Tectonic History for the folds, Hamrin, Ajil,& Makhul in the north Mesopotamian . Iraq

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1-Abstruct :

Hamrin, Makhul & Ajil oil fields & their surrounding were concerned by this study. It was situated at a distance of about 200km. north Baghdad. The information of the drilled oil wells in the area were used in the construction of the cross sections which give us a good idea about the variation of thickness of the sedimentary formations in the Basin during Mesozoic & Cenozoic, which help us to visualized the structural picture of the area.

المستخلص:-

تشمل هذه الدراسه طيات حمرين،عجيل،مكحول النفطيه والمناطق المجاوره لها في شمال السهل الرسوبي.ان المنطقه المذكوره اعلاه تقع على بعد حوالي ٢٠٠كم شمال بغداد .ان المعلومات المستقاة من الآبار النفطيه التي حفرت في تلك الحقول استخدمت في بناء مقاطع ارضيه حيث حصلنا منها على قيم جيده عن الاختلافات في سمك الترسبات للتكاوين الرسوبيه المختلفه في الحوض الرسوبي خلال الحقبتين الوسطى والحديثه من الزمن الجيولوجي لغرض استنتاج الوضع التركيبي للمنطقه .

2-Introduction:

Hamrin Makhul zone was located in the southern part of the foot hill zone of the Mesopotamian for deep of the unstable shelf of the Arabian plate form during Tertiary (Neogen period) (AL-Mubarak &al,1976, Buday,1980).

The above mentioned area was cut by Tigris fault which has north- south direction. This fault extend with Tigris river from Al-fatha north Bejee to the south of Samarra (about 120 km.long).This fault age is between Jurassic-cretaceous & proved by geophysical cross sections. The tertiary sediments was not affected by this fault.

Jassim.S.Z.& al 2006 was considered that Hamrin & Makhul represent the south western borders of the foot hill zone; while Chamchamal- Butma zone represent the north eastern borders. the area was cut by several transversal faults which have NE-SW directions. These faults are generally strike slip faults, because there are indications of horizontal displacements along the plans of these faults .Anah –Fatha fault is an example of these transversal faults. It cause a horizontal displacement between the axis's of Hamrin & Makhul anticlines of about 1000m. Longitudinal faults of NW-SE are also presents. They are generally of thrust type &cuts parallel to the axis's of the principal folds in the area. The low folded zone represents the peripheral parts of the marginal depressions. The folded structures are generally formed from the molasses deposits that accumulated in the basins due to the active erosion which happened for the elevated areas that originated by

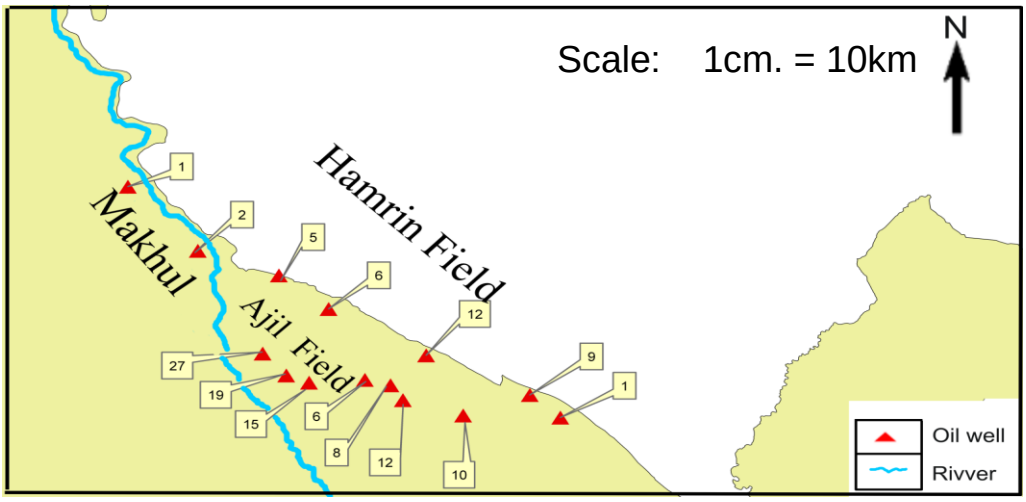
the first phase of folding of alpine orogeny before mio-pliocene age The greatest deformation of the molasses sediments was happened during the period of Pliocene age.(Beydoun.R.Z.1993).

