RELATIONS BETWEEN HYDROLOGICAL AND GEOMORPHOLOGICAL PARAMETERS OF A RIVER BASED ON A PARTICULAR CASE STUDY FROM ROMANIA

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Abstract: The paper proposes an almost unique aproach of studying the relation between the geomorphology of a river basin and its hydrological characreristics. It is "almost" unique because except Ialomita river, in Romania there isno other similar study.

The Casin valley was chosen for its paritcular characteristics which is that on a relative small river length and small basin surface, the river crosses through a mountaneous section (the eastern Carpatians), a so called zone of "Under – Carpatians" and a dpressed area, all of these with different gelological ages. Another reason for choosing this river was that it has no antropic pressure factor, except the digs from the town Onesti, which were build after the catastrophic floods from 1970, but which do not influence very much its natural flow.

The paper was realized based on the modern technology that is using the PC with the Microsoft Office – Excel. With its aid different relations between the geomorphological characteristics of the basin and the hidrological parameters of the river were calculated and represented as trendlines on specific charts. These charts give a more comprehensive image of the mutual influences between geomorphological and hydrlogical parameters, between river and landscape as entitities, that is the landscape looks the way it looks partly because of the river and the river flows the way it flowsdue to some geomorphological aspects.

The basic material were topographic maps of the region (1:50000; 1:25000), geological maps (1:200000), and terrain work. Thedata gathered in this way were than organized and introduced in the computer for a deeper analysis.

The results were sometimes as expected, but quite often it happened to discover that nature doesn't always respect some general geomorphological laws. It is this contradiction between known and accepted theory and the real natural behaviour of the river, that the paper is mainly concerned about. Thus it goes on the field of many controverses between specialists and it tries to give an objective opinion over the particularities of the Casin river and its basin, characteristics which can be then generalized for all the similar rivers that cross the Eastern Under – Carpatians.

1.Introduction

In Romania there is an extreme low study of the relations between geomorphological and hydrological parameters. Thus it was considered intereseting to present a case study of a river basin with a relatively small area, a study which was formerly done only for large basins.

The present paper is based on the geomorphological analysys of the data from the field and from the topographic and geological maps. The analysis is made on river sectors, defined as beeing parts of the main river between two confluences with its tributaries, thus beeing obtained a detailed geomorphological analysys on the valley, in this case the Casin valley.

BEZIEHUNGEN ZWISCHEN HYDROLOGISCHEN UND GEOMORPHOLOGISCHEN PARAMETER DER GEWÄSSER BERUHEND AUF EINEM STUDIUM – FALL AUS RUMÄNIEN

Kurzfassung: Das Werk schlägt ein Studium, fast einzig in Rumänien, der Beziehungen zwischen hydrologischen und geomorphologischen Parameters eines Einzugsgebiet for. Das ist "fast" einzig weil, der Bach Ialomita ausgenommen, hat man Studien von diesem Muster in Rumänien nicht Verfassen.

Das Casin Tal wurde für seine besondere Charakteristiken ausgewält, nämlich dass auf einer verhältungsmässig kurzen Strecke des Wasserlaufes dieser von einer Gebirgs-zone zu einer daniederligenden-zone überlegt, Zonen mit verschiedenen Alter und geologische Formationen. Ein anderer Grund war dass dieser Wasserlauf nicht antropisch war(mit Ausnahme der Deiche aus der Stadt Onesti welche aber einen mindestenmässigen Einfluss haben).

Das Werk wurde des Programs Excel durchgeführt mit dessen Hilfe verschiedene Korelationen zwischen den geomorphologischen Charakteristiken des Einzugsgebiet und dessen hydrologischen Parameter berechnet und trassiert wurden.Diese Diagramms gaben einen viel klarer Ausdruck der gegenseitigen Einflüsse zwischen den hydrologischen und geomorphologischen Parameter und der Beziehung: Wasserlauf-Landschaft-Relief, und deuted die Rolle des Wasserlaufe in der Modellierung des Reliefs und der Geologie so wie die Rolle des Reliefs in der bestimmung des Abflusses.

