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Morphological Analysis of Topolog Basin Fluvial Terraces: A Valleys System Evolution Approach

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Abstract

The organisation of valleys network leads to the morphological identity of a territory, developing particular internal developmental models that take into account a number of parameters, such as the climatic, tectonic, eustatic and glacioeustatic ones, the local and regional basic levels or the local morphodynamics. Their highlighting is being reflected in the landscape by structural and quantitative differences resulted from the valley's evolution up related to each terraces level. In that sense, a probative example is the Topolog's basin which overlaps three morphostructural units having distinctive dynamics: the Făgăraş Mountains' Group, the Argeş and Vâlcea Subcarpathians and the Cotmeana Piedmont. The analysis of the position, number, features and structure of the current fluvial terraces, of the way in which the hydrographic network was imposed in the landscape by its evolution enables the identification and tracking of some models with different characteristics on the three sections drained by the Topolog river. Therefore, in the mountain sectorthe valley's evolution has imposed hydrographic disturbances, in the Subcarpathian one a deepening of the initialcourse and in the piedmont sector some changes through lateral dislocation determined by the amplitude of the elevation process and the thickness of the piedmontan deposits, concurrently with the existence of certain subsidence areas along the Olt river. The direct correlation between the structural features of terraces and the thickness of the deposits along the Topolog river wasaccomplished by an integrated interpretation of the data we have achieved from the electrical resistivity method (49 vertical electrical sounding) and geotechnical survey.

Keywords: *fluvial terraces, Topolog drainage basin, evolution of valleys system, hydrographical remoulding, geoelectrical interpretation*

Rezumat. Analiza morfologică a teraselor din Bazinul Topologului: un mod de abordare a evoluţiei reţelei de văi

Organizarea retelei de vai este cea care impune definitivarea morfologica a teritoriului, construind anumite modele de relatii, care iau in considerare o serie de parametri, cum ar fi cei climatici, tectonici, eustatici si glacioeustatici, nivele de baza locale si regionale, morfodinamica locala. Concretizarea lor se reflecta in peisaj prin diferentieri structurale si cantitative ale rezultatelor evolutiei vailor la nivelul teraselor. Un exemplu in acest sens este bazinul Topologului care se suprapune peste 3 unitati morfostructurale cu dinamica diferita: grupa Muntilor Făgăraş, Subcarpatii Argesului si ai Valcii, respectiv Piemontul Cotmeana. Analiza pozitiei, numărului, fizionomiei si structurii teraselor actuale, a modului in care reteaua hidrografica, evoluand, s-a impus in peisaj permite identificarea si urmarirea unor modele cu particularitati diferite pe cele trei sectoare drenate de raul Topolog. Astfel, in sectorul montan evolutia vaii a impus remanieri hidrografice, in cel subcarpatic, o adancire pe traseul initial, iar in sectorul piemontan modificari prin deplasari laterale impuse de amplitudinea înălţării şi grosimea mai mare a depozitelor piemontane in paralel cu existenţa unor arii de subsidenţă în lungul Oltului.

Cuvinte-cheie: *terase morfologice, bazinul Topolog, evoluţia reţelei de văi, remanieri hidrografice, interpretare geoelectrică*

Introduction

The Topolog River and its tributaries have locally created fluvial landforms and by their analysis and interpretation it can be deducted the evolutive stages of the hydrographic basin and the intermediate and current evolutive levels. The Pleistocene–Holocene evolution highlighted, through characteristic processes, landforms resulting either due to climate oscillation or tectonic uplift: terraces (Chang et al., 2006; Olszak, 2011). Because of the issue of this type of relief is vast and complex - can itself constitute an interesting subject of detailed research, in this paper we choose that the fluviatil morphology processing to be carried out on characteristic sectors.

The distribution of the terraces and their age provide important information about the quaternary evolution of the region and the hydrological basin they belong to, provided that their research consider connecting and mapping them in accordance with the situations within the neighboring hydrographic basins. (Viveen and co., 2013).Geographical Settings

The wide altitudinal expansion of Topolog basin between 2535.4 m (Negoiu Peak) and 184 m (Galicea - Ostroveni) is the primary factor of the complexity and great diversity of fluvial forms and processes. Topolog's hydrographic basin is determined by the geomorphological registers of the major geographic regions by developments within the hydrographic network and by quaternary and current modeling.

The three major geographic regions crossed by the Topolog River are morphologically required by ensembles of steps overlapped on the major types of relief: mountains in the north of the basin area, hills and subcarpathian depressions in the middle section and piedmont plateau in south, in the lower sector.

The morphostructural and tectonic units that the Topolog river drains are the Fagaras Mountains, Iaroslavele depression area – Manita, Frunti Mountains in the east and Poiana Spinului in the west, then Topolog Subcarpathians (Visan, 1998) and Cotmeana Plateau (Fig. 1).

Fagaras Mountains are the first reliefs in the Paleogene which were emerged and subdued to denudation in the hydrographic basin so that the first network of valleys was concomitant with the Borascu leveling complex (Eocene) (Sircu, 1958, Popescu, 1972, 1984, Posea, 1997, Posea, Armaş, 1999, Andra, 2002).

