

The sedimentary model of Thi-Qar governorate during the holocene, south west Iraq.

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Abstract:

Nine boreholes that do not exceed 20m depth were studied in Thi-Qar Governorate to determinate the sedimentary model of this area, so the boreholes were studied from lithological point of view, four beds were identified from bottom to top 1. Dense silty sand bed could belong to the Hammar Formation 2. Medium silty clay \ silty sand bed 3. Stiff silty clay bed 4. Marly silty clay bed, as well as, the faunal assemblages was determinate one bore hole (B.H9). Depending on the Lithological and paleontological information, three stages of sea level fluctuation were characterized, there are: 1. The maximum of transgression, the shore line covered the region of south east of Mesopotamia but did not reach Shattrah and Al-Gharraf cities towards the west 2. Simple regression of the shore line, reached to Nassiriya city borders (BH.5) 3. Rapid regression of the shore line, where the marine sand is disappeared throughout the study sections.

Keywords: Thi Qar geology, Clastic deposits, Sedimentary Models, Holocene events,

Introduction:

The Holocene epoch is of great interest because it provides a recent analog for past environments and processes. Its sediments and landforms provide important clues to changes that occurred as a result of the last shift from the glacial to the nonglacial climatic mode [1].

'Mesopotamia' is in origin a Greek name (mesos 'middle' and potamos 'river', so 'land between the rivers'). The name is used for the area watered by the Euphrates and Tigris and its tributaries, roughly comprising modern Iraq and part of Syria. South of new Baghdad, the alluvial plains of the rivers were called the land of Sumer and Akkad in the third millennium, Thi-Qar governorate lies within Mesopotamia plain, so it has played an important part in the history of mankind, especially in the end of 3rd millennium B.C.

The present work deals with the paleontology and paleoecology of the Holocene sediments in Thi-Qar to determine the ancient model of the governorate before 10 thousands years ago

Methodology

Valuable data was obtain from detail study of samples from nine borehole, drilled by Nassiriya water project, Snafee Engineering construction in November, 2004 in the many places covered Thi-Qar governorate (fig.1),(table 1) the method of boring by auger up to depth 20 m from surface. Fifteen samples were collected from Bada'a borehole (B.H.9) as a detail study in addition to randomly samples from the other sections to compare the results with the other sections. For paleontological purpose, the weight of each samples used in this study is 50 g. The samples were washed using 75mm. then sieved with tap water and dried in an oven; the fossils content were examined and picked up under binocular microscope.

