Water resources and wetlands, *Editors: Petre Gâştescu, William Lewis Jr., Petre Breţcan*
Conference Proceedings, 14-16 September 2012, Tulcea - Romania
ISBN: 978-606-605-038-8

BRATIA HYDROGRAPHIC BASIN, MORPHOMETRIC FEATURES

Mihai Dumitrescu
German „Goethe" College, Bucharest

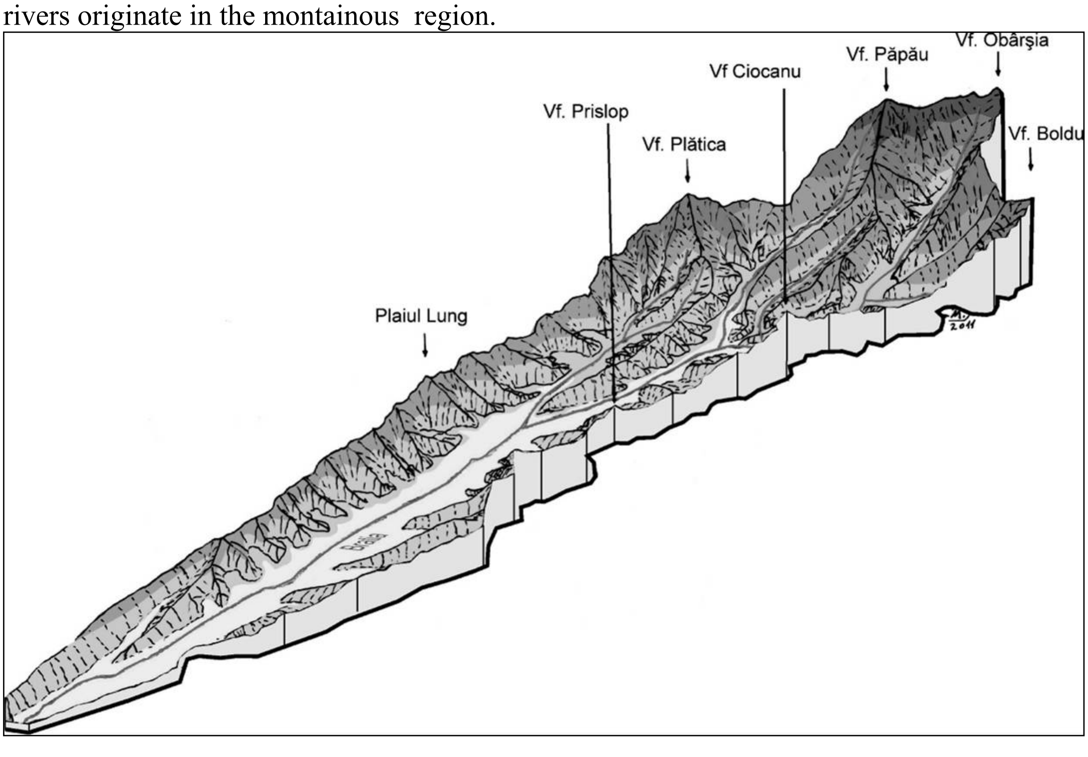
Abstract

In the hydrographic basin of Râul Doamnei stands out in axial plan Bratia hydrographic Basin which is a tributary of the Râul Târgului overlapping three major units of relief: Iezer Mountains, Muşcelele Argeşului, Gruiurile Argeşului. They influence the morphometric features of the basin. The Bratia springs can be found under the peak Obârşia Iezer of 2300 m altitude and under the saddle Curmătura Groapele of 2038. In the Subcarpathian sector, the relief morphology is complex, given the presence of folded structures located across the river, the anticline Măţău - Ciocanu and syncline Aluniş and Câmpulung being reflected in the basin through parallel valleys, river catchments and sub-Carpathian depression. The monotonous landscape of Piemont Getic is noticeable in the landscape due to a broad valley corridor. Thus, we notice the presence of a large confluence in the sector of the sub-Carpathian basin, even if Râuşor and Brătioara have their springs in the mountain. Bratia basin extends between an altitude of 2300m and 320m in Obârşia Peak from its outfall into Râul Tâgului; this having an amplitude of 1980 m between maximal and minimal level of the basin. The main affluents of Bratia are: Brătioara on the left side and Năvrapul, Râuşorul şi Slănicul at the right side. Each participant basin occupies different regions, due to the length of its flow, geological stratum and morphometric features of the landscape. Thus Năvrapului Basin occupies 5%, Brătioara basin 9%, Slănicul basin 13% and Râuşorul Basin 17 %.