Die Ergebnisse waren manchmal die erwarteten, es geschah doch often dass die Natur die Regeln, in geomorphologie angenommen, nicht genau beachtete.

Das Werk schlug vor grad diese Wieder sprüche zwischen Theorie und das reale Benehmen des Wasserlaufs und dessen Einzugsgebiet, wie möglich zu erklären. Durch dieses Werk hat man versucht einen obiektiven Standpunkt vorzutragen, im mittel so wie vieler Streitfragen zwischen Spezialisten über die Eigentümlichkeiten des Casin Bach Eizugsgebiet.

Charakteristiken welche nachher für andere ähnliche Einzugsgebiete der Moldauer Untergebirgs-Karpaten verallgemeinert werden können.

2. Short characterisation of the casin valley

The casin springs at an altitude of 1230m, in Vrancei mountains. It has two sectors of gorges, one with 5 km in lenght which begins after 6 km from the spring, at the confluence with Zboina and another one which begins after 13 km from the spring, at the confluence with Bucias river, its main tributary. After this confluence two things change: the geology and the Strahler order, which becomes 5 and will remain like this on the whole river. As for the geology it changes from the grey sandstones to red clay intercalated with Inocerami.

The second gorge sector begins at an altitude of 570m and it ends after 7.5 km at an altitude of 410m. Although the landscape is mainly mountaneous, judging after the altiutde and quite wide flood plain it is obvoius that the casin river enters the Under-Carpatians. On the first terrace of 5m, on the left side of the river the first inhabited areas appear. The terrace of 10 – 20 m is very abrupt and it stays like that till almost the confluence with Trotus river which is where the Casin ends its journey.

From the confluence with Curita river a series of 5 major meanders begin, the river changing its orientation from E to W with 180^0; after that it comes back to the former orientation of 50 – 60^0 towards N, but only for 1.5 km after which it flows directly to N direction.

The confluence with Trotus river is found on the terirtory of Onesti town, which is at its turn placed in the depressed area of Casin. The latter is more a gulf of the Trotus river than a real depressed area. The Casin depressed area is a Myocene age syncline is found under the Paleogene flysch. In the inferior Lyasic the valley is invaded by the marine waters, the exundation taking place in the old kymeric movements (medium – superior Lyasic), together with the general rise of the Eastern Carpatians.

The Casin valley has been also afected by the Cenomanian trangression, the external flysch beeing eventually exundated and folded in the Neogene.

In the Plyocene, three erosion levels formed: Corni erosion level at 600m, Ghidarani between 500 – 600m and Grumazesti at 400m.

The Vrancei mountains, the spring place of Casin has an ondulated relief, which is in fact a series of alternating synclines and anticlines, oriented from N to S, and made from marls, conglomerates and clays. The relief has this aspect only on the peaks, and not on the valleys.