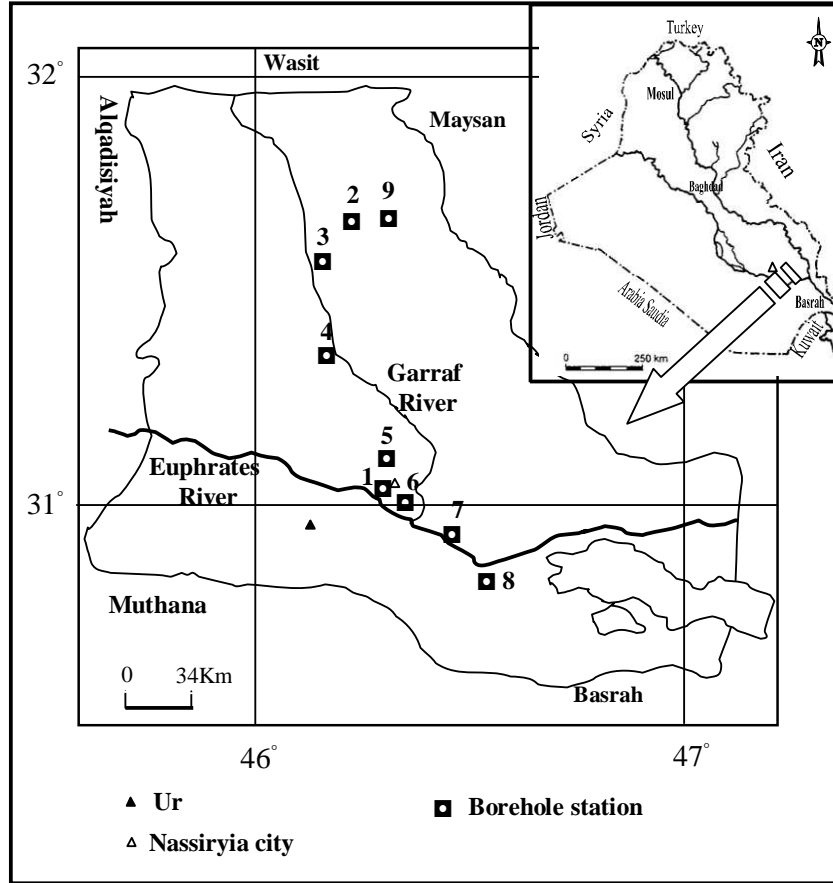


Fig. (1) Study area in Thi-Qar governorate (Google Earth)

Table (1) location of borehole station in Thi-Qar governorate

symbol	Place	symbol	Place	symbol	Place
B.H.1	Clarifying tank at Nassirya city	B.H.4	Storage tank at Al-Garraf	B.H.7	Booster pump station No.3 near the traffic cross to Basra
B.H.2	Intake on Al-Garraf river at Badaa	B.H.5	Booster pump station No.2 near chick point in Nassirya city	B.H.8	Storage tank at Suq Al-Sheuk
B.H.3	Storage tank at Shattrra	B.H.6	Booster p. station No.1(Alfrook co.) in Nassirya city	B.H.9	Storage tank at Duwaiah

Lithology and Stratigraphy:

There is a similarity in lithology between the studied sections, all of them comprise of clastic deposits, mainly silty sand and silty clay, and based on the lithological content of the studied section, four beds were distinguished (fig.2, 3, 4):

1. Dense silty sand bed, it is a grey coarse grained of silty sand, the average depth of the bed is (15-20) m., this bed belong to Hammar Formation, The major part of the Holocene succession is the Hammar Formation, which thickens to more than 30m toward the Arabian Gulf, it composed of brackish water /marine deposits of mid Holocene transgression that prograded northwestward beginning at about 9000BP [2], the Hammar Formation was carbon dated to 5020±90 years BP and 4310± 160 years BP (Oyster)in the southern shore of lake Hammer and 5730±201 years BP and 4770±140 years BP north of Khor Abdullah [3].
2. Medium silty clay \ silty sand bed, it's grey to brown medium of silty sand with silty clay, the average depth of the bed is (10-15) m., this bed belongs to alluvial plain, the alluvial sediments are highly variable ranging from medium sand to silty mud, sediments within the Euphrates are sandy in Nassiriya center but in Shattrra and Al-Gharraf cities essentially subaquatic, deposited in the marshes and levee regions, under these conditions sediments within the channel are grey silty clay. Alluvial – plain mud and lacustrine clayey and sandy silt were deposited above the Hammar Formation during the late Holocene beginning about 3000yr BP [4], [5], [6].
3. Stiff silty clay bed, the average depth of the bed is (5-10) m, it is characterized with grey by it is with increasing in organic matters, with a few gypsum and mica, this bed probably represent lake and marshes sediments, generally it is characterized by it is fine textures of mud and silt, light grey color with massive organic intercalation . The earliest Holocene deposits is organic –rich marsh \lacustrine silty sand found along the axis of the Mesopotamia depression, towards the depression margins, these sediments grade laterally into gypsiferous alluvial plain deposits, playa evaporates and sandy silt also occur at the western margins, reflecting low-stand sea level [2].
4. Marly silty clay bed, it is brown, grey medium to stiff of marly silty clay, the average depth of the bed is variable could be (5 to surface, this bed probably belongs to the flood plain, generally the flood plain reveal a massive brown silty soil profile lacking bedding, this massive character results man's activity and the intense bioturbation by roots.

