GEOLOŠKI ANALI BALKANSKOGA POLUOSTRVA
Volume 81 (1), July 2020, 41–66
–
https://doi.org/10.2298/GABP191018004S
Review Paper
Прегледни рад

60 years of the Serbo-Macedonian Unit concept: From Cadomian towards Alpine tectonic frameworks

Darko Spahić[1] & Tivadar Gaudenyi[2]

Abstract. The study represents a summary of the hitherto tectonic concepts revolving around a peri-Gondwanan fragment referred to as the Serbo-Macedonian Unit. The Serbo-Macedonian Unit as a gneiss-dominated basement segment is positioned in the proximity of the Baltican craton (peri-Moesian realm). This area represents a repository of the transferred broadly similar thus highly complex, elongated polycrystalline vestiges of the Pan-African inheritance. This peculiar far-travelled composite crustal fragment of north Gondwana is amalgamated on top of the Supragetic unit during the late Variscan peri-Moesian amalgamation. However, the original early Paleozoic tectonostratigraphic configuration of these three intimate greenschist- and medium- to high-grade gneiss-amphibolite basement vestiges (Serbo-Macedonian/Supragetic and Getic) is further perplexed by the presence of poorly documented pre-Variscan (Ordovician?) lithospheric-scale event.

The Pan-African to Lower Paleozoic subduction/magmatic arc stage led to the amalgamation, breakup and dispersal of a cluster of peri-Gondwanan continental and oceanic terranes. Breakup and dispersal from the northern shore of the Gondwanan active margin triggered the development of the Paleozoic deep-marine sedimentary cover ("Kučaj unit" or Getic unit). To make matter more complex, prior the Lower Paleozoic terrane agglomeration and subsequent dispersal, it appears that a Lower Paleozoic geodynamic linkage is additionally marked by the poorly investigated cross-lithospheric event. This event connects the outboard oceanic Supragetic/"Kučaj" succession with a segment of the former north Gondwanan protobasin (juvenile Serbo-Macedonian Unit).

Key words:
Serbo-Macedonian Unit, "Lower Complex", Supragetic basement/"Vlasina Complex", geotectonic subdivision, Peri-Gondwana Cadomian margin, Lower Paleozoic tectonic event.

Апстракт. Екстерне бејсмент-јединице које се налазе у близини Балтичког кратона тј. у домену Мезијског промонторијума представљају колаж, на први поглед, веома сличних, комплексних, издужених поликристаластих тела која су махом Пан-Афричког порекла. Пан-Афричко порекло указује да су бејсментски терани настали и нешто касније транспортовани током неопротерозоика и доњег палеозоика на шелфу северне Гондване). Један од најкомплекснијих бејсментских ентитета средњег- до високог степена метаморфизма се налази у оквиру касно-варисцијског сутурног асемблажа, суперпозиционо у алпском структурном склопу изнад Супрагетика или некада тзв. "Власинског комплекса".

[1] Geological Survey of Serbia, Rovinjska 12, 11000 Belgrade, Serbia. E-mails: darkogeo2002@hotmail.com; darko.spahic@gzs.gov.rs
[2] Geographical Institute "Jovan Cvijić" of the Serbian Academy of Sciences and Arts, Đure Jakšića 9, 11000 Belgrade, Serbia.

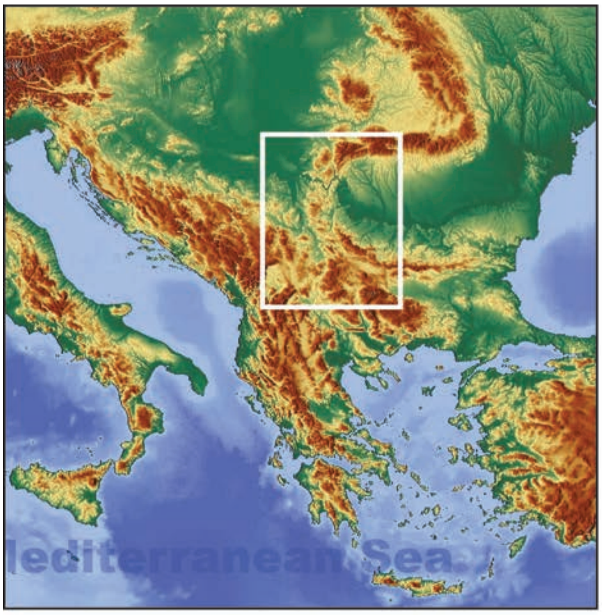
Овај сада завршни навлачно-наборни пакет неопротерозојско-доњопалеозојске старости је Српско-македонска јединица, тзв. „Доњи комплекс Српско-македонске масе“. Тектонска интеракција изме-ђу ова два ентитета током доњег палеозоика је оверпринтована и прерађена каснијим варисцијским и алпским покретима. Поред високог степена тектонске прерађености овог кристаластог ентитета, студијом се указује на постојање слабо документованог тектонског догађаја преварисцијске тј. доњопалеозојске старости. Овај доњопалеозојски догађај, је могуће био у склопу касно кадомске- до доњопалеозојске тектонске активности која је кулминирала амалгамацијом периферних теранских асемблажа, након чега је уследио латитудинални тектонски дрифт према промонторијуму Балтичког кратона (Мезијски микроконтинент). Током палеозојског тектонског дрифта сукцесија источне Србије („Кучај“/Гетик) је депонована у океанским условима. Сублимација публикованих резултата указује на постојање доњопалеозојских геодинамичких услова који повезују асемблаж океанске коре (бејсмент Супрагетика) са недовољно корелисаним пери-Гондванским издуженим маргиналним басеном (Српско-македонска јединица) и слабо документованог доњопалеозојског литосферског догађаја.

Кључне речи:
Српско-Македонска јединица, „Доњи комплекс“, Супрагетски бејсмент/“Власина комплекс“, геотектонска рејонизација, Пери-Гондванска кадомска маргина, доњопалеозојски тектонски догађај.

Introduction

For 60 years now, the polycrystalline Neoproterozoic – Lower Paleozoic Serbo-Macedonian Unit (*sensu* Dimitrijević, 1959, 1963, 1997) or "…*Zwischengebirge*…" ("…*intramontane*…"; Kossmat, 1924) remains to be the most intriguing tectonic unit(s) distributed along the NNE–SSW-striking Alpine Carpathian-Balkan fold-and-thrust belt (Fig. 1). Despite a significant focus on the Alpine inferences of local- (*e.g.*, Dimitrijević, 1997; Dimitrijević & Krstić, 1999; Grubić et al., 1999; Kräutner & Krstić, 1992, 2002, 2006; Karamata & Krstić, 1996; Karamata, 2006; Zagorchev et al., 2018) and international community (*e.g.,* Carminatti et al., 2004; Schmid et al., 2008, 2020; van Hinsbergen et al., 2020) it remains unclear whether this basement unit belongs to the Carpatho-Balkanides and/or South Carpathians or not. In terms of the Alpine tectonics, to the west, the "Lower Complex" of the Serbo-Macedonian Unit (hereinafter LC SMU) represents a Neotethyan continental hinterland (former Cretaceous–Paleogene active margin). However, its eastern realm (towards the Supragetic Unit: *sensu* Spahić et al., 2019/"Lužnica Unit"; *sensu* Kräutner & Krstić, 1992, 2002, 2006) remains highly ambiguous, in both, the Paleozoic- and the Alpine paleogeography and tectonics (Fig. 1).

Within the poorly investigated late Paleozoic/Variscan context (with exceptions of contributions of Liégeois et al., 1996; Iancu et al., 2005; Decourt et al., 2002; Antić et al., 2017; Plissart et al., 2018), the Serbo-Macedonian crystalline inlier belongs to the reconfigured southeastern segment of the Central European Variscan crust (Fig. 1). In the framework of the pre-Variscan terrane amalgamation and dispersal stage or in the Pan-African to Lower Paleozoic sense, the scarce recent studies outlined the Serbo-Macedonian Unit as a peri-Gondwanan Cadomian-type terrane (meaning that the protoliths of these terranes originate from the vicinity of Cadomian orogen formerly accommodated along a segment of the distant northern margin of Gondwana, chapter 4.5., *c.f.*, Winchester et al., 2002; Carminatti et al., 2004; *sensu* Linnemann et al., 2007; Oczlon et al., 2007; Himmerkus et al., 2009; Meinhold et al., 2010; Antić et al., 2016a,b; Stephan et al., 2018; Abbo et al., 2020). Current ideas for the Neoproterozoic supercontinent crustal break-up (Will & Frimmel, 2018) is that these inherited lithospheric-scale structures (Murphy et al., 2006) were the predecessors marking the onset of the contrasting Lower Paleozoic interplay. The Lower Paleozoic cross-lithospheric interaction was between the distant subduction/accretion terranes microplates originating from the north Gondwana and south-



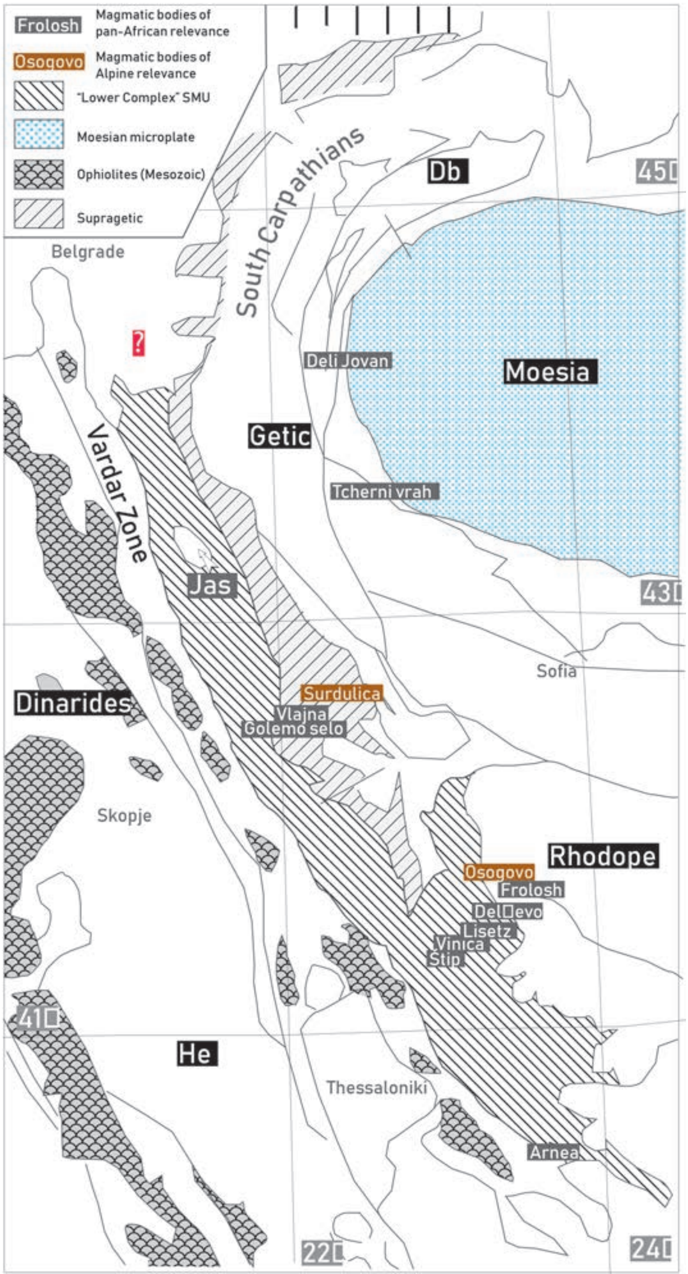


Fig. 1. Tectonic map of the investigated tectonic units (modified after Kounov *et al., 2010, 2017; Alpidic tectonic concept after* Schmid *et al., 2008 and* Bernouli *et al., 2001). Map clearly exhibits the problem of the Serbo- Macedonian Unit to the east of Belgrade or after the Vršac settlement (question mark and rectangle with the question mark). Map includes the positions of the magmatic bodies of Pan-African and Alpine relevance. Jas Jastrebac tectonic window (*Marović *et al., 2007;* Erak *et al., 2016).*

western boundary of the Baltican craton. The Serbo-Macedonian Unit as a highly complex crystalline basement inlier has documented controversies revolving around its polyphase tectonometamorphic evolution (*e.g.*, Grubić et al., 1999; Popović, 1991; Popović & Miljković, 2000; Gerdjikov et al., 2014; Zagorchev et al., 2015; Spahić & Gaudenyi, 2018, 2019). The following issues pending the answers:

(1) Is the gneiss-dominating LC SMU also referred to as the "Serbo-Macedonian Massif" discrete or the same geotectonic unit (in both, Variscan and Alpine configuration)? Is the LC SMU connected with the adjoining greenschist-facies Supragetic basement/"Vlasina Complex" (concept of Dimitrijević, 1959, 1963, 1995)?;

(2) What is the exact continuation of the LC SMU to the north of the Danube River (i.e. is it the Sebeş-Lotru terrane/nappe)?;

(3) What was the original depositional-tectonic environment "digesting" such a huge volume of Cambrian clastic detritus (*c.f.* Avigad et al., 2017)?;

(4) What is the relationship of the latest Cambrian metamorphic imprint (numeric age by Balogh

et al., 1994) with the poorly documented Ordovician event?;

(5) In addition to a documented repeated anatexis (Zagorchev, 2015 and references therein), during which tectonic event widespread Ordovician tectonothermal imprints were produced (472–456 Ma, numeric age by Antić et al., 2016a; Sebeş-Lotru terrane, ca. 460 Ma; Balintoni et al., 2010; Ograzhden Unit, 462 Ma; Zagorchev et al., 2012, 2015; Macheva et al., 2016)?;

(6) What is the LC SMU and Supragetic basement Cadomian to Lower Paleozoic tectonic setting, and what were the circumstances for such atypical late imprints?

