nonion tennerbankense* Mc Culioch, edge view, apertural view, scale bar 205µm.

Family: Planorbulinidae SCHWAGER, 1877
Subfamily: Planorbuliniae SCHWAGER, 1877
Genus: *Planorbulina* D'ORBIGNY, 1826
Planorbulina mediterranensis D'ORBIGNY, 1826
Pl. IIX, Figs. 10-11.

Remarks: this species was recorded indifferent regions such as Florida (Buzas and Severin, 1982), France (Debenay *et al*., 2001), Marmara Sea (Kaminski *et al*., 2002), Guadiana Shelf in southwestern Iberia (Mendes *et al*., 2004) and from Mediterranean Sea in Italy (Dias *et al*., 2010). In Yemen, *Planorbulina mediterranensis* D'Orbigny was recorded from Hudaydah, Salif and Zabeed Sea shore by El-Nakhal, 1993. In this study, this species was identified as a rare form in samples SQB25 and SQB26 (Table 1).

Family: Cymaloporidae CUSHMAN, 1927
Subfamily: Cymbaloporinae CUSHMAN, 1927
Genus: *Cymbaloporella* CUSHMAN, 1927
Cymbaloporella tabellaeformis BRADY, 1884
Pl. IIX, Figs. 12-13.

Remarks: This species was identified from Maldives Ridge in south eastern Arabian Sea (Sarkar *et al*., 2009). In this study, this species was found as abundant form in sample SQB3 and as a rare form in sample SQB13 (Table 1).

Superfamily: Asterigerinacea D'ORBIGNY, 1839
Family: Alfredinidae S. N. SINGH and KALI, 1972
Genus: *Epistomaroides* UCHIO, 1952
Epistomaroides punctulatus PARKER and JONES, 1865
Pl. IIX, Fig. 14.

Remarks: In this study, *Epistomaroides punctulatus* Parker and Jones was found as rare form in samples SQB25, SQB26, SQB27 and SWQ2 (Table 1).

Family: Asterigerinidae D'ORBIGNY, 1839
Genus: *Asterigerina* D'ORBIGNY, 1839
Asterigerinata mamila WILLIAMSON, 1858
Pl. IIX, Figs. 15-16.

Remarks: This species was recorded in different regions such as France (Debenay *et al*., 2001), Marmara Sea (Kaminski *et al*., 2002),Guadiana Shelf in southwestern Iberia (Mendes *et al*., 2004) and Turkey (Meriç *et al*., 2009). In this study, this species was found as a common form in sample SQB13 and as a rare form in samples SQB12 and SWQ2 (Table 1).

Family: Amphisteginidae D'ORBIGNY, 1839
Genus: *Amphisteginida* D'ORBIGNY, 1826
Amphistegina vulgaris D'ORBIGNY, 1839
Pl. IIX, Fig. 17.

Remarks: *Amphistegina vulgaris* D'Orbigny was recorded as a frequent form in samples SQB22 and SQB25, and as a rare form in samples SQB2, SQB26 and SWQ2 (Table 1).

Amphistegina radiata FICHTEL and MOLL, 1798
Pl. IIX, Fig. 18.

Remarks: It was recorded from different regions such as beach sands along Saurashtra coast in north-west India (Rao and Srinath, 2002), East Coast of India (Gandhi *et al*., 2002) and Indian coast (Devi and Rajashekhar, 2009). In this study, the present species was found as an abundant form in samples SQB2, SQB23, SQB26 and SQB27, as a common form in

samples SQB20 and SWQ2, as a frequent form in sample SQB1and SQB7 and as a rare form in samples SQB4, SQB8, SQB13, SQB14, SQB22 and SQB25 (Table 1).

Superfamily: Nonionacea SCHULTZ, 1854
Family: Nonionidae SCHULTZ, 1854
Subfamily: Nonioninae SCHULTZ, 1854
Genus: *Nonion* DE MONTFORT, 1808
Nonion tennerbankense MC CULIOCH, 1977
Pl. IIX, Figs. 19-20.

Remarks: In this study, *Nonion tennerbankense* was found as a rare form in samples SQB1, SQB2, SQB13, SQB25 and SQB26 (Table 1).