Keywords: Bratia hydrographic Basin, morphometrics, affluents, coefficients

INTRODUCTION

Within the large Doamnei river basin the Bratia hydrographic basin, which is a tributary of the Târgului river, can be noticed in the center of it, covering some major landscape units such as the Iezer Mountains, Argeşului Hills and making a major impact on the morphometric characteristics of its basin. The river originates in the Obârşia Iezer (at an altitude of 2300 m) and in the saddle Curmătura Groapelor (at an altitude of 2035 m). In the Carphatian foreland area the landscape morphology is very complex due to the folded structures which cross the basin (the Măţău – Ciocanu anticlines and the Aluniş and Câmpulung synclines) and which result in parallel running river valleys, catchment areas and Carpathian foreland depressions which caused changes in drainage pattern *(N. Muică 1971).*The plain landscape of the Getic Piemont is disturbed by a large river valley within the river basin. Due to this situation great tributaries junctions are to be noticed within the basin in the Carpathian foreland area even if Râuşorul and Brătioara rivers originate in the montainous region.



The Brătia river stretches from 2300 m (the altitude of the Obârşia peak) to 320 m where it flows into the Târgului river, which means a difference of 1980 m between the maximum and minimum height level. Among the most important tributaries of the Brătia river there are Brătioara on the left side and Năvrap, Râuşor and Slănic on the right side. Each river basin that composes the Brătia hydrographic basin weighs differently due to their course length, geological layers and the morphometry of the landscape. For example the Năvrap river basin represents only 5% out of the whole Brătia hydrographic basin, Brătioara river basin 9%, Slănic river basin 13% and Râuşor river basin 17%. The Bratia hydrographic basin consists of the main river course, Brătia and its tributaries: Brătioara on the left side and Năvrap, Râuşor and Slănic on the right side. *Fig. 1*. To find out the morphometric features of the Brătia river basin some formulae are to be applied. According to the **pie diagram** the total area of the Năvrap river basin represents 5%, followed by the Brătioara river basin 9%, then Slănic river basin 13% and the Râuşor river basin 17%. The rest represents interbasin areas on the left as well as on the right which represent 28%. *Fig 2*.

