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ABOUT THE MORPHOTECTONICS OF THE SOUTH MOESIAN MORPHOSTRUCTURAL ZONE (BALKAN PENINSULA EASTERN PART)

Abstract: The South Moesian Morphostructural Zone is the most fragment from the post Early Pleistocene Orthoplain in the eastern part of Balkan Peninsula. The analysis of it morphostructural peculiarities and the contemporary relief (Tzankov, Stahkova, 2012) have given the possibility for the preparing of the offer in this article Survey map of the South Morphostructural Zone. This map illustrates the contemporary authors` concept for the relationships between the North Bulgaria relief and morphostructure.

Keywords: Post Early Pleistocene Orthoplain, morphostructures, anticline, syncline

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Introduction. The article proposes a morphotectonic review to the South Moesian Morphostructural Zone in North Bulgarian with original prepared morphostructural map in a scale 1:50000. The investigation was realized on a base of the contemporary Plate tectonic study principia by means of the morphostructural analysis application (Tzankov, 2013, Tzankov at all., 2016). It was provided the principal relief building role of the regional mosaic pattern in the eastern part of the Balkan Peninsula (Fig. 1).

Some problems of the North Bulgarian Quaternary morphostructure and morphotectonic are briefly discussed from different authors (Tzankov, 2008, Burchfiel at all., 2008, Tzankov, 2009, *Цанков, Станкова*. 2012, *Цанков, Станкова*, 2012a, *Цанков, Станкова*, 2012, *Tzankov, Stankova*, 2013, *Stankova, Tzankov*, 2016, *Tzankov* at all., 2017, *Stankova* at all., 2017). The first regional mobile morphostructural research of the area (*Tzankov, Stahkova*, 2012) shows some important differences in the Quaternary internal pattern between the Bulgarian Continental Micromorphotecture and South Moesian Morphostructural Zone (as a bigger southern part of the Moesian Continntal Micromorphotecture). The present investigation was added the morphostructural characteristics of the Zone and discussed it origin and morphotectonic evolution.

Methodological basement. The adopt type and the regional relationships between the morphotectonic and morphostructural units are represent on a Table I

Table I

MORPHOTECTONIC AND MORPHOSTRUCTURAL UNITS

GLOBAL MORPHOTECTURAS

CONTINENT

Continental margin

Active	***Passive***
Continental shelf	
Continental slope	
Accretionary prism	***Continental foot***

Collision zone

Transcontinental ***Intracontinental*** ***Suture***

OCEAN

Oceanic bottom

Oceanic ridge

Oceanic trench

Hot spot

Island arc

Volcanic ***Avolcanic***

Subduction zone

Spreading zone

Obduction zone

REGIONAL MORPHOTECTURES

Macrotecture - Macroplate

Tecture - Plate

Microtecture - Microplate

Continental ***Oceanic***

REGIONAL MORPHOUNITS

Obligatory	***Optional***
Morphostructural zone	**Morphostructural sequence**
Morphostructural area	**Morphostructural group**
Morphostructural region	**Morphostructural range**

Morphostructure

REGIONAL MORPHOSTRUCTURES

INITIAL

Orthoplain

DERIVATIVE

Negative	***Faults***	***Positive***
Plain	**High angular (normal)**	**Mountain arched**
Lowland	**Low angular listric**	**Concentric**
Passage	**Strike-slip**	**Dome-like**
Complex passage	**Overthrust**	**Comb-like**
Kettle	**Upthrust**	**Anteclise**
Threshold	**Transform**	**Hemianteclise**
Gorge	**Fault bundle**	**Syneclise**
	Fault zone	**Hemisyneclise**
	Listric prism	
	Listric prisms Cascade	

Fig. 1Overview map of the Balkan Peninsula eastern part

Orohydrographic survey. The South Moesian Morphostructral Zone covers the lands of the Lower Danube Plain the south from Danube River in North Bulgaria and South-East Rumania (Fig. 1). This territory is know as a Lower Danube Hilly Plain. It is prolonged from the Timok River westward till the Black Sea Coast eastward and between the Danube River northward and the Fore Balkan hilly-mountain area and Stara Planina Mountain Ridge Area southward (Fig.1).Most of the above mentioned north-eastern part of Balkan Peninsula is (**draying)** through the Danube right tributary rivers: Timok, Topolnitsa, Vitbol, Archar, Skomlya, Lom, Tsibritsa, Ogosta, Skat, Iskar, Vit, Osam, Rositsa, Yantra and Rusenski Lom (Fig. 1). The Provadiyska and Kamchia River flow direct into the Black Sea (Fig.1).

