کارگاه های آموزشی و سی و چهارمین گردهمایی
و دومین کنگره بین المللی تخصصی علوم زمین
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Structural phenomena of Kalmard area (west of Tabas) from the perspective of geotourism

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Abstract:

Iran is regarded as one of the prone and able countries in geotourism. The occurrence of various geological processes and climatology conditions have placed a variety of forms and geological phenomena among which Tabas County, as a valuable treasure, is regarded one of the most significant geological areas and geotourism in the country. On one hand the desert features of this County, as well as the attractions and socio-historical perspectives, beside the geological potentials, make this area to be considered as one of the prone and important area of the geotourism development in Iran.

Of the most beautiful and most important geotourism potentials of this County in which it could have the most efficiency in the structural phenomena are folding (Kalmard, Robatkhan box , Kooh Namaki, Jafari anticlines and Kachalbeik suspended syncline) and unconformities (Darin, Rahdar mountain and Mount Bakshi) of the Kalmard area in the west of the County. Kalmard area is of sedimental-structural states which forms one of the components of block of Tabas in the geological divisions. Because of having a wide range of structural attractions in large and small scales, it could have a valuable role to conduct the scientific-geotourism activities in this County.

Keywords : Tabas, geotourism, Kalmard, folding, unconformity.

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Introduction

Geotourism is type of informed and responsible tourism in the nature with the aim of visiting and recognizing the phenomena and geological processes, and learning the way to form and the way to evolve (Amrikazemi, 2011). Geotourism in different perspectives takes a look at geological phenomena, and its examination depends upon examining the term ‘geopark’ (Amrikazemi, 2006). The geotorism is also new solutions to explain geology, and recognize the natural assets of every area (Vakilzade et al, 2011). Tabas is located in the northwest of south Khorasan province extending 55460 KM. It approximately covers 3.36 percent of total Iran’s area and is the biggest County of Iran; some even claim it is the biggest in the middle-east (Saberifar & fathi, 2005). Tabas is so abundant in geological features and a very valuable treasure of various geological phenomena is observed everywhere. This area, having sediments and stones of different era of geology (Precambrian till current age), contains a wide range of geological phenomena; and it was introduced as the paradise of geology in the perspective of many thinkers of this discipline, so that we could observe all the geological attractions such as tectonic, sedimentology, stratigraphy and paleontology and economical geology, etc. on the one hand the energetic passage of structure and geology of this area causes it has a very good situation in tectonic perspective and various structures of geology; consequently it has brought an appropriate ground to observe and study different geological structures (Nazemi, 2009).

This study has attempted to investigate the structural attractions of a small area of this County (Kalmard area) in which it could have a specific significance in the geotourism activities (Figure 1). Kalmard area is of sediment-structural states, where the geological divisions of Iran compose one of the components of block of Tabas (Aghanabati, 2006). In the perspective of sediment-structural features show salient difference with its adjacent

areas such as Shotori block. This area, in addition to the structural attractions and mineral potentials, has various forms of erosive phenomena such as flatiron forms and erosional windows. And beside the geotourism features, Kalmard area, in the socio-historical perspective, contains historical places such as Kalmard inn, Robatkhan inn and Kachalbeik tower and ancient petroglyphs. In this study the structural phenomena of Kalmard area is divided into two sections folding and unconformity. The desert features of this County, in addition to the historical and cultural perspectives, beside the geomorphological potentials, make this area is known as an area prone to develop geotourism. Spa, caves, waterfalls with the specific features of geology, tourism valleys, different mines with geological features and tourism-prone potentials, sand hills, types of stones and volcanic craters, the Nayband wildlife sanctuary (the largest Iran's wildlife sanctuary and home the last Asian cheetah survivors) including simultaneously the geomorphotourism and environmental features , are considered part of the capabilities of this County. Having the features of this County in mind, Tabas has the potential to turn into a geopark (Orooji, 2012).

