Available online at: www.geo-dynamica.com

ISSN 2345 - 4997

Vol. (I) - No. 02- (Special Issue on Intra- Plate Earthquakes) Feb.2014
6th Article- P. 50 to 55

GRIB
Geodynamics Research International Bulletin

The Relationship between Tectonics of Hossein Abad Ferdows and Lut Block

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Article History: Received: Jan. 18, 2014 Reviewed: Feb. 05, 2014
Revised: Feb. 10, 2014 Accepted: Feb. 12, 2014 Published: Feb. 14, 2014

ABSTRACT

In this paper, the investigations on the Hossein Abad district located in the northern part of Lut block illustrate that the main trend of strike slip in the zone is mostly NE - SW and N – S. Furthermore, the folds of the zone under the pressure NE - SW trend to the south. Moreover, the tendency of the folds as well as the thrust faults in the region are NW - SE. Hence, the current trend in Hossein Abad zone has been affected by development and evolution of the Lut block structure.

Keywords: Lut Block, Folding of Hossein Abad, Eocene Volcanic Rocks.

1. INTRODUCTION

The area under study is located in the Cenozoic magmatic belt, the east of Iran, at 20 kilometers distance from northwest of Ferdows city. This belt which includes Lut block orients in the N-S direction (Berberian and Mohqjer 1977). Notably, the Jurassic and Cretaceous rock units are the oldest units of the area in which no outcrop of more ancient units has been observed there. Generally, in this area, there are Cenozoic sediments on the older rocks, unconformably. Moreover, the Tertiary Orogenic phases affect the region via fracturing and faulting in the region (Pourlatifi 2003).

2. THE STUDY AREA

2. 1. THE GEOLOGICAL AND STRUCTURAL FEATURES OF THE LUT BLOCK

The Lut block is a stretched and stable zone whose stability is due to the density and hardness of the metamorphic rocks that underlie it. In the middle Triassic, this block has been developed about 900 km and 200 Km in the N- S and E – W directions, respectively (Jackson et al, 2002) (Fig. 1). The Lut block with other structural zones of Central Iran and Alborz region constitute Paleozoic sedimentary basin and is located in platform of Central Iran (Aghanabati 2004), (Berberian and Berberian 1981).

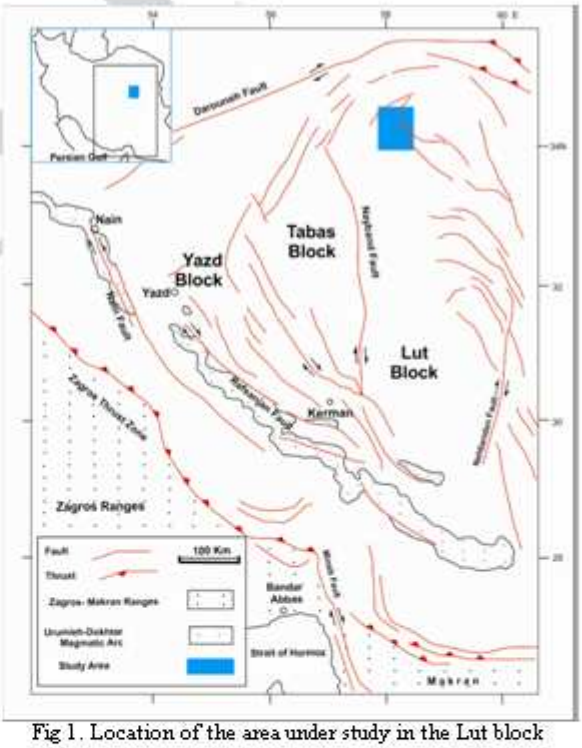

Fig 1. Location of the area under study in the Lut block

2. 2. THE STRATIGRAPHY AND GEOLOGY OF THE STUDY AREA

The stratigraphy and geology of the study area consists of Cenozoic volcanics which are 2000 m to 3000 m thick. Furthermore, the Cenozoic volcanics have been composed of andesitic, basalt and dacite.

Moreover, the thickness of the Paleogene volcanic rocks is less. Also, their compositions are andesitic-dacite in which most of the mineralizations in the zone have been affected by these rocks (Golonka 2004).