Superfamily: Rotaliacea EHRENBERG, 1839
Family: Rotaliidae EHRENBERG, 1839
Subfamily: Pararotaliinae EHRENBERG, 1839
Genus*: Pararotalla* Y. LE CALVEZ, 1949
Pararotalia calcar D'ORBIGNY, 1839
Pl. IX, Figs. 1-3.

Remarks: *Pararotalia calcar* D'orbigny was recorded in East Coast of India (Gandhi *et al*., 2002). In this study, this form was found as an abundant form in samples SQB25 and SQB26 and as a rare form in samples SQB2, SQB19, SQB23 and SWQ2 (Table 1).

Pararotalia sp. NOBES and UTHICKE, 2008
Pl. IX, Figs. 4-5.

Remarks: *Pararotalia sp*. was recorded in Australia marines by (Nobes and Uthicke, 2008). In this study, It was found as abundant form in samples SQB25 and SQB26 and as a rare form in samples SQB 12 and SQB13 (Table 1).

Subfamily: Ammoniinae SAIDOVA, 1981
Genus: *Ammonia* BRÜNNICH, 1772
Ammonia beccarii CUSHMAN, 1926
Pl. IX, Figs. 6-7.

Remarks: *Ammonia beccarii* Cushman, was recorded from different regions such as southern Thailand (Jumnongthai, 1980), Florida (Buzas and Severin, 1982), France (Debenay *et al*., 2001), beach sands along Saurashtra coast in north-west India (Rao and Srinath, 2002), East Coast of India (Gandhi *et al*., 2002), Marmara Sea (Kaminski *et al*., 2002), Western Australia (Glover *et al.*, 2003), and from Guadiana Shelf in southwestern Iberia (Mendes *et al*., 2004). In Yemen, *Ammonia beccarii* Cushman was recorded as an abundance form in Hudaydah, Mukha Salif and Zabeed Sea shores by El-Nakhal, 1993. In this study, this species was found as abundant form in samples SQB2, SQB10, SQB12, SQB25, SQB26, SWQ1 and SWQ2, as a common form in sample SQB20, as a frequent form in samples SQB1, SQB11, SQB16 and SQB22 and as a rare form in samples SQB13, SQB17, SQB19 and SQB24 (Table 1).

Ammonia convexa NOBES and UTHICKE, 2008
Pl. IX, Figs. 8-9.

Remarks: This species was recorded in Australia marines (Glover *et al.,* 2003) and (Nobes and Uthicke, 2008). In this study, this species was found as abundant form in samples SQB10, SQB12, SQB25, SQB26, SWQ1 and SWQ2 (Table 1).

Family: Calcarinidae SCHWAGER, 1876
Genus: *Elphidiella* CUSHMAN, 1936
Elphidium macellum FICHTEL and MOLL, 1798

Pl. IX, Figs. 10-11.

Remarks: This species was recorded from different regions such as Island of Laesø in Denmark (Michelsen, 1967), Marmara Sea (Kaminski *et al*., 2002), Maldives Ridge in south eastern Arabian Sea (Sarkar *et al*., 2009), Indian coast (Devi and Rajashekhar, 2009) and from Turkey (Meriç *et al*., 2009). In this study, *Elphidium macellum* Fichtel and Moll was found as an abundant form in samples SQB25, SQB26 and SWQ2, as a common form in sample SQB2 and as a frequent form in samples SQB1, SQB13, SQB14, SQB20 and SQB23 (Table 1).

Elphidium gerthi VAN VOORTHUYSEN, 1957

Pl. IX, Figs. 12-13.

Remarks: this species was recorded in Island of Laesø in Denmark (Michelsen, 1967). In this study, *Elphidium gerthi* Van Voorthuysen was found as an abundant form in samples SQB26 and SWQ2, as a common form in sample SQB25, as a frequent form in sample SQB12 and as a rare form in samples SQB1, SQB2, SQB3, SQB13 and SQB19 (Table 1).

Elphidium jenseni CUSHMAN, 1924

Pl. IX, Figs. 14-15.

Remarks: This species was recorded from different regions such as Marmara Sea (Kaminski *et al*., 2002) and Indian coast (Devi and Rajashekhar, 2009). In this study, it was found as a common form in sample SQB25, as a frequent form in samples SQB3 and SQB26 and as a rare form in samples SQB2, SQB8, SQB12, SQB13 and SWQ2 (Table 1).

