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Morphotectonic affilation of the Lilyak Plateau

Svetla Stankova[1], Tzanko Tzankov[2]

[1] University of Shumen Bishop Konstantin Preslavski, Faculty of Natural Sciences, Department of Geography, Regional Development and Tourism, 115 Universitetska Str., 9700 Shumen, Bulgaria

[2] South-West University Neofit Rilski, Faculty of Mathematics and Natural Sciences, Department of Geography, Ecology and Environment Protection, 66 Ivan Mihaylov Str., 2700 Blagoevgrad, Bulgaria

Abstract: *The morphostructural features of the Lilyak Plateau and it's spatial and morphotectonic relationships with the adjacent parts of the Eastern Pre-Balkan Mountains are examined in the light of modern mobilist ideas. The Lilyak Plateau landform is part of the South Moesian morphostructural zone. This morphostructure borders distinctly to the south with the northern border of the corresponding part of the Fore Hemus morphostructural zone. There are significant morphostructural and morphotectonic differences between these two regional morphostructural units.*

Keywords: South Moesian morphostructural zone, orthoplain, plateau morphostructure, morphostructural analysis

Introduction

The present study was carried out on the basis of modern ideas about the relief construction from the point of view of the mobilist theory of the plates, a concept imposed on a global scale in the second half of the 20th century. The proposed scientific work is a mobilist pioneering study of the relief of a fragment of the eastern part of the Balkan Peninsula. The article is aligned with the modern morphotectonic studies of the Danube (South Moesian) natural-geographic region in Bulgaria.

In the last decades of the 20th century and the beginning of the 21st century, the structural-geomorphological direction gained wide development and popularity in geomorphology. Its main goal is to clarify the genetic links between the modern relief and the geological structure of a given territory, as

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well as to evaluate and characterize the most fully the relief-forming role of the endogenous (tectonic) factor in the formation and development of the Earth's relief.

The topicality of the topic stems from the lack of a modern morphotectonic concept for this region, as well as the unclear temporal and spatial relationships of the southern periphery of this part of the Danube hilly plain with the neighboring morphotectonic unit of the Eastern Pre-Balkan Mountains.

The purpose of the present study is to analyze the morphostructural features of the relief within the borders of the Lilyak Plateau with a view to clarifying its character, evolution and proving its geomorphological and morphotectonic affiliation. For this purpose, the species, morphological features, spatial location, elevation, relationships and grouping of individual morphostructures in the area were studied and compared.

Achieving the set goal of the study required the geomorphological characteristics of the Lilyak Plateau to be aligned with the modern morphostructural representations of these lands [1-4]. This concept was achieved as a result of the application of the morphostructural analysis in the modern mobilistic characterization of the relief [5]. In this regard, the plate-like structure in this part of the Danube Plain has not been described in a similar way so far. Conducting this kind of research in the future would also be an important criterion for the assessment of near-surface lithospheric geodynamic processes and trends in local relief changes.

Brief overview of the geological-geomorphological studies to date

The problems of the geology and tectonics of the studied area and its adjacent parts have attracted the attention of a number of geologists, especially when the northern border of the Pre-Balkan Mountains with the Moesian Plate was extended etc. [6-9].

In recent years, the Lilyak Plateau has been the subject of research by a number of natural geographers. This was dictated by the need to clarify the relationship between the Pre-Balkan Mountain and the Danube hilly plain in the area east of the Cherni Lom River. More precisely, it concerns a case where one of the plateaus in the plain – the Lilyak Plateau – is in direct contact with the relief of the Pre-Balkan Mountains along this border. Some scholars interpret these relationships with the thesis that the Lilyak Plateau represents a northward extension of the Pre-Balkan relief [10-13], etc. Other authors refer the plateau to the Danube Plain [4, 14-18], etc. Sarafov [19] conducts a thorough review of the views on this issue and analyzes facts with different evidentiary argumentation on the fragment of the border line between the Danube Plain and the Pre-Balkans on the territory of Targovishte municipality. In this work he presents his idea of establishing truth in geographical space.

The first detailed morphostructural study of the Lilyak Plateau was made by Vladev [18]. According to him, it is the westernmost of the series of the Shumen-Provadiya remnant plateaus.

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Research in recent years [2-4, 20] offers another solution to the question in the light of the modern geomorphological and mophotectonic analysis of the Eastern part of the Balkan Peninsula.

