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ACTIVE TECTONICS ANALYSIS IN JAHAN ABAD-ABADEH TASHK BASIN (ZAGROS FOLD AND THRUST BELT) BY MORPHOTECTONICS INDICES

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ABSTRACT
Morphotectonics indices are helpful for identify the properties of one region Such as determination of tectonics activity level. We use this indices for obtaining the details of active tectonics in Jahan abad - Abadeh Tashk basin where is located at high Zagros zone. The Basin shape, Asymmetry factor and Hypsometry integral calculated for this purpose. Geological map, satellite image of Google earth and processing geological map softwares such as Elwise and Arc GIS is used. The results show that Jahan abad – Abadeh Tashk is located at moderate tectonics activity level.

KEYWORDS: Geotectonic, Indices, Jahan abad – Abadeh Tashk Basin, Morphotectonics.

INTRODUCTION
Active tectonics or active tectonics geomorphology study the dynamic and active processes which are caused the shapes of surface earth and landscapes form. In recent years, tectonics geomorphology is the one of main tools for distinguishing the active tectonics forms, providing seismic hazard map and understanding the history of present landscapes, significantly [1].
Tectonics demonstrates the building factors of structures such as folds , faults and the relation between the geometry form of structures and their created forces [2].Evaluation of structures and landforms is discussed in tectonics Geomorphology in several geological times [3, 4].Geomorphic indices are useful for tectonics studies because of rapid assessment of one region.
Needed data often obtained from Arial photos and Topography maps. Each of indices indicates a relative active tectonics classification. The result of using the several geomorphic indices is better than the result of using one index.
The result of geomorphic indices used for estimation the relative active tectonics index at one region. There are three relative active tectonics levels include: active, semi-active and non-active [5].
Generally, the purpose of this research is identification of relative active tectonics level at Jahanabad-AbadehTashk basin by geomorphic indices include integral hypsometric, basin shape and asymmetry factor. Figure 1 shows the situation of study area on Iran map.

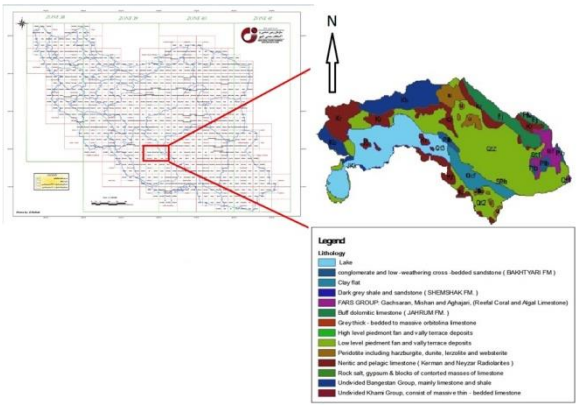

Fig.1: Situation of Jahan abad-Abadeh Tashk basin on Iran map (Derived from geological survey of Iran)

MATERIALS AND METHODS
Geological and Geographical setting
Iran plateau is a part of Alp-Himalaya orogenic belt [6] Where is located between Arabian shield at South and Russian plateau at North. There are two main mountain ranges in Iran plateau related to Alpian phase include: Alborz at North in East-West trend, Zagros at West and Southwest of Iran in Northwest-Southeast. Zagros Mountain is subdivided into three zones from Northeast to southwest include high Zagros, simple folded belt and Khuzestan plain [6].
High Zagros have two folding phase [7]. First phase is in last Cretaceous and second phase is in Miocene age to now. This tow continues phases created folds

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with more than 5000 meters amplitude and more than 8000 meters wavelength [8]. These folds are elongated from Northwest to Southeast with oblique axial plane and Northwest dip direction.

Faults of this subzone are thrust and normal. The dip of thrust faults is often northwest which is caused thickness of continental crust. The operation of these faults horizontal and vertical displacements in Zagros Zone is about 3.5 to 4.8 centimeter and more than 2 millimeters, respectively [6].

