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Tectonic Evolution of East Margin of Lut Block in Nosratabad Area, SE Iran.

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Research Article

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ABSTRACT

Nosratabad area is located between Lut block and satellite images in this study show that this area has a complex tectonic history. The deformational event in this area has occurred from upper cretaceous until Quaternary. Tectonic evolution of this area has happened in four stages. The first tectonic evolution (T.E.1) has occurred in lower Eocene and prior to; T.E.1 is a subduction process that has occurred in the north margin of Neotethys Ocean. The second tectonic event (T.E.2) has occurred in upper Eocene to Oligocene, T.E.2 is a syncollision process. This collision has occurred between Lut block and east basin of Iran. During of this event some tectonistratigraphic unit has been added to Lut block and thrusting has occurred in this area. This stage is synchronic with closing of east basin of Iran. The third tectonic event (T.E.3) has occurred in the Oligocene to Miocene, it is related to completing of collision event, during of this stage structural unit that had been formed in this area, has added to the Lut block, this event is synchronic with third deformation event. the last event (T.E.4) has occurred in the Pliocene to Quaternary this stage include post collision event, at first in the Pliocene a transpression basin has been formed and Pliocene sediment has been folded at this time. Then a Trans tension basin has been formed in the Quaternary and the evidence of this event include: Kahurak fault activity and reactivity of Nosratabad fault, also alluvial sediment of Quaternary has been deposited at this time in the study area.

INTRODUCTION

The East basin of Iran has been considered of the nine structural zones of Iran since the work Stocklin (1968). The Sistan suture zone of east Iran. is a Cretaceous Tertiary orogenic belt which forms part of the complex Alpine Himalayan collision zone. This origin, which is also referred to as the Iranian ranges. Separator the Lut continental block of central Iran from the Afghan block to the east (figure 1) and is considered by Tirull *et al.*,. The present eastern border of the Lut block would have belonged to the active margin of the sub ducted Neotethys Ocean this ocean was closed in eastern Iran , between the helmand and Lut plates, in Oligocene-Middle Miocene [1,2,3,4].

However, studied the ophiolitic complex of Eastern Iran , between the Lut and Afghan continental block, and considered that the subduction of oceanic lithosphere had a major role and that is should have taken place beneath the Afghan block. The bulk of the origin consists of an accretionary complex of disrupted ophiolitic rocks. Metamorphic rocks within the older and more easterly part of this accretionary complex include blueschists and eclogites, reflecting subduction of Neotethys oceanic crust. Unlike the Alps and Himalayas, the Sistan suture zone contain neither large-scale nappe complexes of continental provenance nor a Barrovian type metamorphic belt, indicating that its formation was not accompanied by major continental crustal thichening [4,5,6].

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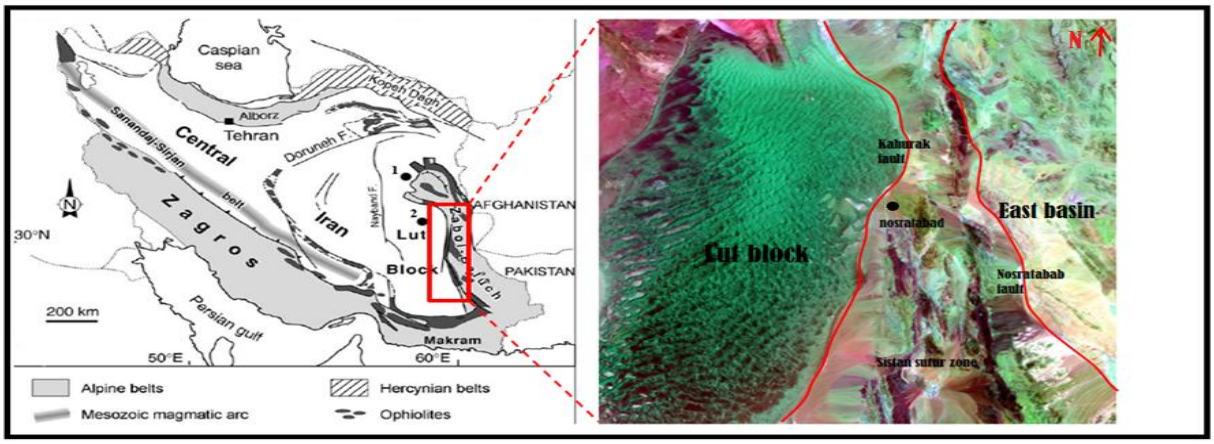
MATERIAL AND METHODS

Study site description

The study area is located in the southeast of Iran between Lut block and Afghan block in the Sistan suture zone and lies between longitude E58 55 and E5, 58 between latitude N30 40-N3 55 and is covered by the Allahabad 1:250,000 sheets (Geological survey of Iran 1990 a.b).