Plate IX

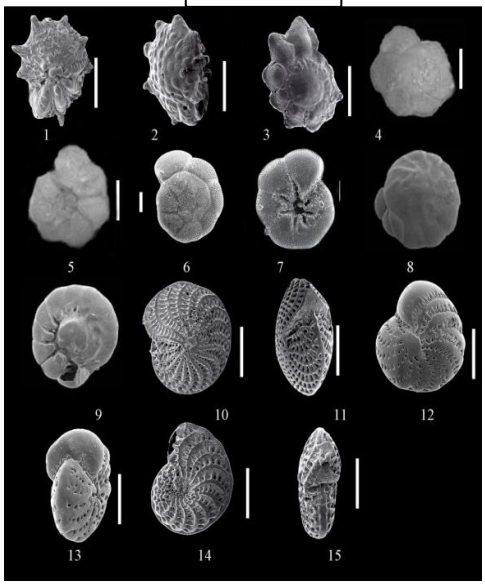


Plate IX

1- *Pararotalia calcar* D'orbigny, scale bar 265µm., 2- *Pararotalia calcar* D'orbigny, edge view, scale bar 235µm., 3- *Pararotalia calcar* D'orbigny, spiral view, scale bar 340µm., 4- *Pararotalia* sp. spiral view, X60, 5- *Pararotalia* sp. umbilical view, X60., 6- *Ammonia beccarii* Cushman, spiral view , Scale bar 100µm., 7- *Ammonia beccarii* Cushman, apertural view, Scale bar 100µm., 8- *Ammonia convexa* Nobes and Uthicke, spiral view, Scale bar 100mm., 9- *Ammonia convexa* Nobes and Uthicke, apertural view, Scale bar 100mm., 10- *Elphidium macellum* Fichtel and Moll, spiral view, scale bar 305µm., 11- *Elphidium macellum* Fichtel and Moll, edge view, apertural view, scale bar 280µm., 12- *Elphidium gerthi* Van Voorthuysen, spiral view, scale bar 300µm., 13- *Elphidium gerthi* Van Voorthuysen, edge view, apertural view , scale bar 260µm., 14- *Elphidium jenseni* Cushman, spiral view, scale bar 285µm., 15- *Elphidium jenseni* Cushman, edge view, apertural view, scale bar 220µm.

Table 1: Distribution of recorded foraminiferal species in collected samples

NO	Recorded Species	SAMPLES																								
		SQB1	SQB2	SQB3	SQB4	SQB5	SQB6	SQB7	SQB8	SQB9	SQB10	SQB11	SQB12	SQB13	SQB14	SQB16	SQB17	SQB19	SQB20	SQB22	SQB23	SQB24	SQB25	SQB26	SWQ1	SWQ2
1	*Martinottiella communis*												R													
2	*Martinottiella* sp.												R													
3	*Textularia agglutinans*	R		R														R					C	A		
4	*Textularia conica*	R	R	F										F				R	R	R			A	A		F
5	*Textularia foliacea*			R																			F	A		
6	*Sejunctella sp.*																						R	R		
7	*Vertebralina striata*			R										R									F	R		
8	*Spiroloculina depressa*			R										R									R	R		
9	*Spiroloculina laevigata*																						R			
10	*Spiroloculina ornate*												R										R			
11	*Spiroloculina aequa*																						R	R		
12	*Spiroloculina* sp.												R											R		
13	*Hauerina bradyi*			R										R									A	A		
14	*Massilina granulocostata*			R																			F	F		
15	*Quinqueloculina flavescens*		R																F				A			
16	*Quinqueloculina poeyana*										A		F												F	R
17	*Quinqueloculina parkeri*	R			R																				F	F
18	*Quinqueloculina subdecorata*																								R	
19	*Quinqueloculina* sp.			F														R						C		
20	*Biloculina labiata*			R																			F	C		R
21	*Triloculina trihedra*	C		F									R	C									R	A	R	A
22	*Triloculina longidentata*													R	R						R		C	A		
23	*Triloculina mindenensis*			F										F												A
24	*Triloculina oblonga*	R		F									A		F			R					F			
25	*Triloculina peroblonga*			C										C	R								C	F		
26	*Triloculina quadrata*			C										R				R					F	F		