Quaternary morphostructural generations. The territory of the South Moesian Morphostructural Zone is distinguished for the completely conserved Quaternary proto morphostructure – the post Early Pleistocene Orthoplain. This circumstance is the most important difference between the investigated morphounit and the Bulgarian Micromorphotecture.

The other important peculiarity of the South Moesian Morphostructural Zone are the widespread post Early Pleistocene came-like morphostructures (Fig. 2 after Tzankov et all, 2017 – in print). They are result from the very weak epidermal bending of some Earths superficial regions. Those morphoelements are formed the regional proto - morphostructures, very flat and shallow syneclisas and anteclisas or their parts (hemisyneclises and hemianteclises).

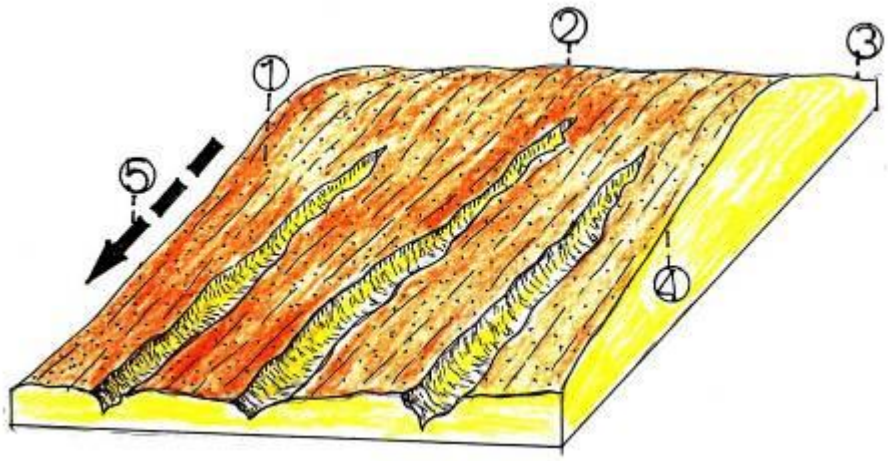

Fig. 2 Shematic block-diagram of the came-like landforms (after Tzankov et all., 2017 – in print)

1- orthoplain superficial, 2- top (most elevated parts), 3- stronger slope, 4- sloping slope, 5 – direction of the orthoplain superficial generl dipping.

The post Early Pleistocene came-like morphostructures are very flat and shallow sagging of some parts of the Orthoplain surface. Its inclination is very slowly (of the order of some grades). Those homoclinal morphostructures form specific came-like (initially "fork-like" called - *Цанков, Станкова*. 2012a) landforms (Fig. 2). It relatively most elevated part is limited by one relatively stronger and one more sloping slope. The last one is indented by longitudinal or sub longitudinal different deep combs or gullies (Fig. 2). The direction of the sloping slope dipping is parallel to the homoclinal inclination. The size of the various came-like landforms is very different.

The third morphostructural specific of the South Moesian Morphostructural Zone is the everywhere widespread Early Pleistocene-Holocene regional block dividing (Ann. I). It is controlled by the regional or local fault net. The last one is composed by high angular normal faults. The listric faults aren't established.

The contemporary relief building influence of the exogenous processes in the territory of South Moesian morphostructural Zone find expression in of the large and non stop spatial increase alluvial, abrasion or alluvial-abrasion level form land with 100 meters maximal altitude (Ann. I). It is developed in a marginal areas of the Balkan Peninsula marginal areas and probably marks the beginning of the most Late Pleistocene (?)- Holocene Orthoplanin building.