Brief hydrographic characteristics of the studied area

Morphographically, the Lilyak Plateau falls within the boundaries of the eastern sub-region of the northernmost natural-geographical region in Bulgaria – the Southern Moesian (Danube) hilly plain.

The layer-platform geological construction of the South Moesian (Danube) region has reflected the specific morphographic and morphological features of its Neogene-Quaternary paleogeographic relief and development.

The late Neogene-modern intensive uplift of the Stara Planina Mountain system involved the South Moesian Plain in positive movements with increasing intensity in the southern direction. Wide plateau-like and flat-hill spaces are formed. As a result of the inundation of the tributaries of the Danube River, the periphery of the plain is torn and a number of isolated monoclinal elevations and plateaus are formed in the relief.

The Lilyak Plateau is located in the southwestern periphery of the Eastern Danube (South Moesian) Plain on the border with the Eastern Pre-Balkan Mountains. The large orographic contours in this region are given by the northern periphery of the Eastern Pre-Balkan – the Antonovo uplands in the southwest, the Slannik area in the south, the Preslavska Mountain in the southeast and the southwestern periphery of the eastern sub-region of the South Moesian Plain – the Razgrad uplands – in the north and the Popov uplands in the northwest (Fig. 1 and Fig. 2) (Photo 1 and Photo 2).

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Figure 1. Overview natural geographical map of Bulgaria

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Figure 2. Overview map of the South Mysian (Danube) natural geographical area [17]

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Photo 1. Eastern slopes of the Lilyak Plateau – photo after the village of Probuda, on the way to the town of Targovishte

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Photo 2. Western slope of the Lilyak Plateau on the road Svetlen village – Aprilovo village

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The relief of the South Moesian Plain east of the Yantra River valley has a markedly hilly-plateau-like character. It is represented by denudation plateaus, depressions between them and canyon-like valleys with wide valley bottoms.

From a geomorphological point of view, the Lilyak Plateau represents a positive, structurally conditioned form of horizontal to sub-horizontal layers of the relief. Its surface parts are formed in "armoring" layers that are more resistant to weathering processes.

To the north, the Lilyak Plateau is surrounded by the valley of the Kazalarskodere River, to the west by the valley of the Cherni Lom River. To the south and southeast, the plateau is surrounded by the valleys of the rivers Cherni Lom and Siva Reka, which separate it from the hilly and hilly region of Slannik and the northwestern parts of the Eastern Pre-Balkan. To the east, the plateau borders the Targovishte depression (Fig. 1 and Fig. 2).

The Lilyak Plateau is distinguished by a hilly-plateau-like relief. Morphometrically, most of it falls within the limits of the hilly hypsometric belt 300 – 500 m. There are gentle northern and western slopes, and steep southern and eastern slopes. The plateau is cut by the deep valleys of the Dermendere River and its left tributary, the Kyumurzhidere River, etc. smaller tributaries of the Cherni Lom River that spring from it. Here is the highest point of the South Moesian region – Alexander Peak (516.9 m).

A series of high elevations, culminating in gently sloping peaks, give the area a hilly appearance. In the northern part of the plateau, these are the peaks – Meshelik (410.6 m), Tabiyata 450.7 m), Kumludzha (461.4 m), Dyuza (491.2 m) and others. Along the watershed ridge between the Dermendere River and the left strait of the Kyumurzhidere River from west to east, Mandra Peak (442.1 m), Hendekbair Peak (479.8 m), Aleksandrov Peak (516.9 m), elevation stand out 511.2 m etc. Along (above) the southern, steep slope of the plateau, a series of high peaks stand out - elevation 469.5 m, Topkoru (505.5 m), elevation 477.4 m, etc. [21].

The study area has a length in the west-east direction of about 13.5 km in the northern and 17.5 km in the southern part of the plateau. Its width in the north-south direction varies from 11 km in the western part to 9.5 km in the eastern direction. It also has a relatively well-defined oval shape.

The widespread exposure of denudation-prone Lower Cretaceous sandstones and marls is one of the reasons for the relatively highly dissected ridge of the plateau. On the other hand, the presence of local accumulation of calcareous joint in the sandstones forms separate peaks that give a hilly appearance to the relief in the study area.