27	*Triloculina bertheliana*		R																		F			
28	*Triloculina* sp.																				R			
29	*Articulina antillarum*			R																				
30	*Articulina carinata*																				F	R		
31	*Coscinospira hemprichii*	R																						R
32	*Peneroplis planatus*	R	F										R				R				R	F		
33	*Peneroplis pertusus*	R	F		R			F	R				A	R			R				A	R		
34	*Sorites orbiculus*		F																		A	A		R
35	*Dentalina inornata*																					R		
36	*Amphimorphina butonensis*																				R			
37	*Amphicoryna* sp.																				R			
38	*Procerolagena clavata*																				R			
39	*Pseudopolymorphina hanzawai*			R									R											
40	*Sigmoidella elegantissima*																				F	F		
41	*Oolina* sp.																				R			
42	*Fissurina lacunata*																				F	R		
43	*Fissurina* sp.																				F	R		
44	*Palliolatella bradii*												R	F							A	C		
45	*Palliolatella* sp.																				R	R		
46	*Globorotalia mendardii*			F									R								F	A		R
47	*Globigerinita* sp.													F							F			
48	*Globigerina bulloides*			C																	C	F		F
49	*Globigerinoides rubber*			C																	R	C		F
50	*Globigerinoides sacculifer*	R		F																	A	A		C
51	*Bolivina pseudopunctata*	R		F									F								A	A		C
52	*Bolivina seminuda*			F				F	F	R	A										F	R		
53	*Bolivinella folia*																				R	R		
54	*Abditodentrix rhomboidalis*			R									R	R										
55	*Loxostomina limbata*			R							F		F	R										

56	*Sagrinella lobata*											A	F	R							R			
57	*Chrysalidinella dimorpha*												R								A	A		R
58	Chrysalidina pacific																				R	R		
59	*Pavonina flabelliformis*																				A	A		
60	*Sigmavirgulina tortuosa*			F								F	R	R							F			
61	*Eponides cribrorepandus*	R	R										R								F	F		
62	*Eponides repandus*					R							R								C			
63	*Neoeponides schreibersii*		R										C	R				F			R	F		F
64	*Schaferina annamaryae*			R																	R	R		R
65	*Rosalina bradyi*			C						F		R									A	A		R
66	*Discorbinoides minogasiformis*												A					R			A	A		R
67	*Bulimina williamsoniana*																					R		
68	*Siphoninoides* cf. *laevigatus*																				A	A		
69	*Siphoninoides echinatus*												R								A	A		R
70	*Siphoninoides* sp.																				C	C		
71	*Cibicides refulgens*	F	R							R		R	A				R	C		R	A	A		A
72	*Montfortella bramlettei*																				R	R		R
73	*Planorbulina mediterranensis*																				R	R		
74	*Cymbaloporella tabellaeformis*			A									R											
75	*Epistomaroides punctulatus*																				R	R		R
76	*Asterigerinata dominicana*											R	C											R
77	*Amphistegina vulgaris*		R																F		F	R		R
78	*Amphistegina radiata*	F	A		R			F	R				R	R				C	R	A	R	A		C
79	*Nonion tennerbankense*	R	R										R								R	R		
80	*Pararotalia* sp.											R	R								A	A		
81	*Pararotalia calcar*		R														R			R	A	A		R
82	*Ammonia beccarii*	F	A							A	F	A	R		F	R	R	C	F		R	A	A	A	A
83	*Ammonia convexa*									A		A									A	A	A	A
84	*Elphidium macellum*	F	C										F	F				F		F	A	A		A
85	*Elphidium gerthi*	R	R	R								F	R				R				C	A		A
86	*Elphidium jenseni*		R	F					R			R	R								C	F		R

R=Rare: 1-5, F=Frequent: 6-15, C=Common: 16-25, A=Abundant: over 25 specimens.

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مثقبات حديثة من جزيرة سقطرى، المحيط الهندي، اليمن

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ملخص

تم استخلاص 68 نوعا من أنواع الفورامنيفرا من خمس وعشرين رملية جمعت من شواطيء الشريط الساحلي الشمالي لجزيرة سقطرى. هذه الأنواع تتبع في تصنيفها لـ 52 جنسا، 22 تحت عائلة، 35 عائلة، 16 فوق عائلة و 6 تحت رتبة.

تم مناقشة الوضع التصنيفي لهذه الأنواع كما تمت مقارنة هذه الأنواع مع الأنواع النظامية لها ووصف الأنواع التي لم نتمكن من تعيين الوضع التصنيفي لها إلى مستوى النوع.