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Depositional environment and Biofacies of Selected Sediments North Basra

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Abstract

The study deals with the depositional environment and biofacies of sediment north Basra where the southern marshland (Ahwar).Grain size analysis indicates three types of sediment texture are; mud ,silt ,and sandy silt. The size parameters indicates manifold environment. The specify foraminifera species in the present study determine two biofacies; B_1 is a brackish estuarine environment graded up to fluvial condition, and B_2 is a brackish-marine to marine environment. The species of foraminifera distincted the marine influence in studied area.

Introduction

The northern part of Basra between the two main tributaries Al-Masahab and Al-Sallal where extent the southern marshland (Ahwar) represent a suspenseful area to examine the nature of sediments and biofacies.

Aqrawi (1993) studied the marshland of southern Mesopotamia, he found 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 emergence and development the marshland. Aqrawi and Evans (1994) 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 (1998) studied the sedimentary environments during the Holocene period in southern Iraq. He distinguished group of the marine fossils of what prove existence the marine action in southern marshland. Al-Badran (2006) 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 varied 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(1974).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 (1974).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 (1957).

In the preparation foraminifera for examination under light microscope, the residue of sand was collected and dried, hence the sample is spread thinly over the picking try, then picked, using o.oo1mm 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 Loblich and Tappan (1988).

