

The geotourism potential investigation in Khorasan Razavi with the emphasis on Kashmar Township (Northeast of Iran)

**Morteza Taherpour Khalil Abad^{*1}, Ibrahim Fazelvalipour², Habib Allah Torshizian³,
Mohsen Allameh⁴, Mitra Taherpour Khalil Abad⁵**

1: Islamic Azad University, Mashhad branch, Faculty of Science, Department of Geology–Young researchers Club (mortezataherpour@yahoo.com)

2,3,4: Islamic Azad University, Mashhad branch, Faculty of Science, Department of Geology.

5: Islamic Azad University, Mashhad branch, Faculty of Science, Department of Biology.

Abstract

The remains of natural and human activities in some parts of the earth register as geopark. Actually, geopark is one or more geological phenomenon which is important from ecological, historical, cultural and archeological view. The aim of geotourism description in an area and creating a geopark is trying to keep the earth's inheritance and locality the economic of the area. Iran with an old history, diversity of the environment and a lot of geological phenomenon has a great potential in creating geoparks. From this point of view, we can divide it into 5 geotourism area which are North, South, East, West and Central of Iran. One of the deposited area is Kashmar which is located in Kharasan Razavi province in northeast of Iran. This area because of the nearness into the desert is hot and dry. The main rocks of the area are volcanic rocks and from stratigraphical view, there are Paleozoic (Cambrian – Ordovician – Silurian – Devonian), Mesozoic (Triassic – Jurassic – Lower Cretaceous) and Cenozoic (Middle Eocene – Upper Miocene) units. There are Ophiolitic complex outcrops in the Northwest of this area. The volcanic rocks of the area are because of the activity of the Iran's first volcanic which are located in this part. The area has an active tectonic because of two main strike-slip faults (Darouneh & Taknar faults). The area is rich of mines like bentonite, kaolin, malachite, iron-ore and etc. the other geological point in the area is hot-water spring which called Garmab and is located in Khalil Abad (a town which depends into Kashmar township).

Keywords: *geotourism, Iran, Kashmar, geoparks*

Introduction

The term Geotourism is essentially taken to mean 'geological tourism'. It encompasses tourists looking at natural landscapes including the landforms and rocks, as well as processes that shaped them over time. The earth's geological wonders have always fascinated people and are a fundamental part of a culture's identity. Many also form the basis for the establishment of protected areas and world heritage sites. From Iguazu Falls to the Grand Canyon, examples abound of outstanding geological features which have attracted visitors from time immemorial. It is not just spectacular landform either, but also the processes which have shaped the earth. So tourists also visit sites where glaciers are in action, volcanoes are active, sand dunes are sculpted and rivers are causing erosion and etc. it is the understanding of this 'form-process relationship' that is important in geology and by extension, geotourism. Through geotourism the relationship is explored and the consequences of geological landforms and activities on our lives are more fully understood. Tourism sector is among the

most successful industries in the world, since it involves considerable results and achievements among which one can name: making the scientific-cultural development, earning great incomes, direct and indirect employment rate increase, and demonstrating the stability and security in the country. In the world today, tourism has adopted a broad approach towards the issue of ecotourism. The people tired of urban and mechanical life are always looking for a way out till they may spend a moment far from all the fuss and day-to-day living of the modern life. Iran is one of a few countries in the world that due to its geographically superior status enjoys a wide variety of beautiful natural and geological graces and therein Kashmar can be considered as the gate to Iran's geotourism.

1.1 Geography

Kashmar is located between the eastern longitudinal 58 27 and northern width 35 11 and its distance is 220 km from Mashhad. This township linked to Neishabour from north, to Torbat Heydarieh from east, to Gonabad from south and to Sabzevar from west. Its height from sea level is 1052 m. the north parts of this township are mild because of mountains and rains although the south parts are desert. The amount of people in this township is 226662. the related towns are Bardaskan (55487 peoples), Khalil Abad (42766 people), Kouh Sorkh (30844 people). The ancient name of this township was Torshiz.

1.2 climate

The climate state of this township is Mild to desert which as described above. It means that the north parts of this township are mild because of mountains and rains although the south parts are desert. The average of raining in a year is 195 mm.

1.3 plants

In general, the plants are tropical and need much humidity in summer and are mostly observed in the form of desert short shrubs.

1.4 potentialities, facilities and transportation

The regular internal and international flights by Mashhad airport is one of the most important ways and then traveling by bus or cars are common. There are a few hotels and inns which receive the travelers.

1.5 The general geology and geotourism potential of Kashmar

The Kashmar's rectangular area is located in the northeast of Iran. The mountain chains are continued to Afghanistan boarder. The strike of mountains are from southwest to northeast. The shape of mountains are like convex shape which is formed according to general strike of Darouneh fault. The geological map of Kashmar (1:250/000) is provided by Eftekharnajad (1976) which includes of petrologic and tectonic units.

