

## New Paleozoic – Mesozoic Foraminifera from Egypt-North East Africa

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**Abstract:** Eighteen new foraminiferal species have been recorded from the subsurface Lower Paleozoic – Mesozoic rocks in the north western part of the Egyptian Western Desert. These agglutinated species belong to eight genera and five families of the suborder Textulariina. Two of them were detected from the Ordovician, four from the Silurian and ten from the Devonian while the remaining two have been encountered from the Lower Jurassic and the Lower Cretaceous intervals. All of these species have been described, microphotographed and followed stratigraphically throughout the studied succession.

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**Key Words:** New species- Ordovician- Silurian- Devonian- Jurassic-Cretaceous

### 1. Introduction

The materials of the present foraminiferal species were separated from the Lower Paleozoic – Mesozoic deposits of Bahrein -1 well, which lies at the southwest of the Qattara Depression, Lat.28 48' 10"N. and Long.26 33'15'E (Fig.1). About 152 ditch samples from the studied well, were prepared for foraminiferal investigation (Fig.2). The foraminiferal content recorded in these samples were identified and used in biostratigraphic differentiation and age assignment of the Paleozoic- Mesozoic sediments in Bahrein-1 well (present authors, in press). Among the identified foraminifera, 18 species are believed to be unknown before (fig.2). After a wide survey in most available catalogues, text books and literatures as well as sites on the internet, these species have been described, photographed by using the Scan Electron Microscope (plates 1-2) and systematically arranged according to **Loeblich & Tappan 1988**.

The type slides of the described foraminifera are deposited in the Department of Geology, Zagazig University, Egypt. The figured specimens are stored under the numbers ZU- PM 1001 To ZU-Pm 1018

### Taxonomy

Phylum: **Protozoa**

Class: **Sarcodina**

Order: **Foraminiferida** Eichwald, 1830

Suborder: **Textulariina** Delage and Hérouard, 1896

Family: **Psammospaeridae** Haeckel, 1894

Subfamily: **Psammospaerinae** Haeckel, 1894

Genus: **Psammophax** Rhumbler, 1913

**Psammophax compressus** n.sp. (Plate1, Figs. a, b)

**Holotype:** Zu-PM 1001

**Type horizon:** Depth: 2397m. (Sample no. 109), Silurian.

**Type locality:** Bahrein-1 well, north Western Desert, Egypt.

**Derivation of the name:** From its compressed tests.

**Dimension:** Width: 0.15mm-Length: 0.5 mm

**Materials:** Five well preserved specimens

**Description:** Test free, small, compressed; consists of two subequal chambers; wall agglutinated, smooth, fine to medium grained, highly cemented; suture slightly depressed; no visible aperture.

**Occurrence:** Specimens of the present species have been recorded in the middle and the upper parts of the Silurian throughout the upper half of the Acacus Formation and the basal part of the Kohla Formation in Bahrein-1 well (Fig. 2).

**Remarks:** This species differs from *P. consociata* **Rhumbler (1913)** in its compressed tests.

**Psammophax egyptiacus** n.sp. (Plate1, Fig. 2)

**Holotype:** Zu-PM 1002

**Type horizon:** Depth: 2538m. (Sample no. 130), Ordovician.

**Type locality:** Bahrein-1 well, north Western Desert, Egypt.

**Derivation of the name:** After Egypt.

**Diameter:** 0.15 mm; Length: 0.4mm

**Materials:** Two well preserved specimens.

**Description:** Test free, of medium size; consists of two unequal globular chambers, the second last chamber arranged in a oblique position to the first one; suture slightly depressed; wall agglutinated, medium to coarse grained; surface rough, with some large prominent, projected, subrounded to subangular quartz grains; no visible aperture.

**Occurrence:** It is found in the upper half of the Ordovician succession within the Zeitoun Formation in Bahrein-1 well (Fig. 2).

**Remarks:** The present species is different from *P. consociata* Rhumbler (1913) and *P. compressus* n. sp. in its large prominent quartz grains and the oblique position of the second chamber.

*Psammophax globulatus* n.sp. (Plate1, Fig. 3)

**Holotype:** Zu-PM 1003

**Type horizon:** Depth: 1812m. (Sample no. 65), Devonian.

**Type locality:** Bahrein-1 well, north Western Desert, Egypt.

**Derivation of the name:** Owing to the globular shape of its chambers.

**Diameter:** 0.8mm

**Length:** 1.0 mm

**Materials:** Three well preserved specimens.

**Description:** Test free, large to medium in size; consists of two subequal or unequal, globular chambers arranged in a rectilinear series; suture depressed or flush; wall agglutinated, medium to coarse grained, surface roughly finished-no visible aperture.

