GEOMORPHOLOGICAL OBSERVATIONS ON THE VALEA OILOR CATCHMENT

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Abstract. The Valea Oilor catchment, located in the Moldavian Plateau, at the contact between the Suceava Plateau in the west and the Jijia Rolling Plain in the east, has 9.723 hectares in size. The present study required both a Geographical Information System (G.I.S.) approach by using topographic maps at a scale of 1:5.000 in order to analyse the geomorphometric parameters, and field mapping. The general monoclinal structure of the surface geological layers resulted in development of a cuesta landscape. The sculptural landforms, represented by hilltops and especially slopes, with the average altitude of 150 - 200 meters, are prevailing. Valea Oilor valley highlights the first structural asymmetry, where the left valleyside is a south-looking cuesta backslope, while the right valleyside is a cuesta front with northern orientation. Land degradation processes are very active through soil erosion, gully erosion, landslides and sedimentation. Landslides are the most characteristic geomorphologic process, while gully erosion has a reduced incidence.

Key words: *G.I.S., cuesta, soil erosion, landslides*

1. Introduction

The Valea Oilor catchment, located in the North-Eastern Romania is integrated in the Bahlui hydrological system. The catchment lies between the Suceava Plateau, in the west and the Moldavian Plain (*Băcăuanu V., 1968)* or the Jijia Rolling Plain (*Ungureanu Al., 1993*) in the central and the eastern part. This involves a large range of physical and geographical conditions which influenced the formation and the evolution of the local landscape, with multiple implications concerning the present day geomorphic processes. The Valea Oilor River, a left tributary of Bahluieţ, has a total length of 18 km and it covers a catchment area of 9.723 hectares. The catchment has a maximum width of 23,7 km, while the length reaches 50,2 km.

2. Material and methods

Data acquired during field survey have been completed with information gathered from digitized topographical maps at scale 1:5000, 1984's edition. In order to analyse the geomorphometric parameters, the present study used Geographical Information System (G.I.S.).The use of the *TNT Mips v.6.9* program has resulted in obtaining the Digital Elevation model in a 5*5 m spatial resolution and the associated thematic maps, such as hypsometric map, map of slopes and orientation of slopes.

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3. Discussions and results

The relief of the Valea Oilor catchment overlaps two geomorphological units (Figure 1):

1. The Eastern part of the Suceava Plateau (Dealul-Mare Hârlău), where the following subunits can be distinguished:

a. The higher area with the geological layers belonging to Sarmatian, laid in littoral facies, where the predominantly sandy deposits are intercalated with more consolidated strata of sandstones and limestone, which allowed the development of structural-lithological plateaus (*Tufescu V., 1937, Ştefan P., 1989*);

b. The coast scarp, with a sculptural nature, formed mainly by the selective erosion, based on petrographic facies.

