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The Transverse Topographic Symmetry Factor of Darakeh Stream in the North Tehran, Iran

Edvin Asatour Dizaj Takieh[1*], Manochehr Ghorashi[2], Fereydon Rezaie[3]

[1]Department of Geology, Science and Research Branch, Islamic Azad University, Tehran, Iran
[2]Department of Geology, North Tehran Branch, Islamic Azad University, Tehran, Iran
[3]Department of Applied Geology, Earth Science Institute, Geologic Survey of Iran, Tehran, Iran
Email: *edvin.asatour@gmail.com

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Abstract

The study area is located in the north Tehran, Iran. Calculation of transverse topographic symmetry factor (T) is suitable for rapid assessment of active tectonics. Therefore, transverse topographic symmetry factors have been calculated for the Darakeh stream. The study area is located in the Tehran Piedmont and transverse topographic symmetry factor is calculated for it. Based on values of this index, there is high relative tectonic activity level. This condition can be related to existence of a blind north-south striking fault which it may be buried by alluvium of the Darakeh stream. Dendritic drainage pattern of Darakeh stream and the fact that the western tributaries are longer than the eastern tributaries provide indirect evidence of ground tilting toward the east. Also, based on our results, most part of the study area have got high tectonic activity that it is compatible with its tectonic setting on the Tehran in north Iran.

Keywords

Transverse Topographic, Symmetry Factor, Darakeh, Tehran, Iran

1. Introduction

The Darakeh stream is located in the north Tehran, Iran (**Figure 1**). The Darakeh stream is located in the West-Central Alborz and lesser Caucasus province (**Figure 2**). This area belongs to Tehran piedmont geologic unit [1]

*Corresponding author.

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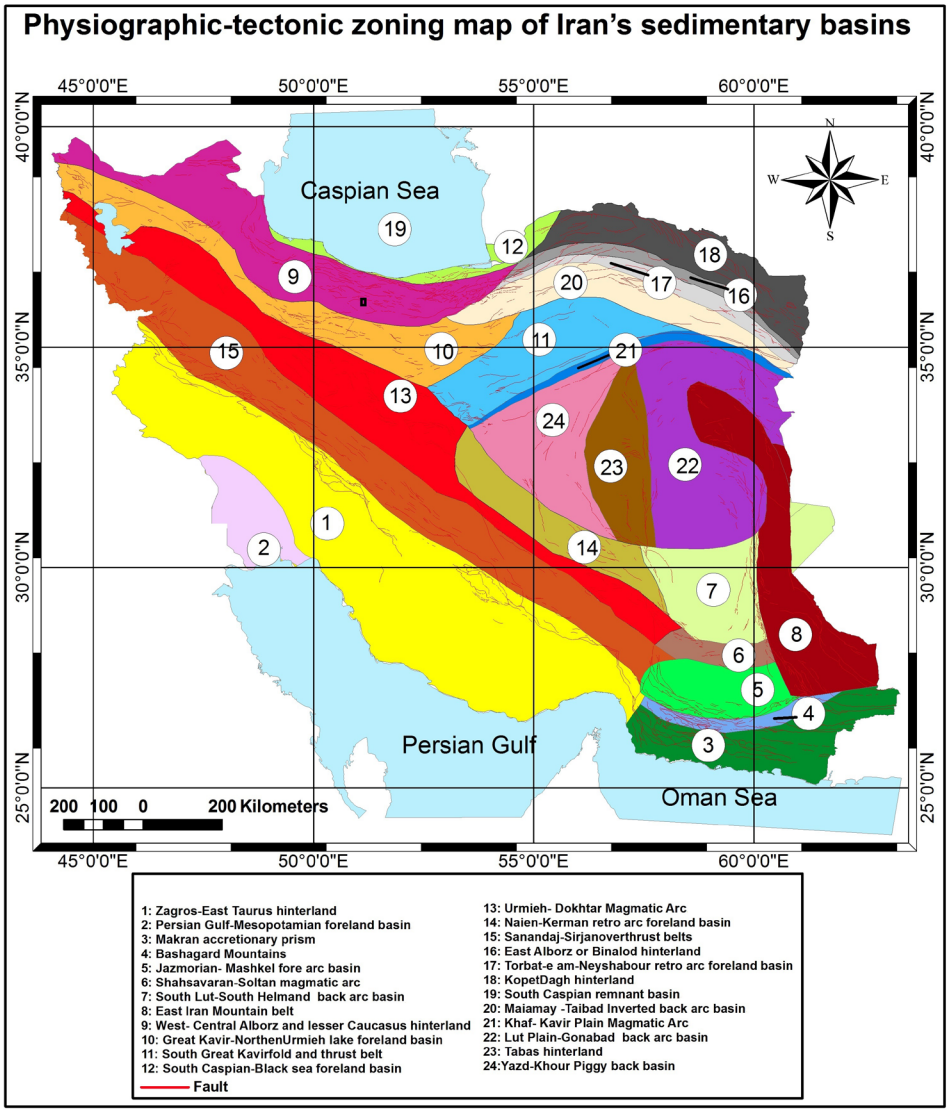