(7) What was the role of the LC SMU in the Neotethyan Permian-Triassic opening (*e.g.*, Spahić et al., 2020), and an eventual relationship with the Paleotethys (*e.g.*, Spahić et al., 2019b)?

In order to obtain the outline of a Lower Paleozoic geodynamic paleoenvironment, the study incorporates the recent regional-geological constraints (Spahić & Gaudenyi, 2018, 2019; Spahić et al., 2018, 2019 a,b). Study also includes a scarce analytical data repository (Himmerkus et al., 2009; Meinhold et al., 2010; Kounov et al., 2012; Zagorchev et al., 2012, 2018; Antić et al., 2016a, 2017; Abbo et al., 2020) focusing almost exclusively on the LC SMU. We tune up the constraints on the regional pre-Alpine *i.e.* pre-Variscan configuration. By consolidating earlier and recent data, we provide a rejuvenated data platform, ultimately attempting to outline the important Lower Paleozoic cross-lithospheric event connecting the pre-Variscan LC SMU with the Supragetic basement.

Geographic-geologic outline

The westernmost edge Moesian microplate (Euxinic craton; Balintoni et al., 2011a and references therein) represents the easternmost segment of the orogen agglomerated with a set of elongated basement units (Liégeois et al., 1996 and references therein; Seghedi et al., 2005; Haydoutov & Yanev, 1997; Balintoni & Balica, 2012; Kounov et al., 2012; Seghedi, 2012; Iancu & Seghedi, 2017). These basement units are of the Avalonian (peri-Amazonian), Ganderian and Cadomian continental inheritance (Balintoni et al., 2010, 2011b, 2014; Zagorchev, 2015; Spahić & Gaudenyi, 2018 and references therein). The mentioned peri-Moesian basement systems are positioned at the southwestern edge of the Baltican craton reconfigured by the Variscan, Eocimmerian (*c.f.* Spahić et al., 2019b) and Alpine interference.

The westernmost gneiss-dominating basement inlier in Serbia referred to as the LC SMU has an arcuate contour of a general NNW–SSE strike (Figs. 1, 2). This inlier outcrops starting from southern Banat (Romania and Serbia). Crystalline blocks, including gneiss-dominated LC SMU are accommodated underneath the southeastern Banat / southeastern Pannonian realm (with the exception of the outcrops exposed at the Vršačke Mts., Kukin et al., 1987). Towards Central Serbia and the eastern edge of Kosovo and Metohija, striking farther through eastern North Macedonia, southwestern Bulgaria and northern Greece (Chalkidiki peninsula; e.g., Savezni geološki zavod, 1970; Mahel', 1974; Anđelković, 1982; Aleksić et al., 1988; Himmerkus et al., 2007, 2009; Fig. 1). South of Vršac, the LC SMU continues across the Danube (Serbia; Fig. 2), striking towards the Morava river system (Fig. 2), crossing near Crni Vrh (mountain peak), Juhor Mt., Mojsinjske Mts, Poslonjske Mts, Jastrebac Mt., Stalać Hills, Seličevica Mt., Pasjača and farther across Osogovo Mts. in North Macedonia, reaching the Aegean coast in Greece (Fig. 1. In Bulgaria, it encopasses the most southwestern segment of the country (Fig. 1), the Kraishte, and Ograzhden Mt.

Depending on the applied tectonic concept (for review see chapter 4.1 of this paper), the LC SMU has *ca*. 50 to 100 km in width, with its regional analog units, reaches the length of over 1000 km. The western borderline of the LC SMU striking NNW–SSE is referred to as the "*Moravsko-Šumadijska dislokacija"* (Anđelković, 1982). This fault system has the character of a strike-slip fault (Kräutner & Krstić, 2002). This western border zone of the LC SMU represents a junction with the Mesozoic late Alpine Neotethyan suture referred to as the Vardar Zone. This tectonic lineament can be traced in Serbia from the river Danube in the north, southwards, near Kragujevac, between Trstenik and Kruševac, continuing between Jastrebac and

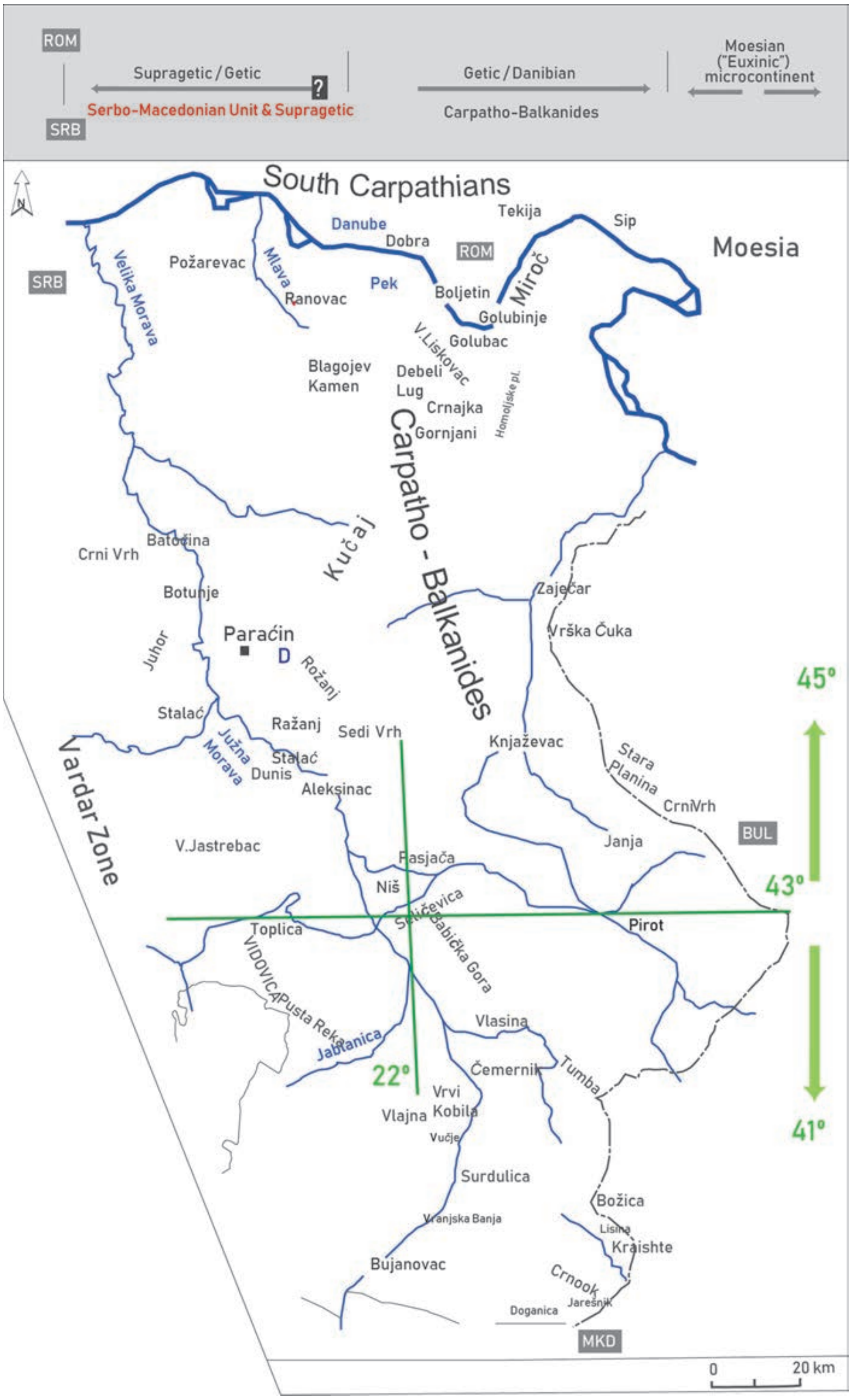


Fig. 2. *Carpatho-Balkanides of eastern Serbia including the "Lower Complex" of the Serbo-Macedonian Unit and Supragetic basement) (inlet from* Dimitrijević *et al., 1967, modified). The question mark denotes the eventual uncertain extension of the Serbo-Macedonian Unit („Lower Complex").*

Kopaonik Mts., and crossing near Kumanovo in North Macedonia.

The eastern contact zone of the Supragetic unit is the tectonic lineament locally referred to as the "*Moravska dislokacija*" (PETKOVIĆ 1930; ANĐELKOVIĆ, 1982) or the Morava fault system. This nappe system crops out near the town of Golubac, Danube River (east Serbia) (Fig. 2), striking along the Pek and Mlava rivers, east of the settlements Aleksinac, Niška Banja, passing near Modra Stena farther continues in Bulgaria. Southwards, this fault system separates the Rhodope unit, crossing in North Macedonia and northern Greece. To the east of the LC SMU is the Supragetic unit. The two latter systems are separated by the nappe of Alpine age (KRÄUTNER & KRSTIĆ, 2002; Fig. 1).

In the frame of Alpine tectonics and paleogeography, the LC SMU is considered as a marginal entity of the northwestern Tethys *i.e.* the eastern overridden margin of the Mesozoic Vardar Zone (*e.g.*, DIMITRIJEVIĆ, 1997; DIMITRIJEVIĆ & KRSTIĆ, 1999; DIMITRIJEVIĆ et al. 2003 CARMINATTI et al., 2004; SCHMID et al., 2008; VOZÁR, 2010 and references therein; ROBERTSON et al., 2013; SPAHIĆ & GAUDENYI, 2019). There is a general acceptance that the Alpine shortening and thrusting occurred during the Late Jurassic and latest Cretaceous in connection with the closure of the Severin oceanic basin (*e.g.*, IANCU et al,. 2005; PLISSART et al., 2017). From the east to the west, predominantly basement nappes are reconfigured during the Alpine rearrangement and nappe stacking (Kraütner & Krstić, 2002, 2006): the Lower Danubian, the Upper Danubian, the Severin (Mid-Jurassic ophiolitic rocks), the Getic and the Supragetic. The westernmost crustal sliver referred to as the LC SMU (or SMU *s.s.*, Karamata & Krstić, 1996) is outlined towards the Supragetic basement in Serbia (Andjelković, 1982; Dimitrijević, 1997; Kraütner & Krstić, 2002, 2006; Spahić et al., 2019a) and Morava nappe in Bulgaria (Haydoutov, 1989; Haydoutov & Yanev, 1997; Boncheva et al., 2010; Kounov et al., 2012). The (tentative) continuation of the Getic Unit from Romania (Bulgaria–North Macedonia–Serbia) also referred to as the Struma Unit (Zagorchev, 1984, 2001; Haydoutov & Yanev, 1997; Kounov et al., 2012; Fig. 1). The (Crnook-) Osogovo-Lisets Complex has recently been under consideration to represent the core-complex exhumed underneath the Struma and Supragetic basements (Kounov et al., 2010; Antić et al., 2017; position of the Fig. 1b and Fig. 2).

Definition of the Serbo-Macedonian Unit

Initially, Cvijić (1901, 1902) attributed the crustal fragment representing a modern-day Serbo-Macedonian Unit as a segment of the "Rhodopean Mass". After the definition of the Serbo-Macedonian Unit, during last 60 years a plethora of local and international geoscientists attempt to describe this crystalline basement. The LC SMU represents a member of essential Alpine- and pre-Alpine relevance exposed within the hitherto Carpathian-Balkan regional geotectonic charts. With a few exceptions, the published studies discussing the Alpine configuration in the frame of Tethyan tectonics describing the South Carpathian/Carpathian-Balkan nappe stack (including LC SMU, so-called "Lower Complex"). The recent studies of the LC SMU segment in Serbia, though scarce, attempt to integrate the knowledge on the Pan-African and Variscan geodynamic evolution of the cluster of displaced basement inliers of oceanic and continental affinity (e.g., Antić et al., 2016, 2017; Spahić & Gaudenyi, 2018; Spahić et al., 2019a).

Historical overview

The SE European tectonics have been more than 150 years in the focus of several generations of geologists, whereas each generation introduced a different interpretation. The ideas about the structural positioning of the Rhodope *s.l.* (or Thracian Massif) are in a function of considering the nature and the evolution of the Tethys and subsequent Alpine orogenic belt. Many ideas have been intuitively derived from a "*rhodopocentrism*" or the first research performed in the 19th century by Boue (1840), Peters (1863), Mojsisovics et al. (1880), Suess (1895) and Cvijić (1900). The earliest authors assumed that the central parts of the Balkan Peninsula are composed of the oldest (crystalline) mass. Cvijić (1901, 1903) designates this geologic entity as the Rhodope Mass (in Serbian: *Rodopska masa*). The Rhodope Mass is described by Cvijić (1924) as "*the great old core or the oldest mountain around which were formed the smaller mountains later connect to it*". Cvijić (1901, 1903) was the first explorer who recognized that the "*Central Crystalline Core*" should be a discrete unit relative to the Rhodope Mass (In Serbian: *Centralno kristalasto jezgro*; see Table 1). Cvijić, moreover, formulated a generic tectonic chart, describing it as a "*chessboard*", composed of crystalline blocks displaced by the faults. Mihailović (1955) pointed out that this crystalline entity has "*horst-type*" structural fabric. According to Muratov (1949), the Macedonian Massif represents the core of a single large, but destroyed anticline, whereas Petković (1957, 1960) the SMU landform still interprets as the "*anticlinorium*" or a large-scale anticline. Sikošek (1971) and Bonchev (1971) independently from each other stated that this mass has features of a single mega anticline (Andjelković, 1977; Grubić, 1999) (Table 1).

