Structural style and hydrocarbon trap of The Karbasi anticline, Interior Fars region, Zagros, Iran

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Abstract

The Study area is located in the Zagros Simply Folded Belt of Iran and in the interior Fars sub-basin.The Karbasi anticlineis located between west- northwest parts of Jahrom town and northwest of the Aghar gas anticline (40 km to this anticline). This anticline has asymmetric structure and some faults with large strike separation observed in its structure. Activity of the Nezamabadsinistral strike slip fault in west part of this anticline caused fault plunge change in this region.

Because of complication increasing of structures geometry in Fars region and necessity to exploration activities for deeper horizons especially the Paleozoic ones, the analysis of fold style elements, which is known as one of the main parts in structural studies seems necessary. In this paper because of some reasons such as The Karbasi anticline structural complication, importance of drilling and hydrocarbon explorations in Fars region, it is proceed to analysis and evaluation of fold style elements and geometry with emphasis on the Nezamabad fault operation in Interior Fars region. According to fold style elements analysis results, it became clear that in east part of anticline the type of fold horizontal moderately inclined and in west part it is upright moderately plunging, so west evaluation of anticline is affected by more deformation. In this research the relationship present faults especially the Nezamabadsinistral strike slip one with folding and its affection on Dehram horizon and Bangestan group were modeled. Based on received results may be the Nezamabad fault is located between G-G' and E-E' structural sections and this fault in this area operated same as fault zone. In different parts of The Karbasi anticline, Dashtak formation as a middle detachment unit plays an important role in connection to folding geometry, may be which is affected by the Nezamabad main fault.

Keywords: Karbasi anticline,Fold style**,** Folding geometry, Nezamabadfault,

1. Introduction

The Zagros fold –thrust belt in Iran lies on the northeastern margin of the Arabian plate. This fold thrust belt with northwestern – southeastern strike located from Tarus mountain in the northeastern of Turkey and Kurdistan in north of Iraq up to Strait of Hormuz in southwestern of Iran (Fig.1). More than 65 percent (~107.5 billion cubic meters) of the remaining prove oil resources (~159.6 billion cubic meters) and nearly 34 percent (~ 49.5 trillion cubic meters) of the total gas resources (~146.4 trillion cubic meters) of the world have accumulated in numerous giant and super giant hydrocarbon fields of the Middle East.Clearly, the accumulation of hydrocarbons in the Middle East has been intricately related to the stratigraphy and structural evolution of the Zagros fold-thrust belt (Alavi, 2007). This belt as one of the valuable oil-rich provinces provides approximately 2/3 of oil-resources and 1/3 of gas-resources the world.

The anticlines of the Fars region, which are placed in Zagros fold-thrust belt, are valuable because of possessing a lot of gas resources in the Permo-Triassic carbonate sediments. According to the geological classification, this understudy area is located in the Interior Fars region(Fig.1).

A lot of studies to be done on this area based on stratigraphy and geophysical exploration for the reason that optimization method but no studies to be done based on folding geometry, folding style for obtain study and investigation of structural oil traps with emphasis basement involved. On the other hand, a few studies should be done on understudy area based on kinematics pattern of folding in this fold –thrust belt.

Fold geometric form and mechanical stratigraphy evolution are affected by thickness, detachment unit's ductility and stratigraphy sequence of formations. Moreover fold geometric form and mechanical stratigraphy evolution depends on above mentioned cases (Kashfi, 1972; Falkon, 1969; Alavi, 1994; Sherkati, 2006). Many studies to be done according to variation of structural style and effects of detachment folding on folding pattern (Sherkati&Letouzey, 2004; Sherkati et al., 2005). These investigations that mentioned above confirm the effects of mechanical stratigraphy on folding geometry in Zagros but did not study the relationship of folding patterns by middle detachment horizons in the Paleozoic horizons based on relationship kinematics with main folds.

Other researchers such as O’Brien (1950) mentioned the effects of detachment layers on folding process for the first time. On the other hand, in the recent years, geologists present different types of geometric and mechanical models and the obtained results of these studies increase researcher's information. Other researchers such as Supp (1983), Jamison (1989), Mitra (2002 & 2003), Dahlstrom (1990) present papers which cause to increase geologists information about cases mentioned above.

Geometry of anticlines in Zagros affected by type of deformation and mechanical behavior of stratigraphic units. Detachment units such as Dashtak formation in Zagros are important for controlled folding pattern especially in Farsregion. Dashtak formation with Triassic agebelongs toKazeron group and this formation have evaporates units such as shale and dolomite. On the other hand, other detachment formations in this area are Kazdomi and Gachsaran formation.

In this paper because of some reasons such as structural complication of The Karbasi anticline, importance of drilling and hydrocarbon explorations in Fars region, it is proceed to analysis and evaluation of fold style elements and geometry with emphasis on the Nezamabad fault operation in the interior Fars region.

The Karbasi anticline isan asymmetric structure and its stratigraphic units are affected by many faults in this region. Some of these faults may affect on the Dehram horizon in this region.As the result of effects of this faults that exist in stratigraphic units, faults operation may affects on gas reservation in this horizon(Tavakoli 2000).Because of complication increasing of structures geometry in Fars region and necessity to exploration activities for deeper horizons especially the Paleozoic ones, the analysis of fold style elements, which is known as one of the main parts in structural studies seems necessary.

Specific features are important for folds describes and understanding how they develop (Twiss and Moors, 1992). According to this cases that mentioned above, wetried analysis and investigated on the complications in The Karbasi anticline with fold element style analysis, structural map, modified structural sections(based on Tavakoli 2001) and folding- faulting relationship modeling.

Description of fold geometry is important because they allow comparisons within and between folds and allow us to recognize patterns in the occurrence and distribution of fold systems. The main aim of this paper is determination ofstructural style and hydrocarbon trap of the Karbasi anticline in the Fars region.

