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THE SPECIFIC CHARACTER OF THE HYDROGRAPHIC BASINS OF VALCEA SUBCARPATHIANS

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Abstract*: The natural, renewable, vulnerable and limited source is represented by water which is an indispensable element for man and for the society, but also the determining factor in maintaining the ecological balance, so it must be protected, treated and guarded accordingly. The waters are part of the state public domain. The preservation, protection and improvement of the aquatic environment, in accordance with the conditions of a sustainable use of water resources are based on the principles of precaution, prevention, to avoid damage at source and the polluter-pays principle. The water resources within the territory of Valcea county are made up of resources of surface water and resources of underground water. All of these provide both the water supply for the population and the industrial and agricultural needs*
Keywords: *water catchment area, runoff, flow, storage lake, indices*

1. Introduction

The hydrographic network of the studied subcarpathic sector consists primarily of the rivers: Oltețul, with its origin from approximately 1600m, in the Cindrel mountains, where it records slopes that exceed 40m/km, the Sub Carpathian area(hills and depressions) then gathers Cornățelul and Tărâia,then Aninoasa and Horezul, Barluiul; Cerna, an affluent of the Olteț river, receives in this region Cernisoara, Igiminea, Draganu; Luncavatul, with the springs beyond 2000 m, collects the Ursanilor and Monastery brooksin the Horezu vacuum; Bistrița, receives Bistricioara and Otăsăul as the most important affluents.

The region is crossed by a network of valleys with a parallel progress until the confluence with the river Olt.The parallelism is imposed by the composition of the geological structures within the same intervalley with materials that are relatively homogeneous and that are carried out towards the north-south direction and partially west -east; they have generated approximately the same morphological overview characters when crossed by the systems of hydrographic basins (the general appearance of the valley, symmetry or asymmetry, the presence of terraces, river meadows,etc.).

Among others we can distinguish the following geological structures located in the southern part of the crystalline-mesozoicformations in the mountainous area : sarmatians(sandy diorite sand-insertions with sand and sandstone); meotiens (diorite sand,sandy diorite sand and clay diorite sand); dacians (sandy diorite, sand, black clay); levantins (sandy clay, sand, gravel).

The studied area represents a form of relief between the mountains and the low regions from their outside part, the northern limit being a space of connection of the mountain peaks located in the north with the subcarpathianhills situated in the south at over 400 m. The southern limit towards the Getic Piedmont is more difficult to specify, the shift from one unit to another is being made gradually, without obviousdistinctions. Generally, along the passing strip between the two units, the sedimentation groups have monoclinal layout, without being affected by important tectonic accidents which might determine morphological changes. After L.Badea,1970, the Cuaternar limit also represents the southern limit of the subcarpathian hills idesand the eastern and western limits of the concerned area, given by the valleys of the Otasau and Oltet are conventional.

Generally the Cuaternar is represented by terraces inclusively deposits of terrace - Ilie Mircea,1947; Popescu Gr.(1955); Motas I.(1955), L.Badea,(1967).

The petrographic and tectonic complexity determined the presence of a relatively soft relief with some bumps imposed by the structure and tectonics, on which the modeller agents have acted differently.

2. MATERIALS AND METHODS

The study of driver basins Tărâia, Cerna, Cernișoara and Otasău, stand out by the autochthonous affiliation (Tab 1), the middle course of the river Cernișoara, but also allochthonous (Olteț, Luncavăț, Bistrița) the rivers belonging to the " dependent hydrographic systems ", which flow into other rivers- (I.A Pisota,1995), the main collector being the river Olt. The main rivers that pass through the region(Olteț, Cerna, Luncavăț, Bistrița) have their springs in the Capătânei Mountains to which is added a secondary network sufficiently developed.

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Table 1 The main rivers from the subcarpathian area

The river	The springs	Spilling	The length in the Sub Carpathian region	Autochthonous /allochtonous
Olteț	The Căpățânei mountains	Olt	26,7 Km	autochthonous
Tărâia	The Căpățânei mountains	Olteț	24,1 Km	allochtonous
Cerna	The Căpățânei mountains	Olteț	29,4 Km	autochthonous
Cernișoara	The Căpățânei mountains	Cerna	16,4 Km	allochtonous
Luncavăț	The Căpățânei mountains	Olt	40 Km	autochthonous
Bistrița	The Căpățânei mountains	Olt	36 Km	autochthonous
Bistricioara	The Căpățânei mountains	Bistrița	22 Km	autochthonous
Otăsăul	The Căpățânei mountains	Bistrița	25,3 Km	autochthonous