The Mesopotamia flat plain, up to 200 km wide, is underlain by fine grained alluvium of Euphrates and Tigris rivers, the modern floodplain includes active channels, natural levee, crevasse splays and floodbasins, as well as areas now removed from active fluvial deposition by avulsion or channel migration overlying sand and silt containing small marine gastropods of the Hammar Formation, the alluvial silty deposits overlying the marine Hammar Formation can be interpreted as resulting from a deltaic progradation to the southeast [7],[8].

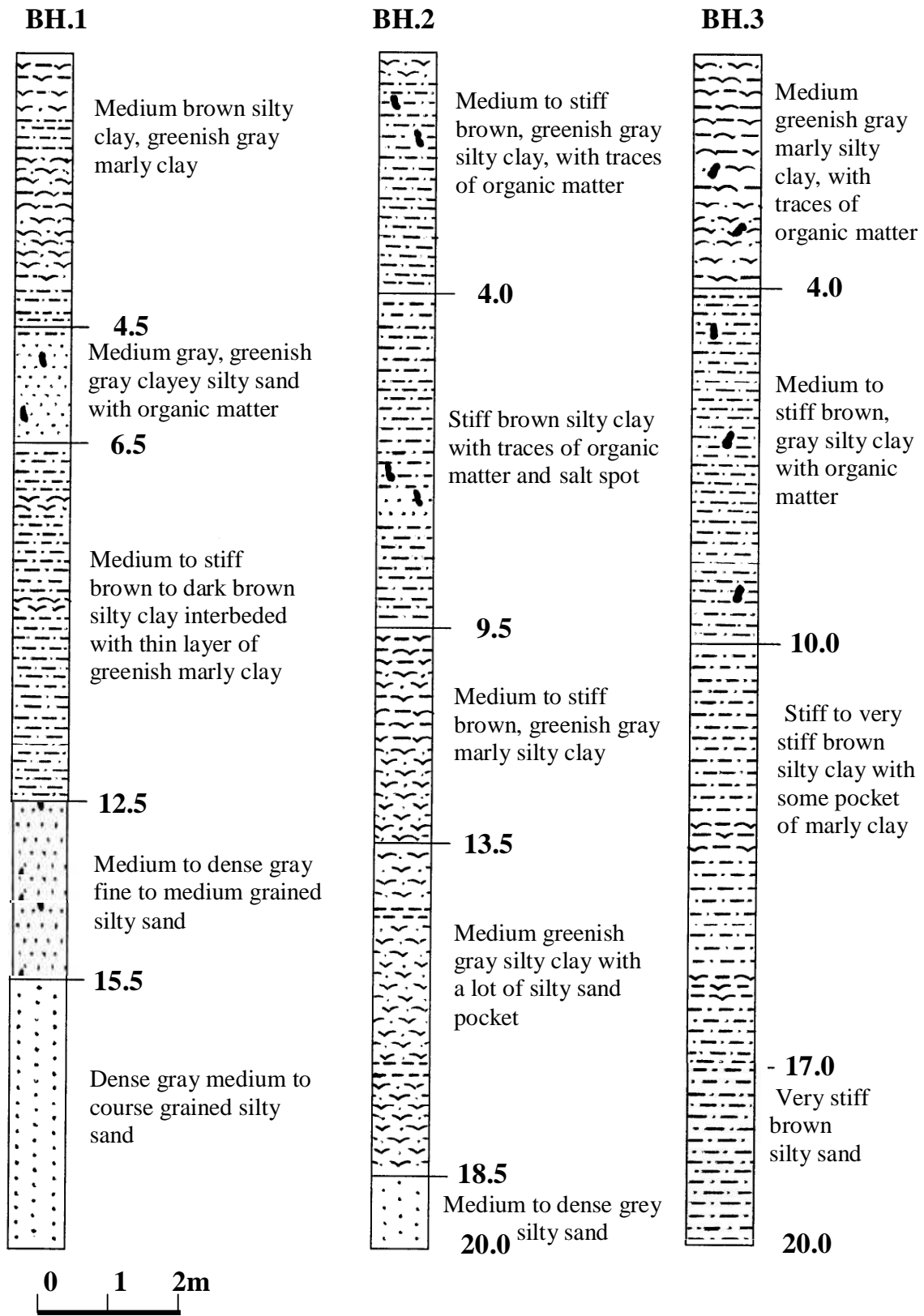


Fig.(2) Lithologic columns to the Boreholes (B.H.1),(B.H.2),(B.H.3)

