

Depositional environments and Biofacies of Selected Sediments, North Basrah

ISSN 1817 - 2695

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((Received 17/5/2010 , Accepted 28/9/2010))

Abstract

The study deals with the depositional environments and biofacies of sediment north Basrah where the southern marshland (Ahwar). Grain size analysis indicates to three types of sediment texture are; mud ,silt ,and sandy silt. The size parameter indicates to manifold environment. The specified foraminifera species in the present study determine two biofacies; B₁ is a brackish estuarine environment graded up to fluvial condition, and B₂ is a brackish-marine to marine environment. The species of foraminifera distinguished the marine influence in the study area.

Keywords: Ahwar, Al-Masahab and Al-Sallal, Foraminifera, Sediments, Southern Mesopotamia

Introduction

The northern part of Basrah between the two main tributaries Al-Masahab and Al-Sallal where extent the southern marshland [Ahwar] represents a suspenseful area to examine the nature of sediments and biofacies.

Aqrabi [3] studied the marshland of southern Mesopotamia, he found the turn, the area facies from brackish lagoon and coastal marshes to inland lakes/marshes, and contributor. The sea-level fluctuation and differential sedimentation as the main factors, and neotectonic activities as additional factor in the emergence and development, the marshland.

Aqrabi and Evans [4] investigated the sedimentation nature in Ahwar of Tigris-Euphrates delta in the southern Mesopotamia, they explained three sources of the sediments are; a seasonal inundation of Tigris-Euphrates rivers, the dusty storms, and in situ biological activity. Al-Baidhany [2] studied the sedimentary environments during the Holocene period in southern Iraq. He distinguished a group of the marine foraminifera fossils of what proves the existence, the marine action in southern marshland. Al-Badran [1] shows the sediments of Ahwar consisting of clayey silt with little quantity of sand.

Materials and Methods

Twenty eight samples were collected from thirteen location of Al-Masahab and Al-Sallal marshland [Fig.1]. The depth of samples ranged from the surface to a depth of 2.20m. Sampling was carried out during 28 May 2009 by using a shovel. The grain size analysis was obtained by a wet sieving on a sieve of 230 mesh to separate the sand from silt and clay were measured by a

pipette based on Folk[12]. The percentages of sand, silt, and clay were calculated for each sample. Data were plotted on triangular graph and used in the classification of the sediments into textural class Folk [12]. The results of grain size distribution were also plotted as cumulative curves on logarithm probability graphs where grain size parameters such as mean [M_Z],

inclusive standard deviation [σ_i], inclusive graphic skewness [SK_i], and kurtosis [K_G] were calculated according to Folk and Ward [13].

In the preparation of foraminifera for the examination under light microscope, the residue of sand was collected and dried, hence the

sample is spread thinly over the picking tray, then picked, using 0.001mm hairbrush and placed specimens of foraminifera in a slide. The foraminifera slide is examined and identified under a binocular microscope. The classification of foraminifera was based on Loeblich and Tappan [19].