**Occurrence:** It occurs in the lower part of the Devonian (lower part of Kohla Formation) in Bahrein-1 well (Fig. 2).

**Remarks:** The chambers of *P. globulatus* are more globular than those in *P. consociata* Rhumbler (1913) and the inflated test.

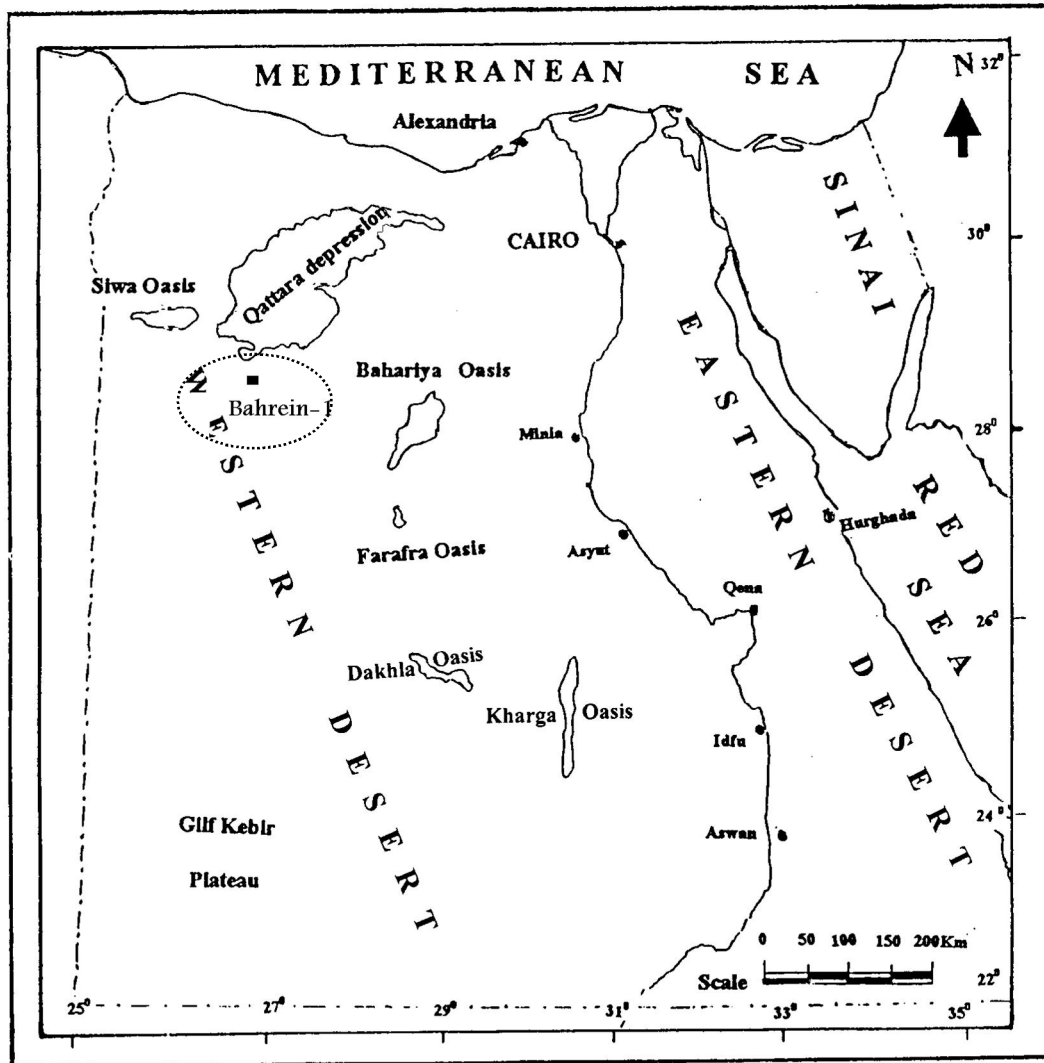


Figure (1): Location map of the studied Bahrein-1 Well

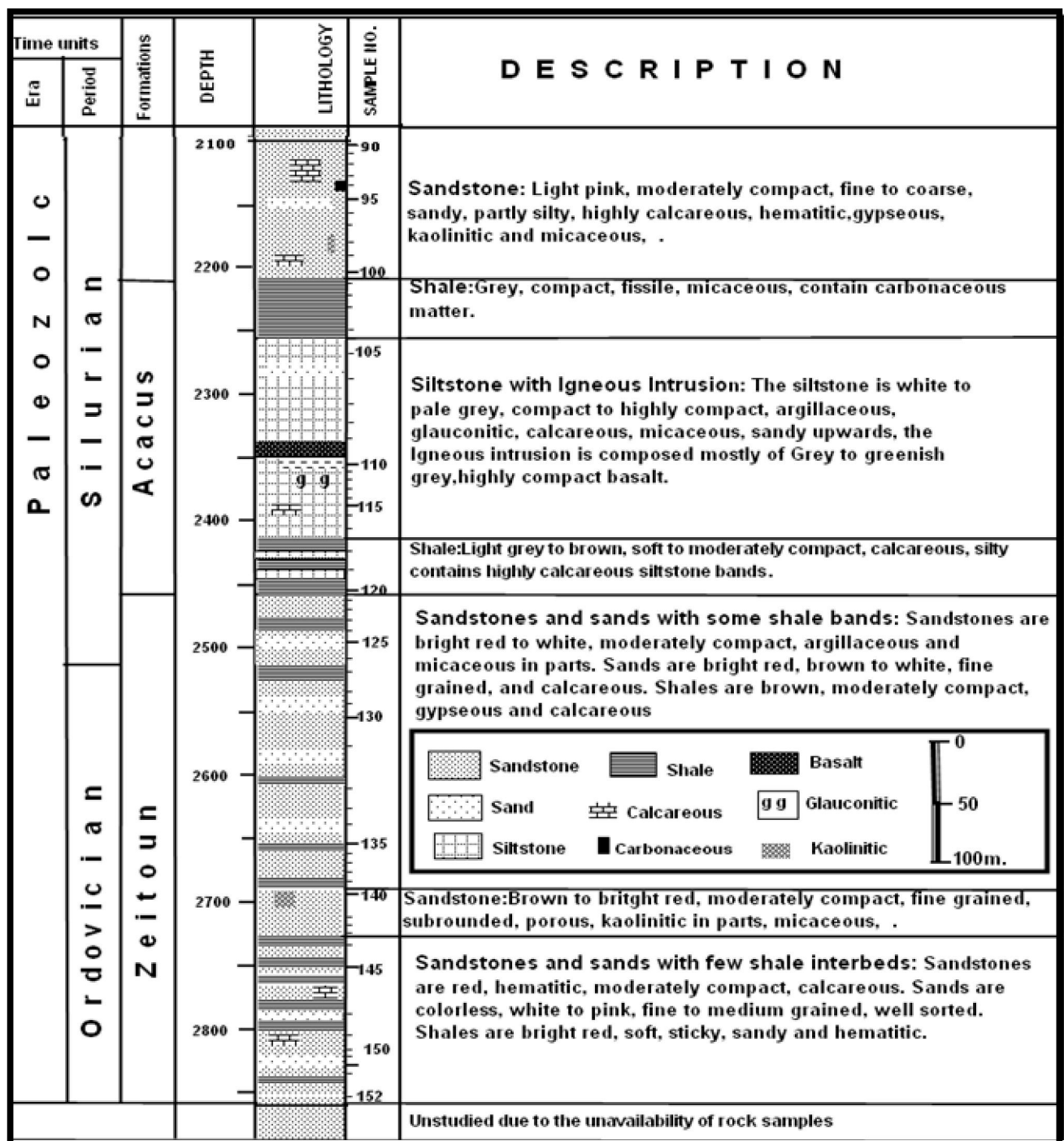


Figure (2): Lithostratigraphic succession of the studied Paleozoic rock units in Baharein-1 Well.

