Review of Structural Relationship between Salt Domes in Central Zagros with Dena Fault

Ehsan Aziz, Mohsen Pourkermani, Korus Yazdjerdi, Ali Sorbi

ABSTRACT

Dena fault is one of the fundamental and basic structures in central Zagros with a length more than 130 kilometers. Based on field studies, along this fault at least two salt domes have been recognized, which are referred to in this research as the “Tol Khaki” and “Kouh-e Gol” salt domes. This fault can be this fault can be divided into two sections including dome (south and central section) and the section without dome (north section) and these two sections have two completely different processes from one another. In other words, the geometrical property and the current situation of Dena fault are the result of growth of these two sections in various periods and ultimately their link to each other. The process of the section including salt domes has been controlled to a large extent by domes which have been aligned linearly.

KEY WORD: Salt Domes, Central Zagros, Dena Fault

INTRODUCTION

Tectonic situation:

Zagros Mountain is a series with the length more than 1500 kilometers and 250-400km width which has been spread from the east of Turkey to Gulf of Oman and it is connected to the Makran subduction zone (Tavakoli et al. 2008). This region of Iran is one the most key regions for studying collisional processes and development of plateau and associated structures (Sarkarinejad et al., 2008) (figure 1).

Fig. 1: map of topographic bumps and structures and situation of basic fault zones in Zagros fold-thrust belt. (Sepehr et al., 2006).
Dena fault is one of the fundamental and basic structures in the central Zagros with more than 130km length. This fault starts from the mountainous areas 25km from northeast of Yasuj and near northern terminals of Kazerun fault. At first, this fault had a northwest – southeast aligned with the general process of structures in Zagros which faces a sudden 38-degree clockwise rotation in the rest of the direction and after passing the Dena Mountain and has an approximately northern-southern extension. This fault, as it gets closer to "Ardal" fault and high Zagros, faces a change in the process and it gains a northwest – southeast process by dividing to some branches. This fault gets divided to two branches in its own terminal which transfers a part of deformation and motion from the Kazerun fault to Ardal fault and "Sabzeh Kuh" by moving toward Kazerun fault and the other branch find an approximately eastern-western process and moves towards high Zagros Mountains (figure 2).

Fig. 2: map of activated faults in southwest of Iran quoted by Bechmanov et al (2003) (figure A) the situation of Dena fault in satellite photos SRTM

Mechanism of Dena fault:
This fault contains large components of strike slip in the present age as well based on field observations and new geodesy measurements (Tavakoli et al, 2008). Based on geodesy measurements, for this fault, Tavakoli et al (2008) consider more than 13km of horizontal movement. They believe the beginning of the strike slip for this fault 2.6 to 4.3 millions. This fault has a rate of 3 to 5 millimeters of strike slip in year.

Table 1: rate of horizontal slip of Dena fault and time of the beginning of horizontal quoted by Authemayou et al (2006) and Tavakoli et al (2008)

<table>
<thead>
<tr>
<th>fault</th>
<th>Total horizontal slip</th>
<th>Age of fault onset</th>
<th>Average geological slip rate</th>
<th>GPS derived slip rate</th>
<th>GPS inferred fault onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dena</td>
<td>13km</td>
<td>2.6-4.3 ma</td>
<td>3-5mm/yr</td>
<td>2.9-4.5mm/yr</td>
<td>2.8-4.5ma</td>
</tr>
</tbody>
</table>

Therefore, we can claim that this fault was a thrust component at first until early Miocene period and after the collision of Iran and Arabia following the neotethys closure, this fault contained components of strike slip. In such way that now, the right rotation strike-slip component, this fault is dominant compared to its thrust components and the performance of the fault in the present day is of the right lateral reverse kind.

Discussion and conclusion:
Among other index properties of stratigraphy in the range which is being reviewed, development of salt domes are of the Hormoz series in the region. According to the field studies along this fault at least two salt domes have been recognized, which are referred to in this research as the "Tol Khaki" and "Kouh-e Gel" salt domes.

Kouh-e Gel dome:
This salt dome is located in the northeast of Sisakht city and alongside with Dena Mountains. This dome has dimensions of about 1km*2km due to outcrops of igneous rocks together with this dome which are in its cap. In other words, this dome is about 200 hectares. The existing salt in this dome exits through the existing
fountains on the margins of it which fulfills area’s needed salt as the economic storages of salt in the area the conduction of surface waters inside the evaporation ponds and production of salt from them in the past.

**Fig. 3:** situation of Kuh-e gel salt pond and Dena fault in Zagros belt view toward east

The considerable note in the surroundings of this salt dome is the environmental embayment which is created as a result of salt exiting from the salt ponds and the depletion of the lower parts of salt and subsidence and structural reversion in the area (Aryan, 2011) (figure 4).

**Fig. 4:** secondary environmental ponds in periphery of Kuh-e Gel's diapir view to the southTol Khali diapir

This salt dome is located in the Kakan village 25km from the city Yasuj. This dome is located in a 12-km distance from Mansourkhani village of the villages of Kakan between the geographical latitude 30°38’20” to 30°38’20” and 51°52’ to 51°52’10” longitudes. This salt dome has an area of 900 hectares. In the location of the dome and in its west margin, there is a salt pond and the water of this pond demonstrates economic storages of salt in the evaporative ponds (figure 5).
Above this salty pond, a fresh water pond flows which is one of the interesting natural phenomena of this area. Location of this two ponds with their different and opposite natures can most probably be the result of performance of Dena fault and movement of groundwater and the result of collision of a part of the groundwater with salt (figure 6).

Evolutionary model of salt domes and Dena fault:
Side shortening through undercoat thickening and creation of essential structural bumps for starting the flotation process lead to rise of salt (Aryan, 2011); this side shortening process is among the compression structures properties of the earth. Many researchers believe that the start of the salt movement depends on rocky basis structures (Player, 1969; Edgell, 1996; Hessami et al., 2001). According to this, in the studied area, the processes of diapirism are probably more affected by the Halotectonic activities than the Hawkins activities; because as it was specified earlier, the salt domes in the studied area are only seen adjacent to the rocky Dena fault. This structural relationship creates this belief that the diapirism process in the studied area is in accordance with the tectonic activities of the base rock. Estimating the starting age of the activity of salt and the length of diapirism period only based on desert observations is a very difficult act and this is not without a defect by having hollow seismogram data. By interpreting a large number of seismogram lines of the Persian Gulf and
Zagros, it is deducted that the starting point of the movement of Hormoz salt is at the beginning of previous Paleozoic and it has started in a short time after the end of sedimentation and has continued until now (Jahani et al., 2009). This fault can be divided into two sections including dome (south and central section) and the section without dome (north section) and these two sections have two completely different processes from one another. In other words, the geometrical property and the current situation of Dena fault are the result of growth of these two sections in various periods and ultimately their link to each other. The process of the section including salt domes has been controlled to a large extent by domes which have been aligned linearly.

**Fig. 7:** evolution and growth model of Dena fault in sections containing salt dome

Salt domes of the area are of the thrust supplied by plug type based on Hudec et al (2006). These sheets are of the type of the advanced thrusts. This type of salty sheets move toward a drifted fault and this movement as a flowing sheet leads to transmission of its sedimentary cover (Hudec and Jackson, 2006; in Aryan 2011).

**REFERENCES**

Aryan, Mehran, 2011. Salt tectonics and diapirism, Asar-e Nafis publications