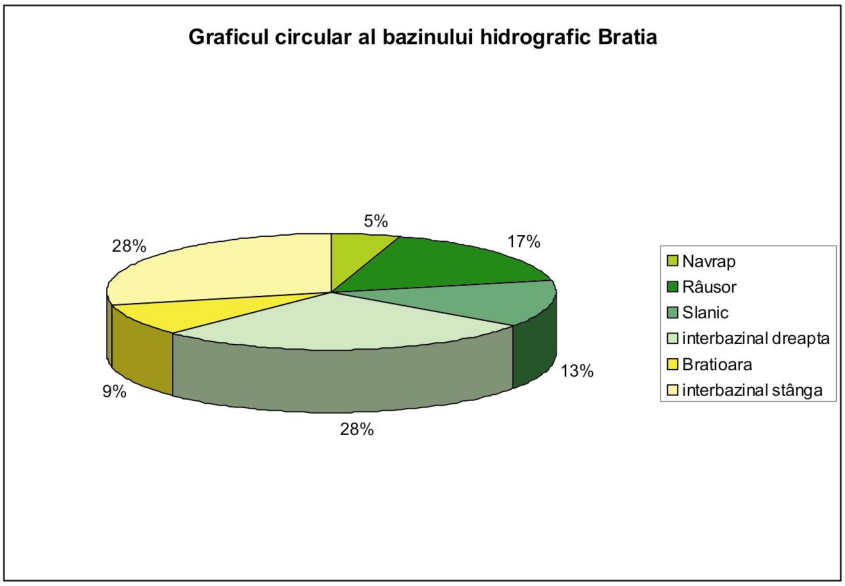


Figura 2. The pie diagram of the Brătia hydrografic basin

- **The meandering coefficient** can be found out by applying the following formula:
  Ks= Ls/Ld = >1

where:
Ks represents the meandering coefficient
Ls represents the real meandering river course
Ld represents the straight river course
The result is:

$$Ks = \frac{58,5}{49,8} = 1,17$$

- **The length of the watershed divide line** was measured using computer programmes and the result was 125 Km.
- **The average slope of the watershed divide line:**

$$P = \frac{2 \text{ x } 2296}{125} = 36,73$$

The coefficient of the watershed divide line extension was calculated using the formula M=P/S where M is the coefficient of the watershed divide line extension, P is the length of the watershed divide line (km) and S is the length of a circle circumference; this can be also expressed as $M = \frac{P}{2\sqrt{\pi} \text{x F}}$; where F is the river basin area. Therefore the result is $M = \frac{127}{2\sqrt{3,14} \text{x } 360}$ so M= 2135. Since the coefficient shows a high value, it also indicates a slower runoff process.

The average height of the watershed divide line is also worth to be known since it indicates the raining status as well as the distribution of the climatic differences within the river basin. It is calculated using the formula: $H = \frac{Hmed + hmed}{2}$, where Hmed is the average height of the elevation and hmed is the average height of the saddles, therefore Hmed = 1366 and hmed = 1234. Consequently $H = \frac{1266 + 1234}{2}$ =1250.

The shape of the catchment area is elongate, having the greatest extension in the upper and intermediate river course the most important tributaries being situated on the right side. Applying the coefficients used by S.A. Schumm for the calculation of the elongation ratio (R_a= D_c/L,, where Dc is the circle diameter having the same area as the catchment area, and L is the length of the catchment area), then Ra = 21,42/59 =0,363 which represents the value of the elongation coefficient. The value indicates a great elongation of the catchment area since the values below 1,27 are specific for elongate basins.

Morphometrical data

The length of the Brătia river basin is 50 km from north to south. The length of its tributaries were determined by using both the computer programmes as well as the topographical maps at a scale of 1:25000 and the values are as follows:

Bratia = 58,5 km
Năvrap = 9,51 km
Râuşor = 20,4 km
Slănic = 18,1 km
Brătioara = 7,27 km

The maximum width of the river basin equals 14 Km from east to west.

The asymmetry coefficient is determined by the formula Kas = 2*(Fs-Fd)/F where Kas is the asymmetry coefficient, Fs is the area of the left river bank, Fd is the area of the right river bank and F is the area of the river basin. Applying the formula the result is Kas = 2*(135-225)/360 = -0,5, so the asymmetry coefficient equals 0,5.

The slope of the river basin is determined by the formula

P = H1-H2 / D where
H1 is the altitude at the origin of the river.
H2 is the altitude at the mouth of the river.
D is the drainage density measured in km/km²
By applying the formula the result is
P = 1900-322,5/ 58,2 = 26,96% which represents the slope of the river basin.

