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Investigation of oil trap in the Asmari Anticline (Zagros, Iran)

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Abstract

Asmari anticline (with 30 km length, 10 km width & 1391 m height) is a NW-SE anticline in the North of Dezful Embayment sub-basin of Zagros. Anticlines of Zagros are signal for oil resources. Hence, Asmari anticline is analyzed, because it should be extended to trap. Items such as tectonic system after and before trap forming, detection of workable traps and finally resolving proper points for well drilling are investigated. We found that there is a relation between growth of Asmari anticline up Asmari fault, fracture spread and first oil migration in Asmari formation. As a result, with reference to Asmari thrust depth, Khami and Dehram groups could be suggested as a proper oil reservoir.

Keywords: Asmari, Anticline, Dezful, Khami, Oil resource, Zagros.

Introduction

Importance of anticlines of the Zagros causes many researchers to study various aspects such as tectonic system in forming anticlines and traps, fractures style and development fractures, fractures effect in oil spills (Ala,1982) detection workable traps and resolving proper points for well drilling.

In this article, we investigated Asmari anticline as an anticline traps. Asmari anticline is a part of Dezful Embayment sub-basin of Zagros (Perry & Setudehnia, 1966). It is signal for oil resources, so we try to analysis fold style elements, fractures style, tectonic system after and before trap forming, proper reservoir for exploitation are surveyed (Fig 1).

Fig.1.Viewing from limb of northern anticline, view toward SW

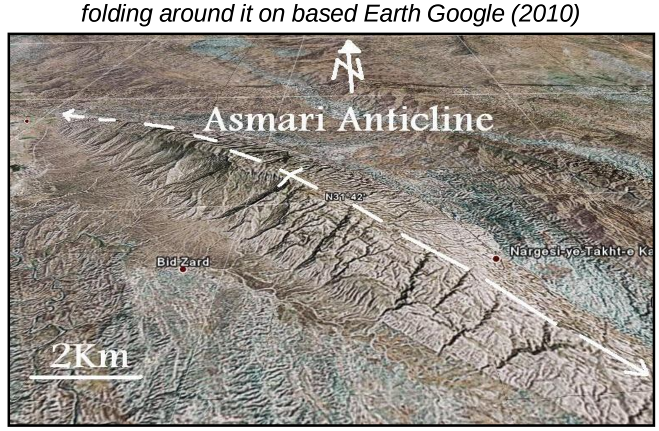
Geographical position

Asmari anticline positions in Gulgir village of 22 km distance SE Masjed-E Suleyman country. This mountain be located between longitudes 49° 30' and 49° 42' E and latitude 31° 36' and 31° 42' N. This anticline with 30 km length and 10 km width in axis is a fold decreases toward lateral. Maximal height of fold is in the Asmari formation and fold hinge with 1391 m.

Geology position

Asmari anticline is a NW-SE anticline in the north of Dezful Embayment sub-basin of Zagros. In this anticline, there is a relation between growth of the Asmari anticline up Asmari fault, fractures spread and first oil migration in the Asmari formation, so oil reservoirs are wasted. But, as a result with reference to the Asmari thrust depth, Khami and Dehram groups could be importance as a proper oil reservoir.

Fig.2. Oriented satellite image of the Asmari anticline and folding around it on based Earth Google (2010)



Anticline structure setting

Asmari asymmetric anticline is a whale back, pericline fold (Park, 1997). Its limb decreased toward its plunges. Systematically and its inclination is toward SW (Fig 2). Researches show, the Asmari anticline is a sub-cylindrical fold in axis and a coniferous with ellipse section fold in south-easterly and north- westerly and fore limb slope is more than back limb. Folding angle (φ) changes from 60 to 75 degree, so it is a open fold on based Fourier analysis (Ramsay & Huber, 1987) fold type defines parabolic to sub-elliptical with amplitude 2-3. True thickness of the Asmari formation 35 meter and axial surface parallel thickness 450 meter was measured. Dip isogons model of the Asmari formation is convergent type (class1), and dip isogons model changes from 1A to 1C from anticline core toward limbs (Fig 3).