In terms of hydrography, the majority of the Lilyak Plateau belongs to the watershed of the Cherni Lom River (left tributary of the Rusenski Lom River), including the watersheds of the Kazalarskodere, Dermendere, Kyumurzhidere Rivers (right tributaries of the Cherno Lom River). The southeastern and

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eastern parts of the Lilyak Plateau belong to the watershed of the Vrana River (a left tributary of the Golyama Kamchia River). In this part, the plateau is drained by the left tributaries of the Vrana River – Siva River, Keshka River and the Karameshe River (right tributary of the Keshka River).

The general plan of the river-valley network is predetermined by the configuration of the main morphographic units.

The Lilyak Plateau morphostructure is characterized by an orthogonal type of river network [22, 23]. This type of river-valley network is characteristic of the flat-plateau areas of the South Moesian Plain.

Brief geological-tectonic information

In tectonic terms, the territory of the Lilyac Plateau, as part of the border zone between the Eastern Pre-Balkan Mountains and the southern peri-platform zone of the Moesian plate, has been studied in relative detail by a number of scientists. Some of them refer the Lilyak Plateau to the so-called Shumen transitional zone [8, 24], etc. This originally described as Kamchiya-Kolarovgrad transition zone [24] covers a number of wide and shallow synclines (Severnoslannishka, Shumenska, Provadiyska) with anticlinal bulges between them in the eastern part of the northern strip of the Pre-Balkan Mountains.

According to Karagyuleva [8], it is characteristic of the area east of the Yantra River that the northern strip of the Pre-Balkan Mountains significantly expands and acquires a specific appearance. A number of flat and broad synclinal structures are observed here, developed on the southern flexure of the Moesian plate (on the southern flank of the North Bulgarian Bulge).

Karagyuleva and Stoyanov [9] consider the studied territory as part of the eastern part of the Shumen transition zone and give a detailed description of the construction of the flat, extensive Severnoslannishka syncline. It is followed a little south of the village of Kesarevo, the town of Antonovo and north of the village of Izvorovo to the village of Lilyak. In its eastern most part, it abuts and visibly flows into the northern hips and western periclinals of the Omurtag and Preslav anticlines.

According to Bonchev [7], no reasonable conclusions can be drawn from the surface exposures about the nature of the tectonic boundary between the Pre-Balkan and the Moesian plate in front of the Shumen transition zone. Some information in this regard is provided by Dimitrov's [6] gravimetric photograph of Northeastern Bulgaria. It shows that the gravity maximum in the North Bulgarian bulge is separated from the strip with minimum values in the Shumen transition zone by lines of increased horizontal gradient. This gradient in individual sections reaches significant values and with a high probability traces faults of a flexural-sedimentary nature. This is the case between the Popov bulge and the Slannish syncline.

According to Bonchev [25], this zone is structurally transitional between the Moesian platform and the Pre-Balkan proper. It also occupies a transitional position, being formed on the tectonically mobile

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outer (peripheral) part of the platform. The same author is of the opinion that although it is an epiplatform formation, the ú structures are linear and fully coupled with those of the real Pre-Balkan. All this, taking into account the geological development, shows the transitional place of this structural zone. Bonchev et al. [24] believe that, according to the given definition, the transitional zone should equally be considered as an integral part of the Moesian platform and the Pre-Balkan.

Within the boundaries of the study area, a formation with minor facies differences is revealed.

On the surface, within the boundaries of the Lilyak Plateau morphostructure, mainly Lower Cretaceous thick clasts of sandstones with interlayers of marls united in the Roman Formation (rmK_1^{ap}) and marls with thin sandstone interlayers united in the Gornooryahovo Formation ($gK_1^{h\text{-}ap)}$ are revealed (Photo. 3).

Cheshitev and Filipov [26] point out that in these lands the Pre-Balkan differs from the South Moesian peri-platform area in the north in several features: 1) the development of Upper Triassic sediments, among which there are also evaporites, which are absent in the north; 2) the flysch-like nature and great thickness of the Upper Jurassic-Valanginian sediments; 3) the development of the Kamchi formation, characteristic only of the Pre-Balkan region, which in the north is replaced by the marls of the Gornooryahovo formation, etc.

Morphotectonic position of the area

The Lilyak Plateau spatially overlaps with the Lilyak Plateau morphostructure. It is located in the southern parts of the Danube (South Moesian) hilly plain in Northern Bulgaria, which in turn spatially overlaps with the regional morphounit, the so-called South Moesian morphostructural zone (Fig. 2 and Fig. 3).

