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Morphometric aspects of the Cârcinov basin (the Cândeşti Piedmont)

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Abstract. The basin of the Cârcinov Valley is situated in the Cândeşti Piedmont, being one of the tributaries of the Argeş River which ensures the drainage for a surface of approximately 202.7 km. The altidude becomes lower and lower from the north of the region (742m) to the south (225m) where it flows into the Argeş River. The most important part of the Cârcinov basin is represented by the hypsometric values between 400-500 m, namely 28.60% from the analysed surface. The analysis of the relief fragmentation offers us an important geomorphologic clue regarding the dynamics and distribution of the shaping processes from different time stages, data that will be taking into consideration within the process of durable development of the researched area. The degree of the relief fragmentation, with values included between 0-200m/km^2 is the result of some complex causes and conditions as for instance: the setting of the basic level in general and of the local one, the slope, the neotectonic movements, etc. The inclination of the sides defines different categories of sides: with small slopes, between 0 and two degrees which characterize little inclined grounds in the neighborhood of water meadows and small rivers, with middle slopes between 16-17 degrees which are found on the most important part of the surface of the Cârcinov Basin and with big slopes under 27 degrees which are met on the fore sides of the terraces and fields. The exposure of the sides determines a certain caloric behaviour of the soil with implications on the regime of humidity, geomorphologic processes and, last but not least, on the agricultural utilization and exploitation. The way the network of rivers is organized represents one of the factors that condition the character of the relations between different current morphogenetic processes which are, most of them, subordinated to the drainage down the sides or in hydrographic channels of different size orders.
Key Words: the Cândeşti Piedmont, slopes, hypsometric values, energy of the relief.

Introduction. In the existing Geograhy literature there cannot be cited a work whose object of study is exclusively the natural environment of the Cârcinov hydrographic basin. However some references have been made to different problems which appear within this basin (Paraschiv 1965). The documentation on the studied sector is based on some works of some specialists consecrated at the national level as well as a series of cartographic materials (Mihăilescu 1966; Badea et al 1976). Thus, the history of the research is short, the bibliographical list being scanty. Moreover, the available data do not refer exclusively to the researched zone. Nevertheless there are some geographers and geologists who dealt closely with wider areas which encompass the Cârcinov basin too. The geographic research of the Cârcinov Basin represents a work related to a less studied hydrographic basin. The study of the hydrographic basin of the Cârcinov River, which I started in 2000 and I continued with a huge interest between 2008 and 2012 is a crowning of all the efforts tangentially made by some specialists (Coteţ 1951; Mihăilescu 1966). It is more valuable due to the fact that this region is rather little studied. Consequently, the analysis of the influence of the physical and geographical factors on the surface drainage and water accumulation in the ground water layer will lead to a better understanding of the particularities of this territory with a view to taking some right decisions regarding the territorial development and the management of the water resources (Răuţescu 1939).

The studied unit, named the Cârcinov Basin from the Cândeşti Piedmont has a surface of 202.75 km^2 (Figure 1).

Figure 1. Cândeşti Piedmont.

This is inclined from the north on a length equal to 37.75 km^2 and a medium width of 6.12km (max.l=9.25km and min.l=3km). Analysing the topographical charts, I noticed that globally/as a whole the surface of the Cândeşti Piedmont inclines from the north to the south. Thus, the maximum height of 744.6 m is found on the Perilor Hill (Valea Mare village, Dâmboviţa county, the place where Valea Mare, a tributary of the Cârcinov springs from) and 742m is found on the Pietrelor Hill (Cândeşti Deal village, Dâmboviţa county, the place where the Cârcinov springs from), heights that coincide with the northern limit of the studied unit (Figure 2).