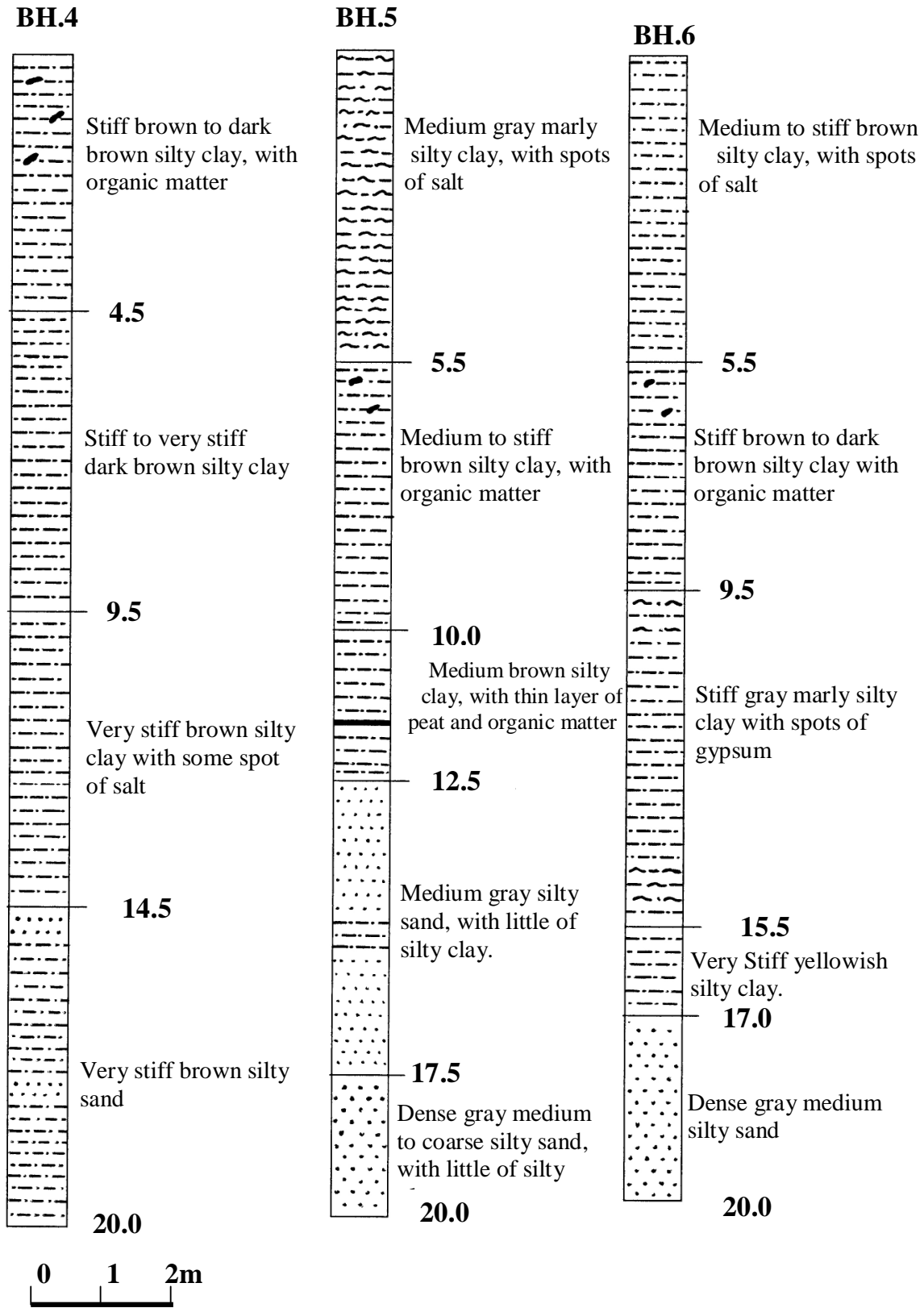


Fig.(3) Lithologic columns to the Boreholes (B.H.4),(B.H.5),(B.H.6)