Figurer 1: location of study area in Iran

Method:

Deformation event

The first deformation event (D1)

The first deformation event (D1) has occurred lower Eocene and prior to. The evidence of this deformation event is folds with E-W trend. This stage is related to process of oceanic subduction. This evidence mostly observe in the turbidity and melang tectonistratigraphic unite in figure 2 an anticline is observed, surveying of dip and stick of anticline sides in field study and diagram chart(figure 2) show that the axis of this fold is E-W trend.

Figure 2: panorama image of plait e-w in the study area

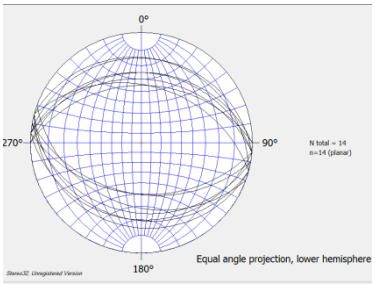


Figure 3: diagram of plait e-w in the study area

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Figure 4: Arial image of plait e-w

The origin of this event is unknown.

The second deformation event (D2)

The second deformation event (D2) has occurred in upper Eocene to Oligocene; this stage is related to syncollision event and probably occurred in the same time with the closing of Iran East basin. Evidence for this deformation event include: angular unconformity between Eocene , Oligocene litho – structural unit , existence of thrust fault with NW trend, local dynamic metamorphosis about phyllite, and existence of inverse folds with SW vagrancies (figure4) and the diagram of these folds has been shown in figure 5.

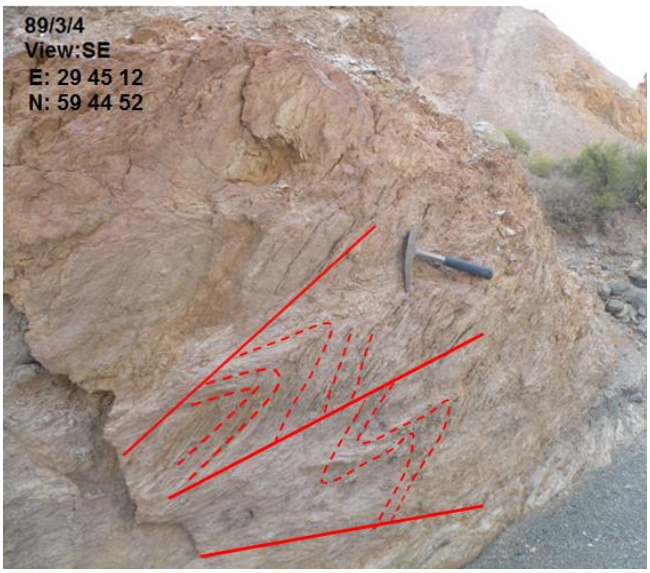

Figure 5: image of Inverse folds with SW vagrancies

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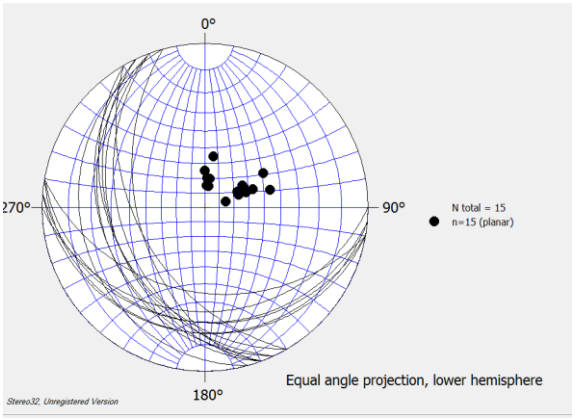