Borders. The northern border of the South Moesian Morphostructural Zone is marked from the Lower Danube Fault Bundle (Ann, I). It is following the Danube down stream eastward from the flow of Timok River to the big Danube Elbow near the Karasu River flow (Rumania). The eastern boundary prolonged past probably on the line of the towns of Medzhidia – Konstantsa (Ann, I). The exact regional position and morphotectonic character of this terrestrial boundary segment be liable to additional investigations. The mentioned border separates the South Moesian Morphostructural Zone from the most of northern morphounits of the Moesian Continental Microtecture.

The short western boundary of the Zone is marked by the Timok Fault Bundle between the town of Zaechar southward till the Timok River flow (Serbia and Bulgaria) northward (Ann, I). It separate the South Moesian Morphostructural Zone eastward from Dinarian Continental Micromorphotecture westward.

The southern boundary is following the line Vrashka Chuka Pass (on the boundary between Serbia and Bulgaria) – the northern margin of the Fore Balkan Hill-mountain Area (villages of Rakovitsa, Rabisha, Oreshets, Ruzhintsi, Belotintsi, Lesura, Borovan, the town of Cherven bryag, village of Zlatna Panega, to the north from the Mikre, Sevlievo, Tarnovo, Antonovo Hill, Preslav and Dragoitsa Mountain (Ann, I). The most of eastern boundary prolongation is following the Kamchia River to the Black Sea (Ann, I). This last border segment separates the South Moesian Morphostructural Zone from the Stara Planina Morphostructural Zone southward (Ann. I). The aforementioned southern boundary present the suture zone between the South Moesian Morphostructural Zone and the Bulgarian Continental Micromorphotecture.

The investigated South Moesian Morphounit includes the western Black Sea Passive Continental Margin segment between the degree of latitude of the town of Kyustendzha and the Kamchia River mouth (Fig. 3 – *Stankova* et all.,2017 – in print).

Ann. I

Regional morphostructure. The first realized mobile morphostructural analysis of the South Moesian Morphostructural Zone (*Цанков, Станкова*, 2012) has given a model of the Quaternary regional pattern and has showed the principal differences between the investigated regional morphounit and the Bulgarian Morphostructural Zone.

The most important characteristic of the South Moesian Morphostructural Zone is the completely conserved embryonic morphostructure of the post Early Pleistocene Orthoplain (Ann, I). The superposed brittle deformations don't cover up the tracks of the primary regional pattern. It is represent by very low-stile sagging of the orthoplain surface. The last one is marked by numerous came-like landforms (Fig. 2), which have formed synclises, anteclises or its parts – hemi syneclises and hemi anteclises (Ann, 1).

The area and region borders of the South Moesian Morphostructural Zone have a transitive character. It is expressed in gradual different continued passage between the morphostructural peculiarities of the both morphounits. This circumstance make difficile the punctual map presentation of the respective border.

The internal regional dividing of the South Moesian Morphostructural Zone is given on Tab. II

Table II

INTERNAL REGIONAL PATTERN OF THE SOUTH MOESIAN MORPHOSTRUCTURAL ZONE

SOUTH MOESIAN MORPHOSTRUCTURAL ZONE

PERI DANUBIAN MORPHOSTRUCTURAL AREA	***LUDOGORIE MORPHOSTRUCTURAL AREA***
Lom Morphostructural Region Kula Syneclise *Bregovo,Vidin,Gramada and Dunavtsi Block* Pleven Hemisyneclise *Drenovets,Valchedram, Kozloduy, Byala Slatina, Oryahovo, Gulyantsi, Slavyanovo, Nikopol, Belene, Svishtov, Dve Mogili and Ruse Block*	**Isperih Morphostructural Region**
Lovech Morphostructural Region Suhindol Homoclinale	**Shumen Morphostructural Region** Popovo, Razgrad, Lilyak and Losnitsa Syneclise, Shumen Anteclise, Sarta and Stana Syneclise, Frangen Homoclinale, Varna Anteclise, Provadiya and Momino Syneclise
	Dobrich Morphostructural Region

The South Moesian Morphostructural Zone is composed by the Peri Danubian Morphostructural Area westward and northeastward and the Ludogorie Morphostructural Area eastward (Tab. II, Ann. I).

