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Tectonostratigraphic History of Mesopotamian Passive Margin during Mesozoic and Cenozoic, South Iraq.

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Abstract

Passive margin of Mesopotamian zone formed by two tectonic phases: opening and closing phases. Opening tectonic phase (Permian-Jurassic) represents the beginning of Wilson cycle. This phase includes three stages: pre-rifting, rifting and post-rifting. In opening phase the passive margin was beginning in formation when the Iranian and Turkish plates split off from Arabian plate with the opening of the Neo-Tethys Ocean. The clastic sediments and evaporites deposited in passive margin, and then the gradual subsidence occurred for two reasons: thermal decay and crustal isostacy. Because of this subsidence, the thick chemical deposits accumulated in the passive margin. Closing tectonic phase (Cretaceous-Recent), include three stages: pre-collision, initial collision and collision stages. In this tectonic phase the plates moved together so Neo-Tethys became narrow. The compressive forces that effected on passive margin deformed the rocks and moved the salt rocks. Then the oil traps are formed and the width of Mesopotamian passive margin become narrow. Mesopotamian passive margin was ended in the Miocene, when the Arabian plate collide with Iranian plate.

Introduction

Generally, the passive margins are very important areas in the world because they represent areas of petroleum accumulations and thick stratigraphic column of sedimentary rocks. Examples of present-day passive margins include the eastern and Gulf coast margins of North America, the eastern margin of South America, both the eastern and western margins of Africa, the western margin of Europe, the western, southern and eastern margins of Australia, and all margins of Antarctica (Van der Pluijim & Marshak, 1997).

In fact, the continental passive margins appear and disappear during the geologic history of earth as result of plate movements (Condie, 1989). One of the passive margins that occur in past geologic history especially in Mesozoic and middle Tertiary is Mesopotamian passive margin. However, the historical study of passive margin gives us better understanding about the nature of sedimentation, structural development and petroleum accumulations in Mesopotamian zone.

Mesopotamian zone has subsurface complex structures like faults, folds and salt domes that form the oil traps. Beside these structures, there are high and complex stratigraphic columns containing the deferent types of sedimentary rocks. In this study we would like to interpret the historical events of these complications that formed in Mesopotamian passive margin. The information which used in that is article depended on the tectonic, structural, geophysical and oil wells data.

Geological Setting

According to Buday and Jassim (1987), the Mesopotamian zone lies within unstable shelf of Arabian platform. In these divisions, Buday and Jassim depended on classical geosynclinal theory (fixistic concept). Based on plate tectonic theory (mobilstic concept), Numan (1997) put the tectonic divisions. According to these tectonic divisions, the study area lies in sagged basin within the Mesopotamian zone of the qusiplatform foreland belt of the Arabian plate (Fig. 1). The original definition of the stable shelf (Buday & Jassim, 1987) has been modified to include Mesopotamian Zone by Jassim and Goff (2006).

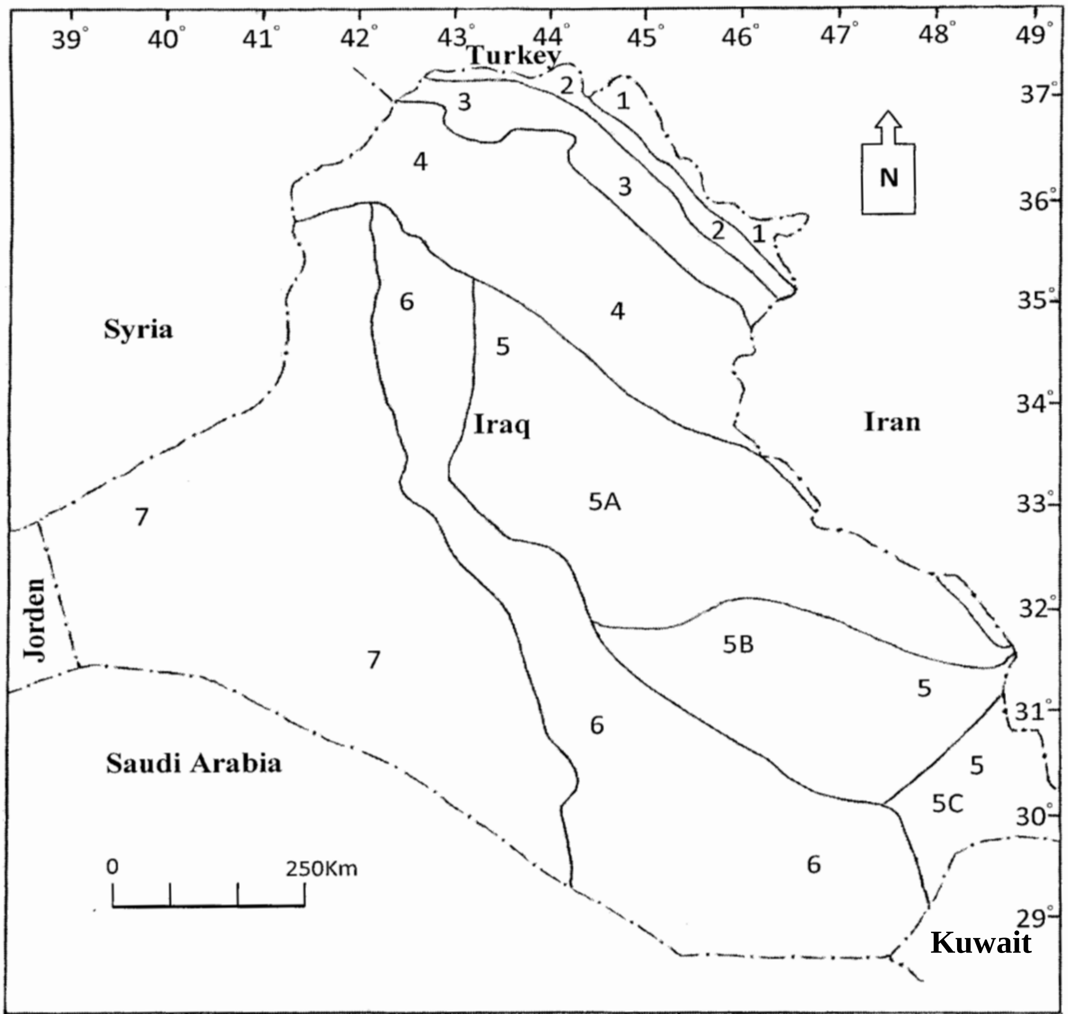
The Mesopotamian zone lies between the Abu Jir Zone to the southwest and the Makhul Zone to the northeast. The area characterized by the existence of many gently plunging subsurface structures of different sizes which usually have very poor reflection of the surface relief (Karim, 1989). Beside these structures there are subsurface and surface faults and salt structures. These subsurface structures represented important oil fields in the middle and southern Iraq. The surface of the Mesopotamian zone is flat and covered by Quaternary fluvial-eolian plain deposits of the Tigris and Euphrates rivers and marsh/ lacustrine sediments of southern Mesopotamia (Fox & Ahlbrandt, 2002). According to Buday and Jassim (1987) the Mesopotamian zone is divided into three subzones: the Tigris Subzone in the North East, the Euphrates Subzone in the West and the Zubair subzones in the South of Iraq (Fig.1). The Tigris is the most mobile unit of the Mesopotamian Zone, it contains subsurface broad synclines and narrow anticlines trending predominately NW-SW, accompanied by normal faults. The Euphrates Subzone lies in the W of the Mesopotamian zone. It is shallowest unit of Mesopotamian zone. The basement is generally 7-9 km deep. The Zubair subzone forms the southernmost unit of the Mesopotamian zone and has a uniform structural style controlled by the underlying basement because of the faulting and uplifting.