Figure 1. Physiographic-tectonic zoning map of Iran's sedimentary basins, modified from [1]. The study area is shown in the black rectangle.

[2]. Dominant structural trend in West-Central Alborz and lesser Caucasus province is NW-SE. From tectonics view, it contains deformed zone (fold and thrust belt) of Cimmerian miniplate that formed in northern active margin until late Triassic. Then it has rifted by tension in a back arc basin of Neotethyian subduction zone in the south margin of Cimmerian miniplate.

Development of that rift stopped in the late Cretaceous and then, renewed in the Eocene by spreading in submarine arc basin of Neotethyian subduction zone. In the other word, this hinterland is the result of a magmatic arc system spreading in the evolutional back arc basin. After that, West-Central Alborz and lesser Caucasus hinterland have formed by deformation and regional uplift from SW part of Caspian Sea to Black sea.

Recently, Damavand and Sebalan cones have formed by late volcanism that related to final subduction of Neotethyian oceanic slab toward north and northeast. Five dominant orogenic phases and four deformational events in Alborz Mountain building processes have suggested by [3].

The first deformational event is one from the Syn-collision type between Cimmerian-Eurasian plates (late Triassic) and the other ones are from post-collision deformational events and in with the deformational of sedimentary cover which is result of shortening and increasing the thickness of active continental crust in north of Cimmerian miniplate.

Figure 2. The Darakeh stream (blue line) and Iranzamin construction project (red part) on Shahrak-e Ghods in the North Tehran, based on Google earth (2015).

Based on previous work on the salt and mud diapirism [4]-[15] and neotectonic regime in Iran [16]-[21], Zagros in south Iran is the most active zone [22]-[44]. Then, Alborz [45]-[84] and Central Iran [85]-[100] have been situated in the next orders.

2. Materials and Methods

The calculation of transverse topographic symmetry factor (T) is suitable for rapid assessment of active tectonics. Therefore, transverse topographic symmetry factors have calculated for the Darakeh stream. Based on digital elevation model, there is a north-south sub-basin. The study area is located between longitudes E51˚22' - E51˚25' and latitudes N35˚44' -N35˚48' in the Tehran province, in the north of Iran.

Transverse Topographic Symmetry Factor (T)

The transverse topographic symmetry factor (T) was calculated as follows: T = Da/Dd.

Which Da is the space from the midline of the drainage basin to the midline of the active belt and Dd is the space from the midline to the basin limit [101]. In a completely symmetric basin T = 0 and as asymmetry increases T approaches to value of 1.0 [102]. Two views from an open pit (red part in **Figure 2**) at the west of the Darakeh stream that used for construction project have presented in **Figure 3**.

Finally, we can consider class 1 for T > 0.4 in the study area that shows high relative tectonic activity (**Table 1**).

3. Results and Discussion

There is high level of active tectonics and this situation can be related to the main blind fault such as Iranzamin fault. This fault that is cropping out in the open pit (**Figure 4**) has introduced in this paper for the first time. Iranzamin fault with nearly east-west strike, 60˚ dip toward the north and 2.5 meters dip separation has cut the Hezardareh (A) alluvial formation. This formation has got 45˚ dip toward the north and possibly, it has cropped out associated with development of a piggyback basin in front of the north Tehran fault.