3- Aim of study:

The aim of study is illustration the tectonic history of the area that extand from Tharthar lake in the west to the area comprising Hamrin & Ajile & Makhul structures in the east & North east. This area was desiccated by many Deep-seated faults which were affected the thicknesses of Mesozoic & Cenozoic sedimentary formations, & also on the hydrocarbon accumulation natures.

4- Method of study:

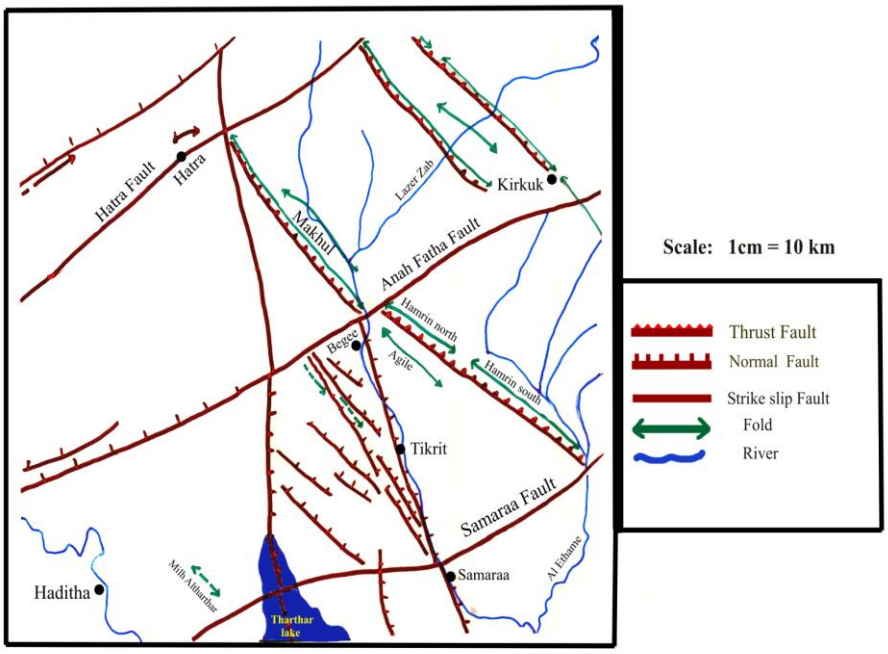
Many deep oil wells which are drilled in the above mentioned area were used in this study (fig.1).These wells are cuts in Cenozoic & Mesozoic sedimentary deposits .True thicknesses of different sedimentary formations were calculated in the drilled wells. The tectonic interpretation was depend on many cross sections which passes by the deep oil wells & also from many surface field observations on the area.



Fig(1): Map showing the distribution of drilled Oil wells in area projected from the coordination of the wells .

5 - Description of the structural elements:

Many structural elements could be recognized Fig(2) ; these are:-



Map showing the essential structural elements in the area

3

5-1 Folds:

Surface folds were recognized. One of these fold was Hamrin fold of more than 100k long & of NW-SE direction & elevate more than 350 m. above sea level. Tow saddles are separate the fold of Hamrine in to three domes which are from NW : Albufdul, Ainukhaila & Allass. Ajile fold is about 20 km. long & about150m.hight above sea level . it can be recognized at distance of 5km. to the SW of Hamrin fold It has a NW-SE direction & separate from Hamrin by narrow syncline. Lower Miocene Jeribe & fatha formation exposed on the core of Hamrin fold , while upper miocene Injana formation exposed along Ajile fold. Makhul fold of more than 45 km.long & more than 500m hight can be recognized to the NW of Hamrin fold across Tigris river .To the NW of Tikrit town ,the subsurface Tikrit structure can be recognize.

5-2 Faults:

Surface faults of NW-SE direction found along the north east flank of Hamrin fold. The type faults are thrust .