This basin is located in Abadeh Tashk, Arsenjan and Chahak geological maps in 1:100,000 scales. It is a part of Maharlu- Bakhtegan- Tashk basin. In the view of geomorphology, Jahan abad - Abadeh Tashk basin can divided to three main zones include:

1. Low terrains around Bakhtegan lake
2. Neyriz mountains rang in general Northwest- Southeast
3. Central part.

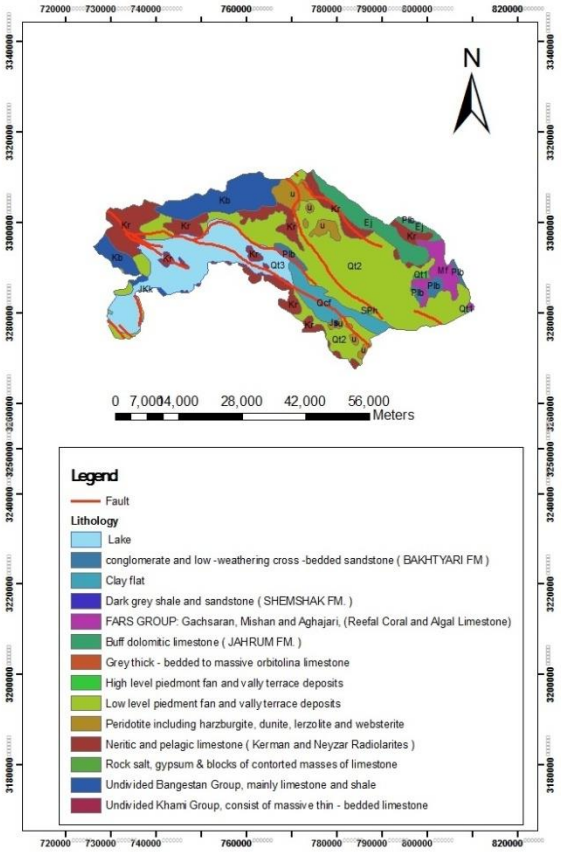

Fig.2: The geological map of Jahan abad-Abadeh Tashk basin

The highest point is 3076 meters and the lowest point is 1556 meters from open seas level. There are relatively flat alluvial plains at southwest of basin which converted to salt – clay playa toward Bakhtegan lake. Dominant high of this region is an igneous ophiolitic complex consists of Gabro. Old alluvial are well sorted, coarse-grained calcareous gravels at Northeast of basin. Sachun and Jahrom formations have out crop in study area [9, 10, 11, 12, 13, and 14]. Figure 2 shows the geological map of Jahanabad-AbadehTashk basin.

Methodology

The geology maps (1/100,000) and satellite images are used. Study area is located at two different geographic zones so that we converted coordinates to one zone by Elwise for geo-referencing the maps in Arc GIS. Then we export fault and Elevation layers. Created layers converted to Kml format for correcting in Google earth. Finally, Morphometric parameters consist of basin shape, asymmetry factor and hypsometric integral calculated and the average of them obtained for relative activity assessment.

Hypsometric Integral

They can describe elevation distribution of a region from a watershed to the all of the earth surface. The hypsometric curve is drawn total elevation (relative elevation) in to total area (relative area), [15].

The hypsometric curve may also be shown as a continuous function and graphically displayed as an x-y plot with elevation on the vertical, y-axis and area above the corresponding elevation on the horizontal or x-axis.

The curve can be also shown in non-dimensional by scaling elevation and area by the maximum values. The non-dimensional hypsometric curve provides geomorphologist to access the similarity of watersheds.

Therefore, available topographic maps in all of scales are suitable for calculating this index [4].

This indices calculated by formula 1

$$HI = \left(\frac{\text{mean eleavation} - \text{minimum eleveation}}{\text{maximum eleavation} - \text{minimum eleavation}}\right) \quad (1)$$

High values of HI (0.5) show young topography and many heights and lows.

They are associated with depth cuts, high rises, and uplifted surfaces and curved surfaces by drainages network.

The HI near 0 means the region is in old stage which equilibrium in geomorphologic processes and relatively flat surfaces are its properties.

The relation between HI and the cutting degree has been caused that this index is used as an indicator for distinguishing the erosion stage of landscape [16].