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Photo 3. Discovery of the Roman Formation sandstones near the village of Alexandrovo

The South Moesian morphostructural zone is a modern fragment of the large post-Early Pleistocene orthoplain in the northeastern part of the Balkan peninsula. The plain-lowland zonal relief contrasts with the relief of the neighboring first-order morphotectonic units (Fig. 2). The internal zonal model includes the Lower Danube morphostructural area (with the Lomski and Loveshki morphostructural areas) and the Ludogorie morphostructural area (with the Isperih, Shumen and Dobrich morphostructural areas) (Fig. 3) [4].

The Lilyak Plateau morphostructure is one of the eleven positive morphostructures, preserved to varying degrees, within the boundaries of the eastern part of the South Moesian Plain.

Nature of geomorphological evolution

The lands of the Lilyak Plateau represent a relatively well-defined plateau-hilly area that stands out among the surrounding depressions and low-mountain elevations (Photo 1 and Photo 2).

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Figure 3. Morphostructural map of the South Moesian morphostructural zone [3]

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From a structural-geomorphological point of view, this plateau represents part of the outer structural strip of the southwestern periphery of the Eastern Danube (South Moesian) Plain. It is characterized by a relatively oval shape with a west-east orientation. To the north, the structures of the plateau smoothly pass into the structures of the Razgrad uplands, and to the west into the structures of the Popov uplands. From the south, the Lilyak Plateau sharply and distinctly separates from the structures of the Eastern Pre-Balkan (Slannik area) through the rift valley of the Cherni Lom River. To the northeast and east, steep slopes separate the plateau from the Targovishte depression. There are also steep slopes to the southeast, where through the valley of the Siva River (a left tributary of the Vrana River) it separates from the structures of Preslav Mountain.

The contemporary relief of the Lilyak Plateau is the result of the complex and constantly changing in time and space interaction of endogenous and exogenous forces. It represents a positive form of the relief, structurally conditioned by horizontal to sub-horizontal layers of the Roman formation. In most cases, they play the role of "armoring" layers against the action of modern weathering processes. The plateau has a relatively flat ridge and increasing slopes to the south, east and northeast (Fig. 1 and Fig. 2). The rounded character of the relief is due to the Lower Cretaceous lithological substrate represented by sandstones (Fig. 3).

Lilyak Plateau is a structural-erosive form. Its formation was influenced by the erosion of the nearby rivers. The northern borders are defined by the valley of the Kazalarskodere River, the western and southern borders by the valley of the Cherni Lom River, and the southeastern borders by the valley of the Siva River (a left tributary of the Vrana River).

According to Tzankov et al. [27, 28] the beginning of the Neogene-modern morphogenesis in these places is related to a very wide-ranging planation of the former late Alpine relief. It has led to the formation of several orthoplains of various ages. The last of these emerged definitively at the end of the Early Pleistocene. It had the morphological character of extensive flatness. The emergence of the modern hilly-mountainous and hilly-hilly relief in Bulgaria is the result of postalpine (late early Oligocene) morphogenic processes. They took place after the almost complete erosional erasure of the traces of the last Alpine morphostructural plan. Spatially isolated solids have been preserved from it.

According to Tzankov and Stankova [1, 5] plateau morphostructures are positive paleomorphostructures, which represent relict fragments of the last post-early Pleistocene initial surface (orthoplain). It, in turn, served as the basis for the emergence of the modern relief.

To the south of the studied area, this orthoglacial was gradually destroyed by the mountain-forming processes that began in the late Pleistocene. A large part of its lands have turned into mountain

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ranges [28]. Endogenous forces are at the basis of these processes, which gradually take precedence over exogenous ones.

Plateaus as part of the oldest morphostructural generation do not belong to the range of younger mountain morphostructures. They are part of the modern Quaternary morphostructural block mosaic of the eastern part of the Danube (South Moesian) hilly plain.

The youngest visible processes, which are in progress in the lands of the South Moesian morphostructural zone and in particular in the Lilyak Plateau, give a clear indication that exogenous processes have an important (predominant) importance for the relief formation in these places.

On the ridge of the Lilyak Plateau, traces of a high-lying denudation level formed in Lower Cretaceous sandstones can be found. The surface is formed at an altitude between 450 – 500 m. It is heavily cut by the river-valley network of the Cherni Lom River and its tributaries. There is a decrease in its height in the western and northern direction up to 360-400 m. In the northern part of the region, fragments of this initial surface stand out around Tabiyata Peak (450.7 m), Kumludzha Peak (461.4 m). To the south, it is traced around an elevation of 469.5 m, Topkoru Peak (505.5 m), elevation 477.4 m, Aleksandrov Peak (516.9 m), elevation 511.2 m, etc.