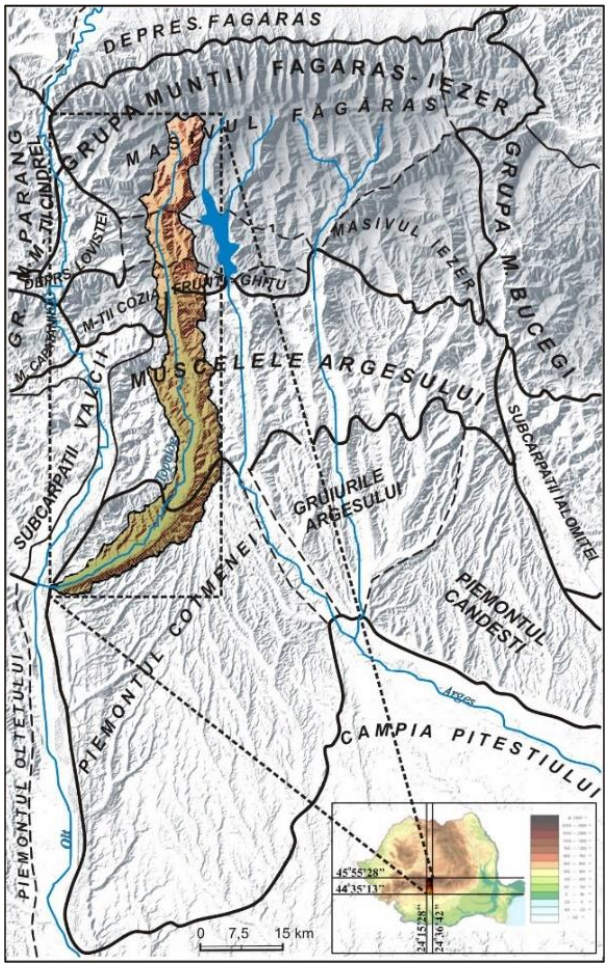

Fig. 1: Location of Topolog basin and geographical regions

Related to the subsequent intermittentelevation, the valleys paleo system, as modified and subjected to the influence of tectonic lines newly generated, it is responsible for the formation of the other correlated leveling complexes with both Miocene deposits submitted in the Getic Piedmont and Brezoi - Titeşti and with the Pliocene ones deposited in the Dacian Lake. During the next stage (Pliocene - Quaternary) the general features of the valley system that extends in the Subcarpathians are configured and lifted during the Wallachian movements (Dragos, 1959; Badea, 1983; Visan, 1998); the latter are responsible for the defining of the southern piedmonts; they will also be affected by emergence movements and transformed by the rivers' widening and cut in plateau units.

The hydrographic network structure is determined by the relationship between the main morphostructural units, tectonic lines and elements which condition the drainage (morphometric, climatic and hydrological factors). The Topolog's hydrographic basin is characterized by a dendritic type of network, in which the confluence angles record low values, the exceptions being tectonic, structural, petrographic and evolutive determined (confluence Scara – Modrugaz, Topolog – Topologel, Topolog - Sutu (in the mountain section), Topolog – Valea Satului (in the subcarpathian sector).

The Topolog valley is formed by the union of the river segments Scara and Negoiu Spring at an altitude of 1339.8 m and flows into its collector, the Olt river at 185 m (Table 1), being its left tributary.

Table 1: Topolog tributary valleys parameters

River	L [km]	A.s [m]	A.c [m]	S [m/km]	m.c.
Topolog	106,812	1339,8	184	11.345	1.404
Izvor Negoiu	4,738	2110	1339,8	162.558	1.196
Scara	4,581	2100	1339,8	165.946	1.088
Topologel	9,469	1970	963	106.347	1.137
Cumpăna	12,047	1430	712	59.6	1.088
Valea Satului	6,097	960	639	52.649	1.104
Cărpeniş	9,775	820	452	37.647	1.063
Bădislava	16,758	840	384	27.211	1.158
Momaia	5,933	550	381	28.485	1.187
Bălceasca	7,392	515	259	34.632	1.041

L – length; A.s. – altitude spring; A.c. – altitude confluence; S – slope; m.c. – meandering coefficient

The Topolog's tributary valleys generally have reduced lengths and are structurally determined, often with a torrential character. Some of them, however, had experienced a more complex evolutive path reflected in the preserved terraces' fragments along them: the Topologel, the Cumpana, the Manita, the Valea Satului, the Cărpeniş, the Bădislava, the Valea Bălceasca.

Under the influence of the collector river's deepening rhythm, they had developed a system of 1-2 terraces, which are characterized by the following three aspects: they are monolateral, they have reduced widths and surfaces and have alluvial or rocky structure.

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Materials and methods

The morphological analysis was based on the cartographic documents, represented by topographic maps at 1: 25,000 and topographical plans at 1: 5000, 1: 10,000 made by the Military Topographic Direction, between 1964, 1977 and 1982, aerial photographs (1966), geological maps and orthophotoplans (2011).

