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Some Results of the Latest Geomorphological Mapping of Srem

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Abstract

The Institute of Geography in Novi Sad is in the phase of finishing the project of Geomorphological Mapping of Vojvodina. Some phenomenons which appeared when mapping the mountain of Fruška gora are analysed in this paper. They are the following:

1. The reasons for the change of the direction in which the mountain crest extends,
2. The different directions in which the stream-valleys of the Fruška Gora extend,
3. The reasons for the existence of the relatively large number of "pirating" streams.

The topic of this paper is to analyze the above problems and to illustrate them with the examples from the latest geomorphological mapping.

Keywords: Srem, geomorphology, mapping

The Institute of Geography in Novi Sad is in the phase of finishing the project of Geomorphological Mapping of the Vojvodina. That was a part of a federal project which resulted in the Geomorphological Map of Yugoslavia in a scale of 1:500,000, which was published right before the country fell apart. The mapping was carried out in reverse order due to the many difficulties in the administrative affairs. The general map was made before the detailed mapping was conducted. This turned out to be a lucky solution because this big area of 250,000 square km could have never been mapped later by the uniform methodology.

Simultaneously, around 1985, all the republics and provinces of the former Yugoslavia have started the detailed geomorphological mapping in the scale of 1:500,000. The realization of the projects was carried out at different paces and, as far as I know, until 1999, it was completed only in the Vojvodina. The new maps of this area have mainly fixed the basic presumptions made by the previous geomorphological researches, but they have also illuminated some unknown elements. Many of these new elements are to be the signs for the further geological and geomorphological research in this area. This paper tends to show solely the problems connected to the Fruška Gora Mountain, and they are:

1. The reasons for the change of the direction in which the mountain crest extends,
2. The different directions in which the stream-valleys of the Fruška Gora extend,
3. The reasons for the existence of the relatively large number of the "pirating" streams.

The aim of this paper is to analyze the above problems raised by the latest geomorphological mapping.

The Fruška Gora is a low mountain which takes up the northern part of Srem. Its base has the shape of an ellipse which is 80 km long and 15 km wide. There are only seven peaks higher than 500 m, and the highest one is 539 m high. On the west, its outskirts penetrate the territory of Croatia.

The Direction in Which the Mountain Crest Extends

The main geomorphological characteristics of the Fruška Gora were formed during the Herzine and Alpine orogenesis. The original range, of the same area as today, was formed in the first orogenesis. In the second one, that range was turned into a Horst by the sliding of the terrain along the "faults" in the ground. Many of these faults later served as gullies in the process of the water erosion. The final result of the tectonic movements was a mountain whose crest, generally speaking, lies along the east-west axis. This main direction of the crest is disturbed on certain localities by the backwards cutting in of the stream valleys. In certain places the direction of the crest turns to the north and in others to the south. On the west outskirts of the mountain, where the streams are not long and strong, there are no such bends. They start to appear near the village of Cortanovci and spread to the west, where the mountain is higher and the system of streams is well developed. These bends usually have small diameters (Bukurov 1953, Milić, 1973).