The Thracian Massif (Rhodope Mass *s.l.* according to Cvijić, 1901) had often been used for a tectonic entity that occupies the Rhodope Massif *s.s.* of Bulgaria and Greece and the parts of the North Macedonia and Serbia ("Serbo-Macedonian Mass") (at the beginning of the 20th century, after Zagorchev, 1998).

Kossmat (1924 p. 122, 125) concludes that the Rhodope Mass for the Balkan Peninsula is the same geologic entity as it is the Central Zone for the Eastern Alps. Koch (1930 p. 3) supported this opinion. Nevertheless, the Kossmat's conclusion was not further developed by other authors of that time (Table 1). Bonchev (1936) in his most detailed report introduce the Kraishtides "*the youngest orogenic system on the Balkan Peninsula that is accommodated obliquely to South Carpathians and Balkanides, further associating these systems in a form of a Balkan arc*" (the tectonic unit accommodated in the southwest Bulgaria). According to Bonchev (1936), the Kraishtides "*escaped*" from the Balkanides. The Kraishtides were depicted as an allochotonous system or as a „*thrust land*" ("*Deckenland*"). According to the author, "*the rocks are considerably folded, having the fold axes trending NNW–SSE, i.e. perpendicular to the principal stress trend...*". Zagorchev (2006) in the review of the Kraishtides concludes *"...only in Paleogene and Neogene times, the Strouma (Kraishtid) lineament played the role of a fault belt with considerable dextral strike-slip movements, and repeated rifting in transtensional conditions*" (Table 1). Jaranoff (1938) points that Rhodope Mass entity in the western (and the eastern) parts have own shortening fold and thrust episodes, whereas Muratov (1949 p. 18–19) indicated that the „*Rhodope Mass has own continuity in the Macedonian Massif*". A similar opinion had Petković & Maksimović (1976; p. 165). A considerably different perspective on this subject exhibited Bonchev (1940, 1943) pointing out that the area between the Kraištides and Vardar Zone represents an uniform old massif designating as the "*Macedonian-Pannonian Mass*" (*Makedonsko-panonska masa*). Later, similar opinions exhibited Mihailović (1955) and Dimitrijević (1959, 1963) (Table 1).

For an extended period of time, the prevailing hypothesis between geologists was that the Rhodope Mass is an uniform tectonic unit. The results of systematic, decades-long field-geological surveying for the purpose of the Basic Geological Map of Yugoslavia in scale 1: 100,000 exhibited that the crystalline rocks of Serbia and Macedonia (North Macedonia) differ in comparison with those in Bulgaria (with an exception of its SW parts). The following key features and discrepancies, Dimitrijević (1959) emphasized in order to uncouple the "Serbian Macedonian Mass" (*Srpsko makedonska masa*) from Rhodope:

a) *The marbles, a regular member of the Bulgarian Rhodope Mass, is absent in the "Serbian Macedonian Mass" complex with an exception of the "Vidojevica Series"*.

b) *Feldspar mica-schists and mica-rich gneisses which are a constituent of the "Lower Complex" (lowermost metamorphic unit) of the "Serbian Macedonian Mass", in the Rhodope Mass have rather poor mica content*.

c) *The "Serbian Macedonian Mass" can be characterized by the often interchange of lithofacies, as horizontally, but also stratigraphically (vertically) whereas the Rhodopean Mass has a prominent consistency of the rock formations*.

d) *The "Serbian Macedonian Mass" can be characterized by the linear folds with gentle b axis rotation, whilst the Rhodope Mass is abundant with, so-called "brachi-form structures". Additionally, linear features are restricted to a few structurally unstable zones*.

e*) Another essential argument of* Dimitrijević *(1959) was that the Bulgarian structures of the Rhodope Mass do not continue westwards directly into the "Serbian Macedonian Mass"*.

The crystalline base has asymmetric structures which are composed of numerous rather complex synforms and antiforms (according to Dimitrijević, 1995; Marović, 2001). After that time, the "Serbian Macedonian Mass" was established and accepted within a scientific community as a tectonic unit crosscutting Southeast Europe (Table 1). Some early researchers, *e.g.* Kober (1952), "*the crystalline belt between the Carpatho-Balkanides and the Vardar Zone does not represent any kind of "mass" even is not an "old" and a "middle" mass*. Kober this unit entitled to "*Moravides thrust over the Carpatho-Balkanides*". Later, a similar perspective had Codarcea (1964), Andjelković (1963, 1965, 1976) and Andjelković & Lupu (1967) (after Grubić et al., 1999) (Table 1). With the acceptance of the plate tectonics, the mobilistic concepts have exhibited broadly different standpoints relative to the "Serbian Macedonian Mass". Dewey et al (1974) described the "Serbian Macedonian Mass" as the Rhodope Mass, Chanell et al. (1976) pointed out that the "Serbian Macedonian

***Table. 1**. Historical overview of the SMU and associated tectonic hypotheses.*

Reference (s)	Position and descriptionnof the SMU	Notes
Peters, 1863	“old land”	Descriptive denomination.
Mojsisovics et al., 1880	“Eastern Land”	Descriptive denomination.
Cvijić, 1900, 1903	Rhodope Mass (*Rodopska Masa - RM*)	Rhodope Mass (*s.l.*) it encompass RM+SMU.
Cvijić, 1924	“big crystalline core”, “the oldest mountain”	Descriptive denomination.
	Thracian Massif	In the first decades of 20[th] century adopted the term from Boue (1840). Encompass RM+SMU.
Bonchev, 1940	Macedonian-Pannonian Mass	
Muratov, 1949	Macedonian Mass (*Makedonski masiv*); Macedonian-Rhodope intrageosyclinale	
Kober, 1952	Moravides (*Moravidi*)	
Dimitrijević, 1953, 1963	Serbo-Macedonian Mass (*Srpsko-makedonska masa - SMU*)	Also in English some other translations (from Serbo-Croatian) are known: Serbo-Macedonian Massif, Serbian-Macedonian Massif, Serbian-Macedonian Mass, SMU subdivided to Lower Comple (LC SMU) and Upper Complex (UC SMU)
Anđelković, 1965; Vujisić et al., 1980	Morava Zones (Moravska zona)	
Petković, 1969	Serbo-Macedonian Mass	The “Upper Complex” renamed to “Vlasina Complex” (VC) whereas the LC SMU keep its original name.
Bonchev, 1971	Dardan Mass (*Dardanska masa*)	
Maksimović, 1974	Serbian crystalline core (*Srpsko kristalasto jezgro*)	
Veselinović et al., 1978	Morava nappe (*Moravska navlaka*)	
Malešević et al., 1980; Kalenić et al., 1975	Morava structural unit (*Moravska strukturna jedinica*)	
Anđelković, 1982	Dardanides (*Dardanidi*)	
Jacobshagen, 1968	SMU is assignated as separate tectonic unit of Greece	Later under names Pirgadikia-, Kerdilion-and Vertiskos Units stated that belongs to the SMU (e.g. After Himmerkus et al., 2006).
Haydoutov, 1980, 1991, 1997	Thracian terrane (SMU+RM) + western parts of the Balkan terrane	After Yanev et al. (2005):The Balkan terrane subdivided to West Balkan Mts and Kraishte region.

***Table. 1**. Continued.*

Reference(s)	Position and descriptionnof the SMU	Notes
Ćirić, 1996	Serbian Median Mass (*Srpsko međugorje*)	
Grubić et al.,1999	Moravicum (*Moravikum*) and Jastrebicum (*Jastrebikum*)	The SMU defined as Inner Charpato-Balkanides
Krstić & Karamata, 1992	SMU + Ranovac-Vlasina terrane	The UC SMU/VC renamed to Ranovac-Vlasina terrane (RVT) which belong to the Carpatho-Balkanides – Carpatho-Balkanides
Karamata & Krstić, 1996	SMU + Vlasina Unit	RVT renamed to Vlasina Unit belongs to the East Serbian Carpatho-Balkanides
Karamata, 1996	Composite terrane of SMU + Ranovac-Vlasina-Osogovo Terrane	"Ranovac-Vlasina Terrane" renamed to "Ranovac-Vlasina-Osogovo – Terrane" which is separated from the SMU and included into the east Serbian Carpatho-Balkan Composite Terrane within the Carpatho-Balkanides
Iancu et al., 2005	The Romanian Supragetic unit is a same tectono-depositional complex as the SMU.	On the tectonic analysis of the Romanian South Carpathians shows that the Supragetic units has a same provenance as the SMU (UC SMU).
Schmid et al., 2008	SMU + Supragetic nappe (or Suprageticum)	"Ranovac-Vlasina-Osogovo Terrane" renamed to Suprageticum. Following the map of Sandulescu (1984) the SMU and Suprageticum represented as a segment of the Carpatho-Balkanides/Dacia Mega-Unit.
Zagorchev et al., 2015	SMU + and W segment of the Morava Rhodope Alpine Collage (MRAC)	The "Upper Complex" is in the western part of the MRAC
Antić et al., 2016a	Paleozoic Galatian supra-terrane (Eastern Veles Series + SMU)	The SMU (within Carpatho-Balkanides) contains: LC SMU and "Vlasina Unit" (syn. VC)
Antić et al., 2016b	SMU is an eastern part of the Galatian super-terrane	
Antić et al., 2017	The 'Eastern Veles Series' incorporated to the SMU	The SMU (within Carpatho-Balkanides) contains: EVS, LC SMU and "Vlasina Unit" (syn. "Vlasina Complex")
Spahić & Gaudenyi, 2018	Indicate problematic name "Serbo-Macedonian Massif" including the issue of the southern realm in Greece (difference in the age)	Accepted that LC SMU and Supragetic basement could two different entities
Abbo et al., 2020	Indicated the problems in the age determination of the southern realm in Greece	Highlighted the dominant magmatic protolith

Mass" is an individual part of the Rhodope Mass, Dimitrijević (1974, 1995) and Grubić (1980) described the "Serbian Macedonian Mass" as an independent tectonic unit. Zagorchev (1976) introduced the polycyclic Ograzhden complex in a SW Bulgarian part of the "Serbian Macedonian Mass". Later in 1996 (Zagorchev, 1996) gives more details about the Ograzhdean Supergroup (Table 1).

The term "Serbian Macedonian Mass" coined by Dimitrijević (*e.g.,* Dimitrijević 1959, 1963), describes a discrete unit in the classical subdivision of the geology of northern Greece (*e.g.*, Jacobshagen, 1986). Later it was recognized as Pirgadikia-, Kerdilion- and Vertiskos Units that belong to the "Serbian Macedonian Massif" (after Himmerkus et al., 2006) (Table 1). Haydoutov (Haydoutov, 1989, 1991; Haydoutov & Yanev, 1997) from the Thracian Massif ("Serbian Macedonian Massif" and Rhodopean Mass) differentiate the Balkan Terrane or its westernmost parts as a segment of the "Serbian Macedonian Massif" (def. after Dimitrijević, 1959). The easternmost parts in Serbia are later referred to as the "Ranovac-Vlasina-Osogovo Terrane" (Table 1). Popović (1991) use lithostratigraphical and metallogenic reasons to subdivide the "Serbian Macedonian Massif" into the two units: Morava Massif in the north and Pelagonia Rhodope on the south. Ćirić (1996 p. 17) in his monography, criticized the "Serbian Macedonian Massif" as a „mass" because „it can be characterized by a series of different mophostructures, horsts and faults, having differentiated geological formations", The author underlines that the "Serbian Macedonian Massif" cannot be described as a "uniform mass" (Table 1). Krstić & Karamata (1992) subdivided the SMU (defined by Dimitrijević, 1959 of "Serbian Macedonian Mass" *s.l.*) into "Serbian Macedonian Massif" *s.s.* and "Ranovac–Vlasina Terrane". The "Ranovac-Vlasina Terrane" was incorporated into the Carpatho-Balkanides. Same year, similarly, Karamata & Krstić (1996) subdivided the Serbian Macedonian Massif" *s.l.* into „Serbian Macedonian Massif" *s.s.* and "Vlasina Unit", according to the mentioned subdivision the "Vlasina Unit" belongs to the Carpatho-Balkanides. One year later, Karamata (1997) subdivided the "Serbian Macedonian Massif" (coined by Dimitrijević, 1959) into the two subunits: "*the west composite terrane of "Serbian Macedonian Massif" and „Ranovac–Vlasina–Osogovo terrane"*. The west composite terrane kept its original name ("Serbian Macedonian Massif" *s.s.*), whereas the "Ranovac–Vlasina–Osogovo terrane" was assigned to the Carpatho-Balkanides. Similar attempts were in the past Aleksić et al. (1974) and Bogdanović (1976) pointing out that the eastern parts of the "Serbian Macedonian Massif" belong to a system of the inner napes of the Carpatho-Balkanides. Following the "Serbian Macedonian Massif" concept of Karamata (1997), in the paper of Kräutner & Krstić (2002) for the "Serbian Macedonian Massif" *s.s.* and Supragetic units has been introduced: "*both units derived from the same Bucovino-Getic microplate, the western, Serbo-Macedonian part overthrust towards the west the ophiolitic Vardar zone, whereas the eastern, Supragetic part obviously belongs to the east-vergent Carpathian nappe system*". The two units are differentiated by a prominent (probably dextral) shear zone, extending a few hundreds of meters in width. The zone is of post-Upper Cretaceous age being mostly covered by younger sediments. The shear zone is exposed at Vršac, between Veliki- and Mali-Jastrebac, north of Leskovac (Dušanovo mylonite zone). The aforementioned report introduced a new structural framework of the Carpatho-Balkanides (Oraviţa, Niš, and Sofia), whereas the Serbo-Macedonian Unit and the Vardar Zone were introduced as a segment of Carpatho-Balkanides. A few recent authors (*e.g.,* Vozárová et al., 2009) mentioned that the "Ranovac-Vlasina-Osogovo Terrane" and the Supragetic are synonymous (Table 1). The authors published in the colored tectonic sketch of the Carpatho-Balkanides within the geological map of Carpatho–Balkanides (Kräutner & Krstić, 2006). However, this new map is more-less the same as it is the version published previously by Kräutner & Krstić (2002). The aforementioned map along with the earlier map ("*Harta geneto-tectonicâ a Europei Alpine central şi de sud-est*") introduced by Sandulescu (1984) seems to be a groundwork for the paper and associated map "*The major tectonic units Alps, Carpathians and Dinarides*" introduced a bit later by Schmid et al. (2008). This paper contains rather ambiguous observations of the "Serbian Macedonian Massif": "*…the south, in Serbia and western Bulgaria, we also included the structurally highest unit, referred to as Serbo-Macedonian "Massif" (e.g.*