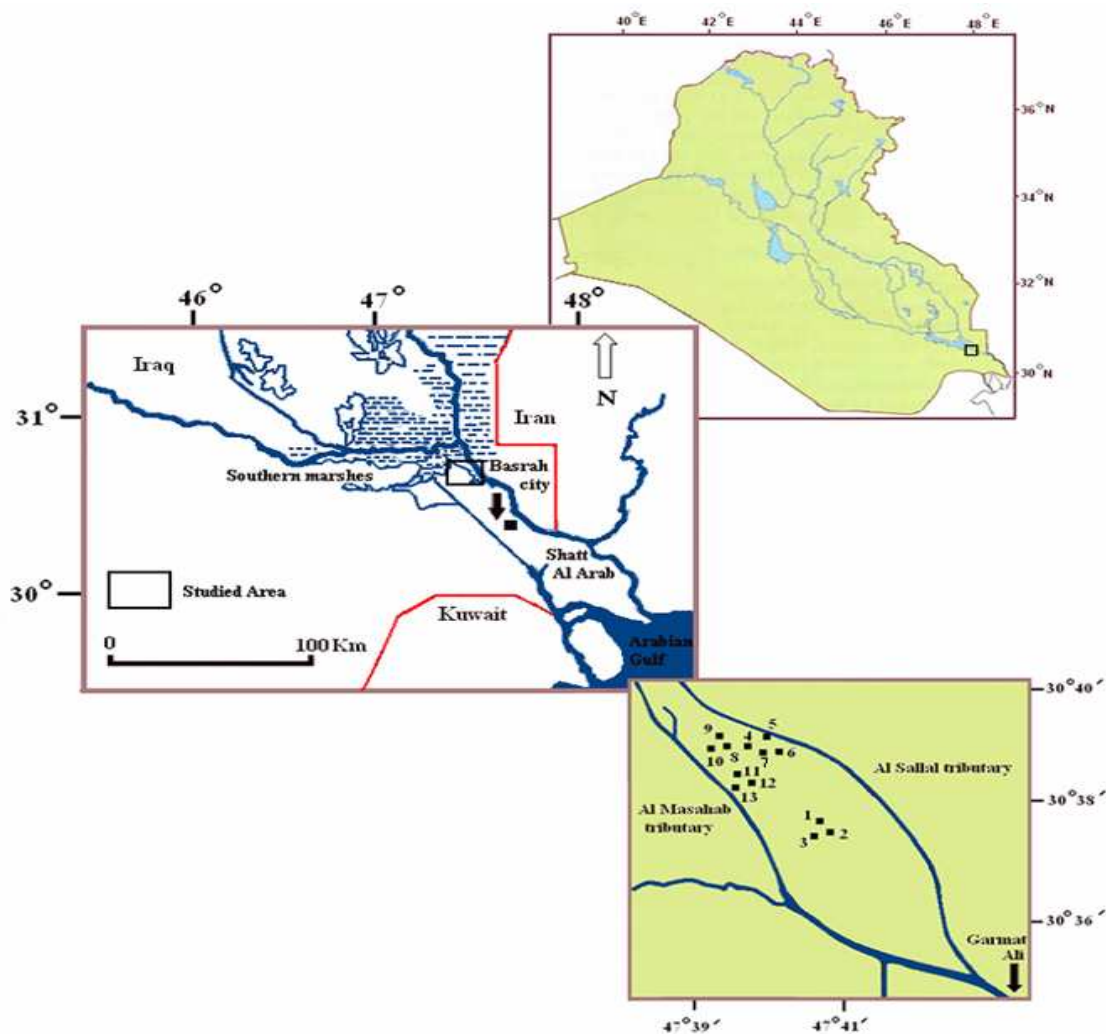


Figure [1] Location map of the study area

Results and Discussion

Depositional environments

Grain size distribution, in conformity with Folk [12], reveals three sedimentological textures; mud, silt, and sandy silt (Table-1). The mud was the most dominant sediment where it formed 51%, followed by silt about 31% and at last sandy silt found in a mount 24%.

Grain size parameters of the sediments [Table-1] expose the property of area sediments; a fine size, the sorting values show poorly to very poorly sorted, whereas the skewness values

vary from negatively skewed to positively skewed, and the graphic kurtosis varies from platykurtic to leptokurtic. The variousness in ranges values of statistical parameters indicate to multiple environment, one derived from riverine / aeolian environment and the other derived from marine environment[14]. This proposition is suitable for the study area where the sediments supply to the area by both fluvial discharge and aeolian transport[5].

Table-1 .Average values of the size parameters of sediments textures.

Sediment texture		Sand %	Silt %	Clay %	Mean M_z	Sorting σ_1	Skewness SK_1	Kurtosis K_G
Mud	Max.	9.6	64	55	7.8	2.05	- 0.057	1.17
	Min.	0.6	43.5	32	6.36	1.31	- 0.37	0.73
	Av.	3.46	55.25	41.29	7.13	1.70	- 0.22	0.97
Silt	Max.	0.4	67.6	33.8	6.8	1.74	0.031	0.87
	Min.	0.2	66	32	6.7	1.7	0.025	0.8
	Av.	0.3	66.8	32.9	6.75	1.72	0.028	0.84
Sandy silt	Max.	14	61.5	24.5	6.28	2.09	- 0.13	1.31
	Min.	12	60.1	22.2	6.01	1.99	- 0.15	1.01
	Av.	13	60.8	23.35	6.15	2.04	- 0.14	1.16

Biofacies

The Microscope examination of foraminiferal assemblages [Plate 1-3] from the studied sediment showed two biofacies:

1- Biofacies [B₁]:

It is present in the thirteenth locations at a depth 0.15-0.65 m [Fig.2]. The sediment texture is; mud, silt, and sandy silt. The foraminiferal species distinguished two sub-biofacies as follows;

I- Intermediate Fluvial Sub-biofacies [B₁F]:

This subfacies was observed at depth 0.15-0.30 m [Fig.2]. The foraminifera species are chiefly represented by; *Miliammina fusca*, *Ammonia beccarii*, *A. beccarii* var. *parkinsoniana*, *A. tepida*, *Nonion grateloupi*, *Elphidium discoidal*, *E. excavatum* forma

clavata, *E. excavatum* forma *excavata*. In addition other species recorded as; *Buccella frigida*, *B. sp.*, *Ammonia sp.*, *Elphidium advenum*, *E. excavatum* forma *selseyensis*, *E. gunteri*, *E. incertum*, *E. incertum mexicanum*, *E. matagordanum*, and *E. subarcticum*.

