Study on geomorphology dynamics of limestone-shale collapse in the Kollah-Ghazy Area, south Esfahan, Iran

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Abstract

The focus of geomorphology is concerned with an analysis of the nature, arrangement and differentiation of landforms and an understanding of the processes that have shaped or are shaping those landforms. Uplift at the end of Cretaceous and beginning of the Tertiary created asymmetric domes. Foresets of limestone and shale in stratigraphic units of Shear folding area to Cretaceous in the Kollah-Ghazy of south and south-east of Esfahan have resulted in many collapse features that have developed several shapes like cuesta. Erosion of these uplifted rocks produced the present landscape .resistant sandstone that are ordered near the shale layer has been formed the cuesta like form .Results of morphology showed in spite of these forms lay in folded structure, they have any characteristics that they have contained in monoclimb structures such as foresets of hard and weak layers with temperate slope in construction simple and agreeable limb. In this paper we have tried to investigate the relationship between slope particulars and speed of destruction and layer dynamics, with measuring some geomorphology quantitative parameters. Analysis of regression showed a significant relationship between slope of weak layers with slope and thickness of hard layers. Also the slope of weak layer desire to angle of repose because of weathering effects, gravity and friction forces. So if the slope of weak layers exceed from the slope of repose, the hard layer destroy slowly and vice versa. According the results the among of the weak slope is suitable generally for velocity of destroy forests and study its dynamics. Conclusion of limestone and shale and formation of the forms like cuesta in this area has led to different problem in environmental management because of the cuesta limb ready for rock falling .Appreciation of the landscape of these geomorphologic features involved in the activity of human for quarry of stone that should be considered in land use planning in the south and south-east of Esfahan city where urban population need to the natural landscape for refreshment.

Key words: *Geomorphology,cuesta like from, , angle of repose, forests, Kollah –Ghazy.Esfahan.*

1.Introduction

The science of geomorphology has certain common elements, regardless of the scale of investigation or the system being examined. A fundamental proposition of geomorphology was proposed in which landscape stability was described as a function of the temporal and spatial distributions of the resisting and disturbing forces.

Land future is frequently the driving force in many systems and human activity acts as a modifying influence understanding and predicting change is not, however ,merely a matter of understanding the mechanics of the change process. It requires the recognition and comprehension of the nature of the links between individual system components concepts such as thresholds of change (Schumm, 1977), response time and magnitude, rates and paths of change and recovery, are all important if the full nature of changes are to be appreciated (Brunsden, 1990).There is little doubt that the resistance of natural systems to change, be they

geomorphological ,is complex and poorly understood subject.Stratigraphic units and its sensitivites is considered by most of moderns geomorphologists to be one of several independent variables that effect the morphology and evolution of landscapes (Kinghton;1984,Ritter;1986,Schumm;1977,Schumm and Lithy;1965). Whereas advances have been made in understanding many of the processes leading to changes in landscapes, recent scientific advances have shown the joint nature of forms and processes driving many geomorphic system changes and the nature of feedback processes between physical and morphological systems (e.g., Zeng et al., 1999). Detail on the coupling effects between these two systems, however, is poorly understood (e.g., Scheffer et al., 2001). Thus, with increasing pressures on the environment, a strong trend exists to manage environmental changes (Thoms and Parsons, 2002).Terzaghi(1969),Robertson(1970),Einstein et al(1995),Eberhardt et al(2001)and several researchers developed some physical and mechanical approach for stability of slope with complexity equation. Morphological study of slope dynamic is less than physical study. At present geomorphologists decide to solve this problem by investigation morphometric relations.

One of the active and sensitive slopehills is cuesta and pseudo cuesta like forms. changing in ancient sedimentation environmental was caused to establish its landscape. Foreset of limestone and shale in stratigraphic units of shear folding area and uplift process at the temporal period was affected to appear pseudo cuesta like forms. Erosion of these uplifted rocks produced the present landscape. The difference between soft and hard layers resistance has been formed geomorphic form that they are susceptible of change.