Figure 6: diagram of Inverse folds with SW vagrancies

The third deformation event (D3)

The third deformation event (D3) has occurred in upper Oligocene to Miocene, in during of this event, molasses basin generate in the west of Nosvatabad and then this basin is folded Also Nosratabad fault has considerate activity during of this event. Also flysh tectonistratigraply unit has cut and has been displaced with Nosratabad fault during this stage (Figure7)

Figure 7: E: Eocene flysch, Ol: Oligocene conglomerate, PlQ: Plio-Quaternary sediment

The fourth deformation even (D4)

The last deformation even (D4) has occurred in plio-Quaternary. Evidence of this event include , displacement of stream (figure 8) and old fold axes, kahurak fault activity in this area and bending at structural trend of Nosratabad in this event has occurred during of post collision of blocks .

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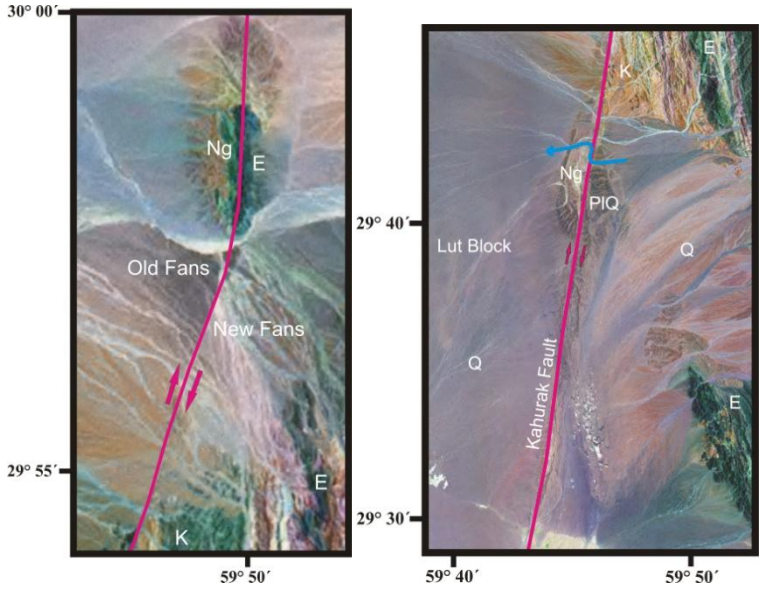

Figure 8: displacement of stream and old fold axes

RESULTS AND DISCUSSION

Tectonic model:

First stag (T.E.1): subduction as a possibility of area formation

This stage has occurred in the lower Eocene and prior to. This stage has occurred at the same time with the first deformation even (D1). This stage is synchronic with adding of turbidite and Melange tectonistratigraphic unit to active margined of Neotetheys accretionary prism. In this area, at first oceanic basin sub duct and then the structure of this area like as folds with E-w trend has formed during of this tectonic event. Most of these structures observe in flysch tectonic stratigraphic unit. Since folds with NW trend have refolded E-W trend fold, so they must have deducted EW trend folds, so EW trend folds are older than structures with NW trend. Figure8 has shown a schematic model to illustrate firs tectonic evolution event in this area