The drainage density

The drainage density is calculated by using the following formula
D= ΣL/F km/km² where:
D is the drainage density measured in km/km²
L is the total length of its tributaries measured in km
F is the area of the river basin measured in km²

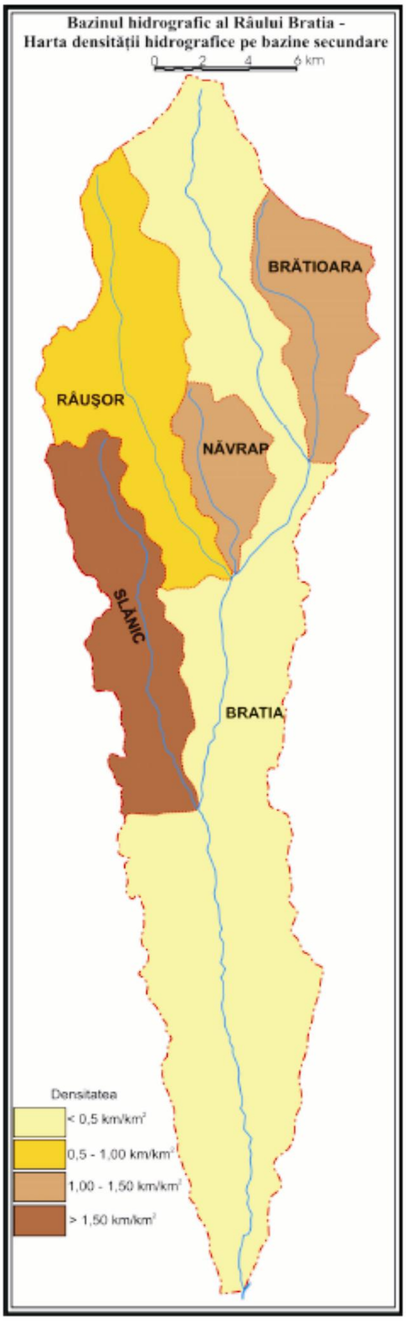


Figura 3. The hydrographic density map

Therefore:
Râuşor river basin = 23+ 20 km = 43 km
Năvrap river basin = 8 + 10 km = 18 km
Brătioara river basin 33 + 7 km = 40 km
Slănic river basin 11 + 18 km = 29 km
Bratia river basin 28 + 59 km = 77 km
To find out the drainage density the formula was applyied and the following results were determined:
Râuşor 43/ 61 = 0,704 km/km²

Năvrap 18/18 = 1 km/km²
Brătioara 40/32 = 1,25 km/km²
Slănic 47/ 29 = 1,62 km/km²
Bratia 77 / 202 = 0,381 km/km²

Therefore the highest value belongs to the Slănic river basin (1,62 km/km²), then it follows Brătioara river basin 1,25 km/km² and Năvrap river basin 1 km/km². The lowest values belong to Brataia river basin 0,381 km/km² and Râuşor river basin 0,704 km/km².

The hierarchy of the drainage pattern

According to Horton-Strahler method which was used for hierarchy analysis the maximum order in the basin is the 5-th which is to be found at the junction of Brătioara river with Bratia river. Upwards to the junction Brătioara reaches the 4-th order, while Năvrap, Râuşor, Slănic, Bahna, Ulita and Poienița reach the 3-rd order. The rest of the tributaries being of the 2-nd and 1-st order. *Fig 4.*

The hydrographic representation of the Bratia basin

While analysing the hydrographic representation of the Brătia basin one cannot help noticing the greater length of the tributaries on the right side compared to the tributaries on the left side. For example on the left side Brătioara is 7 km long and its tributaries Clincea is 5 km long and Turda is only 4 km long. Downstream there is Satului valley which is 5 km long and Ulita which is the same length. Only the Valea Mare is 7 km long. On the right side Năvrap is 10 km, Râu□or is 21 km, Slănic is 9 km and its tributaries Slănicul Mare which is 9 km and Slănicul Sec which is 8 km. Downstream there is Băj valley which is 7 km long. *Fig 5.*

CONCLUSIONS

The landscape units crossed by Bratiei valley as well as by its tributaries which form all together the above mentioned river basin play an important part in shaping the morphometric characteristics of the Bratia river basin, among which there are to be mentioned the length of the watershed divide line, the drainage density, the peculiarities of the hydrographic coefficients determining the typology of the river basin which in this case belongs to the Carpathian-mountainous foreland-sedimentary deposits type. The asymmetry of the river basin is due to the evolution of the catchment basins in the area, each of which suffering complex evolution at the edge of the Carpathians range and the border of the montainous foreland within the Câmpulung depression.