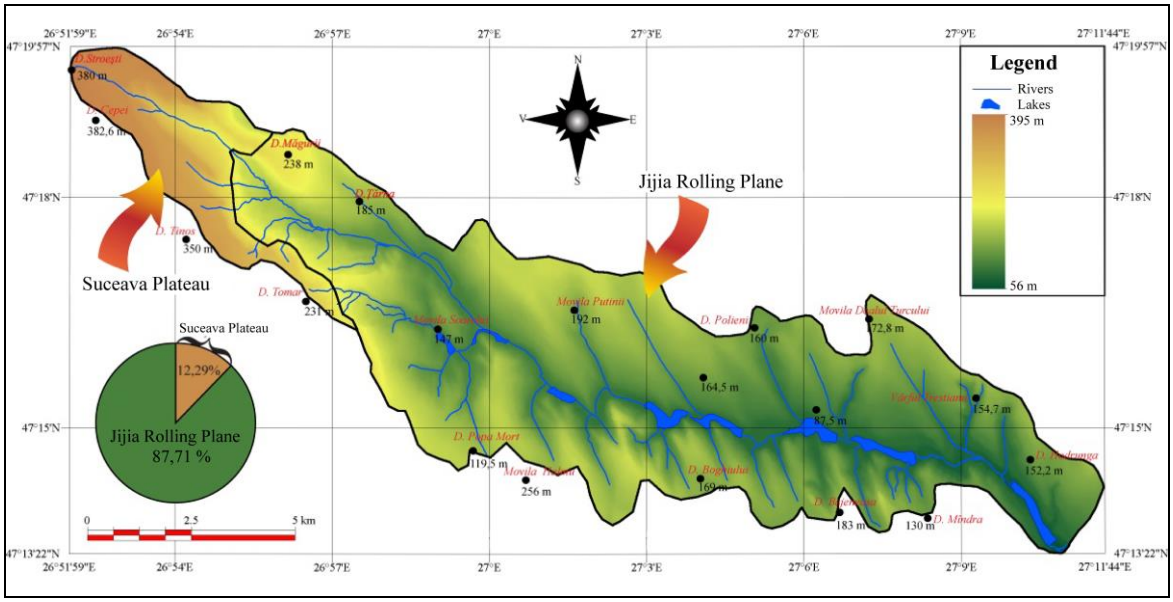

Figure 1: The landform units within the Valea Oilor catchment

2. The Jijia Rolling Plain, where the Bessarabian sediments, deposited in marine-brackish facies are frequently made of clay-marns, with sand intercalations, an area whose the main characteristic is described by prolonged interfluves *(Ionesi L., 1994, Brânzilă M., 1999, Băcăuanu V., 1968, Ungureanu Al., 1993*). The Jijia Rolling Plain is constituted of two subunits:

a. The depression area, oriented from North to South;

b. The Jijia Rolling Plain itself.

The main morphography of the catchment is subscribed to the typical pattern of the Jijia Rolling Plain, characterized by large rolling hills, arranged into interfluves sequence, represented by plateaus and hills with gentle slope. In the local landscape there are specific

contrasts between the long, gentle cuesta backslopes and the cuesta fronts, short, affected by present day geomorphic processes.

The North-Western part of the catchment is dominated by the Suceava Plateau, imposing a high rate of relief energy, with various slope gradients, characterized by a high potential of land degradation being subjected to soil erosion and landslides.

From a *hypsometric* point of view, the average altitude of the relief reaches 165 m, with maximum relief amplitude of 217 m, between the lowest altitude of 63 m, at the junction with Bahluieţ river and the elevation of 380 m, in the Valea Oilor spring-area, in the Stroieşti Hill. In general, the altitude is decreasing gradually, from North-West to South-East, big differences being noticeable all over these sectors.

In the superior part of the catchment, the average altitude is 275 m, while in the middle sector reaches 200 m and in the lower sector is 100 m.

The hypsometric analysis reveals that the areas with smaller values than 100 m are characteristic to Valea Oilor floodplain, in the northern half of the catchment. On the other side, 83,7% of the field has altitudes lower than 250 m, concluding for including the majority of the study area into the Jijia Rolling Plain. Only 10,4% of the field is higher than 300 m, this altitude corresponding to the Suceava Plateau and it represents 7,7% of the total area.

Regarding the proportion of altitudinal steps, the altitudes between 150 and 200 m are prevailing (43,3%), followed by those between 200 and 250 m (27,7%) and those between 100 and 150 m (12,6%). The other altitude values have a very small rate within the study area.

The morphographic characteristics of the relief are highly revealed by the toponymy. In this sense, the most dominant forms, well individualised, with a more or less rounded contour are called „holms" in the local toponymy, like Holm Hill, nearby Cucuteni, Holm Top, etc.

The declivity of the land was automatically determined using the Digital Elevation Model (DEM). We applied a randomisation and obtained four geomorphological value classes. The maximum value of the slope reaches 57,58%, and the average value of slope is 10,2%, with a standard deviation of 9,25%. Therefore, it results that the majority of slope values are between 5 and 18% (54,4%), values which indicate a specific type of fragmentation of the land, determining the presence of some relatively wide, quasi-horizontal surfaces bounded by high slopes.

The slopes with smaller values than 5% are found especially in the Valea Oilor floodplain, but also on some structural-lithological plateaus and on the majority of the hilltops. The field with slope over 28% (9,2% of the total) appear in the north-western side of the catchment, in spring's area and also on the front of cuestas, being associated to cornices or to some gullies banks.

The slope orientation is a very useful tool in the analysis of distribution and intensity of geomorphic processes, being a consequence of the river system's evolution due to the generally monocline structure, with a gentle gradient of 7-8 m/km, NNW-SSW.

The main valley is subsequent and the slopes with southern and south-western orientation are prevailing within the catchment. These are typical cuesta backslopes which highlight the first structural asymmetry.

The northern orientation is characteristic for 13% of the slopes which are cuesta fronts, affected by intense deluvial processes. The eastern orientation slopes (10% of the total area) follow the mentioned sequence, with cuesta backslope highlighting the second structural asymmetry.

The western and north-western facing slopes aren't very present, under 5% for each out of the mentioned orientation.

Within the Valea Oilor catchment are represented all the main genetic landforms from the platform regions, such as: the structural topography, the sculptural landforms and the accumulation relief.

The structural topography is strongly connected with the geological monoclinal structure and with the alternation of layers with different erosion resistance (*Băcăuanu V., 1968*). The structural relief is represented by the structural-lithological plateaus and by different types of valleys formed and developed within the geological monoclinal structure, specific to the Moldavian Plateau.