2. Material and methods

This paper presents part of the results of a regional study of the Fars province in the Zagros Simply folded belt, based on satellite images, thin sections, geological maps, well dataandoriginal fieldwork. Our fieldwork in the study area and some data such as geological maps and geological regional data were prepared and provided by the National Iranian Oil Company (NIOC). In the study area, not provided seismic data to analysis and discuss the structural features by Oil Companies in this region. All geological reports have been studied and all the elements of fold style have been calculated and analyzed. We used fold style elements analysis methods (description of folds) base on Twiss and Moors (1992) , Rickard (1971), Ragan (1985) and Ramsay (1967). We used Tectonics FP software for prepared and analyzed Stereoplots of the Karbasi anticline. Also, we used Global Mapper Software for prepared 3D SRTM of the study area and 3D Path Profile (along cross sections) based on Global Mapper Software. 3D SRTM has been prepared base on Digital Elevation Model (DEM) and geological map of study area (in scale 1:100,000, 1:250,000 and 1:1000,000—published by the National Oil Company and the Geological Survey of Iran).

3. Geological and geographical setting

In this paper, the Study area is located in the Zagros Simply Folded Belt of Iran and Fars region (Fig 1). The Zagros Fold-thrust belt is home to one of the largest petroleum producing reservoirs in the world (Molnar,2006). The Fars region, on the basis of geological facies units perpendicular to Zagros belt have been divided the interior Fars, coastal Fars and sub-coastal Fars sub-basins (Beydoun et al., 1992; Motiei, 1993) and the study area is located in the Interior Fars sub-basin. This area is easily recognized by the NW-SE trending parallel anticlines that verge to the SW in a 6-12 km cover sequence (Colman-Sadd, 1978; Molnar, 2006).

In the Zagros fold-trust belt, the oldest known stratigraphic unit with 2000-1000 meters thickness estimated as Hormuz Series (Ala, 1974; Kent, 1970; Player, 1969) and is exposed in the form of salt domes in the Fars region. Structures in this area have complications and the oldest stratigraphy unit that outcropped in the Khaftar anticline on the surface belongs to Hormuz Series (salt plug). The age of Hormuz Series is Pre- Cambrian- Cambrian (Fig. 2).

Anticlines outcrop stratigraphic units in the most of structures Fars region often include Upper Cretaceous stratigraphic units (MaesTryshtyn - Campanian to the present) and in the sub-coastal Fars region, includes the Lower Cretaceous stratigraphic units (Neocomian to the present). The youngest formations that outcrop in the study area are Aghajari and Bakhtiari and Razak formations. Also, in the interior Fars sub-basin, the oldest outcrops is Hormuz Series observed in the Khaftar, Kuh-e Qazi and Surmeh anticlines form of salt domes (e.g. Beydoun et al., 1992 ; Motiei, 1993; DehbashiGhanavati, 2008).

The Khaftar anticline is located in the West, North -West of Jahrom city in the Fars province (148 km to Persian Gulf). The trend of this anticline has three orientations that consist of

North- Northeast, East- West and South- Southwest. This anticline is bounded from north by Kuh-e Qazi anticline, from north- northeast by Qutbabad anticline, from south- southeast by Karbasi anticline and from southwest by Sim anticlines (Fig. 1).The trend of this anticline is N60°W. This anticline is bounded from south by the Chaghal, from southwest by the Noura, from north- northeast by the Khaftar and from north- northeast by the Jahrom anticlines (Fig.1). The Karbasi anticline is an elongated structure, which has 40 km length and 7.5 km width in the Asmari horizon. MundRiver is flow with northern- southern path in this area and in the western part of anticline; this river has changes in flow of path. By whirling this river in the western part of anticline finally MundRiver continue them path to south.

4. Structural setting

The Karbasi anticline is an asymmetric structure(Fig.3). This anticline located in Interior Fars province. From point of topography is extension structure. Eastern part of anticline ended to Jahrom city and in the western part ended to mountains. The oldest formation that outcropped on the surface of this anticline is Gurpi formation that existed in the Gurbidstrait. In this anticline, some parts eroded on the surface and then cause outcrops the oldest formation such as Pabdeh- Gurpi on the surface. In the southern flank at the location which Asmari formation covered surface, some cliffs are exists with vertical walls. The highest part of The Karbasi anticline has 2013-meter elevation.

The most of surface of anticlinegenerally covered with Asmari- Jahrom formation. This anticline is an asymmetrical anticline that the dip of southern flank is greater than the northern flank(Fig. 4). On the other hand, plunges dip value in western part of anticline more than eastern part.

Structure of The Karbasi anticline is complicated also affected by some faults with high lateral displacement that operation faults could divided to different parts. By operation mentioned fault, western part of anticline plunged to north and in this part of flank has a regular dip.This anticline in the western part has complication structure but in the eastern part, structure has gentlechange.

Some faults exist in the anticline that could be account to weakness for reservation gas in the Dehram horizon. In view of the fact that exist main faults in this anticline, may be anticline has complication in the deeper horizon. We tried to investigate these cases with modeling by structural cross section and drilling information well of anticline that investigate and analysis in the next part of paper.

Because of The Karbasi anticline, has complication structure; the analysis of element fold style is necessity. Then for more studies in this structure, fold style elements changes will be analysis and investigation from east to west of anticline in the different structural cross section.

5. Faulting in the study area

Fault system in the Karbasi anticline has two type faults. One type is longitude fault and another type is transverse one. The Nezamabadsinistral strike slip fault is main fault in this area that affected on western plunge of The Karbasi anticline.The longitude faultsare located in the hinge line zone of anticline. On the other hand, some longitude faults located parallel with fold axis. Transverse faults located with high angle to fold axis.

The Nezamabad fault is one the strike slip fault with northeast- southwest trend in theGavbandi High that divided Gavbandi High from central Zagros (Setudehnia, 1978). This fault has 265 km lengthand sinistraldisplacement. In view of the fact that,at the first time Barzegar (1994)was introducedthe Nezamabad fault, he introduced this fault based on satellite image. This fault has 2.5 km strike slip displacement and beginning from southern flank of Shahini anticline to southeastern of Neyriz. The most displacement of the Nezamabad fault easily observed in the satellite image of the Khaftar anticline and caused until change and rotation of anticlines plunge by affected on them (Dehbashi, 2008).