2. 2. 1. THE JURASSIC SEDIMENTS (JS AND TRN)

At the beginning of the Jurassic period, the shallow marine conditions prevailed in Central Iran, where the deposits of shale, sandstone and sometimes the limestone stratas appeared. Notably, the contacts of these rocks with the older layers on the earth have not been observed (Fig 2).

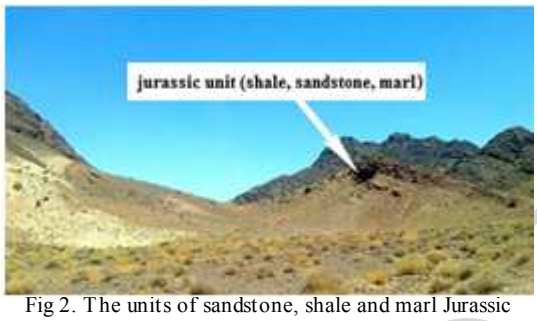

Fig 2. The units of sandstone, shale and marl Jurassic

2. 2. 2. THE LOWER CRETACEOUS SEDIMENTS (K)

The late Cimmerian tectonic event occurred in late Jurassic and caused the spreading of the Cretaceous sea in Central Iran to distant points. Therefore, it resulted in an angular unconformity in the Cretaceous system. It is Noteworthy to mention that the volcanic rocks belonging to the early Tertiary have been located on the carbonate rocks (Fig 3)


Fig 3. The Cretaceous limestone units in the anticline core of Hossein Abad.

2. 2. 3. THE TERTIARY VOLCANIC ROCKS

The volcanic rocks in Central Iran have been created mostly in the form of andesitic lavas accompanied by rhyolite and dacite tuffs. It seems that an important extensive phase prevailed in the area in the early Tertiary. Moreover, it resulted in a tremendous volcanism that affected the great extent of the area (Pourlatifi 2003) (Fig 4)

2. 2. 4. THE QUATERNARY SEDIMENTS

The Quaternary sediments have formed the alluvial terraces which are composed of conglomerate and fluvial sediments. The Qt2 sediments are low-height alluviums and alluvial plains. Also, they embody the old bed of the river and extend to the plains.

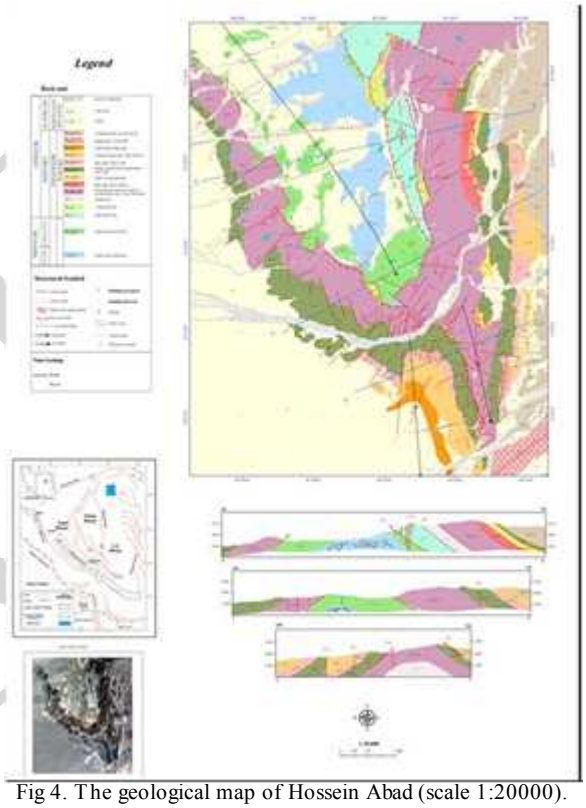

Fig 4. The geological map of Hossein Abad (scale 1:20000).