The structural-lithological plateaus are more present in the north-western side of the catchment, developed on Sarmatian facies with sandstones and limestones. The plateaus have a horizontal surface (the slope has smaller values than 5%) and are characteristic for altitudes over 370-400 m. The most extended structural platform is situated between Stroieşti and Vaşcani, named by *Tufescu V.*, (1937) "The structural Platform Broscaria - Laiu".

The valleys have been created by the river system, under the important influence of geological structure, illustrated in the local morphology by the relief cuesta.

For a better understanding of the cuesta relief in the Moldavian Plateau, *Ioniţă I.* (1985, 1992, 1998, 2000) recommends to take into account two dipping planes of the outcropping layers: a major one, oriented from North to South of 6-7 m/km, and a secondary one, West-East of 3 m/km. By combining the two dipping planes, a general monocline structure of de 7 – 8 m/km southwards is resulting.

On this basis, the author proposed two types of asymmetrical structures:

- *First* order structural *asymmetry*, comprises classical northerly faces of cuestas;
- *Second* order structural *asymmetry*, determines westerly and moderate steep faces of cuestas.

For the first asymmetry are specific the subsequent valleys, the main characteristic of the transverse profile, typically asymmetric, is the classic cuesta front with northern orientation and the south-looking backslope (such as Valea Oilor, upstream Filiaşi, Valea Sârca).

By the downstream Fliliasi, Valea Oilor is subsequent, diagonal, oblique, with a uniform left valleyside, with south-western orientation, while the right valleyside illustrates a cuesta front, with a north-eastern looking, smaller and sectioned by two obsequent valleys.

The second asymmetry includes a series of small valleys, consequent and reconsequent, like Valea Oilor, upstream Boureni, the lower valley, before the junction with Bahluieţ and Turcu Valley. In the morphology of the valleys, generally oriented from north to south, the specific feature is given by the presence of cuestas front, with a northern looking, with a small amplitude (the left valleyside) and the backslope with an eastern orientation (the right valleyside).

The obsequent valleys have the largest extension on the right side of the catchment, oriented from south to north, in an opposite direction to the dip of the geological layers. Generally, these valleys have symmetrical slopes, with small longitudinal profile, short, with high declivities, sometimes in rock steps (*Băcăuanu V., 1968*).

The northern looking cuestas are prevailing within the Valea Oilor catchment, developed on the existence of a subsequent river system. But the area is also represented by cuestas with a western orientation that illustrate the second structural asymmetry.

The sculptural landforms, a result of the erosional activity and the deluvial processes in the monoclinal general structure, are prevailing within the study area. This type of relief is represented by both the hilltops and the deluvial slopes.

Slopes frequently play role of either the cuesta front or cuesta backslope within the Valea Oilor catchment. The northern facing valleyside play the role of classic front cuesta, subjected to present day geomorphic processes, such as soil erosion, gullying and landslides. The opposite valleysides, with a southern looking represent cuesta backslope, suitable for arable land.The left valleyside southern facing emphasizes the first order structural asymmetry. The southern looking valleysides are prevailing, well outlined on the left side of the studied catchment. The valleysides with northern and western orientation play the role of a front cuesta, subjected to severe degradation processes.

The most common geomorphic processes that play an important role in landscape evolution in the studied catchment are soil erosion, landslides, sedimentation, while the gully erosion has a reduced incidence.In terms of conditions that favour the installation of soil erosion, land located on slopes higher than 5% are the most exposed areas (*Moţoc M., 1983*).

Landslides represent the most typical process with high occurring potential within the study catchment. The landslides are spread on the cuesta front, associated with the first order structural asymmetry, on the right side of Valea Oilor, developed on Sarmatian deposits, with deluvium landslide formation, with variable depths (figure 2). By analysing the spatial distribution and the dynamics of the present-day process, it is obvious that the most landslides have a high degree of stability.

The gully erosion occurs especially on the slopes with declivities higher than 10%, in long of the coasts and on cuesta front. Because of the prevailing of clay and marls within the catchment, the incision through gullying is an important factor in triggering other processes, like landslides, therefore the initial configuration of the gully changes very quickly.

The discontinuous gullies, with small dimensions are more frequent within the Valea Oilor catchment, situated especially on the slopes, and more rarely on the valleys. The slope gullies are associated to small catchments and they form in A or B horizons of the soils, and rarely in the C horizon. The main factors causing gully initiation are the hydrological factor (the way the laminar flow is organized into the form of concentrated stream) and the lithological factor (*Ioniţă I. 1998, 2000*).