Geometric classification of the Asmari formation on based dip isogons' model, (modification from Twiss &

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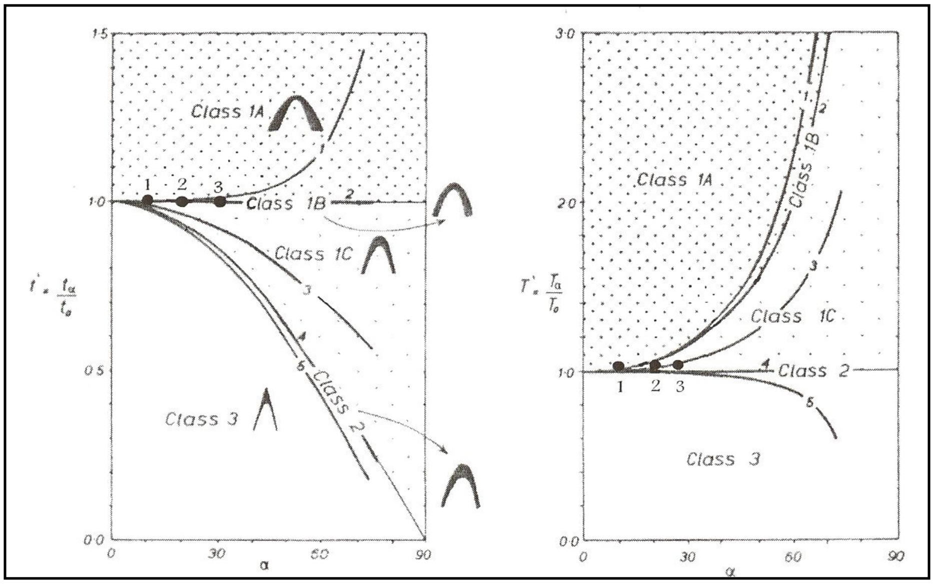
Fig.3. Geometric classification of the Asmari formation on based dip isogons' model, (modification from Twiss & Moores, 1992). $T_0 = t_0$ and it shows axial surface parallel thickness in folded unit hinge. T_α and t_α in order show axial surface parallel thickness and true thickness in limb. α is a index for dip amount of the Asmari anticline, in parts of were measured.

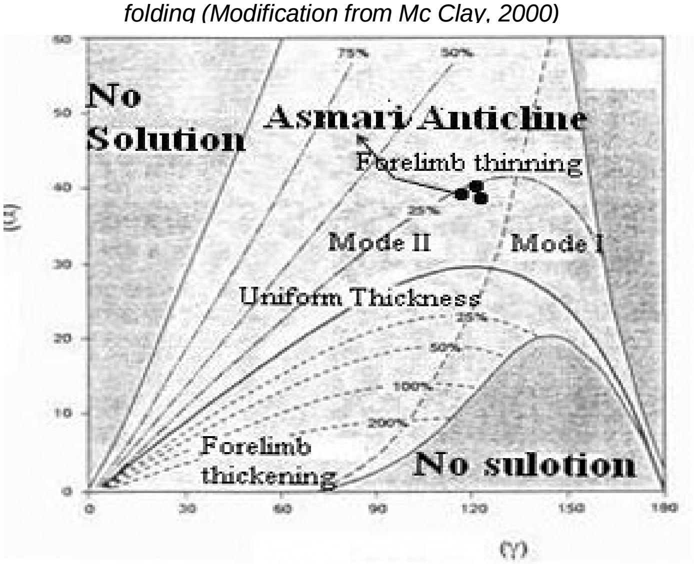


Moores, 1992) $T_0 = t_0$ and it shows axial surface parallel thickness in folded unit hinge. T_α And t_α in order show axial surface parallel thickness and true thickness in limb. α Is an index for dip amount of the Asmari anticline, in parts of were measured.

Folding mechanism

Asmari anticline is a fault bend folding mode I. They usually formed by hanging wall deformation up a ramp. Evidence such as none being footwall syncline formation and cutting low angle show, the Asmari anticline is a fault bend folding mode II. So based on Fig. 4, fore limb shows less 25 % thinning.