Dimitrijević 1959, 1997), into this nappe sequence. However, we do not imply that this also applies to a unit that carries the same name in Greece and which experienced a severe Alpine metamorphic overprint (Kilias et al., 1999)". The authors ambiguously proposed that the northern parts of the same tectonic unit ("Serbian Macedonian Massif") are incorporated into the Carpatho-Balkanides as the part of the "Dacia Mega-Unit", whereas for its southern limb authors provide no comment considering the tectonic configuration. On the basis of this paper of Schmid et al. (2008), Cvetković et al. (2015) introduced the Serbo–Macedonian Massif as the structural uppermost part of "Dacia terrane" and a more internal unit relative to the above-described Carpatho–Balkanides (comparable to the Supragetic nappe of Romania).

Grubić et al. (1999) stated that the "Serbian Macedonian Massif" is "*neither unique, nor old nor middle unit*". This system, according to the authors, is comprised of the two tectonic layers: the "Upper Complex" – Moravicum, and the "Lower Complex" – Jastrebicum (Jastrebac tectonic window, western margin of the LC SMU). The Moravicum is consisting of the Juhor–Jablanica composite terrane and the "Ranovac–Vlasina–Osogovo terrane" (terranes defined after Karamata & Krstić, 1996). The most recent paper of Grubić et al. (1999, 2005) suggests that the Moravicum and Jastrebicum should be a part of the Carpatho-Balkanides denominated as the "Inner Carpatho-Balkanides" (Table 1).

With regards to the southern extension of the LC SMU in Bulgaria, North Macedonia and Greece, there is a separate ongoing discussion. Ricou et al. (1998) according to the analysis of the metamorphism and some rather unclear observations classified the "Serbian Macedonian Massif" as a part of the Rhodope Massif (Table 1). Zagorchev (in Carminati et al., 2004) concluded that the "Serbian Macedonian Massif" was initially a discrete entity – a peri-Gondwanan fragment "Dardania". A bit later (Zagorchev & Milovanović, 2006) still kept the "Serbian Macedonian Massif" as an open question because the "Serbian Macedonian Massif" is a peri-Gondwanan fragment or the relict of the pre-Cadomian continent. The latest analytics of Peytcheva et al. (2015) corroborates that the "Serbian Macedonian Massif" is a peri-Gondwanan fragment (Table 1). Iancu et al. (2005) recognized the tectonic similarities in the Banat Mts. (Suprageticum) and the SMU (Table 1). Antić et al. (2016a,b) defined a Paleozoic "Galatian supra-terrane" whereas the author incorporated the 'Eastern Veles Series' and the "Serbian Macedonian Massif" *s.s.* suggested earlier by Dimitrijević (1995, 1997), Robertson et al., (2013) (Table 1). Abbo et al. (2020) just recently indicated an orthobasic origin of the Greek segment indicating a pre-Silurian age instead Silurian that was pointed out by some earlier authors (Himmerkus et al., 2009).

Discussion

Overview of the hitherto geodynamic concepts

The LC SMU and Supragetic basement as the metamorphic inliers have been considered within several, rather contrasting tectonic concepts with an abundance of discrepancies (see also discussion in Spahić et al., 2019a):

(1) The tectonic concept of Dimitrijević (1959, 1963, 1992, 1997, 1999) which configured the SMU (LC SMU and Supragetic/"Upper Complex") as a discrete first-order tectonic unit. SMU is comprised of the two subunits: the low- grade metamorphic complex ("Upper Complex"), and the medium- to high-grade metamorphic complex (LC SMU);

(2) The tectonic concept of the *Moravides* which explains a set of the four nappes within the first-order entity (interpreting also as the southern extension of the Romanian Supragetic) introduced by Anđelković (1982);

(3) Milestone of the Alpine concept in the Southern Carpathians portrayed the SMU as a segment of the Getic/Supragetic Unit (*sensu* Sandulescu, 1984). This configuration is comprised of several basement terranes interfingered by a network of Variscan and Alpine thrusts (see also Iancu et al., 2005 and references therein);

(4) The concept of the SMU *s.s.* which is exclusively the LC SMU which means a discrete first-order terrane, accommodated to the west of the contemporary "Ranovac-Vlasina-Osogovo Terrane" or the

Supragetic in Serbia (*sensu* Krstić & Karamata, 1992; Karamata & Krstić, 1996; Kräutner & Krstić, 2002; Fig. 3a). The authors divided the Supragetic basement into the "Upper Supragetic" ("Bosca–Bukovik Vlasina nappe") and the "Lower Supragetic" ("Locva–Ranovac–Poružnica nappe") excluding a non-differentiated Serbo-Macedonian Unit or the LC SMU. Despite a significant contribution to the Alpine configuration (Kräutner & Krstić, 2002, 2006), it remains unclear which unit or terrane makes the northern extension of the LC SMU in Romania;

(5) The recent tectonic synthesis enclosing the central part of SEE (including the LC SMU and Supragetic), excludes the correlation with its basement analogs in North Macedonia and Greece (Schmid et al., 2008, 2020). This attempt synthesizes a regional Mesozoic configuration favoring the interpretation of the Alpine–Carpathian–Balkan fold-and-thrust belt as an aggregation of the lithotectonic units referred to as of Mesozoic aggregated "terranes" – "Major tectonic units" (Schmid et al., 2008). Accordingly, to the Alpine basement "terranes" (Supragetic basement and LC SMU) are the members of the "Dacia Mega-Unit". This terrane represents an agglomerated terrane (probably depicted by the similar exhumation times) connecting the pre-Mesozoic exotic- and local Alpine allochthones;

(6) The pioneering pre-Alpine or the Variscan-based reconstruction explaining the Variscan or "Thracian suture" (Haydoutov, 1989) of Southern Carpathians, E Serbia, NW Bulgaria. The definition of the Balkan terrane (includes the Supragetic base-

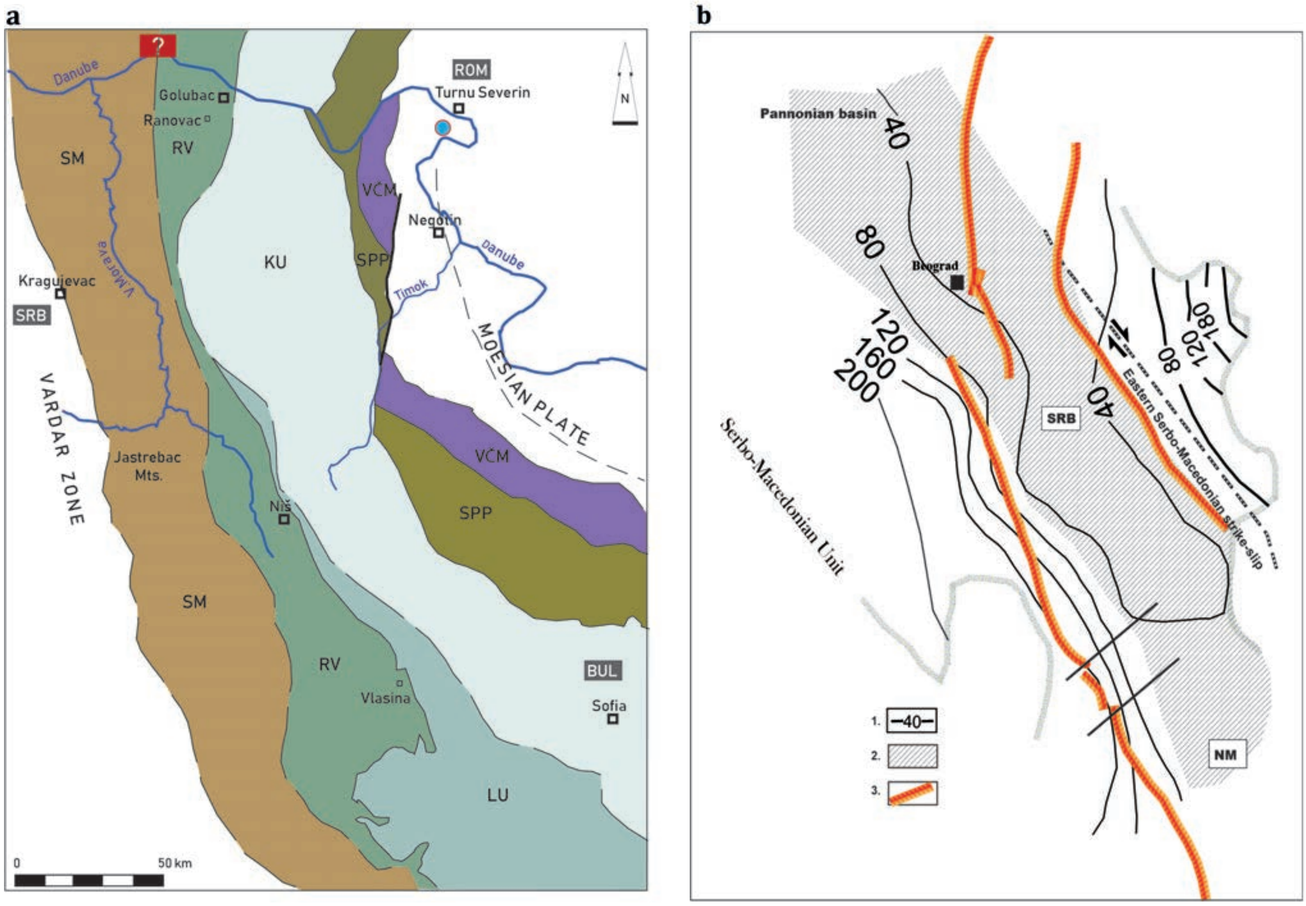


Fig. 3. a. *Terranes of eastern Serbia (inlet from* Krstić *et al., 2005; position on Fig.1b):* ***VČM,*** *"Vrška Čuka – Miroč" (Lower Danubian),* ***SPP,*** *"Stara Planina - Poreč" (Upper Danubian),* ***KU,*** *"Kučaj" (Getic),* ***RV,*** *"Ranovac – Vlasina" (Supragetic),* ***LU,*** *"Lužnica Unit" (West Kraishte),* ***SM,*** *Serbo-Macedonian Unit. Question mark denotes the correlation problem between segments in Serbia and those in Romania;* ***b.*** *Map of lithospheric thickness (km) for Serbia and North Macedonia.* ***1,*** *Isolines of lithospheric thickness,* ***2,*** *zone of Neogene magmatic activation (modified after* Milivojević*, 1993). The map of the crustal thickness indicated the areas experienced the (upper) crustal extension. The minimum crustal thickness of ca. 20 km is associated with the surface SMU slivers.*

ment) and Thracian terrane (includes the LC SMU) of Pan-African inheritance (*e.g.*, HAYDOUTOV, 1989; HAYDOUTOV & YANEV, 1997; YANEV et al., 2005; WINCHESTER et al., 2002, 2006);

(7) A recent attempt of the reconstruction of early Paleozoic tectonics based on the detrital zircon analyses of the LC SMU and Supragetic basement (ANTIĆ et al., 2016b) was driven by a Paleozoic paleogeographic reconstruction favoring the "Galatian Superterrane" proposed by STAMPFLI et al. (2013 and referenced therein). A set of samples (with sedimentary protolith) collected from the Supragetic basement, LC SMU and its regional analogs (Ograzhden unit). The diagrams exhibited the two main source systems of the recycled grains. The dominant ages are: (i) Supragetic basement has distinctive peak of 540 Ma (lowermost Cambrian), (ii) within the LC SMU there are two peaks – 560 Ma and the distinctive peak of 460 Ma.