According to fold style elements analysis results, it became clear that in east part of anticline the type of fold horizontal moderately inclined and in west part it is upright moderately plunging, so west evaluation of anticline is affects by more deformation. In this research the relationship present faults especially the Nezamabadsinistral strike slip one with folding and its affection on Dehram horizon and Bangestan group were modeled. Based on received results may be the Nezamabad fault is located between G-G' and F-F' structural sections, moreover a second order fault introduced in relationship with the Nezamabad fault. In different parts of The Karbasi anticline, Dashtak formation as a middle detachment unit plays an important role in connection to folding geometry, may be which is affected by the Nezamabad main fault and second order one.

6. The Description of Folds

Descriptions of fold geometries are important because they allow comparisons within and between folds and allow us to recognize patterns in the occurrence and distribution of fold systems. For example, orogenic belts contain characteristic fold systems: along their flanks are large fold and thrust belts, with little metamorphism, but underlain by décollements; and in core zones where intense folding has been accomplished, accompanied by high-grade metamorphism under high temperature and pressure.The folded surfaces that analysis for top of Neyriz - Dashtak formations as Kazeron group and top of some formations of Bangestan group. According to gave result limbs in The Karbasi anticline are unequal length.

Twiss and Moors (1992) described the geometry of folded surface by specifying three style elements: aspect ratio, tightness and bluntness. Based on these cases we will analysis geometry of fold style for The Karbasi anticline. Because of some parts of anticline affected by faults and faults effects observed on surface, we could not in this parts measured and calculated some parameters. There are three chief descriptors of a folded surface:aspect ratio the ratio of the fold amplitude to the distance between two adjacent inflection points; tightness, or the interlimb angle; bluntness, a measure of the curvature of the surface in the zone of closure.

In this part, we mentioned how calculated and measured this parameters for studied area. Finally gave results showed by comparable diagram (Table. 1).

7. Elements of Fold Style

The style of a fold is the set of characteristic that describe its form. Over years of working with folds, geologists have identified certain features as particularly useful in describing fold and understanding how they develop (Twiss and Moors, 1992).

Because the Karbasi anticline, has complication structure; the analysis of fold style elements is seems necessary. Therefore, for more studies on this structure the changes of fold style elements will be analyzed and investigated from east to west in the different parts of this anticline. Because of the Nezamabad fault may be effect on the Karbasi anticline, we have been evaluated and calculated elements of fold style in this structure. In this respect, cylindricity, symmetryhave evaluated and in the Geometry of axial plane and Folding Mechanism.

7.1 .Cylindericity

Folded surface forms a symmetric fold if in profile, the shape on one side of the hinges a mirror image of the shape on the other side, and if adjacent limbs are identifiable in length (Twiss and Moors, 1992).

Based on previous studies in the Karbasi anticline and layered location, this anticline has asymmetric anticline. In addition, anticline is an asymmetric anticline that the dip of southern flank is greater than the northern flank. Southern flank from 15° to 75° is changing and in northern flank dip value from 3° to 57° is changing.

7.2 .Symmetry

The studied anticline is an asymmetric fold with changed plunge in the north of the western part of fold.

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8.1. Aspect ratio

The aspect ratio P is the ratio of the amplitude A of a fold, measured along the axial surface, to the distance M, measured between the adjacent inflection points that bound the fold (Twiss, 1988). In the Karbasi anticline, measured the aspect ratio (P) or ratio of amplitude to half of wavelength fold in seven part of structural cross section of this anticline.

According to calculated values of aspect ratio, this parameter variable from -0.847 to -0.322 for top of Bangestan group formations (table) and values of aspect ratio variable from -1.08 to -0.156. This variable result gave for tested top of folded surface from eastern part to western part. At finally folds based on aspect ratio defined in Table 2.

Based on logarithm P and description term of folds in The Karbasi anticline just between three parts of folds (E-E' to G-G') description term of fold is broad and in the other parts is wide for top of tested surface formations of Bangestan group. That seems this changes affected on the some faults in mentioned parts of anticline.Because of most changes in the western part observed same as one domain of deformation (from E-E' to G-G' sections), May be operation of the Nezamabad Fault in this area operation same as fault zone that specific states especially observed in top of tested surface formations of Bangestan group.

8.2. Tightness

The tightness of Folding is defined by the Folding angle ϕ or the interlimb angle□ (Twiss and Moors, 1992). As the degree of folding increases, the folding angle increase and the interlimb angle decreases. Based oninterlimb angle calculated in seven parts of fold from A-A' to G-G' sections, the minimum of interlimb angle is 62° degree for western part of anticlinethat located in the G-G' structural cross section (for top of tested surface formations of Bangestan group). In addition, the maximum of interlimb angle is 136° for Eastern part of anticline that located in the A-A' structural cross section (for top of tested surface formations of Bangestan group), (Table,2).The minimum of interlimb angle for top of tested surface Nz-Dkis 84° degree for G-G' structural cross section in western part andmaximum of interlimbis 152° degreefor A-A'structural cross section in eastern part. In the Diagrams 1, showed comparable diagrams for gave results. Ramsey (1967) classified folds based on folding angle that used in this paperand gave results showed in Table, 2.

According to gave results, only in one parts of The Karbasi anticline, based on folding angle fold is close that observed in part of G-G' structural cross section where as fold type of anticline is rabbit ear fold (in southwest flank of rabbit ear fold). This complication of structure May be affected by operation of the Nezamabad Fault. In this area, seems that faults affects on folding style and complications of structures.

8.3. Bluntness

The bluntness b measures the relative curvature of the fold at its closure. It is defined by Twiss (1988).In seven parts of fold from A-A' to G-G' sections Based on bluntness b calculated for tasted surface of Bgp formations (Ilam- Sarvak formations) and Nz- Dk formation this parameter. Gave results showed folds in different parts are angular, sub-rounded, rounded and blunt and just in E-E' section, fold is angular (Table.2).

9. Geometry of axial plane

In the Karbasi anticline, seems that geometry of axial plane is planner. In the figure 5, based on analysis and calculations of some parameters, showed gave locations of axial plane in the seven structural cross sections of anticline. Based on gave location of axial planes and changes of them may be operation of the Nezamabad Fault operated same as fault zone. On the other hand, based on figure 6, The Karbasi anticline is a horizontal fold. According to gave results and output of Tectonics FP software for seven parts of The Karbasi anticline, gave seven stereoplots that showed location of axial plane (AP) and cylindericity (AC) for seven parts of The Karbasi anticline (Fig.6)(also structural cross sections show in the Fig.10).