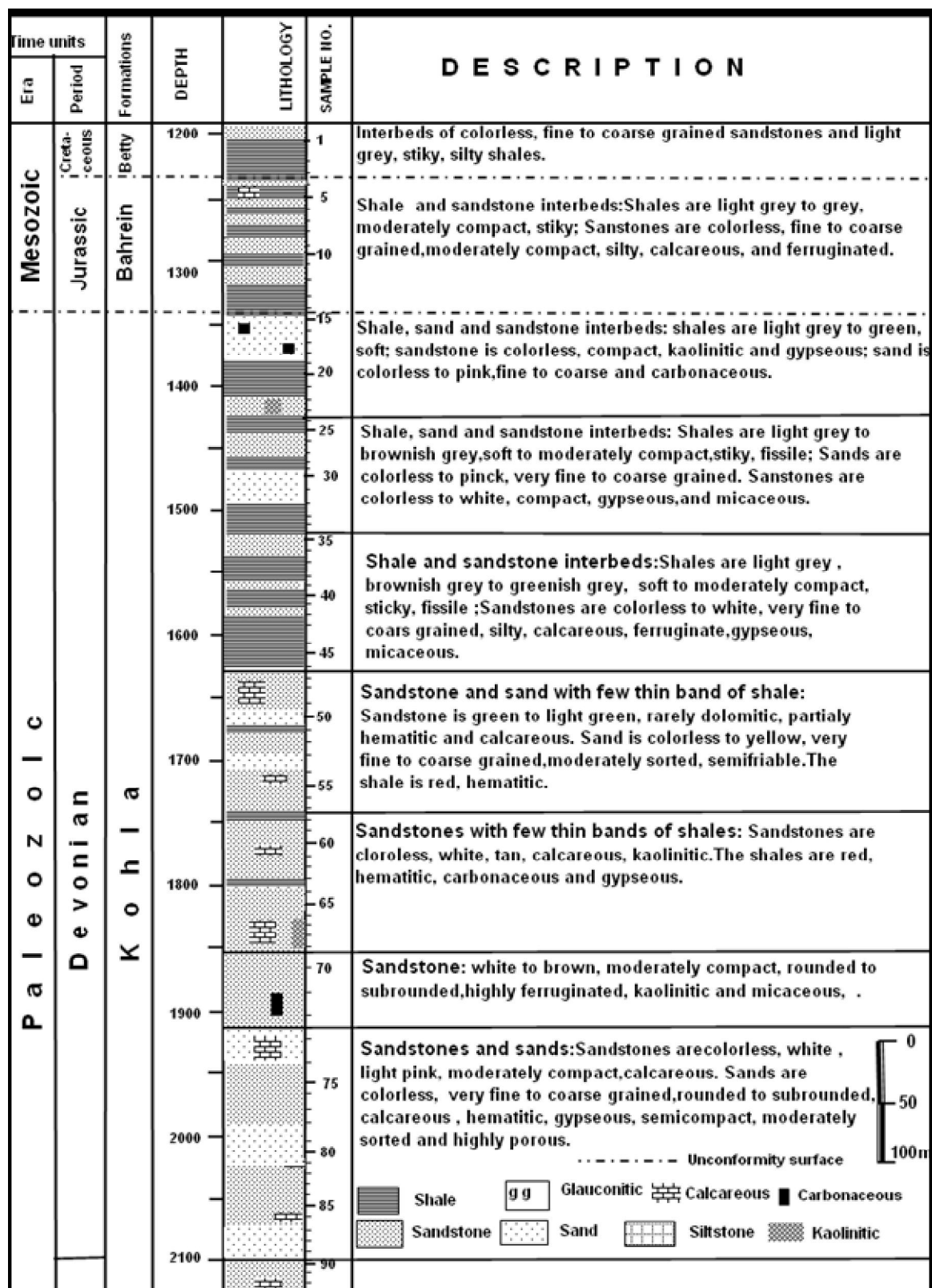


Figure (3): Lithostratigraphic succession of the studied Paleozoic- Mesozoic rock units in Bahrein-1 Well.



***Psammophax minutus* n.sp.**

(Plate1, Fig. 4)

**Holotype:** Zu-PM 1004**Type horizon:** Depth: 1524m. (Sample no. 35), Devonian.**Type locality:** Bahrein-1 well; north Western Desert, Egypt.**Derivation of the name:** Owing to its minute size.**Diameter:** 0.15mm. - **Length:** 0.30 mm.**Materials:** Three well preserved specimens.**Description:** Test free, minute in size; consists of two globular equal chambers, arranged in a rectilinear series; sutures depressed; wall agglutinated, surface roughly finished; no visible aperture.**Occurrence:** It is found in the upper part in the Devonian (upper part of Kohla Formation) in Bahrein-1 well (Fig. 2).**Remarks:** This species is characterized by the very small test sizes compared with those of other *Psammophax* species.***Psammophax quadratus* n.sp.**

(Plate1, Fig. 5)