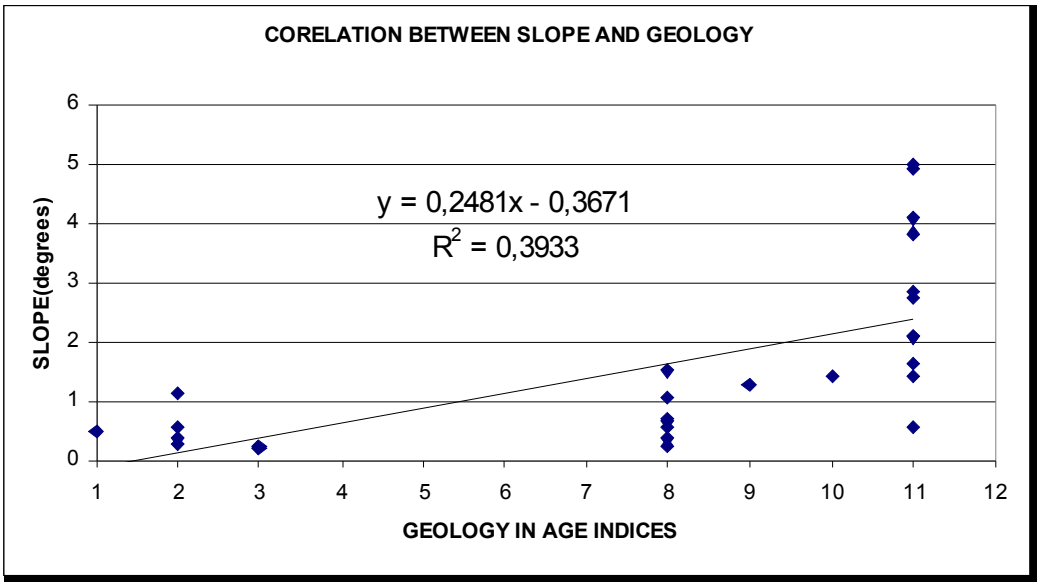
In the oligocene sediments areas, where the sandstones are fewer, and the marls appear more often, a relief of coasts and ridges is present, as it is Bucias river area. In what concerns the age, the relief is relatively new and it belongs to the Quaternary. The relief of Casin valley is affected also by present geomorphological processes like landslides and gullying. These have taken place especially in the very rainy years like 1936 – 1942, 1955 – 1956, 1968 – 1971.

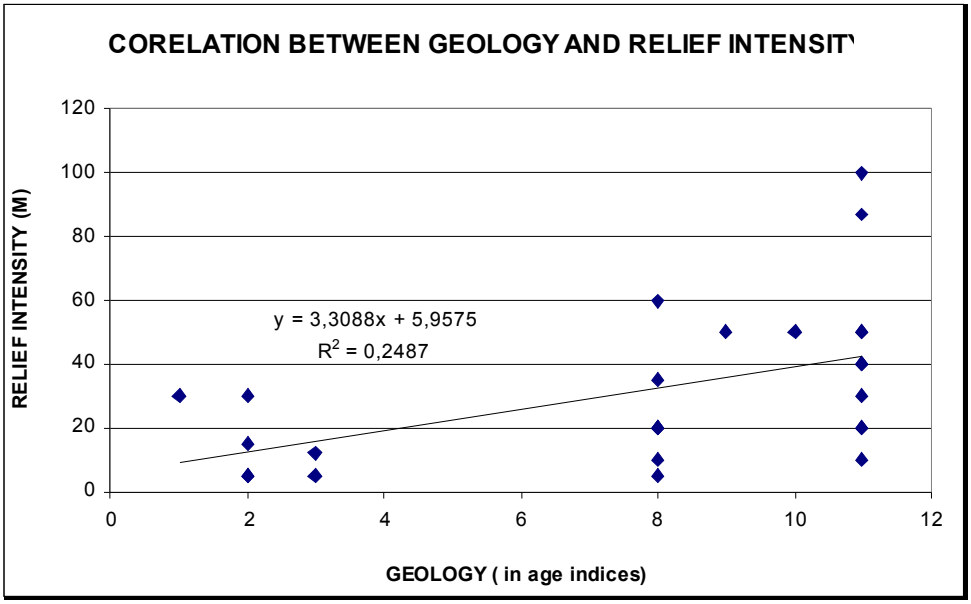
3. The paper's methodology

The analysis of the geomorphological parameters has begun by deligniating the river sectors on the topografic map; it shall be mentioned that this deliginiation has been made only between tributaries bigger than 2nd Starhler order, because those of the 1st Strahler order were too small and very much alike in characteristics. Than the river and its sectors were classified according to Strahler and Sreeve methods, together with the calculation of the lengtht, maximum and minimum altitude, orientation, slope, and relief intensity. The last two parameters were calculated by computer as tangent of the ratio between length and relief intensity. From the geological map there has been observed every segment's geology, with a total of 11 geological units. These been units have assigened numbers from 1 to 11, in order to be processed on the PC, 1 beeing the newest and 11 the oldest. These data are presented in tabel 1. Based on this tabel, using Excel 2000, some charts have been made to show the relations between these parameters.