The thrust was initiated in fatha formation of lower Miocene age, along the incompetent sulfurous beds of this formation. Many deformed beds &fractures & minor folds are seen along the thrust line. It is possible to recognize many small scale reverse faults of about 30 cm in displacement cut on the upper Pliocene Mukdadiya & Bihassan clastic deposits.The Quaternary sediments are not affected by these faults.(Carpnar.A.1989)

Surface minor Dextral & Senstral strike slip faults are recorded on the clastic rocks of Ingana formation. They are originated by NE-SW compression during Alpine orogeny. Smale scale normal faults are noticed especially along the axis of the folds. They are forming during the compression phase when the external parts of the bended beds are affected by extension.NE-SW faults also can be

fined. These faults are deep-seated subsurface faults, but their effects can be seen on the surface especially along Anah- Fatha fault which is causing a clear shift between Hamrin & Makhul axis's.

5-3:- Joints:

Joints are fractures without displacement on its plan. Many sets of joints are recognized on the surface of the area, most of them are related to the compression .These joints are inclined on the principle stress axis which was generally of NE-SW direction. Some extension joints can be recognize near the axis of the folds.

6-Stratigraphy:

Deep oil wells in the area were showing the following stratigraphy:-

6-1: The tertiary deposits are increased in thickness from west & south west toward east & north east. Fatha formation of lower Miocene age was exposed along the folded area of Hamrin & Makhule . Jeribe formation which is older than Fatha formation can be seen exposed along axial plan of Makhul. In Ajile fold which is lower than Hamrin & Makhul ,it is possible to observe Injana formation of upper Miocene age exposed on the surface of the axial plan . The thickness of Injana formation reach about 500 m. in Ajile oil well No.27 & 19 & 15 . The thickness of the underlying Fatha formation was variable betweens 400-500m.

The lithology of Fatha formation is interbedding of cyclic deposits of claystone ,gypsum & limestone.

The deposinal environment of Fatha formation is laggonal environment, while Injana formation is of fresh water environment which is carry continental deposits. The youngest formations are Bihassan & Mukdadiya of upper Pliocene age, which can be easily recognized on the NE flank of Hamrin & on the SW flank of Makhul fold.

The Quaternary sediments are deposited & covered all the underlying older formations, & they are not affected by folding or faulting.

the older tertiary formations like Jeribe limestone , Dhiban anhydrite & Serkagni , basal anhydrite , Kirkuk group of oligocene age , Jaddala formation of Eocene age & Aliji of

Paleocene age cuts by drilling. the total thickness of all of the above mentioned formations are between 350-750m.

6-2 Sedimentary formations of Cretaceous age cuts by drilling in some deep oil wells. Shiranish formation of upper Cretaceous age found in all drilled deep wells. The underlying formations like Hartha ,Saadi,Tanuma,Khasib are cut by drilling. The total thickness of these upper cretaceous formations more than400m. Middle cretaceous formations reached & crossed in the deep wells.Ahmadi formation ,Maudud , Jawan & Nahrumar are of middle cretaceous age.The total thickness of these formations between 200-450m.Lower cretaceous formations also reached by drilling in some oil wells.Shuiba , Ratawi & Yammama formations are an examples of these formations, which have a totale thickness not more than 100m.

6-3 Upper Jurassic formations like Chiagarra , Gotnia , Najma , Nowkhilikan & Butma reached & recorded in certain oil wells .Middle Jurassic formations like Sargelu ,Mus also reached in few deep oil wells in the study area. The drilled thickness in the Jurassic beds is 500m .the variation in thickness of Tertiary sediments , tops of Shiranish ,Maudud , Shuaiba & the top of Jurassic beds **used as stratigraphic markers for structural interpretation.(Aqrawi & al.2010).**

7- Description of cross sections:

NW-SE cross section sketched & passed by the deep oil wells that drilled in Hamrin & Makhul folds (fig 3) .This section indicated that the area was affected by tension forces during Mesozoic age. These forces originated many normal faults of NW- SE direction, & mostly dipping to the east. The normal displacement is clear on the tops of lower, middle & upper cretaceous formations, so the lower part of tertiary affected by these normal faults. The thickness of formations deposited post Maoudud formation increased toward the SE due the lowering of the basin by the normal faults that dipping east ward.