For the inventory and correlation of the terrace fragments we have applied the chorology method, based on the data gathered in the field in several campaigns. The field investigations have consisted in running multiple shallow drillings in the lower terrace of the Sălătrucu, Galicea, the execution of 49 geoelectrical vertical soundings (ABEM SAS 300), 9 geoelectrical sections interpretative (Botezatu, 1987; Morris, 1997), in 5 districts of the Topolog Valley (Galicea, Tepsenari - Mănicioiu, Dedulesti, Ceaureşti, Suici and Sălătrucu), in the terraces' geomorphological mapping and the integrate interpretation of terraces information from the subcarpathic and plateau area.

The processing of cartographic resources and the thematic maps, the morphological profiles and geoelectrical sections acquiring were achievedusing the following tools: ArcGIS, Global Mapper - Blue Marble Geographics, Surfer - Golden Software.

The geotechnical analysis and the terrace deposits' mapping have locally shaped the structural characteristics of the terraces, but their extrapolation, in conjunction with the results of the others applied methods, allowed a uniform view achievement on the evolving model of the valley network from this basin.

Morphological analysis of terraces

The morphological, evolutive perspective's diversity, caught in cross and longitudinal section, is generated by the alternation of characteristic sectors from those of narrow valley to those of wide, mature valley. The Topolog's Valley is transversalon the geographical units which it pervades, with local epigenesis characters and a history, strongly tectonic influenced in the mountain area and locally elsewhere.

Linking the Topolog's fluvial system with neighboring systems

The complexity and difficulty of the research regarding the Topolog's river terraces are created by:

- the various morpho-litho-structural and tectonic units crossed by it;
- the altitudinal differencesof over 2,300 m;
- the affiliation and allegiance of erosive-accumulative regimen to the Olt's hydrographic basin; Olt – Topolog confluence represents a basic level lower than that of the Arges river from the neighboring area (Fig. 2);
- the presence and dynamics of the modeling floors carried out within the basin;
- the pronounced dynamics of the relief, which required strong fragmentation of the terraces;
- the anthropogenic interventions.

The specialty literature indicates a variable number of terraces in the adjacent space of the Topolog basin, which is why it is necessary, in a first phase, a comparison and putting in parallelof all available results until the present (Table 2).

The Topolog valley's evolution and the terraces' defining are closely linked to the Olt Valley during the Quaternary. The upper level of the Olt's terraces has a Middle Quaternary age and has a relative altitude of 210-240 m (Badea, 1983). Its position at the cut-water level off the confluence between the Olt and the Topolog indicates the role the two rivers had in the formation of this terrace level. The third terrace is widely developed in the plateau area and discontinuous in the subcarpathian one due to the evolution of the paleo-layer during the generation of the second terrace or because of the current morphodynamics; in the mountain area of this terrace level, fragments were found in the depression area Iaroslavele - Manita and in the lower section of the Topolog's defile.

The second terrace has a wide development, being highly fragmented by the Topolog's tributaries of order 4 and 5. The subjacent terrace is widely extended in the subcarpathian and plateau sectorsn, with a monolateral development, especially in the down subcarpathian, and bilateral in the piedmont (Fig. 3), but the elbow that the Topolog makes to SW caused this level's erosion on the left, near Ciofrângeni.

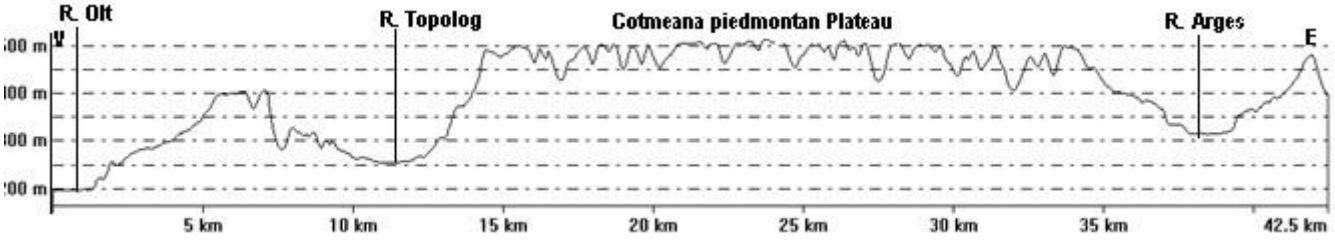

Fig. 2: Cross-section of the differentiated local base level of erosion in the Cotmeana Piemont

The characteristics of the terraces' system related to the regional geographical units

The terraces' system constitutes in 4 levels, one in bedrock, two alluvial and one fill-cut alluvial deposit. The terraces number and structure highlight the link between the form, the deposit and the type of evolution of the relief through phases of aggradation or sinking. These are the correspondents of the climatic and glacioeustatic changes (Merritts, Vincent, Wohl 1994) differently reflected in each region which is drained by the Topolog River.

