Geodynamics Evolution of the Oil Traps in Southern Regions of Zagros Due to Closing of Neotethy

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Abstract:

In the northern part of the Persian Golf & the Southern region of Zagros, the signs of Oil hydro carbore from the Silurian period can be chased .Also it has determined the beginning of Oil producing in some formation of Middle Jurassic .This shows the great accumulation of Oil & gas before the Orogenic of Zagros in several regional heights. After the Complete closing of Neotethys & formation of the anticlines in the end of Miocene & Pliocene, great amount of Oil & gas has been piled up. The thickness for various formations from Jurassic till Miocene have revealed that these heights with lightly steep limbs have been stretched from Qatar to southeastern part of Hormoz island & the center part of the fars Zone.

High amount of the produced Oil in Silurian Basin is gathered in the heights of Qatar arc & the rest is amassed in northern parts of Bandar Abbas. At the end of cenomanian, the fault system of N-S Paleozoic has been activated & since the end of cretaceous the produced gas has made the Oil move to the sides & formed the oil sources in both sides of the heights. During the upper Miocene & Pliocene a portion of this gas gathered in new structure of Zagros & even some of the oil reached to the earth's surface.

Generally the oil traps of this region are divided into these parts:

1) Large anticlines with slightly steep limbs which are not due to the pressure or folding of Zagros .In Persian Gulf area & the southern parts mostly these kinds can be found.

2) The NW- SE anticlines in folded parts of Zagros that are grown up by the function of the final stages of closing Neotethys .These deformations have kept on till now like in Asmari regions.

3) The functions of the faults & the rising pieces of the basements caused the formation of N-S anticlines.

4) The oil traps that are the result of infracambrian salt diapers in Persian Gulf.

Keywords: *oil Trap, Tectonic, Zagros.*

Introduction

According to status of oil fields reserves of Persian Gulf, only 12-15% of oil reserves of this region are in anticline that are formed after Alp orogenic at mountainside of South Zagros and more than remained 85% are accumulated at Platform and anticlines with different processes due to continent and salt movement before Alp orogenic. During infra-camberian the Arabian plate was gone under tension phase performance and as a result of creation of mountains and opening sediment basin and Arabian evaporate sediment some breaking were created inside of shells. In continuation for orogenic katangaei the Strike Slip and in next stages shallow sediments and evaporite sediments at broad Graben and Rift basin of Oman, Persian Gulf, Zagros, Pakistan were created (Husseini 1988). There are several movements of Transform Fault and Sinestral at Graben basin of South Oman, Persian Gulf and Zagros. Tension in

continent shell at the end of infra-camberian has created initial linear indentations and normal faults alongside of rift. Creation of indentation is accompany with parallel faulting at border of indentations and because of different sagging, large volume of shallow marine sediments and evaporate sediments of source rock are developed during initial period and simultaneously hydrocarbon source rock with salt reserves and non-metal elements and magnates are created at rift basin, consequently cap rock will be created(Fig 1). Lower Paleozoic sediments contain great organic materials and rock that are suitable for source rock. During priming period the changes of thickness is very low because of shallow sediments and platforms. During Triassic period at regions of Qeshm and north of Bandar Abbas the sinking was continued and maximum Triassic thickness is seen at north of Bandar Abbas. At Qatar region toward north and Shiraz there is lower thickness of Triassic and it seems that salt movements from start of Triassic create ascending and in Jurassic the continent and salt movements has ascended Persian Gulf region. In cretaceous because of continent and salt movements the region of hall, Boushehr, Kangan, Bahrain, Qatar and Ghavar are ascended and lower thickness is seen at this region during Cretaceous period and on the contrary at regions of Sarvestan, Shiraz, Dezfoul, Lorestan, north of Hormoz and Oman some descending and increasing thickness of Cretaceous sediments can be seen. During Tertiary period the condition was vice versa and thickness of sediments at north of Persian Gulf and Shiraz, Dezfoul and Lorestan is decreased.