On the northwestern and western slopes of the plateau between the villages of Gloginka, Koshnichari and Marchino, separate patches of lower leveled surfaces between 300 – 350 m and 250 – 300 m are observed. Vladev [18] describes them as Plio-Pleistocene, most of which are erosional in origin, and those in the lower part of the slope have a mixed erosion-accumulative origin.

In the upper parts of the Cherni Lom River and its tributaries, high floodplain river terraces are hardly observed. Low floodplain terraces are found on the slopes of the tributary valleys immediately next to the confluence of the Cherni Lom River [18].

The conducted medium-scale analysis Tzankov et al. [1] of the morpho-structural features of the eastern parts of the Balkan Peninsula shows that the large negative areas - the Lower Danube hilly plain, the range of the Trans-Balkan valleys, the Upper Thracian, Lower Thracian and Western Thracian lowlands have the character of sizeable relics of the once single, all-encompassing post-early Pleistocene orthomelt. It was gradually destroyed by the mountain-forming processes that began in the late Pleistocene. A large part of its lands has turned into mountain ranges [27]. Endogenous forces are at the basis of these processes, which gradually take precedence over exogenous ones.

In contrast to this course of Quaternary morphogenesis, only traces of the first generation – fragments of the post-Early Pleistocene orthoplain are found in the South Moesian morphostructural zone and in particular the Lilyak Plateau landform. The emergence and development of the post-Early Pleistocene orthomelt in these places is distinguished by the formation of a number of regional

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morphostructures. These are very low-style bends of the starting plane, which are characteristic of the areas with platform construction. In connection with this, syneclises, anteclises or their parts have arisen. The morphostructures that arose in this way were subjected to fragile deformation by variously oriented steeply dipping faults (faults). It is important to emphasize that no traces of listric fracturing have been found anywhere on the territory of the South Moesian morphostructural zone.

The Lilyak Plateau landform is located in the southwestern part of the Ludogorie morphostructural area of the South Moesian morphostructural zone [4]. The name derives from the name of the Lilyak Plateau and completely overlaps with it.

The Ludogorie morphostructural region includes Isperih, Shumen and Dobrich morphostructural regions (Fig. 4). It is oriented in the west-east direction with a maximum length of about 17.5 km. The maximum width of the region is in its western part – about 11 km. The total area of the studied area is about 178 km^2.

From the analysis of the morphostructural map of the area (Fig. 5), it can be seen that the overall spatial orientation of the modern relief has a mosaic, but uniform structure.

Traces of the post-Early Pleistocene orthoplain (the first morphostructural generation) are currently found in the Lilyak Plateau landform.