The accumulation relief is represented by floodplains, terraces, alluvial cones and glacises.

The floodplains are the most recent accumulation landforms, formed in Post-Glacial-Holocene. The Valea Oilor floodplain is weakly individualised in the upper course, but it widens in the same manner as the altitude, until the junction with Bahluieţ, where is very well represented. The floodplains have different dimensions from one valley to another, but, as genesis, structure, composition and microrelief they are very much alike. The alluvial deposits are made by clay with small intercalations of sand or gravel.

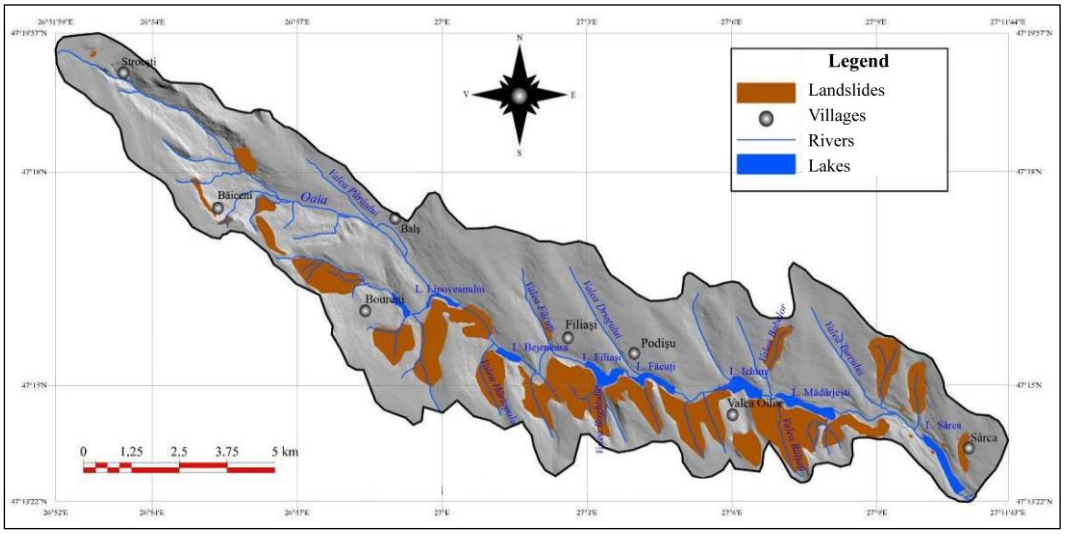

Figure 2: Landslides density map within the Valea Oilor catchment

The fluvial terraces appear as morphological steps, situated on different heights above the Valea Oilor floodplain.

On the left valleyside of Valea Oilor River, upstream Podişu Village, on the flanks of Bejeneasa Hill, we can observe the gravel, spread all over the soil, indicating the alluvial origin of the deposits from the superior sector of the hill. The lack of wide openings didn't allow establishing their exact elevation. The gravel occurs in the north-western part of the hill, then, with some interruptions, it continues until the edges of the actual floodplain, where it is highlighted by many springs (*Băcăuanu V., 1968*).

The accumulation glacises formed as connection areas between the hillslopes and the floodplains.

At the contact between Broscaria Laiu Platform with Moldavian Plateau, the torrents have created contact accumulations, such as cones and glacises, refilled with coast materials, so that denudation processes have been replaced by accumulations. Therefore, the contact area it is transformed into a depression-type area with erosive-accumulative origin. The relief is represented by gentle slopes, with average declivity of 5%, with low relief energy (20-30 m) and with reduced incidence of geomorphic processes.

Conclusions

The Valea Oilor catchment lies within two geomorphological units: the Jijia Rolling Plain, which is prevailing and the Suceava Plateau, represented by Dealul Mare-Hârlău.

The maximum relief amplitude is 217 m (380 m, the maximum altitude in the north-western side of the catchment and 63 m, at the Valea Oilor's junction with Bahluieț River). The average altitude is 165 m and it decreases gradually to South-East.

Jijia Rolling Plain stands out as a well individualised natural entity, and is well defined in comparison with the Suceava Plateau, the last one with a relief energy over 200 m, with slopes that often have values higher than 28%.

The analysis of morphographic and morphometric parameters of the relief within the Valea Oilor catchment emphasizes an asymmetry from the geomorphological parameters point of view, determined by the evolution of rivers on the generally monoclin structure.

The sculptural landforms are prevailing, where the deluvial slopes have the biggest share among the existing relief forms. Slopes frequently play role of either the cuesta front or cuesta backslope.

Landslides are the most characteristic geomorphic process, but due to the drier period of time after 1982, they have a high degree of stability.

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