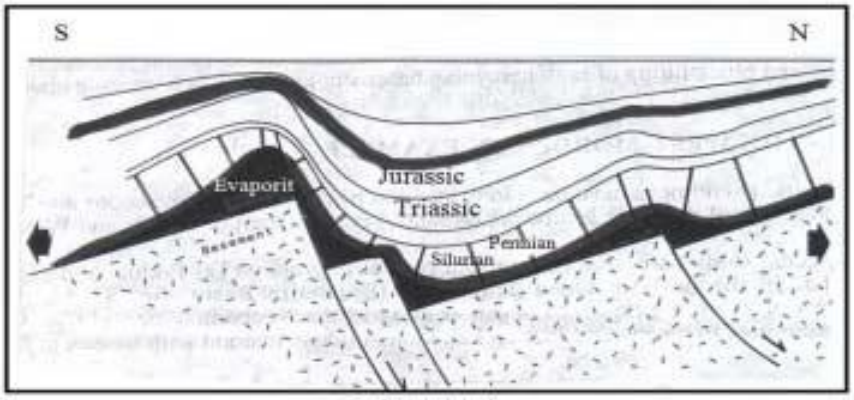

Fig 1: Uplift and diapiric structure at Permian to Jurassic in the south of Zagros belt

Hydrocarbon Source Rock: Generally we can say that source rock for oil gas of Permian are among greatest organic fields and Silurian Shale, limestones and Permian dolomite because of high heat and pressure of organic materials are changed into gas in sediments and have lateral immigrate to anticlines at upper part of Persian Platform i.e. Qatar, Pars, Kangan and Bahrain oil field. Source rock for Jurassic limestone reserves at North of Persian Gulf and some parts of shale are started from Masjed Soleiman region and continue to west north. Type of source rock for cretaceous reserve is formation; Borgan and Zobeir toward east and north east are respectively changed into Kazhdomi & Gadvan shale. Oligocene source rock has Marl, Shale, Pabdeh and Gorpi formation. That are located beneath Asmari limestone reservoir; then after Alp orogenic and formation of anticline of South Zagros the hydrocarbons with Pabdeh and Gorpi formation at indentation of Dezfoul and anticlines of Asmari reservoir will be immigrated (Fig 2).