10. Folding Mechanism

In the eastern and western part of The Karbasi anticline observed rabbit ear folds (G-G' and A-A' cross sections). In the western part observed most of changes. In this part of fold exists specific style, that based on folding angle, fold has close style. May be operation of the Nezamabad fault and some faults that exist in this anticline caused this changes. In the Proposed pattern of folding model for The Karbasi anticline, we will represent changes in different parts of The Karbasi anticline.

Based on classification of Rickard (1971) in the Karbasi anticline, type of fold is difference (Fig.7 and Table 3). In the eastern part of anticline (A-A' section) type of fold is moderately inclined horizontal and in the western part of anticline (G-G' section) type of fold is moderately inclined moderately plunging. According to this results, seems that western part greater deformed than eastern part. May be the Nezamabad fault affected on this case.

11. Results and discussion

In this research, the relationship present faults especially the Nezamabadsinistral strike slip one with folding and its affection on Dehram horizon and Bangestan group were modeled (Fig.8 &9). Based on received results may be the Nezamabad fault is located between G-G' and E-E' structural sections and this fault in this area operated same as fault zone. In different parts of The Karbasi anticline, Dashtak formation as a middle detachment unit plays an important role in connection to folding geometry, may be which is affected by the Nezamabad main fault. Relationship between the Nezamabad Fault and The Karbasi anticline modeled by 3D modeling based on structural cross section from A-A' to G-G' (Tavakoli, 2001).

12. Conclusion

Orientation of axial plane in thedifference parts of The Karbasi anticline is different and may be the Nezamabad Fault affected on this case. Varity of axial plane characteristic and axis of fold in thedifferent parts of anticline may be showplunge rotation of anticline affected by the Nezamabad Fault operation.

In the eastern part of anticline, type of fold is moderately inclined horizontal and in the western part of anticline, type of fold is moderately inclined moderately plunging. According to this results, seems that western part greater deformed than eastern part. Relationship between geometry of folding and faulting with operation faults in this area is possibility. Some faults that exist in the upper stratigraphic units of anticline is possibility jointed with the Nezamabad Fault in the western part and because of operation this joint; fold in the western part tightness than other parts.

At finally, In different parts of The Karbasi anticline, Dashtak formation as a middle detachment unit plays an important role in connection to folding geometry, may be which is affected by the Nezamabad main fault.

13. Acknowledgement

This work is funded by the Department of geology, Islamic Azad University, Science and Research branch, Tehran, Iran. Also, we thank Vice-President for Research in Science and

Research branch, Tehran and Exploration Management of National Iranian Oil Company, especially Dr. Mohammad Ali Ganjavian.

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Table 1: Comparable diagrams 3D line chart and 3D Bar chart showed interlimb angle, folding angle, amplitude and wavelength for tasted surface of Bgp formations(Ilam-Sarvak formations) and Nz- Dk formation.

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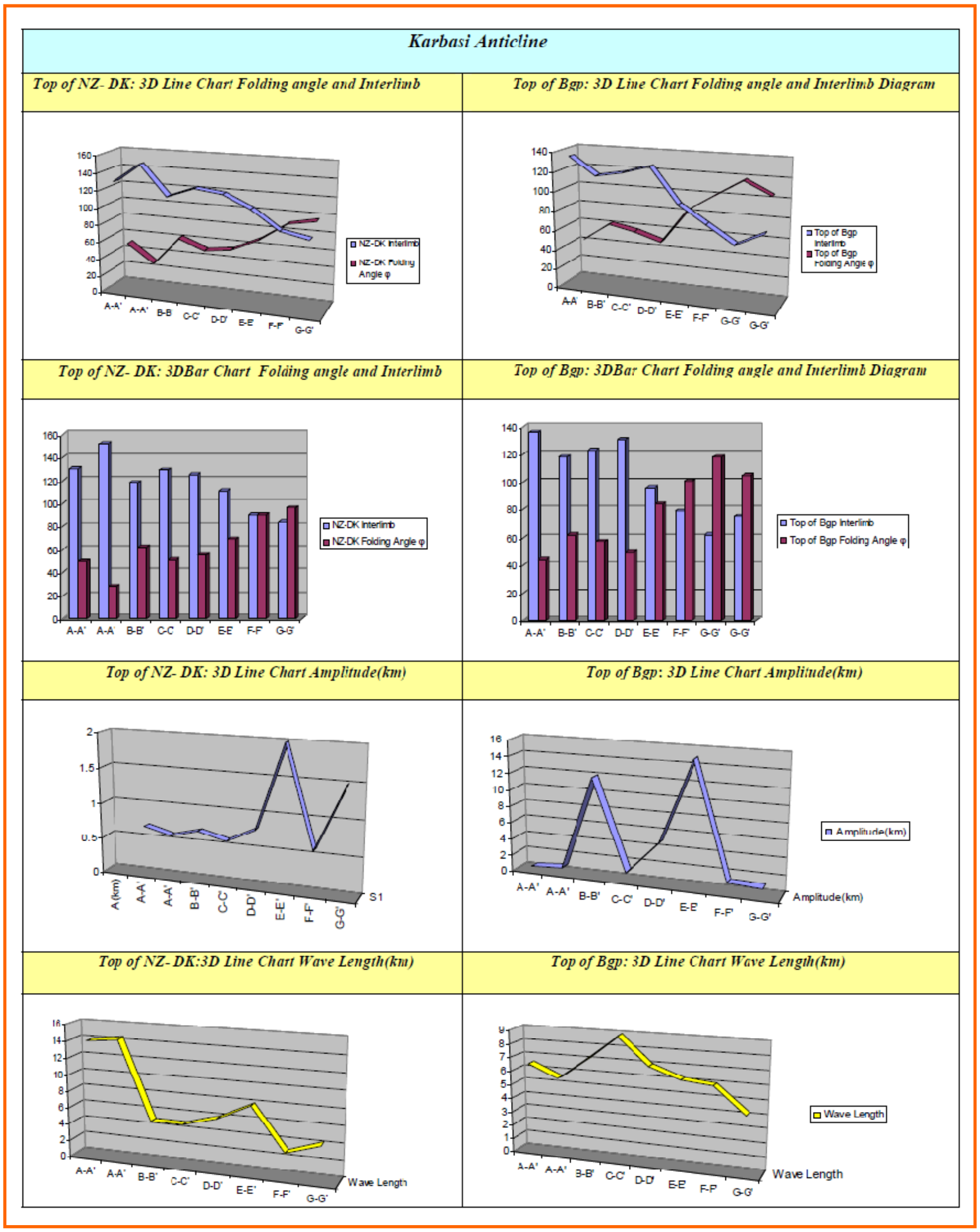

Table 2: Indicate style for tasted surface of Bgp formations (Ilam- Sarvak formations) and Nz- Dk formation.