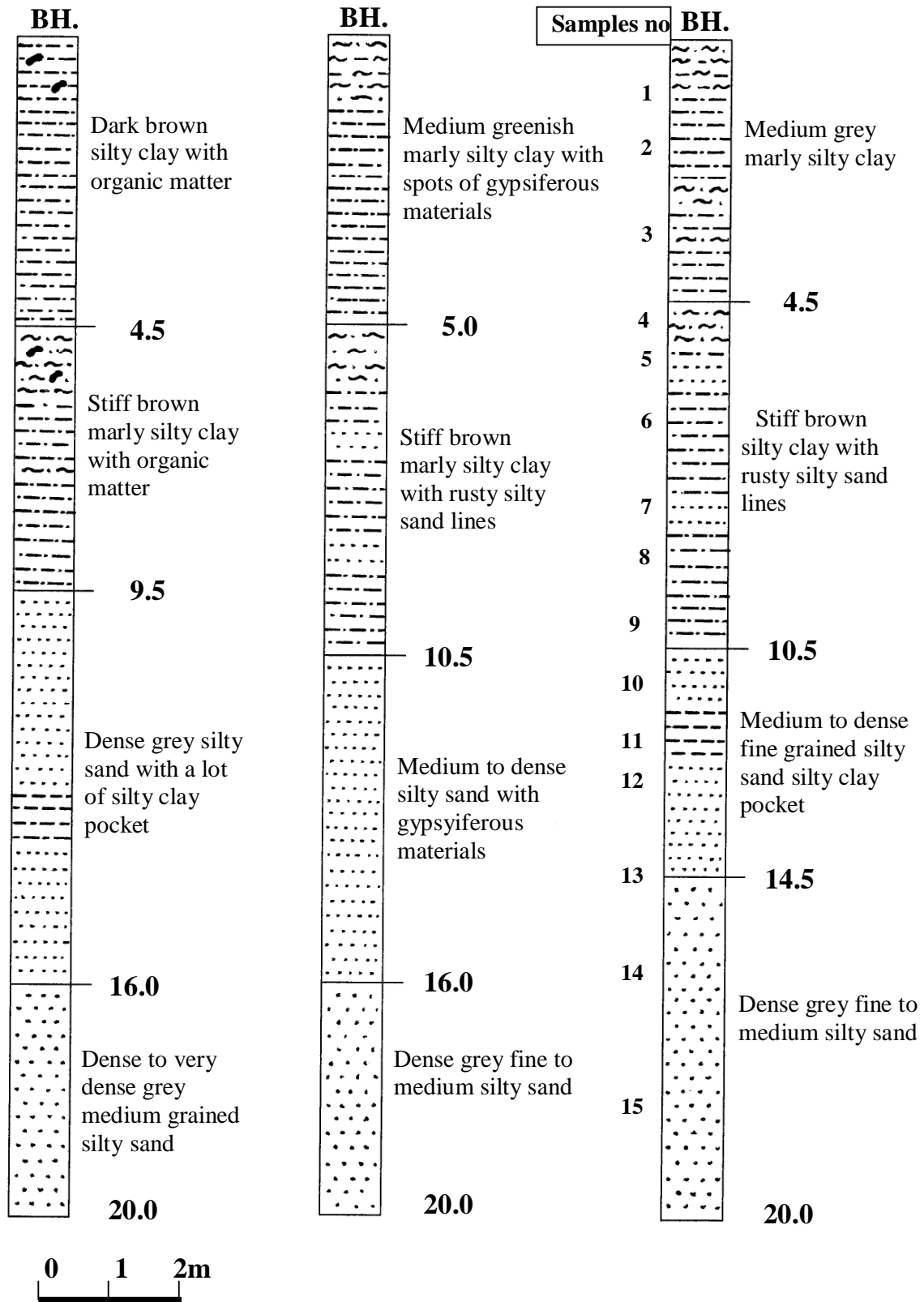


Fig.(4) Lithologic columns to the Boreholes (B.H.7),(B.H.8),(B.H.9)