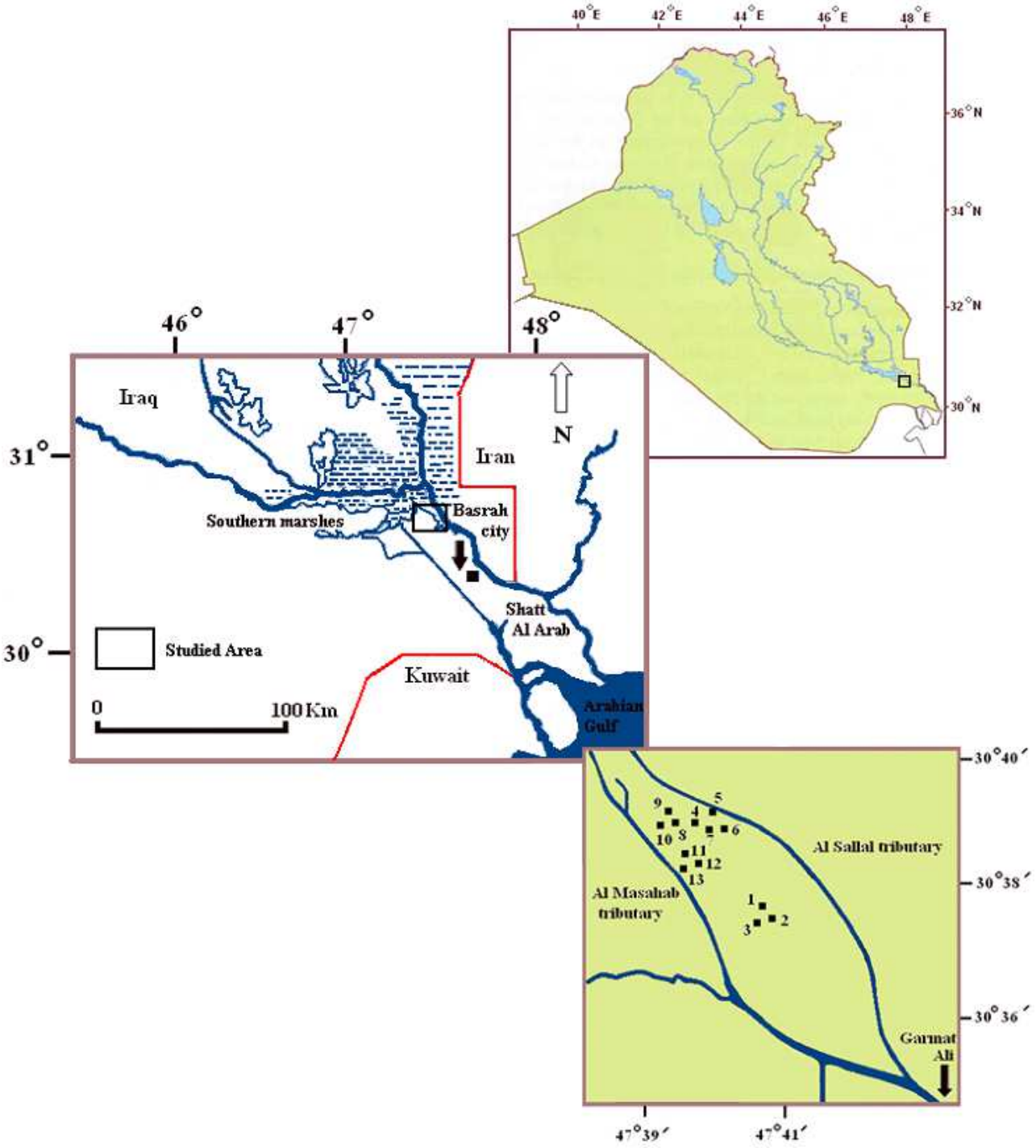

Figure (1) Location map of samples

Results and Discussion

Depositional environment

Grain size distribution, an conformity with Folk (1974),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 multiple environment, one derived from riverine / aeolian environment and the other derived from marine environment(Gandhi *et.al*.,2007).This proposition suitable for the area of study where the sediments supply to the area by both fluvial discharge and aeolian transport(Aqrawi,2001).

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

Sediment texture		Sand %	Silt %	Clay %	Mean M_Z	Sorting σ_I	Skewness SK_I	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 defines two biofacies:

1- Biofacies (B_1):

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 subbiofacies as follows;

I- Intermediate Fluvial Subbiofacies (B_1F):

This subfacies was observed at depth 0.15-0.30 m (Fig.2).The foraminifera species are chiefly represented by;*Miliammina fusca*, *Ammonia beccarii*, *Ammonia beccarii* var.*parkinsoniana*, *Ammonia tepida*,*Nonion grateloupi*, *Elphidium discoidal*, *E. excavatum* forma *clavata*, *E. excavatum* forma *excavata*. In addition other species recorded as; *Buccella frigida*, *Buccella 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 (Boltovskoy and Wright, 1976; Javaux and Scott, 2003), but abundance species of the first group indicate intermediate fluvial environment specialty existence the species *Ammonia beccarii* var.*parkinsoniana* with high plenty (Urien, 1972 in Murray, 1976; Boltovskoy and Lena, 1974in Murray, 1976). The charophyta (Plate 4) occurrence in this subfacies consolidate the fluvial effect (Bohacs *et.al*., 2000).The charophyta is index to freshwater environment (Serra-Kiel,1991).Besides, abnormal foraminifera tests(Plate 3,Fig.1,4and5) which found at this subbiofacies index rapidly changing environment conditions(Ellsabeth,1995 in Carnahan,2005).The occurrence of abnormal foraminiferal specimens depends on lowered salinity(Waldron,1963; Coccioni,2000).