4. Results

CASIN VALLEY										
NO.	**Stralher**	**Shreeve**	**L(m)**	**H (max)**	**h(min)**	**Orientation (degrees)**	**Relief intensity (m)**	**Slope (^{0})**	**Total lenght**	**Geology**
1	2	4	1000	1057	970	90	87	5	0	11
2	3	8	400	970	950	0	20	2,87	1000	11
3	3	11	350	950	920	4	30	4,92	1400	11
4	3	19	700	920	870	1	50	4,1	1750	11
5	3	20	800	870	850	23	20	1,43	2450	11
6	3	36	1100	850	810	60	40	2,08	3250	11
7	4	50	2100	810	710	95	100	2,73	4350	11
8	4	59	1000	710	700	120	10	0,57	6450	11
9	4	66	750	700	650	90	50	3,83	7450	11
10	4	68	1100	650	610	90	40	2,08	8200	11
11	4	74	1400	610	570	55	40	1,64	9300	11
12	4	78	2250	570	520	57	50	1,27	10700	9
13	5	109	2000	520	470	83	50	1,43	12950	10
14	5	123	3250	470	410	78	60	1,06	14950	8
15	5	130	1600	410	390	30	20	0,72	18200	8
16	5	133	750	390	385	55	5	0,38	19800	8
17	5	135	3000	385	350	15	35	0,67	20550	8
18	5	140	750	350	330	30	20	1,53	23550	8
19	5	148	2250	330	320	45	10	0,25	24300	8
20	5	150	2000	320	300	85	20	0,57	26550	8
21	5	186	750	300	295	65	5	0,38	28550	2
22	5	188	3000	295	265	20	30	0,57	29300	2
23	5	202	750	265	250	0	15	1,15	32300	2
24	5	222	1000	250	245	10	5	0,29	33050	2
25	5	236	3500	245	215	15	30	0,49	34050	1
26	5	239	1250	215	210	60	5	0,23	37550	3
27	5	248	3500	210	198	355	12	0,2	38800	3
				198					42300	





5. Conclusions

The careful analysis of the parameters of the river sectors, by means of trendline charts, was done in order to see what elements influence the relief intensity and the slopes, two of the main elements that influence at their turn the final aspect of the relief.

The corelation with the river sectors length is important because a river sector is the part of the river between 2 tribuatries, which means that if a sector is longer, there fewer tributaries for that zone and so the relief is les fragmented.

In order to see where the sectors are longer or shorter, there have been made corelations between length and Strahler order, beeing known that generaly a small Strahler order means a short sector. As it was shown in the charts in the case of Casin river these parameters do not depend very much on each other, and this is why the relief is so less fragmented.

As it was presented in the intrductory characterisation of the valley of Casin river – it has a lot of rapids, gorges and waterfalls up to 20 m high – these facts are also proved mathematically by almoost perfect corelation between Strahler order slope.

Relief intensity, an indicator of the vertical fragmenting, is determined by the geology as it is seen in the corelatioon made between the geology and relief intensity, that is especially on river sectors of the same Strahler order where the R^2 is almost 1.

The Shreeve magnitude is also an indicator of the relief intesity, because it represents in fact the number of the first Strahler order rivers and river sectors. The fact that it has no relation with the other parameters shows again the masivity of the relief.

As for the slopes, both at analysis on the whole basin and for river sectors of the ssame Strahler order, the R^2 has low or medium values, which means that geology has or has had a medium importance in detremining the landscape.

As a personal conclusion, analysing the Curita (a tributary of Casin) river's orientation which at the spring flows towards Oituz basin turning then with 180 degrees towards Casin, as well as the orientation of Casin river in the final sector, and taking into acount the very narrow interfluve and the closeness of their confluences with Trotus river, it is possible that eventually the Oituz river would capture Casin river.