This winding is of the erosive character and it does not significantly disturb

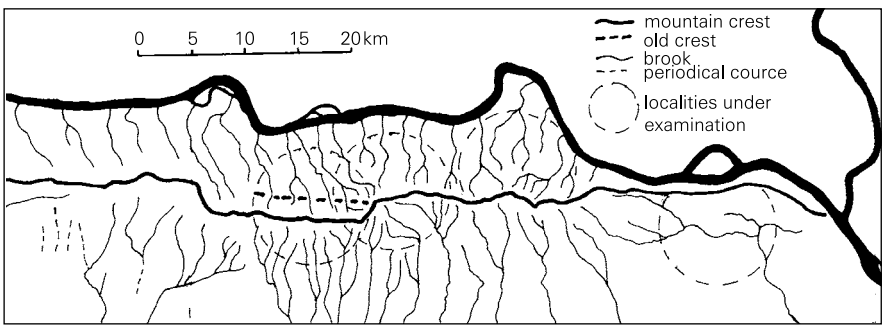

Fig.1. The direction in which the mountain crest extends

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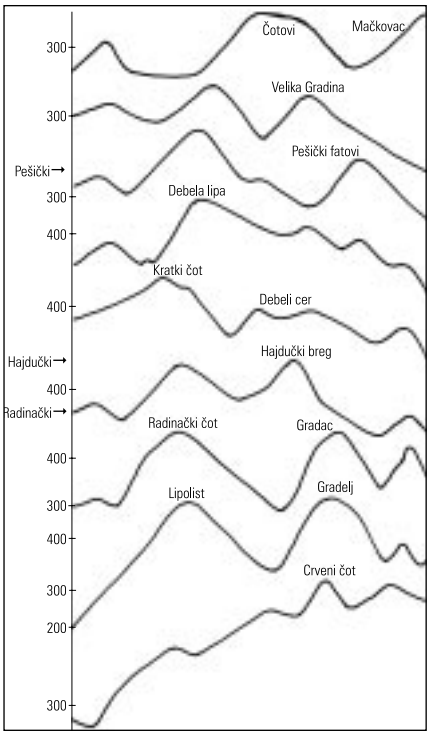

Fig.2.Thecharacteristictransversalprofileon the middle part of the mountain crest

the main direction in which the mountain crest extends, from the east outskirts to the central mountain part, i.e. to the highest peak "Crveni čot". From that point on to the west, the mountain crest disappears only to re-appear again 2 km further on the south. The parts of the crest, east and west from the "Crveni čot" peak, are connected by a watershed between the Potoranj stream on the north and Besenovo stream on the south. According to the orographic criteria, this watershed, 2.5 km long, also represents a part of the mountain crest.

At first, this turning of the mountain crest looks like the formation of bends by the regressive cutting in of the stream valleys, mentioned above. However, there are strong reasons to believe that these two phenomena are basically different. In the latter situation, the main direction gets re-established almost immediately, while it is not the case in the former situation. Further to the west, the crest also extends along the east-west axis for the next 12 km, with a smaller number of bends made by the regressive formation of stream valleys.

The turning of the mountain crest has another interesting effect. On the west from the "Crveni čot", in the direction of the north parts of the mountain crest, there are eight distinct peaks, some of which are so striking that they have got the names:

West from the "Crveni čot", which is 539 m high, on the distance of 1 km, there is the "Gradelj" peak, 478 m high. The opposite peak "Lipov čot" on the south part of the crest is of the same height (479 m).

On 2 km west from the "Crveni čot", the "Gradac" peak (445 m high) stands opposite the "Radanicki čot" peak (455 m) which is a part of the mountain crest.

Further on, 3 km west from the "Crveni čot" peak, the re is the "Hajdučki breg" locality on the 460 m of height. It is higher than the opposite part of the crest which is 450 m high.

The locality "Debeli cer", 4.5 km west from the "Crveni čot", contains the peak 395 m high, while the opposite peak on the mountain crest "Kratki čot" is 464 m high.

The "Mali Trešnjevac" peak, 6.5 km west from the "Crveni čot", is 405 m high, while the mountain crest on the opposite side (the "Debela lipa" peak) is 465 m high.

On the distance of 8 km west from the "Crveni čot", there is a locality called "Pešićki fatovi" which is 372 m high. The opposite peak on the mountain crest is 430 m high.

9 km west from the "Crveni čot" peak, these is a 338 m high peak called "Velika gradina", while the height of the opposite part of the mountain crest is 400 m.

The last peak in the row (the "Mačkovac" peak) is 361 m high. It is located on the distance of 11.5 km from the "Crveni čot". The highest part of the mountain crest on the south (the "Čotovi" locality) is 372 m high.

Further on the west, there are no more such fragments because the mountain crest turns and changes its direction again. This time it turns towards the north. The next part of the crest lies 4 km on the north from the previous part and 2 km on the north from the first part of the mountain crest (east from the "Crveni čot" peak).

