Tectonic Interpretation of the Relation Between Rivers Courses and The Subsurface Structures in Central Maysan Petroleum Province S.E. Iraq

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Abstract

River courses are controlled by the ground slopes and subsurface structures. The relation between subsurface structures and river courses are studied in the part of the Mesopotamian area. The Tigris river behavior in Amara city (Maysan Governorate) were studied carefully on the aerial photograph mosaic and Landsat 8 satellite images to compared with the subsurface data in the Amara oil field. Then a field work compiled and the known tectonic subsurface structures are compared. The image interpretation of the geological features of the study area clear up an obvious relation between the rivers behavior and underground structures. The results compared to the structural styles of the petroleum traps and with the recent interpretations in the neighboring countries locating in the same tectonic and depositional basin. The final conclusion that the subsurface structures may controlled by thrust folding structures.

Key words:- google earth software ,Rockware.

الخلاصة

يرتبط مسار الانهار عادة بانحدار المنطقة وبالتراكيب الجيولوجية التحت سطحية والتي تكون مرتبطة بدورها بالتاريخ التكتوني للمنطقة. تم استخدام الصور الجوية وصور الاقمار الصناعية لتحليل ودراسة مسارات الانهار في منطقة السهل الرسوبي، حيث تم اختيار منطقة العمارة (حقل العماره النفطي). تم التحقق من نتائج الدراسة من خلال العمل الحقلي ودراسة بيانات الابار النفطية لحقل العماره في محافظة ميسان. تم تفسير الصور الفضائية بصريا من خلال دراسة سلوك انهار دجلة والبتيرة والكحلاء ثم قورنت النتائج مع الموديلات التكتونية المرتبطة توزيع المصائد النفطية. كما قورنت النتائج مع الدراسات الحديثة في الحقول النفطية الواقعة في نفس الحوض الترسيبي في جنوب تركيا وغرب ايران. تبين من الدراسة انه من المرجح ان تكون المنطقة قد تاثرت بفوالق زاحفة اثرت على توزيع المصائد النفطية كما اثرت على المسامية والنفاذية للتكوينات الحاملة للنفط.

الكلمات المفتاحية :-برنامج كوكل ايرث ، برنامج معالجة المعلومات الجيولوجية .

Introduction

The remote sensing data were used to study the underground oil bearing structural traps (like faults and folds traps). Interpretation of the geomorphological features like river meanderings represent one of the first applications of this technology in geological fields. Many researchers give indicators about the importance of satellite images in discovering the assemblages of hydrocarbon structures, analysis the sedimentary basins and tectonic models. These structures generally are repeated in regions of similar deformation styles, and their associated hydrocarbon traps can be anticipated prior to exploration. Styles are differentiated on the basis of basement involvement or detachment of sedimentary cover (Sodesri,1992; Selly,1998).

The developments and availability of the remote sensing images and databases encourage to develop these types of analysis (Gong and Lary,2003). Especially remote sensing and mapping databases were contributing in understands the picture of the surface of the earth by downloading satellite data from a remote server. Where the scale of any area in the image is fully under control by the user and the details can increase or decrease during few seconds. The coordinate systems used in google earth is a geographic coordinate (Latitude/ Longitude) on the world Geodetic system of 1984 (WGS 84) datum. The ground in google earth like an orthographic projection, except that the point of perspective is a finite (near earth) distance rather than an infinite (deep space) distance. The resolution of the images is varied according to the

area but generally 15m (in some locations like Antarctica, are is extremely low resolution), but this depends on the quality of the original images uploaded. The dates of taking images in the software are varying and can be seen from squires when digital global coverage is enabled (Herman,2012). The date next to copyright information is not the correct image date. The images zoom in or out may change the date of the pictures. Most urban areas images like cities are from 2004 and not updated. Google earth represents one of the important base programs in the tectonic and field studies, especially when used with GPS utilities to compile quick and accepted accuracy maps.

