SEDIMENTOLOGICAL STUDIES OF THE MUKDADIYA FORMATION SOUTH—EAST OF BADRA

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Abstract

The upper of Mukdadiya Formation (Pliocene), which exposed south-east of Badra on the west of the anticline. This part of the Formation ranging between 80m to 120m in the study area. Two sedimentolgical sections were studied in the area. The Formation composed mainly of clastics sediments. These clastics consist of conglomerate, sandstone and mudstone facies.

The conglomerate facies mostly are with trough cross bedding and normal graded bedding. The matrix content decrease upwards within the conglomerate beds. The sandstone facies is mostly of very coarse to coarse sand grains, andmostly with trough cross bedding. The bed thickness of the both above facies varies vertically and laterally from one location to another as well as in the same section. The mudstone shows no sedimentary structures and constant thickness, most of the mudstone beds have light brown color; few clay beds have light green color. The conglomerate facies with normal graded bedding represent the channel river deposits while large scale trough cross bedding conglomerate beds represent the longitudinal channel bar deposits, and the trough cross bedding sandstone facies represent a typical river channel point bars deposites.The mudstone beds are river flood plain deposits. The conglomerate, sandstone and mudstone facies repetitions in number of cycles in all the studied section indicate that these deposits are production of braided rivers, the bed thickness and the trough cross bedding size and pebble size as well as the sand content is very good indication of typical variation of braided rivers activities throw the deposition time.

دراسة رسوبيه لتكوين المقداديه جنوب–شرق بدره

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الخلاصة

ينكشف الجزء العلوي من تكوين المقداديه العائد لعمر (الباليوسين)، الى الجنوب الغربي من مدينة بدره في محافظه واسط،وعلى طول السفح الغربي للطيه. السمك الكلي لهذا الجزء من التكوين في منطقة الدراسه الحاليه تراوح بين 120م الى80م. تم دراسة مقطعين رسوبيين في المنطقه حيث تالف التكوين بصوره رئيسه من رواسب فتاتيه متمثله (بصخور المدملكات conglomerate ، الحجر الرملي sandstone، الحجر الطيني(mudstone). تتميزسحنة المدملكات باحتوائها على تدرج حجمي اعتيادي ، والبعض الاخر على تطبق متقاطع حوضي، كمية الملاط (matrix)ضمن السحنه ينخفض باتجاه اعلى الطبقه.تمتاز سحنة الحجر الرملي بحجم حبيبي كبير جدا الى كبير،و تظهر معظم الطبقات الرمليه تظهر

تطبق متقاطع حوضي باحجام مختلفه،سمك طبقات صخور المدملكلات والحجر الرملي تظهر تغير في سمكها افقيا وعموديا في جميع المقاطع المدروسه في منطقة الدراسه. الصخور الصلصاليه والطينيه لم تظهر اي تراكيب رسوبيه واضحه.تمثل سحنة المدملكات ذات التدرج الحجمي رواسب قناة نهريه ، اما المدملكات ذات التطبق المتقاطع فانها يمكن ان تمثل رواسب نموذجية لرواسب حواجز القنوات الطوليه، اما سحنة الحجر الرملي ذات التطبق الحوضي المتقاطع فانها يمكن ان تمثل رواسب الحواجز النهريه النقطيه (point bars).تتمثل رواسب السهول الفيضيه(flood plain) بسحنتي الصلصال والغرين. أن التكرار الحاصل في سحن المدملكات ، الحجر الرملي والصلصال والطين ، اضافة الى طريقة وجودها يشير الى أن معظم هذه الرواسب هي ناتج لفعاليه انهار ظفائرية(braided rivers). أن التغير في مجموعة من المعطيات مثل حجم المدمالكات ، سمك الطبقات وحجم البنيات (التطبق المتقاطع) خير دليل على التغير المستمر في نشاط فعالية الانهار اثناء عملية ترسيب التكوين.

Introduction

Mukdadiya Formation was firstly described in Iraq by (1). The clastics deposits well exposed along the west side of the Foothill to the High Folded Zone of Iraq. The formation sediments were described as afluviolacustrine by (2).The recent geological studies indicate that the calstics which represent the formation are of fluvial environment.

The upper part Mukdadiya Formation is very well exposed about 20km southeast of Badra Town along the west side of the Foothill Zone (Fig 1). The formation was indicated from the first exposed of the conglomerate bed. The lower contact with the underneath Injana Formation not well exposed in the studied area. The formation formed mostly of conglomerate, sandstone and mudstone beds. These beds were seen in number a repetition cycles in the studied sections. The total thickness of well exposed of the formation in the study area reach about 120ms.The present study concentrated on the bed thickness of the conglomerates, sandstone and mudstone facies .Vertical and lateral bed thickness variation. The sedimentary structures and the relation with environment of deposition.