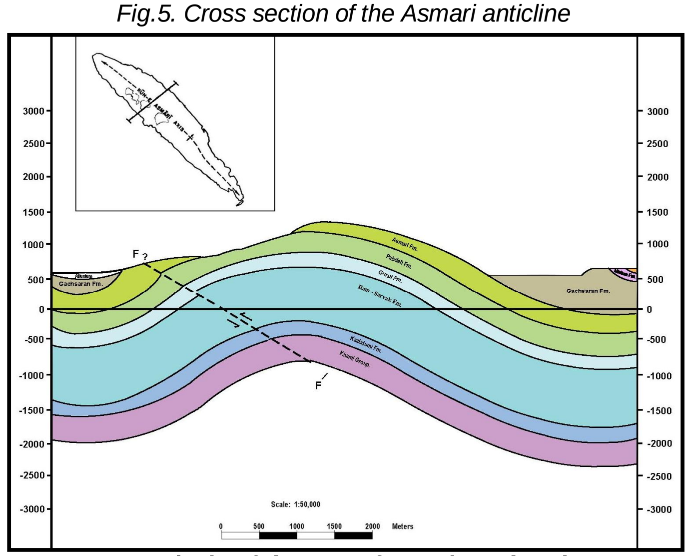
Fig.4.Thinning diagram and fore limb accretion in fault bend folding (Modification from Mc Clay, 2000)



Structural analysis of the Asmari thrust

Asmari thrust, introduced for first time during the Asmari anticline, is surveyed. This thrust places in mountain-front site. It is in strike south-westerly limb from north-westerly plunge to south-easterly plunge and its strike is 311 degree, its slopes in cross section in order are 43, 21, 26 and 30 degree (Fig. 5). This ramped buried thrust in the core anticline causes elevation anticline, Asmari and Pabdeh outcropping and fold style changing. This thrust and its back-thrust with inclination toward hinterland causes, this anticline appears alike pop-up structure. Geomorphic evidence (S_{mf} =1/2 and low V_f) show one branch of the Asmari thrust is receiving to surface in fore limb anticline, so it is known as a cause for several landslide in this limb. Asmari thrust creates in relation with fault-propagation folds of the thin bedded stratums (Fig 6).

Fig.5. Cross section of the Asmari anticline



UGC map analysis of the apex formation Khami group

On based underground topographic contours map was prepared, we can see south-westerly limb of the anticline on the apex Khami group has more slope than north-easterly, so this subject beside geomorphic evidence show performance Asmari thrust causes fore limb more shortening. This anticline has a culmination in this horizon and performance a basement fault SE-NW cause's north-easterly plunge has dragged (Fig 7).

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Fig.6. Oriented satellite image of the Asmari anticline on based Earth Google (2010), It shows lineage structural for fore limb