Despite a significant effort of regional authors (IANCU et al., 2005; KRÄUTNER & KRSTIĆ, 2002; BALINTONI et al., 2010, 2012, 2014; ANTIĆ et al., 2016b, 2017; ZAGORCHEV, 2015 and references therein; KYDONAKIS et al., 2016; IANCU & SEGHEDI, 2017; SPAHIĆ & GAUDENYI, 2018; SPAHIĆ et al., 2019a), it is still difficult to even infer the complete Alpine architecture and displaced Variscan imprints. Thus, a proper definition and outlining the original LC SMU includes the connection with the Supragetic Unit and its basement is of vital importance (Fig. 1, 3a). To make matters more complex, the southern continuation of the LC SMU (North Macedonia, Greece) has indeed another set of peculiarities: a presence of the "Eastern Veles Series" (DIMITRIJEVIĆ, 1997; ANTIĆ et al., 2016b; SPAHIĆ et al., 2019b; position in Fig. 1); the Vertiskos unit of northern Greece (southern extension of the LC SMU) is of Silurian- (HIMMERKUS et al., 2009) or still of pre-Silurian age (ABBO et al., 2020), whereas the Supragetic basement is absent in Greece.

The modern ultra-thin slivered crustal configuration of the LC SMU is largely depicted by the deep-crustal geophysical data beneath the investigated basement inlier (MILIVOJEVIĆ, 1993; Fig. 3b). With regards, the Alpine structural configuration or boundaries of the inlier, the overprinted interface between the Supragetic and Getic is in the form of the east-vergent nappe (Serbia; Fig. 3a). The LC SMU is positioned to the west, on top of the documented Mesozoic suture referred to as the (East) Vardar Zone (SPAHIĆ & GAUDENYI, 2019 and references therein; Fig. 1). Towards the eastern boundary *i.e.* towards the Supragetic Unit, the interface is represented by an east-verging nappe (Fig. 3a). Nevertheless, the very character of the boundary varies along the strike. In the vicinity of Mali Jastrebac Mt. (see Fig. 1 for position) interface is in the form of the shear zone (ERAK et al., 2016; SPAHIĆ & GAUDENYI, 2019). The apatite fission track ages derived from the samples collected across the central-southern LC SMU (Serbia) point to the Late Cretaceous cooling (97±21 and 73±13 Ma; ANTIĆ et al., 2016a). Similar age and the low-temperature thermochronology (zircon and apatite fission-track from gneisses and mica schists of the "Morava unit" or the LC SMU (chlorite-sericite schists of the "Boljevac–Vukanja sub-unit") indicated the late early to early late Cretaceous exhumation times (~110–90Ma; ERAK et al., 2016). Similar Eocene to the Oligocene extensional core-complex event exhumed the Osogovo–Lisets Metamorphic Complex (ANTIĆ et al., 2016a; Fig. 4). However, the Alpine criteria (nappe stacking architecture and its vergence), does not provide a satisfactory correlation level between these basement units tectonically displaced within the region. One of the prominent examples is the greenshist-facies Miniş unit in Romania (IANCU et al., 2005). At the first glance, this unit which requires further correlation with the "Lužnica Unit" in eastern Serbia (Fig. 3a).

Serbo-Macedonian Unit within the pre-Alpine context

The LC SMU is comprised of the metamorphic rocks of the Neoproterozoic to Cambro–Ordovician age (DELEON et al., 1972) of late Cadomian paleocontinental inheritance (ANTIĆ et al., 2016b). The western segment of the LC SMU is comprised of medium- to high-grade predominantly gneiss, mica-schist, quartzite, amphibolite-facies system with the sporadic occurrence of marbles and migmatites (KALENIĆ et al., 1975; ANĐELKOVIĆ, 1982; DIMITRIJEVIĆ, 1995, 1997; SPAHIĆ, 2006; MAROVIĆ et al., 2007; ERAK et al., 2016).

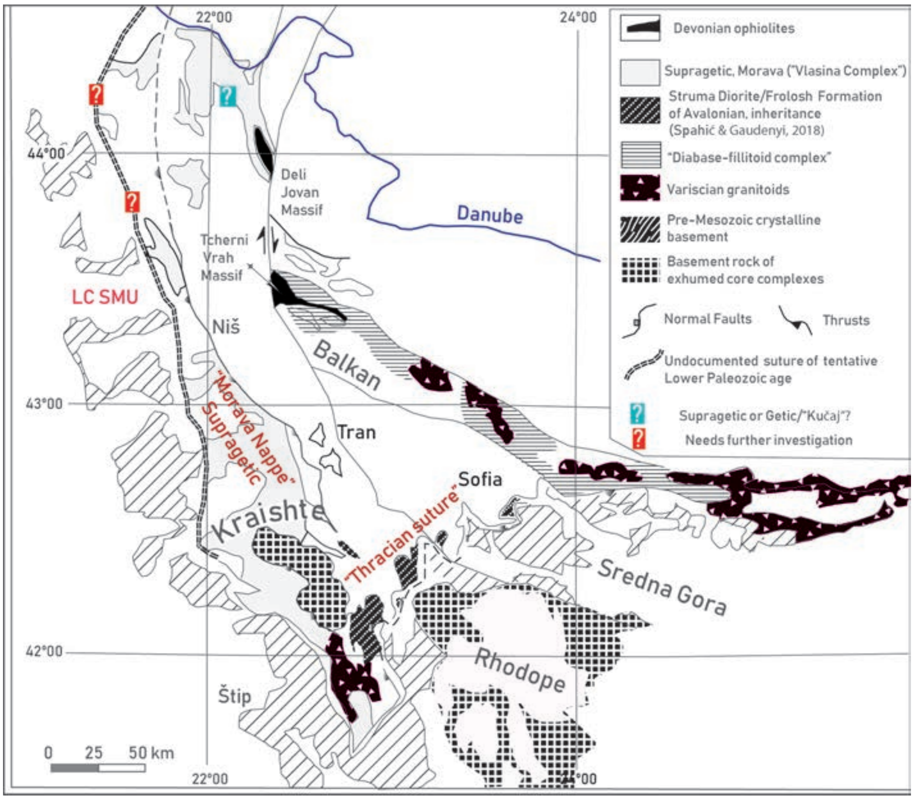


Fig. 4. The sketch representing the eastern Supragetic contact zone towards the Carpatho-Balkanides and Rhodope Unit – Serbia, Bulgaria and Republic of North Macedonia (simplified after Haydoutov & Yanev, 1997; Kounov et al., 2012 and references therein).The geotectonic inheritance of the greenschist-facies rocks remains unclear: Supragetic (Morava nappe) or "Kučaj Unit"/Getic? Segment of the "Thracian suture", and its tentative continuation in Serbia.

In the outcrops of Juhor–Stalać Mts., the age of granite dated by the Rb–Sr yields the lowermost Cambrian to Lower Ordovician age (541 to 475 Ma; Deleon et al., 1972). Gneisses of the Mojsinje Mt. have the Neoproterozoic (Ediacarian) age (547 Ma; Deleon et al., 1972). The post-metamorphic granite plutons are dated at ~450 and 347 Ma, respectively (Milovanović, 1989; Milovanović et al., 1998 and references therein). The presence of the Vučje granitoid of magmatic protolith marks the late Cadomian position of the LC SMU, as well as the rocks of Juhor-Stalać system (central part of the LC SMU). In general, clastic protolith (psephites-psammites) dominates the entire LC SMU (Dimitrijević, 1997).

The LC SMU and the analog Ograzhden Unit (*sensu* Zagorchev, 1967; Kounov et al. 2012; Fig. 4) have the two prominent synoptic density peaking of the magmatic and metamorphic zircon spectra of 480 Ma to 550 Ma. The age of the Ograzhden Unit is reported as ~462–451 Ma (ortho- and parametamorphic rocks are dated with a combination of LA-ICP-MS and ID-TIMS U/Pb zircon methods, Zagorchev et al., 2012, 2015; Macheva et al., 2016) whereas Peytcheva et al. (2015) in the Ograzhden and Belasitsa Mountains use ID-TIMS with the *in-situ* LA-ICP-MS U-Pb zircon dating suggesting the 450–455 Ma age of the Ograzhden orthogneisses. A segment with the Silurian age of LC SMU is documented within the augengneisses (orthogneisses) of the Vertiskos Unit in Greece (Himmerkus et al., 2009).

The peculiar medium-grade Variscan metamorphism of the LC SMU was recently dated according to the overprint of the Silurian igneous rocks (Antić et al., 2016b). The earlier results indicated the Early Paleozoic or late Cambrian event (Balogh et al., 1994; Zagorchev & Milovanović, 2006), whereas the amphibolite facies overprint is attributed to a Variscan orogenic event (Dimitrijević et al., 1967; Medaris et al., 2003). However, as the LC SMU is positioned far from the Variscan Carpathian-Balkan front (location of the late Paleozoic suture at Spahić et al., 2019), it remains unclear in which manner the LC SMU was overprinted reaching the medium- to high-grade level (similar to some of the basement units of the Getic basement; Fig. 3a) whereas the more internal proximate Supragetic basement has a greenschist-facies imprint. Thus, the original tectonostratigraphic relationship between the LC SMU and the Supragetic basement is the vital criterion for successful deciphering of the modern tectonic framework.

Scarce Variscan and pre-Variscan early Paleozoic imprints

As a segment of Alpine orogeny, it is obvious that the Variscan, pre-Variscan imprints or original tectono-stratigraphic relationship between the LC SMU and Supragetic suffered from the repeated tectonic reworking (Aleksić et al., 1988; also in Dimitrijević, 1997). However, the pre-Alpine kinematic markers or tectonic indicators of the Neoproterozoic–Lower Paleozoic magmatic episodes (Antić et al., 2016b) imprinted into the Carpatho-Balkanides/South Carpathian "terrane" assemblage are:

Late Paleozoic suture ("Thracian suture"; *sensu* Haydoutov, 1989; Plissart et al., 2018). The late Paleozoic suture connecting the "Protomoesian", "Balkan Terrane" and the "Thracian microcontinents" (the "Thracian suture") placing the obducted ophiolite-bearing volcanic arc (Struma Diorite/Frolosh assembly of the Neoproterozoic age; Haydoutov, 1989) (Fig. 4). The zone is later characterized as a pre-Mesozoic west-verging thrust, positioning the Supragetic basement over the LC SMU (Krstić & Karamata., 1996). In terms of paleogeography, the presence of the major Carpathian-Balkan Paleozoic suture just recently was proposed at the expense of closing Rheic Ocean (Boncheva et al., 2010; Spahić et al., 2019). Moreover, the back-arc ophiolites of the Devonian age accommodated within the opposed Danubian basement (Zakariadze et al., 2012; Plissart et al., 2017). It includes the cluster of the Variscan and late Variscan granitoids within the Getic unit (Jovanović et al., 2019 and references therein). The Carboniferous to Permian age by the $^{40}Ar/^{39}Ar$ plateau results (*ca*. 351 Ma to 284 Ma, in mica- and chlorite schists, respectively; numeric age by Antić et al., 2017) for the Vrvi Kobila shear zone (southeast Serbia; LC SMU) identified a late Variscan involvement of the LC SMU.

Recently, in a more external position (near the interface of the LC SMU, Sebeş-Lotru terrane and Supragetic basement) another still enigmatic pre-Variscan suture is depicted (Iancu & Seghedi, 2017). In this context, as pointed in the previous chapters, there is a high likelihood that the majority of the Neoproterozoic – Lower Cambrian to Lower Ordovician depositional or tectonic structures underwent several deformational events. More precisely, Exactly in the case of the LC SMU and the Supragetic basement (exhumed) crustal contact or the shear-zone of the Mali Jastrebac Mt. (Central Serbia, see Fig. 1 for position) (Erak et al., 2016).

Pan-African to Lower Paleozoic paleocontinental inferences and a peculiar Ordovician imprint

A typifying Cadomian section include the associated basement units of ca 2.0–2.2 Ga West African crust (Nance et al., 2008; Murhy et al., 2012; Fig. 5): (i) the oldest segments are of the Palaeoproterozoic age (Icartian gneisses, ca. 2 Ga), followed by (ii) the Cryogenian plutonic complex of ca. 750 Ma. (iii) The Ediacaran turbidites with the presence of mafic volcanics, conglomerates, inclusions of acid volcanics (ca. 650) (iv) the Cambrian redbeds (ca. 542 Ma), (v) the Cambro-Ordovician clastic series with involvement of acidic volcanics (granites). The early Paleozoic clastic rocks in Cadomian segments yield age clusters of ca. 0.60–0.65 Ga, 2.0–2.2 Ga, 2.4 Ga and 2.6 Ga (Murphy et al., 2012 and references therein).

The evident cluster of ca. 550 Ma within the Supragetic basement indicates minimum depositional age with the abundance of 2.2 to 2.4 Ga old grains (zircon spectra from Antić et al., 2016b). The LC SMU distinguished in the vicinity of the Paleoproterozoic West African basement source is fitting with the Avalonian minimum zone (*sensu* Samson et al., 2005). Low number of late Mesoproterozoic zircons (1.6–1.0 Ga) determined in the Ograzhden Unit (samples by Antić et al., 2016b) does not exclude the influence by an Avalonian source.