According to Al-Sakini (1995) there are three reasons responsible for movement in the Mesopotamian zone: (1) deep faults extending from basement to the surfaces in some cases (2) the effect of alpine movements which continued to present days (3) the existence of thick salt beds which represented by Hormuz and Gotnia formations.

Numan (2000) suggested a possible mechanism of sagging in the Mesopotamian Zone where a marginal rift in the Triassic and Jurassic rocks near the Zagros Main Thrust is pushed up and a major rift basin in these rocks has subsided progressively underneath the Mesopotamian Zone(Fig. 2).

According to Numan (1997) the Phanerozoic plate tectonic scenario for Iraq consists of four plate tectonic set-ups; they are recognized as follows:

1. Intraplate set-up, Infra-Cambrian – Lower Triassic (E. Werfenian).
2. Marginal cratonal platform with rifting and passive continental margins, Lower Triassic (L. Werfenian) – Upper Jurassic (E. Tithonian).
3. Pre-collisional set-up, platform, passive continental margin, active continental margins and island arcs, Upper Jurassic (L. Tithonian) – Paleocene.
4. Collisional set-up, platform, marginal basin and molasses basin, Eocene-Recent.



Numan, 1997, 2000, 2001

1 subductional tectonic facies of the Zagros Thrust.

2 Zone of imbrication of the foreland basin.

3 Highly folded Zone of the foreland basin.

2+3 Foreland basin. 4 Suspended basin, foothill zone of the quasiplatform foreland. 5.Sagged basin of the Mesopotamian zone of the quasiplatform foreland.

4+5 Quasiplatform foreland.

2+3+4+5 Foreland Belt of the Arabian Plate

.6 Salman zone.7 Rutba-Jezira zone. 6+7 Stable platform deposition.

Buday and Jassim, 1987

1 Eugeosynclinal,2 Miogeosynclinal

1+2 Gosynclinal,

3 High Folded Zone

4 Foothill Zone

5 Mesopotamian Zone

5A: Euphrates subzone

5B: Tigris subzone,

5C: Zubair subzone

3+4+5 Unstable Shelf

6 Salman Zone

7 Rutba-Jezira Zone,

6+7 Stable Shelf

Fig(1): Tectonic division map of Iraq (Numan, 1997,2000, 2001; Buday & jassim, 1987).

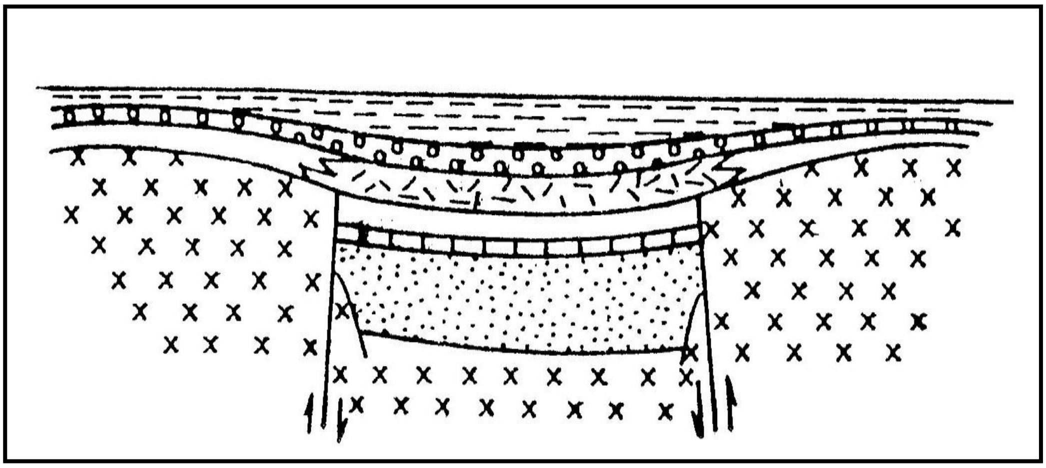


Fig (2): sagging basin formation in southern Iraq (Numan, 2000).