All eight peaks are situated on the east part of the crest, distinctly set apart from the south mountain crest and several dozens of meters higher than the surrounding terrain. They are separated by deep valleys. The "Gradelj" and "Gradac" peaks are separated from the mountain crest by the upper valley of the Potoranj stream. The other six peaks are located on the watersheds between the streams. The bends which occur on the watersheds, and which separate them from the mountain crest, are 10 m ("Debeli cer") to 90 m ("Pešički fatovi") lower.

The next and the last tuning of the mountain crest is 17 km west from the "Crveni čot" peak. This turning is located on the north from the village of Divos and the next 3 km long part of the mountain crest lies on the north-south axis. After that, the mountain crest regains its original direction (east-west) with occasional windings, similar to the ones on the east part of the mountain.

Discussion: The question is why the mountain crest changes its direction at the "Crveni čot" locality. The further research should establish whether the crest of the old Herzine range coincides with the crest of the new Alpine Horst. For that purpose, we need a detailed geological mapping of the mountain or, at least, to establish the directions of the fall of the stream valleys west from the "Crveni čot" peak. Previous mapping has discerned that the present mountain crests and opposite peaks are made of old crystallized schist and the depression between them of chalk formations. In the northern part of this yone horizontally distanced layers were perceived. (Petkovic, 1976). It will be even more difficult to establish the possible connection between the turning of the mountain crest and the great turning of the Sava riverbed towards the south. Both of them lay along the north-south axis.

The reasons for the change of the direction might be much simpler, i.e. they may be of the erosive nature. Namely, the peaks might have been formed on the mountain crests under the strong influence of the erosion. Still, it is hard to explain the fact that all these processes have coincided and the reasons for the turning of the upper course of the Potoranj stream to the east-west direction, which is unusual for the neighboring streams. The geomorphological mapping has not noted any large erosion-made valleys in that direction.

The turning of the crest on the west outskirts of the mountain is also an interesting phenomenon. The new direction of the crest lies north from the direction of the crest on the east outskirts (figure 1). If these two directions coincided, we would be able to assume that the tectonic movements have caused the deformations only in the central part of the mountain, 17 km long. This might be very well true. The moving of the west part of the crest could have been caused the regressive erosion by the streams – the erosion which was more intensive on the south side of the mountain. It was intensified by the lowering of the old Pannonian mass in the southwest Srem, south from the Fruška Gora Mountain. This phenomenon was discovered by the deep drilling of the ground (Jankovic and Stankovic, 1970). The lowering of the Pannonian mass, since it effected the top layer of the ground, must have disturbed

the vertical profiles of the streams in this area and contributed to the regressive cutting in of their valleys. This assumption could be confirmed if we established the disharmony between the topographic surface on the north-south axis and the incline of the layers which represent the main mountain mass.

The Directions in Which the Stream-Valleys Extend

The largest number of the stream-valleys in the Fruška Gora, both on the north and the south side of the mountain, has the north-south direction. This direction stands at right angle to the mountain crest, which is considered to be a common way of the parallel drainage. However, in several cases this drainage direction was disturbed. The most typical examples for this can be found south from Petrovaradin, in the area of the Novoselo and Ešikovacstreams, on the "Crveni čot" locality and in the valley-system of the Budovar stream on the east outskirts of the mountain.

The cases of the Novoselo and Ešikovac streams will be presented together because they are close to each other and their basins have deformed in the same way. Their lower courses have the usual north-south direction. However, the upper courses of both streams are considerably deformed: the Novoselo stream has an extremely wide east part of the source section, and the Ešikovac stream has a rather large west part of the source section. In that way, although they are not the neighboring streams, their source sections border on each other. Their lower basins are separated by the valleys of the Bukovac and Matej streams. The upper courses of these two streams (the Bukovac stream and the Matej stream) do not reach the mountain crest, which is a common thing in the Fruška Gora. The water from the upper courses is pirated i.e. "stolen", on the west, by the Veliki stream, the largest right-hand side tributary of the Novoselo stream, and, on the east, by the Steažilovo stream which is a left-hand side tributary of the Ešikovacstream. This arrangement of the main courses and their tributaries is characteristic for the sub-parallel drainage.