**Holotype:** Zu-PM 1005**Type horizon:** Depth: 1569m (sample no. 40), Devonian.**Type locality:** Bahrein-1 well, north Western Desert, Egypt.**Derivation of the name:** Owing to its quadrate shape of chambers.**Diameter:** 0.2mm. - **Length:** 0.35 mm.**Materials:** Eight well preserved specimens.**Description:** Test free, medium in size; consists of two inflated, quadrate chambers, arranged in a rectilinear series; wall agglutinated, of medium grains; surface rough; sutures depressed; no visible aperture.**Occurrence:** It is recorded throughout the upper part of the Devonian (upper segment of Kohla Formation) in Bahrein-1 well (Fig. 2).**Remarks:** *P. quadratus* differs from the other *Psammophax* species in the quadrate shape of its chambers and the quadrate shape of the test.Family: **Saccamminidae Brady, 1881**Subfamily: **Saccamminidae Brady, 1881**Genus: **Saccammina Carpenter, 1869*****Saccammina globulata* n.sp.**

(Plate1, Figs. 6a, 6b)

**Holotype:** Zu, Zu-PM 1006**Type horizon:** Depth: 1644m. (Sample no.44), Devonian.**Type locality:** Bahrein-1 well, north Western Desert, Egypt.**Derivation of the name:** Owing to its globular shape.**Diameter:** 0.9: 1mm.**Materials:** Four well preserved specimens.**Description:** Test free, large in size; consists of a single globular chamber; wall dens, agglutinated, medium to fine grained, cancellate, highly cemented; aperture ovate, surrounded by a neck of moderate length.**Occurrence:** It is found in some samples spreading throughout the upper part of the Devonian of Bahrein-1 well (Fig. 2).**Remarks:** *Saccammina globulata* n.sp. differs from other *Saccammina* species in its comparatively large size and its ovate aperture which lies at the end of a moderate neck.***Saccammina granulata* n.sp.**

(Plate1, Fig. 7)

**Holotype:** Zu-PM 1007**Type horizon:** Depth: 1785m. (Sample 62), Devonian.**Type locality:** Bahrein-1 well, north Western Desert, Egypt.**Derivation of the name:** Owing to the granulate appearance of its surface.**Diameter:** 1 – 1.25mm.**Materials:** Eight well preserved specimens.**Description:** Test free, single globular chamber, moderately large in size; wall agglutinated, granular with coarse, elongate, angular to subangular, highly cemented grains; aperture ovate and flush.**Occurrence:** It is present in middle part of the Devonian succession (Kohla Formation) in Bahrein-1 well (Fig. 2).**Remarks:** The present species is characterized by its large size, coarse, elongate, and angular to subangular wall grains.***Saccammina polygona* n.sp.**

(Plate1, Figs. 8a, 8b)

**Holotype:** Zu-PM 1008**Type horizon:** Depth: 1326m. (Sample no.13), Lower Jurassic.**Type locality:** Bahrein-1 well, north Western Desert, Egypt.**Derivation of the name:** Owing to its polygonal shape.**Diameter:** 0.5 mm.**Materials:** Two well preserved specimens.**Description:** Test free, unilocular, medium in size, polygonal in outline; wall agglutinated, granular with coarse, angular, moderately cemented grains; aperture polygonal shape, wide and surrounded with thick lip.**Occurrence:** Its specimens have been encountered from the Lower Jurassic sediments present in Bahrein-1 well (Fig. 2).**Remarks:** It is characterized by its polygonal outline and the polygonal aperture having a thick lip.Subfamily: **Thurammininae Miklukho-Maklay, 1963**Genus: **Thuramina Brady, 1879**

***Thurammina ovata* n.sp.**

(Plate1, Fig. 9)

**Holotype:** Zu-PM 1009**Type horizon:** Depth: 1713m (Sample no.55), Devonian.**Type locality:** Bahrein-1 well, north Western Desert, Egypt.**Derivation of the name:** According to the ovate outline of its tests.**Diameter:** 0.2 mm.**Materials:** Twenty one well preserved specimens.**Description:** Test small, globular to subglobular, ovate in outline, with many short conical protuberances; wall agglutinated, dark brown to black in color; aperture multiple, a small opening at the summit of each protuberance.**Occurrence:** Specimens of this species were found spreading throughout the Silurian and the Devonian in Bahrein-1 well (Fig. 2).**Remarks:** It distinguished by its small size and ovate outline.Genus: *Scyphocodon* Kristan – Tollmann, 1971***Scyphocodon hemisphericus* n.sp.**

(Plate2, Fig. 1)