It appears that juvenile LC SMU was a kind of Neoproterozoic marginal basin associated with the north Gondwanan foredeep (including the Avalonian-Cadomian magmatic arc stage; Antić et al., 2016). The Neoproterozoic relationship with the Supragetic basement is still ambiguous, despite a widespread Neoproterozoic to early Cambrian magmatism (Antić et al., 2016) connecting these two basement units. The perplexing relationship is further marked by the presence of Lower Ordovician brachiopods (Pavlović, 1977). To make matters more complex, the presence of a widespread Middle Ordovician magmatic event

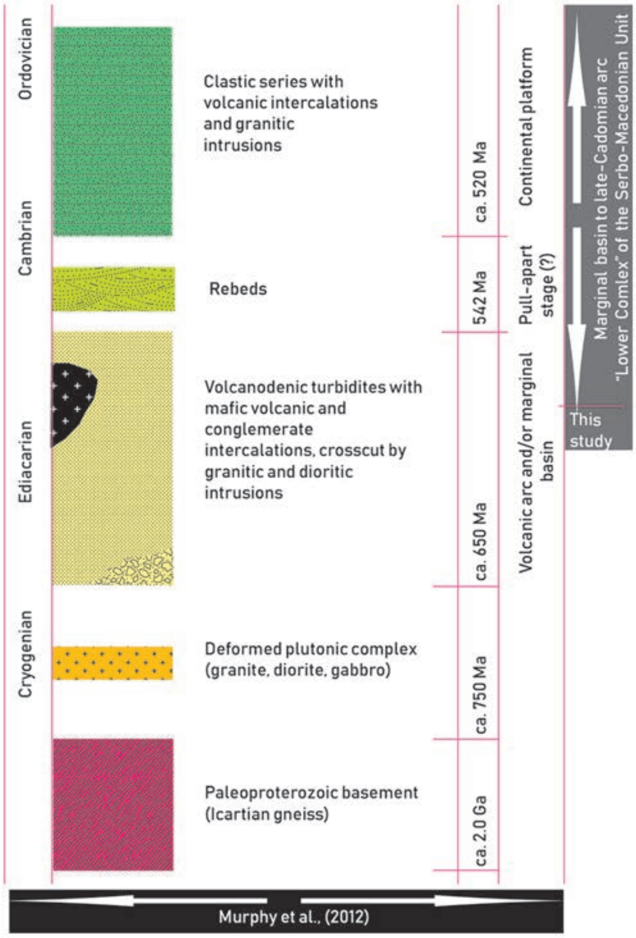


***Fig. 5.** Synoptic stratigraphic chart of the Cadomian continent (after MURPHY et al,. 2012, simplified).The comparison with the LC SMU: LC SMU is fitting with the uppermost Cadomian events, a segment of Cadomian continental platform i.e. margin basin.*

(472–456 Ma, emplacement of mafic dykes; ANTIĆ et al., 2016) with almost identical age is documented within the Sebeş-Lotru terrane, ca. 460 Ma; BALINTONI et al., 2010; Ograzhden unit; ZAGORCHEV et al., 2012, 2015; MACHEVA et al., 2016). Such early Paleozoic imprint pattern suggests a more complex "intra-Ordovician" lithospheric-scale episode (see STEPHAN et al., 2019, for a discussion). Extension and the onset of the Paleozoic latitudinal drift of these peri-Gondwanan terranes begun after this peculiar stage. This stage can tentatively be marked by the contact between latter terranes (Fig.4). The separation from the northern Gondwana mainland enabled the oceanic spreading and drift that produced deep-marine conditions and the formation of the sedimentary cover belonging to the "Kučaj/Getic Unit" (latest Ordovician – Silurian; sensu KRSTIĆ et al., 2005; c.f. SPAHIĆ et al., 2019a and references therein).

Conclusions

A short summary after 60 years of working in the complex Serbo-Macedonian basement entity is as follows:

– The LC SMU represents a segment of wider continental margin of Neoproterozoic–Lower Ordovician age imprinted with a set of Cadomian and early Paleozoic isotopic characteristics. This setting reflects a protracted Pan-African to Lower Paleozoic setting of peri-Gondwanan nappes;

– LC SMU is a highly complex crustal amalgamation (no evidence of cratonic crust; Fig. 5) with the documented repeated anatexis (ZAGORCHEV, 2015). The Supragetic basement is an ocean floor assembly of the similar age (ANTIĆ et al., 2016b; SPAHIĆ et al., 2019 and references therein);

– In a broader tectonic context, we suggest that these peri-Gondwanan systems (in the configuration of Alpine nappes) with distinctly different basements were under direct control of the southward subduction of an early Paleozoic ocean. This terrane assembly LC SMU-Supragetic initially amalgamated along the north Gondwanan – Cadomian continental margin involving an unknown event that occurred sometime during post-Cambrian. In paleogeographical terms, both peri-Gondwanan systems (the LC SMU and the Supragetic/Getic) were situated in an outer flank of the Pan-African margin;

– Post-Lower Paleozoic events significantly disrupted the original configuration of the two adjoining systems: LC SMU and Supragetic basement. Despite significant tectonodepositional discrepancies, both systems can be regarded as discrete entities in the Alpine structural plan as suggested by the KARAMATA & KRSTIĆ (1996).

Acknowledgements

This research did not receive any specific grant from funding agencies in the public, commercial or not-forprofit sectors. The paper benefited from the constructive review of Prof. Dr Ivan Zagorchev from Bulgarian Academy of Sciences.

References

Abbo, A., Avigad, D. & Gerdes, A. 2020. Crustal evolution of peri-Gondwana crust into present day Europe: The 527 Serbo-Macedonian and Rhodope massifs as a case study. *Lithos*. 356-357: 105295.

Aleksić, V., Dimitriadis, S., Kalenić, M., Stojanov, R., & Zagorčev, I. 1988. Serbo-Macedonian Massif. In: Zoubek, V., Cogné, J., Kozhoukharov, D. & Krautner, H. (Eds.). *Precambrian in Younger Fold Belts*. Wiley & Sons, 779–820.

Aleksić, V., Kalenić, M., Pantić, N. & Hadži, E. 1974. Istorijsko-geološka evolucija kontinentalne, prelazne i okeanske litosfere u Srbiji i susednim oblastima. [Historical geology of the evolution of continental, transitional-oceanic and oeanic lithospere in Serbia and the surrounding areas – in Serbian]. *Zbornik „Metalogenija i koncepcije geotektonskog razvoja Jugoslavije"*, Faculty of Mining and Geology, Belgrade, 229–274.

Anđelković, M. 1963. Rasporstranjenje šumadijske zone prema severu i jugu i njena geotektonska pripadnost. [The area of Šumadija zone in the north and south direction and its geotectonic affinity – in Serbian]. *Zapisnici SGD*, 143–150.

Anđelković, M. 1965. Position of the Morava and Šumadija zones in the geotectonic structure of the Balkan Peninsula. *Proceeedings of the VII CBGA*, 1: 243–249.

Anđelković, M. 1967. Šumadijska zona [Šumadija Zone – in Serbian]. *Geološki anali Balkanskoga poluostrva*, 33: 1–39.

Anđelković, M. 1977. Srpsko-kristalasto jezgro [The Serbian crystalline core – in Serbian]. In: Petković, K. (Ed.). *Terminologie et Nomenclatures Geologiques V – Tectonique.* Institute de Geologe Regionale et la Paleontologie – Universite de Belgrade, 230 pp.

Anđelković, M., 1982. *Geologija Jugoslavije – Tektonika* [Geology of Yugoslavia – Tectonics – in Serbian]. University of Belgrade, 692 pp.

Antić, M., Kounov, A., Trivić, B., Wetzel, A., Peytcheva, I. & von Quadt, A. 2016a. Alpine thermal events in the central Serbo-Macedonian Massif (southeastern Serbia). *International Journal of Earth Sciences,* 105 (5):1485–1505.

Antić, M., Peytcheva, I., von Quadt, A., Kounov, A., Trivić, B., Serafimovski, T., Tasev, G., Gerdjikov, I. & Wetzel, A. 2016b. Pre-Alpine evolution of a segment of the North-Gondwanan margin: Geochronological and geochemical evidence from the central Serbo-Macedonian Massif. *Gondwana Research,* 36: 523–544.

Antić, M.D., Kounov, A., Trivić, B. & Spikings, R. 2017. Evidence of Variscan and Alpine tectonics in the structural and thermochronological record of the central Serbo-Macedonian Massif (south-eastern Serbia). *International Journal of Earth Sciences,* 106 (5): 1665–1692.

Avigad, D., Morag, N., Abbo, A. & Gerdes, A. 2017. Detrital rutile U-Pb perspective on the origin of the great Cambro-Ordovician sandstone of North Gondwana and its linkage to orogeny. *Gondwana Research,* 51: 17–29.

Balintoni, I. & Balica, C. 2012. Avalonian, Ganderian and East Cadomian terranes in South Carpathians, Romania, and Pan-African events recorded in their basement. *Mineralogy and Petrology,* 107: 709–725.

Balintoni, I., Balica, C., Cliveți, M., Li L.-Q., Hann, H.P., Chen, F. & Schuller, V. 2009. The emplacement age of the Muntele Mare Variscan granite (Apuseni Mountains, Romania). *Geologica Carpathica,* 60: 495–504.

Balintoni, I., Balica, C., Ducea, M.N., Zaharia, L., Chen, F., Cliveti, M., Hann, H.P., Li L.-Q. & Ghergari, L. 2010. Late Cambrian–Ordovician northeastern Gondwanan terranes in the basement of the Apuseni Mountains, Romania. *Journal of the Geological Society of London,* 167: 1131–1145.

Balintoni, I., Balica, C., Ducea, M.N. & Hann, H.-P. 2014. Peri-Gondwanan terranes in the Romanian Carpathians: A review of their spatial distribution, origin, provenance, and evolution. *Geoscience Frontiers,* 5: 395–411.

Balintoni, I., Balica, C., Seghedi, A. & Ducea, M. 2011a. Peri-Amazonian provenance of the Central Dobrogea terrane (Romania) attested by U/Pb detrital zircon age patterns. *Geologica Carpathica,* 62 (4): 299–307.

Balintoni, I., Balica, C., Ducea, M.N. & Stremțan, C. 2011b. Peri-Amazonian, Avalonian-type and Ganderian-type terranes in the South Carpathians, Romania: The Danubian domain basement. *Gondwana Research,* 19: 945–957.

Balintoni, I., Balica, C., Ducea, Hann, H.P. & Şabliovschi, V. 2010. The anatomy of a Gondwanan terrane: The Neoproterozoic–Ordovician basement of the pre-Alpine Sebeş–Lotru composite terrane (South Carpathians, Romania). *Gondwana Research,* 17: 561–572.

Balogh, K., Svingor, É. & Cvetković, V. 1994. Ages and intensities of metamorphic processes in the Batočina area, Serbo-Macedonian massif. *Acta Mineralogica-Petrographica,* 35: 81–94.

Bogdanović, P. 1976. Tumačenje geološko-tektonskog razvoja Srbije sa stanovišta nove globalne tektonike. [Interpretation of geological and teconic evolution of Serbia by using a model of new global tectonics – in Serbian]. *Glasnik Prirodnjačkog muzeja u Beogradu.* A, 31: 53–71.

Bonchev, E., 1936. Experience for tectonic synthesis of Western Bulgaria. *Geology of Bulgaria*, 2: 5–48 (in Bulgarian).

Bonchev, E. 1940. Alpine tectonic events in Bulgaria. *Review of the Bulgarian Geological Society,* 12 (3): 155–247 (in Bugarian).

Bonchev, E. 1943. Geologic structures of the Bugarian land. *Geologija na Balkanite*, 3: 89–106 (in Bugarian).

Bonchev, E. 1971. *Problems of Bulgarian tectonics*. Tehnika, Sofia, 204 pp. (in Bulgarian).

Boué, A. 1840. *La Turquie d'Europe; observations sur la geographie, la géologie, l'histoire naturelle, la statistique, les moeurs, les coutumes, l'achéologie, l'agriculture, l'industrie, le commerce, les gouvernements divers, le clergé, l'histoire et l'etat de cet empire*, I, Paris: Arthus Bertrand, 539 pp.

Carminati, E., Doglioni, C., Argnani, A., Carrara, G., Dabovski, C., Dumurdzhanov, N., Gaetani, M., Georgiev, G., Mauffret, A., Nazai, S., Sartori, R., Scionti, V., Scrocca, D., Seranne, M., Torelli, L. & Zagorchev, I. 2004. Transect III: Massif Central – Provence, Gulf of Lion – Provencal Basin – Tyrrhenian Basin – Southern Apennines – Apulia – Adriatic Sea – Albanides – Balkans – Moesian Platform. In: Cavazza, W., Roure, F., Spakman, W., Stampfli, G. & Ziegler, P. (Eds.). *The Transmed Atlas. Part Two* – CD-ROM. Springer, Berlin.

Chanell, J.E. & Horvath, F. 1976. The African Adriatic Promontory as Paleogeographical Premise for Alpine orogeny and Plate Movements in the Carpatho-Balkan region. *Tectonophysics*, 35: 71–101.

Ćirić, B. 1996. *Geologija Srbije*. Geokarta, Beograd, 271 pp.

Codarcea, A., 1964. Geological evolution of the South Carpathians. *Moskovskoe obshchestvo ispytateleĭ prirody, ser. geologiya,* 39 (2): 2–23 (in Russian).

Cvetković, V., Prelević, D. & Schmid, S. 2015. Geology of South-Eastern Europe. In: Papić P. (Ed.). *Mineral and Thermal Waters of Southeastern Europe.* Environmental Earth Sciences, Springer, Cham, 1-29.

Cvijić, J. 1900. Struktura i podela planina Balkanskoga poluostrva [The structure and the subdivision of the mountains of the Balkan Peninsula – in Serbian]. *Glas Srpske kraljevske akademije,* 63: 1–72.