This area has located in sub-basin no. 27, based on a new classification [103] that is shows the highest relative tectonic activities. Therefore, our results based on calculation of T index are compatible with evaluation results of relative tectonic activity by other geomorphic indices. According to these researches, the study area has got the highest relative tectonic activities in the Tehran region. This situation may be related to existence of a blind normal north-south striking fault, under the western border of Darakeh stream valley. Darakeh stream has got dendritic drainage pattern (**Figure 5**) which the western tributaries are longer than the eastern tributaries and it

Figure 3. Two view from the open pit of Iranzamin construction project in the Shahrak-e Ghods at the west of the Darakeh stream.

Figure 4. A view from the Iranzamin fault in the Shahrak-e Ghods open pit.

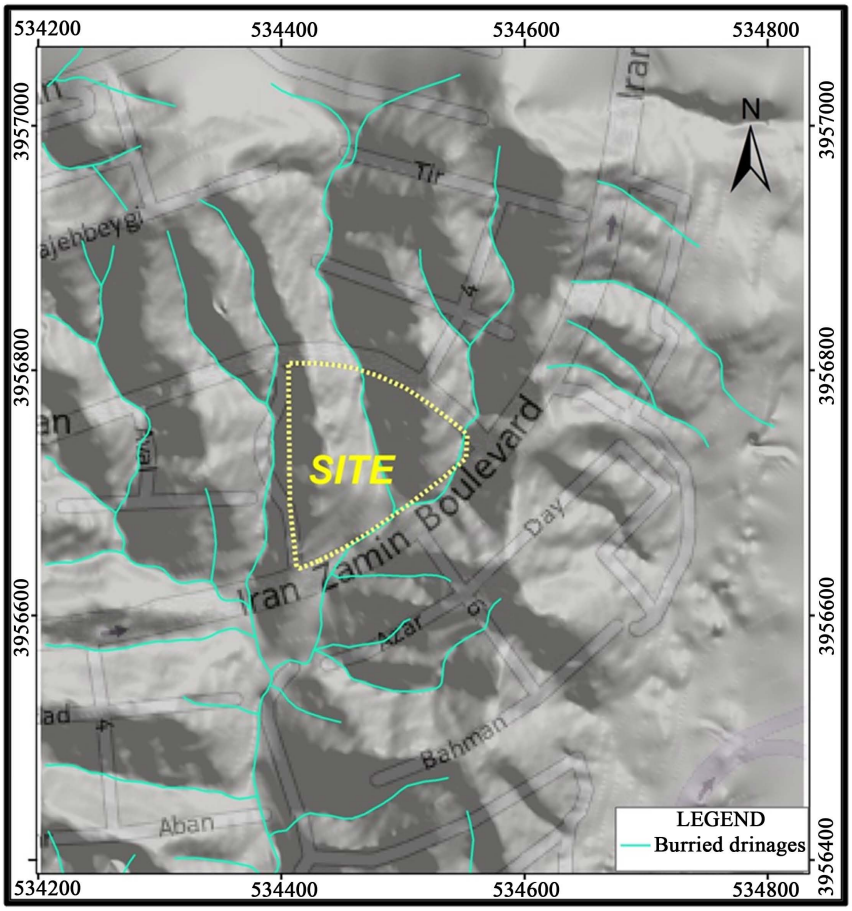

Figure 5. A part of aerial photograph related to 1963 from the site of Iranzamin construction project in the Shahrak-e Ghods, Tehran that shows dendritic drainage pattern of Darakeh stream.

Table 1. Values of T index for Darakeh basin.

Number	Da (m)	Dd (m)	T (m)	T_{ave} (m)	Tectonic class
1	577	2281	0.25	0.53	1
2	1214	1497	0.81		
3	2029	3929	0.52		
4	568	997.3	0.57		

shows a possible evidence of ground tilting toward the east. This tilting can be result of dip slip activity of above mentioned normal fault with the west dip direction.

4. Conclusions

Calculation of transverse topographic symmetry factor (T) is suitable for rapid assessment of active tectonics. The T index has been calculated in the Darakeh stream in the north Tehran, Iran.

The study area is located in the Tehran Piedmont and transverse topographic symmetry factor is calculated for it. Based on values of this index, there is high relative tectonic activities level. This condition can be related to existence of a blind normal north-south striking fault which may be buried by alluvium of the Darakeh stream. Dendritic drainage pattern of Darakeh stream and the fact that the western tributaries are longer than the eastern tributaries provide indirect evidence of ground tilting toward the east.

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