GEOGRAPHY

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ACCUMULATION OF ORGANIC MATTER IN THE LINEAR FORMS OF EROSION IN THE NORTHERN PART OF QUITO, ECUADOR

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Abstract

The research revealed a high content of organic matter as the result of accumulation of eroded soil particles in sediments of gullies that are more than 2 meters deep. Even gullies with high degree of erosional activity contain organic matter in their sediments. At the gully wellhead there is an exposition of more ancient erosional deposits developed in the same bed.

Keywords: Gullies, gully bottom, sediments, stratification of sediments

Introduction

Both relief erosion and accumulation are found to be in a close relationship and mutual influence. The research of relief erosional forms like gullies focuses on their top accumulation where regressive erosion degrades fertile soil and causes a number of negative consequences. In spite of several years of research [1, 2, 3, 4], the accumulation effects on the dynamics of erosional forms and water catchment areas are still not fully understood. Still, the presence of organic matter in the sediments can be considered as an indicator of accumulative processes.

The study of linear forms of erosion was carried out in the northern part of Quito, Ecuador. In the present, those suburban area lands are no longer economically productive and remain idle. The widespread gullies in the studied area, located near the equator on

2600 - 2700 m above the sea level, differ in length, width, depth and degree of erosion activity.

Gullies are formed in modern loose sediments partially overlying in the slops. Significant differences in slope heights and tilt angles create the necessary conditions for water flows. Climatic characteristics generally favor the water erosion; the average annual rainfall exceeds 1000 mm per year and, as a result of frequent torrential rains [5], the soil is greatly eroded and extremely poor in organic matter.

Materials and methods

To determine the location, coordinates and elevation of research spots, were used satellite images, cartographic sources and GPS. The field research of soil and geological profiles was performed through drilling and pit digging. Several analyses of soils and sediments, micro relief, morphometric characteristics and sediments, both at the gully bottoms and slopes, were carried out in the Laboratory of The Central University (Quito).

Results and discussion

The organic matter content in sediments was researched earlier [6, 7], thus the present article provides a comparative description of sediments in gullies of several degrees of erosion activity.

The research of sediments was carried out in gullies typical for this area. The gully number 1 is 23.5 m long and 1.85 m deep with slopes tilted at 11 degrees and presents a moderate erosional activity.

During the research, it was revealed that modern sediments were accumulated under the surface of the gully bottom as a result of water flow. Evident sediment stratification provides a convincing proof of that. Gully is developed in light yellow parent sediment rock with prevalence of clay particles. Sediments at the bottom and adjacent areas of the gully slopes present some differences. Layers of sand alternated with dark gray clay sediment with organic matter clearly manifest stratification which reveals flows of different intensity and gullies of different shapes. Regarding the presence of organic matter, the results of analysis prove that the visible form of the relief in the wide and shallow gully bottom was created by the filling of its bed (Table 1).

Table 1. The content of organic matter (%) in the sediments of gully #1 (an average degree of erosion activity)

Sampling depth, cm	The gully bottom apex	Sampling depth, cm	The gully bottom mid-point	Sampling depth, cm	The gully bottom lower part
0-220	0.12	15-20	1.25	15-20	1.70
		30-40	0.50	40-45	0.76
		50-90	0.12	70-75	1.00
		90-100	0.07	100-105	0.52
		100-110	0.70	118-121	0.13
		110-230	0.12	150-155	0.07
				195-200	0.12
220-230	0.55			225-230	0.50

The gully is developed in the slopes with quite poor soil. The upper layer is 20 cm thick and contains about 1.06% of organic matter. Deeper layers in the parent rock steadily show 0.12%. However, sediments in the gully mouth present layers with different content of organic matter where layers of sand, with a minimum value of 0.07% of organic matter, are alternated by rocks with other indicators. Particular attention is drawn to the fact that, at a depth of 225 -. 230 cm, the sediment is dark brown and the content of organic matter there is higher than in layers more than a meter above.

It is a definite proof that this layer consists of deposits of soil particles that were covered by other sediments later on, for example, layers of sand carried and accumulated by water flow. Thus, in the past, the gully in the study site was deeper and had a different shape of transversal profile, but it was subsequently filled by layers of sediments.

The analysis of different parts of the gully reveals a much thinner accumulation in the mid-part than in the wellhead of the gully. The results show the organic matter content of 0.12% and the incision of the gully top into the parent rock. Those values are characteristic for the parent rock at the slopes. However, in layers 220-230 cm deep, a rate of up to 0.50% of organic matter content is observed. Apparently, the erosion uncovered sediments from an older refilled gully that had developed alongside the same bed.

Gully number 2 (with a high erosion activity) is located on the same slope as gully number 1. It is 51 meters long and 4 meters deep without clear marks of stratification in its upper and middle parts (see Table 2).

Table 2. The content of organic matter (%) in the sediments of gully # 2 (high erosion activity)

Sampling depth, cm	The gully bottom apex	Sampling depth, cm	The gully bottom mid-point	Sampling depth, cm	The gully bottom lower part
0-230	0.12	0-80	0.12	0-20	1.04
				20-90	0.12
		80-90	0.07	90-100	0.07
		90-230	0.12	140-150	0.57
				150-230	0.12

The fact that the content of organic matter is the same as that of the parent rock provides the evidence of an active incision and removal of the matter. However, despite the high erosion activity, over a meter below the gully bottom, a considerable content of organic matter and well defined stratification of sediments are discovered.

CONCLUSION

The presence of sediment layers with different content of organic matter is a proof of the accumulative process.

The visible shape of a relief form that we call gully is not only created by erosion. Its broad bottom is usually the result of sediment accumulation.

The presence of a considerable amount of organic matter found even in gullies with a high degree of erosional activity is a clear indicator of sediment accumulation.

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