Tab. 2 The average multiannual leak

River	**Imed.am²/av m.Km**	**Altitude of the point**	**Hmed(m)**	**Qv** mc.s.	**Xv** mm/year	**Y0** mm/year
Bistrița (Frâncești)	234	300	997	3,97	1000	501
Tărâia	242	359	1403	2,62	1080	675

I med"I/AV (the average slope of the collecting basin)
H med (the average altitude of the basin)
Xv- the average amount of the annual rainfall(mm)
Y0- the average multiannual leak

In the region can be found relief levels that mainly delimit the presence of some geomorphological details such as: the level of the highlands and peaks located around the value of 600 ± , and the level of the dingle and of the dingled corridors which are situated at around 400-500m. Within the limits of the second level, can be identified ,locally, an increase in the values of the hydrographic basins density, particularly in the areas of convergence of the rivers (Miloștea-Horezu-Bogdanești-Costești) which increases the image of a slightly fragmented area in which are associated relatively callow areas with heights covered with vegetation and easy-to-cross.

But in the geomorphologic profile of the entire region are found variations in altitude from less than 375m (Olteț), up to 623m (Vf.Rusița) located on the interfluve between Cernișoara and Luncavăț (Figure 1) also marking the presence of some topographic slopes relatively emphasized.

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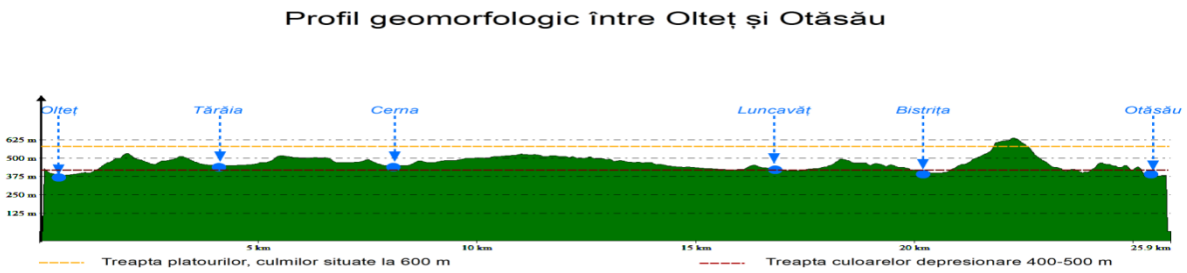

Figure 1- The Geomorphologic profile between Olteț and Otăsău

Thus, in the profile of the interfluve Olteț-Tărâia, up to 500 m there are fleet slopes associated with a sharp erosion that can be also noted and within the limits of the interfluves Tărâia-Cerna and Cerna–Luncavăț, which record the same characters (Figure 2) and only at 300-350m the slope slows down.

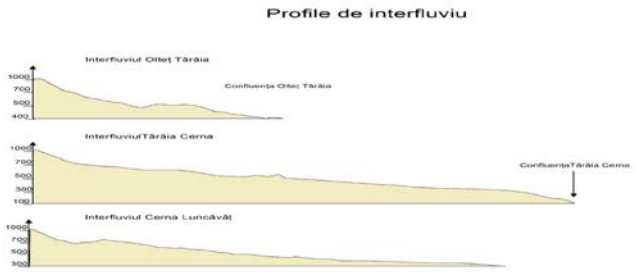

Figure 2 –Interfluve profiles: Olteț, Tărâia, Cerna, Luncavăț

Taking into consideration the layout of the affluents as related to the main route, we can identify a divergent hydrographic basins network and a converged network. In the subcarpathian depressions Polovragi - Horezu Male-on the pleistocene deposits (gravel and sands) there is a developing hydrographic network in a parallel position (NV-SE), with a low degree of sweep and undoing. Analyzing the characteristics listed in the table below results that Cerna has the greatest index of sweep and undoing. When entering the area of the subcarpathian hills, including those formed on the anticlines and saddles, up to the limit of the southern part of the Sub-carpathians the rivers increase their degree of sweep.

As regarding the density of the hydrographic network (Figure 3) there are values of more than 5 km/kmp between Cernei Valley and Luncavățului Valley (Măgura Slătioara), as well as on the Bistrița Valley between Bărbăteşti and Pietrari and average values along the middle course of these rivers.

