

## RECENT TRENDS IN RIVER MORPHODYNAMICS OF TURNU ROȘU – CĂLIMĂNEȘTI SECTOR\*

ANCA AFLAT<sup>1</sup>, IOANA CIOBAN<sup>1</sup>, CLAUDIA CRISTEA<sup>1</sup>, V. PETREA<sup>1</sup>

**ABSTRACT.** – **Recent Trends in River Morphodynamics of Turnu Roșu – Călimănești Sector.** Turnu Roșu-Călimănești sector is characterised by a fluvial morphology influenced by numerous conditional factors: lithology, morphometrics and morphology, gradient, sediments, all these creating a transition from the current trends that become apparent in the study of the river morphodynamics. In order to achieve the intended purpose the following objectives were laid down: to improve the methodology of analysis and geomorphological investigation in line with current trends in the field, to highlight aspects of recent morphodynamics, as the study is based on GIS to capture the correlations between the current processes of bed scour and the effects of anthropogenic activities on inland waterway transport sector; to reveal the tendencies of development of riverbeds and slopes. The most obvious human intervention on the river system is the construction of dams (Turnu, Călimănești) and the fitting of artificial lakes (Robești). Olt River has witnessed important features of this type, with an evolutionary trend.

**Keywords:** *aging, the River Olt, trends, sector, natural units.*

### 1. INTRODUCTION

Historical studies on the dynamics of water courses have special attention, on the one hand to reconstruct the natural behaviour of the river, in which case the call to the historic information, cartographic materials, aerial photographs, and on the other, the conditions of the current evolution and on its anthropogenic footprint. The material presents a sectorial analysis of Olt River Valley by highlighting items which give it its individuality, by analysing the behaviour of the minor valley borders over time and an attempt to capture the trends on Olt Valley morphodynamics, in relation to anthropogenic influence in the area, principally through adjustments to the minor riverbed geometry, due in most situations to non-anthropogenic causes (dams, works to strengthen the banks etc).

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<sup>1</sup> *Babeș-Bolyai University, Faculty of Geography, 400006, Cluj-Napoca, Romania,  
e-mail: anca.aflat@geografie.ubbcluj.ro;claudia.cristea@geografie.ubbcluj.ro*

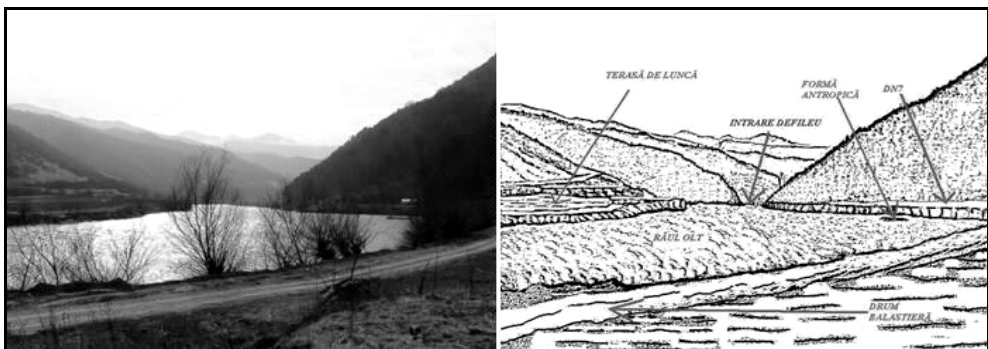
In order to highlight the evolutionary trends in Olt Valley gorge sector (Turnu Roșu-Călimănești sector), it is necessary first to consider the circumstances that determine the conditions of entry and maintain the old river bed processes: liquid and solid discharge entries, but also the slope conditions and the nature and extent of changes in the evolution of anthropogenic-induced characteristics, determining the changes generated by accumulating in the whites of threshold effects, induced the anthropogenic accumulation through dams, gravel pits etc.