Table 2: Briefly overview on the Romanian literature about the Olt, Topolog and Arges terraces

Authors, year	Floodplain	T_1	T_2	T_3	T_4	T_5	T_6
Mihăilă N., 1971	holocen	Pleistocen sup qp_3^3 Wurm III	Pleistocen sup qp_3^3 Wurm II	Pleistocen sup qp_3^1 Wurm I	Pleistocen med qp_2^2 Riss	Pleistocen med qp_2^1 Mindel II	?
		4 - 10	**15 - 22**	**30 - 40**	**60 - 70**	**80 - 100**	
Vişan, Gh., 1998 Mihăilă, N, 1971	holocen	W III	W	Pleistocen med	Pleistocen med.	?	Pleistocen inf
		8 - 12	**40**	**60**	**100 - 110**	**150 - 160**	**200**
Coteţ P, 1957 Liteanu, E, 1971 Parichi, M., 2001	Holocen sup	WIII	WII	WI	Pleistocen supW1	Mindel	?
		5 - 13	**20 – 30m**	**40 - 70**	**80 - 108**		
observations			Echivalentă T4 Vultureşti (Olt)	Echivalentă T5 Verguleasa Cp Govorei	Terasa Slatina		

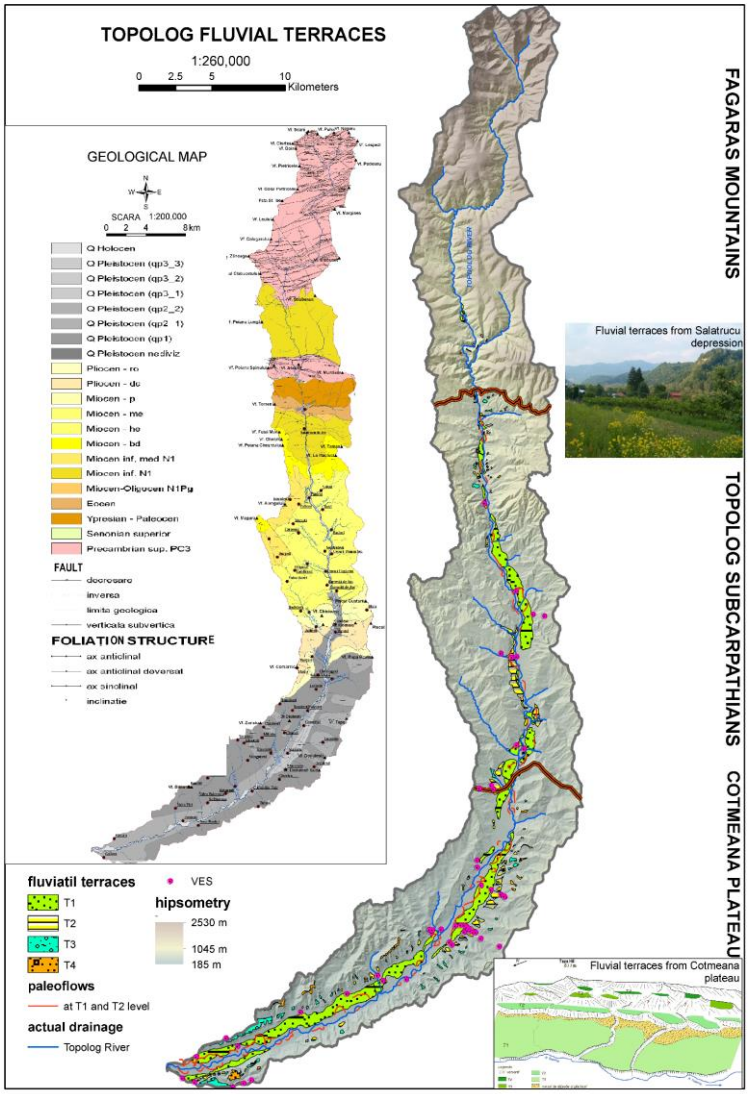

Fig. 3: Topolog drainage basin fluvial terraces and geological units map (source: *geological maps, 34. Piteşti and 27. Sibiu 1:200 000, 1968, 109 a, Negoiu, 126 b, Călimăneşti 1:50 000, 1977, 108 d, Titeşti, 1 : 50 000 (1982), 109 c, Cumpăna, 1 : 50 000,1985*)

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The mountainous sector

Within the pre-Mezozoic crystalline area from the Fagaras Mountains, some valleys sectors are formed by antecedent and superimposed genetic processes; this is also the case of the Topolog defile (Ielenicz, Tirla, 2012).

Between the confluence of the rivers Scara and Negoiu (the training point of the river Topolog) and the confluence of Topolog and Topologel, the valley is narrow, symmetric, with strongly inclined slopes, whose base has direct contact with the layer and falls in width, within 5-15 m. In horizontal plane, the valley looks tortuous being conditioned by the petrographic and fault systems. Cumpana's gneisses amphibolous formation, characteristic of this sector, is marked in fluviatil relief by strong elbows with angles from 90 ° to 180 °, being determined either by the fault system oriented NNW - SSE or by the amphibolites and gneiss bands oriented ENE - WSW. This sector of the valley, whose slopes have inclines of 35-55°, has the characteristics of a meandering valley; the valley meanders are kept on about 4 km distance, and they can be identified on slopes up to 200-250 m relative altitude.

The next sector of the valley – Iaroslavele - Manita depression compartmentfollows through a narrow key type valley segment, grafted onto the Cumpana granitoid.