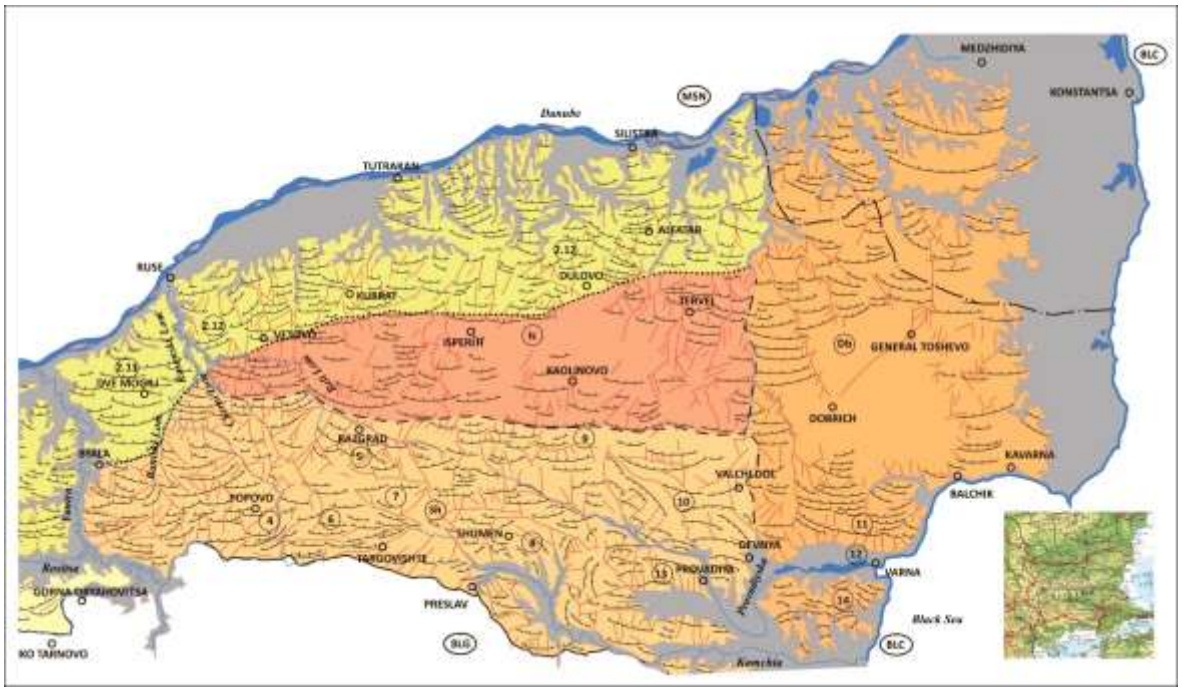


Figure 4. Ludogorie morphostructural region [4]

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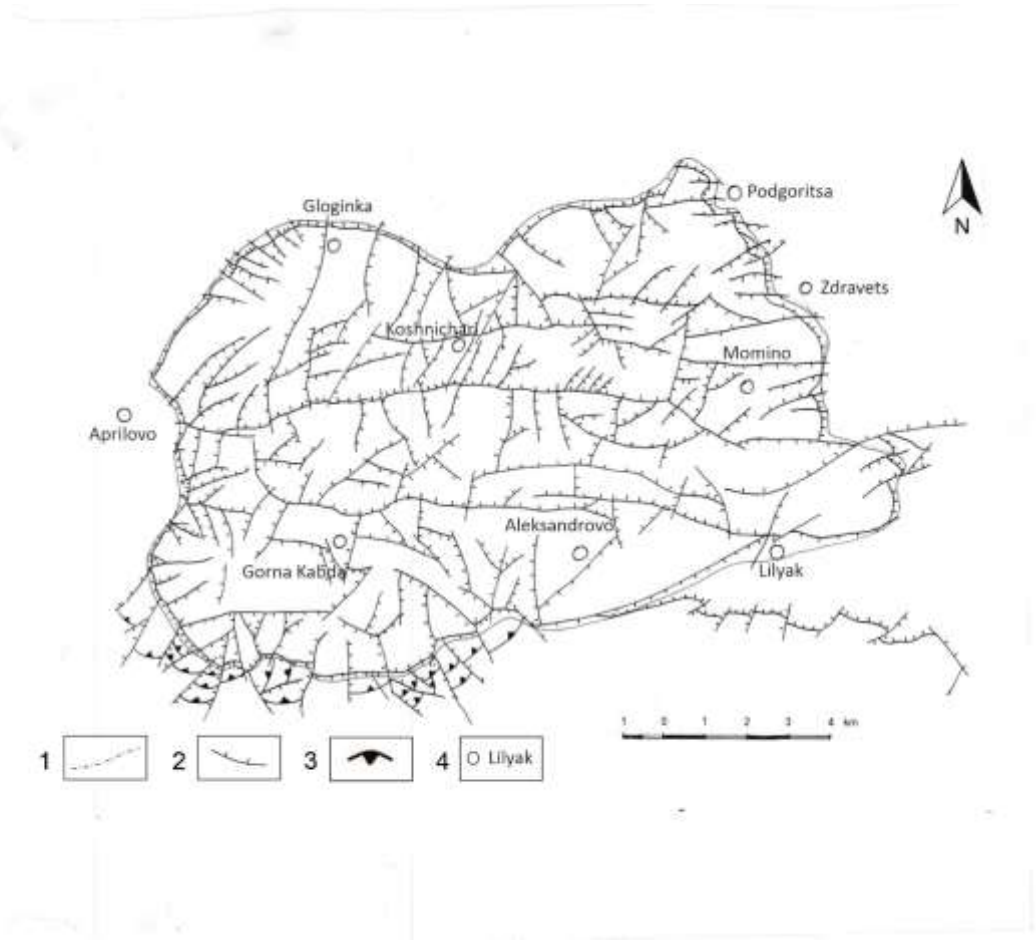