## 2. AREAS OF RECENT FORMATION AND RIVER MORPHODYNAMICS

The gorge itself is a breakthrough of 58 km in the narrowest portion of the Southern Carpathians, guarded at the two ends by Boița and Călimănești settlements. Far from being uniform, there are clearly individualized sub-sectors, each corresponding to mountain landscape divisions, as follows:

**2. 1. Turnu Roșu – Călimănești Sector** – constitutes a physical-geographical well packaged in its links with the Lovișteea Basin and the mountains nearby. In the northern part of the gorge, the Boița-Câineni area individualizes a breakthrough of 17 km of Făgăraș and Lotru Mountains, then follows the basin down to the confluence with Lotru River, where Olt River enters the Cozia Gorge, extended over a distance of 16 km down to the area of Turnu.

**2. 2. Turnu Roșu Gorge** – the effective entrance in the Gorge is made in the commune of Boița, which gives a varied landscape, with meadows, the piedmont hills, as Boița village is at the contact area of the basin to the mountain. The slope of Boița reflects the contact between chrySTALLINE-Mesozoic and Neogene formations, evidenced by a steep scarp of 350 – 400 m. At the entrance of the gorge to the right of Greblesti, the slopes are between 15 °-35 ° tilt, which explains the presence of the embankment. The meadow is very limited in this region and in some instances the river digs its path directly through the slope, especially on the left side.



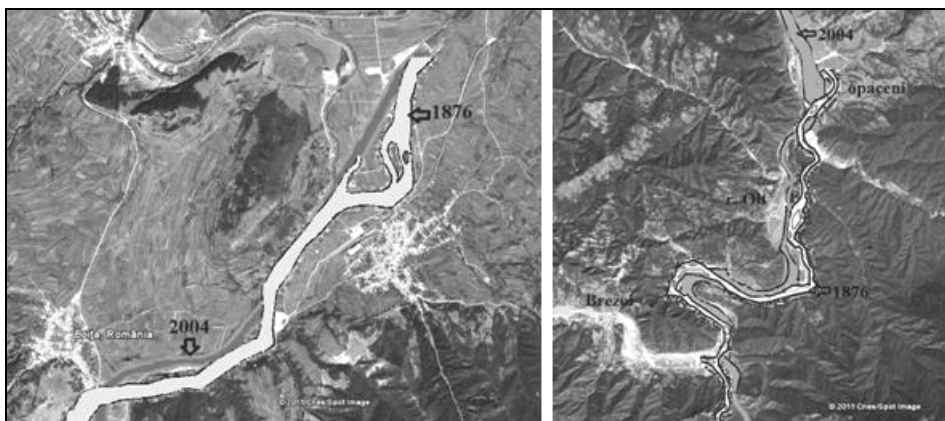
**Fig. 1.** Olt River at the entrance to Turnu Roșu Gorge, Boița (pictured on the ground, processed in GIMP2 outline).

**2. 3. Lotru – Brezoi – Titești Chute** – the sector between Căineni and Gura Lotrului, including the broadenings of Căineni, Balota, Racoviță and Călinești. The river has a skewness at Racoviță (left), where it widens to Copăceni, and from Călinești to Brezoi, the course has a strong meandering to the right, by Corbu, closing towards Golotreni. There Olt River receives one of the most important tributaries, Lotru River (Vărătica), following a significant narrowing. South of the River Greblesti to Brezoi, it has formed a wider opening allowing the location of built-up areas of localities. This is the area of Titești Brezoi Corridor – where the slopes range from  $0^\circ$  to  $15^\circ$  in the meadow and up to  $20^\circ$  -  $30^\circ$  on the hillsides.