**Holotype:** Zu-PM 1010**Type horizon:** Depth: 1821m (Sample no.66), Devonian.**Type locality:** Bahrein-1 well, north Western Desert - Egypt.**Derivation of the name:** Owing to its hemispherical outline shape.**Diameter:** 0.8:1mm.**Materials:** Eight well preserved specimens.**Description:** Test a single hemispherical inflated chamber, with broad open side that may be the position of attachment; wall agglutinated, coarse grained, highly cemented, constructed form of a series of bands (possibly growth rings) but this rings are not clear well in our specimens.**Occurrence:** It appears in the material of the middle and upper parts of the Devonian of Bahrein-1 well (Fig. 2).**Remarks:** This species differs from *Schyphocodon verrucosus* Kristan and Tollmann (1971) in its spherical to hemispherical shape, coarser grained with high cement, smooth wall, the growth bands are not clear well, the position of attachment is flush and the chamber is more inflated than those of *Schyphocodon verrucosus* (Kristan – Tollmann, 1971).Genus: *Nephrosphaera* Kristan – Tollmann, 1971***Nephrosphaera zigzaga* n.sp.**

(Plate2, Fig. 2)

**Holotype:** Zu-PM 1011**Type horizon:** Depth: 2433m. (Sample no.109), Silurian**Type locality:** Bahrein-1 well, north Western Desert, Egypt.**Derivation of the name:** Owing to the zigzag aperture.**Diameter:** 0.4 mm.**Length:** 0.5 mm.**Materials:** Four well preserved specimens.**Description:** Test free, of medium size, monothalamus, ovoid in shape; wall agglutinated with coarse to medium grains, surface rough; aperture an elongate, deep, zigzag opening at one side of the apertural face.**Occurrence:** The individuals of this new species are recorded at some intervals in the Silurian of Bahrein-1 well (Fig. 2).**Remarks:** It is characterized by the apertural zigzag shape.***Nephrosphaera minuta* n.sp.**

(Plate2, Fig. 3)

**Holotype:** Zu-PM 1012**Type horizon:** Depth: 1506m (sample no.30), Devonian.**Type locality:** Bahrein-1 well, north Western Desert, Egypt.**Derivation of the name:** Owing to the very small size of its tests.**Diameter:** 0.2 mm.**Length:** 0.4 mm.**Materials:** Eighteen well preserved specimens.**Description:** Test free, small in size, monothalamus, ovoid to spherical shape; wall agglutinated with coarse to medium grained with high to moderate cement; suture depressed; aperture is an elongate groove at one side.**Occurrence:** It is recorded throughout the middle and upper parts of the Devonian succession in Bahrein-1 well (Fig. 2).**Remarks:** *N.minutus* n.sp. differs from *N. fissurata* Kristan – Tollmann (1971) in its small size and the deep elongate groove of the aperture.***Nephrosphaera quadrata* n.sp.**

(Plate2, Fig. 4)

**Holotype:** Zu-PM 1013**Type horizon:** Depth: 2001m (sample no.75), Devonian.**Type locality:** Bahrein-1 well, north Western Desert, Egypt.**Derivation of the name:** According to the quadrate shape of the tests.**Diameter:** 0.9 mm. **Length:** 0.8 mm.**Materials:** Twenty one well preserved specimens.**Description:** Test free, monothalamus, large in size, quadrate in outline; wall agglutinated, surface rough, although the grains are of moderate size among enough cement; aperture elongate, slightly sigmoidal groove at one side.

**Occurrence:** It is found throughout the upper part of the Devonian succession of Bahrein-1 well (Fig. 2).

**Remarks:** *N. quadrata*. differs from *N. fissurata* Kristan – Tollmann (1971) by its large size, quadrate shape and shape of aperture.

Superfamily: **Ammodisceae Ruess, 1862**

Family: **Ammodiscidae Ruess, 1862**

Subfamily: **Tolypammininae Cushman and Waters, 1928**

Genus: ***Granulodiscus* Abd El-Azeam, 1997**

***Granulodiscus bahreinensis* n.sp.**

(Plate2, Fig. 5)

**Holotype:** Zu-PM 1014

**Type horizon:** Depth: 2832m (sample no.145),

**Type locality:** Bahrein-1 well, north Western Desert, Egypt.

**Derivation of the name:** After the locality of the studied well (Bahrein-1 well), within which the studied species is recorded.

**Diameter:** 0.2mm – 0.1mm

**Materials:** Two well preserved specimens.

**Description:** Test small, nearly rounded in outline, attached to a relatively small, elongate quartz grain, which constitutes about 1/3 the size of the test and appears from one side only; wall is finely arenaceous, thin, surface smooth, the last whorl is very compressed, elongate in outline; periphery angular, aperture at the open end of the tube.

**Occurrence:** It is restricted to lower part of the Ordovician succession (Zeitoun Formation) of Bahrein-1 well (Fig. 2).

