



## Evidence for Late Neogene braided rivers in Blagoevgrad graben

### Доказателства за съществуването на преплетени реки през Късния Неоген на територията на Благоевградския грабен

*Miroslav Ivanov*

*Мирослав Иванов*

South-West University “Neofit Rilski”, 66 Ivan Mihailov str., 2700 Blagoevgrad; E-mail: m\_ivanov@swu.bg

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#### Introduction

The Neogene sediments in Blagoevgrad graben have been a subject of numerous researches. First Bakalov (1979) conducted detail investigation of the sediments and determined the stratigraphic units in Blagoevgrad graben. After that Valkov (unpublished work in Nedjalkov et al., 1990), based on Bakalov (1979) defined 2 lithostratigraphic units: lower clay and sandy horizon – Dzherman Formation, and upper pebbles and cobbles horizon – Barakovo Formation. Later Nedjalkov et al. (1990) also separates the sediments in the graben into two formations – Dzherman and Barakovo. In new research, Tzankov et al. (2005) introduced the litho complex theory and include the Neogene sediments in the above mention graben in the Slatino litho complex. Nedjalkov and Aleksiev (2004) did an interpretation of the paleogeographic evolution of the grabens along the Struma valley including Blagoevgrad graben, based on facial analysis of the sediment deposits. They divided the sediments into 3 facial zones. The first one consists of not well-rounded sediment, deposited by temporary streams, which is developed along the east boundary of the graben close to Rila dome morphostructure, the second one is stagnant water deposits consisting mainly of clay and sand, and in the middle of the graben an alluvium facial, 3rd zone is developed.

#### Results and discussion

The purpose of this study is to use one of the basic principles in geology, combined with facial analysis as a tool of investigation, on the Late Neogene and Quaternary sediments in Blagoevgrad graben in order to achieve better results in reconstructing the palaeo environments and the relief evolution. The study also aims to present new evidence that the alluvium facial zone (Nedjalkov, Aleksiev, 2004) actually coincide with the braided canal of paleo river Struma. For the first time the idea for braided river pattern in the area

is presented by Tzankov et al. (2005), later Ivanov (2015) developed a theory for existence of such pattern in the presumably Quaternary reddish sediments observed along SW Rila foothills between the town of Dupnitsa and the town of Blagoevgrad. In this study new sediment outcrops located 10 km north of Blagoevgrad and close to the town of Kocherinovo, and further north close to the town of Boboshevo are presented. Comparative research between this Neogene sediment sections situated in Blagoevgrad graben and modern alluvium sediments along the rivers Struma and Dzherman, as well as with some additional Neogene sediment section is done. In order of better statistical representation, the sediments with the different facial features are presented as a benchmark and crosscheck of the representativeness of this study. The lack of similarity of the facial features also is used as an analytical tool. Alternation of sandy-clays and pebbles lenses and crossed bedding are typical facial features observed in the presented Neogene sedimentary profiles. These sediments are white to light yellow colored with traces of reddish laminations, rich of iron oxides. The average size of the individual pebbles is 2–3 to 10 cm in diameter; they consist predominantly of gneisses, quartz, amphibolite, schists, red to pink colored granites and other predominantly metamorphic rocks. The lenses with the fine-grained materials are built mainly of quartz sands, with less presentation of clay materials. On the top, these sediments are covered by well rounded, reddish cobbles, which are abundant in mid-grained biotite granite, diorite, gneisses, quartz, amphibolite and biotite micaschists. These rocks types resemble the modern geology settings of surrounding areas. After thorough examination it is concluded, that the Neogene sedimentary sequences has little to none resembles, with the facial feature of the modern alluvium along the Struma river in the area, but possess some similarities with the modern alluvium along Dzherman river, where sandy lenses and cross bedding, exactly as in the investigated

Neogene sediments and also typical for the sediments deposited by braided rivers can be observed. Only the sizes of the individual lenses are different, which are much bigger in Neogene sediments than in the modern river alluvium, probably due to the difference in the river discharge. As it is revealed, the size of the lenses and the cross bedding in the Neogene sediments, subjected to this study, is beyond comparison with those in the modern sediments along the river Dzherman, but the facial features are similar. Furthermore, on satellite images, it is easy to detect the braided pattern of Dzherman river at the spot of deposition of the modern sediments that are used as a model of sediments, deposited by braided river. Because of that, based on facial features and the actuality method a conclusion can be made, that the depositional environments of the investigated Neogene sediments, are similar to the modern one deposited by Dzherman river, which possess clear braided pattern at the spot of deposition. The only difference is the size of the transport agent, which is bigger in the Neogene and probably is the paleo river Struma.

## Conclusion

Based on the facial similarities, between the Neogene sediments presented in this study and the modern alluvium deposited in clear braided river canal of river Dzherman, a conclusion can be made that the paleo river, which deposited the Neogene sediments also had a braided pattern (Leopold et al., 1995). This pattern can be used as evidence of a sudden loss of energy in the transport agent, as well as for a current with a great load of sediments transported from substantially elevated terrain subjected to erosion. Furthermore, the size of the pebbles and the stage of roundness suggest, that they were transported from a great distance. The fact that, the rock types of some pebbles are not matching the petrographic settings in the nearby areas that

are subject of substantial modern vertical dislocations, supports this. Based on the presented evidence by using actuality method and facial analysis the existence of braided pattern of paleo Struma along Blagoevgrad graben is proved and now on this base we can trace it through new sediment cuts on a distance more than 20 km long and 2–3 km wide. Furthermore based on the fill and cut function of the water body the foundations of a new stratigraphy scheme of the sediments in Blagoevgrad graben, where the emphasis is put on the lateral interaction instead of the superposition principle has emerged. In addition, a newly discovered fossil site, with presumably Upper Neogene, large leaf deciduous macro flora can be used as a comprehensive tool for better understanding of the stratigraphy of the graben.

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