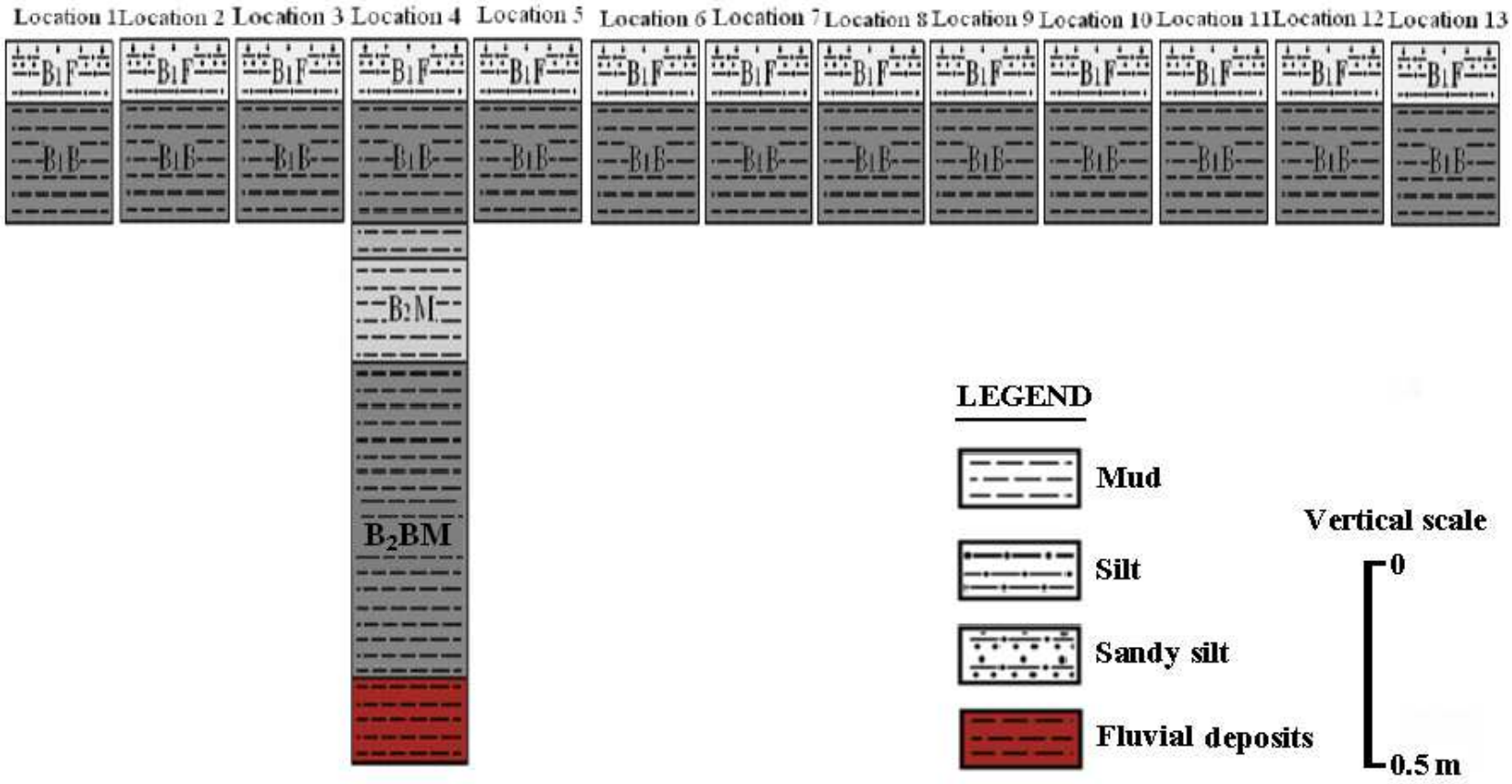

Figure (2) Sediment facies and Biobacies of study area

II- Brackish Subbiofacies (B_1B):

It is found at the depth 0.35-0.65 m (Fig.2) from the thirteen locations that previously mentioned. The subfacies represented by; *Buccella frigid*a, *Ammonia beccarii*, *Ammonia tepida*, *Elphidium advenum*, *E.discoidal*, *E. excavatum* forma *clavata*, *E. excavatum* forma *excavata*, *E. gunteri*, *E. incertum*, and *E. matagordanum*. In addition to 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*, *Poroeponides 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 fauna are within the range indicative of a brackish water environment (Rao and Rao, 1974; Boltovskoy and Wright, 1976; Nomura and Seto, 1992).

The important observation in the subfacies is the Elphidiidae family has the greatest number of species and total abundance thereof indicate estuarine environment influence (Haman, 1971.The other evidence for estuarine impact is a variability in the *Elphidium excavatum* species (Miller *et.al*., 1982).

2- Biofacies (B_2):

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

I- Normal Marine Subbiofacies (B_2M):

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, 1973in Williams, 1988).

II- Brackish-Normal marine Subbiofacies (B_2BM):

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*, *Ammonia tepida*, *Eponides repandus*. The association species were *Elphidium discoidal* and *E. gunteri* but their plenty less than the first assemblage species. The majority of species in both groups reflect a normal marine environment (Murray, 1976; Gandhi, 2007) of what namely this subfacies similar to the subfacies B_2M, but *Ammonia beccarii* and *Ammonia tepida* were the most ampleness than the rest which support the inference of the reduction in water salinity (Nomura and Seto, 1992; Kumar and Manivannan, 2001;Chendes *et.al*.,2004 ;Borcic *et.al*., 2007; Wennrich *et.al*., 2007).The observation in subfacies existence foraminifera tests abnormality (Plate 4, Fig.2 and3)with few numbers, and this prove the environment variation(Geslin *et.al*.,2000).

Under this surfaces 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 (Williams, 1988).The deposition of fluvial mud occurred throughout southern Mesopotamia (Aqrawi, 2001).

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-o.75 m between the two biofacies represent transition in the environmental circumstance.