2. 3. THE STRUCTURAL GEOLOGY OF HOSSEIN ABAD OF FERDOWS

The most considerable structural feature in Hossien-Abad Ferdows locality is the large folding (the Hossein-Abad anticline), in which the trace of bedding surfaces of Eocene units has been displayed in aerial-photographs and satellite images (Fig. 5). Notably, the axial trend of the anticline is N, NW-S and SE and also the southern terminal of this fold is truncated by the NW-SE dextral faulting. Moreover, the trend of fold axis is corresponding to the trend of large-scale thrust fault in paradise sheet (including Ferdows fault). This is due to the regional compressional forces in the NE -SW.

Fig 5: The Hossein Abad anticline in which the Eocene rock units in the limbs and the Jurassic rocks in the core have outcropped.

2. 4. FAULTING

The most important trend of the fracture with regional development in Hossein Abad map is NE-SW (Fig. 6). Furthermore, the main faults of F6 and F9 are consistent with this trend. Besides, the N-S trend is one of the major trends in the investigated area which expands locally in the region. Also, the fault F11 is consistent with this trend.

Moreover, the faults F1, F2, F3 and F10 have not been developed and caused the local separation in the stones. Additionally, the faults F4, F5, F8 and F9 have expanded as the reverse faults with the approximate trend N-S (Figs.7 and 8).

3. RESULTS AND DISCUSSION

The large-scale folds of Hossein-Abad are open folds with soft folding. The trend of the large folding axis in this region is N–S which is similar to the trend of the large-scale thrust fault in paradise sheet (including Ferdows fault). These trends have been created by the regional compressional forces in NE-SW. In satellite images, several dextral and sinistral separations in the eastern limb of the Hossein Abad anticline. It should be noted that this separations can be seen locally (Fig 9).

Considering the above-mentioned evidence, a right-slip dextral model is suggested for the Hossein-Abad area in which its main trend of tension is the same of that for Central Iran (collision of the Arabian and Iranian Plates) (Fig.10). The overall trend of the structures separating the Lut block are N-S, but the general trend inside the Lut block is NW-SE. Most noteworthy, the Hossein Abad region follows this trend (Fotovat Roudsari, 2013).

Furthermore, at great distances from the collision zone of Arabian and Iranian plates, the compression rate decreases and deformation behaves as shearing-rotational. It is due to the intense volcanic activities as well as the change in the areas of Lut block.

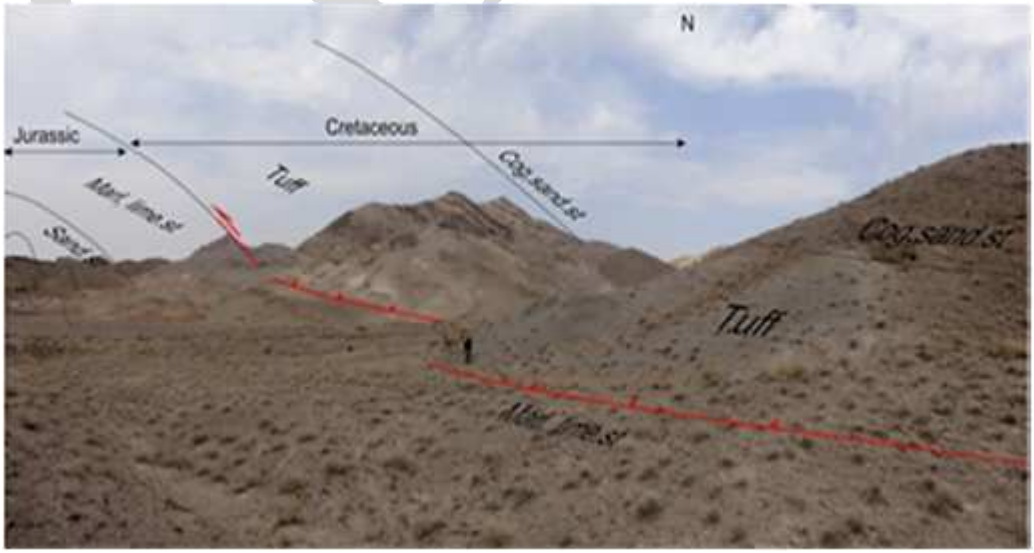

Fig 6: The outcrops of the rock units, the Eocene tuff unit in the east limb of anticline as well as the zone of reverse fault F4.