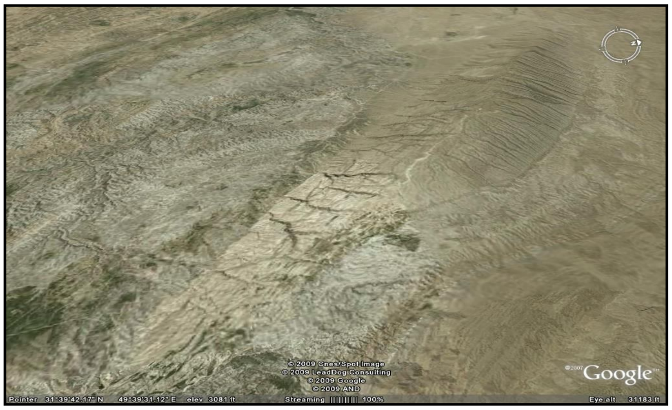


Fig.7. UGC map that show the top of Khami group

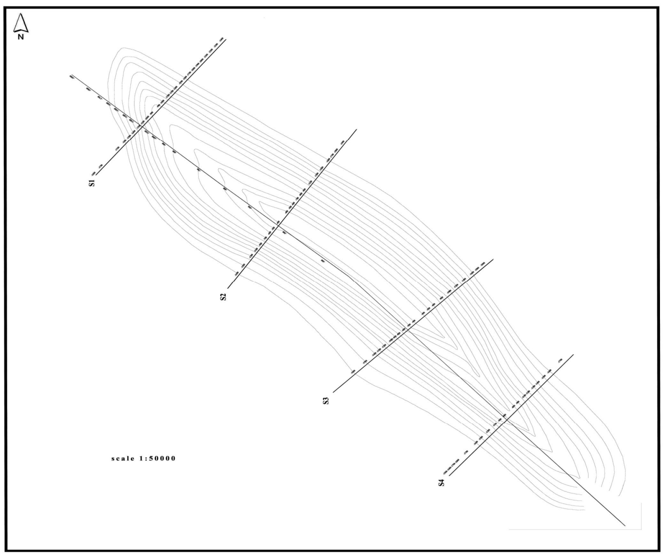
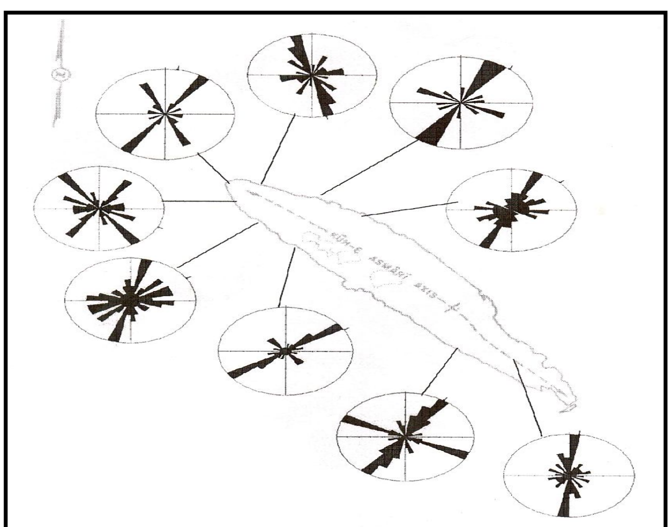


Fig.8. Rose diagrams and contours fractures in the Asmari anticline



Fracture analysis of the Asmari anticline

Fractures style in the north- westerly nose

In this area in order, the first dextral shear fractures then longitudinal fractures and finally sinistral fractures grow well. However, because of existence of a basement fault in this area causes rotation of north-westerly nose, so transverse fractures were reduced (Fig 8). This basement fault with NW-SE trend places in north-westerly nose. We can see it in Koop's depth map.

Fracture style in the south-easterly nose

Evidence shows in this area in order transverse fractures, then dextral shear fractures and sinistral fractures grow well, but because of imported pressure reduction in this area longitudinal fractures don't have development (Fig. 8).

Fractures style in north limb

Longitudinal, dextral shear and sinistral fractures have the most development toward north- westerly nose. Although transverse fractures have development well toward mid fold.

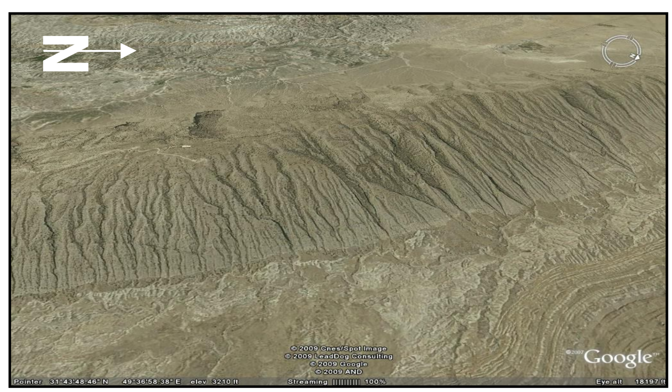
Fractures style in south limb

Longitudinal fractures have development in this area. Dextral shear fractures and sinistral fractures have development well toward north-westerly plunge. Shearing and rotation of north-westerly plunge are because of performance a basement fault in this area and so transverse fractures reduce from south-easterly toward westerly (Fig. 8).

Oil reservoir formation

Fractures survey on the anticline show that these fractures formed before and synchronic with event folding. The older units were forming in sync with anticline formation on the Asmari fault. Therefore, first migration of the oil fluid was possible where the anticline expected. So Khami and Dehram groups can be introduced as proper reservoirs with attention to Asmari fault depth (Fig. 9).