The dominance of hyaline foraminifera in the area reflected environment with rather low concentration of calcium carbonate might be 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.

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البيئة الترسيبية والسحنات الحياتية لرواسب مختارة شمال البصرة

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المستخلص

تناولت الدراسة الحالية البيئة الترسيبية والسحنات الحياتية لرواسب مختارة من شمال محافظة البصرة حيث أمتداد الاهوار الجنوبية.أجريت عملية التحليل الحجمي للرواسب وتم فصل أصداف المنخريات لغرض تشخيصها.أظهرت النتائج وجود ثلاثة أنواع من الانسجة الرسوبية هي وحل وغرين وغرين رملي.كما بينت معاملات الحجم الحبيبي أن منطقة الدراسة تمثل بيئة تعددت فيها مصادر الرواسب.أعتمادا على مجاميع المنخريات لتعين السحنات الحياتية تم تشخيص سحنتين هما: B_1 والتي تمثل بيئة مصبية مويلحة تتدرج الى الاعلى حيث ظروف البيئة النهرية، و B_2 تمثل بيئة مويلحة – بحرية تستقر في أعلاها كبيئة بحرية. لقد وضحت الانواع البحرية من المنخريات أحتمالية كبيرة في وجود تأثير بحري على منطقة الدراسة.

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 cribrorepandus* (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)