The tectonic units of the area are :

- 1- Lut block in the south of Darouneh fault.
- 2- Taknar zone between Darouneh and Taknar fault.
- 3- Sabzevar zone in the north of Darouneh and Taknar fault.
- 4- Binalood zone in the north of Sabzevar zone.

Now, in this part we introduce some geotourism potential of the area.

1.5.1 Taknar inlier

Which is introduced as Taknar zone and is a narrow uplifted of Precambrian, Paleozoic and also Mesozoic and Cenozoic rocks. The structure of this zone is Anticlinorium from west to southwest and east to northeast direction with over 80 km length and over 10 km width.

1.5.2 Taknar Formation

The outcrop of Taknar formation is in Taknar inlier and composed of rhyolite, Precambrian tuffs with accompany of sandstone and dolomite. These rocks are affected by a low metamorphism which a granitic and dioritic complex intruded into it. The age of this formation is Precambrian (Riphean-Vendian). This formation divided into three members.

1.5.3 Soltanieh Formation

This formation is composed of dolomite and shale with accompany of cherts, white to yellow lime stones, dolomitic shales and sandy shales and located in the west of Taknar inlier between Dahan Ghaleh and Darouneh area. The total thickness of this formation is about 200-250 m. probably, shales and colored sandstones are related to Barut formation. The age of this formation is lower Cambrian.

1.5.4 Lalun Formation

There are a few sandstones in Taknar inlier between Dahan-Ghaleh and Darouneh area and also the outcrop of these sandstones is located in northeast of Rivash village. The lithology of this formation is sandstone. By the way, the age of this formation is upper part of lower Cambrian.

1.5.5 Milla group

There are series of rocks in the west of Taknar inlier and also in northeast of Rivash which are comparable with Milla group. This group is composed of thick bedded of dark dolomite and red to green marl in Taknar inlier. The age of this formation is from middle to upper Cambrian.

1.5.6 Sibzar and Bahram Formations

There is a big amount of Devonian sediments in the south of Kashmar (Razaghmanesh, 1968) also there are same sediments in the south of Kalateh-Jomeh and composed of dolomite and lime but, Eftekharnjad (1976) believed that there is no Devonian sediments in this area.

1.5.7 Shishtu, Sardar, Jamal Formations

Near Kalateh-Jomeh and in the southwest of Sir, There are some layers which composed of shales and sandstones which are comparable with Shishtu formation (Frasnian-Viséan) and Sardar formation (early Carboniferous-late Permian). its thickness near Kalateh-Jomeh is 26m and near Sir is 130m. a carbonate sediment series of Jamal formation created a range of mountains in the south boarder of Precambrian uplifted Taknar inlier and in the south of Sir (in Aho-Bam mountain). The thickness of these sediments is over 100m.

1.5.8 Triassic and Jurassic sediments

In spite of the other parts of Central Iran, there is no Triassic sediments in this area and Jurassic sediments aren't developed in the mentioned area. The Jurassic sediments which include of shales and sandstone are located between Dahan-Ghaleh and Darouneh also there are green shales in the south of Kalateh-Jomeh which are related to Jurassic sediments by the way, there are some sediments in the south of Bardaskan which are related to lower-upper Jurassic.

1.5.9 Cretaceous sediments

The Cretaceous sediments and rocks have covered the main parts of the area which a big amount of these parts related to the Sabzevar zone. The lower Cretaceous sediments include of massive lime stones, marl and sandstone that created heights in Taknar zone, Darouneh zone and Shesh-Taraz region. By the way, there are Cretaceous sediments in the north of Rivash and in the northeast of the area. The upper Cretaceous sediments include of benthic sediments with volcanic rocks which consist of fine-grain pyroclastic, andesitic and dasitic lava. In this part we mustn't forget Ophiolite mélange (Coloured Mélange) which is located in this area and includes of radiolarite, cherts and lime stones with Globotruncana.

1.5.10 Tertiary sediments

The most parts of the area are composed of tertiary sediments. These sediments include of green marl, sandstone, conglomerate and volcanic rocks and tuff.

1.5.11 Darouneh Fault

Darouneh fault or big desert fault has about 700 km length and it is located in Darouneh area which is on the south west of Kashmar and it is extended till Afghanistan boarder. Darouneh Fault is Quaternary Fault in Iran (The biggest Quaternary Fault in Iran). As Darouneh & Harat fault's displacement is about 100 km. along this fault, the blocks have a dextral & senestral movement and one of the latest movement of Darouneh fault is dextral movement. This fault's name is Darouneh before Torbat Heidarieh town and after this town till Mashhad city its name is Sangbast fault. After Zagros fault, Darouneh fault is one of the important linear structure and a few people believe that this fault is the North boarder of Lut. the main stress in this fault is N20E but Jackson in 1999 introduced N15E till N23E for this region. a lot of earthquakes have occurred along the Darouneh fault and caused the huge destruction near the Kashmar township in the winter of 1998 and also in the spring of 1999. These earthquakes had a magnitude between 3/5-5/4. the most important earthquake in this area had occurred in 13/2/1998 between Kashmar and Bardaskan township, in this circumstance one person died and 15 persons injured. Darouneh Fault has a big role in changing of crust's structure in the Iran plateau. According to the evidences the activity of Darouneh Fault is Aseismic and has creep and swarm activity. The biggest activities of Darouneh Fault are occurred in the central and eastern blocks. One of the most important earthquakes which occurred in Kashmar was happened in 25/9/1903 its magnitude was 5.9 that in this event 350 persons were died. the other important earthquake which can be related to this fault was occurred in 25/5/1923 in the south of Torbat-e-Heidarieh. This earthquake was the result of hitting between central part and eastern part of this fault. In spite of these big earthquakes there were three earthquakes in