Fig.9.Oriented satellite image of the Asmari anticline on based Earth Google (2010), It shows fractures style



Fractures formation age

UGC map (the top of Khami group in Fig.7) explains fractures formed before and synchronic with event folding in the Asmari anticline; because of planar pole crosses

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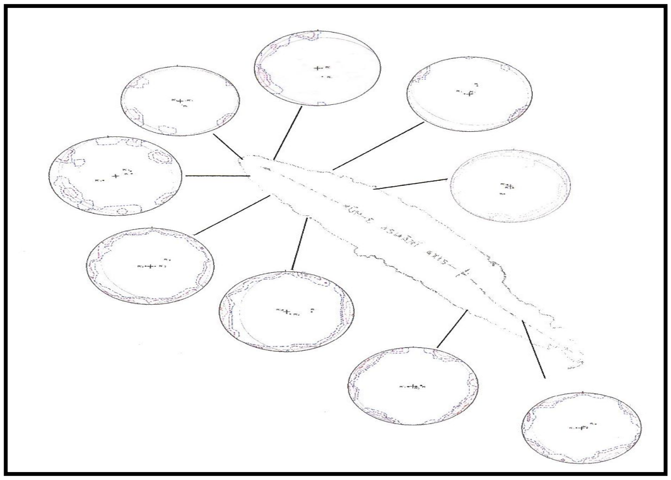
Fig.10. Contours fractures of the Asmari anticline after drawing pole bedding and passed planner from among (inter mediate) contours



from the mid contour diagram and bedding pole are near together in net (Fig 10).

Fractures effect in oil spills

Totally there are several springs in the Asmari anticline, we can discover tectonic forces and its effect on oil spills. Some of these springs originate from the piedmont alluvial reservoirs, and they have water of normal quality (Bid-Zard spring) and others are the Sulfur springs place in north-westerly plunge of the Asmari anticline. Having eight sprigs boom and their strike between 130 to 140 degree this trend correspondsto the trend of longitudinal fractures meaning 120 to 150 degree. So, we can say most of the oil spills occur by longitudinal fractures in this anticline.

Asmari thrust effect in oil spills is interesting point. As spring alike Tange-Mohammad Hossein places in south limb of the anticline, although it has water with normal quality in surface, but spring was polluted to oil in 200 meter depth because of oil spills by fractures of the Asmari thrust (Fig 11).

Fig.11. Location site of sulfur springs, oriented satellite image of the Asmari anticline on based Earth Google (www.earth.google.com. 2010)

Conclusion

Asmari anticline places in south- easterly of Masjed-e Solaiman. It is of bending fault fold model and the ramping hidden thrust causes anticline up-forming. With attention to Asmari fault depth and fractures creation before and in sync with anticline formation, we can say when the anticline was evaluating, first migration of the oil fluid was possible on the Asmari formation, so there were impossible oil escape from the Khami and Dehram formations, and these formations can be surveyed for posterior oil exploration and extraction in this area. Proper site for drilling was determined in UGC map of the apex formation Khami group.

General trend fold is north-westerly, south-easterly. It's south limb slope in westerly part is more than north limb slope in easterly part. Asmari anticline is important because of its oil reservoirs. Asmari formation is characteristic for its three groups of longitudinal, transverse and shear fractures development. Asmari fault ramping causes oil spills from its reservoirs. Ramping hidden Asmari thrust causes unusual outcrop Asmari and Pabdeh formation and thinning fore limb anticline to < 25 %.

Fracture style in north-westerly nose shows that dextral shear fractures developed very well, but performance basement fault causes transverse fractures don't develop in this headland. Longitudinal fractures don't grow so much in south-easterly nose, because of delivered pressure reduces in this area. Instead we can see a lot of transverse fractures in this nose. Three sets of the longitudinal, dextral shear and sinistral (left-lateral) shear fractures have development toward north-westerly plunge in the north limb. While transverse fractures have development toward median fold. In the south limb, Fractures style shows that longitudinal fractures developed well. The basement fault performance causes decreased transverse fractures toward north-westerly nose. Also, correlation trend of sulfur springs with longitudinal fractures trend expresses longitudinal fractures effect in oil spills. By the way, performance of the Asmari thrust causes oil spills to escape by longitudinal fractures.

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