Tectonostratigraphy of Passive Margin

There are two basic types of continental margins, active and passive margins. Active margins are continental margins that coincide with either transform or convergent plate boundaries, and thus are seismically active. In contrast, passive margins are not seismically active and develop over the edge of a rift after the rift-drift transition (Condie, 1989; Park,1997 and Van der Pluijim & Marshak, 1997)

We can divide the history of Mesopotamian passive margin into two phases: First, is **opening phase**, which is represented by divergent plate boundaries formed where the plates moved apart from one another. Second is **closing phase**, characterized by convergent plate boundaries that formed where plates moved toward each other.

Opening Phase (Permian-Jurassic):

The major geologic processes in opening phases at divergent plate boundaries are tensional stress, block listric faulting, and basaltic volcanism. In opening tectonic phase there are two classes of passive margins were formed. These classes depend on whether the margin evolved from the upper-plate side of the rift or the lower-plate side of the rift based on the dip direction detachment fault. In margins originating as upper plates (upper-plate margins), the lithosphere has not been stretched substantially, and there is relatively little subsidence. In margins that started as the lower plates (lower-plate margins), the lithosphere has been stretched substantially and there is more subsidence (Van der Pluijim & Marshak, 1997). The class of the Mesopotamian passive margin is **lower-**

plate passive margin; whereas the passive margins of Iranian and Turkish plates are **upper-plate passive margins**.
However, there are three stages of continental rifting, they are (Fig. 3):

(1) Pre-rifting Stage (Early and Middle Permian): Began when the thermal bulge happened in a Gondwana continent by hot spots. So the lithosphere expanded and thined, thus the shallow basins formed. This episode is a sign to the beginning of Wilson Cycle (Numan, 1997, 2000). The triple junction of hot spot located at the south east corner of the Arabian plate (Jassim & Goff, 2006). The extension of the continental crust happened by group of the listric normal faults (Fig.3A).

(2) Rifting Stage (Late Permian – Early Jurassic (Liassic)): Continental rifting begins when the crust is up arched and stretched and resulted with block faulting (Fig.3B). During the early stages of rifting, the rift basin is dry or contains fresh-water lakes (Hamblin & Christiansen, 1997). Eventually, the floor of the rift drops below sea level and a shallow sea forms. Continental sediment accumulates in the depressions of the down faulted blocks, and basaltic magma is injected into the rift system. Flood basalt can be extruded over large areas of the rift zone during this phase (Van der Pluijim & Marshak, 1997). In late Permian time the Neo-Tethys Ocean opened. Upper Permian basal clastics or carbonates overstep across older Paleozoic rocks (Jassim & Goff, 2006).Thermal subsidence or decay led to the formation of a passive margin megasequence along northern and eastern margins of the Arabian plate, and the development of the Mesopotamian basin.(Jassim & Goff, 2006). Buday (1980) thought a short freshening cycle within the prevalently lagoonal condition of the Liassic. In the Liassic, Butmah Formation deposited in lagoonal shallow water basins and it is upper contact in the type section is faulted, it is comprises of detrital limestone and terrigenous clastic admixture and sometimes reddish marl beds, silt, purple shale, marl and sandstone (Buday, 1980). Bellen et al. (1959) suggested that the red color might be related to Triassic volcanicity. During late Permian to early Triassic the deep water continental slope is formed along northern and eastern margins of the Arabian plate.

(3) Post-rifting Stage (Liassic–Late Jurassic 'E. Tithonian'): Rifting continues, and the continents separate enough for a narrow arm of the ocean to invade the rift zone (Fig.3C). The injection of basaltic magma continues and begins to develop new oceanic crust that is formed in the rift

zone, and the ocean basin becomes wider. By Oxfordian time the Mesopotamian basin was relatively deep restricted basin fringed by carbonate shoal along it is rim. In the Kimmeridgian–early Tithonian time a rapid subsidence occurred in the southern Mesopotamian basin in southern Iraq with deposition of thick evaporites (Jassim & Goff, 2006).

During the rifting and post rifting stages the evaporation rate might be very high, so various salt precipitated out of the seawater and are deposited on the floor of the rift. Therefore, thick salt deposits lie at the base of passive-margin basins. It represented with Adayia, Mus and Alan formations, as well as a high thickness of Najmah Formation reachs 424m. of limestone compact argillaceous partly anhydrites. Gotnia formation with thickness 535 m of anhydrites interbedded with limestone and four cycles of salt rock separated by anhydrites (Esmail & Abid, 1988) Fig (5). In this stage the neo-tethys ocean attained maximum width since no subduction was evident as yet (Numan, 1997, 2000) (Beydoun, 1991). According to Murris (1980), in Neo-Tethys area over 2,000 km wide and 4,000 km long and over 3 km thick carbonates were deposited on the newly creating shelf margins.

Closing Phase (Upper Jurassic 'L. Tithonian' – Recent):

The major geologic processes in closing phases at convergent plate boundaries are compressional stress, reverse movements on preexisting listric fault surfaces, and volcanic activities in one side of rifted zone. However, there are three stages of continental convergent are explained here in (Fig.4):

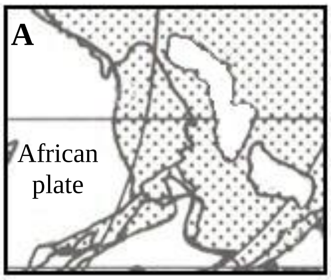
(1) Pre-collision Stage (Upper Jurassic 'L. Tithonian' – Paleocene): Before collision, African plate is connected to oceanic lithosphere that is being subducted beneath Iranian plate. The margin of Arabian plate is a passive margin, along which a sedimentary basin was developed (Fig.4A).