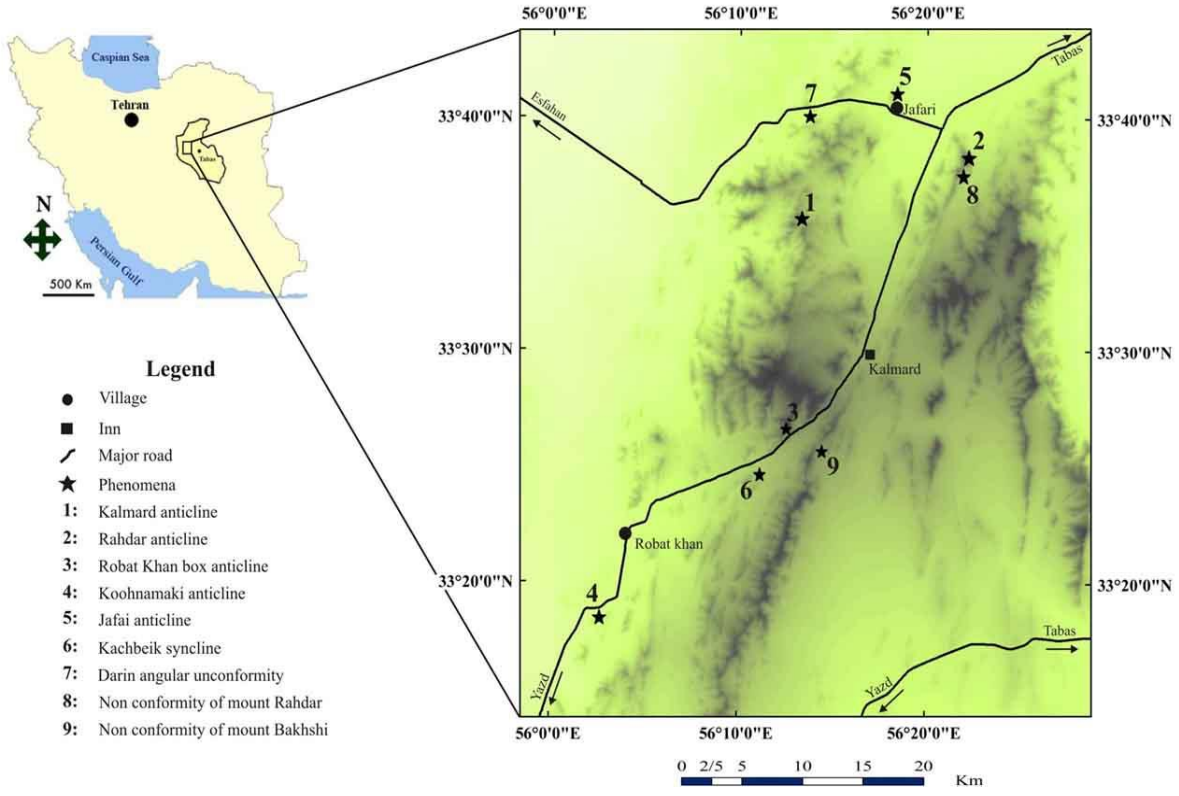

Figure 1: The roads map of Structural phenomena in the Kalmard area (west of Tabas)

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Discussion
Folding

These structures, which are made in the ductile or semi-ductile conditions in the stones of crist of earth, are of the most beautiful geological and structural phenomena. Due to their simple and beautiful form and geometry are considered by the geologists and the other interested people. Also, of the considerable points of the folding of Tabas area are a wide range of various types of almost simple and extended folding (similar to folded Zagros) to complex folding in almost little distance from each other (Nazemi, 2009), and because of the specific situation of the tectonic of Tabas block and its active tectonic in various span of time of geology, types of various folding could be observed. Of the most important foldings of Kalmard area, in which its extension is significantly related to Halvan and Robatkhan geology with the scale of 1:100000 and they are dealt with, Kalmard large anticline, Mount Rahdar anticline, Jafari anticline, Robatkhan box anticline, Koohnamaki anticline and Kachalbeik syncline could be mentioned, most of them are so typical in the perspective of access ease and structural face and has so many attractions.

Kalmard large anticline

Of the largest and most prominent folding of Kalmard area is Kalmard large anticline. This anticline covers a wide section of Kalmard sediment-structural area and its core is one of the oldest sediment stones of Tabas area dependent upon Kalmard formation to the age of Precambrian (including a very much thickness of shale sediments and sandstone in the green toward black color) (figure 2- A).

Rahdar anticline

Rahdar anticline is located in 65 KM in west of Tabas (in the left border of ancient road of Tabas-Isfahan). Rahdar mount is of the most important and most recognized places which is considered by so many geologist because of outcrops and typical sequences of Paleozoic to Mesosoic stones (Shirgesht, Rahdar, Gachal, Khan, Abhaji and Badamu formations) (figure 2- B). The heart morphology is one of the largest erosional windows of Kalmard area and flatirons formed in the west hillside of Mount Rahdar and could be observed in the intersection of ancient road of Tabas-Yazd and Isfahan (a place named Jafari mosque). In addition to this outcrop, igneous rocks in the core of this anticline lead to formation of the igneous unconformities. They will be discussed in the unconformity section.