**2. 4. The Cozia Gorge** – between Gura Lotrului and Călimănești, highlights a narrowing up to the localities Căineni – Cozia Călimănești – then, with the demise of the hillsides, one notices the presence of massive escarpments whose degree of inclination surpasses  $35^\circ$ . This is the range with the most active slope processes, generally, due to the gravitational gradient of the slope of the landscape. Descending towards Cozia and Căciulata, Olt River receives Căciulata tributary, changing over to the left, and forming a broad bend. One notices the presence of an improved island (Ostrov Convent). At the gorge exit (Călimănești), Olt River Valley widens considerably.

### 3. MEASURES FOR UPGRADING AND REGULARIZATION OF THE TERRITORY

The most important morphological modifications of Olt River system occur at the level of accumulation and erosion processes in the riverbed, the effects of meandering, unplaiting or conversely by deepening scour, both as a result of anthropogenic activities, as well as during high water or significant floods, as a result of large flow rates passing the bed in a relatively short time, but they occur at irregular intervals. Stronger flash floods for the analyzed sector were recorded at: Căineni –  $Q_{max} = 2580 \text{ m}^3/\text{s}$ , 1975-1800  $\text{m}^3/\text{s}$ , 7-May 13, 1981-1380  $\text{m}^3/\text{s}$ , 1941, 1950, 1970 and 2003). The average flow of Olt River under normal conditions does not exceed the  $93 \text{ m}^3/\text{s}$ .



**Fig. 2.** The dynamics of the Olt River in Boița and Brezoi, having as reference the years 1876 and 2004.

Of the changes that occur as a result of the accumulation and fluvial erosion which meet and study within the framework of sector-level changes of islands and the number of meanders, changes of the original course of the river and the emergence of abandoned meanders (taking birth due to rectification of the channel, both naturally and artificially), the main question being posed by the migration of alluvial thresholds. As regarding modifications to the forms of accumulation (islands), following their evolution one notices a decrease in their number as a result of natural evolution, but mainly due to anthropogenic causes.

In the 1970s there was a total of 14 islands in the studied sector; at present their number has reduced to 6. Adjustments rates were made in Vadului – Căineni – Greblesti – Robești, Balota – Racoviță, Cozia – Călimănești. As regards the embankments, they are present in the major sectors along the river and are built with the ballast body of reinforced concrete plates: CHE Cornetu – left bank L = 4071m, right bank L = 4926m; CHE Gura Lotrului – left bank L = 1125m, right bank L = 5300m; CHE Turnu – left bank L = 343m, right bank L = 283m; CHE Călimănești – left bank L = 1369m, right bank L = 2136 m.

In the sector between Turnu Roșu and Cozia, the process of meandering is more underrepresented Olt River through a process of correction because of reservoirs and dams. An important element in the process of modelling by fluvial erosion is given by the geology of the substrate and the kind of dynamic characteristics of erosion in the meantime, in gorges their structure is more rough and the materials in the bed of the river are also littered with boulders, reducing transport capacity and a river-bed of aggradation. Thus, a crest conditioning is being carried out in such a threshold which distinguishes cross an area of alluvial and another to downstream erosion.



**Fig. 3.** Gravel excavation in the Olt River.

Human actions over Olt River flows consists of attenuation by building collections as those from Turnu Severin, Căineni, Robesti, Cornetu, Gura Lotrului or settlement and impoundments, Călimănești-Căciulata, borders, by the presence or possible collections associated with dams due to mining in local channels, or of the type of gravel pits.

We note the existence of two types of construction of water projects that have different implications in the fluvial dynamics of cross-sector with strikethrough, they interrupt the longitudinal connectivity in rivers resulting effects on the hydrological regime and the sedimentary transport; and strikethrough that interrupt the connectivity of the longitudinal sides of the water bodies with meadows as important fields known as important self-control spaces and at the same time stresses the increasing concentration in the currents, erosion, pushing material to the cross-sectional areas of strikethrough, however resulting in deterioration of general condition of the River. In most cases the influence of the dam on the flow stream would result in additional volume of water and sediment in suspension, thus changing the liquid and solid natural outflow.