The Peri Danubian Morphostructural Area spreads on the territory between Timok River westward and land of the town of Tutrakan (Ann. I). Its eastern and southeastern boundaries pass

with the line Yantra River (between the towns of Gorna Oryahovitsa and Byala), Baniski Lom River, the towns of Vetovo, Kubrat, Dulovo, Alfatar and Silistra (Ann. I). The Area is composed by the Lom and Lovech Morphostructural Regions (Ann. I). The most of western morphostructure of the Lom Morphostructural Region – the good detached oval Kula syneclise is formed between the Timok and Archear River (Ann.I). Its relief includes numerous densely disposed plateaus. They are separate by relatively narrow river-valley morphostructures. The large Pleven hemisyneclise includes the other part of the Lom Morphostructural Region (Ann. I). Its internal pattern is composed by the secondary blocks of Bregovo,Vidin, Gramada, Dunavtsi, Drenovets, Valchedram, Kozloduy, Byala Slatina, Oryahovo, Gulyantsi, Slavyanovo, Nikopol,Belene, Svishtov, Dve Mogili and Ruse (Ann. I). Their borders are marked by the Danube right tributary Archear, Lom, Tsibritsa, Ogosta, Iskar, Vit and Yantra River (Ann. I). The central parts of the blocks has a table-land relief. All blocks between the Archear and Vit River are inclined south-southeastward.

The Lovech Morphostructural Region is disposed between the towns of Lukovit, Pleven, Levski and Ugarchin (Ann. I). The southern margin of this part of the Area (on the land of the towns of Lovech and Pavlikeni) shows a table-land model relief (Ann. I). In its territory is formed the Suhindol Homoclinale (Ann, I). Its secondary block pattern is different in comparison with the same one from the Lom Morphostructural Region – in this Region predominate the meridian oriented faults (Ann. I).

The Ludogorie Morphostructural Area includes the Isperih, Shumen and Dobrich Morphostructural Regions (Ann, I). The first of them is disposed to the north of the flow between the Malki Lom River into the Beli Lom, to the north of the towns of Razgrad, Kaolinovo and Valchdram (Ann. I). The eastern border of the Region is marked by the fault zone of Suha reka (segment from the Venelin-Prut Faolt Bundle – after Krastev, Stankova, - Ann. I). The relief of the Region is occupied by large plateau-form relief forms (with around 200 sea level attitude – Ann. I). The river valleys and dray valleys have a canyon-form profile. Typical plateaus absent. The morphostructural character of this belt is liable to the future investigations.

The relief of the Shumen morphostructural Region (Ann. I) is different. The river valleys and dray-valleys show a V-form profile. The water-shed areas are occupied by groups of plateaus. It relief peculiarities form the Popovo, Razgrad, Lilyak, Losnitsa, Shumen, Sarta, Stana anteclises, the Frangen monoclinale, the Varna anteclise and the Provadiya and Momino syneclises (Ann. I).

The Dobrich Morphostructural Region (Ann. I) corresponds to the segment of the Black Sea Western Passive Continental Margin between the fault bundle lines of the towns Medzhidia – Konstantsa to the north and Kamchiya River Valley to the south (*Stankova* et all., 2017 in print – Fig. 3). It western boundary coincide with the south parts of the long Venelin – Prut fault bundle (*Stankova, S., Tz. Tzankov. 2016*). The relief of the terrestrial shelf western part (between the Suhata reka Dray-walley and the meridian of the town of Dobrich - Ann. I) has a plateau-form character with no more than 200 sea level attitude. The most eastern terrestrial shelf part is a low-land. The peculiarities of the submarine shelf parts of the region are described from *Stankova* et all. (2017 – in print). The most of southern parts in Dobrich Region are occupied by the Frangen Homoclinale and Momino Anteclise (Ann. I).