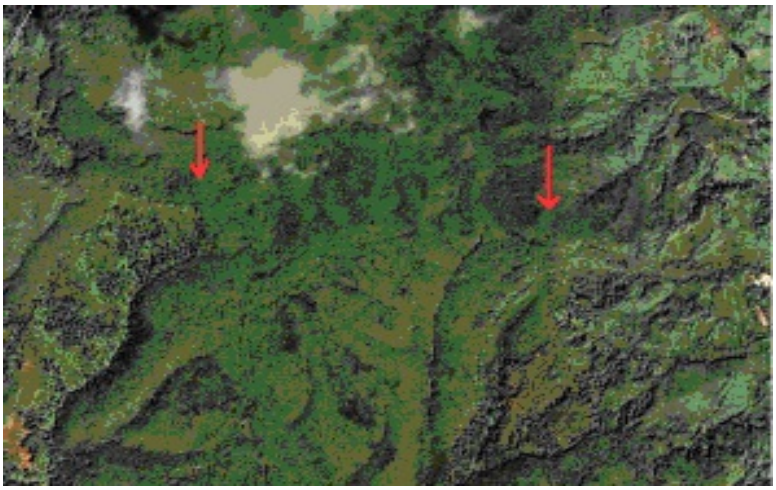
Figure 2. The Perilor Hill and the Pietrelor Hill.

Among the rivers that spring and enlarge within the boundaries of the Cândeşti Piedmont, the Cârcinov is the most important both for its length and for the surface of its hydrographic basin (Ujvari 1959). Starting from Beleţi to the north, the Cârcinov Valley bifurcates, both its branches having the same name, the Cârcinov. Due to this fact, the necessity of a specific name for each valley was felt. Thus, the branch that springs from under the Stones Hill and flows through the east side of Cândeştii de Deal and then through Boţeşti and Dobreşti was named the Eastern Cârcinov and the branch that has its origin under the Dealul Corbului (599m) and flows through Negreşti was named the Western Cârcinov. The Eastern Cârcinov is the most important branch in point of length and surface. It springs from the northern extremity of the Cândeşti Piedmont, more exactly from the point named Dealul Pietrelor (742m) and its tributary on the right, Valea Mare, has its origin under Dealul Perilor (744m), the highest point of the region (Paraschiv 1965). The unit in which the Cârcinov Valley is encompassed is not only a morphologic element or a morphohydrographic artery but it also offers to the interested

one a complex landscape with intense morphodynamics. After the research done so far I discovered that the Cârcinov stream developed on a friable, predominantly sandy geologic substratum.

The minimum elevation of 225m is found in the zone where the Cârcinov Valley intersects with The Argeş water meadow (on the interfluve on the right of the mentioned stream) (Figure 3).

Figure 3. The confluence of the Cârcinov with the Argeş.

This difference of level of almost 520m is the result of the positive movements more and more noticeable towards the foot of the mountain that took place in the region during the Quaternary. But the analysis of the elevation also reveals that the surface of the Cândeşti Piedmont inclines in the northern zone from east to west with almost 40m, whereas in the southern zone it is inversely inclined, from west to east, with almost 180m. These differences of levels are also the result of the vertical tectonic movements during the Quaternary.

The unit in which the Cârcinov Valley is encompassed is not only a morphologic element or a morphohydrographic artery but it also offers to the interested one a complex landscape with intense morphodynamics. After the research done so far I discovered that the Cârcinov stream evolved on a friable geologic substratum, predominantly sandy, the valley having specific climatic conditions imposed by the channeling of the air masses among it, by a various layer of soils and by a vegetation made of a mixture of vegetation species specific to the steppa as well as to the forest of zonal type and of those specific to the water meadows. The Cârcinov Valley shows, from the economic and geographic point of view some features that differentiate it from the whole Cândeşti Piedmont: advanced settlements, widely used ways of communication, diversified agriculture due to the various relief and soils. From this blendig of the natural and anthropic elements there appeared a geographic complex or landscape whose analysis should emphasise, first of all, the connections that exists among its components (Răuţescu 1939). This main purpose is the one which subordinates the necessity of finding the elements that differentiate it from the valleys and the dividions from the east or from the hills in the western side of the Argeş county, units by which the Cârcinov Valley is flanked (Ielenicz 1993; Cîndea & Erdeli 1984).