HI classified in three classes includes:

Class1: 0.6< HI<1, Class 2: 0.35< HI<0.6 and Class3: HI<0.35

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Asymmetry factor

Asymmetry factor analyzed to determine tectonics tilt in the basin. Drainage network is affected by tectonics deformations in some region. These drainage basins often have different geometry shape and pattern.

The asymmetry factor of the basin is calculated using formula as;

$$AF = 100(\frac{Ar}{At}) \quad (2)$$

Where AF is asymmetry factor, Ar is area of the basin belongs to right of the stream and At is total area of basin.

In this method, it is assumed that lithology controllers (such as dip), climatic conditions (such as vegetation difference between north and south slopes) didn't cause asymmetry [16].

The asymmetry factor (AF) classified to three classes include: Class1: Af≥65 or AF≤ 35, Class2: 57< AF<65 or 35 < AF<43, and Class3: 43 ≤ AF≤ 57

This index is sensitive to bucking perpendicular to the strike of main stream in drainage basin.

Basin shape factor

Basin shape can be described as circular, rectangular, triangular or pear. Shape can also be quantified using equation for basin shape factor, sometimes called shape factor [17, 18].

$$BS = \frac{L}{W} \quad (3)$$

L= length of watershed from head water

W= width of watershed in widest point

Width of basin is measured in several points and then it's mean were derived as the basin shape factor. This index has been classified to three classes include: Class 1: BS ≥ 4, Class 2:3 ≤ BS < 4, and Class3: BS<3

RESULTS AND DISCUSSION

The HI value of Jahanabad-AbadehTashk basin calculated 0.47 so that it is in class 2. It shows the basin is in maturity stage and has moderate activity.

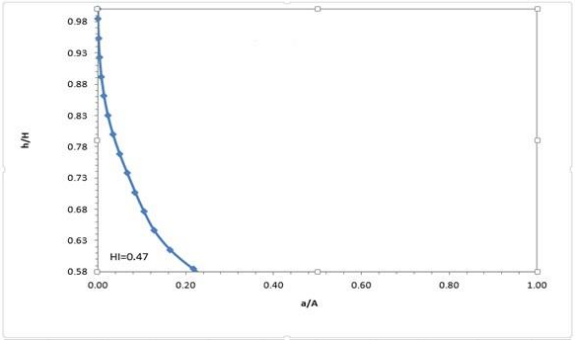

Fig.3: Integral hypsometric curve of Jahan abad-Abadeh Tashk basin.

Table 1: Distribution of elevation and area in Jahan abad-Abadeh Tashk basin

Elevation Classes	Area(Hectare)	Frequency%	Cumulative Frequency%	Middle Elevation(meter)
1476-1500	0.00335302	3.1	3.1	1488
1500-1600	0.08251353	77.2	80.3	1550
1600-1700	0.02983442	27.9	108.2	1650
1700-1800	0.02204368	20.6	128.8	1750
1800-1900	0.01316573	12.3	141.1	1850
1900-2000	0.01015710	9.5	150.6	1950
2000-2100	0.00695329	6.5	157.1	2050
2100-2200	0.00458704	4.3	161.4	2150
2200-2300	0.00381705	3.6	165.0	2250
2300-2400	0.00352264	3.3	168.3	2350
2400-2500	0.00335474	3.1	171.4	2450
2500-2600	0.00286752	2.7	174.1	2550
2600-2700	0.00226424	2.1	176.2	2650
2700-2800	0.00165580	1.5	177.8	2750
2800-2900	0.00121276	1.1	178.9	2850
2900-3000	0.00078175	0.7	179.62	2950
3000-3100	0.00041312	0.4	180.0	3050
3100-3200	0.00026498	0.2	180.3	3150
3200-3252	0.00004392	0.0	180.3	3226
SUM	0.19280632	100.0		
The weighted average of elevation(meter)			1763.0	
Mode elevation (meter)			2400.0	

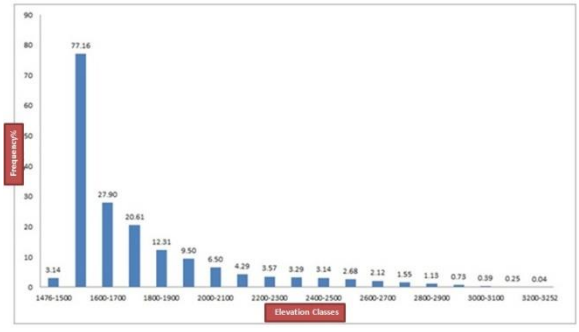

Fig.4: Distribution of elevation diagram in Jahan abad-Abadeh Tashk basin. X-axis shows elevation (meter) and Y-axis shows percentage of frequency.