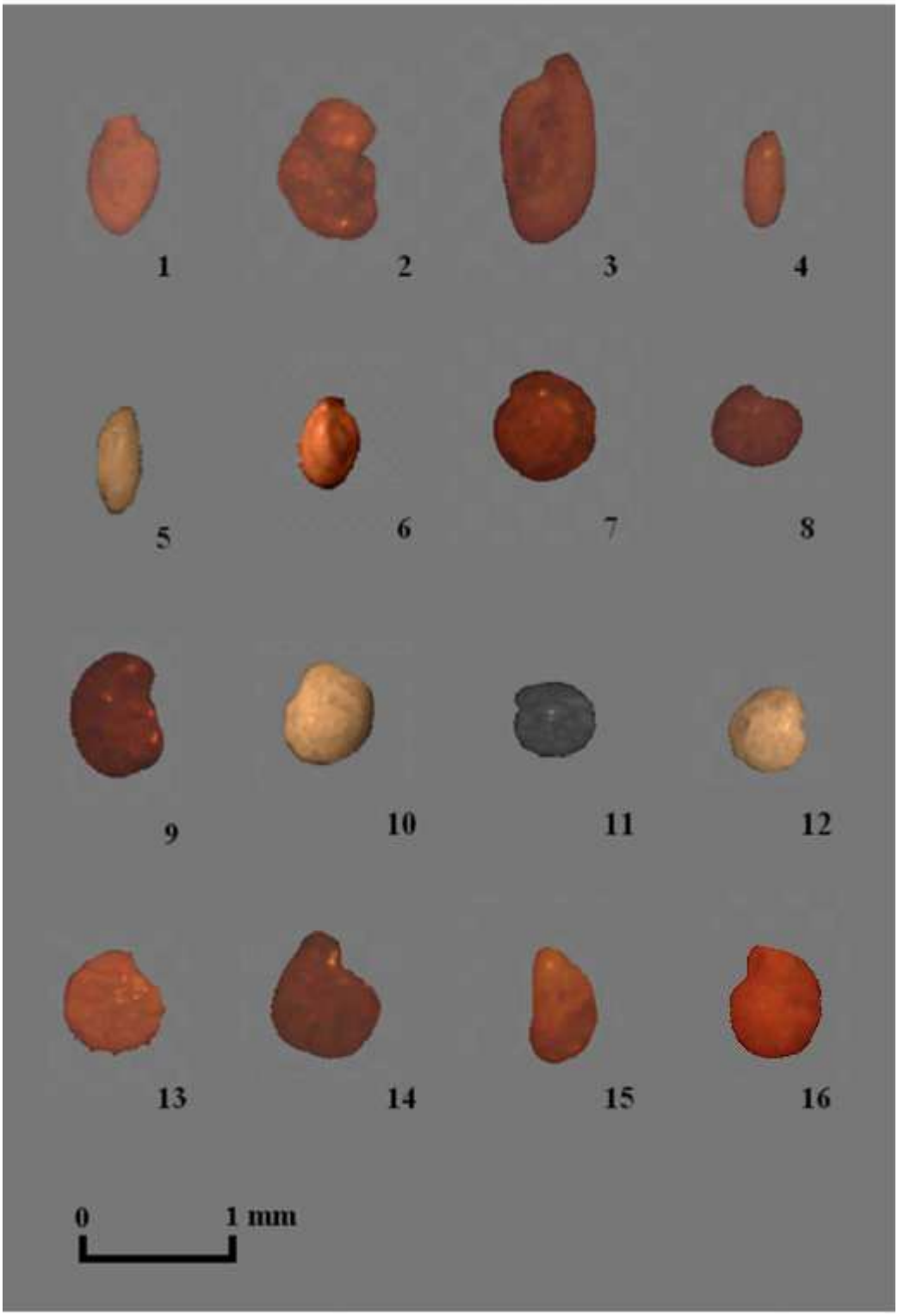

Plate (2)

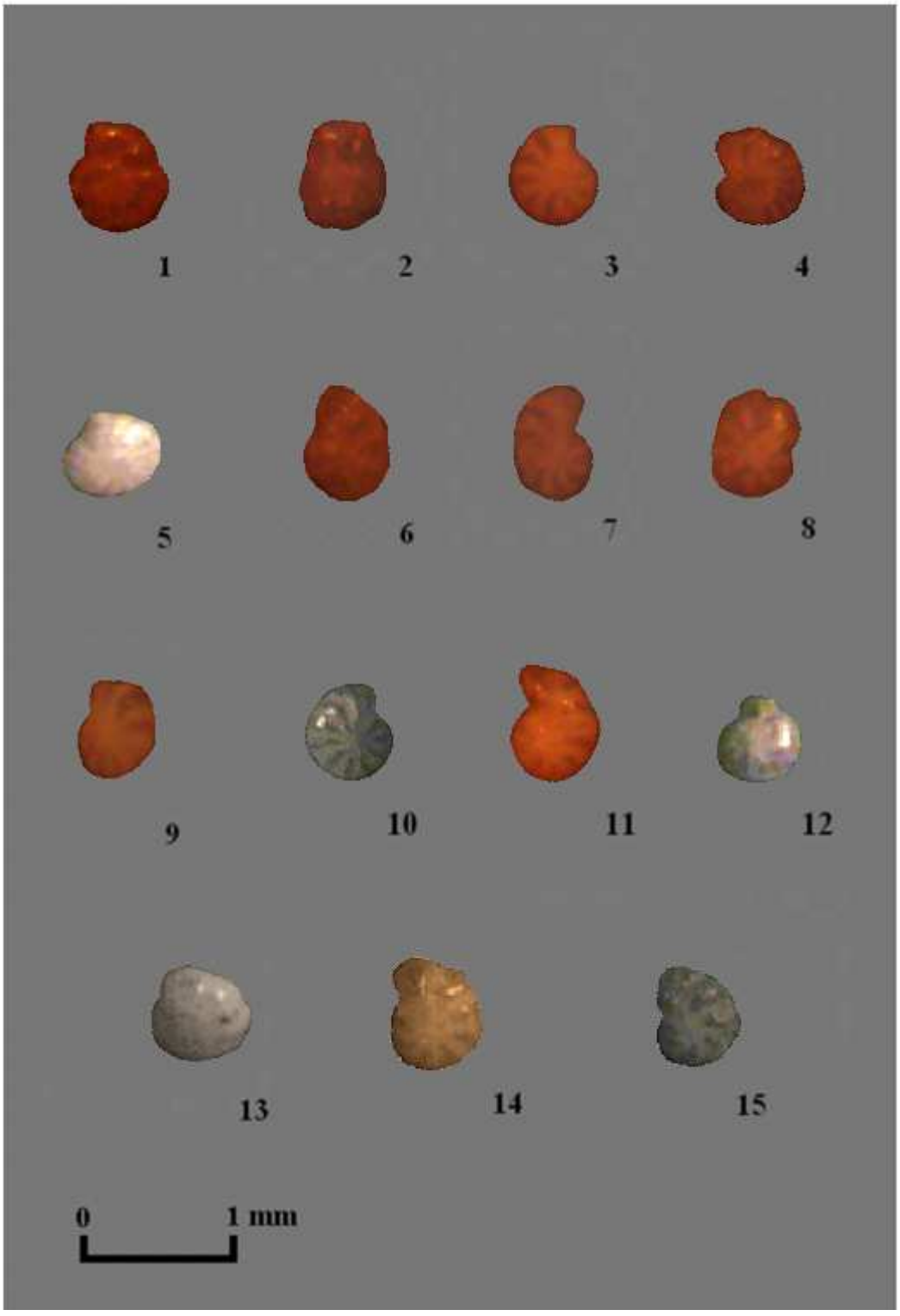

Plate (3)