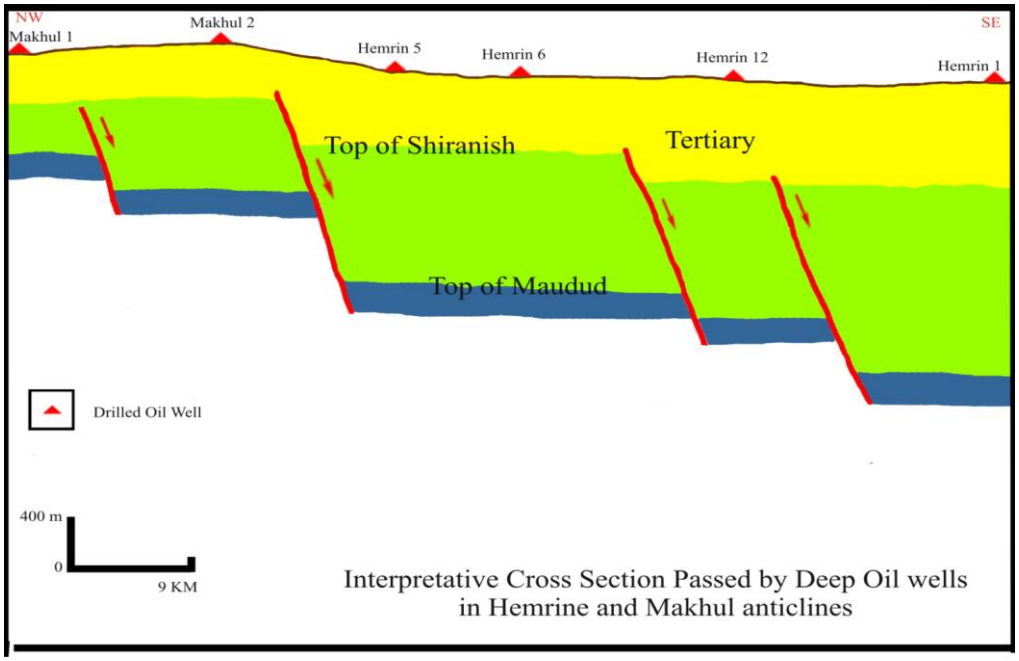


Fig (3)

NW-SE cross section (fig 4) drew along Ajile deep oil wells. This section showing variation thickness of shiranish formation along the field. It increased in Ajile oil well(No.10) an important normal fault passed to the east of Ajile oil well (No. 12).This fault is visible for the increased thickness of Shiranish formation to the east of this well .The variation in thickness of Shiranish to the east & also on the top of Saadi formation in the drilled oil wells can be explained by small Horst & Graben structures along the field. Another NE-SW cross section was plotted between Hamrin & Ajile folds (fig 5) in order to visulize the structural picture of the area .This section is showing a NW-SE over thrust fault cut at Hamrin mountain. The over thrust originated in the sulfurous beds of Fatha formation. The sulfurous beds facilitated the detachment between the

competent upper layers of Fatha formation & the underling incompetent inner beds of salfour. By this fault of the NE. flank of Hamrin fold with their older formatioins are overthrust on the younger formation of the SW flank.

The lower tertiary & cretaceous beds are not affected by this over thrust .The fold below the thrust is simple isoclinals fold (Alsayab 1979).The folding is important in Hamrin with respect to Ajil fold. The top of shiranish formation more elevated along Hamrin due to the important magnitude of folding & it found at depth (832m below surface), While in Ajile the top of shiranish is below 1438m.from the earth surface. Injana formation eroded on the top of Hamrin fold, but in Ajile fold exposed on the surface of the earth & reached about 500m in thickness.