Cvijić, J. 1901. Die tektonischen Vorgänge in der Rhodopemasse. *Akademie der Wissenschaften in Wien Mathematisch-Naturwissenschaftliche*, Klasse I, 110: 409–436.

Cvijić, J. 1903. Die Tektonik der Balkanhalbinsel: mit besonderer Bercksichtigung der neueren Fortschritte in der Kenntnis der Geologie von Bulgarien, Serbien und Makedonien. *Comptes Rendus IX. Congres geol. internat. de Vienne*, 347–370.

Cvijić, J. 1904. Die Tektonik der Balkanhalbinsel. Congrès géologique international. *Compte rendu de la IX. Session de Vienne 1903*, 347–370.

Cvijić, J. 1924. *Geomorfologija I.* [Geomorphology I – in Serbian]. Državna štamparija Kraljevine SHS, Beograd, 588 pp.

Deleon, G., Dromnjak, M. & Lovrić, A. 1972. Stroncijumova starost stena Juhorsko-Stalaćkog metamorfnog kompleksa [Strontium numeric age dating of the Juhor-Stalać metamorphic complex – in Serbo-Croatian]. *VII Kongres geologa SFRJ: Predavanja održana u sekciji mineralogija i petrologija*, 2: 97–112.

DERCOURT, J., GAETANI, M., VRIELYNCK, B., BARRIER, E., BIJU-DUVAL, B., BRUNET, M.F., CADET, J.P., CRASQUIN, S. & SANDULESCU, M. 2002. *Atlas of Peri-Tethys Palaeogeographical Maps*, Commission for the Geological Map of the World, Paris, France.

DEWEY, J.F., PITMANN, W.C., RYAN, W.B.F. & BONIN, J. 1974. Plate Tectonics and the Evolution of the Alpine System. *Bulletin Geological Society of America*, 85: 3137–3180.

DIMITRIJEVIĆ, M. 1959. Osnovne karakteristike stuba Srpsko-makedonske mase [Geological column of the Serbo-Macedonian Mass, basic features – in Serbian]. *First Symposium of Serbian Geological Society*. Belgrade (copy without pagination).

DIMITRIJEVIĆ, M.D. 1963. Sur l'âge du métamorphisme et des plissements dans la masse Serbo-macédonienne. *Bulletin de l'Association Géologique Carpatho-Balkanique,* 21: 45–48.

DIMITRIJEVIĆ, M. 1974. Yugoslavian Carpathians and Serbo-Macedonian Massif – The Serbo-Macedonian Massif. *Tectonics of the Carpathian Balkan Regions*. *Geological Institute Dyoniz Stur., Bratislava*, 291–296.

DIMITRIJEVIĆ, M. 1997. G*eology of Yugoslavia*. Institute Gemini, Belgrade, 187 pp.

DIMITRIJEVIĆ, D., GRUBIĆ, A., PETROVIĆ, B., ALEKSIĆ, V., BABOVIĆ, M., DIVLJAN, S. & KALENIĆ, M. 1967. Metamorphic complexes of the Carpatho-Balkanic arch and adjacent areas. *Acta Geologica Academiae Scientiarurn Hungaricae*, 11: 23–34.

DIMITRIJEVIĆ, M.D. & KRSTIĆ, B.P. 1999. N 3 - Geotectonic Map. In: DIMITRIJEVIĆ, M.D. (Ed.). *Geological Atlas of Serbia 1:2,000,000*. Serbian Ministry for Mining and Energetics & Geomagnetics Institut, Belgrade.

ERAK, D., MATENCO, L., TOLJIĆ, M., STOJADINOVIĆ, U., ANDRIESSEN, P.A.M., WILINGSHOFER E. & DUCEA, M.N. 2016. From nappe stacking to extensional detachments at the contact between the Carpathians and Dinarides – The Jastrebac Mountains of Central Serbia. *Tectonophysics,* 710: 162–183.

GERDJIKOV, I., KOUNOV, A. & VANGELOV, D. 2014. The Paleozoic Balkan terrane: a re-evaluation. Bulgarian Geological Society. *Conference abstracts "Geosciences 2014"*, 43–44.

GRUBIĆ, A. 1974. Istočna Srbija u svetlosti nove globalne tektonike i odraz takvog modela na tumačenje tektonike severna grane Alpida [Eastern Serbian in the context of the new global tectonics and the explanation according to the model of the northern branch of Alpides – in Serbian]. *Zapisnici SGD za 1974 godinu*, 61–68.

GRUBIĆ, A. 1980. Yugoslavia. An outline of the geology of Yugoslavia. *Livret Guide No 15, 20th International Geolological Congress*, Paris, 49 pp.

GRUBIĆ, A. 1994. Geological features of the Carpatho-Balkanides Moutain System. Ground waters in carbonate rocks of the Carpatho-Balkan Mountain Range. In: STEVANOVIĆ, Z. & FILIPOVIĆ, B. (Eds.). Groundwaters in tcarbonate rocks of the *Carpathian-Balkan mt range. Special edition of the Carpathian-Balkan Geologic Association,* Alloston, New Jersey, USA, 9–34.

GRUBIĆ, A. 1999. Tektonika Jastrepca i njen opštiji značaj [Tectonics of the Jastrebac and its general importance – in Serbian]. *Rudarstvo, geologija i metalurgija (Tehnika),* 54 (1–2): 12–17.

GRUBIĆ, A., ĐOKOVIĆ, I., MAROVIĆ, M. & BRANKOVIĆ, M. 1999. Srpsko-Makedonska masa ne postoji [Serbo-Macedonian Massif does not exist – in Serbian]. *Vesnik Geozavoda,* A, 49: 1–14.

GRUBIĆ, A. ĐOKOVIĆ, I., MAROVIĆ, M. & BRANKOVIĆ, M. 2005. Problem tektonskog položaja kristalina Srpsko-makedonske mase [The problem of the tectonic position of Moravicum crystalline – in Serbian, abstract in English]. *Zapisnici SGD za godine 1998-2003.*, 35–40.

HAYDOUTOV, I. 1989. Precambrian ophiolites, Cambrian island arc, and Variscan suture in the South Carpathian-Balkan region. *Geology*, 17: 905–908.

HAYDOUTOV, I. 1991. *Origin and evolution of the Precambrian Balkano-Carpathian ophiolite segment.* Bulgarian Academy of Sciences, Sofia, 179 pp. (in Bulgarian, with English summary)

HAYDOUTOV, I. & YANEV, S. 1997. The Protomoesian microcontinent of the Balkan Peninsula peri-Gondwanaland piece. *Tectonophysics*, 272: 303–313.

HIMMERKUS, F., REISCHMANN, T. & KOSTOPOULOS, D. 2006. Late Proterozoic and Silurian basement units within the Serbo-Macedonian Massif, northern Greece: the significance of terrane accretion in the Hellenides. In: ROBERSTON, A. H. F. & MOUNTRAKIS, D. (Eds.). *Tectonic Development of the*

Eastern Mediterranean Region. Geological Society, London, Special Publications, 260: 35–50.

Himmerkus, F., Reischmann, T. & Kostopoulos, D. 2009. Serbo-Macedonian revisited: A Silurian basement terrane from northern Gondwana in the Internal Hellenides, Greece. *Tectonophysics*, 473: 20–35.

Iancu, V., Berza, T., Seghedi, A. & Mărunțiu, M. 2005. Palaeozoic rock assemblages incorporated in the South Carpathian Alpine thrust belt (Romania and Serbia): a review. *Geologica Belgica*, 8: 48–68.

Iancu, V. & Seghedi, A. 2017. The South Carpathians: Tectono-Metamorphic Units related to Variscan and Pan-African inheritance. *Geo-Eco-Marina*, 2017: 245–262.

Jackobshagen, N, V. 1986. Geologie von Griechenland. Gebrüder Borntraeger, Berlin – Stuttgart.

Jaranoff, D. 1938. La géologie du massif des Rhodopes et son importance – propos de la tectonique de la Péninsule Balkanique. *Révue de Géographie Physique et de Géologie Dynamique*, 11 (2): 131–143.

Jaranoff, D. 1960. *La tectonique de la Bulgarie* [in Bulgarian, with French summary]. Tehnika, Sofia, 282 pp.

Jovanović, D., Cvetković, V., Erić, S., Kostić, B., Peytcheva, I. & Šarić, K. 2019. Variscan granitoids of the East Serbian Carpatho-Balkanides: new insight inferred from U–Pb zircon ages and geochemical data. *Swiss Journal of Geosciences,* 112 (1): 121–142.

Kalenić, M., Marković, V., Pantić, V. & Hadži-Vuković, M. 1975. Gornji proterozoik i stariji paleozoik u profile – Resavski Visovi – Batočinska Straževica – selo Botunje [Upper Protoreozoik and the older Paleozoic in sections: Resavki Visovi – Batočinska Straževica – village Botunje – in Serbian].. *Zapisnici SGD za 1974 godinu,* 3–39.

Karamata, S. & Krstić, B. 1996. Terranes of Serbia and neighbouring areas. In: Knežević, V. & Krstić, B. (Eds.). *Terranes of Serbia*. Faculty of Mining and Geology, University of Belgrade, 25–40.

Karamata, S. 2006. The geological development of the Balkan Peninsula related to the approach, collision and compression of Gondwanan and Eurasian units. In: Robertson, A.H.F. & Mountrakis, D. (Eds.). *Tectonic Development of the Eastern Mediterranean Region*. Geological Society of London Special Publications, 260: 155–178.

Kilias, A., Falalakis, G. & Mountrakis, D. 1999. Cretaceous–Tertiary structures and kinematics of the Serbomacedonian metamorphic rocks and their relation to the exhumation of the Hellenic hinterland (Macedonia, Greece). *International Journal of Earth Sciences*, 88: 513–53.

Kober, L. 1952. *Leitlinien der Tektonik Jugoslawiens*. Serbian Academy of Sciences, Special Edition, CLXXXIX. Geological Institute, 3, Belgrade, 82 pp.

Koch, F. 1930. Pregled geologije i tektonike [Overview of the geology and tectonics – in Serbian]. *Kraljevina Jugoslavija III Kongres slovenskih geografa i etnologa*, 15–26.

Kossmat, F. 1924. Geologie der zentralen Balkankalbinsel. *Kriegsschauplaetze 1914-1918, geologisch dargestellt*, 12: 1–198.

Kounov, A., Seward, D., Burg, J.-P., Bernoulli, D., Ivanov, Z. & Handler, R. 2010. Geochronological and structural constraints on the Cretaceous thermotectonic evolution of the Kraishte zone, western Bulgaria, *Tectonics*, 29: TC2002.

Kounov, A., Graf, J., von Quadt, A., Bernoulli, D., Burg, J.-P., Sewarde, D., Ivanov, Z. & Fanning, M. 2012. Evidence for a “Cadomian” ophiolite and magmatic-arc complex in SW Bulgaria. *Precambrian Research,* 212–213: 275–295.

Kräutner, H.G. & Krstić, B. 2002. Alpine and pre-Alpine structural units within the southern Carpathians and eastern Balkanides. *Proceedings of XVII Congress of Carpathian-Balkan Geological Association, Bratislava, September 1-4*, *2002*, *Geologica Carpathica,* 53, Special Issue CD-R (without pagination, 6 pages length).

Kräutner, H.G. & Krstić, B. 2006. Geological map of the Carpatho-Balkanides between Mehadia, Oravita, Niš and Sofia. *Proceedings of XVIII Congress of the Carpathian-Balkan Geological Association*, *Belgrade, September 3-6*, *2006*, CD-R (without pagination).

Krstić, N. & Karamata, S. 1992. Terani u Karpato-Balkanidima istočne Srbije [Terranes in the Carpatho-Balkanides of Eastern Serbia – in Serbian]. *Zapisnici SGD jubilarna knjiga 1891–1991*, 57–69.

Krstić, B., Karamata, S. & Milićević, V. 1996. The Carpatho-Balkanide terranes – a correlation. In:

Knežević, V. & Krstić, B. (Eds.). *Terranes of Serbia*. Faculty of Mining and Geolology, University of Belgrade, 71–76.

Krstić, N., Maslarević, Lj. & Sudar, M. 2005. On the Graptolite Schists Formation (Silurian–Lower Devonian) in the Carpatho–Balkanides of eastern Serbia. *Geološki anali Balkanskoga poluostrva,* 66: 1–8.

Krenn, K., Bauer, C., Proyer, A., Klötzli, U. & Hoinkes, G. 2010. Tectonometamorphic evolution of the Rhodope orogen. *Tectonics*, 29: TC4001.

Kukin, A., Kemenci, R. & Janković, P. 1987. *Geology of Vršac Mts.* [in Serbian with English summary]. Monografije Vršačkih planina. Matica Srpska, Novi Sad, 65pp.

Kydonakis, K., Brun, J.-P., Poujol, M., Monié, P., Chatzitheodoridis, E. 2016. Inferences on the Mesozoic evolution of the North Aegean from the isotopic record of the Chalkidiki block. *Tectonophysics*, 682: 65–84.

Liégeois, J.P., Berza, T. Tatu, M. & Duchesne, J.C. 1996. The Neoproterozoic Pan-African basement from the Alpine Lower Danubian nappe system (South Carpathians, Romania). *Precambrian Research*, 80: 281–301.