Calculated Geometry Parameters of Karbasi Anticline

M (km)	Log P	Descriptive Term based on LogP	Interlimb	Folding Angle φ	Descriptive Term based on φ	rc (km)	ro (km)	Bluntness
3.25	-0.815	Wide	136	44	Gentle	5.2	5.3	0.981
2.8	-0.602	Wide	118	62	Open	4.4	4.7	0.936
3.6	-0.785	Wide	123	57	Gentle	5.2	7.2	0.722
4.45	-0.649	Wide	131	49	Gentle	6	6.4	0.937
3.5	-0.847	Wide	96	84	Open	1.7	6.2	0.274
3.1	-0.316	Broad	79	101	Open	2.4	6.3	0.38
3	-0.397	Broad	62	118	Close	3.9	5.5	0.709
2.1	-0.322	Broad	75	105	Open	5.1	2.5	1.5

M (km)	Log P	Descriptive Term based on LogP	Interlimb	Folding Angle φ	Descriptive Term based on φ	rc (km)	ro (km)	Bluntness
7	-1	Wide	130	50	Gentle	6.4	7	0.914
7.2	-1.08	Wide	152	28	Gentle	6.8	6.6	1.02
2.5	-0.552	Broad	118	62	Open	3.4	5.2	0.653
2.5	-0.619	Wide	129	51	Gentle	3.4	3.5	0.971
3.05	-0.581	Broad	125	55	Gentle	4.8	6.5	0.738
4	-0.301	Broad	111	69	Open	1.3	6.2	0.171
1.5	-0.397	Broad	90	90	Open	1.5	2.9	0.502
2.15	-0.156	Equant	84	96	Open	3.4	3.8	0.894

Table 3: In this table showed type of fold in seven sections of The Karbasi anticline. This classification based on classification of Rickard (1971) and Ragan (1985).

	A-A' P:9/ 110 AP:117/ 73 *Fold type: Moderately inclined horizontal*	B-B' P:3/ 286 AP:105/ 88 *Fold type: upright horizontal*	C-C' P:3/ 291 AP:111/ 83 *Fold type: upright horizontal*
D-D' P:1/ 105 AP:106/ 66 *Fold type: Moderately inclined horizontal*	E-E' P:2/ 303 AP:122/ 66 *Fold type: Moderately inclined horizontal*	F-F' P:8/ 107 AP:129/78 *Fold type: upright horizontal*	G-G' P:42/ 086 AP:088/ 89 *Fold type: Moderately inclined moderately plunging*

P: Plunge AP: Axial Plane

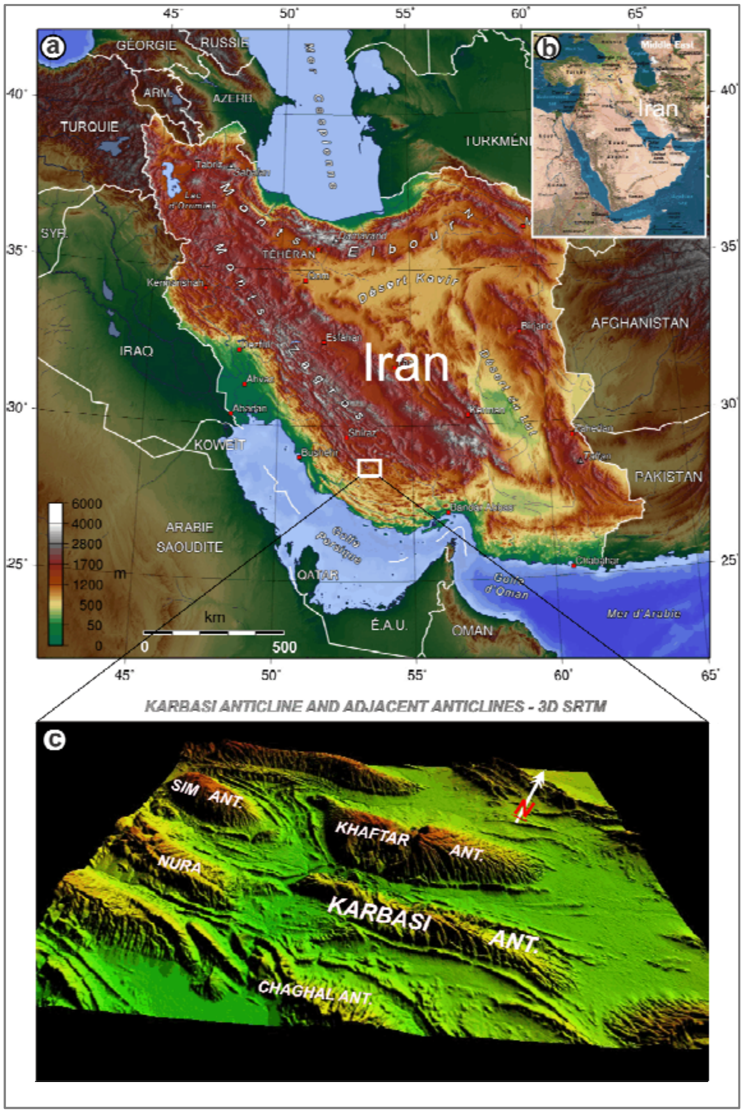

Figure. 1: (a) shows location of the study area, (b) with white framework in the Middle East, (c) 3D SRTM for the Karbasi anticline and adjacent anticlines.