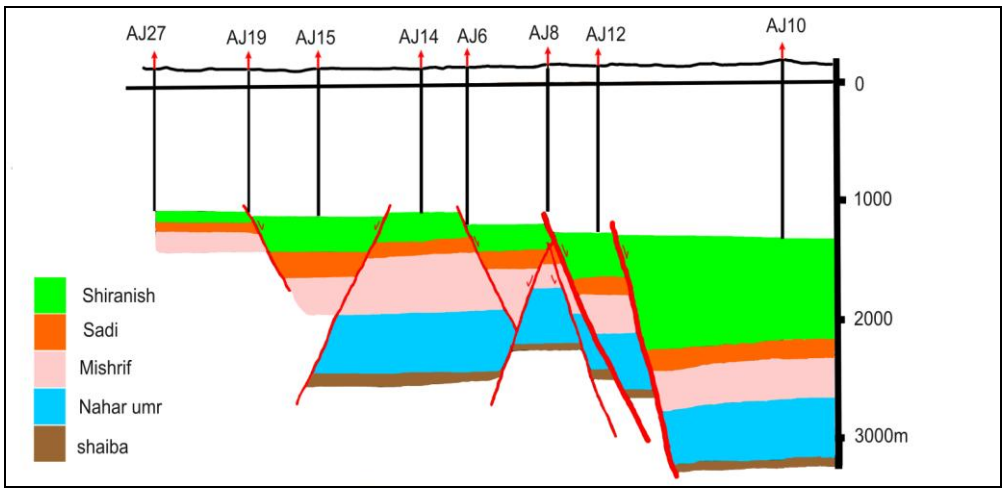
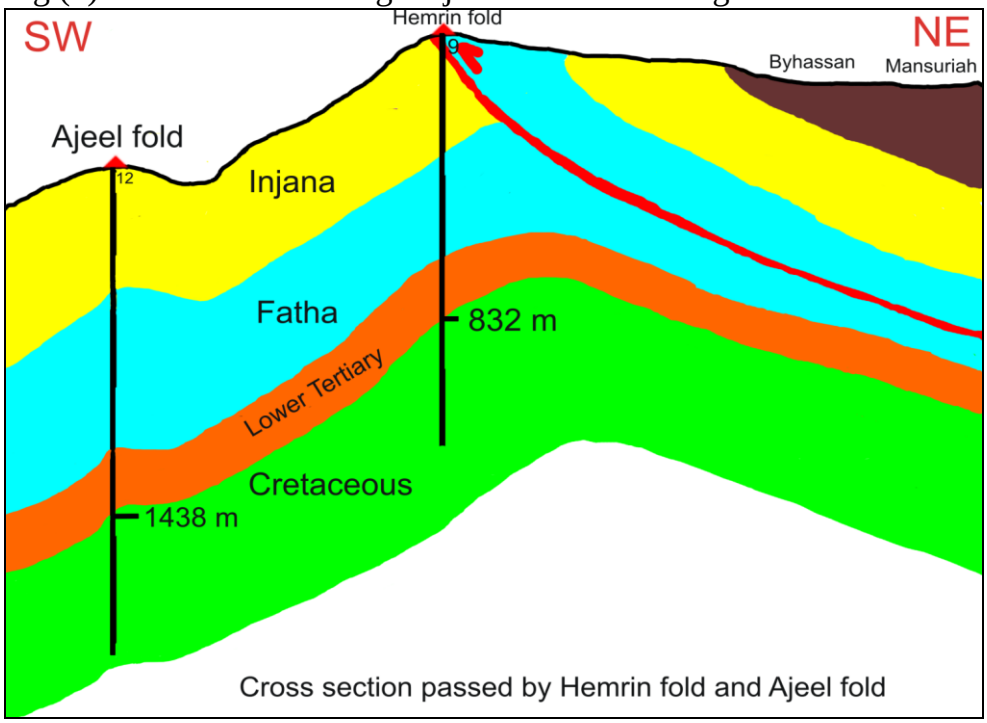


Fig (4) Cross section through Ajil oil fields showing the normal faults.



8- Conclusion:

The study is represente two episode of tectonics recorded in the area . oldest of these episodes is a tension phase, started since Triassic age & continuous until the end of cretaceous. It was responsible for the development of al basins in the area. The direction of tension is NE-SW, which originate NW-SE normal faults .The Thickness of sedimentary formations affected by these faults & also they affected the hydrocarbon distributions in the oil fields.The second tectonic phase which is the youngest was a compression phase started during tertiary & culminated during upper Pliocene ages ,This phase has a direction of NE-SW .it was responsible for all the folds & thrusts in the area.

9-Recommendations:

I recommends to make detail study for the area between Hamrin & Makhul structures & to drill deep oil wells between Hamrin & Kirkuk fold down Jurassic beds to get more structural information about the subsurface beds at the basin.

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