The valley section from Iaroslavele – Manita Depression, the extension of Loviştei Depression, consists of two compartments, grafted on conglomerates and the Podeni's formation sandstones; the characteristics of the valley are determined by the differential erosion, which imposed an asymmetrical aspect in cross section, with slow and prolonged right slope, while the left one is steep and short and the wide layer (150 m). The longitudinal profile shows a decreasing cliff, especially in the right confluences (r. Ruzii, Manita - where a few patches of rock terrace can be identified).

The fault system Brezoi - Titeşti stands out in relief not only by steep slopes of the northern Poiana Spinului Mountains and Frunti, but by the refocusing of the Topolog's flow from NNE - SSW direction to ESE - WNW, on a length of about 1 km. This fault system from the north of the Cozia- Frunti - Ghiţu Mountains has implications in a regional morphohydrographic scale, by imposing the general flow directions and the basins geometric shapes of order 3 and 4 (Penes Valley, Carpenilor Valley – left tributaries of the Cumpana River by Topolog and Pietrosu valley right tributary of the Topolog River).

Between the two depression compartments, Iaroslavele and Manita, there are some geomorphological fluviatile differences; the morphology of the latter has recorded the effects of the lifting in block of the Horst located further south, Poiana Spinului - Frunti, by the deepening of the main hydrographic system and its interruption with about 100 m, above the Topolog's thalweg (Fig. 4) (Andra, 2009). The Topolog's defile (Grigore, 1989) lies between two low massives the Poiana Spinului and the Frunti Mountains, on a length of 5.14 km.

This sector is made up of two narrowing areas and a widening one. Genetically this sector has a tectonic and antecedent character, between the two Paleogene - Miocene sedimentary basins (Muthiac, 2004), from the north and south of the Cozia – Poiana Spinului – Frunti horst.

The ample, sinuous appearance indicates the existence of a valley's meanders, developed only in the lower half of the slopes, below 900 m absolute altitude. On the other hand, at the way out of the clough, the Topolog river has cut itself a gorge sector in Paleogene conglomerates and breccias, which are extending along almost the entire area of the southern slopes of the Frunti Mountains and including the Poiana Spinului Mountain's interfluves; this fact induces the idea either of a more marked elevation of both massifs, in the north, on the fault lines of the system Titeşti – Brezoi, or a mixed epigenetic and antecedent genesis- downstream.

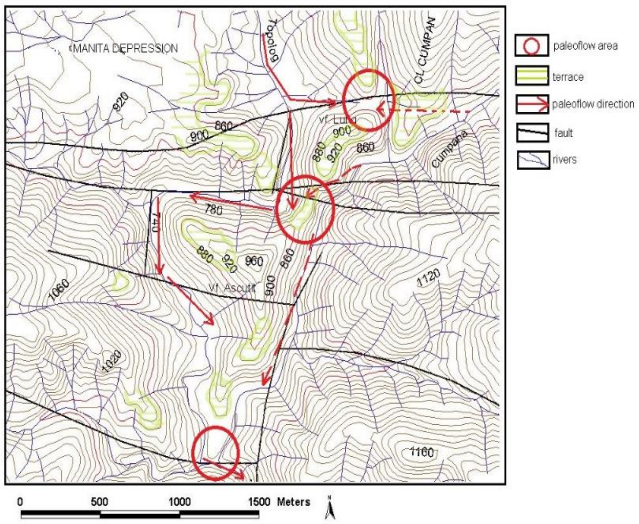

Fig. 4: The draft of the hypothesis of the valley system's evolution under the conditioning of the faults systems, in the mountainous depression Manita

In the slopes two levels have been identified. The first level is located at about 60-80 m relative altitude, being the level at which the intra-mountain depression area Iaroslavele-Manita was modeled, the second level being suspended at this level, above the Topolog current thalweg.

The second level is identified at about 35-45 m relative altitude, being the level of the terrace formed upstream the clough, where this river and Cumpana went deeper, along with the morpho-tectonic completion of the Topolog's clough. To all

these, a terrace level of about 5 m relative altitude is added, together being correlated with the evolutive levels from Sălătrucu Depression.

An additional argument that indicates the state of deepening of the Topolog river during the clough's training and of successive confluences witnesses the Ascutit Peak erosion (979.5 m) (Fig. 4, 5), which binds by the two wide saddles and a short interfluves sector (Lung Peak, 935 m), from the Cumpana crest. This witness is framed by a first fault system oriented V - E, and a secondary N - S. It has the same altitude as the Manita's suspended depression compartment or as a level of beads retrieved just on the right side of the Cumpăna's valley. Moreover, the two saddles are altitudinal found under the mentioned witnesses and bear a gravel layer (mica schist with big, gross, rolled cement less garnet), which indicates the fact that both beads and two saddles belong to two levels of tectonic calm, where the two rivers have created a common channel.