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Figure 3 indicate the integral hypsometric curve of study area table 1 and figure 4 indicate elevation distribution in it.

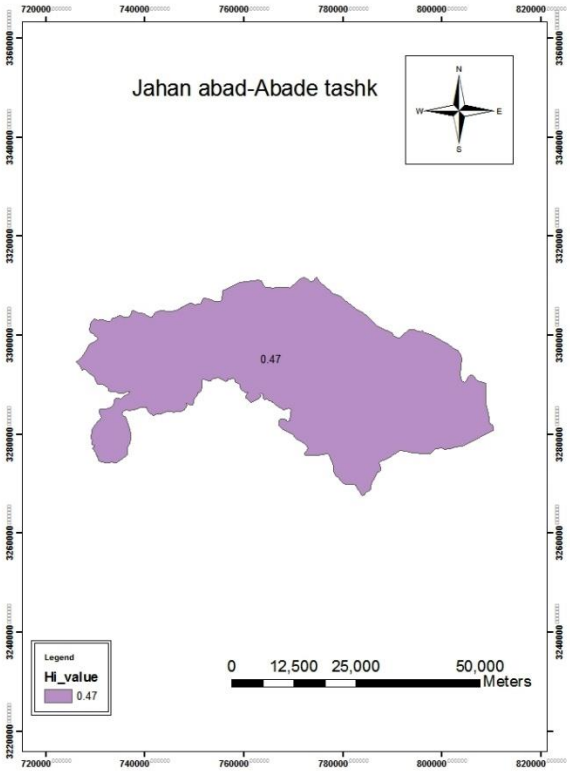

Fig.5: Hypsometric integral value map of Jahanabad-AbadehTashk basin.

In study basin, AF determined as 53.67 suggesting tectonics tilt toward left, due to tectonics influence of faults in the area (Figs . 6 and 7). Jahan abad-Abadeh Tashk basin is in class 3 of AF classification.

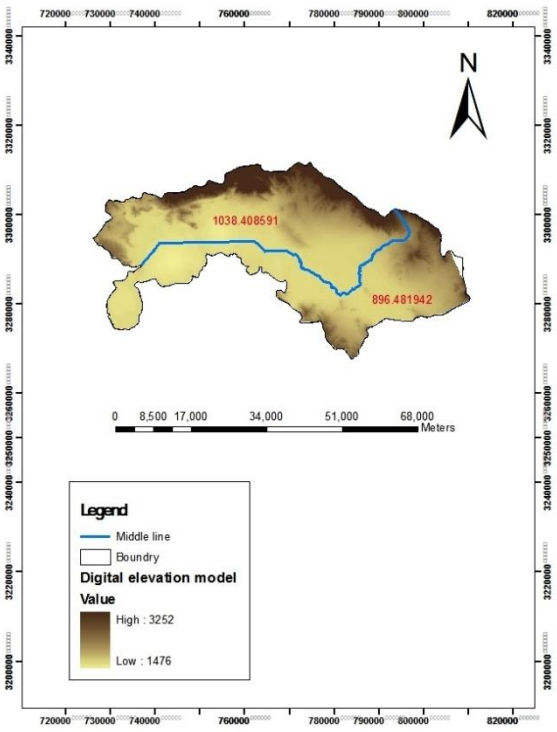

Fig.6: Determination of Asymmetry Factor (AF)