Origin and morphotectonic evolution. The southeastern margin of Europe Continent (include Balkan Peninsula) is composed by numerous micro morphotectures (Fig. 4). Those continental microplates were separated from the northern passive paleo margin the Gondwana Continent in different moments of the Phanerozoic evolution. They have moved as islands or archipelagos with different geological and tectonic history northward during the closing of the Tethys Ocean. The mentioned Gondwana continental fragments were arrived southward and south west margin of the Paleo Europe continental massif in the time of the ending of the Tethys oceanic crust subduction. They have tectonic sutured (weld together) and build the modern southwestern and southern margin of the European continent – Neo Europe. This circumstance determinates the mosaic pattern of the continental crust in the investigated region.

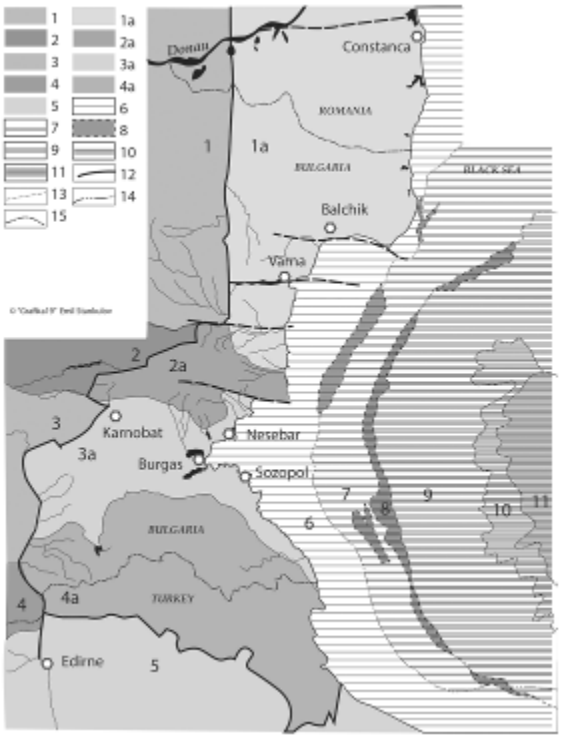

Fig. 3

Survey morphostructural sketch of the West Black Sea Passive Continental Margin after *Stankova* et all. 2017 – in print)

1-5 – subaeral margin area: 1-1a – South Moesian Morphostructural Zone: 1- continental part, 1a- margin part: 2-2a -Hemus Morphostructural Zone: 1- continental part, 1a- margin part: 3–3a - Upper Thracian Morphostructural Zone: 3- continental part, 3a- margin part: 4 – 4a - Sakar-Strandzha Morphostructural Zone: 4- continental part, 4a- margin part: 5- Lower Thracian Morphostructural Zone; 6-11 – subaqual margin area: 6-8 – continental shelf: 6- high step, 7- down step, 8- fault zone; 9- continental slope, 10- continental foot, 11- Black Sea Bottom; 12 – west border of the West Black Sea Passive Continental Margin, 13- some important faults, 14- border between the morphostructural zones, 15 – boundary between Turkey and Bulgaria.

The post Aliped geotectonic evolution of the eastern part of the Balkan Peninsula was began with the Late Oligocene – Early Pleistocene relatively long (28 – 0.78 Ma) apparent geodynamic "calm". This paleogeographical setting was determined the low land – plateau relief and savanna similar landscape of the region. The wide-spread braded rivers were contributed to the building of several super posited large denudation-accumulative planes – orthoplains. The building of the last of them – the Post Early Pleistocene Orthoplain (before 780 000 – 800 000 years) precede probably the beginning of the intercontinental collision between Gondwana and Europe in the East Mediterranean area. This process has and is provoked and controlled the intensive mountain building in the southern part of the Bulgarian Continental Microplate ( ). Its northern border is marked by the suture with the southern margin of the Moesian Continental Micropalte (the southern boundary of the Southern Moesian Morphostructural Zone) alomg the Lover Danube Fault Bundle. The northern margin of the Bulgarian Continental Microplate is a field of the intensive Late Quaternary deformations, which have form the contemporary Stara Planina Mountain Range on a place of the destructed parts of the pre Late Pleistocene Orthoplain. The causes for this deformations are probably connected with the lateral influence of the floued (down the Bulgarian Continental Microplate southern part) Gondwana\Neo Europe Transcontinental Collision. The Moesian Continental Micropalte southern parts (the South Moesian Morphostructural Zone) were and is kept intact to the mentioned processes.