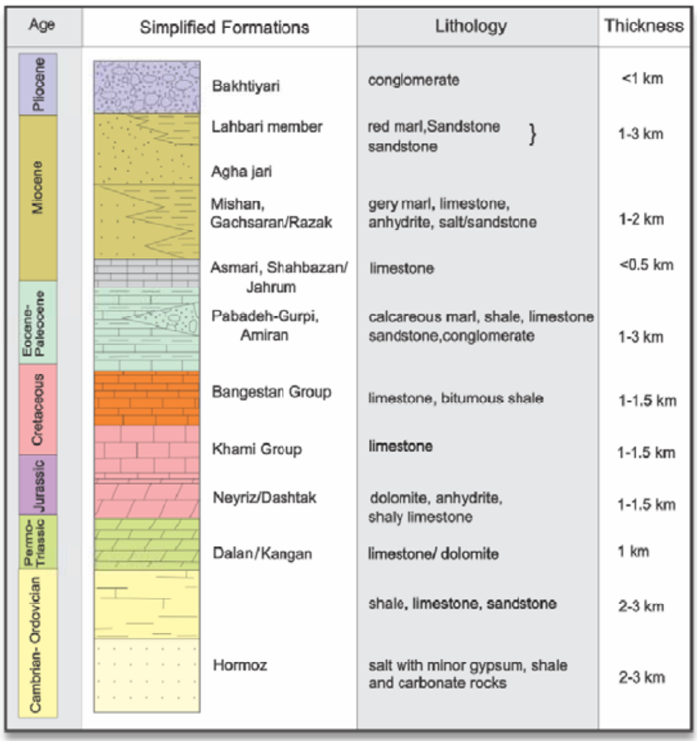

Figure. 2: Generalised stratigraphic column through the Zagros fold–thrust belt. (Modified after McQuarrie (2004).

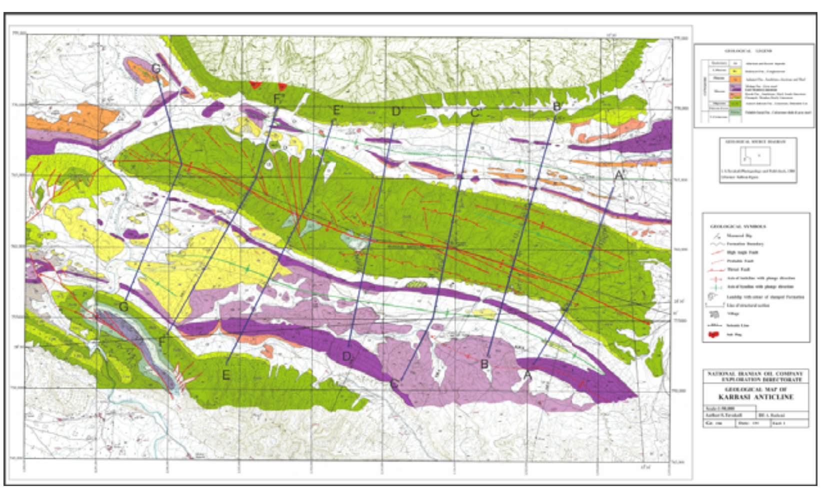

Figure 3. Geological map of The Karbasi anticline and structural cross section(NIOC).

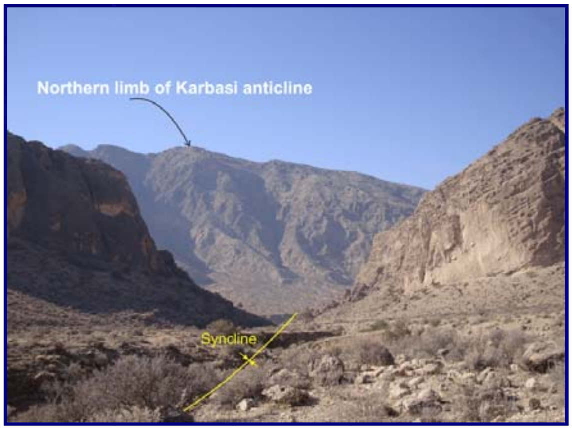

Figure 4. View to the south-west that shows Northern limb of The Karbasi anticline and syncline between The Karbasi anticline in northern limb and the Khaftar anticline in southern limb.

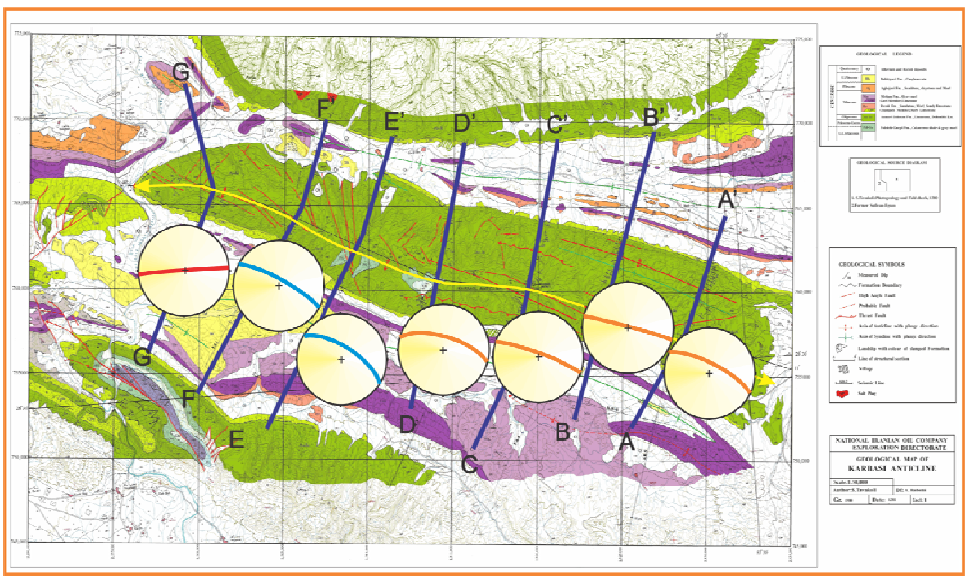

Figure 5. This figure show located axial plane of the Karbasi anticlinebased on gave results in seven sections.