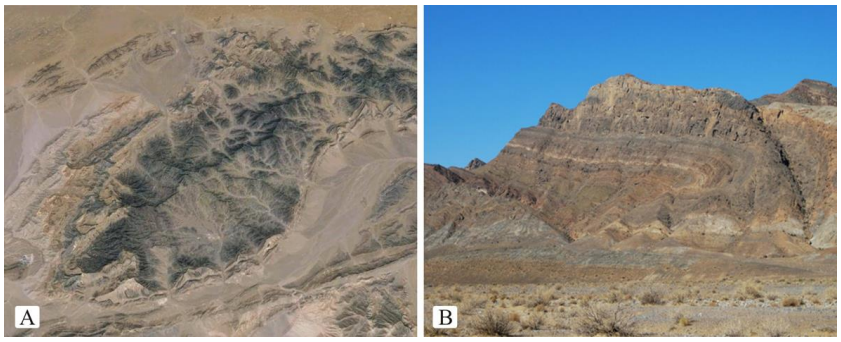

figure 2- A: Satellite picture of Kalmard large anticline (the black areas belongs to Kalmard formation to the age of Precambrian, forming the core of this anticline), B: Landscape of mount Rahdar anticline.

Robatkhan box anticline

Of the most beautiful folding of Tabas area is the Robatkhan box anticline located in 90 Km of ancient Tabas - Yazd road, after the Kalmard (kalmarz or Kalmord) ancient inn and near the fire clay mine of Khajehassan

spring and Kachalbeik tower. This folding was formed in the khan formation carbonate sediment to the age of early Permian (figure 3- A), and of its most prominent features is the existence of Parasitic fold S and Z in its flanks and Parasitic M and W in its hinge. Also, its most typical erosional windows of Kalmard area is in the adjacency of this beautiful and unique folding.

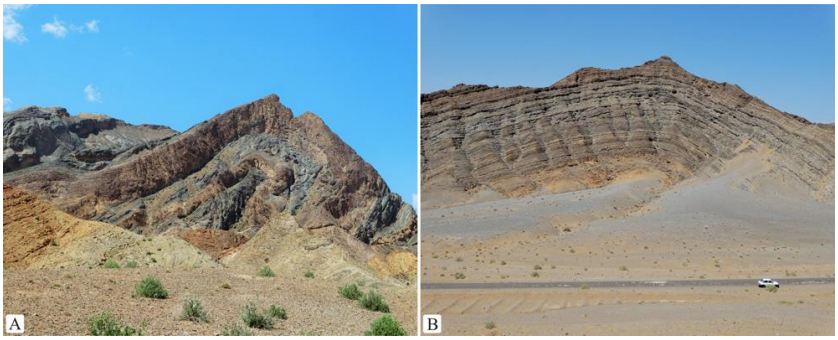

figure 3- A: A beuatiful view of Robatkhan box anticline. B: cross section of Koohnamaki anticline in the yazd -Tabas ancient road

Koohnamaki anticline

This anticline is located between Robatkhan village and shotoran Castle. This anticline was formed in the Sorkhshale and Shotori formations and of its prominent features are sediment forms such as cam-shapaed large sediment windows and flatiron forms located in its flanks. The cross section in this anticline crossing the Tabas-Yazd ancient road and the performance of the sediment processes in its core make a more beautiful view (figure 3- B). Barchan dune and Shotoran large Dunes is located in vicinity of this anticline.

Jafari anticiline

Jafari anticline, known also as Jafari or Jafaran, is located in 68 KM of Tabas-Isfahan road. This anticline was formed in sediments of early - middle Jurassic (Abhaji and Badamu formations) and its exclusive morphology depicts a sign of salt dome appearance (figure 4), and in its adjacency, the deserted Jafari village is located having an old mill and is a reminder of a prosperous past of hardworking people of this area.

Figure 4: Jafari antcline and its dome-like morphology.

The suspended syncline of Kachalbeik tower

The suspended syncline of Kachalbeik tower is located in 94 KM of Tabas-Yazd ancient road and after the Robatkhan box anticline. Its morphology depicts an appearance similar to a ship aground, which some geographers call it Noah ship. This syncline was formed in the Silisiclastic - Carbonate sediments of Badamu formation to the age of early - middle Jurassic (figure 5- A). Of the other folding of Kalmard area, Mount Gachal anticline, Abhaji synclines and anticlines, Mount Chahar-cheshme anticline and tens of other folding could be mentioned.

Unconformities

The unconformities are surfaces showing the interval occurrence in the time of geology due to erosion or lack of fouling, and the time of the intervals could vary between million to hundreds of millions years (Vazirimoghadam et al, 2011). The most important unconformities of the Kalmard area are angular unconformity of Kalmard formation with Shirgesht formation and non unconformity of Mount Rahdar and Mount Bakhshi.