Aims of the Study:

The aim of this study is to find the relation between the surface geomorphological features in the satellite images and the underground structures in Amara area to interpret the tectonic regime controlling the distributions of subsurface structures by comparing with the main structural styles. This area selected because it is covered completely with alluvial deposits. The Amara oil field structural situation has not completely understood.

Study Area Location

Amara oil field located in the south of Amara city, Maysan governorate Southern Iraq at coordinates (UTM38R 694628.72mE, 3520629.67mN) and (706121.34mE, 3516859.11mN). The area covered with Quaternary alluvial despites of Quaternary (Fig.2). In Fig.2, the oil well locations and the main rivers are plotted.

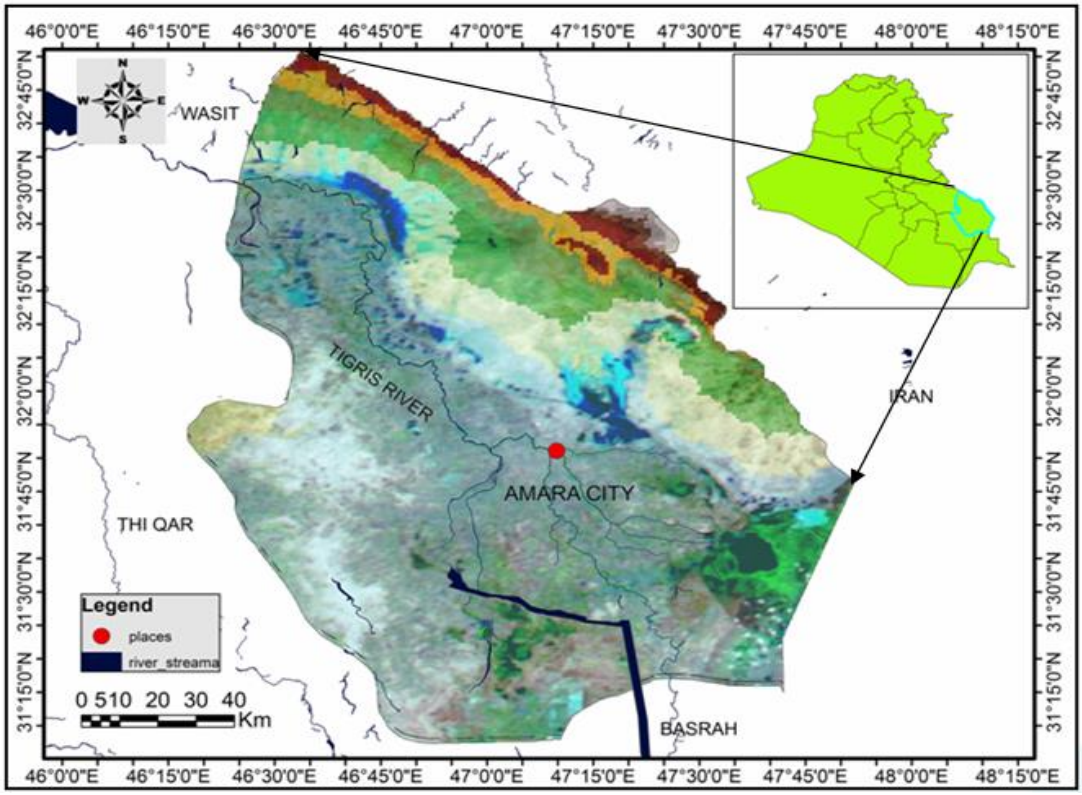

Fig.1: the location of Maysan City

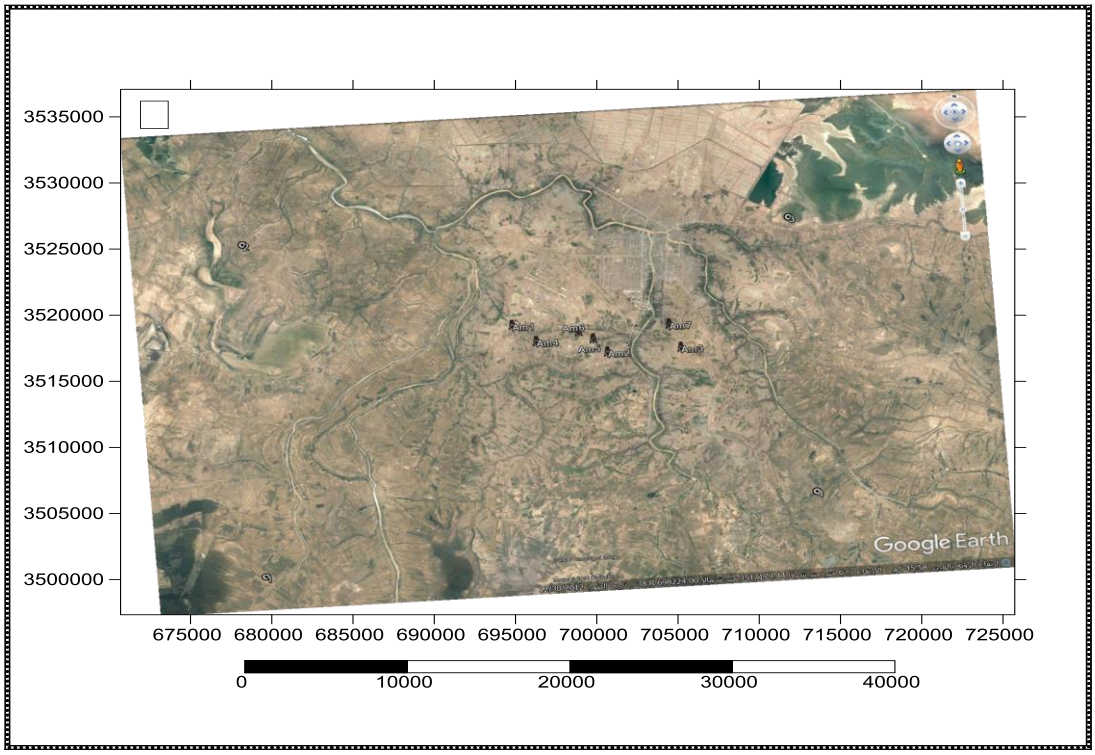

Fig.2: The Amara oil fields and the location map of the oil wells in the field.

The Geology and Tectonics of the Study Area

According the previous geological studies (Table.1) the study area located in the Tigris subzone of Mesopotamian zone (Fouad,2010) (Fig.3). To study the tectonic situation, we must return to the start of the geologic history of all the areas. In the late Permian and Triassic, rifting occurred in Iran, Turkey and Oman which eventually led to the formation of very small fragments of crust, micro plats, and the creation of two seaways, the northern Paleo Tethys and southern Neo-Tethys (Fig.4). This produce great depositional basin for carbonates and clastic reservoirs (Sodsri,1992; Jassim and Gofft, 2006; Fouad,2010). Zagros Mountains are resulting from the closing of the Neo-Tethys, extends from the south southeast Turkey through northeast Syria, northern Iraq and southern Iran and reaches to eastern UAE and northern Oman. Table.2 represent the main Formations in Amara Field and also explain the history of the open and closed deposits of Neo-Tethys.