The objective of this paper is to quantity several morphological of hillslope of topographic development to find a single relationship that can be used to characterize sensitivity of landscape.

2. Regional setting of study area

The study area is in the Kolah Ghazy national park in southern Isfahan city in Iran (fig.1). The area is about 40 km².major rock groups are the Albian with genus of calcareous grey shale containing ammonites and small gastropods,Turorian-coniacian kind of bedded limestone containing *Inoceramus* and *Globotruncana*.

3. Methods

Morphological parameters were studied by analyzing and relating of downhill slope containing among of slope, thickness of soft and hard layers and the direction and the shape of forehead of hard bedrock layer. Analysis of regression was applied for investigation the relationship between slope particulars and speed of destruction and layer dynamics, with measuring some geomorphology quantitative parameters.

4. Results

The physiographic and geologic structure of the Kollah Ghazy has found two wrinkled mountainous string from lower and middle part of Cretaceous sediment. The study area (pseudo cuesta like form) has been fixed during several minor fault and uplift process has been done present of limestone-shale collapse from upper Cretaceus.results of analysis of regression for hillslope parameters has been showed in tab.1.

Results showed a significant relationship between two scopes with the coefficient of determination(R^2)of 0.763.Also soft hillslope with thickness of hard layer has a significant relationship with 0.532 for R^2.The highest coefficient of determination belong to multivariate regression between soft hillslope and two parameters of hard hillslope (slope and thickness)with R^2 of 0.838. Comparison of among of slope for two scopes (tab.2) illustrates a significant difference (α‹0.001) between means (tab.2).
Measurement angle of repose for shale of soft slope with field examination obtained equal 25.47 percent.

5. Conclusions

A series of limestone-shale collapse are located in study area and the base of the formation is two beds of soft and hard layers that they have been formed a cuesta like form in a folding system and appearance these features along several fault because of uplift process. On these geomorphic form two type of hillside, a simple bedrock slope and a compound slope of alternate soft and hard layers. with due attention to obtained the relation ship between slope of compound hillslope(soft layer) and simple bedrock hillslope(slope and thickness)can be state increasing in the bedrock slope and thickness was cased increasing the slope of soft hillslope.if slope of compound hillside were as big as the angle of repose ,destruction speed in bedrock would be fixed. Therefore comparison slope of soft layer and angle of repose itself can be state for bedrock destruction. So if the slope of weak layers exceed from the slope of repose, the hard layer destroy slowly and vice versa. According the results the among of the weak slope is suitable generally for velocity of destroy forests and study its dynamics. Conclusion of limestone and shale and formation of the forms like cuesta in this area has led to different problem in environmental management because of the cuesta limb ready for rock falling .Appreciation of the landscape of these geomorphologic features involved in the activity of human for quarry of stone that should be considered in land use planning in the south and south-east of Esfahan city where urban population need to the natural landscape for refreshment.

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Tab.1.The validation statistics of different relationship for data set.

No	Relationship(variable)	R	R^2	F	P value
1	Soft slope &Hard slope	0.873	0.763	28.917	0.000
2	Soft slope & Hard thickness	0.729	0.532	15.902	0.001
3	Soft slope & (Hard thickness and slope)	0.915	0.838	20.630	0.001
4	Soft slope & Soft thickness	0.090	0.008	0.116	0.739
5	Hard slope &Soft thickness	0.460	0.211	2.140	0.155
6	Hard slope &Hard thickness	0.419	0.175	1.915	0.200
7	Hard thickness &Soft thickness	0.381	0.145	2.380	0.145

Tab.2.mean comparison of soft slope with soft slope without bedrock (angle of repose).

	Mean	Std.Deviation	N	t	Sig.
Soft slope in collapse	29.6	1.18	14	12.848	0.001
Soft slope without bedrock(angle of repose)	25.47	0.92			

Fig.1.Typical exposure of limestone-shale landscape in Kollah Ghazy, southern Isfahan , Iran