Pre-collision happened when the oceanic crust of Neo-Tethys subducted beneath the Iranian and Turkish plates. These subduction zone are active margins but the Arabian plate still passive margin. According to Jassim and Goff (2006) the late Tithonian-Cenomenian represent opening of the southern Neo-Tethys but also mentioned that the mechanism of this rifting was related to a tensional force related to north easterly subduction of old Neo-Tethyan ocean crust beneath the active margin of Eurasian plate. Whereas Numan (2000) stated that the cretaceous period in Iraq witnessed a geodynamic inversion of the regional tectonic regime from extensional to compressional tectonism. There is a typical sequence stratigraphy in the

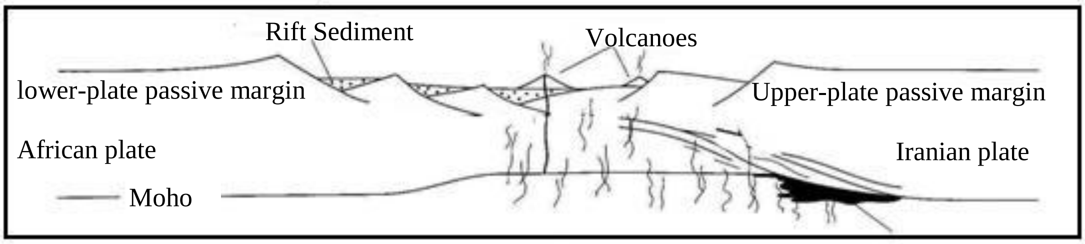
Mesopotamia represented transgression and regression of sea level started with in calcareous Sualy and Yamama Formations, then clastic Ratawi and Zubair Formaions and calcareous Sha'uba Formation , then clastic Nahr umr formation and continue with repetitive succession of clastic and calcareous rock Fig(5,8) Uplift might be sufficient to raise the shelf of the Mesopotamian passive-margin basin above sea level. Uplift period designated disappear of Touronian age in the south Iraq.

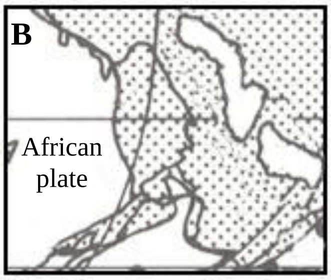
(2) Initial Collision Stage (Eocene-Oligocene): The first indication that a collision is imminent occurred when the edge of continental Arabian plate begins to rise and stretch as it bend around the outer swell just prior to being pulled into the subduction system by the downgoing slab, stretching of the continental edge is accommodated by the formation of normal faults that strike parallel to the margin (Van der Pluijim & Marshak, 1997) Fig(4B). At the end of Eocene the sedimentation continued in the upper Eocene basins along the slope of stable shelf and only these parts were uplifted at the end of the Eocene or even at beginning of the Oligocene. In Iraq the Oligocene is characterized by very restricted sedimentary basins, the intensity of the folding and uplift were increasing so there were three area of sedimentation only (Buday, 1980). In the south Iraq the Oligocene disappear completely as a result of that's uplifting. Ghar formation was deposited of this stage it consists of sand, gravel and limestone with thickness of 175m (Esmail & Abid, 1988). Al-Shadidi, 1995 called the formations deposited through Oligocene to recent as basin closers, generally they have a low thickness.

(3) Collision Stage (Miocene-Recent): With continued convergence, the Mesopotamian passive margin was carried into the trench of the Iranian active margin. Eventually, the process called "basin inversion" should be started because a region that has under went extension during basin formation in passive margin now telescopes back together by reverse slip reaction of these preexisting faults. The Arabian plate converged and subducted beneath Iran and caused the Arabian plate to tilt slightly to the northeast to form a series of anticlines and thrusts in the Zagros Mountains, this stage evaporites of Fat'ha Formation deposited in the Middle Miocene in foreland basin. Generally the evaporite generation during the collision of continental plate (Prothero & Schwab, 1996) Fig (4C). The geological map of the Arabian plate illustrates that divergent margins are formed in the spreading centers of red sea and gulf of the Aden to the southeast of Arabian plate.

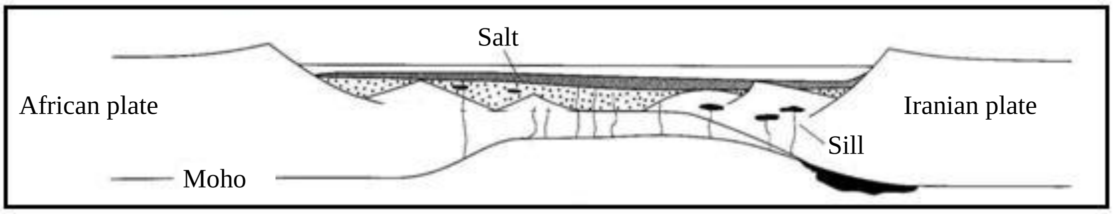


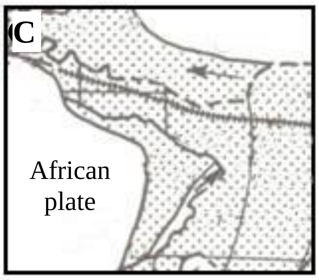
Pre-rifting Stage (Early and Middle Permian), Began when the thermal bulge happened in a Gondwana continent by hot spots





Rifting Stage (Late Permian – Early Jurassic (Liassic)): Continental rifting begins when the crust is up arched and stretched and result that the block faulting occurs during the early stages of rifting, the rift basin is dry or contains fresh-water lakes





Post-rifting Stage (Liassic –Late Jurassic 'E. Tithonian): Rifting continues, and the continents separate enough for a narrow arm of the ocean to invade the rift zone the injection of basaltic magma continues and begins to develop new oceanic crust that is formed in the rift zone