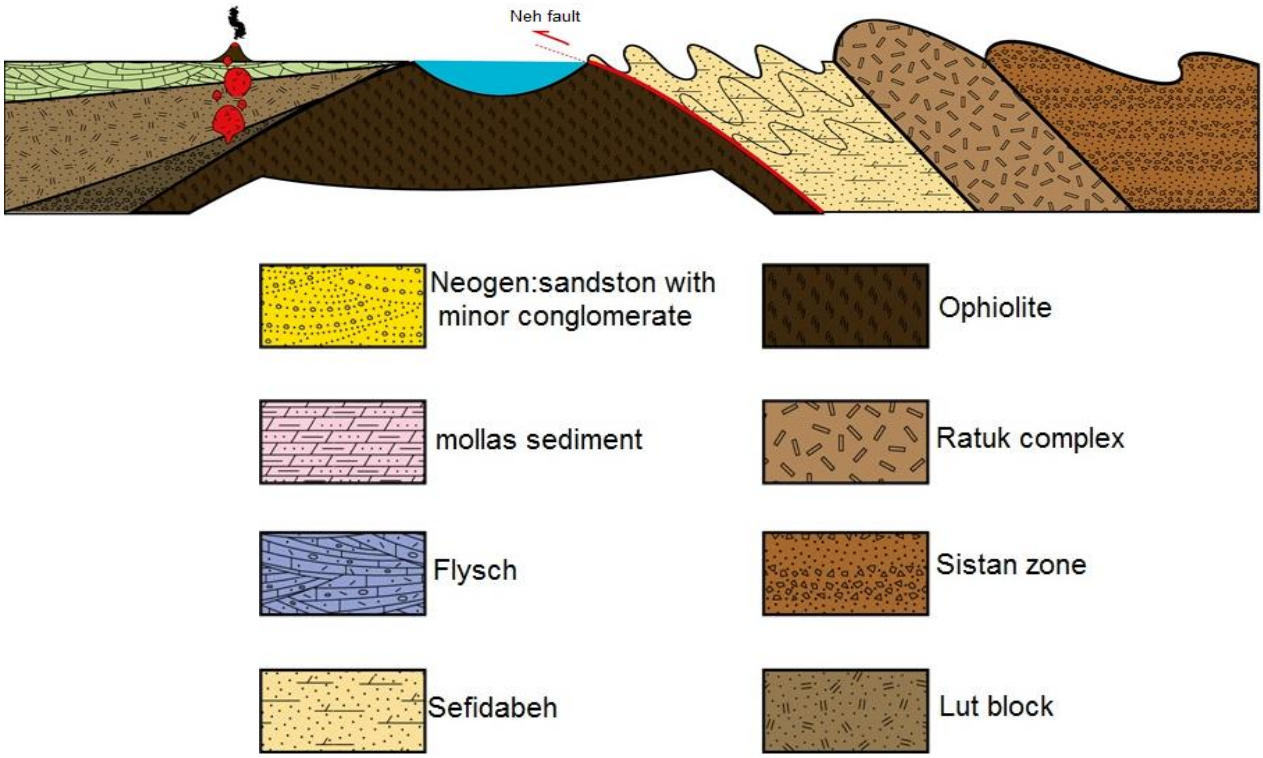

Figure 9 has shown a schematic model for this stage to illustrate adding of turbidities and Mélange tectonistratigraphic unit to active margined of Neotetheys accretionary prism. In this area

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During of second tectonic evolution event (T.E.2) with continued of first stage, collision of blocks has occurred. Synchronic with this event thrust fault has been formed in this area and tectonistratigraphic unit that had been formed in the area has added to east margin of Lut block. this stage has occurred in upper Eocene to Oligocene and the age of Batollite in suture zone of sistan and Batollite age in Nehbandan area is evidence of this claim. During this stage a transpression basin has observed in this area. This stage is synchronic with closing of east basin of Iran. Because of compress condition at this time flysch tectonistratigraphic unit has been formed and then this unit has been added to the Lut block Also flysch and pelagic sediment scraped off down going plat progressively and then adds to Lut block [7,8,9].

In this time because of compress condition and shorting of crust a high area has formed and the evidence of it include: folds and thrust in the study area. During of this stage and at the same time with second deformation event (D2) , invers folds with SW trend have been observed in this area, these folds mostly has been formed in the margin of Nosratabad fault and have been cut with this fault , so relative age of this folds are older than Nosratabad fault. Thrust and stritk – slip fault has been formed during of this stage in the study area. Also non ophiolitic Dykes with N2ow has been observed in this area the formation of these Dykes probably related to syncollision and post collision magmatic. Since these Dykes has cut flysch tectonistratigraphic unit with Eocene age , so the relative age of them is younger than Eocene , and these Dykes have been covered with Oligocene tectonistratigraphic unit , so they are older than Oligocene. Figure 10 has shown a schematic model for this stage to illustrate the second tectonic evolution event (T.E.2)