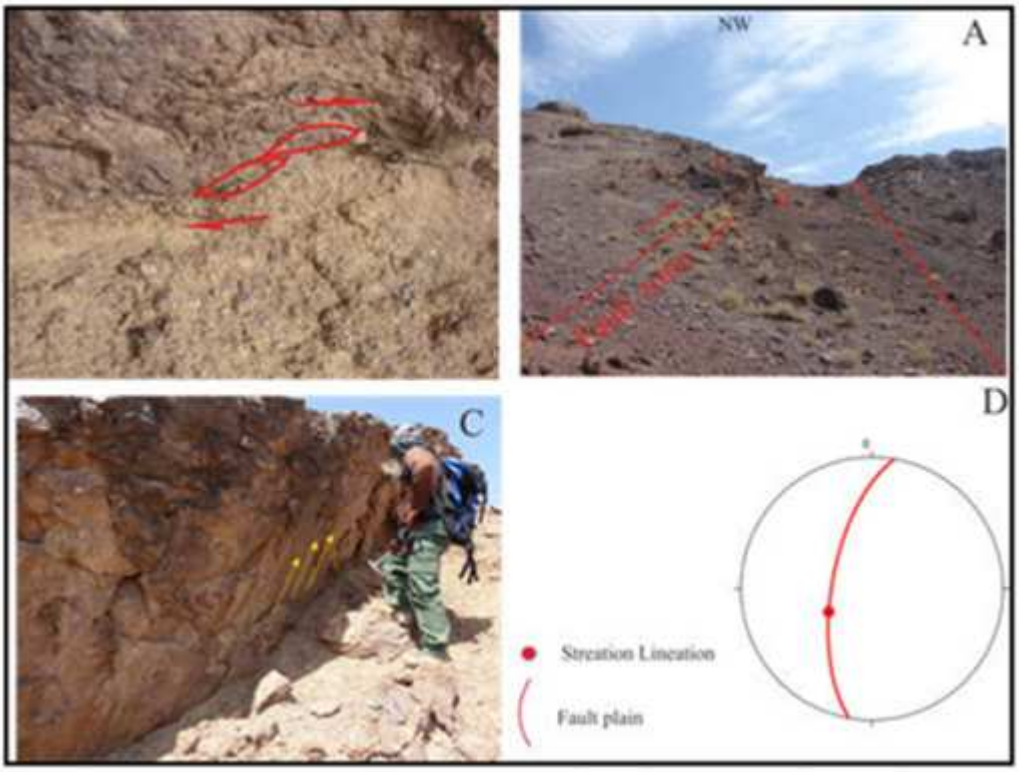

Figure 7-A) The crashed zone and the fault wall F6. B) The lenses in the fault zone indicate the dextral displacement. C) The fault slickensides are on the hanging wall of the fault. D) The Stereont represents the geometry and the slip vector on the fault slickensides.