The two groups of foraminifera species together tend to confirm a brackish environment [7] and [17]], but abundance species of the first group indicate intermediate fluvial environment specialty the existence, the species *Ammonia beccarii* var. *parkinsoniana* with high plenty [Urien, 1972 in [21]; Boltovskoy and Lena, 1974 in [21]]. The charophyta (Plate 4) occurrence in this subfacies consolidate the fluvial effect[6]. The charophyta is index to freshwater environment [24]. Besides, abnormal foraminifera tests[Plate 3, Fig.1, 4 and 5] which

are found at this subbiofacies index are rapidly changing environment conditions [Ellsabeth,1995 in [9]].The

occurrence of abnormal foraminiferal specimens depends on lower salinity [25] and [11]].

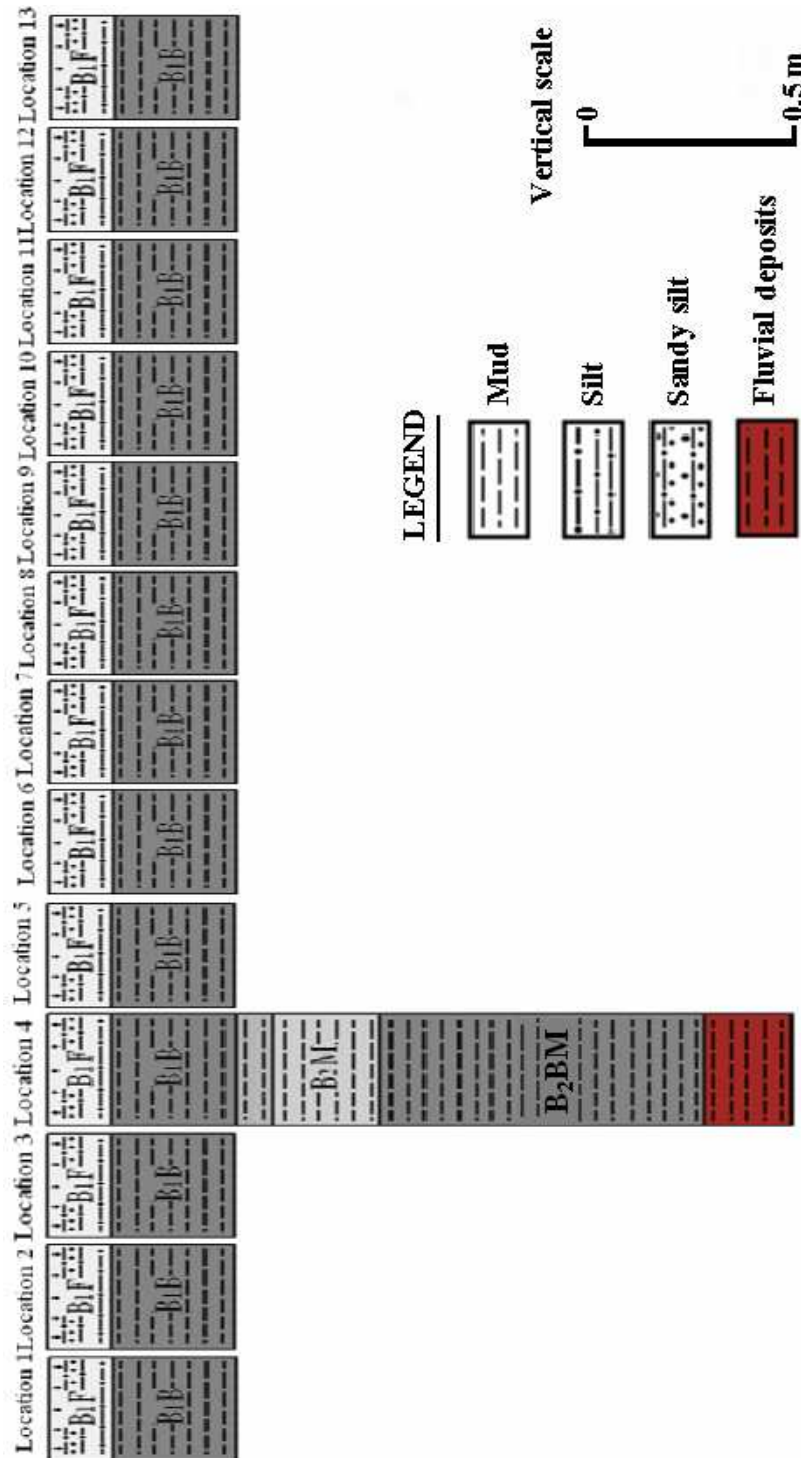


Figure [2] Sediments facies and Biofacies of study area

II- Brackish Sub-biofacies [B₁B]:

It is found at the depth 0.35-0.65 m [Fig.2] from the thirteen locations that previously mentioned. The subfacies represented by are; *Buccella frigida*, *Ammonia beccarii*, *A. tepida*, *Elphidium advenum*, *E. discoidal*, *E. excavatum* forma *clavata*, *E. excavatum* forma *excavata*, *E. gunteri*, *E. incertum*, and *E. matagordanum*. In addition to the association, the species as; *Haplophragmoides canariensis*, *Spiroloculina eximia*, *Quinqueloculina oblungo*, *Q. poeyana*, *Q. seminulum*, *Buccella* sp., *Rosalina columbiensis*, *Ammonia beccarii* var. *parkinsoniana*, *Pararotalia calcar*, *Eponides repandus*, *Eponides cribrorepandus*, *Poroepionides lateralis*, *Elphidium crispum*, *E. excavatum* forma *selseyensis*, *E. excavatum* forma *lidoensis*, *E. incertum mexicanum*, *E. poeyanum*, *Elphidium subarcticum*. Both the fundamental and the secondary species of the forams are within the range are indicative of a brackish water environment [[23]; [7]; [22]].

The important observation in the subfacies is the Elphidiidae family has the greatest number of species and total abundance thereof indicates estuarine environment influence [16]. The other evidence for estuarine impact is a variability in the *Elphidium excavatum* species [20].

1- Biofacies [B₂]:

It is located at a depth 0.75-1.8 m of the fourth location, in muddy sediments. The faunal species recognized are two subbiofacies are:

I- Normal Marine Sub-biofacies [B₂M]:

The subfacies was present at a depth 0.75-1 m [Fig.2]. The foraminifera communities were

dominated by *Rosalina columbiensis*. *Ammonia tepida* and *Eponides cribrorepandus* were common. *Ammonia beccarii*, *Pararotalia calcar*, *Eponides repandus*, and *Elphidium excavatum* forma *excavate* were rare. The abundance of *Rosalina columbiensis* in comparison with the other species gives an impression of normal marine condition [Murray, 1973 in [27]].

II- Brackish-Normal marine Sub-biofacies [B₂BM]:

The subfacies was noted at depth 1-1.8 m [Fig.2]. The common foraminifera species are; *Rosalina columbiensis*, *Ammonia beccarii*, *Ammonia beccarii* var. *parkinsoniana*, *A. tepida*, *Eponides repandus*. The association species were *Elphidium discoidal* and *E. gunteri* but their plenty is less than the first assemblage species. The majority of species in both groups reflect a normal marine environment [[21] and [14]] of what namely this subfacies similar to the subfacies B₂M, but *Ammonia beccarii* and *Ammonia tepida* were the most ampler than the rest which support the inference of the reduction in water salinity [[22]; [18]; [10]; [8] and [26]]. The observation in subfacies existence foraminifera tests abnormality [Plate 4, Fig.2 and 3] with few numbers, and this proves the environment variation [15].

Under this subfacies recognized reddish brown muddy deposits. The foraminifera tests are not found in the sediment. The lack of foraminifera indexes a fluvial origin of the sediment [27]. The deposition of fluvial mud occurred throughout southern Mesopotamia [5].

Conclusions

The biofacies succession of the studied area started as brackish-normal marine to normal marine followed by a brackish to intermediate fluvial environment, while the sediment within a depth 0.65-0.75 m between the two biofacies represents transition in the environmental circumstance.

The dominance of hyaline foraminifera in the area reflected environment with rather low concentration of calcium carbonate due to the influx of fresh water. Aside from the specimens of many foraminifera species are abundant in the marine environment index the area influenced by marine water.

EXPLANATION OF PLATES

Plate (1)

- 1- *Miliammina fusca* (Brady),1870.
- 2- *Haplophragmoides canariensis* (d'Orbigny),1839.
- 3- *Spiroloculina eximia* (Cushman),1922.
- 4- *Quinqueloculina oblungo* (Montagu),1803.
- 5- *Quinqueloculina poeyana* (d'Orbigny),1839.
- 6- *Quinqueloculina seminulum* (Linné),1758.
- 7- *Buccella frigida* (Cushman),1922.
- 8- *Buccella* sp.
- 9- *Rosalina columbiensis* (Cushman),1925.
- 10- *Ammonia beccarii* (Linné),1758.
- 11- *Ammonia beccarii* var. *parkinsoniana* (d'Orbigny),1839.
- 12- *Ammonia tepida* (Cushman),1926.
- 13- *Ammonia* sp.
- 14- *Pararotalia calcar* (d'Orbigny),1826.
- 15- *Nonion grateloupi* (d'Orbigny),1826.
- 16- *Eponides repandus* (Fichtel and Moll),1798.