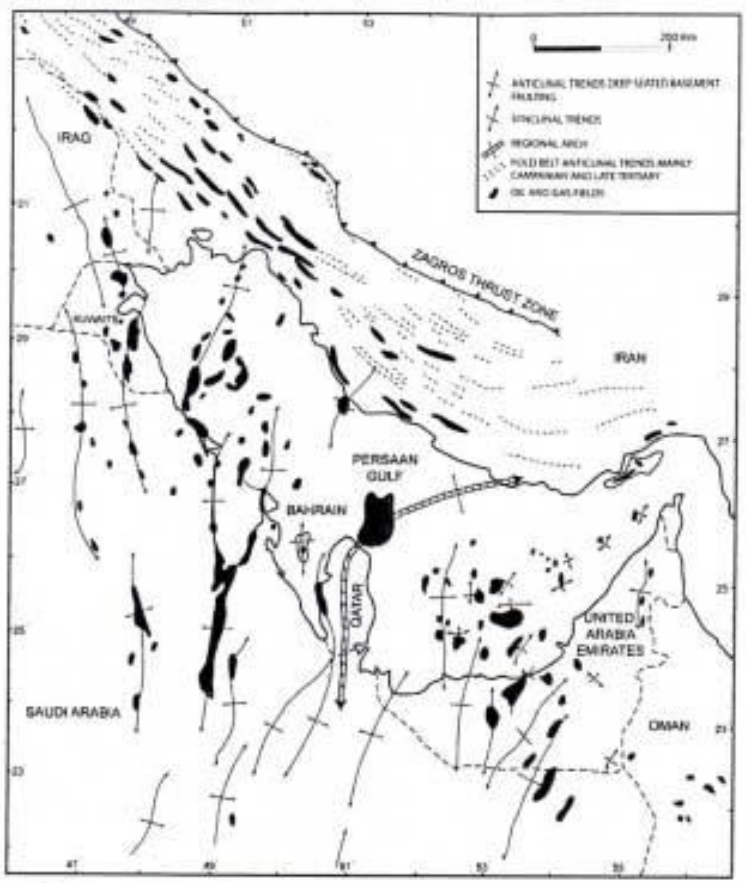

Fig 2: Structural trends over the major oil and gas fields in the Persian Gulf region (cited from Beydom et al., 1992).

Effect of Diapirism on Reservoir: There are 3 factors that have fundamental role in changes of reservoir and source rock that include: a) Speed for ascending salt dome b) Speed of sediment and c) Speed of subsidence. These factors have very important role on creation of reservoir. In case that speed of ascending will be higher than speed of sediment and speed of subsidence will be steady, growth structure will be achieved and thickness of reservoir at top section of anticline will be lower than limb. Under such condition the volume of reservoir will be steady up to some level that decrease in top of reservoir will be compensated by increasing thickness at limbs. In case that speed of ascending will be more than speed of sediments and speed of subsidence, the environment of sediment will be changed and deep environment will be changed into shallow environment and in continuation it will change into shore region, consequently conditions of reservoir will be improved. Increase in ascending will cause formation of erosion and conglomerate, that its result is low angle slopes (Motiei 1988). Some researchers believe that movement of salts at south of Iran and Persian gulf goes back to Permian period and proportion of changes in speed during sediment may result in creation of growth structures, eliminating floors, changes in sediment and disrupting the structure.

Oil structure zone at south of Zagros: The most south fold section of Zagros that is asymmetric with anticline structure is specified alongside of west north and east south and as

it was mentioned, it is separated into several sections with different hydrocarbon characteristics (Fig 3).

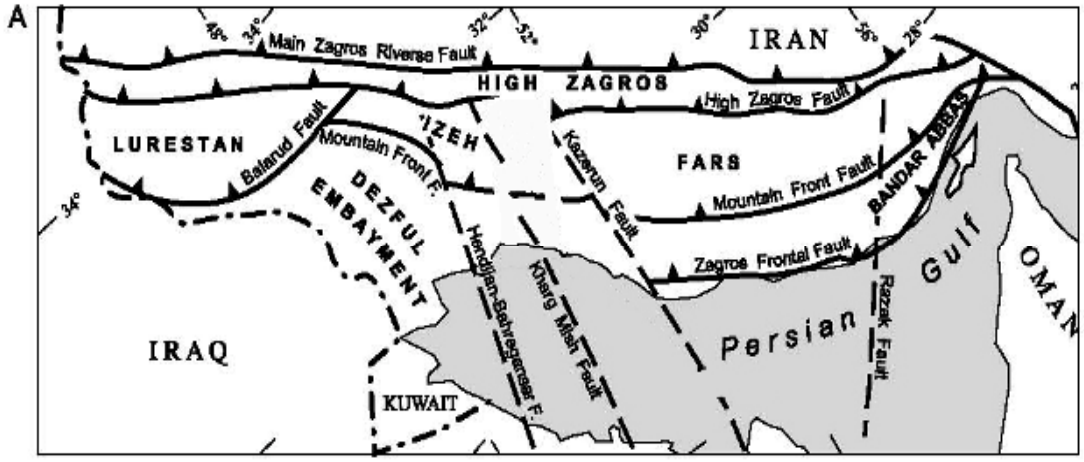

Fig 3: Main structural subdivisions of the Zagros fold (MacQuillan.1993 & Sherkati. 2004)