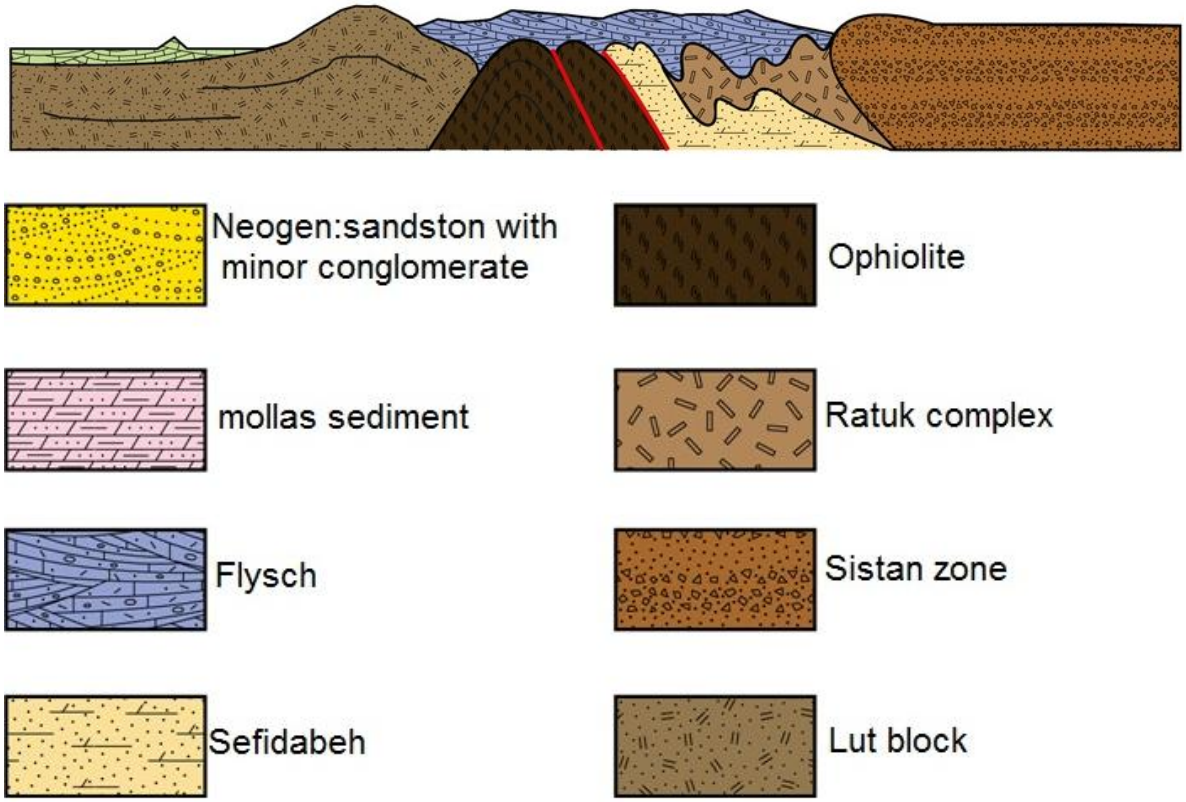

Figure 10 has shown a schematic model for this stage to illustrate the second tectonic evolution event (T.E.2) with continued of first stage, collision of blocks has occurred. Synchronic with this event thrust fault has been formed in this area and tectonistratigraphic unit that had been formed in the area has added to east margin of Lut block

The third stag (T.E.3): completing of collision

The third tectonic evolution event has occurred from Oligocene until Miocene. In this stag structural unit has added to Lut block with continued collision. This event is synchronic with third deformation event (D3).

During of this event, folded tectonistratigraphic unit in the west of Nosratabad has been formed. Also huge Mollies sediment has developed in the study area at this time. Figure10 is a schematic model for third tectonic evolution event in the study area.