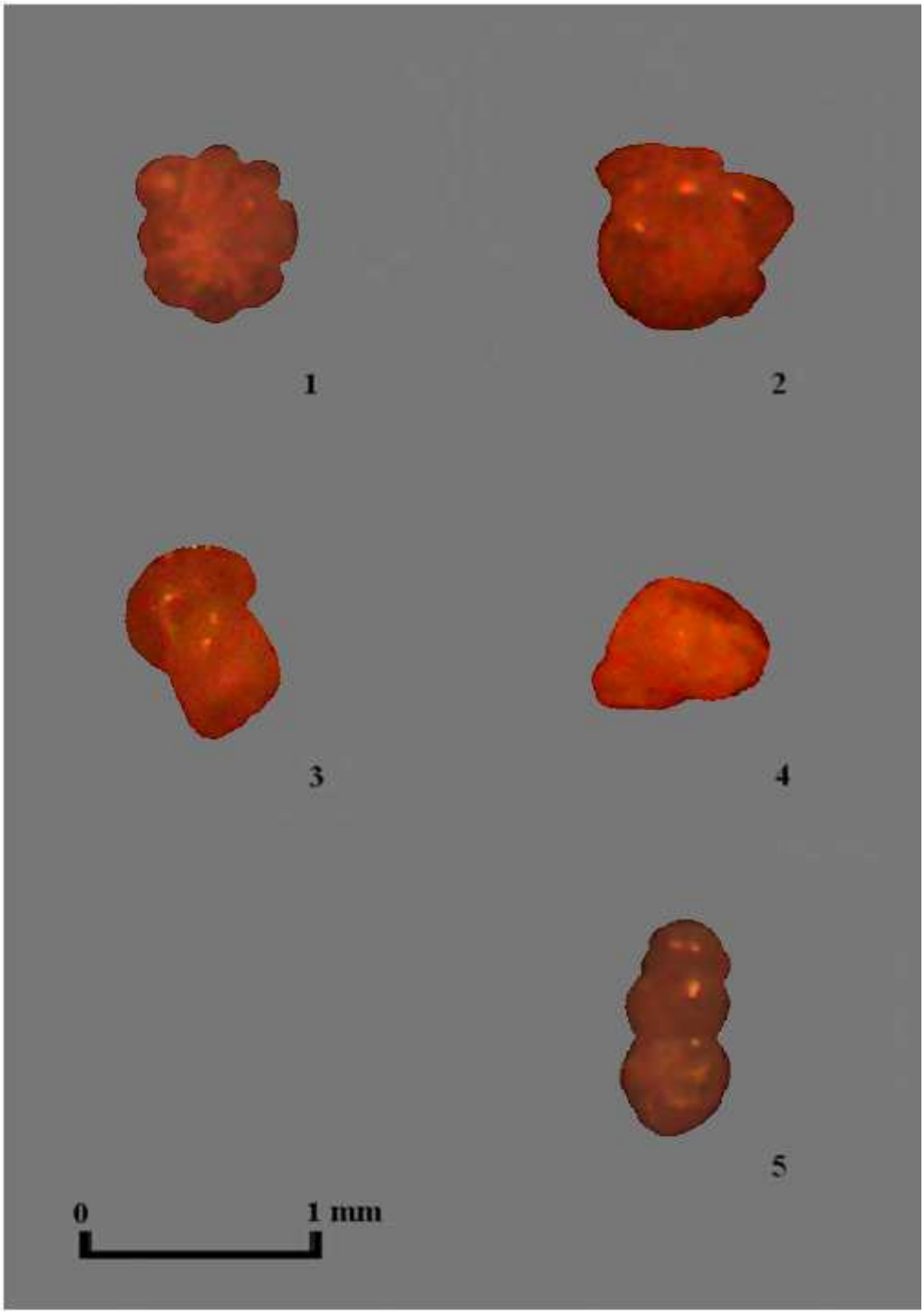

Plate (4)