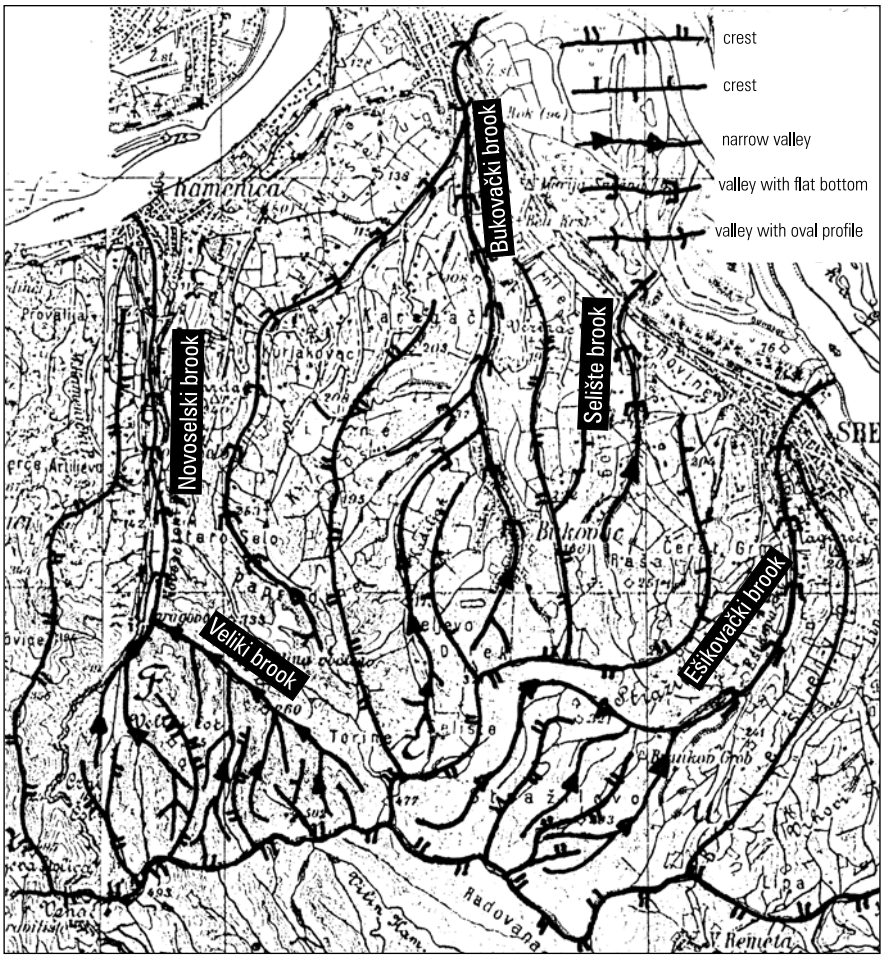

Fig.3. The Novoselo and Ešikovac streams

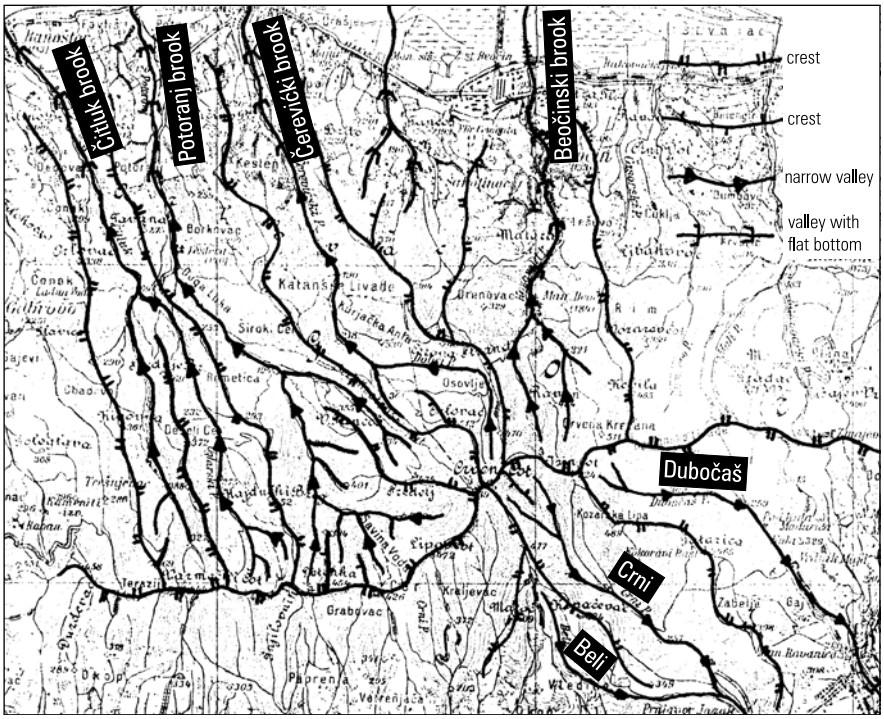

Fig. 4. The streams near the "Crveni čot" peak

Discussion: This is the most typical example of pirating in the Fruška Gora Mountain. Up to now, the professional literature has not paid enough attention to this phenomenon. Branislav Bukurov, in his paper from 1952, notes that the valley of the Veliki stream extends along the split-line (the earth-splitting line) which lays on the east-west axis, but he does not make any notes on the phenomenon of pirating. Čedomir Milić (Milić, 1973) mentions this phenomenon only in one sentence ("…, as well as the left pirated branch of the Ešikovac stream, …"). The right angle between the Veliki stream and the upper course of the Steažilovo stream clearly point to the same split-line mentioned by prof. Bukurov. The lower part of the Stražilovo stream valley is parallel with that line and probably lays along another parallel split-line.

In the area around the "Crveni čot" peak, there are several cases of pirating. However, the radial drainage is, generally, more characteristic for this area. It is interesting that the radial position

of the valleys exists only in two quadrants around the "Crveni čot" peak: on its northwest and southeast side. On the rest of the area, the lines in which the valleys extend are mainly parallel.

On the northwest side, the radial position includes the valleys of the Čerević stream, the Potoranj stream and the Čitluk stream. On the first two kilometers from the Danube riverbed, the Čerević stream valley lays on the north-south axis. In the next four kilometers it turns towards the northeast and then it extends along the east-west axis (in this part it is called: the