## 5. CONCLUSIONS

The Turnu Rosu – Călimănești sector, seen as a morphologically distinct sector in the overall context of Olt Valley, individualizes its composition, the geology of the substrate, the geometry of the morphological, cover with vegetation and not least by anthropogenic component, all these variables in interrelations, carrying both the operation of the system, as well as recent trends in the river form morfodinamics. Adjustments to the shape of the analysed sector as a whole or to the level of detail are responses to the rhythms and sense of energy and mass leak inside the morphological system.

The longitudinal profile of Olt Valley highlights areas of narrowing (gorges) and areas of morfodinamics, the last stretch being materialized in the territory by a depression chute (the depresional passage Lotru – Brezoi – Loviștea).

This scheme of narrowings and stretches, is the result of the evolution and dynamics of the Valley, through the natural processes of evolution over overlapping the intense antropical processes which they undergo this sector at present.

The most obvious human intervention on the river systems are the constructions of dams (Turnu, Călimănești) and fitting of artificial lakes (Robești). Olt River has experienced important developments of this kind, with an evolutionary trend.

Accumulation lakes, built with multiple purposes such as drinking water supply and industrial or energy purposes of protection against floods, causing as a hydromorphological pressure the interruption of the continuity of the flow and settlements of water flows. The main collections of accumulations in the study area can be found on Olt River, and part of the hydrographic network of its tributaries.

With regard to the anthropogenic arrangement of Olt River in Turnu Roșu – Cozia Gorge, references were hardly stroked from 1960 to 1968, when the complex development of the river has been developed by a number of organisations such as ICPGA, IPACA IPCH, etc. (Pop, 1996). In addition to the changes in the characteristics and course of the river, induced by the presence of accumulation, the river has gone through significant changes. Among them were the anthropogenic river bed aggradation processes, such as in the case of CHE Călimănești, construction of which they were required to work which consisted of approximately 6 m with lifting of the Calimanesti Hermitage island, in the case of the dam at Turnu, for which they were required to work the railroad segment with 20 m and DN7the highway that crosses the gorge at Cozia, or lifting and strengthening the remains of a roman Arutela, located in the bed of Olt River.

As a whole, the entire river system in the sector of interest, is influenced by fluctuations of flow and fluctuations of stream bed, which rapidly counterbalances between accumulation and erosion, in search of a state of dynamical equilibrium.

We believe that in these circumstances, the most important factor in defining the trends of the recent evolution of anthropogenic nature, and is mainly linked to the use of collections of water projects and the exploitation of material from the bed of the river.

## REFERENCES

1. Grigore, M. (1989), *Defileuri, chei și văi de tip canion din România*, Edit. Științifică și Enciclopedică, București.
2. Leopold, L.B. (1964), *Fluvial Processes in Geomorphology*, Edit. W.H. Freeman and Company, San Francisco.
3. Orghidan, N. (1969), *Văile transversale din România – Studiu geomorfologic*, Edit. Academiei Republicii Socialiste România, București.
4. Petrea, D., Rus, I., Petrea, Rodica (2006), *Restructurări plan – spațiale în evoluția recentă a albiei Crisului Repede (între Ciucea și Oradea)*, Revista de Geomorfologie, Vol. 8, București.
5. Pop, Gr. (2001), *Depresiunea Transilva niei*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
6. Pop, Gr. (1996), *România hidroenergetică*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
7. Posea, G., Leienicz, M. (1974), *Relieful României*, Edit. Științifică, București.
8. Rădoane, Maria, extras din articolul cu titlul: *Cercetări de geomorfologie aplicată pentru cunoașterea modificărilor la nivelul albiilor de râu.*
9. Tufescu, V. (1966), *Modelarea naturolă a reliefului și eroziunea accelerată*, Edit. Academiei Republicii Socialiste România, București.
10. [www.rowater.ro](http://www.rowater.ro)
11. [www.dsclxjjo/legisiatie](http://www.dsclxjjo/legisiatie)