THE IMPACT OF MARINE TRANSGRESSION IN THE MARSHES OF SOUTHERN IRAQ

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Abstract:

The marshes in southern Iraq are one of the most interesting phenomena to study because of their unique environment. Therefore, this region has received a lot of attention in various studies. It is known about the environment of the marshes that it represents a fresh water environment where it is supplied with river water. Therefore, it would be natural for the sediments to reflect that environment, especially in the surface areas of it. However, the location of the marshes in the southern part of Mesopotamia, which was affected by changes in the sea water level during the Holocene period, may raise interest to know the environmental status of the marshes during that period. To find out, three sites were chosen in the marshes of northern Basra province to represent the southern part of Iraq, where the depths of the samples varied between surface and subsurface samples, reaching a depth of three meters. The samples were subjected to grain size analysis in order to know the nature of the sediments and the extent of their differences or similarities through the depths, as well as the diagnosis of the shells present in them to define the environment in them at the time while they were following the same environment or there was a change in it with the varying depths. The study showed the dominance of silt deposits in the study area clearly over other types of sediments, in addition to the variation in the sources of those deposits. While the shells, which belong to different types of fauna, revealed the presence of the marine influence in addition to the well-known riverine influence in the region, which confirms the arrival of the impact of the change in the level of marine waters during the Holocene period to the marsh areas in southern Iraq.

Key words: Marine Transgression, Marshes, Southern Iraq, Holocene, Northern Basrah.

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Introduction:

The south of Iraq is characterized by marshes, which are called locally (Ahwar), and they are a unique ecosystem, classified as a type of wetland(Young et al., 2002). The marshes area is covered by sediments, including fluvial sediments carried by the Tigris and Euphrates rivers, and others by wind transport (Aqrawi& Evans, 1994). The repercussions of fluctuations in sea level, sedimentation and tectonic activities are factors that affected the development of the marshes in southern Mesopotamia(Aqrawi, 1993). The palynological evidence of climatic and environmental changes in the Quaternary period of southern Iraq showed the effect of marine transgression in the formation of marine sediments at the beginning of the Holocene(Al-Jibouri, 1997). The effect of marine waters was reflected in the sediments of southern Iraq through the presence of forminifera species that indicated as marine (Issa, 2010) , as well as marine species of ostracoda in it (Issa, 2016).