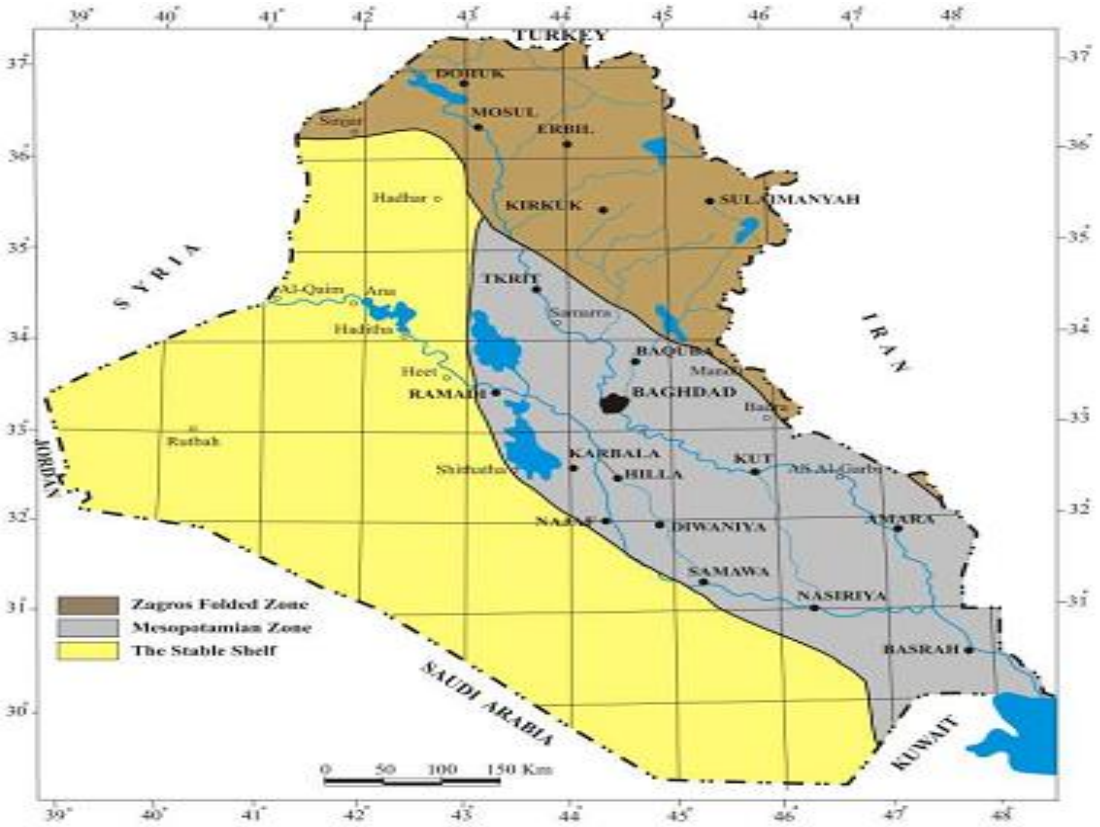

Fig.3 Tectonic Zones of Iraq [Fouad, 2010]