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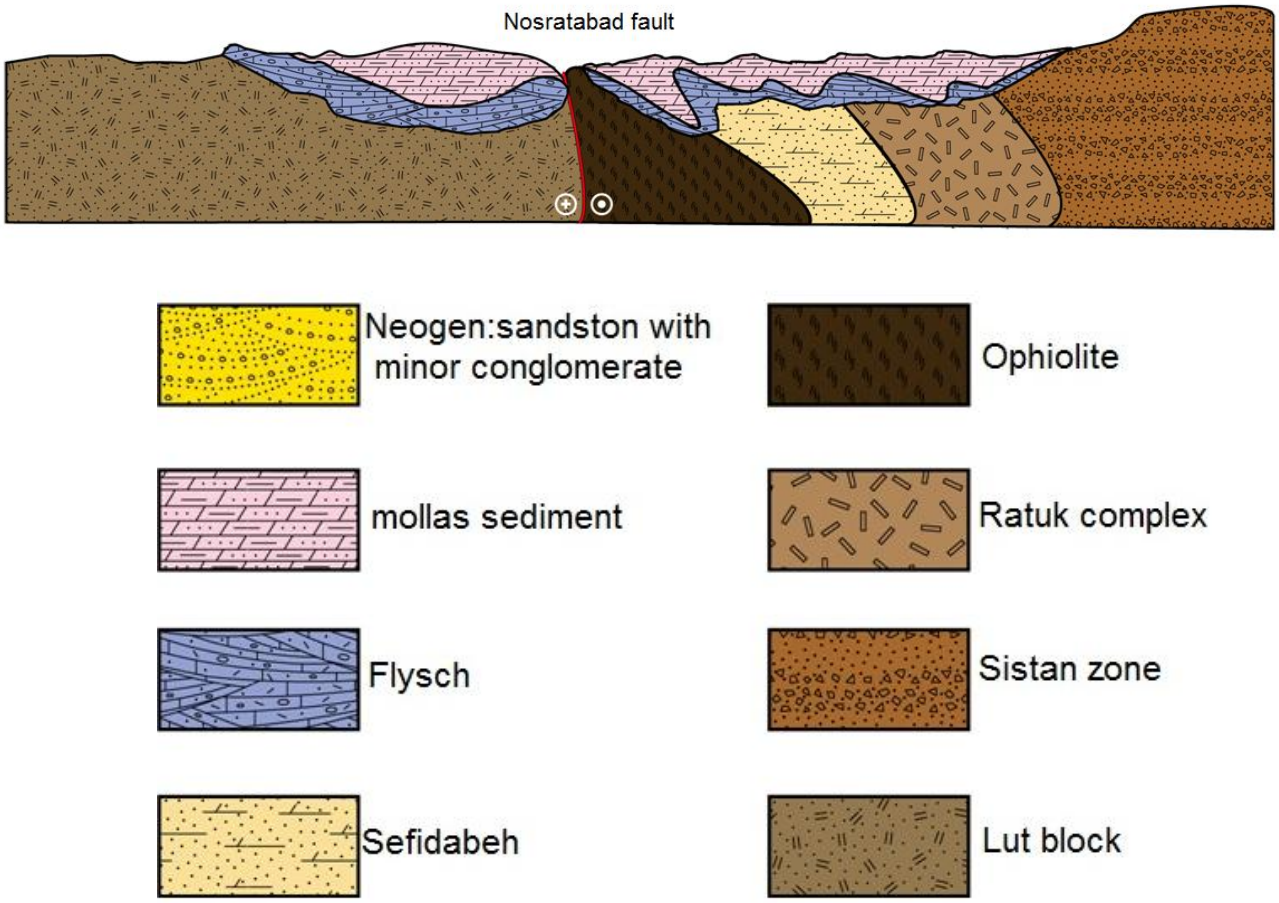
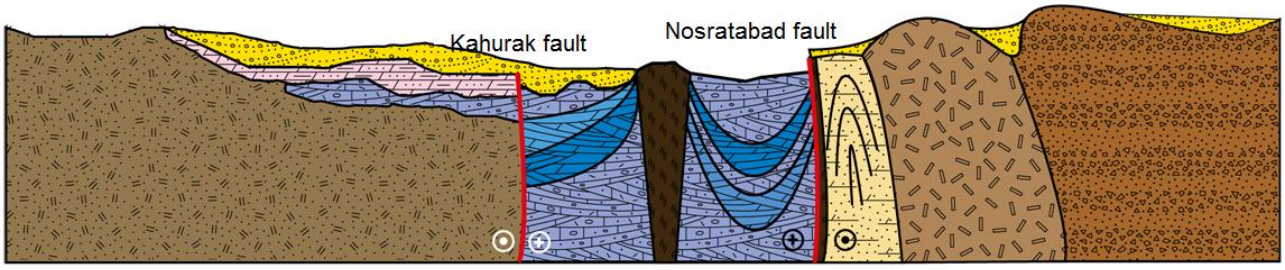