The northern zone, where Boţeşti is situated too, is the most suitable for such an analysis. It interweaves the morphostructural elements specific to the entire basin. At the same time it is individualized by its lithology and by the monoclinal structure of the Pliocene flanked sands in the north and by the Quaternary gravels in the south. A similar differentiation can be noticed from the point the pedo-fito-climatic point of view. To the north of the village Boţeşti, within the Cândeşti Plateau, the forest grown on grey soils

prevails and to the south of the city of Topoloveni the steppa influences are very strong, a fact which can be easily deduced from the medium multiannual amount of precipitation that goes from Piteşti to Topoloveni below 500 mm. Thus the middle zone of the Cârcinov Valley remains a zone of transition of forest steppa type.

The presentation and interpretation of the morphometric data are important for the rural and urban development of the researched area, allowing the practicians to achieve the durable development and planning of the analysed territory, foreseeing ad avoiding certain geomorphologic hazards and risks (Surdeanu 1998).

The multi-stage layout from north to south of the relief of the Cârcinov Valley is shown on the hypsometric map (Grigore 1979), where we notice six classes of hypsometric values included among the extreme altitudes of this area (200 m and above 700 m).

The village of Boţeşti is situated in the Cândeşti Piedmont, the eastern subdivision of the Getic Plateau. The maximum altimetric elevation from this unit is 557 m and the minimum one 380 m in the Eastern Cârcinov water meadow. The level difference of 177 m for this area sustained by the prevailingly friable petrography explains the high erosion potential and the dynamics of the landslide processes.

Material and Method. In the present study I used the topographic maps 1:50000, 1983 version, which offered me the detailed representation of some morphometric parameters. On this ground the hypsometric map, the slopes map, the sides exposure map and the fragmentation depth map were achieved, maps that I considered sufficient for the hypsometric characterization of the researched basin.

Results and Discussion. While elaborating the hypsometric chart of the Cârcinov Valley starting from the topographic chart 1:50000, I noticed that the specific hypsometric curves are those of 700m, 600 m, 500m, 400m, 300m. The curve of 700m is situated in the northern part of the unit, including a small surface of 0,85km^2 which represents 1%. The 600m curve is situated nearby the 700m curve advancing and drawing back along the water threads/streams and encompasses a surface of 14.5hm^2, namely 7.4%. The 500m curve includes a surface of 44km^2, namely 18.25%. The 400m curve includes a surface of 66.5km^2, namely 28.60%. The 300m curve includes a surface of 56.7km^2, namely 27.12%. The rest of 30.20km2, namely 17.26% is situated under 300m.

The most important part of the Cârcinov basin is represented by the hypsometric values between 400-500 m, namely 28.60% from the analysed surface which coincides with the biggest part of the hilly relief, followed by the values between 300m and 400m (27.12%.), specific to the central-south part. Within the water meadow area the most important is the value of 200-300m (approximately 17.26%) from the surface of the basin (Figure 4).

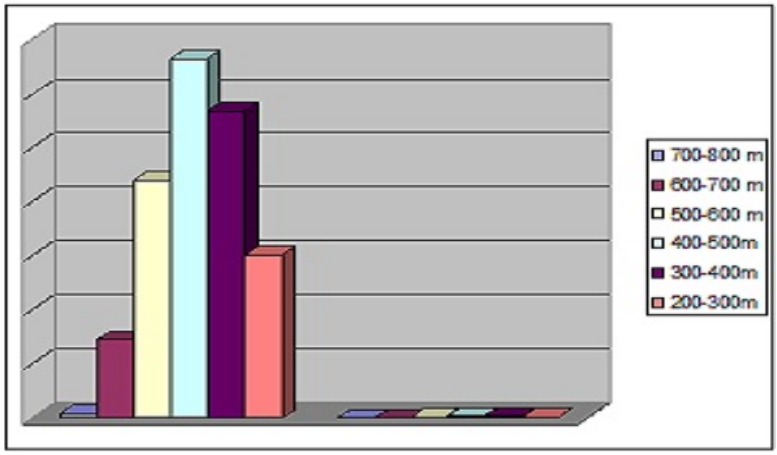

Figure 4. The hypsometric values diagram.