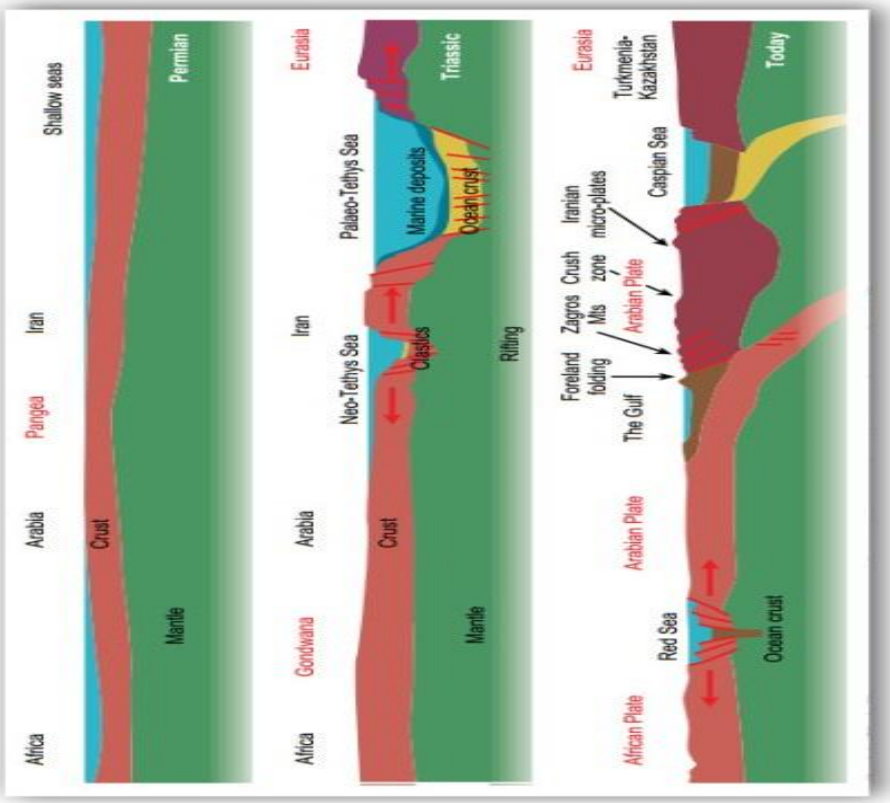

Fig.4: The Paleo and Neo Tethys Units (Sodsri,1992).

Table (1): The Tectonic Classification of Iraq.

Author	Tectonic Division	Location of the study Area
Henson, Dunnigton	Subdivided Arabian Platform to: 1. Stable Part (Southwest). 2. Unstable part (North East).	Unstable Part
Buday & Jassim	1. Stable Shelf (South west) 2. Unstable Shelf (North east) a. Mesopotamian Zone. b. Foothill Zone. c. High Folded Zone. d. Geosyncline Zone.	Unstable Shelf; Mesopotamian Zone (2,a)
Jassim and Goff	1. Stable Shelf a. Rutba Zone. b. Salman Zone. c. Mesopotamian Zone 1.Zubair Subzone 2.Tigris Subzone. 3. Euphrates Subzone. 2.unstable Shelf a. Foothill Zone b. High Folded Zone. c. Imbricated Zones. 3. Zagros Suture Zones	Stable Shelf, Mesopotamian Zone, Tigris Subzone. (1,c,2)
Fouad	1. Zagros Fold-Thrust Belt 2. Mesopotamian Fore deep a. Al Jazzera Area b. Mesopotamian Flood Plain 3. Inner (stable) Platform	Mesopotamian Fore deep; Mesopotamian Flood Plain (2,b)

Table (2): The Stratigraphy of Amara Oil Field [IPEC,2010]

Period	Epoch		Formation	Lithological Description
TERTIARY	Miocene	Upper	**Injana (Upper Fars)**	Clastic with siltstones. (Fluvial System)
		Middle	**Fatha (Lower Fars)**	Sandstone, Anhydrite & Claystone. (Evaporate lagoons)
		Lower	**Jeribe/Euphrates**	Massive dolomite (Carbonate inner Shelf)
			Upper Kirkuk	Mainly dolomite interbred of Sandstone , limestone and mudstone
	Oligocene		**Lower Kirkuk**	Mainly sandstone, shale and limestone
	Eocene-Paleocene		**Jaddala**	Argillaceous Limestone
			Aaliji	Limestone
Cretaceous	Upper		**Shiranish**	Limestone inter bedded with thin layers of Marl.
			Hartha	Limestone interbedded with Dolomite.
			Sadi	Chalky Argillaceous Limestone
			Tanuma	Shale occasionally intercalation with very minor streaks of Limestone.
			Khasib	Argillaceous Chalky Limestone
			Mishrif	Limestone occasionally with very Thin stingers of Shale
			Rumaila	Argillaceous Chalky Limestone.
			Ahmadi	Shale & Limestone inter beds
	Lower		**Mauddud**	Limestone occasionally with very thin stingers of Shale
			Nahr Umr	Sandstone.
			Shuaiba	Carbonates (Limestone and/or Dolomite).
			Zubair	Sandstone & Shale .
			Ratawi	Shale & Limestone inter beds.
			Yemama	Limestone.