The conglomerate beds shows' variation along the vertical sections and from section to the other along the Formation exposures. The sandstone and the mudstone beds also have the same variation .The most important sedimentary structures were seen are trough cross bedding mostly seen in conglomerate and sandstone beds, also some of the sandstone beds have ripple marks. Vertical browse also seen in the upper part of sandstone beds. The conglomerate pebbles and sand grains size also show some variation along the vertical and lateral of the Formation exposures

Sedimentary facies

Depending on the field observations. The clastics sediments of the studied sections were divided into three main facies:-

A-Conglomerate Facies.
B- Sandstone Facies.
C- Mudstone Facies.

A- Conglomerate Facies

This facies can be divided into two subfacies (A1 and A2) according to the pebbles size, sand matrix content and the trough cross bedding size.

A1-Coarse gravels conglomerate subfacies

This subfacies comprises large pebbles up to 7cm long. Most of them seen in lower part of the beds. The pebbles are grain to grain support with very low percent of sand matrix content. This facies shows normal graded bedding and large scale of trough cross bedding. The pebbles are with different origin (quartz, jasper, carbonate and other kinds, with different color too. The coarse pebbles show some imprecation, the long axis oriented parallel to the bedding plane, the sandy matrix content increase in the upper part of the beds and the conglomerate become matrix support. This facies present in the thick beds (up to 4.5m)(fig 2&3). Some of brown clay mud balls where seen scattered with in this facies, some of them reach in length to 10cm.The lower and upper contact of the bed which formed this facies are angular contact. The trough cross bedding reach about 3m long, and bed set reach 70cm thick were seen in the upper part of this facies (fig 2&3)(plate 1).

Plate 1: conglomerate facies with trough cross bedding

A2-Fine gravels conglomerate subfacies

The gravels are fine, with maximam length about 2.5cm, showing some normal graded bedding. The conglomerates are sandy matrix support, some time the sand present as scattered lens in the upper part of the bed. This facies also have trough cross bedding, but in small size up to 1m length and the bed set about 30cm thick. The conglomerate beds have irregular lower and upper contacts and the bed thickness not more than 2.5 m. in most of the studied sections (plate 2) (fig 2&3).

B- Sandstone Facies

This facies is also divided into two subfacies (B1 and B2) according to field observation which depend on the sand grains size and the kind and size of the trough cross bedding:-

B1-Very-coares sandstone subfacies

This subfacies formed of very coarse to coarse sand grains. In some beds it becomes coarse sandstone on the upper part of these beds. Few fine pebbles were seen scattered throw the bed, most of these facies were seen laying over the conglomerate facies (subfacies A1). With irregular lower contact, few of coarse pebbles seen scattered in the lower first few centimeters of this subfacies,. Few small brown mud balls seen in few locations. The trough cross bedding set reach in length to about 4ms,and the set thickness up to 50cms,the bed in each set separated from each others by medium to fine pebbles seen scattered along the bed contacts, some large pebbles (4cm long) seen in the central part of the trough (plate 3)(these pebbles which seen scattered along the bed contact, especially the large size where seen near the center of the trough, may be indicate that these pebbles where carried from older gravel beds by water movement and moved and scattered along the bed contact by gravity depending on there size) (fig 2&3). The bed thickness in the studied locations range from 2ms up to 3ms, and this thickness varied laterally.

Plate 2: Trough cross bedding sandstone, the pebbles separated the bed sets

Carried from older gravel beds by water movement and moved and scattered along the bed contact by gravity depending on there size) (fig 2&3). The bed thickness in the studied locations range from 2ms up to 3ms, and this thickness varied laterally.

Plate 3: Large size of trough cross beddingsandstone

B2-Coares sandstone subfacies

This subfacies is composed mainly of coarse sand grains sometime graded up ward to medium sand. Few fine pebbles were scattered throw bed, this facies were seen laying over sandstone facies (subfacies B1) with lower undulation contact (ripple surface). The trough cross bedding set reach in length to about 1.m, and set thickness not more than 40cm. The cross bedding length and the set thickness become smaller near the top of the bed (plate 4). Few mud balls were seen in some locations. The long axis of balls oriented parallel to the bedding plane (plate 5).Vertical borrows with about 7cm length seen in the upper part of the some beds (the ripples marks which seen on top surface with there direction toward the trough center as well as the borrows may be very good indication for shallowing water depth, which good indication for sand bar deposits). (Fig 2&3).