By calculating the density of the relief fragmentation and from the analysis of the spatial distribution of its values we obtain the morphogenetic features regarding the evolution of the hydrographic network and of the intensity of the linear erosion processes in interrelation with the lithological and biopedoclimatic conditions existing at the local level. The density of the relief fragmentation for the Cârcinov Basin has values between 0.1km/km^2, the highest values of the relief fragmentation density 3.1-4km/km^2 insularly appear in the analysed perimeter (their surface is 8 km^2, respectively 4% from the basin's surface). In the northern part the fragmentation density is between 1.1 and 3km/km^2, a fact that is explained by a big confluence relation which in its turn is justified by the relief's energy going up (att the contact with the morphostructural units) and by the presence of the friable rocks.

The first sector mostly laps over the south part of the unit and the rest is represented all over the unit in proportion of 23.74%, namely 49.5km^2.

The second sector is met on the whole surface predominating in the central north part in proportion of 37%, namely 76.5 km^2.

The third sector predominates in the central part. It represents 35%, namely 68.7km^2.

The fourth sector is weakly represented within the unit and it represents 4%, namely 8km^2 (Figure 5).

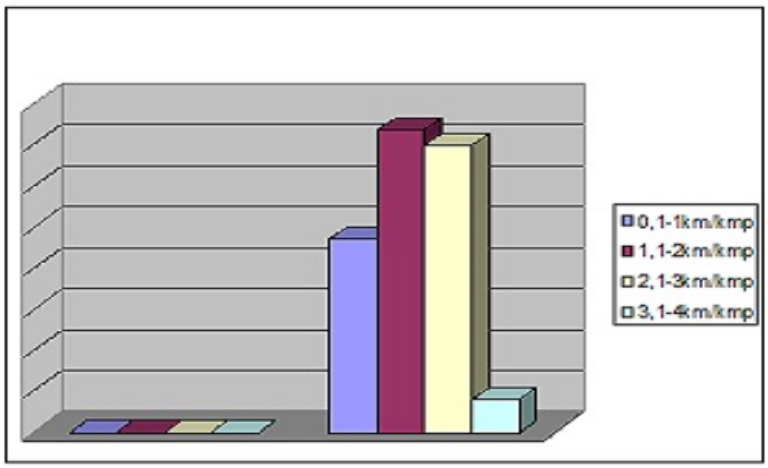

Figure 5. The relief fragmentation density diagram.

The analysis of the relief fragmentation density offers us an important geomorphologic clue regarding the dynamic and repartition of the shaping processes from different periods, data which will be considered in the process of durable systematisation and development of the researched zone. The depth of the relief fragmentation shows the depth to which the vertical erosion reached, sustained by the lithological-structural conditions, being conditioned by the general or local erosion. This geomorphologic element plays a significant role in the process of rural and urban systematisation and planning because, depending on the degree of relief depression, some types of engineering work will be carried out. For example, the evaluation of the ground in order to build roads, and of the characteristic elements: cuts, fills and their cutting slopes (suitable for drippings, gappings and landslides) will accordingly to the values of the relief energy in the area that was chosen for development.

The map of the relief energy (fragmentation) emphasises the degree of depression of the Cârcinov Valley from which we can deduce its way of evolution (the intensity of erosion, the valley's adaptation to the structure, the behaviour of the rocks in relation with the fluvial erosion, etc.). In the village of Boţeşti the depth of the relief fragmentation records values between 51m (the Grecilor Valley ant the Eastern Cârcinov) and 150 m (insularly on the two streams).

Although the lithiological conditions are the same, the action of deepening of the valleys took place according to a series of causes. We notice four characteristics of the zone:

- a greater depth of the fragmentation to the north of the 700m curve with values of 180-200m/km^2 and with values of 180m/km^2 to the south of the 600m curve which represents 4km^2, namely 2% of the territory;
- a smaller depth of the fragmentation than the first is met along the main arteries all over the surface, with values between 101-150m/km^2 representing 13km^2, namely 6.9% of the territory;
- the widest surface in the zone is characterized by a relief energy with values between 51 and 100 m/km^2, representing 67 % of the territory;
- a depth of fragmentation between 0-50m/km^2 representing 27.75 km^2, namely 23,18%.