**Remarks:** It is characterized by the very compressed last whorl.

***Granulodiscus constrictus* n.sp.**

(Plate2, Fig. 6)

**Holotype:** Zu-PM 1015

**Type horizon:** Depth: 2361m. (Sample no.105), Silurian

**Type locality:** Bahrein-1 well, north Western Desert, Egypt.

**Derivation of the name:** Owing to its depressed constrictions.

**Diameter:** 0.25 – 0.30mm.

**Materials:** Two well preserved specimens.

**Description:** Test small, attached, discoidal in shape, coiled around a small grain with a slightly compressed tube with regular to irregular constrictions, the last two coils are clear; wall finely arenaceous; periphery subangular, aperture ovate at the open end of the tube.

**Occurrence:** It is found in the middle part of the Silurian succession (Acacus Formation) in Bahrein-1 well (Fig. 2).

**Remarks:** It is characterized by the regular to irregular constrictions at the last coil.

***Granulodiscus inflatus* n.sp.**

(Plate 2, Fig. 7)

**Holotype:** Zu-PM 1016

**Type horizon:** Depth: 2433m (sample no.119), Silurian.

**Type locality:** Bahrein-1 well, north Western Desert, Egypt.

**Derivation of the name:** Owing to its inflated test from the two sides.

**Diameter:** 0.30 – 0.25mm.

**Materials:** Three well preserved specimens.

**Description:** Test small, attached, ovoidal in shape, inflated from the two sides, fixed on one side by a quartz grain, then the tube coils planispirally, the last coil only is clear, the section of the tube is ovate in outline; aperture ovate at the open end of the tube.

**Occurrence:** It occurs in the lower part of the Silurian succession (Acacus Formation) in Bahrein-1 well (Fig. 2).

**Remarks:** This species differs from *G. glomospiroids* Abd El Azeam (1997) in its wider coiled tube, wider last volution and its ovate aperture.

Superfamily: **Hormosinacea Haeckel, 1894**

Family: **Hormosinidae Haeckel, 1894**

Subfamily: **Reophacinae Cushman, 1910**

Genus: ***Reophax* Montfort, 1808**

***Reophax biloculus* n.sp.**

(Plate 2, Fig. 8a, 8b)

**Holotype:** Zu-PM 1017

**Type horizon:** Depth: 1430m. (Sample no. 25), Devonian.

**Type locality:** Bahrein-1 well, north Western Desert of Egypt.

**Derivation of the name:** It tests are consisting of two chambers only.

**Dimensions:** Width: 0.25mm -Length: 0.5

**Materials:** Ten well preserved specimens.

**Description:** Test free, small in size, consists of two globular to pyriform chambers, in straight uniserial arrangement, the two chambers are equal or unequal in size, that the final one is the larger; suture slightly depressed, sigmoidal; wall agglutinated fine to medium grained, with moderate amount of cement, smooth; aperture terminal, small, rounded and above a short small neck.

**Occurrence:** It is recorded in the upper part of the Devonian succession (Kohla Formation) in Bahrein-1 well.

**Remarks:** This species differs from other *Reophax* species by its small size, two chambers, and small, terminal rounded aperture above short small neck.

Superfamily: **Haplophragmoidea Eimer and Fickert, 1899**

Family: **Nezzazzatidae Hamaoui and Saint. Marc, 1970**

Subfamily: **Nezzazatinae Hamaoui and Saint. Marc, 1970**

Genus: ***Nezzazata* Omara, 1956**

***Nezzazata globulata* n.sp.**

(Plate 2, Fig. 9a, 9b)