The satellite Image Interpretation

Satellite Images in google earth, Landsat 8 and aerial photographs mosaic of 1:10000 scale is interpreted optically. This done by studying the tones, patterns and the behavior of the rivers meandering in the study area, to study the underground structures and interpret the tectonics of the area. In Fig.5 the three rivers are studied, and the meanders of these rivers are denoted (Gluay and Richard, 2004). Fig.6 shows the lineaments map of the study area. The oil wells coordinates used to plot the location map of Amara field, then stratigraphic succession of each well was input to Rockware program to draw the cross section of the oil field and the ross diagram of the lineaments directions.

Fig.5. The lineaments Map.

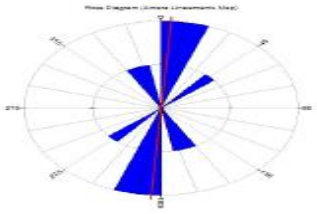

Fig.6: The Ross Diagram of the Area

Fig.7. The river behaviors (the arrows)

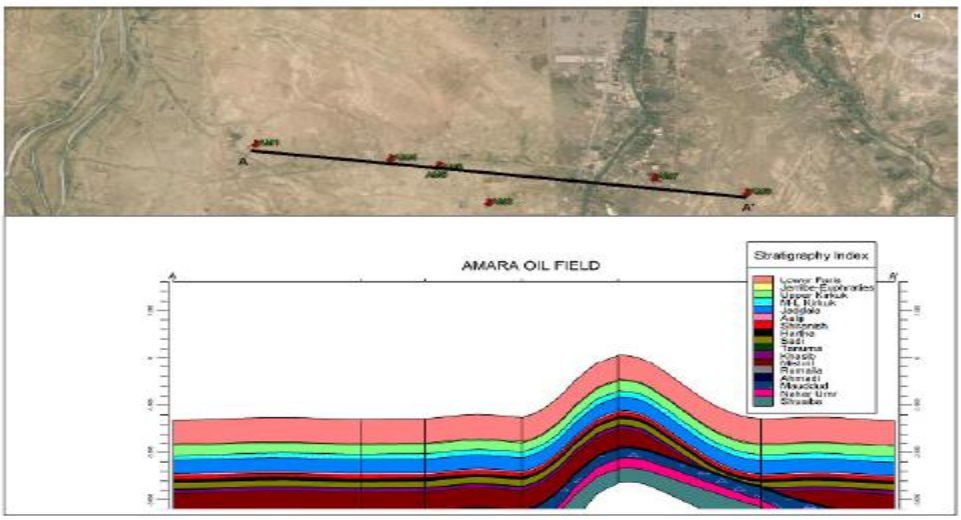

Fig.8. The cross section (A-A') of Amara Oil Field.

Discussion and Conclusions

The main structural styles of petroleum bearing traps are as follows (Lowell, 1990):

1. Wrench faults at transform and convergent plate boundaries.
2. The compressive blocks (fault blocks) and basement thrust at convergent boundaries, particularly in forelands and Orogenic belts.
3. Extensional fault blocks at divergent boundaries.
4. Basement warps in variety of plate-interior and boundary settings.
5. Decollement thrust-fold belts in trench inner walls and foreland zones of convergent boundaries.
6. Detached normal faults. Usually in unstable, thick clastic wedges (mostly deltas).
7. Salt structures primarily in interior grabens that may evolve to completed divergent boundaries.
8. Shale structures in regions with thick overpressures shale sequences.