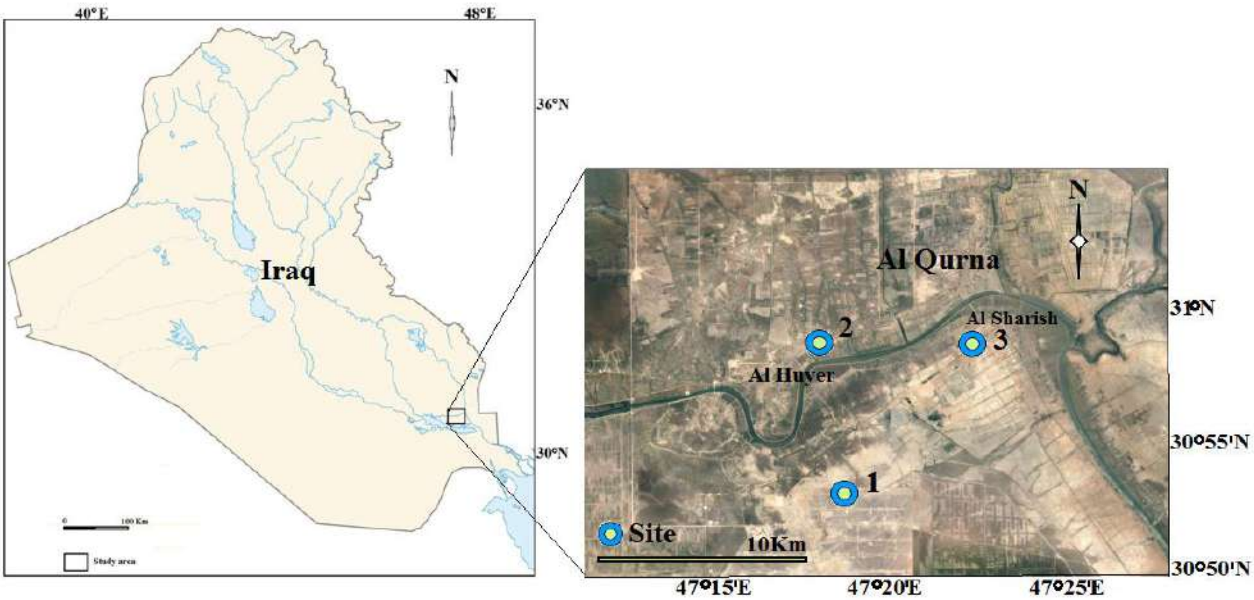
Methods

34 samples were selected from three sites distributed in the study area in the marshes area north of Basra Governorate (Figure 1). The sampling was carried out during November 9, 2009 by using shovel machine. The percentages of sand, silt and clay were determined for all samples using wet sieving on 0.0625 mm sieve in order to isolate sand from silt and clay. As for the particles finer than , pipette method was used depending on Folk (1980).

To identified the fauna shells existent in the samples, the sand remaining on the 0.0625 mm sieve was collected and dried. Thereafter the macrofauna shells were isolated from the microfauna shells, and each of them was placed on a slides appropriate to their size, to diagnosed under binocular microscope, and then their species were determined. In order to classify the species, It was adopted Keen and Coan (1974) for gastropoda and categorization of Moore(1969) for pelecypoda, while the classification of foraminifera was used Loeblich and Tappan (1988), for determine the ostracoda species was used Moore and Bitrat (1961) (Peiris, 1969).

Figure 1

Location map of samples



Results and discussion

Sediments Texure Analysis

The results of the grain size analysis for the three sites according to Folk (1980) detected the percentage of sand, silt and clay(Table 1, 2 and 3). As it was found that 41% of the total samples fall within the type of silt deposit; 27% sandysilt sediment; 15% mud deposit; 11% clay sediment and the remaining 6% is represented by sandymud sediment 3% and the other 3% by sandyclay deposit.

Table 1:

Grain-size texture of Site 1 sediments

Texture of sediments		Sand%	Silt%	Clay%
	Max.	8	56	57
Mud	Min.	3	39	41
	Average	5	48	47
	Max.	18	79	16
Sandy silt	Min.	15	66	6
	Average	3	73	11
Clay	Max.	1	31	71
	Min.	0	29	68
	Average	1	30	70
	Max.	17	21	64
Sandy clay	Min.	12	18	62
	Average	15	20	61

Table 2:

Grain-size texture of Site 2 sediments

Texture of sediments		Sand%	Silt%	Clay%
	Max.	10	80	32
Silt	Min.	2	62	17
	Average	5	70	25
	Max.	19	64	24
Sandy silt	Min.	15	55	12
	Average	17	60	17
	Max.	16	55	34
Sandy mud	Min.	13	51	32
	Average	14	53	32

Table 3:

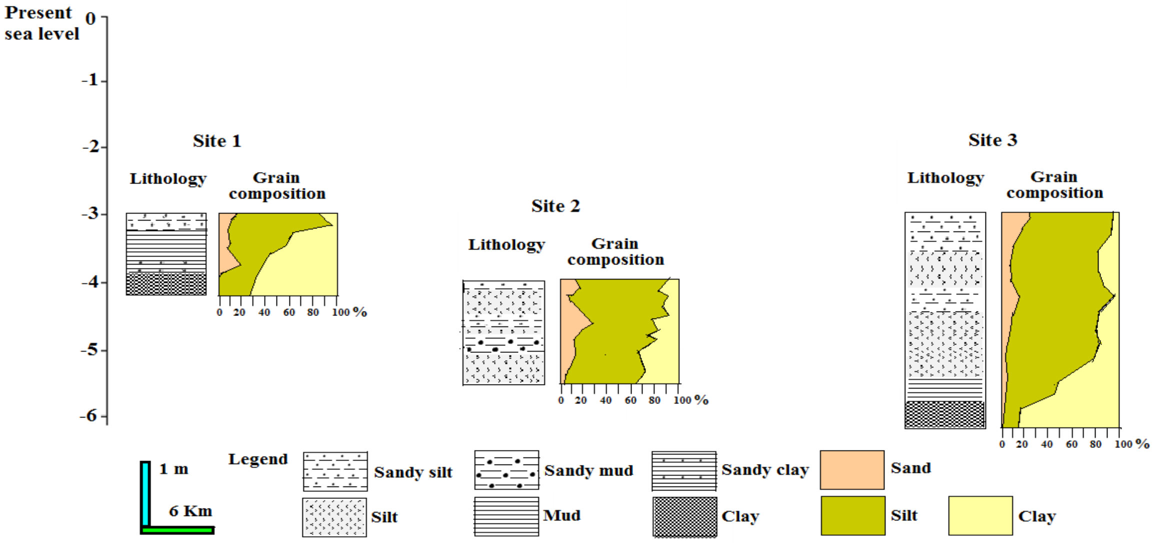
Grain-size texture of Site 3 sediments

Texture of sediments		Sand%	Silt%	Clay%
	Max.	9	77	27
Silt	Min.	2	71	14
	Average	6	74	21
	Max.	25	76	9
Sandy silt	Min.	17	72	3
	Average	20	74	6
	Max.	5	44	55
Mud	Min.	1	42	52
	Average	3	42	53
	Max.	1	17	84
Clay	Min.	< 1	16	82
	Average	< 1	16	82

It was observed that all sites were covered by sandysilt sediments and these sediments extended to depths ranging from 12 to 32 cm. As for the silt deposit, it formed the largest percentage in the second and third sites, with depths of 151 to 209 cm. While the depositions of mud was the most present in the first site. As for the clay deposit, it appeared in sites 1 and 3, but its appearance in site1 was shallower at a depth of 87 cm, while it only appeared at a depth of 280 cm in the third location (Figure 2). This may be due to the physiographic difference of the study area. The appearance of this sediment may also indicate a change in the sedimentation condition, which is closer to a marine water environment (i.e. an indication of marine transgression), which can be confirmed by the nature of the fauna shells accompanying the sediment. Issa (2016) indicated that the sedimentary environment in the marshlands could be fluvial mixed with marine sediments.

Figure 2

Lithological columns of the studied sites and the results of the complete sedimentological analysis



Fauna Shells

After identification the fauna shells for the three sites, the results showed the presence of two groups; macrofauna, whose shells appeared clearly on the study area surface (Figure 3), represented by the Mollusca phylum , the two classes Gastropoda and Pelecypoda. While microfauna represented Foraminifera and Ostracoda (Figure 4). By following the distribution and abundance of species' shells (Figure 5) in the depths of the three sites, three zones were distinguished (Figure 6):

Figure 3

Mollusca shells the apparent at surface of the site 1

(C) *Corbicula fluminalis* (Müller,1774)

(U) *Unio tigridis* (Bourguignat,1853)

(B) *Bellamya bengalensis* (Lamarck,1822)

(Mt) *Melanoides tuberculata* (Müller,1774)

(Mp) *Melanopsis* (*Melanopsis*) *praemorsum* (Linnaeus,1758)

1- Zone 1

The zone was distinguished by the appearance of the five types of molluscs in the three sites, namely; *Corbicula fluminalis* (Müller,1774); *Unio tigridis* (Bourguignat,1853); *Bellamya bengalensis* (Lamarck,1822); *Melanoides tuberculata* (Müller,1774) and *Melanopsis* (*Melanopsis*) *praemorsum* (Linnaeus,1758) except for the second species, which never appeared in the third site.