Paleontology:

Fifteen samples were collected for paleontological study from borehole (9) they are distributed along the borehole (fig.4), as well as random samples from the other sections through the drilling operation in water project, Most of samples are barren of fossils or reworked especially in the bottom sections in the silty sand facies, so it is difficult to appearance biostratigraphic zones to these region due to discontinuous for most of genera identified, as well as maybe transported from far places, the foraminifera assemblages are useless here, cause of a few numbers of species with suspect in origin it, it maybe thanatocoenosis, so the colleague depending on Ostracode assemblages and put the genera with lithology division:

1. Dense silty sand bed, the number of species is rare, but there are some species of Ostracode like *Cyperdeis torosa*, *Eucypris pigra*, *Darwinula stevensoni* in addition to gastropods species as *Guraulus intermixtus*, *Lymnaea(radix) gr.auricularia*
2. Medium silty clay\ silty sand bed, most of species abundant there, like *Cyperdeis torosa*, *Ilyocypris monstrifica*, *Candoniella simpsoni*, *Cyperdis torosa var torosa*, *Ilyocypris sp.*, *Cyprinotus salinus* and gastropods species like *Odostoma sp.* with sponge specula
3. Silty clay bed, there is a few species in this bed, like *Cyperdeis torosa*, *Ilyocypris bradi*, *cyperis sp.*, and other group like *Guraulus intermixtus* and radiolaria sp
4. Marly silty clay, there are many of species in this bed, like Ostracode species, *Cyperdis torosa*, *Darwinula stevensoni*, *Candona compressa*, *Eucypris pigra* and other group like Charaphyte, and detrital gastropods.

The following Ostracoda species could be used on a good indicator for water depth;

Cyprinotus salinus: salinity range (0.5-25)%0 loffer ,1969 in [9].

Candona sp.: bathymetric range is suprlittoral to Eulittoral (depth about 0.6m).[10]

Candona compressa: salinity range (0.5-5.8)

Ilyocypris sp.: bathymetric range is epilittoral. [11]

Darwinula sp.: Bathymetric range supralittoral to eulittoral (depth about 1.1m)

D.stevensoni ; salinity range is (0-15)%0.[12].

Krutak, 1971[13] suggested that the presence of *Cyprinotus sp.*, *Darwinula sp.*, *Candona sp.*, *Ilyocypris sp.*, with abundant in Charaphyte indicate marsh \ lake deposits and may be could indicate on fresh standing water with slight current action [14]. About *Cyprdeis torosa*, the colleague didn't depending it, because of high range of salinity which *Cyprdeis torosa* life it approximate 0.3-140 %0 [9].

Generally most of the genera are influence in fresh water, there is dilution in salinity by fresh water fed by rivers, as well as, few meters of the sea water covered the region, the species of genera and radiolaria indicate a saline water in the bottom part of the sections belong to Hammar Formation, but the other parts of section comprises of fresh water sediments may be belongs to Maymuna Formation [15], since 3000BP fresh water environment of the area has persisted without any major change [16].