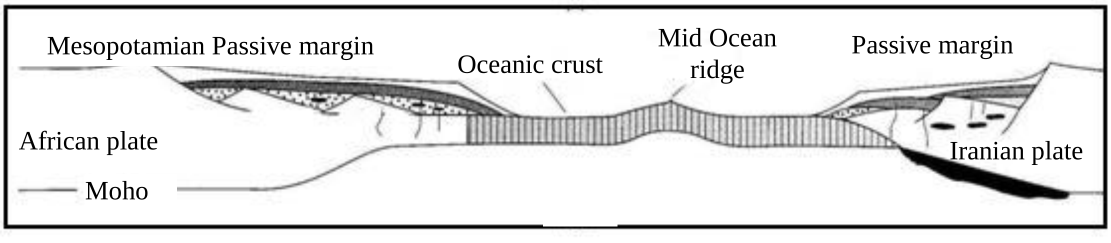
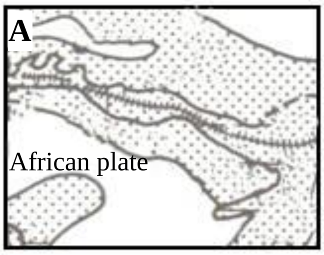
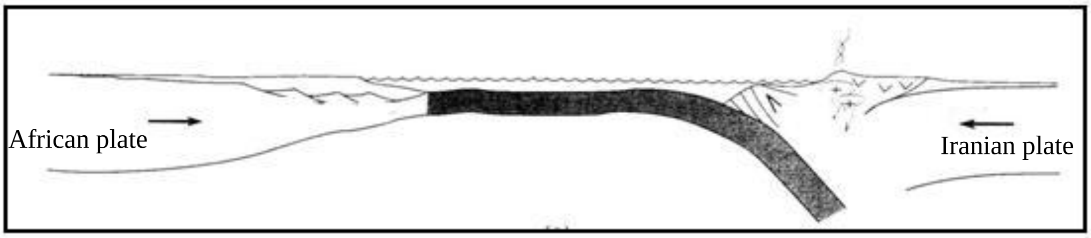
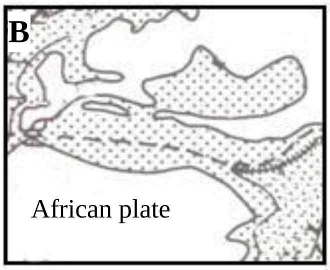


Figure (3): Opening tectonic phase (A, B and C stages) (modified from Condie, 1989).

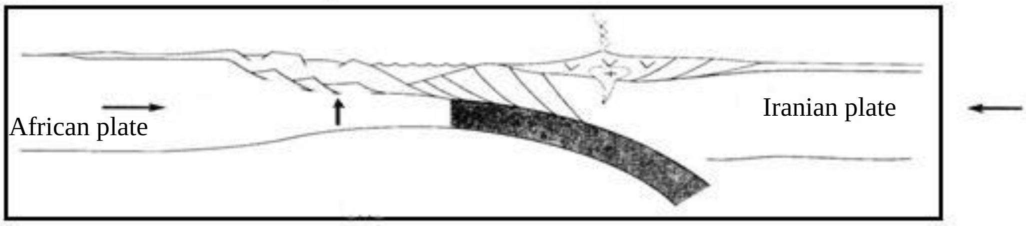


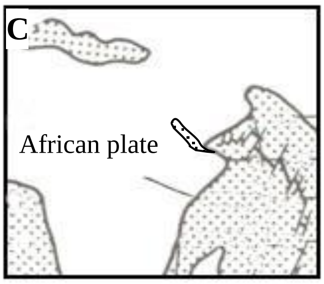
Pre-collision Stage (Upper Jurassic 'L. Tithonian' – Paleocene): Before collision, African plate is connected to Tethys oceanic lithosphere that is being subducted beneath continental Iranian plate.





Initial Collision Stage (Eocene-Oligocene) Collision occurs when the edge of continental Arabian plate begins to rise and stretch as it bends around the outer swell just prior to being pulled into the subduction system by the downgoing slab.





Collision Stage (Miocene-Recent): With continued convergence, the Mesopotamian passive margin was carried into the trench in the Iranian active margin The Arabian plate converged and subducted beneath Iran and caused the Arabian plate to tilt slightly to the northeast to form a series of anticlines and thrusts in the Zagros Mountains.

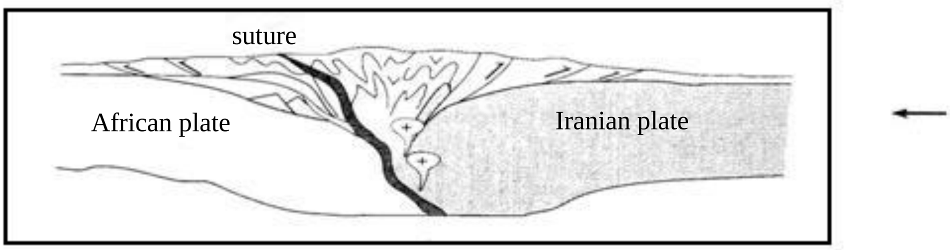


Figure (4): Closing tectonic phase (A, B and C stages) (modified from Condie, 1989).

P.	Age	Lithology	Formation	Environments	phases	
Tertiary	Miocene		Fat'ha	Lagoon	3	
			Ghar	deltiac		
	Eocene		Dammam	Lagoon	2	
			Rus	Lagoon	1	Closing phase
	Paleocene		Ummerdhma	Neritic / Shallow water		
Cretaceous	Maastrichtain		Shiranish	Deep basins		
	Companian		Hartha	Shallow/open M		
	Santonian		Sa'di	Sub basinal		
			Tanuma	Open marine		
			Khasib	Sub basinal		
	Cenomanian		Mishrif	Reef		
			Rumila	Sub basinal		
			Ahmadi	Sub basinal		
	Albian		Mauddud	Neritic		
			Nahr Umr	Deltaic sequence		
	Aptian		Shua'ba	Neritic		
	Barremian		Zubair	Deltaic sequence		
	Hauterivian		Ratawi	Lagoon		
	Valanginian		Yamama	Shallow Marine		
	Barriasian		Sulaiy	Shallow Marine		
Jurassic	Tithonian, Kimmeridgian		Gotnia	Persaline lagoon	3	opening phase
	Oxfodian, Callovian		Najmah	Sallow Marine		
	Bathonian		Sergelu	Sallow Marine		
	Bajocian		Alan	Lagoon		
			Mus	Nertic		
	Liassic		Adiya	Lagoon		
			Butmah	lagoon		

Figure (5) stratigraphic column of Mesopotamian Zone (Zubair Subzone) (modified from Aqrawi *et al*., 1998, Numan, 1997, Esmail, and Abid, 1988, Al-Naqib, 1970).