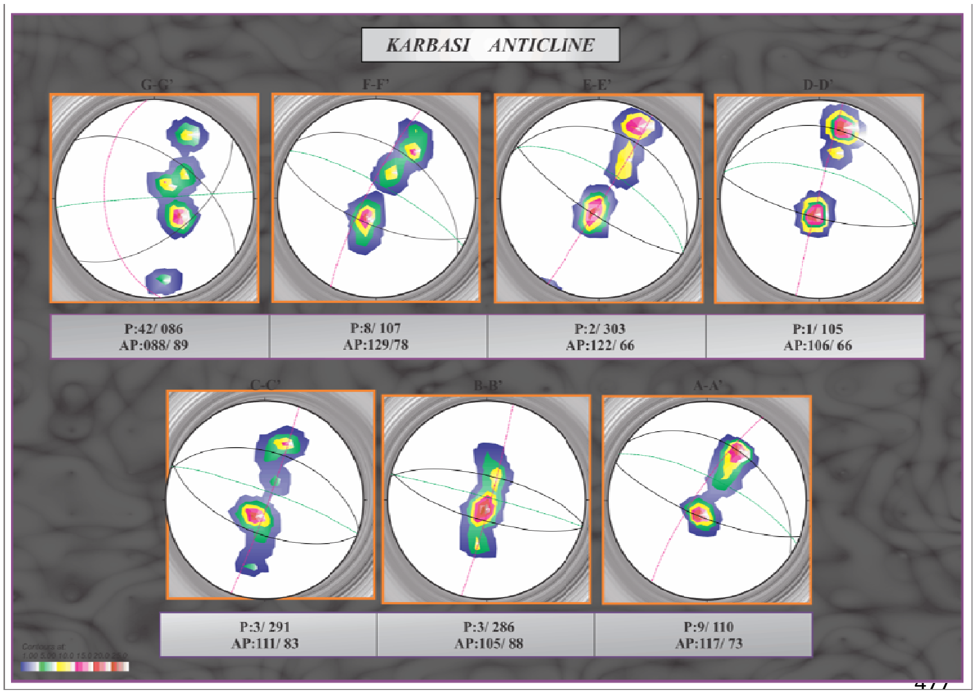

Figure 6. Stereoplots showed axial plane (AP), cylindericity (AC) for seven sections of The Karbasi anticline.

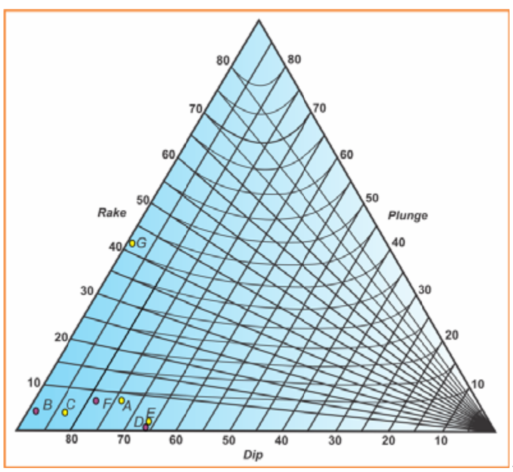

Figure 7. Triangle form diagram showed type of fold in seven sections of The Karbasi anticline, based on Rickard (1971). This Diagram gave based on Rickard classification. Type of fold in Part G (G-G' section) is different to other section completely

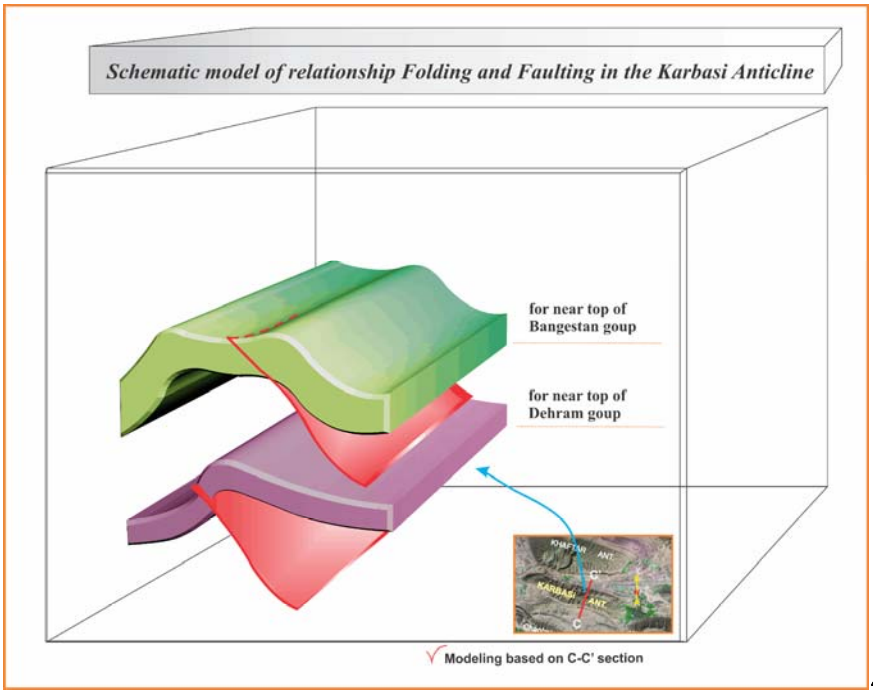

Figure 8. Schematic model for relationship between folding and faulting for near top of Bangestan group and near top of Dehram horizon in C-C' part of the Karbasi anticline that observed fault rapture in surface. This modelling is based on information of C-C' structural cross section with 3D modeling software.