At site 1, mollusca species appeared along the zone. Where the five species appeared close in the abundance at the zone top, but the first species was the most abundant and prevalent in the sediments. The thickness of zone at site 1 is estimated to be approximately 45 cm.

In site 2, the zone thickness was estimated at 31 cm, where the five species appeared at the zone top sediments, and the species continued to appear, except for the second species, whose appearance was confined to the surface only of the zone .The first speciesalso prevailed in its abundance in the zone within the second site.

As for the thickness of the zone in the third site, it reached 51 cm, the species *Corbicula fluminalis*; *Melanoides tuberculata* and *Melanopsis* (*Melanopsis*) *praemorsum* appeared throughout the zone except for *Bellamya bengalensis*.

The distinction of Zone 1 was based on the environment of the five species of molluscs that coexisted together, which reflected the environment of the freshwater marshes.

Corbicula fluminalis, *Unio tigridis*, and *Bellamya bengalensis* are known to exist in the marshland environment where the water is fresh with varying energy of this water for the first species (Plaziat & Younis, 2005), as for *Melanoides tuberculata* and *Melanopsis* (*Melanopsis*) *praemorsum* despite being freshwater species (Plaziat & Younis, 2005; Gutiérrez Gregoric et al. 2007), however, both species can be found in other environments. *Melanoides tuberculata* recorded its appearance in estuarine environments (Bolaji et al., 2011), as well as the type *Melanoides* (*Melanopsis*) *praemorsum*, which was indicated to exist in sediments affected by an estuarine environment (Al Ameri & Briant, 2018). However, these species grouped together and Corbicula fluminalis dominate , the freshwater marshes being a feature of this range.

2- Zone 2

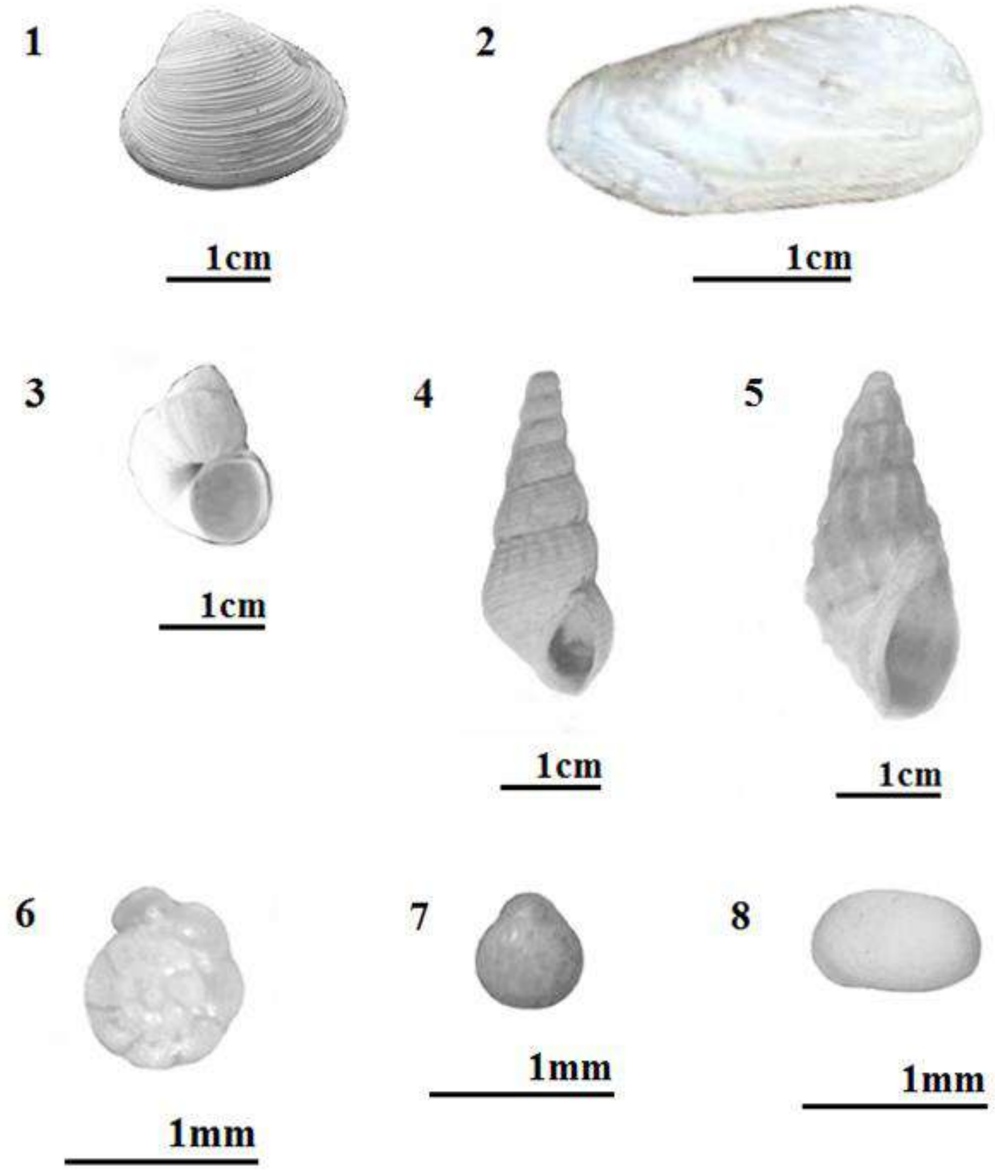
The zone was estimated to have a thickness of 30 cm at site 1, 29 cm in site 2 and the largest thickness of 89 cm at site 3. What distinguishes this zone is the regression of the appearance of molluscs species to two species or only one.