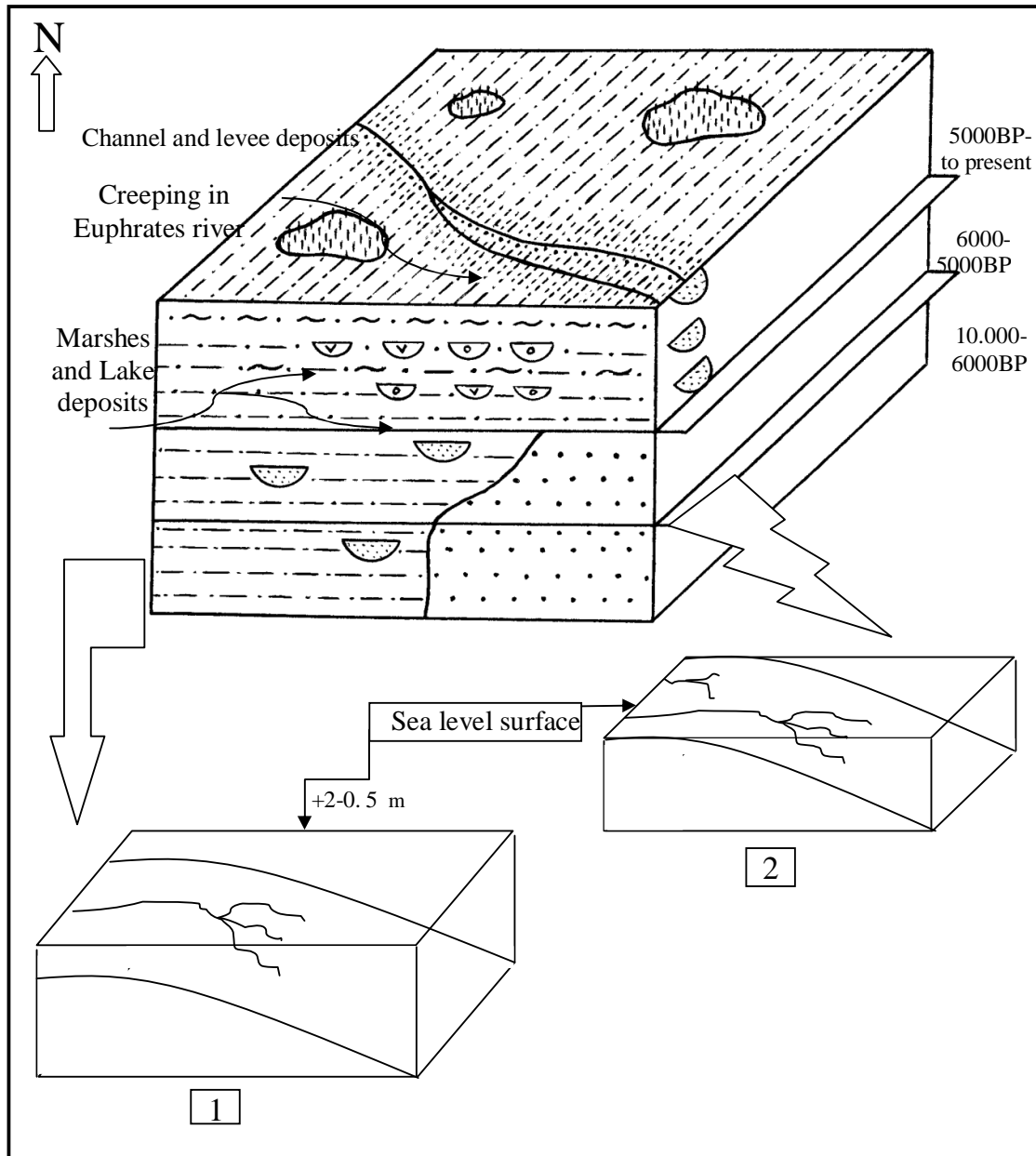


Fig.(5) The sedimentary model suggested for the Thi-Qar governorate during holocene

Model of Nassiriya block in holocene

The Holocene epoch is a geological period that extends from the present day back to about 10,000 radiocarbon years, approximately $11,430 \pm 130$ calendar years BP (between 9560 and 9300 BC). The Holocene is the fourth and last epoch of the Neogene period (second epoch of the unofficial Quaternary sub-era). Its name derived from the Greek words ὅλος ("holos") which means whole or entire and καινή ("kai-ne") which means new or recent [1]. During the 10.000 years BP twenty meter of the sediments have been deposited, so the so the colleague focused of the Holocene period , generally the quaternary age is characterized then by development of the river system and by modeling of country's relief by simultaneous erosion [17], since 21.000 years ago, the temperature and drying are increasing with some periods of the humidity [18], but in the middle Holocene a humid climate was a common [19],