The angular unconformity of Kalmard formation with Shirgesht formation

One of the most important unconformities of ancient Iran is angular unconformity of Kalmard formation with Shirgesht formation, in the 75 KM of Tabas-Isfahan road (figure 5- B).. This unconformity is related to the performance of Katangan orogeny phase making the folding and faulting the shale and sandstone deposits of Kalmard formation (Aghanabati, 2006). Additionally, in some parts it is affected by the intrusive igneous mass and forms the Kalmard large anticline. These folded sediments are covered by the progressive and Ordovicain marine sediments (Shirgesht formation) in angular form. This unconformity is known as the Darin angular unconformity in the between of local geologists. Existence of the extensive sand hills in the intersection of mount and plain, reaching more than 100 meters in some parts, are in adjacency of this unique phenomenon.

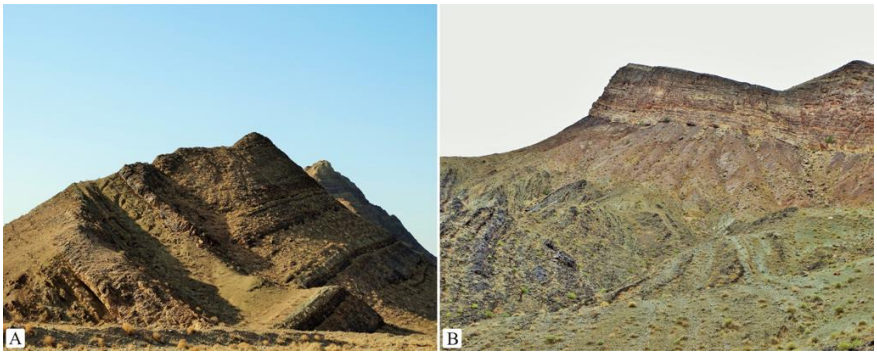

figure 5- A: The suspended syncline of Kachalbeik tower, B: The Kalmard formation angular unconformity with the marine sediments of Shirgesht formation.

The non conformity of Mount Rahdar and Mount Bakhshi

Granitoid mass of Kalmard area has just outcropped in Mount Rahdar and Mount Bakhshi. These stones in the Mount Rahdar form the core of its anticline and Ordovicain deposits of Shirgesht formation are located on that in igneous (figure 6- A). Also the mentioned mass is in the Mount Bakhshi, which is similar to the Mount Rahdar covered in the south of Robat Kalmard inn covered by the late Devonian sediments from the Rahdar formation (Figure 6- B). Existence of such unconformities is a distance close to each other, in small area of Kalmard, made them of unique scientific and geotourism attractions of Iran.

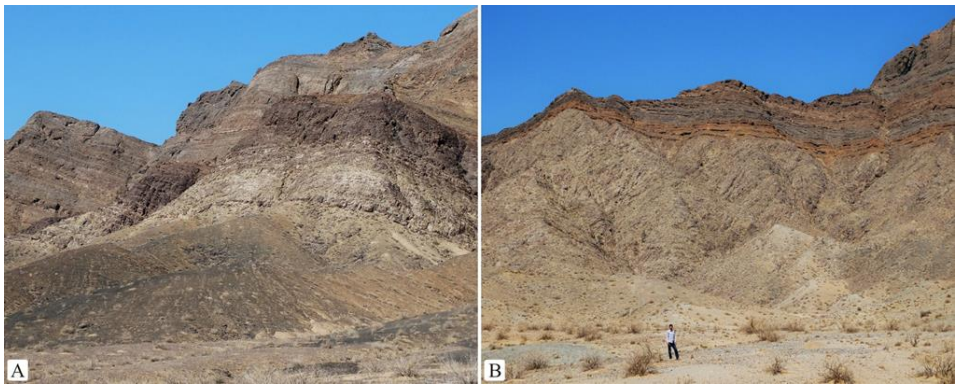

figure 6- A: The Non unconformity of Mount Rahdar, B: The Non unconformity of Mount Bakhshi in the south of Kalmard inn.

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Conclusion

Tabas County, having the valuable features, is less known in the tourism (especially geotourism). Existence of natural tourism areas along with the outcrops and unique geological views could turn that into a region unique in geotourism. Structural attractions of Tabas, especially in Kalmard area, are of the most beautiful phenomena in which they could play a significant role in the geotourism activities. In addition to the structural attractions of Kalmard, including a wide range of types of folding and unconformity, the other potentials such as various different forms and natural views along with cultural-historical places, made it so unique. Having these capabilities and potentials in Kalmard area, geotourism could play a very effective role to attract tourists in this area, and be one of the major factors to introduce Tabas County as a geopark.

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