Plate (2)

- 1- *Eponides cribrerepandus* (Asano and Uchio),1951.
- 2- *Poroeponides lateralis* (Terquem),1878.
- 3- *Elphidium advenum* (Cushman),1922.
- 4- *Elphidium crispum* (Linné),1758.
- 5- *Elphidium discoidal* (d'Orbigny),1839.
- 6- *Elphidium excavatum* (Terquem) forma *clavata* (Cushman),1930.
- 7- *Elphidium excavatum* (Terquem) forma *excavata* (Terquem),1876.
- 8- *Elphidium excavatum* (Terquem) forma *selseyensis* (Heron-Allen and Earland),1911.
- 9- *Elphidium excavatum* (Terquem) forma *lidoensis* (Cushman),1936.
- 10- *Elphidium gunteri* (Cole),1931.
- 11- *Elphidium incertum* (Williamson),1858.

12- *Elphidium incertum mexicanum* (Kornfeld),1931.

13- *Elphidium matagordanum* (Kornfeld),1931.

14- *Elphidium poeyanum* (d'Orbigny),1839.

15- *Elphidium subarcticum* (Cushman),1944.

Plate (3)

1- Abnormal chamber shape of *Ammonia beccarii* (Linné),1758.

2- Over developed chamber size of *Ammonia tepida* (Cushman),1926.

3- Distorted chamber arrangement of *Ammonia tepida* (Cushman),1926.

4- Twinned tests of *Ammonia tepida* (Cushman),1926.

5- Complex form of *Ammonia tepida* (Cushman),1926.

Plate (4)

(1- 14) Various shapes of Charophyta.

Plate (1)