Dobri stream). Finally, the upper part of the valley turns again and re-establishes its position along the north-south axis. This direction changing is characteristic for the structural development of the drainage. The 2 km long part of the valley which lays on the east-west axis is most probably defined by the split-line parallel with the mountain crest. This line is 3.5 km away from the crest. With the exception of the uppermost part of the valley, which is actually a pirated part of the Kozarski stream valley, the main direction of this valley is radial.

Going upstream, the first 4 km of the Potoranj stream lay on the north-south axis and the stream gets the radial direction (northwest-southeast) only when it passes the "Testera" excursion area. Than, after only 2.5 km, the valley splits in two source branches: one of them, called "Tancoš ", continues in the same direction and reaches the "Crveni čot" peak. In this part of the stream, we have noticed a case of pirating which shortened the neighboring Sakotinac stream. The other branch, called "Potoranj", turns towards the south, crosses the old mountain crest between the "Gradac" and the "Hajducki breg" peak and, from there, it continues along the east-west axis. The upper part of the valley separates the two mountain crests and its position is probably defined by the split-line.

The whole valley of the Čitluk stream lays along the northwest-southeast axis. It does not reach the "Crveni čot" peak, but it reaches the mountain crest, 4 km on west. The upper part of the valley cuts through the old crest between the "Hajducki breg" peak and the "Debeli cer" peak. This part of the valley used to belong to the Potoranj stream basin, but it is pirated by the Čitluk stream near the "Andrevlje" excursion site.