Figure 5. Morphostructural map of the Lilyak Plateau

1- boundary of the researched area; 2- steeply dipping fault; 3- listric fault; 4- populated place

Nature of morphodynamic processes

The South Moesian morphostructural zone corresponds to the northern part of the Maastrichtian-early Neogene morphotectonic seam (suture) between the Moesian and Bulgarian continental microplates during the construction of the continental massif in New Europe. The ongoing transcontinental collision between Gondwana and Neo-Europe in the Mediterranean region has led to a very intense destruction of the post-Early Pleistocene orthope and construction of high mountain relief (Rila, Pirin, Rhodopes) in the southwestern part of the Bulgarian continental microplate. The mentioned collision caused the Pre-Balkan and Stara planina mountain synchronous uplift in the seam zone between the Bulgarian and Moesian continental microplates. The South Moesian morphostructural zone is not affected by these morphotectonic processes [4].

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The South Moesian morphostructural zone is the largest fragment of the post-Early Pleistocene orthoplain in this part of Neo-Europe. Its northern, southern and western borders - the Lower Danube, South Moesian and South Moravian fault groups – are elements of global fault networks. The zonal relief in the South Moesian Plain is characterized by various intense regional block faults and lack of listric faults. Most of the area has a general surface homoclinal dip to the north. In the easternmost parts of the zone (Dobrich morphostructural region) the homoclinal slope is to the east. This circumstance is related to the normal gradual transition to the Black Sea oceanic microplate [4].

The modern geodynamic concepts of relief formation in the studied lands can be summarized as follows. The eastern part of the Balkan peninsula has an expressive mosaic block-fault structure. In the studied area, from the south, the frontal northern part of the Pre-Balkan morphostructural zone is located in the range between the gorge of the Vrana River in the Veliki Preslav morphostructural region (Preslav Mountain) and the Moravian morphostructural region (Northern Slannik). In the north, they are articulated with the Lilyak Plateau paleo morphostructure. In fact, this is the place where the plateaus of the Danube hilly plain rest on a fault with the Pre-Balkan Mountains (Fig. 6).

Figure 6 shows several features of the relationship between the fold structures of the Pre-Balkan and the South Moesian platform:

1) The surface of the Lilyak Plateau landform has a horizontal to sub-horizontal character with a pronounced, albeit minimal, slope to the north. In fact, it is a remnant of the old orthoplain structure.

2) The Lilyak Plateau landform is internally complicated by only steeply dipping normal faults (Fig. 5). In contrast, in the adjacent part of the front of the Pre-Balkan morphostructures, the fault tectonics is manifested mainly by gently dipping listric faults, as well as normal steeply dipping faults. It should be noted that listric faults are completely absent in the area of the plateau.

3) The immediate contact between the Lilyak Plateau landform and the frontal part of the Pre-Balkan Range has a distinct morphological appearance of a fault valley (Photo 4 and Photo 5).

4) From the point of view of the geodynamic study of the relief in the studied area, there is a distinct contact between the late Paleocene-Holocene positive morphostructures of the Pre-Balkans from the south and the pre-Paleocene Lilyak Plateau landform in the north. Temporal and structural differences between these two regional morphounits are visible on the face.

5) It should be noted that the height of the relief to the north and to the south of the boundary fault is different, respectively. It is here that the highest point of the Lilyak Plateau landform exceeds in absolute height the southernmost parts of the Pre-Balkan Mountains.