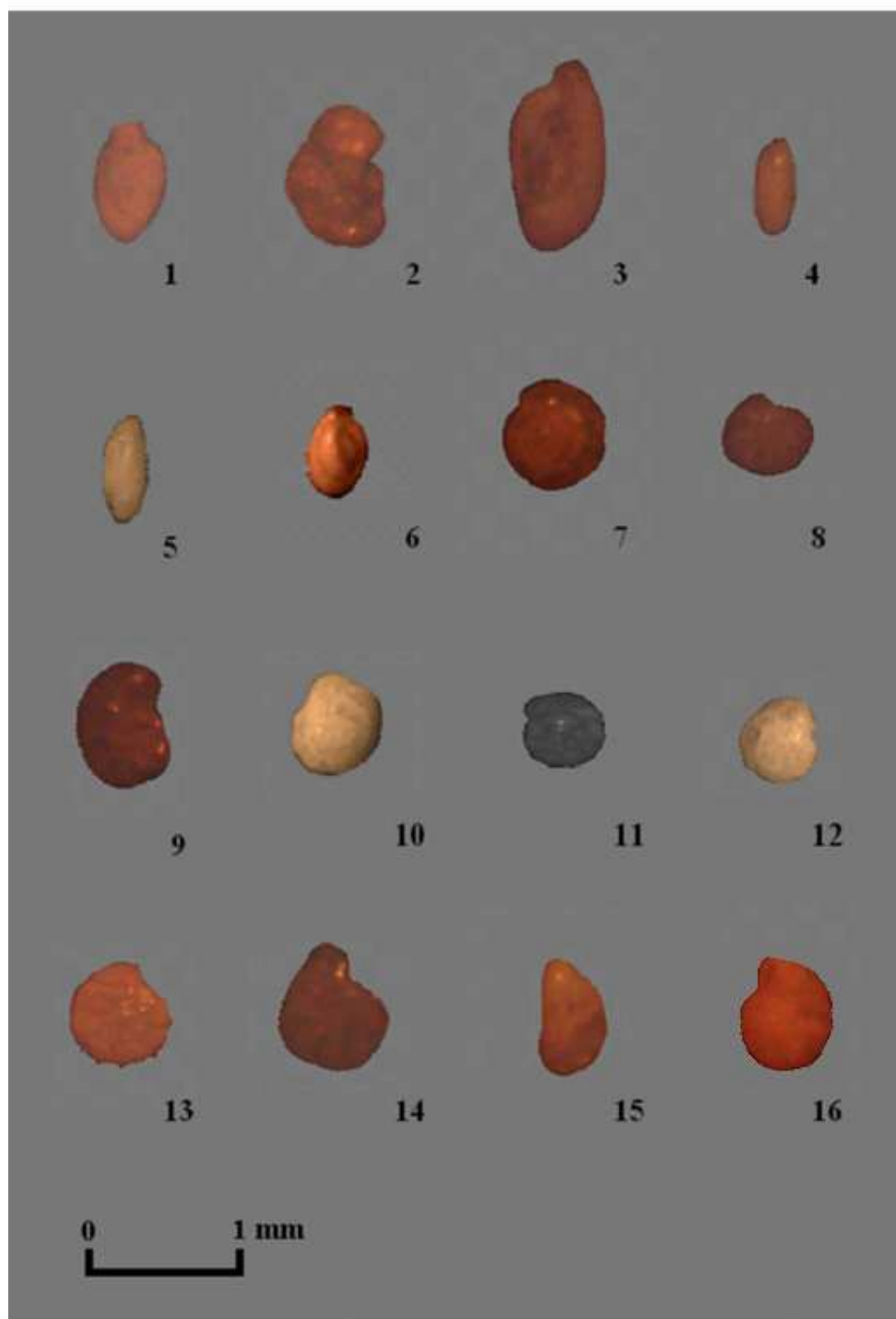


Plate (2)

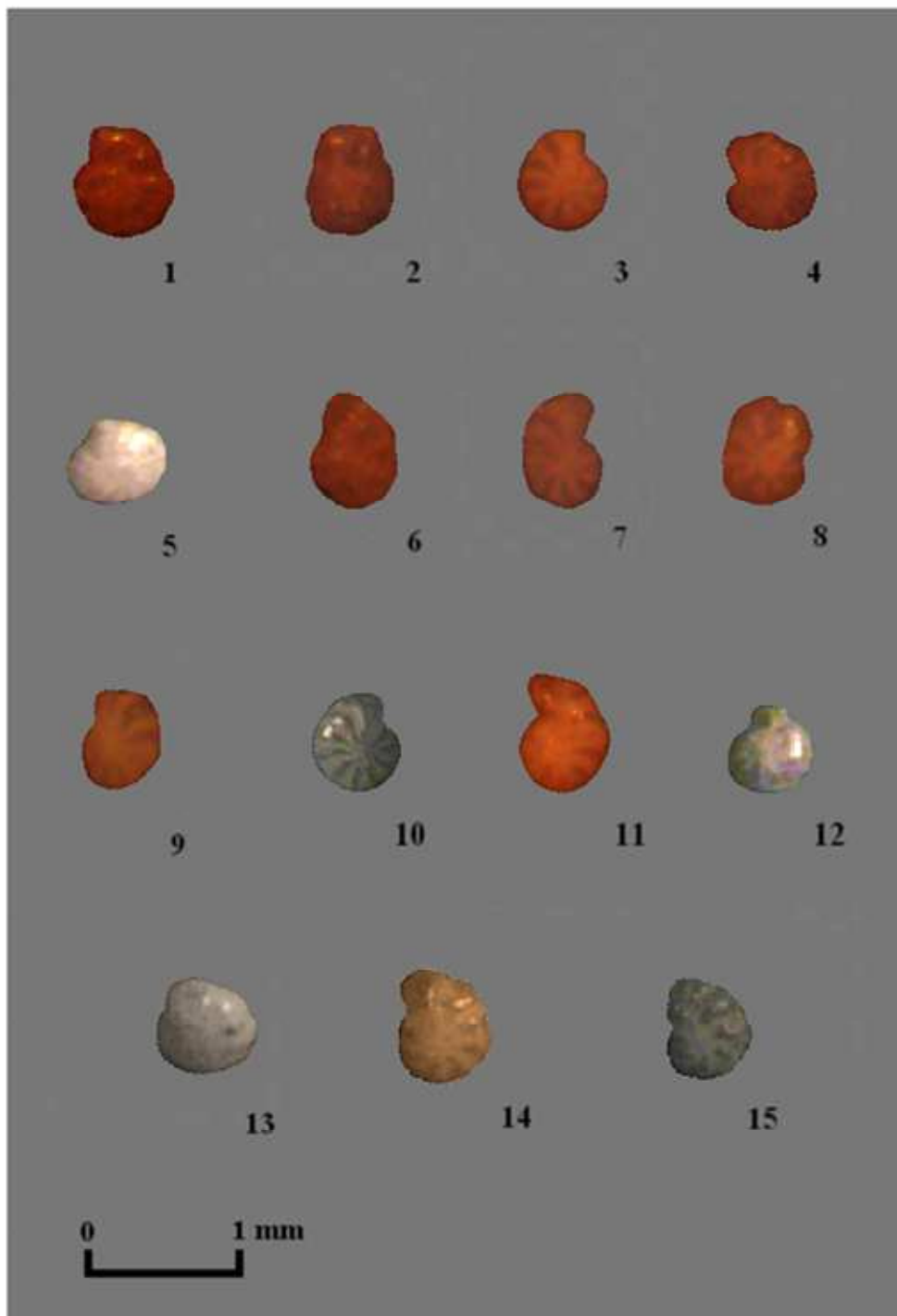


Plate (3)