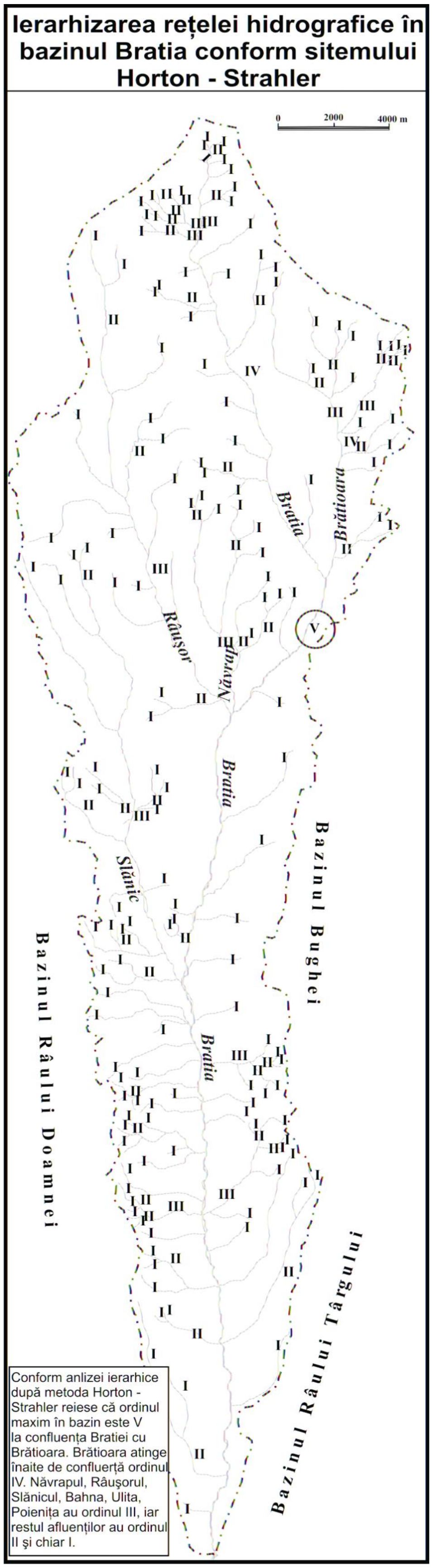


Figura 4. The Bratia hydrographic basin

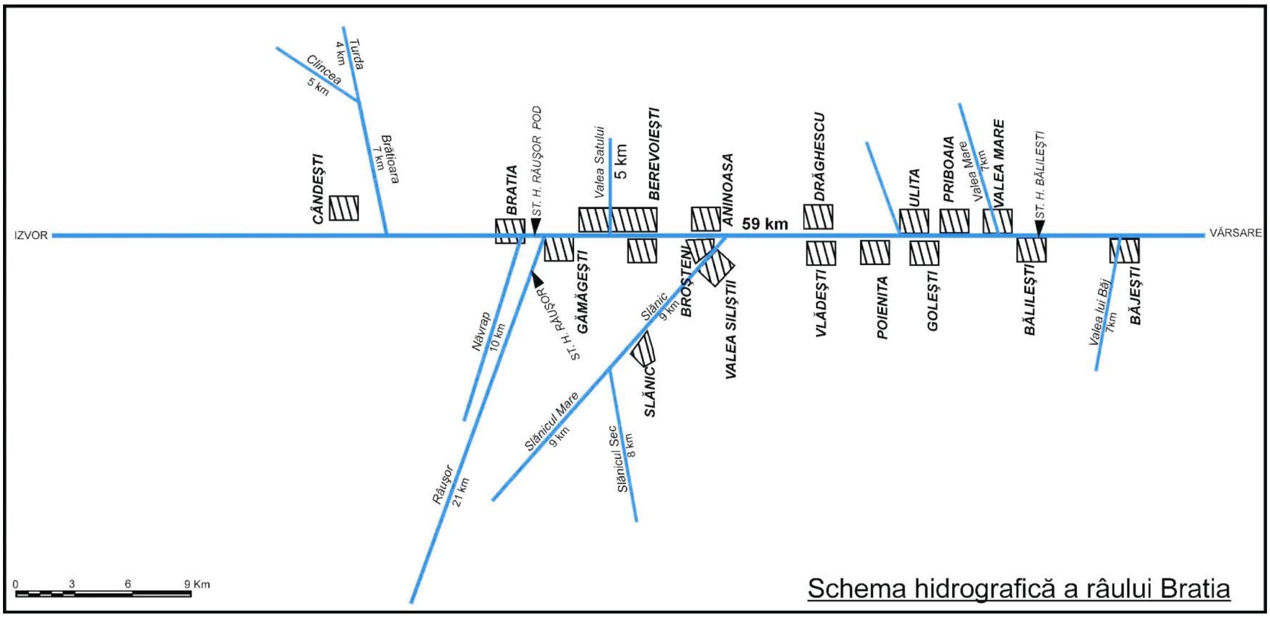


Figura 5. The hierarchy of the river basin Bratia

REFERENCES

Brătescu (1910) Landscape Units in Muşcel, An. G.antr. Bucureşti

Cruceru N. (2008) Introduction in the Romania´s Regional Geography editura Fundaţiei România de Mâine.

Dumitrescu M (2011) Bratiei Valley tourist poket guide, ed Transversal Bucureşti

Dumitrescu M. Dumitrescu Irina Nicoleta (2006) A Practical Guide for Geographical Excursions , editura Detectiv, Bucureşti.

Dumitrescu M., Cruceru N. (2005) The relationship between the fluvial relief and the human impact in the Râu□or river basin. Analele Univ. Spiru Haret

Grigore M. (1979) The Graphic and Cartographic representation of the landscape units, Bucureşti; Ed.Academiei,

Ielenicz M. (1996) Romania´s Hills and Plateaux, Univ. Creştină D. Cantemir, fac. de Geografia turismului, Sibiu.