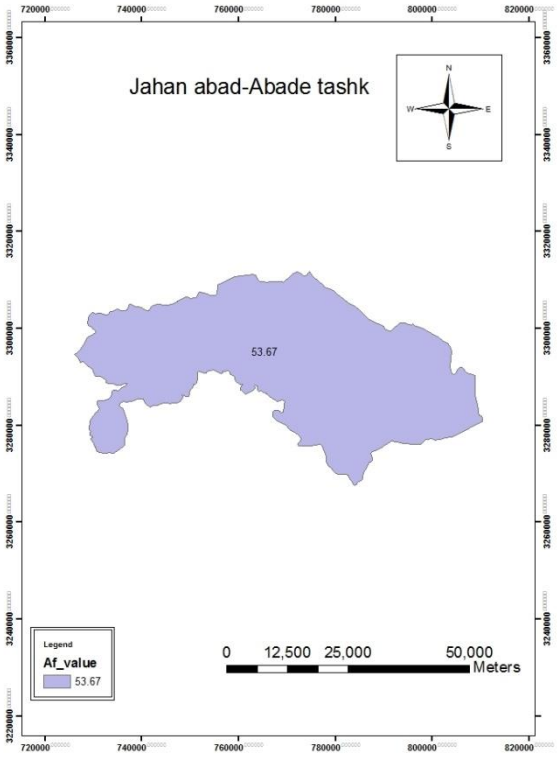

Fig.7: Asymmetry factor of Jahanabad-AbadehTashk basin.

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The value of basin shape factor calculated 3.88 for Jahan abad-Abadeh Tashk basin which shows elongated basin in class 2 (Fig.8).

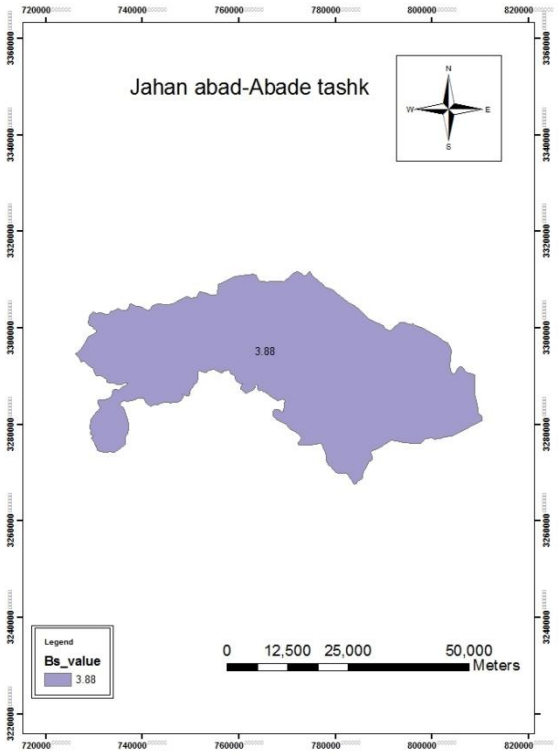

Fig.8: Basin Shape factor of Jahanabad-AbadehTashk basin.

Table 2 shows the summery of Morphometric indices.

Table 2: The value of Morphometric indices

Indices	Class	Value
HI	2	0.47
AF	3	53.67
BS	2	3.88
IAT	3	2.67

CONCLUSION

Morphometric indices are suitable tools for calculation of investigating tectonics activity. Three indices include integral hypsometry (HI), Asymmetry basin factor (AF) and basin shape factor (BS) calculated in Jahanabad-AbadehTashk basin. According to generated results, the Jahan abad-Abadeh Tashk basin mainly influenced by faults that there is at the right of basin. The results of the applied indices include:

HI value is 0.47 in class 2. This index shows the tectonics activity is dominant in basin and it is in maturity stage of erosion.

The strength of lithology is in low to moderate level at the right part of the basin so that the tilt of basin should be toward the right but the results show the tilt of basin is toward the left. So that tectonics activity in the right side of basin is more than the left side.

The calculated value of BS is 3.88 in this basin. According to BS classification, this value indicates the elongated basins in active tectonics region.

According to relative active tectonics (S/N) (El Hamdouni et al., 2008), this basin located in class 3 which show the region is in the moderate active tectonics level.

Finally, the results show the faults of right side basin are more active than one of left side basin. We suggested investigating it more accurate by geodesy studies on this basin.

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