Figure 11 has shown a schematic model for this stage to illustrate the third stage. In this stag structural unit has added to Lut block with continued collision

The fourth stage (T.E.4): post collision event

The last tectonic evolution event has occurred in Pliocene to Quaternary. This stage has happened at the same time with fourth deformation event (D4). At first in the Pliocene a transpression basin has been formed Pliocene sediment has folded in this time because a compress component of force is dominated in this area at this time. In the Quaternary the tensional component has been dominated, so a Tran's tension basin has been formed at this time and it is synchronic with reactivity of Nosratabad strik-slip fault and activity of kahurak o strik-slip fault faults, in this area.

At this stag Quaternary Alluvial sediment has been deposited at the study area widely. Since, movement of kahurak fault cause displacement of streams and fold axes, so the activity of this fault is related to this stage figure 11 has shown a schematic model of fourth tectonic event in the study area [10,11,12,13]



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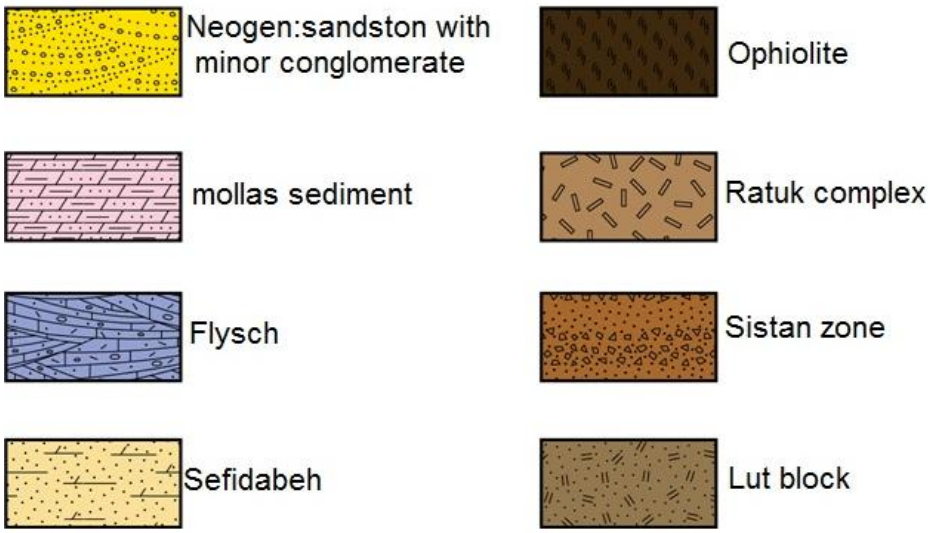

Figure 12: The fourth stage: In this stage post collision event has occurred and Nosratabad faule reactive and Kahurak active in this stage

CONCLUSION

The study of deformation element and structure Analysis in this area show that at least four tectonic evolution event has been occurred from Cretaceous until plio-Quaternary in the study area. The firs tectonic evolution event (T.E.1) has occurred in lower Eocene and prior to. The evidence of this event is folds with E-W trend. This stage is synchronic with the first deformation event (D1). Also this stage is related to oceanic subtraction. The second tectonic evolution event (T.E.2) has occurred in upper Eocen to Oligocene. It is the most important event in the study area and it is synchronic with closing of east basin of Iran, this stage is related to syncollision event, and during of this event, addition of structures and thrusting has been occurred. Also a transpression basin is observed at this time in the study area, due to compress condition in this basin; flysch tectonistratigraphic unit has been formed and has been added to the Lut block. The third stage of tectonic event is related to completing collision event. This stage has occurred in Oligocene to Miocene and the structures have been compressed more. This event is synchronic with third deformation event (D3). The last stage is related to post collision event. It has occurred in Pliocene to Quaternary. At first in the Pliocene a tranpression basin has been formed and Pliocene sediment has been folded at this time. And then a transtension basin has been dominated in the study area and huge alluvial sediment of Quaternary has been deposited. This stage is synchronic with fourth deformation event.

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