Passive margin Model in Mesopotamia during Mesozoic

A passive margin is defined as a continental margin within a single lithospheric plate and fused to adjacent oceanic crust. It includes continental shelf, continental slope and continental rise (Plummer et al, 2003), the passive margin was generally covered by shallow water, however a number of deeper water intra shelf basins had been formed during the cretaceous (Murris, 1980).

The suggested model of passive margin in central and south Iraq did not differ from classical models in the world. It is characterized with listric fault system, thick beds of salt rocks, repetitive succession of clastic and calcareous rocks and reef deposits.

The listric fault extended parallel with longitudinal axes of W.Qurna, Rumalia and Zubair oil fields Fig (6). The extension events in the south Iraq changed the environments due to the uplift and subsidence movements which controlled by faults movement. The compression forces had changed the preexisting listric normal fault into reverse faults Fig (7). This mechanism exist in the foreland belt of northern Iraq (Numan & Al-Azzawi, 1993)

Generally the distance between listric faults in passive margin is (20-30) Km (Van der Pluijim & Marshak, 1997), in the study area the distance between the fold axes is (20 -30) Km. (Buday & Jassim, 1987) but (5-10) Km. in the suspended basin of the foreland (Al-Azzawi, 2003) this means that folds formed by movements on listric faults. There forces helped the salt rocks to motion gently since this faults still normal faults, therfore there are a complex regime of ridges and subsidence in the study area like Amara paleo – high (Amara –Dujaila ridge), as well as a lost by erosion of Coniacian and Oligocene deposits from stratigraphic column of south Iraq. Sadooni and Aqrawi (2000) stated that the halokinetic tectonism (movement of salts by overburden pressure) played a minor role in controlling sedimentation during most of the early cretaceous, but during the late albian (i.e., at the beginning of the middle cretaceous), tectonism became more conspicuous, with possible of the basement faults. As salt tectonics offer a satisfactory explanation of vertical movement of pre Miocene, so far it is believed that the vertical movements of the faulted basement blocks has bulged the stratified salt (Hormuz and Gotnia formations) and forced the upward. As a result the salt rocks was disturbed by uplifting or penetrating it up to the surface of the ground (Karim,1989).

In the Figure 8 illustrated the suggested model to the south part of Mesopotamia zone, the passive margin period started in the lower Triassic with huge continental rifting, this rifting led to deposited a thick beds of Butmah formation after rifting thick salt deposits laid at the base of passive margin represented Adaiya, Mus and Alan Formations, then deposition within the basin occurred in a restricted, relatively deep water environments represented with euxinic argillaceous calcareous Sergelu, Najmah formations and thick beds of Gotnia salts. In the next sedimentary cycle comprises of many thicker formations were deposited in shallow marine and inner –middle shelf, represented Sulaiy, Yamama and Ratawi formations, the shallowing continued in the Hautervalian – Albian age, so littoral and nertic sequence facies deposited in the Mesopotamian zone as well as fluvial, delta, prodelta succession, represented with clastic Zubair, calcareous Shau'ba, clastic Nhr Umar and calcareous Mauddud formations. The next succession started with Ahmadi formation, the shallow water still effects in the ramp of passive margin, due to a relatively regional fall of mean sea level and by uplifting (Aqrawi, et al., 1998) continued up shallowing of basin led to deposition of Rumila and Mishrif formations, the top of the mishrif formation was exposed and highly eroded and covered by conglomerate (Al-Kharsan, 1975).