**Holotype:** Zu-PM 1018

**Type horizon:** Depth: 1218m. (Sample no.2), Lower Cretaceous.

**Type locality:** Bahrein-1 well, north Western Desert of Egypt.

**Derivation of the name:** According to its lobulate outline.

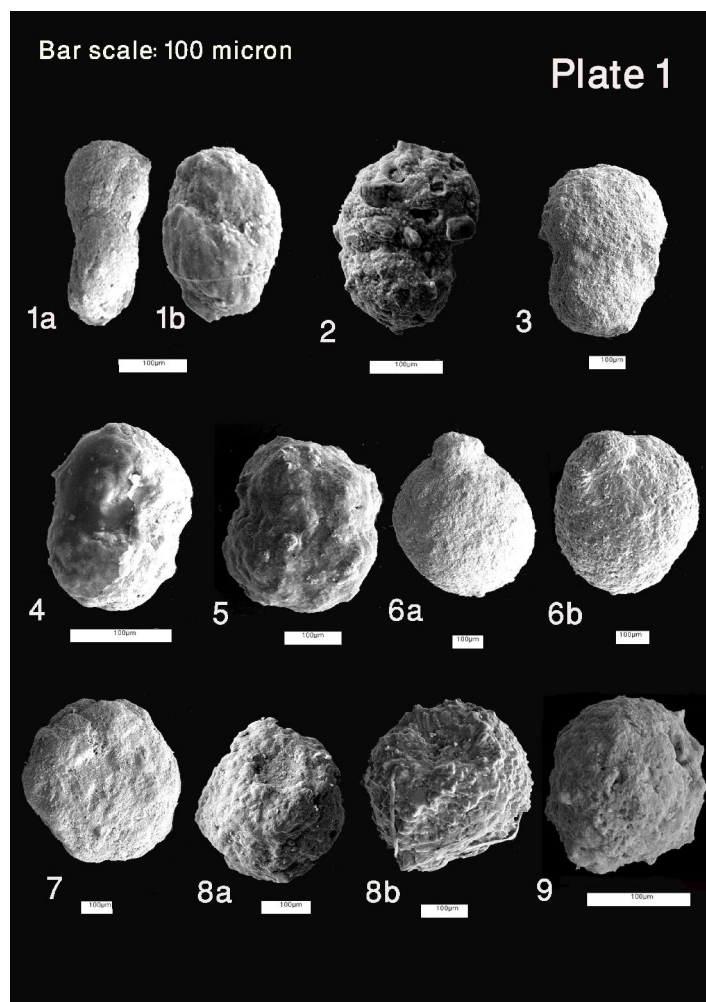
**Diameter:** 0.25 – 0.30mm

**Materials:** Three well preserved specimens.

**Description:** Test free, compressed, low trochospiral, planoconvex, two whorls and half with closed umbilicus; outline lobulate, periphery carinate, wall thin, finely arenaceous; sutures curved; slightly depressed; the final whorl with eight to ten chambers; aperture extending from the umbilicus to the periphery, with an apertural tooth projecting into the aperture.

**Occurrence:** Specimens of this form have been encountered from the Lower Cretaceous sediments represented in Bahrein-1 well.

**Remarks:** This species differs from *N. simplex* Omara (1956) by its thin, fine arenaceous wall, low trochospiral test, less number of chamber per last whorl and lobulate, carinate periphery.



**Plate (1)**

1- *Psammophax compressus* n.sp.; Depth: 2397m. (Sample no.109), Silurian.

1a- side view; 1b- ventral view.

2- *Psammophax egyptiacus* n.sp.; Depth: 2538m.(Sample no.130), Ordovician

3- *Psammophax globulatus* n.sp. : Depth: 1812m.(Sample no.65), Devonian

4- *Psammophax minutus* n.sp Depth: 1524m (Sample no.35), Devonian.

5- *Psammophax quadratus* n.sp: Depth: 1569m (Sample no.40), Devonian

6- *Saccamina globulata* n.sp. Depth: 1644m.(Sample no.44), Devonian

7- *Saccamina granulata* n.sp. Depth: 1785m.(Sample 62), Devonian.

8- *Saccamina polygona* n.sp.a,b Depth: 1326m.(Sample no.13), Lower Jurassic.

9-*Thuramina ovata* n.sp. Depth: 1713m (Sample no.55), Devonian



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Plate (2)

- 1- *Scyphocodon hemisphericus* n.sp; Depth: 1821m (Sample no.66), Devonian.
- 2- *Nephrosphaera zigzaga* n.sp. Depth: 2433m. (Sample no.109), Silurian
- 3- *Nephrosphaera minuta* n.sp. Depth: 1506m (Sample no.30), Devonian
- 4- *Nephrosphaera quadrata* n.sp. Depth: 2001m (Sample no.75), Devonian.
- 5- *Granulodiscus bahreinensis* n.sp. Depth: 2832m (Sample no.145), Ordovician.
- 6- *Granulodiscus constrictus* n.sp. : Depth: 2361m. (Sample no.105), Silurian
- 7- *Granulodiscus inflatus* n.sp. Depth: 2433m (Sample no.119), Silurian
- 8- *Reophax biloculus* n.sp. Depth: 1430, 1445m (Sample no.25, 26), Devonian.  
( a-lateral view and b- apertural view).
- 9- *Nezzazata lobulata* n.sp. Side views; Depth: 1218m (Sample no.2), Lower Cretaceous a- dorsal view. b- Ventral view.

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