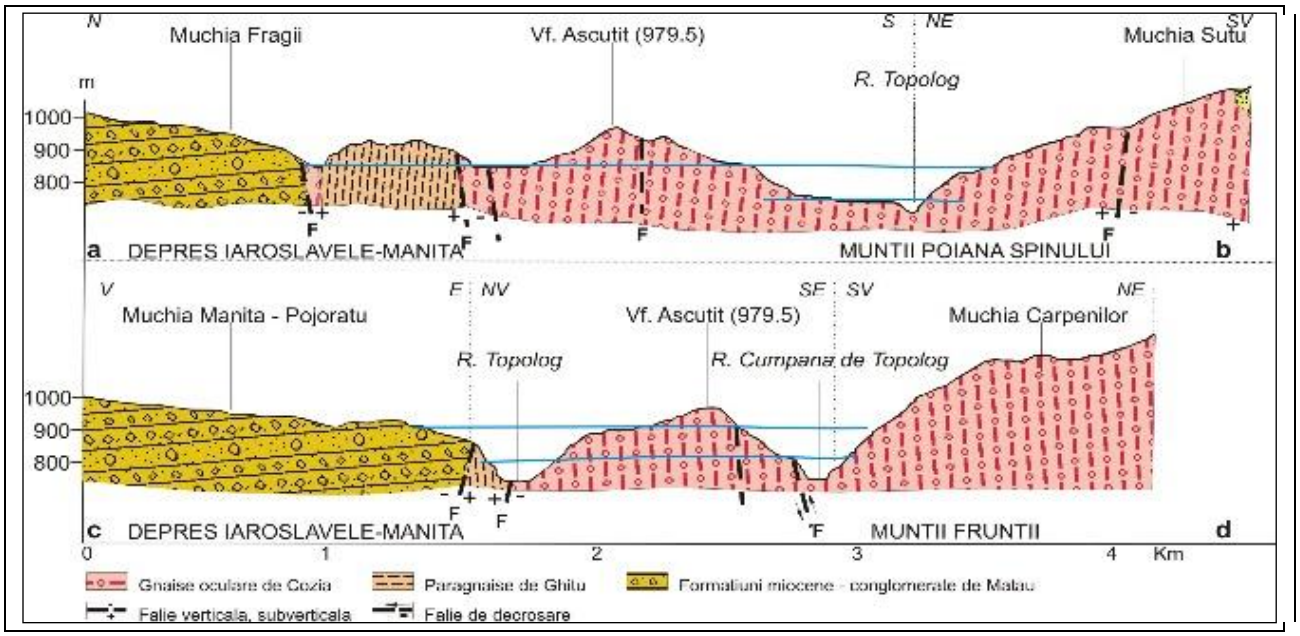

Fig. 5: The Topolog defile, relevant issues in the interpretation of the mountain area's evolution

The two erosion witnesses can only represent, according to this hypothesis, old popins, patches of terraces, detached by the rivers' deepening in the later stages. The morphological areas kept as erosion witnesses have relative altitudes of 60-80 m, which would connect them with T4 terrace (after Mihăilă, 1971) or with T_3 terrace (after Visan, 1998), while the two saddles are above the current thalweg by about 40-45 m relative altitude, thing what includes T_3 and T_2, according to the above cited authors.

The Subcarpathian sector

The internal Subcarpathian sector consists of the Salatrucu submountainous depression area, characterized by a strong asymmetry of the declivity, altitudes, type of relief and morphodynamics of the two slopes. The right side is milder, being subdued to the crossover from conglomerates and sandstones to marls and sandstones - the lower Paleogene, and to Miocene conglomerates, while the left side is characterized by structural landforms in the same lithological conditions (Murgeanu,1953, Dragos, 1959). The morphostructural and morpholithological differentiation is owed to the wide movements from the Frunti Mountains, relatively with the Poiana Spinului Mountains. The terraces are well represented being connected to the upstream ones.

Salatrucu depression is composed of two widening compartments (Salatrucu de Sus and Salatrucu de Jos) and two small narrowing areas, gorges-like, off the anticline drifting to the east of the sandstones and conglomerates: the narrowing of Alunis and the narrowing of Văleni - Dardari (Andra, 2007). The greater width is recorded on the left side of the river, in the northern section - Salatrucu de Sus - and on right side of the river, in the southern one.

This development of the terraces was also reflected in the structure and the occupancy of the two villages: Salatrucu de Sus and Salatrucu de Jos. Downstream, off La Rudari village, the lower terraces T_1 and T_2 have been shaped in piedmont cones that start from high peak Tămaş - La Măcluci, being strongly affected by torrential and areolar erosion processes.

In this area, a strongly anthropic meadow terrace has been identified, due to the construction of the power plant at Salatrucu de Jos by the liquid flow taking-over appliances from the river bed. The lower terrace is unilateral along the entire length of the Salatrucu Subcarpathian sector, with a few

exceptions in the narrowing sectors at Aluniş and Văleni - Dardaria. The surface of the terrace is smooth, but heightened by the alluvial cones from valleys' bottom with torrential character: Tomeni, Clocotici, Valea cu Calea.

The external Subcarpathian sector consists in three depression areas: Şuici, Cepari and the interference sector Tigveni - Ciofrângeni. In Suici area the Topolog alley is relatively symmetrical, with long and mild slopes. The Cepari depression area is characterized by a strong asymmetry due to some fractural lines that led to the east extension of inferior - Miocene micro conglomerates, while the left side, short, mild and affected by a pronounced morphodynamic, is developed on marls, sands, clays and thin sandstones.