this climate effect in the geomorphology of Mesopotamia plain after then it's helped to create a marshes and it's development during 8000-9000 BP [20], with changing to the rivers flow [21]. The Holocene Climatic Optimum was a period of warming in which the global climate became 0.5-2°C warmer than today. However, the warming was probably not uniform across the world [22], It began roughly 9,000 years ago and ended about 5,000 years ago, when the earliest human civilizations in Asia and Africa were flourishing. This period of warmth ended with a cooler period with minor glaciations, which continued until about 2,000 years ago. At that time, the climate was not unlike today's, but there was a slightly warmer period [1]. from the 10th-14th Centuries known as the Medieval Warm Period. This was followed by the Little Ice Age, from the 13th or 14th Century to the mid 19th Century, which was a period of significant cooling, though not as severe as previous periods during the Holocene. The model of Nassiriya block is comprises of three stages of sea level fluctuation 1. The maximum of transgression, the shore line covered the region of south east of Mesopotamia but did not reach to Shattrah and Al-Gharraf cities towards the west, the maximum transgression at about 6000BP extended about 400Km inland from the present shoreline [23], 2. Simple regression of the shore line, reached to Nassiriya city borders (BH.5), 3. Speed regression of the shore line, the marine sand is disappeared in the study sections, many of studies certified a speed regression at 5000BP [21], while Evans *et.al.*, 1969 (in [24]) though that the regression happened before 3750 BP, the shore line retreat until depth 120 m comparing with present day. However, in the end of Pliocene, a huge transgression had took place in the Mesopotamia plain, the water raise to 150m [25], and the marine transgression extended as far inland as 640 km from it's present position [2], and then started Warm glaciers before 70.000-17.000)BP, so the climate of the Arabian gulf become more continental, that's courage to flowing the continental rivers [18], after the 17.000 BP the glacial blocks began dissolution and the period called post glaciations, so a huge transgression had covered the Mesopotamia , this transgression known in name a Flandrian, so in Holocene period before 10.000BP, the maximum sea level raise until to reach Amarah and Nassiriya cities and began to retreat since 6000BP, the marine deposits known in Hammar Formation [9],[5]. Holocene sedimentation rates have been calculated for lacustrine / deltaic deposits of lower Mesopotamia, Rate between 1 and 1.8m/year were dominate throughout the Holocene from 4800 year BP until about 3000 year BP during the later stage of Holocene, rates of 0.4 mm/year were not exceeded [4], that's mean all the fluvial and alluvial deposits don't exceed the 12m overlain the marine deposits.

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الموديل الرسوبي لمحافظة ذي قار خلال العصرالحديث (الهولوسين) جنوب غرب العراق

ماهر منديل مهدي الاسدي
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المستخلص :

تمت دراسة تسع آبار لا يتجاوز عمقها (20م) درست في محافظة ذي قار من اجل معرفة البيئة القديمة لترسبات العصر الحديث بغية وضع موديل رسوبي يمثل الاحداث الجيولوجية التي مرت خلالها المنطقة ، اذ درست صخرية هذه الابار وحددت اربعة طبقات ممكن تميزها وهي من الاسفل الى الاعلى 1.طبقة رملية غرينية كثيفة قد تعود الى تكوين الحمار البحري 2.طبقة رملية غرينية مع طبقة طينية غرينية 3.طبقة طينية غرينية صلبة 4. طبقة طينية غرينية طفلية . فضلا عن دراسة اهم المستحاثات الموجودة في احد الابار المدروسة (البئر 9) وعلى ضوء المعلومات الصخرية والمستحاثية حدد إنموذج رسوبي يمثل البيئة القديمة للمنطقة ويبين تأثير المنطقة بتذبذب مستوى سطح البحر وحدد ثلاثة مراحل لهذا التذبذب 1.تمثل اقصى تقدم بحري اذ غطت المياه شرقا وصولا الى مدينتي الغراف والشطرة 2.تراجع بحري بسيط وصولا الى حدود مدينة الناصرية من جهة الشمال 3. تراجع بحري سريع اذ اختفت جميع الادلة للمياه البحرية في منطقة الدراسة .