The zone at site 1 was determined by the presence of *Corbicula fluminalis* at the top of the zone with a gradual increase in the appearance of *Ammonia beccarii* (Linné, 1758). While *Corbicula fluminalis* and *Melanoides tuberculata* prevailed at the top of the zone at the second site, with *Ammonia beccarii* appearing at the bottom of the zone. As for the third site, the zone was distinguished from the presence of *Corbicula fluminalis* and *Melanoides tuberculata* with fragments of molluscs shells, which extended to the bottom of the zone where *Ammonia beccarii* appeared.

The presence of *Corbicula fluminalis* is a clear indication of the presence of the river influence and thus the fresh water, but the existence of *Melanoides tuberculata* with it and shell fragments as well as the appearance of *Ammonia beccarii* is an indication of an environmental change where salinity differs and the energy of the environment as well. *Ammonia beccarii* is one of the species indicated to exist in a brackish environment with marine influence (Murray, 1991). It also indicates the occurrence of *Melanoides tuberculata*, which was known to be able to tolerate variations in salinity. All species and the circumstance of this zone refer to being affected by saline water, so the range can be defined as representing a brackish environment.

Figure 4

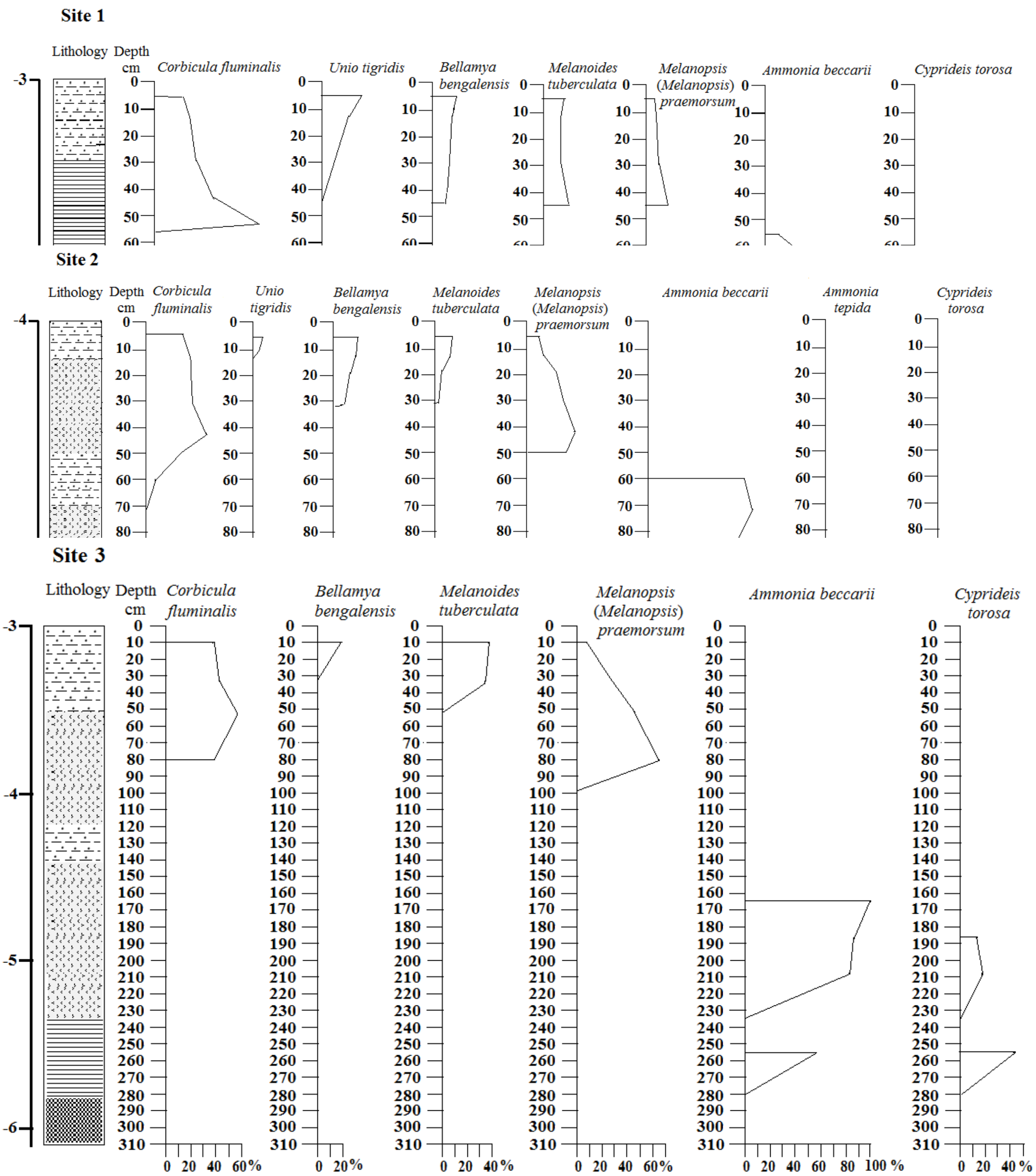
The identified species shells in the study area



Pelecypoda: 1. *Corbicula fluminalis* (Müller,1774); 2. *Unio tigridis* (Bourguignat,1853); Gastropoda: 3. *Bellamya bengalensis* (Lamarck,1822); 4. *Melanoides tuberculata* (Müller,1774); 5. *Melanopsis* (*Melanopsis*) *praemorsum* (Linnaeus,1758); Foraminifera: 6. *Ammonia beccarii* (Linné,1758); 7. *Ammonia tepida* (Cushman,1926); Ostracoda: 8. *Cyprideis torosa* (Jones, 1850).

Figure 5

Relative abundances of the mollusca, foraminifera and ostracoda species in site 1, site 2 and site 3



3- Zone 3

The zone thickness reached 36 cm in site 1, 91 cm in site2 and 170 cm in site3. The occurrence of *Ammonia beccarii* , *Ammonia tepida* (Cushman, 1926) and *Cyprideis torosa* (Jones, 1850) clearly dominated this zone. The first type was the most dominant and continued to appear throughout the zone. The third zone was distinguished as a brackish-marine environment.