In the piedmont - Subcarpathian transition strip the asymmetry is reversed, as the right side is short and has low declivities, and the left one is long and with higher cliff's values. This morphographical change in cross section is due to the Vătăşeştii - Burlusi synclines structures. The middle and lower terraces are well represented, even affected by hydromorphodinamic and gravitational processes.

The terraces of the Suici – Cepari sector are monolateral, according with the Topolog's meandering directions. The lower terrace is extended over the entire length of the valley corridor, subject to anthropogenic pressure, representing the morphological support of the two communities. The lower terrace T_1 (8 m), in Rudeni locality, has an alluvial structure made up of dusty sands, gravels and clays, in bedding (Fig. 6).

The T_2 terrace is found as patches on the steep slopes' bottom, with the surface slightly inclined toward the valley's axis due to the coluvio - proluvial increased heights; its structure is given by the sandy, dusty clays and in bedding gravels, about 6-7 m, where the first hydrostatic level was identified.

The terraces of the Cepari – Tigveni sector are fragmented, predominantly on the left, for these to be identified more on the right side downstream Tigveni, due to the SE migration of the Topolog River at Burluşi locality. The structural variations of this area, induced by the Vătăşeşti - Burlusi sinclinal and the downstream sequence of the Pontian and Dacian deposits, had imposed the terraces' erosion on the left and their conservation on the right.

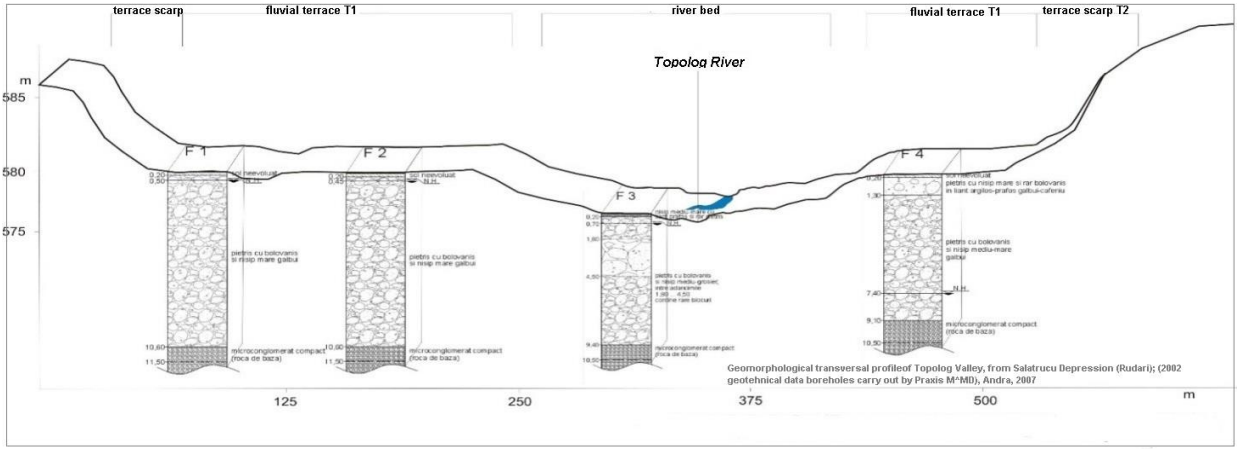

Fig. 6: Cross-section through the lower terrace and the Topolog river bed near to Sălătrucu de Jos and lithostratigraphic column which reveals the sequential formation of alluvial deposits

The piedmont sector

The newest exondated geographical unit in the Topolog's drainage basin is characterized by different amplitudes of the eustatic ascensions, by thicker piedmont deposits and by the existence of some areas of subsidence along the Olt, such as in Băbeni locality, causing the deviation of the Topolog's River bed to South-West (Dragos, 1959). On the Topolog's left side four levels of terraces were identified, near to Poienari village, dominated by the piedmont level and fragmented by the left side tributaries of the collector river. In the Deduleşti - Vărzaru area 12 geoelectrical interpretative sections were made, which revealed an asymmetric arrangement of the terrace's deposits sideways from the river's course.

The T_1 and T_2 terraces in Varzaru - Milcoiu village are covered with the sliding deposits, the entire right slope being affected by a series of deeper slides.

In Milcoiu town, on the right side of the Topolog River, the T_1 terrace (4-5 m) has an alluvial structure: coarse gravels, with the dimensions (major axis, minor axis, thickness) 8/5/3 cm, which have bigger roller gravel in base 13/9/4 cm, laid on a thin layer of 10-15 cm of sand, slightly cemented with oxidation traces; in bedding, the terrace shows small gravels (1.5 / 1 / 0.5 cm) which passes in average gravels 10/5/5 cm. This structure indicates a fluctuated evolution during the T_1 terrace's formation where the river's competence and capacity had variously manifested.