Southeast from the "Crveni čot" peak, the valleys which have radial position are the Dubocas stream valley, which is one of the source branches forming the Veliki stream, and the valleys of the Crni stream and the Beli stream, which are the source branches of the Rovaca stream. The upper valley of the Dubocas stream lays on the west-east axis, as well as the Potoranj stream valley (on the north face). The two of them extend along the same line. This part of the Dubocas stream valley is only 2.5 km long. In the next section, the valley turns towards the southeast, i.e. towards Vrdnik.

The valley of the Crni stream starts to develop in the foot of the "Crveni čot" peak and in the next 5 km, all the way to the Jazak Monastery, it lays on the northwest-southeast axis. Then it turns towards the south. The upper valley of the Beli stream, as well as all neighboring valleys on the west side, lays along the north-south axis. After that part (3.5 km), the valley turns toward the east and adjoins the Crni stream valley near the Jazak Monastery.

In one part of its valley, the Beli stream has pirated two source branches of the stream called Stejanovacki gat.

Discussion: On this side of the mountain, there are several cases of stream valleys which make a sharp turn. The detailed geological research has been conducted in this area. The results have shown that there are seven parallel split-lines, on the north-south axis, in the Vrdnik Basin (Čučulić , 1971). The same axis is followed by particular sections of the three streams mentioned above. The reasons for such extension of the valley is probably the fingerlike structure of the section of Crveni Čot which satellite photographies have shown . (Zeremski, 1990).

The Budovar stream and its tributaries are exceptions to the rule concerning the direction in which the valleys extend in the Fruška Gora. In this area, parts of the streams with parallel directions are the longest. Previous geography-related literature was more concerned with the part of the stream running south from the mountain (Zeremski, 1962). This paper deals with the deformations which occur in the mountain part of the course. The source of the stream is located under the south face of the mountain crest, in the locality called "Brdez". In this area, the lower east part of the Fruška Gora passes into the higher central part. In the upper part, the main direction is north-south, with slight curves towards the southeast, which is also the case of the neighboring streams. After the first 5 km, the valley makes a sharp turn towards the east and extends in that direction for the next 14 km. This is the most prominent case of the inverted extending of a valley in the Fruška Gora. Four left-side tributaries of the Budovar stream have the same direction; those are: the Ab stream, running through Cortanovci, the Barb Dol stream, on the south, the Krcedin stream and the Novi Slankamen stream. The last two streams are connected with the Budovar stream by one penetrating water current. This is a pseudoepigene which appeared when the Kercedin depression was formed (Zeremski, 1962). At one point, the Budovar stream makes a sharp turn towards