In conclusion I can maintain that the degree of the relief fragmentation is high enough with values between 0-200m/km^2 and it is the result of some complex causes and conditions among which: the setting of the general basic level and of the local one, the slope, the neotectonic movements, etc. (Figure 6).

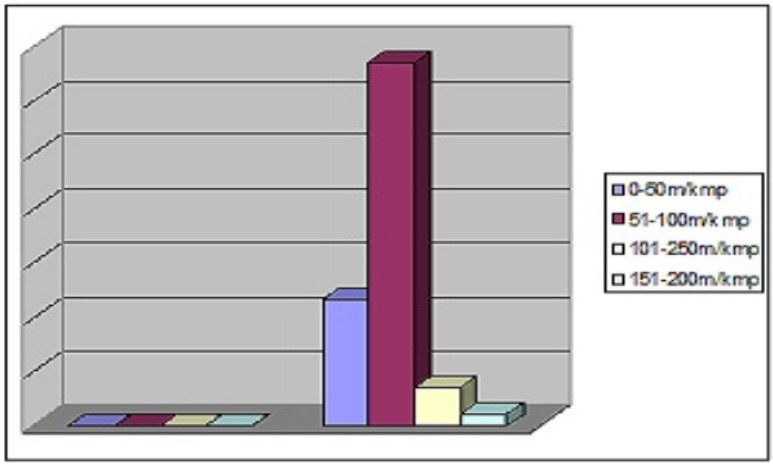

Figure 6. Relief fragmentation diagram.

Analysing the slopes map I noticed a differentiation between the values of delicvity in the valley sector of the researched area ant those recorded in the adjacent sectors, the hills and the hillocks in the plateau unit.

For the map of the slopes I calculated the slope angles and I found that their value reaches 27 degrees. But this slope is not uniform. For the researched zone I noticed, after analysing the map of the slopes, that the value of the slope angles is high enough on the front side of the terraces and fields and lower at the level of the interfluves and water meadows. Within this unit I distinguished eleven categories of slopes which influence in different ways, from a space to another, the processes of shaping of the relief.

The high values of inclination of the sides represent a premise for the starting of the gravitational processes among which the most active ones are the landslides. Beside these, washings and linear erosion under various forms (dripping, gapping, torrents) are also frequent.

Landslides are phenomena that were remarked along the Cârcinov Valley as far back as the first part of our century. Among these we can mention in mod those on the sides of the Potop Valley and of the Eastern Cârcinov. According to the intensity and the resulting forms the landslides of the sides of the Cârcinov Valley and of the tributary valleys are phenomena that involve the shifting strata to a great depth. In the receiving basins of the torrents and on the fore side of the sides we meet superficial landslides affecting the reduced areas (Figure 7).

Figure 7. Landslides – Boţeşti village.

Conclusions. The morphometric parameters have a special importance in evaluating the general morphology of a region but also in evaluating the morphogenetic potential of a certain region. In our case the analysis of the morphometric parameters shows a decrease of the morphogenetic potential in the superior basin of the Cârcinov towards the inferior basin, a fact that is illustrated by the frequency and intensity of the current geomorphologic processes from the middle and upper basin.

The inclination of the sides strongly contrasts with the even appearance of the interfluves and with the flat one of the valleys' bottom. The variety of the relief forms in the case of the valleys, the origin, the intensity of movements and their amplitude, the energy of the relief, the age and the variety of the absolute altitude of the piedmont back sides lead us to distinguish three geomorphologic regions within the Cândeşti Piedmont. The northern zone with a lot of structural forms, the central and south western zone with landslides, alluvial cones and few terraces and the south eastern zone characterized by the development of the terraces and by the reduction of the slope processes.

The anthropic activity which affects mainly the water meadows as well as the interfluves and the sides generated a series of microforms of a great variety represented by lakes, gravel plants, holes, ditches, roads, etc. The sand and gravel banks are exploited in the minor bed of the Cârcinov, the clay is used for bricks and terracotta production and the artesian waters from Priboieni village are used for irrigation and in household.

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