Kashmar (1971 and 1972) in the north of Kashmar, 1994 in the south of Kashmar and 1996 in the east of Kashmar which can be related to Daruneh Fault. about their magnitude they were $M_s = 5/8$ (1971), $M_s = 5/4$ (1972), $M_s = 5/3$ (1994), $M_s = 5/4$ (1996).

The shape of water ways around Daruneh Fault especially in the west and the east of this fault is Sigmoidal (like S and Z), The east side of this fault is (Z) shape. With becoming near to the center of Daruneh Fault its system turns to reverse system. The evidences of this event are changing the shape of the water ways. According to the latest data we can recognize that the tectonic of the area is active.

1-5-12 Alluvial fan deposits

The alluvial fan deposits have covered the most parts of the area. According to the size and the rate of distribution, this is the main morphologic shape of the area which consist of rocks, gravel, sand, silt and clay. The thickness of alluvial fan in changing from meters near of mountain to 150m in the central part.

1-5-13 Hot-water springs

The other phenomena which are so important in tourist aspect or from economic view are hot-water spring. These springs are created by active tectonic of the area which include of the ancient volcanic and quaternary active fault (Darouneh fault). There are a lot of hot-water spring along Darouneh fault in granitic mountain ranges. We could recognize some of them in the north of Khalil Abad (Garmab), north of Kashmar and north of Kuh-Sorkh which are using by the residents of the area. The analysis of its water shows the high amount of sulphur in it. We try to introduce these parts as a place for curing some skin diseases.

1-5-14: Ahoo-Bam cave

Ahoo-Bam cave is near to Bardaskan town. This cave is a kind of karstic cave. Such cave are landscape which is underlain by limestone which has been eroded by dissolution, producing towers, fissures, sinkholes, etc. there are a lot of stalactite and stalagmite in this cave which can be so interesting for people as tourist.

1-5-15: Taknar copper mine

Taknar copper mine is located in the northeast of Bardaskan. The distance of this mine from Bardaskan is 22km. this mine which is one of the most important mines in Iran was passive from 1977 but now it is active and a lot of people (workers & students) are working in this mine. It seems that the mineralization in this area is related to schists. The mentioned schist includes of pyrite and magnetite. According to the layer shape of the deposition we suggest that Taknar copper mine has a massive-sulphide type origin.

1-5-16: Makki kaolin mine

This mine is located between Kashmar township and Rivash village. This kaolin is created by andesite alteration. In the surface parts there is a big amount of Iron-oxide. The deposition of this mine is about 7500t.

1-5-17: The other mines

The other mines of the area are: Dahaneh-siah (copper mine), Zangaloo and Cheshmehgaz (copper mine), Kasf (copper mine), Tanoorche (Iron mine), Chalpoo (arsenic mine), Gardaneh-koohsorkh (Kaolin mine), Khooshab (bentonite mine), gypsum, Coal, Pheldespar, Limounite, Marble and lime, Asbestos, Talk and etc.

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References

- 1- Eftekharnjad, J., 1976, Kahsmar quadrangle map, Geological Survey of Iran, scale 1:250000.
- 2- Aghanabati, A. 2004, Geology of Iran. Geological Survey Of Iran. p. 535-533 (the first vol.)
- 3- Zare, M., 2000, Analyses seismology of Daruneh Fault and inspection of earthquakes in winter (1998) and the spring (1999) in kashmar.
- 4- Muller R., and Walter R., 1983, Geology of the Precambrian-Paleozoic Taknar inliers northwest of Kashmar, Khorasan province, NE Iran. Geological Survey of Iran, Rep. No. 51, p. 165-183
- 5- Parvareh, M., 2007, Petrology and petrography of igneous rocks in Kuh-Sorkh, University of Shahrood, Iran.
- 6- Amrikazemi, A., 2004, The geotourism atlas of Qeshm island. NGDIR publication, Tehran, Iran.
- 7- Fazelvalipour, M. E., 1998, Petrology and petrography of igneous rocks in Seyyed-Morteza mountain, North of Kashmar, PhD Thesis, University of Shahid Beheshti, Iran.