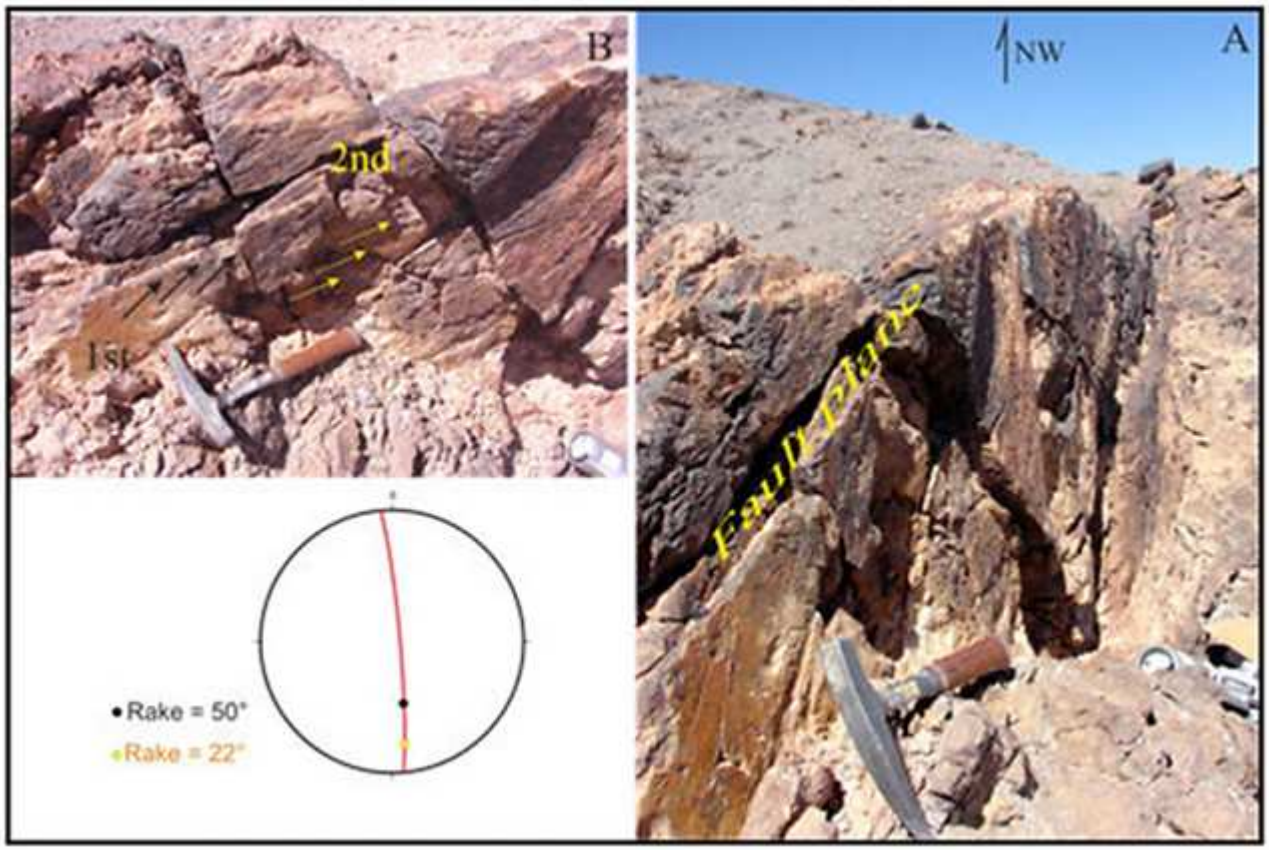

Figure 8: A) The old fault breccia and recent fault plain of fault F10. B) Two generations of slicken lines on recent fault plain which is illustrated by the stereo net graph below the image