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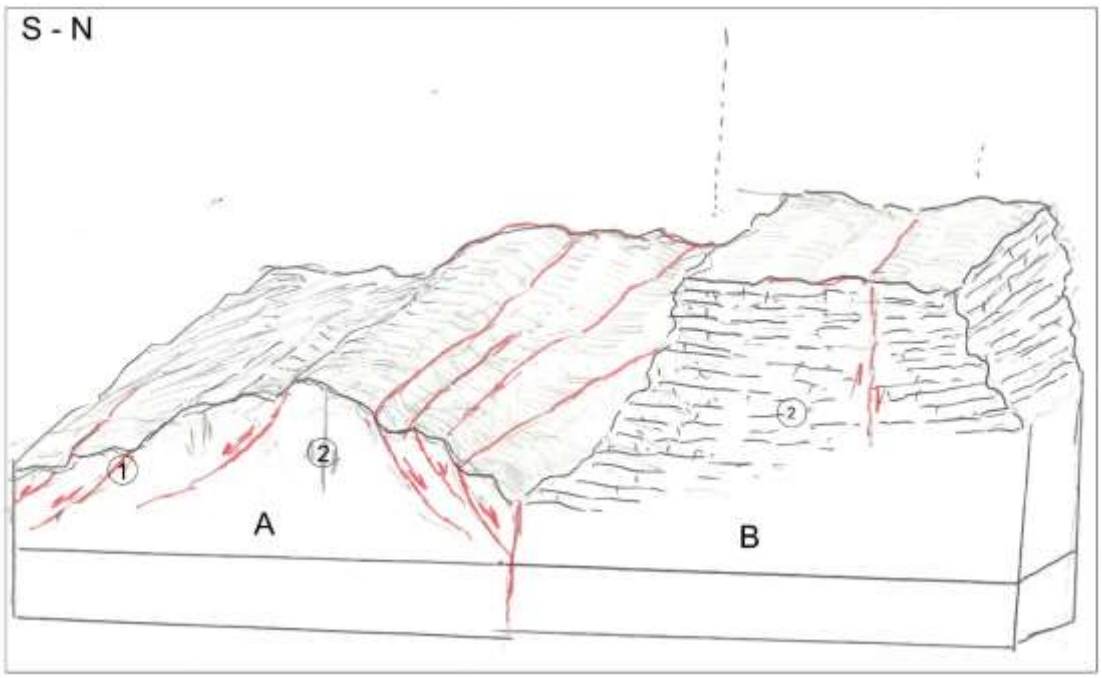


Figure 6. Conceptual mosaic block diagram of the relationships between the Lilyak Plateau landform from the north and the Pre-Balkan morphostructures from the south:
A – Pre-Balkan positive morphostructures, B – Lilyak Plateau landform; 1 – listric fault; 2 – steeply dipping normal fault.

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Photo 4. Rift Valley of the Cherni Lom River on the border between the Lilyak Plateau and the Eastern Pre-Balkan View to the south

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Photo 5. Border between the Liljak Plateau and Pre-Balkan to the right of the road between the village of Alexandrovo and the village of Lilyak

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TECTOCHRONOLOGY OF DEFORMATION PROCESSES IN THE SOUTHEAST PART OF THE SOUTH MOESIAN MORPHOSTRUCTURAL ZONE

Konias – Santonian	- End of subduction in the western part of the Tethys Ocean - Start of the transcontinental collision between Gondwana and Paleo-Europe - Beginning of Gondwanan continental suturing fragments of the Intra-Mediterranean archipelago along the southern and the southeastern margin of the Paleo-European continent
Campanian-Maastrichtian	- Formation of the Neo-European Continental Massif by sutured Gondwana continental fragments of the Intra-Mediterranean archipelago - Emergence of the Bulgarian ortoplain continental microplate
End of the Early Paleocene	- Zonal morphostructural dissection of the Bulgarian continental microplate - Identification of the South Moesian morphostructural zone
Late Paleocene-Holocene	- Blocky dissection of the orthoplain of the South Moesian morphostructural zone - Characterization of the Lilyak Plateau landform

Conclusions

The analysis of the origin, the supposed development and the modern construction of the Lilyak Plateau landform, as part of the South Moesian morphostructural zone, leads to the following main conclusions:

- The Lilyak Plateau landform as part of the South Moesian morphostructural zone represents a fragment of the last post-Early Pleistocene orthoplain in this part of Neo-Europe.
- The Neogene-Quaternary evolution of the studied area is related to the fluctuations of the main erosional base – the Danube River and the Black Sea, on the one hand, and the rise of the North Bulgarian arch swelling (uplift) – on the other.
- The destruction of the post-Early Pleistocene orthoplain did not affect the studied area.

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- The Lilyak Plateau landform is internally complicated only by steeply dipping normal faults, and the gently dipping listric faults, characteristic of the adjacent part of the front of the Pre-Balkan morphostructures, are completely absent.
- Temporal and structural differences between the late Paleocene-Holocene positive morphostructures of the Pre-Balkans from the south and the pre-Paleocene Lilyak Plateau landform in the north are visible on the surface, and there is a distinct contact between these two regional morphounits.
- The morphostructural analysis confirms the categorical opinion that the Lilyak Plateau in morphostructural terms is absolutely different from the parts of the Pre-Balkan bordering on it from the south. In this sense, the new morphostructural studies conclusively prove that the lands on the plateau belong to the Danube hilly plain.

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