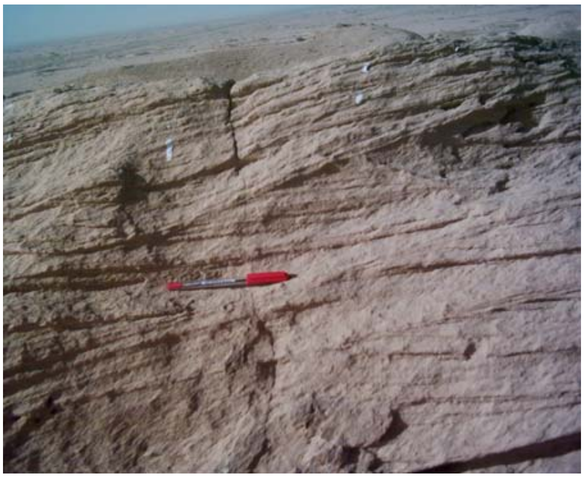

Plate 4: Sandstone beds with small size of trough cross bedding in the upper part

Plate 5: The mud ball in the upper part of sandstone bed

C-Mudstone facies

This facies is mostly with light brown in color, well bedded, the bed thickness varies from 2ms up to more than 5ms, the bed thickness increase upward the sequences, the lower contact for most the beds are nearly sharp with sandstone facies or with conglomerate facies (A2), but the upper contact is mostly irregular contact with conglomerate beds (A1or A2), some pebbles of the conglomerate facies were seen scattered near the top of this facies (fig 2&3)

Interpretation

The present study concentrates on the sedimentary facies kinds. and there repetition and sedimentary features in the studied sections of the formation, to locate the facies deposition place, and the fluvial activities. During the deposition time of the formation in this area.

According to irregular lower contact of the conglomerate facies (A1, A2). The graded bedding features. And the lateral bed thickness variation also trough cross bedding, with correlation with the typical channel facies from different locations (fig 2&3). Indicate that most of the conglomerates are channel river deposits (3, 4, 5, 6, 7). The bed thickness and the sand matrix content may indicate the power of the river activity. The higher activity of fluid movement bring coarse and high amount of pebbles, and of the sand can be washed away and leave the pebbles very close from each others to become grains supported (6,8,9, 10, 11) .The large trough cross bedding are normal result of the strong water flows. Graded bedding also other indication for flow strength. The increasing in sand matrix content and reducing in trough cross bedding maybe good indication for this change in water flow strength (12). The repetition in the conglomerate beds throw the sequence are very good indication for number of river activities during the deposition time, but generally this activity become less upward the sequence. The bed thickness and the pebbles size indicate that changes. The ripples which seen on the upper surface of the last bed which probably indicate shallowing water over these sediments and maybe responsible for producing these ripples during water movement over the bed surface. The pebbles mineralogy shows that most of them were carried from rocks older than the Al-Fatha and Injana formations beneath or may be older beds. The mud balls and the large size of them may be good indication that these balls were carried by current water flow from the oldest clay beds beneath. The presence of the mud balls within the conglomerate beds and there large size, indicate for high current flow regime .The small size of the mud balls which seen scattered.

Near the sandstone bed probably carried as bed load during the deposition time of the sand beds. The low resistivity of these balls to the weathering process means most of them were transported not far way from the deposition location.

The sandstone facies (B1) with large scale trough cross bedding, and there locations above the conglomerate beds indicate that these facies are represent the longitudinal channel bars deposits (3, 4,9, 11,12, 13, 14,15).The lateral variation in the bed thickness(which the maximum thickness seen in the center, may be represent the channel center part. And bed thickness become to the left and right of the channel probably represent the channel flanks)(fig 2&3).The fine pebbles were scattered along the trough beds ,may be transported from the conglomerate beds of the channel bars around or some pebbles supply during water flow movements(the coarse pebbles which exposed in the center part of the trough maybe moved to this place because of there weight along the dip side of the trough). Disappears of the pebbles and small scale trough cross bedding in the upper part of this facies may be, a good in indication for reducing in the water flow power and low pebbles load bed

The sandstone facies (B2) with coarse to medium sand grains, and small size trough cross bedding and the limited exposed over the sand facies B1in on section, with the vertical borrows content in the upper part may be represent a point bars deposits and shallow water depth . The conglomerate and sand stone facies bed thickness and limited lateral exposed may be show that the river channels are very shallow and narrow. The above river channels features (shallow and narrow) probably the main reason for production of thick beds of mudstone beds during the rivers flood season. Most of these mudstone beds represent the flood plane deposits (10, 14, 17, and 18). The studied sections in the area and the repetition of the conglomerate and sandstone beds show number of deposition cycles and distributaries river channels which represent typical braided environment. The variation in the conglomerate bed thickness which can be seen in sedientological logs