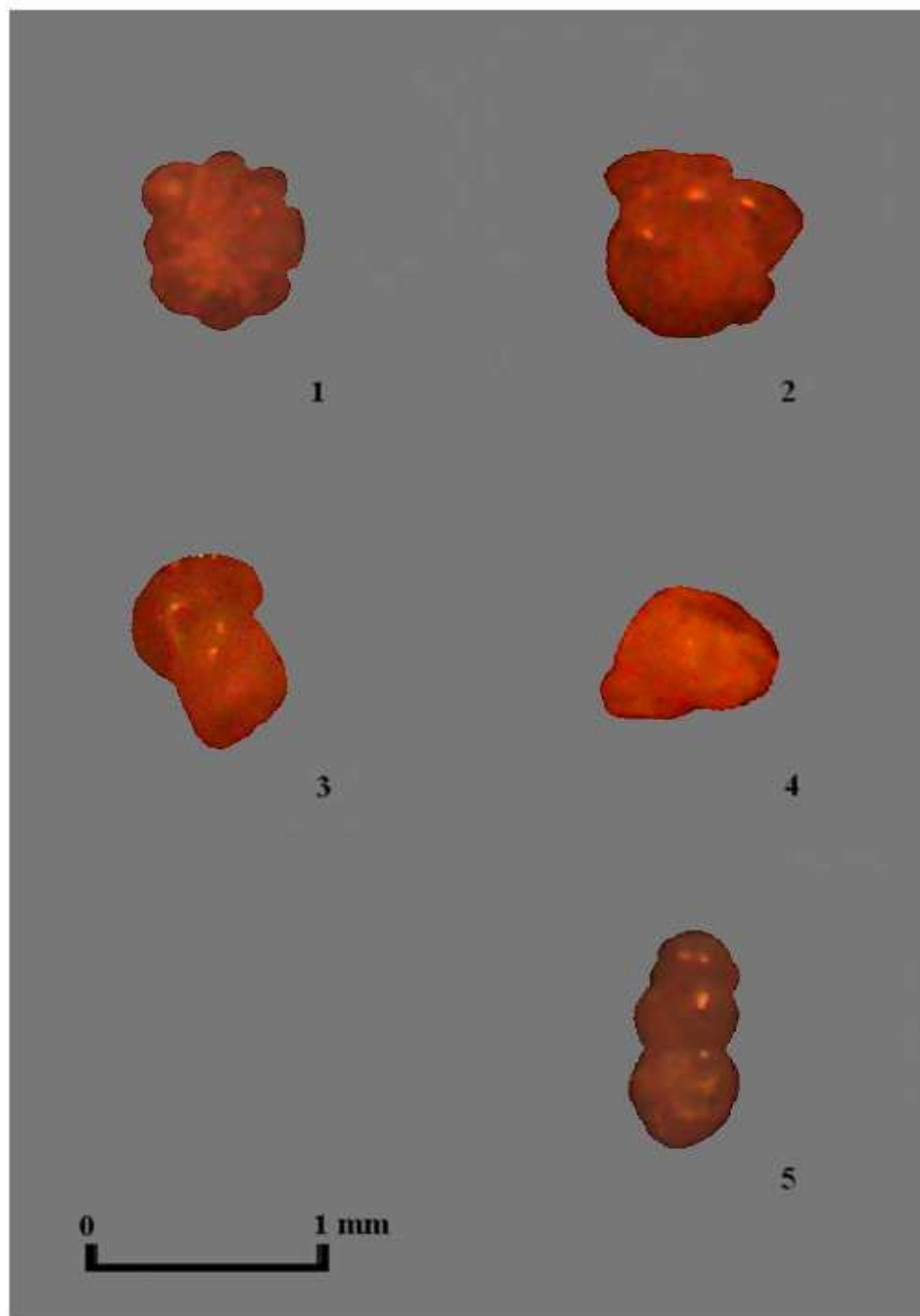
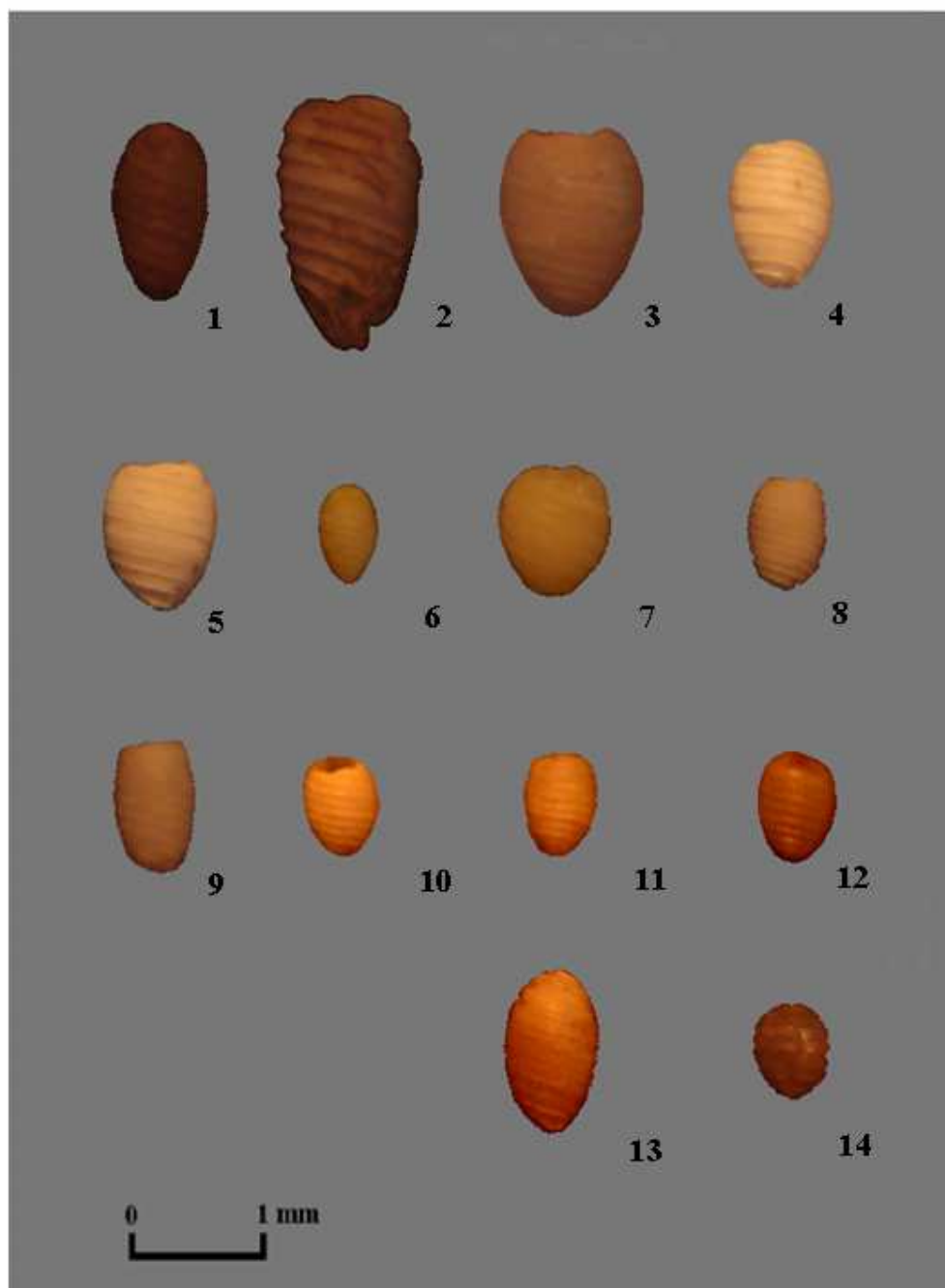


Plate (4)



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البيئات الترسيبية والسحنات الحياتية لرواسب مختارة شمال البصرة

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المستخلص

تناولت الدراسة الحالية البيئات الترسيبية والسحنات الحياتية لرواسب مختارة من شمال محافظة البصرة حيث أمتداد الاهوار الجنوبية. أجريت عملية التحليل الحجمي للرواسب وتم فصل أصداف الفورامنيفيرا لغرض تشخيصها. أظهرت النتائج وجود ثلاثة أنواع من الانسجة الرسوبية هي الوحل وجرين وجرين رملي. كما بينت معاملات الحجم الحبيبي أن منطقة الدراسة تمثل بيئة تعددت فيها مصادر الرواسب. أعتمادا على مجاميع الفورامنيفيرا لتعيين السحنات الحياتية تم تشخيص سحنتين هما: B₁ والتي تمثل بيئة مصيبة موبلحة تتدرج الى الاعلى حيث ظروف البيئة النهرية، و B₂ تمثل بيئة موبلحة - بحرية تستقر في أعلاها كبيئة بحرية. لقد وضحت الانواع البحرية من الفورامنيفيرا أحتماالية كبيرة في وجود تأثير بحري على منطقة الدراسة.