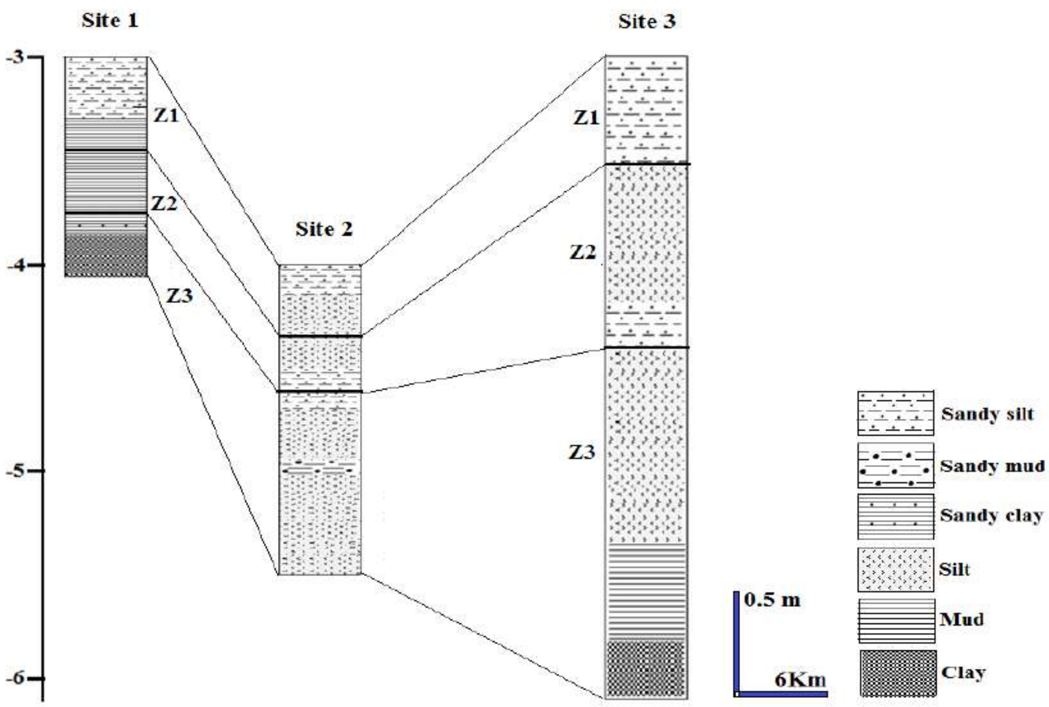
The brackish environment is characterized by the presence of *Ammonia tepida* and *Cyprideis torosa*. Whereas, *Ammonia tepida* is a species that spreads in brackish waters

(Murray, 2006) with salinity less than 33‰ (Le Campion, 1968; Rouvilois, 1970; Debenay, 1978; Redois, 1996 in Debenay, et al. 1998). The environment of *Cyprideis torosa* also indicates the brackish condition through its existence (Meisch, 2000).

It was noted that the presence of the two species was not continuous along the zone, with the existence of *Ammonia beccarii* which it complete dominance over the zone, it is known that this species dominates in marine environments (Debenay, et al. 1998). This imposes the possibility of the presence of marine influence as a result of the change in sea level and the arrival of the impact of marine transgression during the late Holocene period, which is reflected by the nature of the shells, and the age of sediments where these was previously referred to in the study of Aqrawi(2001).

Figure 6

Distribution of zones in the study area



Conclusions

- The types of sediments in the study area are six types; Silt, Sandy silt, Mud, Clay, Sandy mud, Sandy clay. However, the predominant sediment is Silt.
- The different types of sediments are due to the different sedimentation conditions. The sediments of the study area are mixed with fluvial and marine sediments.
- Depending on the distribution and abundance of shells of the species classified in the study area, three zones were identified that varied in their environment. Zone1 reflected the freshwater marsh environment. While Zone 2 represents the brackish environment influence in the marshes. As for Zone 3, it showed the effect of marine waters clearly.
- The effect of marine waters in the study area is likely due to the effect of marine transgression during the late Holocene, depending on the shells appearance nature.

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