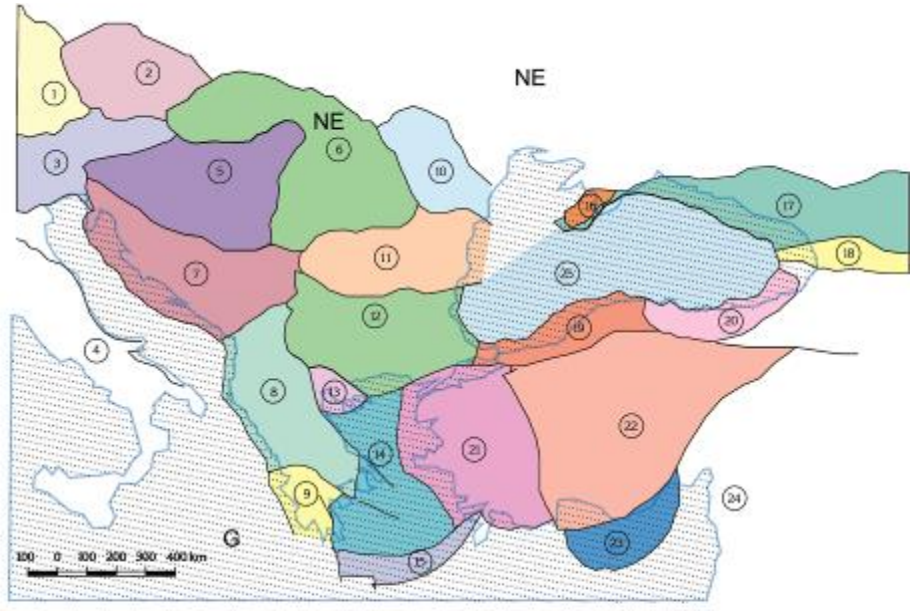

Fig . 4

Mosaic tectonic pattern schematic model of the Neo Europe South-eastern part (after *Tzankov, Iliev*, 2015 with modification and addition)

G- Gondwana Continental Macroplate (Continent); E- Europe Continental Macroplate (Continent): PE- Paleo Europe Continental Macroplate , NE – Neo Europe Continental Macroplate.

1-20 - Neo Europe Continental Microplates: 1- Bavarian, 2- Bohemian, 3- Alpean, 4- Apeninian, 5- Moravian, 6-Carpathian, 7-Dinarian, 8- Pindian, 9- Heladian, 10- Scitian, 11- Moesian, 12- Bulgarian, 13- Halkidikian, 14- Aegean, 15- Cretean, 16- West Pontian, 17- East Pontian 18- West Anadolian, 19- East Anadolian, 20- Cyprian; 21- 23 Paleo Europe Continental Microplates: 21- Creamean, 22- Caucasian, 23- Georgian; 24- Arabian Continental Plate, 25 Black Sea Oceanic Microplate.

Comparative analysis. The comparasion between the Bulgrian Continental Microplate and the South Moesian Morphostructural Zone (as southern part of the Moesian Continental Micropalte) shows following the most important differences:

1/ The post Early Pleistocene Orthoplain in the South Moesian Morphostructural Zone is regional completely conserved. The same Orthoplain in the different parts of the Bulgrian Continental Microplate is destructed in different grade.

2/ The morphostructural generations of the South Moesian Morphostructural Zone are only two, whereas in the established morphogeneration in the Bulgrian Continental Microplate are five.

3/ The listric faults aren't established in the South Moesian Morphostructural Zone.

Conclusion.

The South Moesian Morphostructural Zone is the most fragment from the post Early Pleistocene Orthoplain in the eastern part of Balkan Peninsula. It Quaternary morphotectonic evolution and peculiarities show principal differences with the Bulgarian Continental Microplate. This circumstance confirms the contemporary mega mosaic pattern of the eastern part of Balkan Peninsula.

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