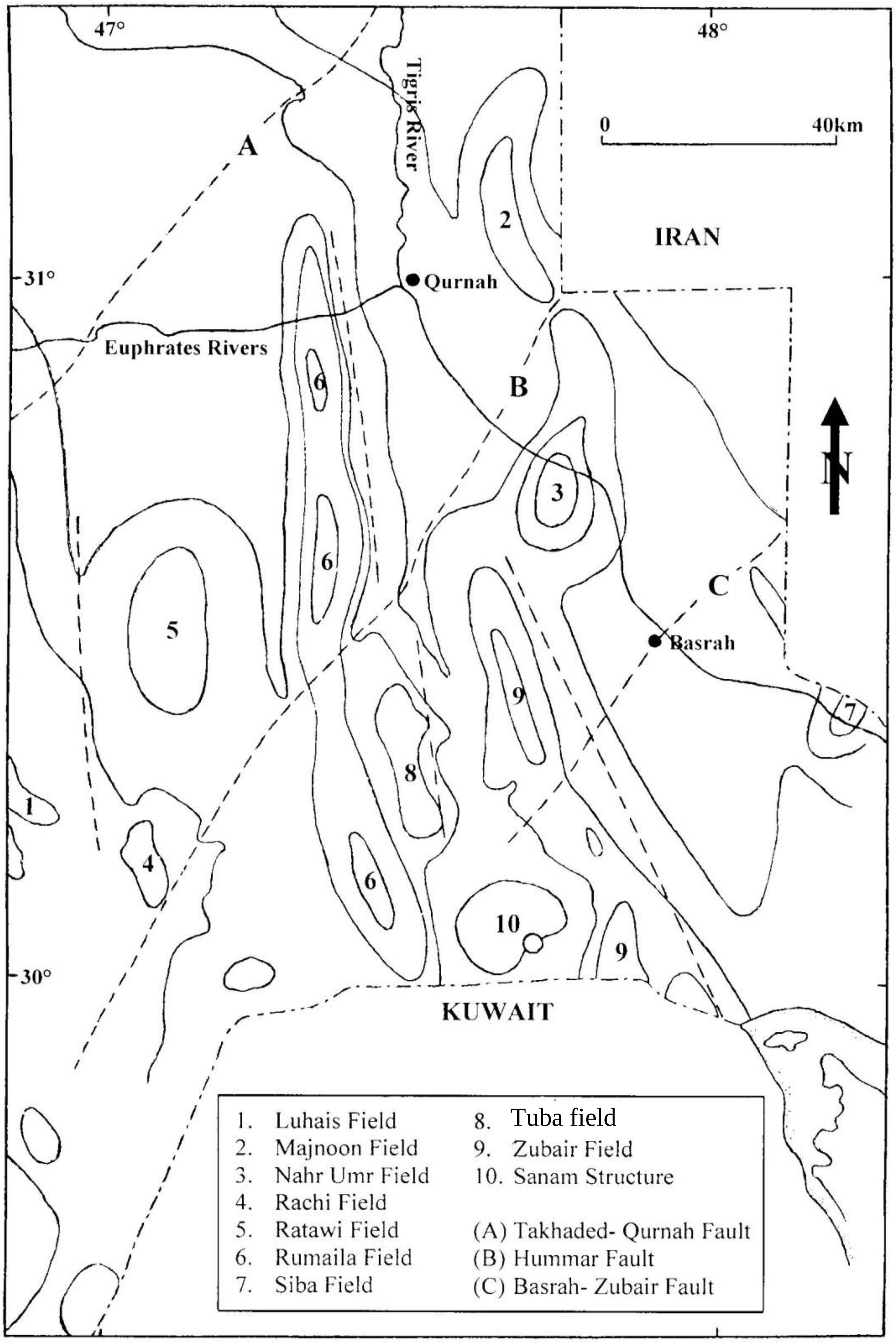


Figure (6): The oil fields and listric faults locations (modified from S.OC., 1986 & Al-Najar,1989).

These mark the end of the regression phase in the (Cenomanian-E.Turonian) sedimentary cycle (Aqrawi, et al., 1998). Khasib, Tanuma and Sadi formation were the next sedimentary cycle, these facies deposited in the sub-basinal environment, then the widespread Hartha and Shiranish formations covered the most of Iraq until the west side of Mesopotamian zone. The Early Paleocene (Danian) age deposits are absent in the shelf area of Iraq (Jassim & Goff, 2006), in Paleocene-L.Eocene age, Umm Rhdama formation was deposited in the neritic environment. The shallowing in the basin continued due to the compression forces, the Mid late Eocene sequence deposited to the SW of emergent uplift during the final phase of subduction and closure of the remnant Neo-Tethys ocean (Jassim and Goff, 2006), Therefore lagoon environments widespread in that 's event so Rus and Dammam formations deposited there.The latest Eocene-recent megasequence is associated with the collision of Neo-tethys terrains along the N. and E. side of Arabian plate and the opening of red sea and gulf of Aden which associated with thermal uplift and rifting (Jassim & Goff, 2006). Clastic sediments covered the area due to the closure of Neo-Tethys, Ghar and fat'ha formations represent the end of the collision.