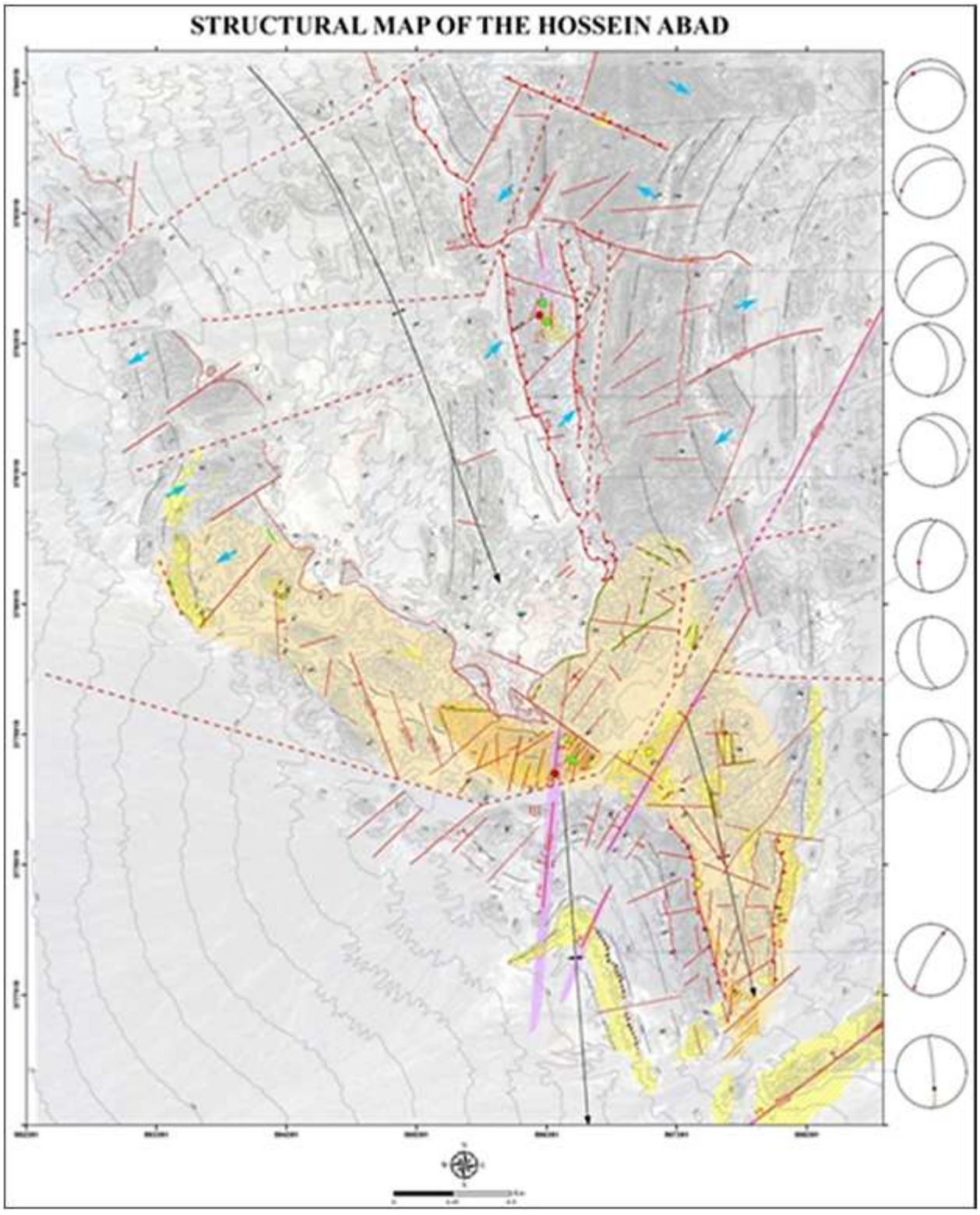

Fig 9: The structural map of Hossein Abad Ferdows with scale 1:20000 .

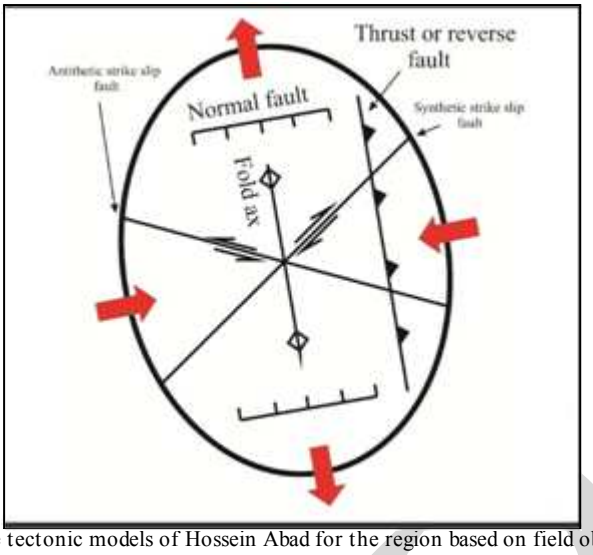

Fig. 10: The tectonic models of Hossein Abad for the region based on field observations

4. CONCLUSIONS

It can be concluded that deformation in Hossein Abad is mostly because of the main stress which has a trend towards NE-SW (the stress from Arabian plate to Central Iran block). Moreover, the trends of Hossein Abad anticline and its thrust faults are the same and also dextral transverse faults break the axis of these folds. Noteworthy, the offered Model for this region confirmed the above conclusions transpressionally. In addition, in this model, the shearing and turning movements are more effective and displacements, volcanic eruptions and changes in large volume can be observed in the region.

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