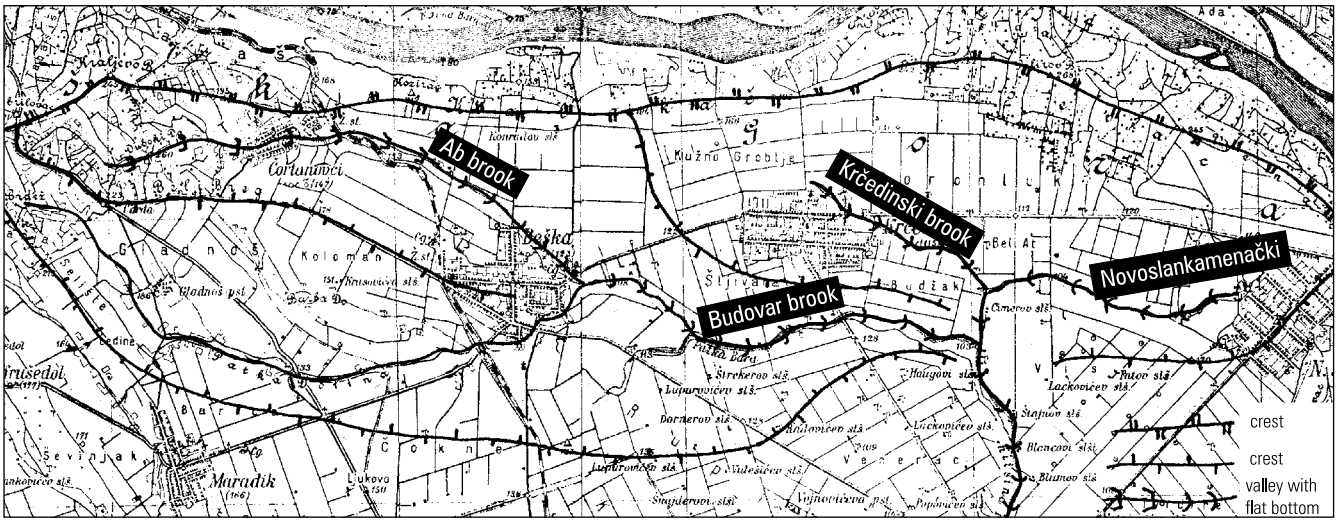

Fig. 5. The valley-system of the Budovar stream

the south and leaves the Fruška Gora Mountain. Thus, one has the impression that the Krcedin stream, the shorter one, is the main stream and the Budovar stream, the longer one, is the tributary; but that impression is wrong.

Discussion: The directions of the valleys of the Budovar stream and its tributaries have the characteristics of the rectangular drainage, which is influenced by the directions of the main split-lines on the Fruška Gora. This kind of valley formation is defined by the structure of the mountain (Zeremski, 1962), in contrast to the free formation, in the cases of other analyzed valleys. The main two split-lines on the mountain are parallel and lay on the north-south axis. The valleys of the Ab stream, the Krcedin stream and the Novi Slankamen stream are formed along the north split-line, and the Budovar stream-valley along the south one. Several short stream-valleys lay at right angles to the streams mentioned above, and a small depression lays along the two split-lines.

Bibliography

Bukurov B. (1952): Tri Fruškogorske doline, Glasnik Srpskog geografskog društva, sveska XXXII – 1, Beograd.

Bukurov B. (1953): Geomorfološki prikaz Vojvodine, Zbornik Matice srpske – serija prirodnih nauka, Matica srpska, Novi Sad.

Ćurčić S: Detaljne geomorfološke karte – listovi Sremski Karlovci 3 i 4, Rukopisne karte sa komentarom, Dokumentacija Instituta za geografiju u Novom Sadu.

Čučulić M. i Aleksić V. (1971): O trijasu na Fruškoj gori, Zapisnici Srpskog geološkog društva za 1970. Beograd.

Grupa autora (1998): Reljef Srema, Institut za geografiju, Novi Sad.

Jankovic P. i Stankovic S. (1970): Prilog poznavanju geologije Srema na osnovu dubokog istraživačkog bušenja, Zbornik radova Kongresa geologa Jugoslavije, Zagreb.

Milić C. (1973): Fruška Gora – geomorfološka proučavanja, Matica srpska, Novi Sad.

Petković K. i dr. (1976): Fruška Gora – monografski prikaz geološke građe i tektonskog sklopa, Matica srpska, Novi Sad.

Zeremski M. (1955): Holoceni epirogeni pokreti na jugoistočnom delu Sremske lesne zaravni, Zbornik Matice srpske, serija prirodnih nauka, sv. 9, Novi Sad.

Zeremski M. (1961): Još jedan prilog holocenim epirogenim pokretima na istočnom delu odseka Sremske lesne zaravni, Zbornik za prirodne nauke, sv. 20, Matica srpska, Novi Sad.

Zeremski, M. (1962): Neke morfološke odlike dolinskog sistema Budovara u istočnom Sremu, Zbornik za prirodne nauke, sv. 22, Matica srpska, Novi Sad.

Zeremski, M. (1990): Geomorfološka morfostrukturna karta Srbije, Geografski Institut Jovan Cvijić, Beograd.