Amara oil field located in Tigris subzone (Table.1), this subzone is the most extensive and mobile unit of the Mesopotamian Zone (Al-Naqib,1967; Gluays and Richard,2004; Jassim and Gofft, 2006). This zone represents the foreland basin during the convergent of Arabian Iranian plates (Fig.9)

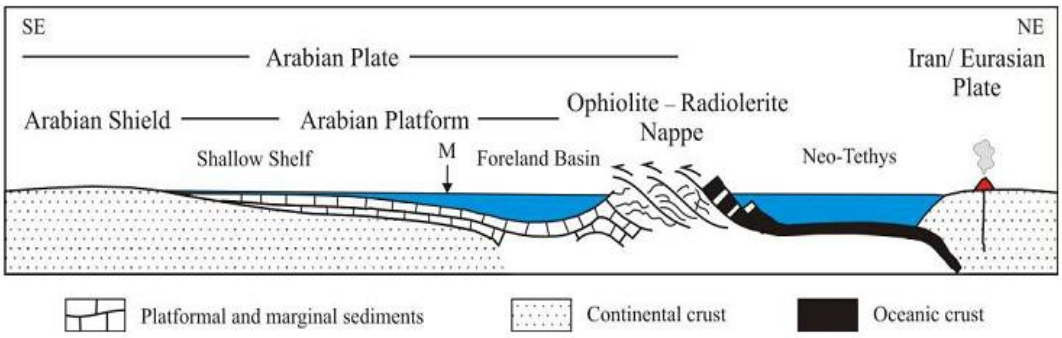

Fig.9: The location of Mesopotamian Basin (M) (Fouad,2010).

The images (Fig.7) were interoperated to study the behavior of the three rivers (AlBtera, Tigris, and Kahla), as pointed in the left and right hand arrows in the same figure, it is obviously seen that the rivers meanders are controlled by subsurface structure. The meanders occurred when the river find hard strata in the bed level (Gong and Lary,2003), or when the slope of the area changes. The location and profile of Amara oil field (Fig.8), compared to the lineaments map of the area and find that the lineaments cut anticline of N-S axis, and this axis agree with the main direction of the lineaments (Fig.6). The tectonic studies of the neighboring countries across the Foreland of Zagros belt are compared to get a clear understanding of the tectonic and structural situation of the area. The last interpretations of the results seismic, dip meter, borehole electrical imagery in the oil field distributed across Turkey, Iran, UAE and Oman give an idea about the subsurface structures. These structures are essentially constituted of thrust faulting controlled the traps distribution and also controlled the fractures distribution and concentration in the reservoirs (Fig.10).

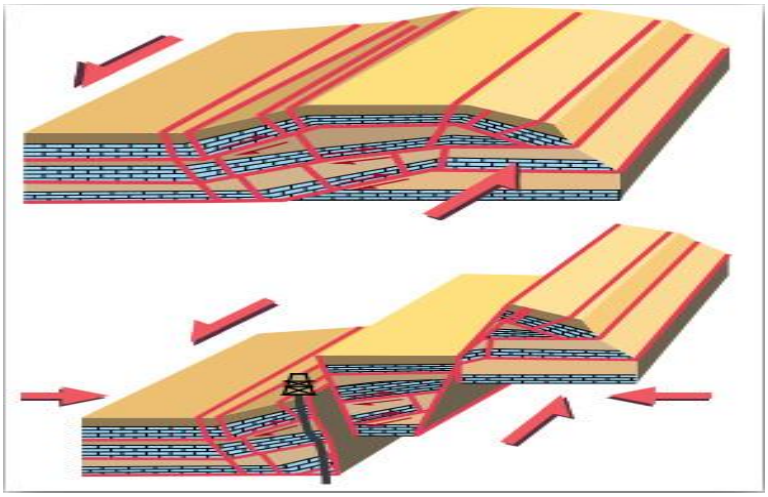

Fig.10: Imagination diagram Show the Thrusting-Folding relation (Sodsri,1992).

From the result of this study, a new interpretation is required for the distribution of the oil fields in the area depending on the results of the new techniques in the petroleum exploration and production and the tectonic understanding of the oil trap distributions.

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