Muică N (1971) Changing of the drainage pattern in the montainous foreland between Dâmboviţa river and Doamnei River. SCGGG, t XVIII, Bucureşti

Nedelcu E. (1967), Morphostructural features of the Iezer Mountain, SCGGG- Geogr., XIV, Bucureşti.

Nedelcu E. Barco Aurelia (1974) The district of Argeş, ed. Academiei Române, Bucureşti.

Posea Gr. (2003-2004) Romania´s Physical Geography, partea I, II, editura Fundaţiei România de Mâine, Bucureşti.

Posea Gr. (1993) Măţăului Foreland, Bucureşti.

Posea Gr., Cruceru N. (2005) Geomorphology, editura Fundaţiei România de Mâine, Bucureşti.

Posea, G.; Popescu, N.; Ielenicz, M. (1974), Romania´s Landscape Units, editura Ştiinţifică, Bucureşti.

Roşu Al. (1980), Romania´s Physical Geography ed. Didactică şi Pedagogică, Bucureşti.

Szepesi A. (2007) The Iezer Mountain- elements of Physical Geography, ed. Universitară Bucureşti.

Velcea, Valeria; Savu, Al. (1982), Geography of the Romanian Carpathians and Montainous Foreland, Editura Didactică şi Pedagogică, Bucureşti.