(Figure 2, 3), and the conglomerate pebbles shows good indication for the fluctuation in the rivers water currents strength and the sediments supply during the time of deposition

Conclusion

The present study of the Mukdadiya Formatiom Badra area, shows that the sedimentary sequence of the clastics facies are typical of active braided rivers. The graded conglomerate facies represent the channel deposites, and the vertical bed thickness shows vertical reduce in water flow discharge and water power activity. While the lateral bed thickness changes are good indication for channel depth during

the deposition time. The channel bar deposit which can be seen in the trough cross bedded conglomerate facies, while the trough cross bedded sandstone facies

represent the point bar deposits, the ripples marks and borrows which seen in the upper part of these facies are very good indication for water shallowing in this part of the river. The floodplain deposits represented by the mudstone facies, the abundances and bed thickness of these facies maybe indicate for shallowing in channel depth

And mud and silt supply more than the other kind of sediments

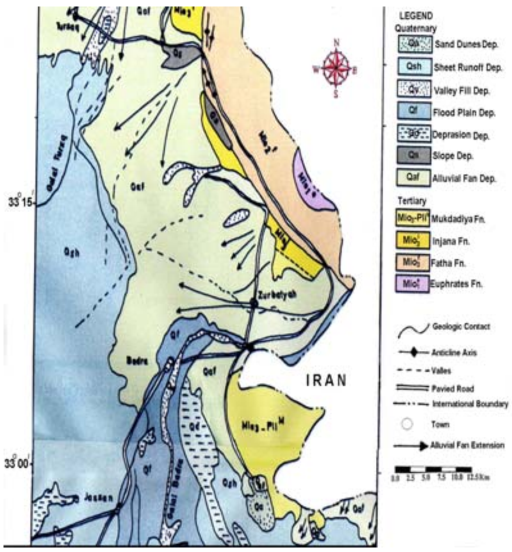

Figure 1A: Geological and Geomorphological map of studied area (Modified from State Company and Geological Survey and Mining, 1996).

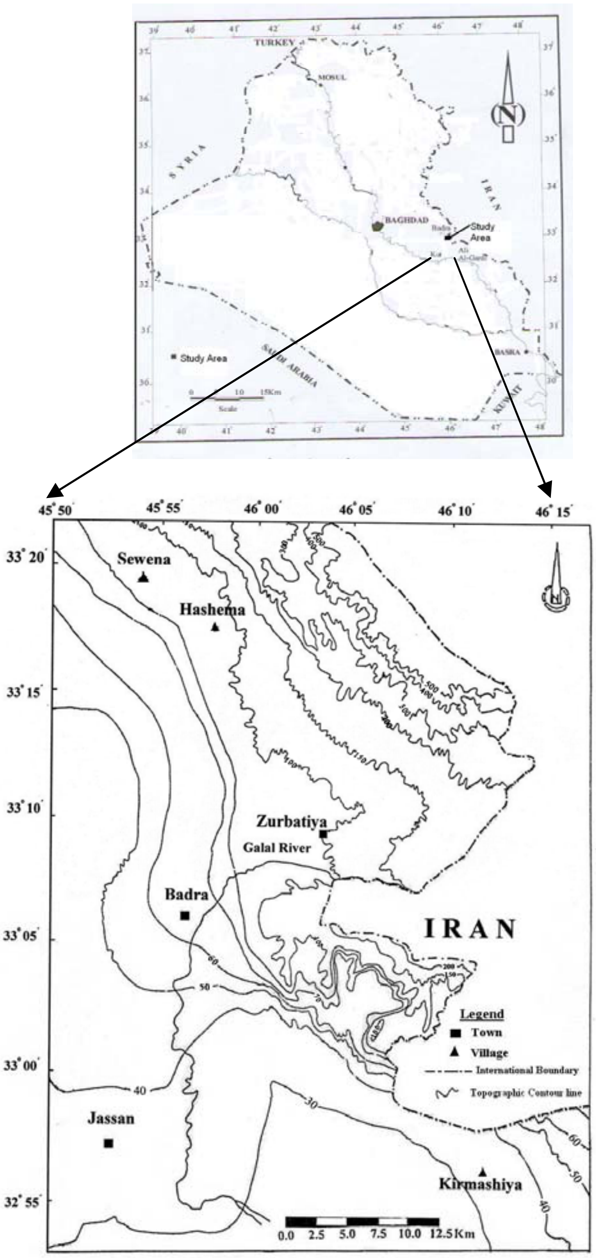

Figure 1B: Location Map of the Study Area

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