Dezful depression: Dezful depression is limited to Kazeroun fault at east and high bending weight at north. Generally Dezful depression is called to a zone in which there is Outcrop Asmari. Dezful depression contains 15km Paleozoic sediments and most of oil fields of Iran are located at this zone. This zone has oil system that is different with other hydrocarbon zones of Iran. At this zone the puberty of source rock and existence of oil and formation of oil traps are important incidents that specify nearly young oil systems which has occurred at 15 million years ago. Prompt accumulation of 1500 to 2000m salt and formation of Gachsaran has occurred during Miocene period and Kazhdomi source rock at Dezful zone has reached to stage of oil bearing. Simultaneous with formation of great folding of Zagros and formation of oil traps, oil is accumulated at descending sections of Dezful. At Gachsaran, Aghajari and Bakhtiyari zone of formation on the contrary of descending at Dezful it has lower thickness and broadness and mountain bearing movements at Miocene and ascending cause to create conditions that oil will be produced and accumulated. After production of oil, it will be in Bangestan group and Pabdeh and Gorpi caprock are cut because of fault and oil is immigrated to Asmari formation. Formation including Sargelo will be possibly created and discharged at Dezful depression before formation of oil traps.

Fars Zone: Bounds of this structural zone is west bound of Kazeroun fault, assumed east bound that separates Bandar Abbas from Fars, north bound to trust and south bound is shore line of Persian Gulf. Continuation of Basement and Arabian Platform via Qatar subduct to this zone may create platform conditions from Mesozoic period until now at Fars zone. Existence of salt domes at anticlines of Fars zone is among important characteristics of this zone. Anticlines of this zone have different directions, so that besides direction of Zagros toward east-west, north east the direction of west south can be seen. At Fars zone there are some source rocks that do not have oil bearing ability and the recognized source rock at this zone is Silurian Shale that are introduced as Sarchahan formation. Triassic Kangan formation is lower than carbonates and shale with thin oil layer are formed from organic materials that

have potential for bearing hydrocarbon. Reservoirs are gas source that have been dominating since start of Mesozoic period under platform conditions at Fars zone that sedimention the sediments that are poor from organic materials. Characteristics of source rocks are so that large sources of hydrocarbon including Dezful depression are not seen at this zone but this zone is important because of its gas sources.

Bandar Abbas Zone: This zone is bounded to Zendan-Minab fault at east, its north is toward some lines are regarded and south bound is toward folding front of Zagros. Most anticlines of this zone are alongside of eastern-western, eastern-north and west-south.

Lorestan Zone: This zone from south is toward upper bending, its north and west north border is border of Iran and Iraq and has gas and oil reserves.

Abadan Plain: Abadan plin is located at west south of Iran, its north and north west bound is toward folded belt of Zagros and from south it is toward Sosangerd, Abteimour and Mansour anticlines and after passing from Rage-Sefid fields it will enter into Gulf. North section of this line enters into Iraq. Anticlines of this zone lack superficial effect and even some structural continuity is not seen at Asmari. Anticlines trend of Abadan plain ends to north south that are in contradiction with usual direction of Zagros. These anticlines are formed based on movement of basement faults (Motiei 1996). During Alp orogonic the pressure tension may create concentric folding and slip bending. Several studies have shown that base rock and Zagros basin are not same. Magnetie maps of this zone indicate that bound of Karoun fault is from separating place of Fars base rock to Dezful depression base rock (Morris 1977) and Hormoz formation at depreesion zone of Dezful and Lorestan lack development. Exploratory excavations for buildings with infra-camberian salt under surface are only concentrated at Fars zone. Anyway folds at Fars zone because of growth before folding are not similar to concentric Zagros and the thickness of limes will be increased and top anticlines will be thin. We can conclude that uplift movement at Fars zone has two parallel components. First general and regional platform movement of Fars is not seen at maximum amount in Gavbandi and other issue is direction of movement for uplift of salt domes (Motiei 1988). General uplift movement may decrease general sediment layers and finally decrease thickness of source formations that its ability of birth is limited and movement of salt domes will aggravate the phenomena of decreasing thickness. Thus by uplift movement the depth of source rock will be decreased, for example if Kazhdomi formation at Dezful depression will be 3500m it will be located at 2000m of Fars platform. In short it can be said that during different periods of plastic formation and Hormoz salts have movement and anticline buildings are created on the contrary of general process of Zagros. In mountain bearing Alp phase the old anticline buildings are located at bound of Zagros folding and repeatedly folded(like Kangan and Boustaneh). Those anticlines that are more farther will be remained without any change and old rupture with process of north-south and old folding are influenced at Persian Gulf and some process that are different with Zagros process are shown (Fig 4).

