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Spatial Analysis of Symmetry or Asymmetry Drainage Index in the Alvand Batholith

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Abstract

1- Introduction

The public opinion is that in the landform-topographic study, the drainage system, and the drainage pattern, by using geomorphic indicators one could assess the performance of active tectonics (Maghsoudi et al., 2011). This is true if we do not consider the primary structure of the earth, rock type, and local factors determining the microclimate (Abedini et al., 2015; Jafari and Barati, 2018). Considering these factors, the results question the geomorphic indicators. In this paper, the researchers study the role of various factors in the drainage asymmetric index of 117 sub-basins in the Alvand mountainous of Hamadan. A subject not considered in the drainage asymmetry index of areas such as the Alvand mass of Hamadan is the shape of the magma lies between the sedimentary layers at the time of cooling. In relation to the drainage symmetry index, this paper tries to study the physical properties and the effect of local factors in the watersheds of the Alvand Hamedan Batholith. Although the drainage networks asymmetry of is analyzed with morpho-tectonic indices, the basic land structure, lithological and erosion properties can also affect the asymmetry of the basin.

2- Methodology

For this purpose, parameters of the dominant slope, average slope, average height, the area of the right and left of the river, main river

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length, river airy length total length of the rivers, distance of the source of the dividing line, and rock types in different parts of sub-basins were determined. These parameters were used in calculation and analyses of Gravelius coefficients (compactness coefficient), elongation ratio, drainage density and asymmetry index. For the phenomenological investigation of the drainage network index status, with the help of topographical maps 1: 50000, the outlet point of the Alvand Batholith sub-basin was identified in the mountainous area. Accordingly, 13 sub-basins were classified in the Alvand Batholith. Class B subclasses are located inside the subclasses of class A and subclasses of class C are located inside class B subclasses. To separate sub-basins in each of the 13 sub-basins, the longest river was considered as the main river. All the streams connected to it are separated as subclasses of Class B. In the next step, the main river basin in the sub-basins of class B was also determined and the rivers entering it were designated as the sub-class C. Accordingly, a total of 117 sub-basins was identified.

3- Results and Discussion

In order to investigate the factors affecting the asymmetry index (tectonics, lithology, microclimate and physiography's characteristics of sub-basins); at first the status of sub-basin rock was studied. The largest area lies in the cordierite-Gabbro Stone (15.4%), and the smallest area lies in the Granite- Schist- Gabbro and cordierite-Gabbro (0.69%) groups. Investigating the elongation coefficient the sub-basins in which the dominant stone is granite shows a very low elongation ratio of these sub-basins. They lie in a group that is less elongated than the rest of the sub-basins in other rocks. In terms of the Gravelius coefficient, it can be said that the more symmetrical the basins tend to be circular in shape, as the mean Gravelius coefficient of the stable sub-basins for the asymmetric index is 3.35 vs. 2.64 in the relatively stable sub-basins, which fully confirms this point. The ratio of bifurcation of unstable sub-basins is very high, and according to the rocky area, the drainage density in the unstable sub-basins is inversely related to the slope of the basin.

4-Conclusion

In general, sub-basins of the northeast slopes are more asymmetrical than sub-basins in the southwest slopes, which it can be due to the zhizman form of the Alvand Batholith, the differences in the physiographic properties, and finally the dominant sub-basin rocks. In the wider sub-basins of the slope and the varying direction of slope, are vectors that can have a significant effect on the drainage network asymmetry. The further elongation ratio of drainage of the basin with low drainage density, in granite rock, affects the drainage network asymmetry of the basin. Investigating the conditions of slope values in different classes of the asymmetric index in sub-basins other than granite rocks indicates that the difference between the value of the left and right slopes of rivers is not a significant effect in the basin asymmetry. By decreasing the sub-basins area, the effect of direction and slope value, elongation ratio and bifurcation coefficient on asymmetric basins decreases. The study of the Gravelius coefficient indicates that the shape of the more stable sub-basins is closer to the circular shape. The bifurcation ratio of most unstable sub-basins is very high. The drainage densities of unstable sub-basins have an inverse relationship to the basin slope. The difference between the rock types on the left and right and the river's position on the boundary between the two rocks have an important role in the basins asymmetry.

Keywords: Morpho-lithology, Derange asymmetry, Tectonic, Derange Density, Alvand Batholith

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