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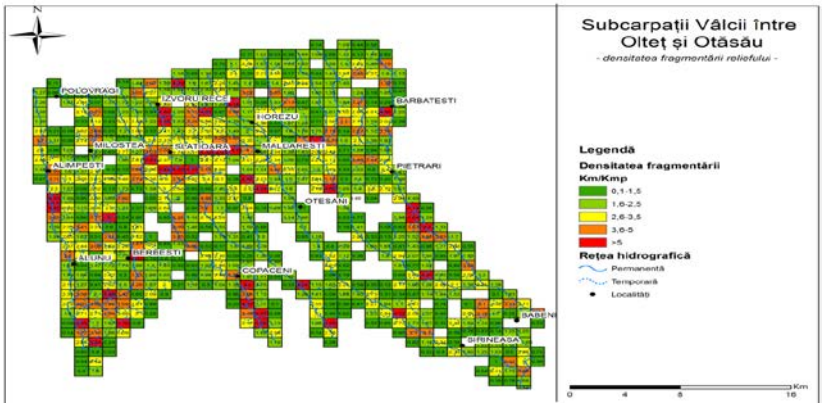

Figure 3 The density of fragmentation

3. RESULTS

With a value of less than 10 l/s/Kmp, as it represents the leak within the submountain-Subcarpathian area and a maximum volume in May and minimum in October, the average flows at the hydrometric stations look as it follows: between 1994-2005 the annual average flow has seen a maximum quota in 2005 on all the rivers which cross the region , at Băbeni-Bistrița (on the river Bistrița), the values being of 8,331 m³/s. Very high values have been registered on Oltețul river – Nistorești station
(3,394 m³/s), Otasaul at Pausesti (1,619 m), etc. (Table 3). The minimum leak is recorded in summer, early autumn and winter. In these periods there are predominantly underground supplies, the secondary elements of the hydrographic system becoming drain.

Table 3 Annual average flow at the hydrometricstations of Vâlcea Subcarpathians

Year / Hydrometric station	Genuneni/Bistrița	Babeni/Bistrița	Pauşeşti/Otăsău	Nistoreşti/Olteț	Polovragi/Tărâia
1994	1.311	1.755	0.221	1.448	0.041
1995	2.648	3.397	0.589	1.7808	0.097
1996	2.382	3.429	0.546	2.2375	0.226
1997	2.612	3.545	0.487	1.7346	0.163
1998	3.399	4.816	0.744	2.033	0.25
1999	3.502	4.929	0.783	0.7835	0.21
2000	1.759	2.276	0.202	1.648	0.105
2001	2.028	2.461	0.2009	1.394	1.394
2002	1.847	2.569	0.336	1.833	0.08

There are a few characteristic elements for the hydrographic systems which drain the region concerned: taking into consideration the analysis of the average flow over 12 years, there is a big difference between the values of the maximum flow, generally of pluvial origin (Hydrology Study,1964), on the analyzed rivers, thus: 8,331 m³/s - Babeni-Bistrița and 1,394 m³/s - Polovragi-Taraia. The map of the fragmentation of the relief may be taken into account when assessing the density of the network, because are taken into consideration the valleys in which there is a temporary flow (permanent and temporary hydrographic basins network).The difference lies on the following situation : the hydrometric station on the Taraia is located approximately 9 km from the source and the one on Bistrița is at 30 km from the source. Comparing the two hydrographic basins from the point of view of the affluents which may contribute to the amount of flow of the manifold river, Bistrița up to the confluence, has a catchment area of over 240 kmp and Tărâia below 30 kmp. Tărâia has a single manifold in the upper basin, and Bistrita 21, from which 17 in the mountain are and 4 in the Subcarpathian area. At approximately the same quantity of rainfall within

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the limit of the catchment area of the quantity of water collected in the mountain area and even in the Subcarpathian area is much higher and also reflected in the flow. There are differences between the minimum values too, so: Bistrița (1,311 m³/s) and Tărâia (0,041 m³/s). This thing shows that both the average values and the maximum values of the average flows decrease unequally from east to west.