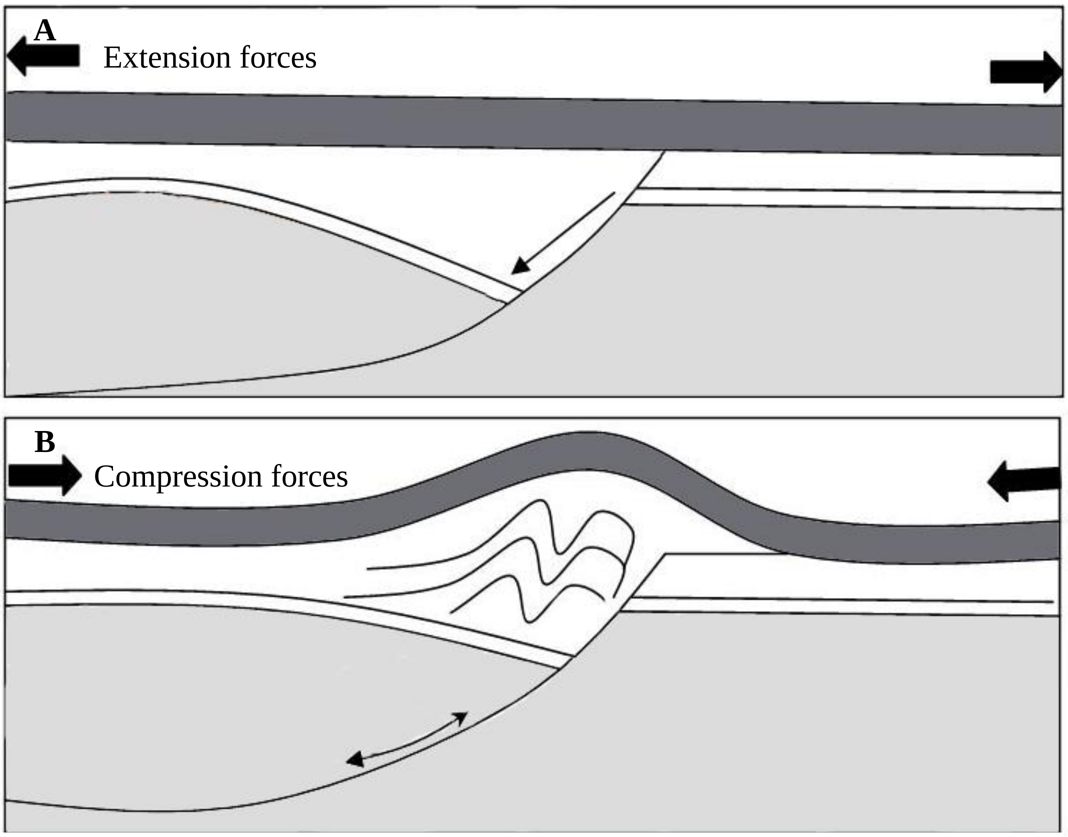
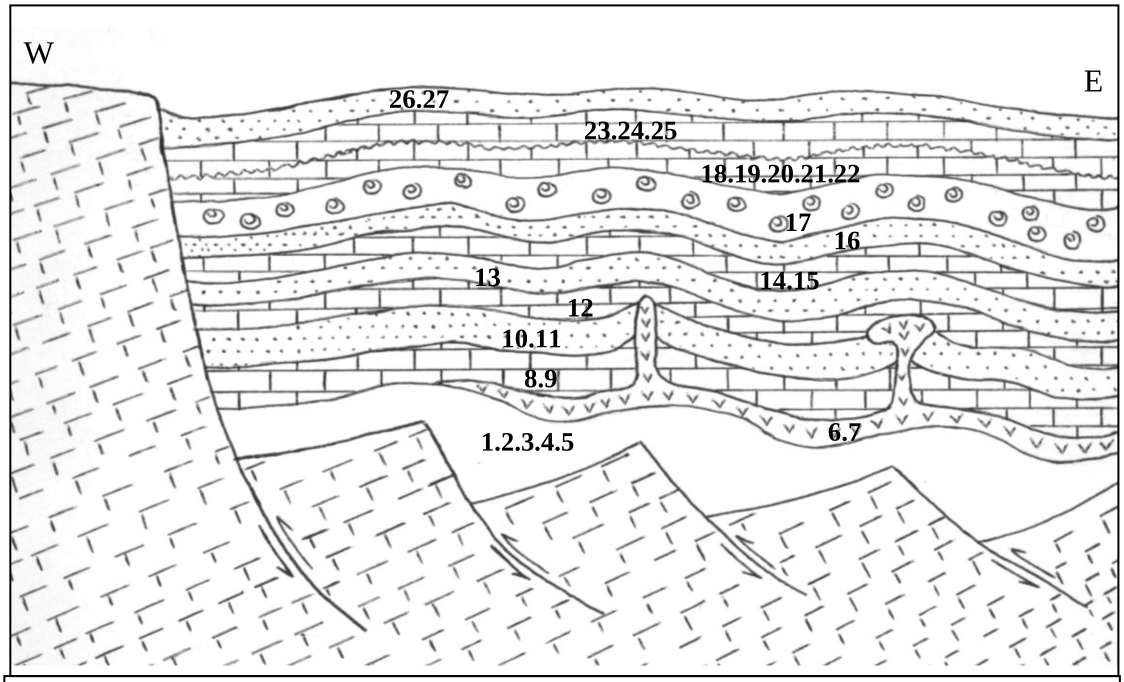


Figure (7) Mechanic of movements of listric faults in passive margin (A) listric normal faults during extensional phase.(B) listric reverse faults during compressional phase and formation of subsurface folds.



1.Butmah f., 2.Adaiya f., 3.Mus f., 4. Alan f., 5.Sergelu f., 6.Najmah f., 7.Gotnia f., 8.Sulaiy f., 9.Ymamah f., 10.Ratawi f., 11.Zubair f., 12.Shua'ba f., 13.Nhar Umr f., 14Mauddud f., 15.Ahmadi f., 16. Rumila f., 17.Mishrif f., 18.Khasib f., 19.Tanuma f., 20.Sa'di f., 21.Hartha f., 22.Shiranish f., 23.Ummerduma f., 24.Rus f., 25.Dammam f., 26.Ghar f., 27.Fat'ha f.

Figure (8) The suggested model of Mesopotamian passive margin.

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التاريخ التكتونوستراتغرافي من الحافة الخاملة لنطاق وادي الرفدين خلال العصر المتوسط والحديث (جنوب العراق)

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الخلاصة

تشكلت الحافة الخاملة لنطاق وادي الرافدين من خلال طورين تكتونيين ،**الاول** هو طور الانفتاح التكتــوني (البرمي – الجوراسي) ويمثل بداية دورة ولسن هذا الطور يتكون من ثلاثة مراحل وهي مرحلة ماقبل التصدع ، مرحلة التصدع ومرحلة مابعد التصدع ، في طور الانفتاح كانت الحافة الخاملة في طور التكوين عندما انفصل الطبقين الايراني والتركي عن الطبق العربي مع انفتاح محيط التيثس الحديث، ونتيجة لذلك تراكمــت ترســبات فتاتية ومتبخراتية في الحافة الخاملة ومن بعد ذلك حصلت عملية تجلس بسبب عمليتي التحلل الحراري وتوازن القشرة وبسبب ذلك التجلس فقد ادى الى تراكم ترسبات سميكة من الرواسب الكيميائية في منطقة الحافة الخاملة. و**الثــاني** هو طور الانغلاق (الكريتاسي – الحديث) ويشمل ثلاثة مراحل وهي ماقبل الاصــطدام والاصــطدام الاولي و الاصطدام ، في هذه المرحلة التكتونية تحرك الطبقين نحو بعضهما لذلك اصبح محيط التيثس الحديث ضيقا والقوى الانضغاطية هي التي أثرت على الحافة الخاملة مما أدى إلى تشوه الحافــة و تحــرك الصــخور الملحية وبعد ذلك تكونت المصائد النفطية وضاق عرض الحافة الخاملة من وادي الرافدين إلى أن انتهت تمامــا في عمر المايوسين عندما اصطدم الطبق العربي مع الطبق الإيران