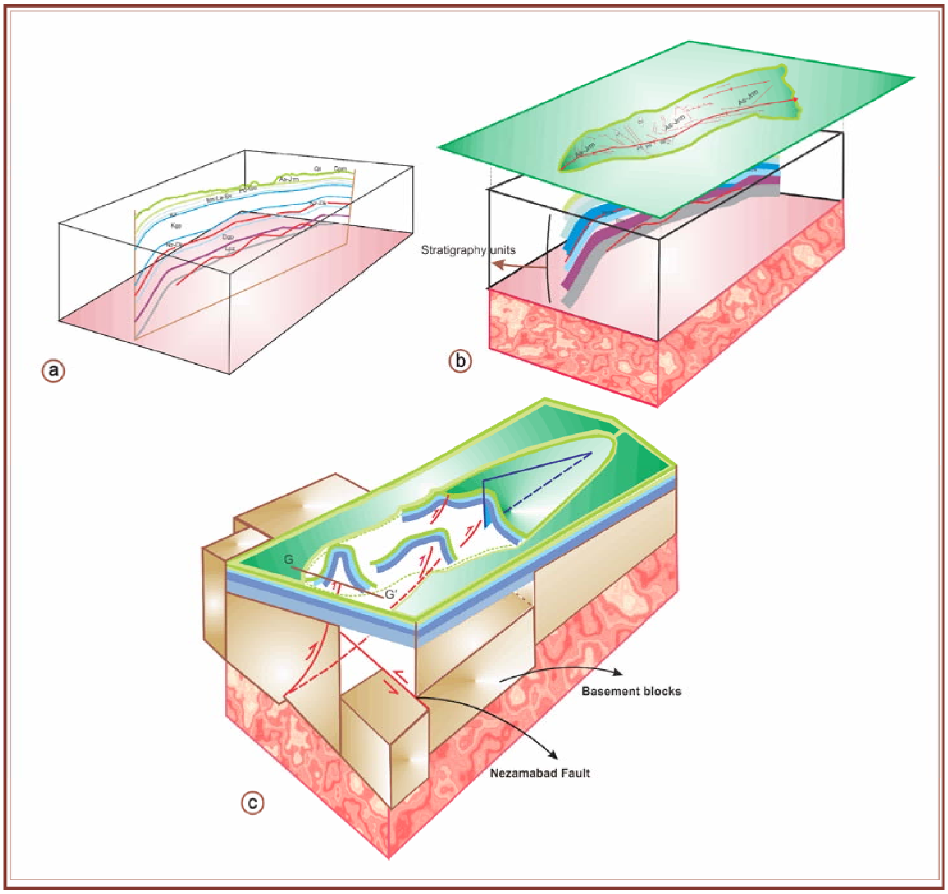

Figure 9.(a) 2D model of longitude structural cross section of the Karbasi anticline. (b) Forms of fold with location of longitude structural cross section. c- Relationship between the Nezamabad Fault and the Karbasi anticline, 3D model (based on structural cross section from A-A' to G-G').

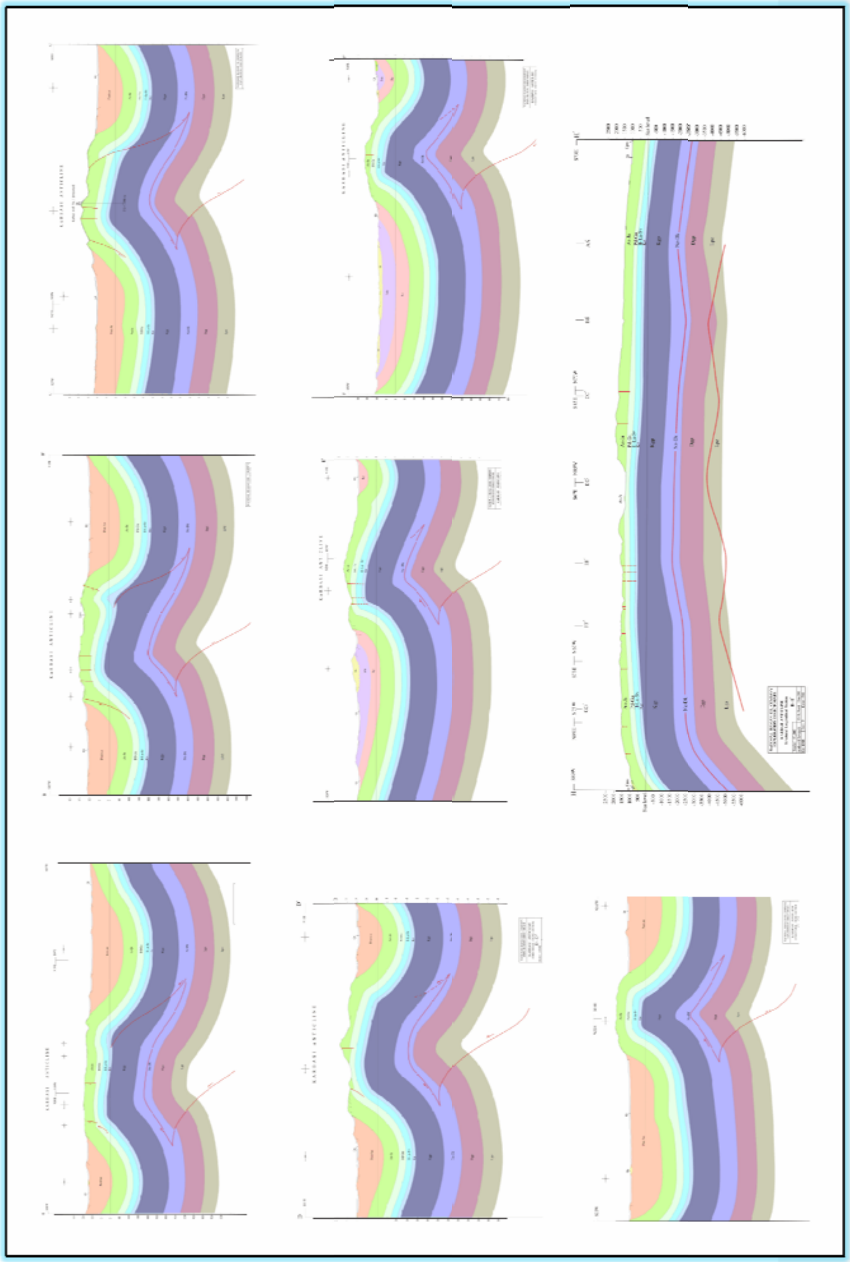

Figure 10.Structural cross sections of the Karbasi anticline, adapted from NIOC(2001).