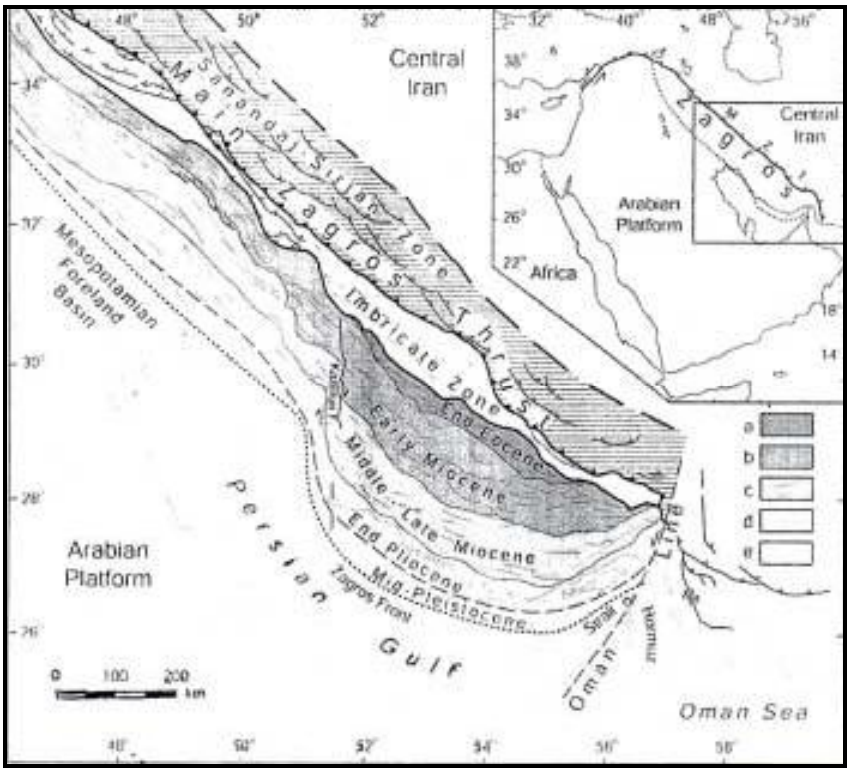

Fig 4: Growth gradual of Zagros belt at Eocene to present.

Conclusion

1- Oil accumulation at south of Zagros do not follow from integrated structural pattern, rather during tectonic evolutions the Paleozoic and Mesozoic because of tension phases of first stage, uplift of salts during Mesozoic and faulting of ancient orogenic and folding because of Alp orogenic and different oil trap will be formed.

2- During Paleozoic with formation of oil source rock in Silurian, first oil is accumulated as zones including Qatar, Gavbandi, north of Bander Abbas and South East of Lorestan and then after Zagros folding it will immigrate to anticlines.

3- Fault oil traps at direction of Dezful, Fars and north depression are mainly related to north section of folding of Zagros and south depression and west and east direction are under influence of tectonic at first period.

4- Generally structures that are created during first, second and third periods at oil traps in south of Iran including anticlines with direction of north west and south east are related to rock faults, north and south processes and oil traps of infra-camberian salt bearing dome and has created compound structures. At the end open and broad anticlines at Zagros trust that has same process with folding of North West and south east and Persian Gulf will be deepen.

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