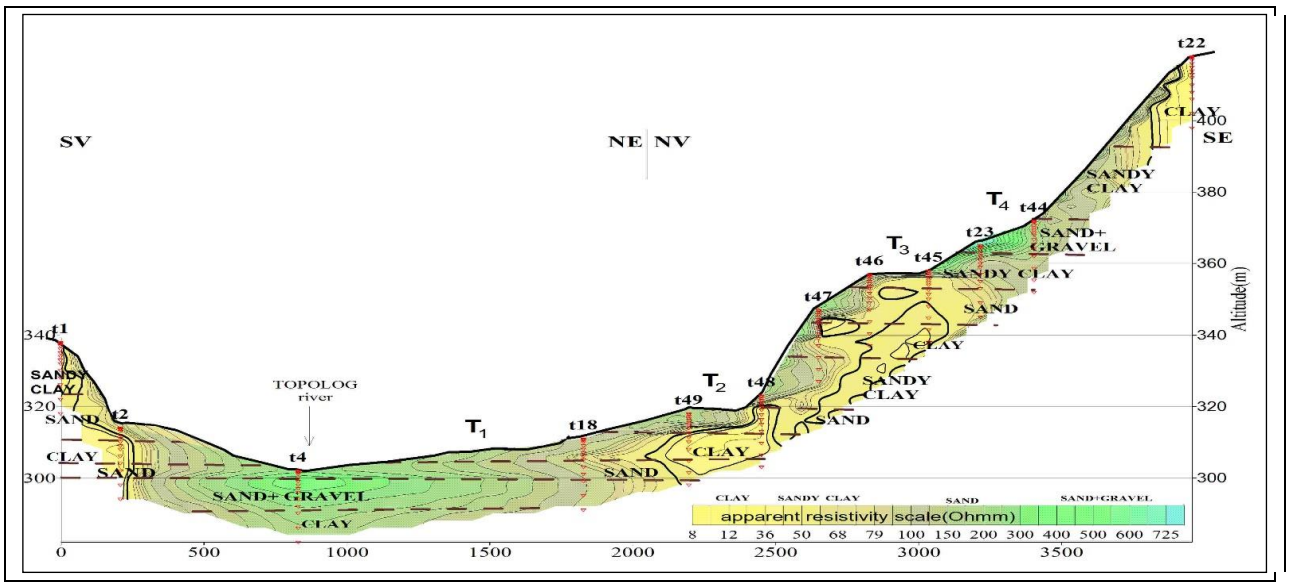

Fig. 7: Dedulesti – Varzaru. Interpretative geoelectrical cross section along geomorphological valley transversal profile regarding the terraces's structure. (scale 1:20000 / 1:1000)

The T_1 terrace (5 - 8 m) in Corbii de Vale locality is represented by a single fragment, identified on the valley's left, where the alluvial cone of a downstream tributary had determined the Topolog river's meandering on the right. The edge of terrace is pinked and the surface width of 200-250 m is used in agriculture.

Upstream the Bălceasca – Topolog confluence, the T_1 terrace, located on the right, is heavily covered by coluvio-proluvial deposits. Terrace T_2, whose scarp was reafforested,is fragmented by torrential organisms. It represents the morphological support for urbanexpansion in the recent years. Fragments from T_2 were also mapped on the left side, but the erosion and fragmentation is much higher than on the right one.Serbăneasa terraces have an equal progress on both sides, in the form of some narrowed strips on the left side and of patches on the right one.Galicea locality's terraces are common to the Topolog and the Olt.

The watershed between the two rivers is being represented by the confluence terrace T_4 on the right (210-240 m). The terraces of Galicea are relatively continuous, but fragmented by erosion such as the cloughs and gullies type. They are unequally distributed on the two slopes and they make, on several kilometers upstream, the basin's watershed.

Vlăduleşti T_4 terrace is formed on quartz sands, poorly cohesive, yellow rust with elements of gravel, and its surface is slightly inclined, without obvious edges, due to the prolonged erosion it went through.

Terrace T_3 has a structure made of gravel embedded in a mass of sand, and red clay in the base, which led to semi profound drifts to the scarp's bottom. These led to the formation of a sliding glacis on the T_2 surface of terrace, widely extended on the both slopes. The surface of terrace is very smooth, with gradients of up to 3º. The edge is clear, trenchant and the scarp is straight. The terrace's structure is described by the following sequence of deposits: 0-1.60 m soil, 1.60-2.90 (phreatic level) gravels and sands with low average granulometries of 2-5 cm and high average of 10-15 m, 2.90-5.20 m reddish loamy sands.

The T_1 terrace, where Galicea town and Cocoru village have expanded, is large, with sinuous contours, revealing the recent dynamism of the Olt's meanderings. It consists of sand and gravel, which repause on a fine clay found bed at depths of approximately 15-20m, possibly the result of the Wurm III deposits. In the recent decades, it has undergone a significant anthropogenic pressure, together with the floodplain, given the construction of Băbeni dam in 1978.

The meadow terrace is characterized by a slightly irregular aspect; its scarp is widely pinked.

Discussions regarding directions of Topolog paleoflows

In order to get a better insight into the morphological aspects of the terrace levels along the Topolog river, this paper was given proof of the necessary aspects for the interpretation of system evolution of river valleys by interdisciplinary analyzing of relative resistivity images which were compared with geotechnical data from boreholes and geomorphological mapping sheet terraces.