The variety of the relief, of the composition of the geological formations, the altitudinal sequence of the vegetation linked especially to the climate, have recorded generally on the leaks and particularly on the flows, visible differences, at least between 1994-2005, some of them have kept the annual spread in some limits close to 2000-4000 m³/s (Bistrița); 1000-3000 m³/s (Oltețul); 0,200-0,700 m³/s (Otăsăul). The rivers which cross the region, most of them coming from the mountains, get here with characteristics imposed by the mountain conditions (Geography of Romania,1992), the subcarpathian one being added or partially influencing the leak. The winter phenomena install in the second decade of December and disappear in the third decade of February, the average length of the frost phenomenon being of approximately 30-60 days. From the point of view of turbidity, this varies between 500 and 5000g· m^3.

Concerning the kinds of river conditions, the studied area can be classified into heavy spring-winter rivers and summer floods and nivo-fluvial supply. The period of small rivers is recorded in summer-autumn (August-September) with a high volume of flowing in March-April and a minimum one in September-October.(Figure 4).

The maximum flows are caused by rain in 70% of cases.

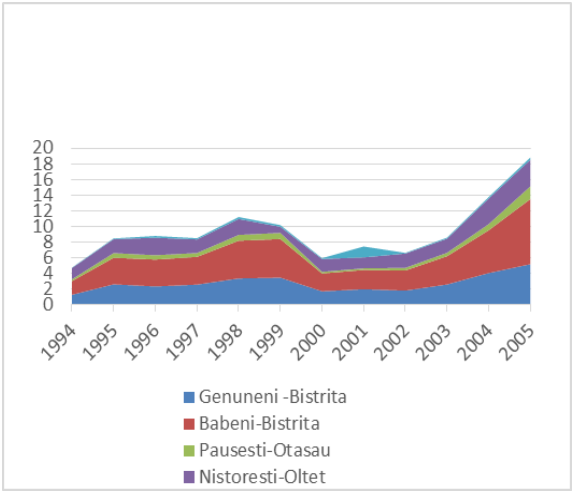

Figure 4 Annual average flow at the hydrometric stations of Valcea Subcarpathians

Taking into consideration the tectonic and the very extremely complex structure and sufficiently irregular from a sector to another, the erosion manifests differently but intense, and at the same time with the degree of modernization, to which shall be added the interventions and their consequences imposed by the man in the biodiversity (deforestation, hydrotechnical facilities, reservation basins, etc.) (Table 4).

Table 4 Monthly and seasonal average flow (% 1950-1967)

					V	VI	VII	VIII	IX	X	XI	XII	I	P	V	t
Bistrița/Genuneni	6,27	7,0	8,50	14,4	17,3	12,5	River	I	II	III	IV	5,90	19,2	40,2	26,4	14,2
Olteț/Nistorești	4,82	5,40	7,32	14,3	20,8	14,6	8,26	5,55	4,15	3,79	5,36	5,65	15,9	42,1	28,4	13,3

Conclusion

Generally the rivers which cross the region of the gate, besides the hydrological characteristics of the crossed area (the mountain area, the depression area including the heights of low-altitude within their limits, the area of the subcarpathian hills with heights of over 500 m and the area of southern piedmont hills (L. Badea, Constanța Rusanescu, 1970) in the chemical content of the waters are found mineral substances too that belong to the area, as well as the sulphurous ones (on Taraia at Aricești, in waters of Cerna atSlătioara in the watersof Otăsău at Costești and Pausești).

As a general conclusion, the hydrographic dynamic manifests somewhat differently on the two morphogenetic complexes, namely the mountain complex and the subcarpathian complex (the Piedmont).In the first complex can be found a certain hydrographic extension with possible reshuffling facilitated by the global climate conditions, but also by the anthropogenic intervention (deforestation, the increasing of the grazing field, etc.) and the subcarpathian complex -Piedmont where there is a certain dynamic balance with all the increases and decreases that can be noticed in the hydrological parameters (M.Grigore,I. Marin,1979).

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The graph of the annual average flows notes a period of growing up to the year 2000, after which followed a decrease of a few years accompanied by a spectacular increase in 2005.
The presence of the meeting areas of the waters (Miloștea, Horezu, Costești for the sector we are dealing with) refers to the areas of subsidence(L.Badea 1967), linked to the neotectonic join to the presence of the basical local level, the river Olt, which has visibly attracted at least the hydrographic systems located to the east of Luncavăț, creating them and a river meadow too (major river bed) which might be confused with that of the Olt river which broadens a lot to the south of the confluence with the Otasău river. The parallelism of these rivers towards Olt is undoubtedly an effect of the neotectonic upon the relief.

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