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Evaluating the Effect of Tectonic on the Entrenchment of Alluvial Fans' Head Around Danehkhoshk Anticline

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Introduction

Alluvial fans are deposit landforms that their development is controlled by a number of factors such as tectonic, climate, lithology, base level change and morphometric properties of catchments. Among mentioned factors, tectonic has a major role in the fan development in tectonically active mountain ranges. The velocity of tectonic uplifting in mountain fronts can affect the rate of river entrenchment and the location of deposition in alluvial fans. When the rate of uplift exceeds the rate of stream-channel down cutting at the mountain front, deposition will tend to be focused near the fan apex. Climatic changes is also an important variable affecting the alluvial fans aggradations and degradation. In the wetter glacial periods, sediment production in the catchments of fans were increased and hence fans surfaces experienced aggradation while during drier present-day climate regime (interglacial period), fans surfaces experience degradation and incision. Although several works have been carried out on tectonic effects on alluvial fan development, little works have been done about tectonic effect on the rate of alluvial fan entrenchment in Iran. The study area is located in the south of Sarpole-Zahab town, Kermanshah province, in western part of Iran. 103 alluvial fans have been formed around uplifting Danehkhoshk anticline. The purpose of this paper is to evaluate the uplifting effect of Danehkhosh anticline on the entrenchment of alluvial fans.

Research Methodology

To evaluate the relationship between entrenchment rate of alluvial fans and active tectonics of Danehkhosh anticline, boundaries of 103 alluvial fans were delineated based on Quick bird satellite imagery as well as field works. After digitizing 20-meter contour lines from topographic maps of Iranian National Geography Organization, at a scale of 1:50 000, Digital Elevation Model (DEM) of study area were prepared in ILWIS (Integrated Land and Water Information System) software. The catchment's borders were identified by topographic maps and Quick bird satellite imagery. The

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borders of fans and their basins were converted to polygons and thereby basin and fan areas were obtained. To determine fan entrenchment, deepest channel on every fan surface was identified by field works. Subsequently, the difference in elevation between the channel bed (C) and the old surfaces of fan, in right (B) and left (A) sides of channel was obtained by a theodolite. Geological data such as lithology, faults and cross sections were derived from 1:250 000 and 1/1000000 scale geological maps. The strata dips of anticline limbs were measured at mountain front by a clinometer.

Discussion and Results

Studied alluvial fans are located around Danehkhoshk anticline that is tectonically active. The lateral growing of anticline towards southeastern and northwestern ends and the presence of a deep canyon (Golin canyon) in the southeastern end reveals that Danehkhoshk anticline is tectonically active and growing laterally toward southeast and northwest. Field works revealed that most fans are composed of inactive or degradational surfaces with large boulders and clasts. The presence of large boulders and clasts, pitting of calcareous boulders, varnished clasts and some soil development on most fans reveal that most of fans surfaces are now inactive. Data show that the areas of fans range from 0.21 to 30.5 hectares. The Largest basin (upstream of fan 74) has an area of 736.8 hectares whereas smallest basin (upstream of fan 41) has an area of 3.77 hectares. The rates of fan entrenchment vary from 0.45 to 14 meters. Evaluating the rates of fan surface entrenchment and structural dips of anticline limb reveals that rate of entrenchment of fans increases with increasing strata dips. Result of this study shows that maximum depth of fan surface entrenchment has taken place over fan surfaces located on steepest limbs of anticline. Data analysis represents that there is positive relation (with a correlation coefficient of 65%) between the fan surface entrenchment and the strata dips at the upstream side of fan. Results reveal that the correlation coefficient between the fan surface entrenchment and the strata dips is higher (86%) among fans with larger catchments (50 to 736.85 hectares). This means that fans with larger catchments are more sensitive to tectonic uplift (or strata dips) than fans with smaller catchments. Results also represent that there is no positive relation between catchment areas and entrenchment of fan surfaces so that correlation coefficient between two parameters is 9%.

Conclusion

Danehkhoshk anticline is part of Simply Folded Belt of Zagros, growing laterally towards southeast and northwest. Studied anticline is composed of same lithology (Asmari unit; limestone and dolomite). The difference in the rate of tectonic uplifting has resulted in the variation in the strata dips of anticline limbs. Hence, this research was focused on the tectonic effects on fans entrenchment rate. Results show that fans entrenchment rate is controlled by tectonic or strata dips of anticline limbs so that fans entrenchment increases as strata dip increases. Data show that there is no meaningful correlation between catchments area and fans entrenchment rate. It seems that this is due to the differences in the tectonic and uplifting rates in different parts of anticline. Studied anticline was subdivided into three tectonic zones. The rate of fan entrenchment is higher along steep slope mountain fronts (zone 1) than gentler mountain fronts (zones 2 and 3). Overall, this research shows fan surface entrenchment is perfectly affected by tectonic situation of strata dips of anticline limbs.

Keywords: Tectonic, Alluvial fan, entrenchment, structural dip, Danehkhoshk.

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