Linnemann, U., Gerdes, A., Drost, K. & Buschmann, B. 2007. The continuum between Cadomian orogenesis and opening of the Rheic Ocean: Constraints from LA-ICP-MS U-Pb zircon dating and analysis of plate-tectonic setting (Saxo-Thuringian zone, northeastern Bohemian Massif, Germany. In: Linnemann, U., Nance, R.D., Kraft, P. & Zulauf, G. (Eds.). *The evolution of the Rheic Ocean: From Avalonian-Cadomian active margin to Alleghenian-Variscan collision*. Geological Society of America Special Paper, 423: 61–96.

Macheva, L., Peytcheva, I., von Quadt, A. & Zidarov, N. 2016. Metamorphic evolution of Gondwana-derived fragment in Ograzhden and Belasitsa Mountains, Serbo-Macedonian Massif, SW Bulgaria. *Proceedings of Conference "Geosciences 2016"*, 70–89.

Mahel', M. 1974. *Tectonics of the Carpathian-Balkan regions: Explanations to the tectonic map of the Carpathian Regions and their forelands.* Geological Institute Dyonis Štur, Bratislava. 453 pp.

Marović, M. 2001. Geologija Jugoslavije: predavanje studentima petrologije i geologije [Geology of Yugoslavia: lectures for the students of petrology and geophysics – in Serbian] University of Belgrade – Faculty of Mining and Geology. 220 pp.

Marović, M., Đoković, I., Toljić, M., Spahić, D. & Milivojević, J. 2007. Extensional Unroofing of the Veliki Jastrebac Dome (Serbia). *Geološki anali Balkanskoga poluostrva,* 68: 21–27.

Medaris, G.J., Ducea, M., Ghent, E. & Iancu, V. 2003. Conditions and timing of high-pressure Variscan metamorphism in the South Carpathians, Romania. *Lithos*, 70: 141–161.

Meinhold, G. 2007. *Sedimentary rocks of the Internal Hellenides, Greece: age, source, and depositional setting*. Unpublished PhD Dissertation, Johannes Gutenberg-Universität, Mainz, Germany. 303 pp.

Meinhold, G., Kostopoulos, D., Frei, D., Himmerkus, F. & Reischmann, T. 2010. U–Pb LA-SF-ICP-MS zircon geochronology of the Serbo-Macedonian Massif, Greece: palaeotectonic constraints for Gondwana-derived terranes in the Eastern Mediterranean. *International Journal of Earth Sciences*, 99: 813–832.

Mihailović, J. 1955. Geosinklinalna mediteranska ili alpijska [Mediterranean or Alpine geosyncline? – in Serbian]. *Geološki anali Balkanskoga poluostrva*, 22: 237–241.

Milivojević, M.G.1993. Geothermal model of Earth's crust and lithosphere for the territory of Yugoslavia: some tectonic implications. *Studia geophica et geodetica*, 37.

Milovanović, D. 1989. Metamophism of the Serbo-Macedonian Massif. *Proceedings of 28th IGC*, 2: 439–441.

Milovanović, D., Marchig, V. & Dimitrijević, M.D. 1998. Petrology and chronology of Vučje gneiss, Serbo-Macedonian Massif, Yugoslavia. *Slovak Geological Magazine*, 4: 29–33.

Mojsisovics, E., Tietze, E. & Bittner, A. 1880. Grundlinien der Geologie von Bosnien-Hercegovina. Erläuterungen zur geologischen dieser Länder. *Jahrbuch der Kais. u. Königl. Geologischen Reichanstalt*, 30: 166–462.

Muratov, M. 1949. *Tectonic and history of the evolution of Alpine geosyncline area of the south of Europen part of USSR* [in Russian]. Part II. Academy of Sciences SSSR, Moscow - Leningrad.

Murphy, J.B., Pisarevsky, S.A., Nance, R.D. & Keppie, J.D. 2004. Neoproterozoic–early Paleozoic evolution of peri-Gondwanan terranes; implications for Laurentia–Gondwana connections. *International Journal of Earth Sciences*, 93: 659–682.

Murphy, J.B., Pisarevsky, S. & Nance, R.D. 2012. Potential geodynamic relationships between the development of peripheral orogens along the northern margin of Gondwana and the amalgamation of West Gondwana. *Mineralogy Petrology*, 107 (5): 635–650.

Nance, R.D., Murphy, J.B., Strachan, R.A., Keppie, J.D., Gutiérrez-Alonso, G., Linnemann, U., Fernández-Suárez, Quesada, C., Linnemann, U., D'Lemos, R. & Pisarevsky, S.A. 2008. Neoproterozoic–early Palaeozoic tectonostratigraphy and palaeogeography of the peri-Gondwanan terranes: Amazonian v. West African connections. In: Ennih, N. & Liégeois, J.-P. (Eds.). *The Boundaries of the West African Craton*. Geological Society, London, Special Publications, 297: 345–383.

Neubauer, F. 2014. Gondwana-Land goes Europe. *Austrian Journal of Earth Sciences*, 107 (1): 147–155.

Oczlon, M.S., Seghedi, A. & Carrigan, C.W. 2007. Avalonian and Baltican terranes in the Moesian Plate (southern Europe, Romania, and Bulgaria) in the context of Caledonian terranes along the southwestern margin of the East European craton. *GSA Special Paper*, 423: 375–400.

Pavlović, P. 1977. O "Gornjem (Vlasinskom) kompleksu" i podeli metamorfnih stena Srpsko-Makedonskog metamorfnog terena. [The "Upper Vlasina complex" and the subdivision of metamorphic rocks of the Serbo-Macedonian metarmophic realm – in Serbian]. *Zapisnici SGD za 1975. i 1976. godinu*, 123–132.

Peters, K.F. 1863. Bemerkungen über die Bedeutung der Balkan-Halbinsel als Festland in der Liasperiode. *Sitzungsberichte der Akademie der Wissenschaften mathematisch-naturwissenschaftliche Klasse*. 48: 418–426.

Petković, K. 1930. *Geološki sastav i tektonski sklop Suve Planine* [Geology and tectonics of Suva Planina Mt. – in Serbian]. Srpska Kraljevska Akademija, 144 pp.

Petković, K. 1957. *Istorijska geologija* [Historic Geology - in Serbian]. Publisher "Veselin Masleša", Sarajevo, 314 pp.

Petković, K.V., 1958. Neue Erkenntnisse über den Bau der Dinariden. *Jahrbuch Geologische Bundesanstalt*, 101 (1): 1–24.

Petković, K. 1960. *Tektonska karta FNR Jugoslavije 1:2,500,000* [Tectonic map of FPR Yugoslavia 1:2,500,000]. Zavod za geološka i geofizička istraživanja, Beograd.

Petković, K. & Maksimović, B. 1976. Tektonska skica SR Srbije [Tectonic notes of SR Serbia]. In: Petković, K. (Ed.). *Geologija Srbije – Tektonika IV*. University of Belgrade, p. 165.

Petrović, B. 1969. *Struktura kristalastog kompleksa Vlasine na širem području Crne Trave* [Structure of the Vlasina crstalline complex in the wider area of Crna Trava– in Serbian]. Unpublished Ph.D. Dissertation. University Belgrade – Faculty of Mining and Geology, 124 pp.

Peytcheva, I., Macheva, L., von Quadt, A. & Zidarov, N. 2015. Gondwana-derived units in Ograzhden and Belasitsa Mountains, Serbo-Macedonian Massif (SW Bulgaria): Combined geochemical, petrological and U-Pb zircon-xenotime age constraints. *Geologica Balcanica,* 44: 51–84.

Plissart, G., Monnier, C., Diot, H., Mărunţiu, M., Berger, J. & Triantafyllou, A. 2017. Petrology, geochemistry and Sm-Nd analyses on the Balkan-Carpathian Ophiolite (BCO – Romania, Serbia, Bulgaria): remnants of a Devonian back-arc basin in the easternmost part of the Variscan domain. *Journal of Geodynamics*, 105: 27–50.

Plissart, G., Diot, H., Monnier, C. & Mărunţiu, M. 2018. New insights into the building of the Variscan Belt in Eastern Europe (Romania, Serbia, Bulgaria). In: Ferrero, S., Lanari, P., Goncalves, P. & Grosch, E.G. (Eds.). *Metamorphic Geology: Microscale to Mountain Belts*. Geological Society, London, Special Publications, 478: 389–426.

Popović, R. 1991. Srpsko-Makedonska masa ili Pelagonsko-Rodopski i Moravski masiv [Serbo-Macedonian Massif or the Pelagonic-Rhodope and Morava Massif – in Serbian]. *Radovi Geoinstituta*, 25: 7–20.

Popović, R. & Milijković, Lj. 2000. Geochemical evolution and distribution of ore deposits in the Morava massif during the pre-Mesozoic time. *Geographica Pannonica*, 4: 14–21.

Ricou, L.-E., Burg, J.-P., Godfriaux, I. & Ivanov, Z. 1998. Rhodope and Vardar: the metamorphic and the olistostromic paired belts related to the Cretaceous subduction under Europe. *Geodynamica Acta*, 11 (6): 285–309.

Robertson, A.H.F., Trivić, B., Đerić, N. & Bucur, I.I. 2013. Tectonic development of the Vardar ocean and its margins: Evidence from the Republic of Macedonia and Greek Macedonia. *Tectonophysics*, 595–596: 25–54.

Samson, S.D., D'Lemos, R.S., Miller, B.V., Hamilton, M.A. 2005. Neoproterozoic palaeogeography of the Cadomia and Avalon terranes: constraints from detrital zircon U-Pb ages. *Journal of the Geological Society*, 162: 65–71.

Săndulescu, M. 1984. Overview on Romanian Geology. *Romanian Journal of Tectonics & Regional Geology*, 2: 3–16.

Savezni Geološki Zavod (Federal Geological Survey) 1970. Geološka karta SFR Jugoslavije, 1:500000 [*Geologic Map of SFR Yugoslavia, 1:500 000*], Beograd.

Schmid, S.M., Bernoulli, D., Fügenschuh, B., Matenco, L., Schefer, S., Schuster, R., Tischler, M. & Ustaszewski, K. 2008. The Alpine-Carpathian-Dinaridic orogenic system: correlation and evolution of tectonic units. *Swiss Journal of Geosciences*, 101: 139–183.

Schmid, M.S., Fügenschuh, B., Kounov, A., Matenco; L., Nievergelte, P., Oberhänsli, R., Pleugerg, J, Schefer, S., Schuster, R., Tomljenovići, B., Ustaszewski, K. & van Hinsbergend, D.J.J. 2020. Tectonic units of the Alpine collision zone between Eastern Alps and western Turkey. *Gondwanan Research*, 78: 308–374.

Seghedi, A. 2012. Palaeozoic Formations from Dobrogea and Pre-Dobrogea - An Overview. *Turkish Journal of Earth Sciences*, 21: 669–721.

Seghedi, A., Berza, T., Iancu, V., Maruntiu, M. & Oaie, G. 2005. Neoproterozoic terranes in the Moesian basement and in the Alpine Danubian nappes of the South Carpathians. *Geologica Belgica*, 8: 4–19.

Sikošek, B. 1971. Tumač geološke karte SFRJ 1: 500 000 [*Explanatory booklet of the Basic Geological Map of SFRY 1: 500,000* – in Serbian]. Savezni geološki zavod, Beograd.

Spahić, D. 2006. Geološka građa istočnog dela Velikog Jastrepca [*Geological setting of Veliki Jastrebac Mountain* – in Serbian, with an English Abstract]. Unpublished Magister Thesis. Faculty of Mining and Geology, University of Belgrade.

Spahić, D. & Gaudenyi, T. 2018. Primordial Geodynamics of Southern Carpathian-Balkan Basements (Serbo-Macedonian Mass): Avalonian vs. Cadomian Arc Segments. *Proceedings of Geologists Association,* 130: 142–156.

Spahić, D. & Gaudenyi, T. 2019. Intraoceanic subduction of the northwestern Neotethys and geodynamic interaction with Serbo-Macedonian foreland: Descending vs. overriding near-trench dynamic constraints (East Vardar Zone, Jastrebac Mts., Serbia). *Geološki anali Balkanskoga poluostrva*, 80 (2): 65–85.

Spahić, D., Gaudenyi, T. & Glavaš-Trbić, B. 2019a. The Neoproterozoic–Paleozoic basement in the Alpidic Supragetic/Kučaj units of eastern Serbia: a continuation of the Rheic Ocean? *Acta Geologica Polonica*, 69 (4): 531–548

Spahić, D., Gaudenyi, T. & Glavaš-Trbić, B. 2019b. A hidden suture of the western Palaeotethys: regional geological constraints on the late Paleozoic 'Veles Series' (Vardar Zone, North Macedonia). *Proceedings of Geologists' Association*, 130 (6): 701–718.

Spahić, D., Glavaš-Trbić, B. & Gaudenyi, T. 2020. The inception of the Maliac Ocean: Regional geological constraints on the western Circum-Rhodope belt (northern Greece). *Marine and Petroleum Geology*, 113: 104–133.

Stampfli, G.M., Hochard, C., Vérard, C., Wilhem, C. & von Raumer, J. 2013. The formation of Pangea. *Tectonophysics*, 593: 1–19.

Stephan, T., Kroner, U. & Romer, R.L. 2018. The pre-orogenic detrital zircon record of the Peri-Gondwanan crust. *Geological Magazine*, 156 (2): 281–307.

Stephan, T., Kroner, U. & Romer, R.L. 2019. From a bipartite Gondwanan shelf to an arcuate Variscan belt: The early Paleozoic evolution of northern Peri-Gondwana, *Earth-Science Reviews*, 192: 491–512.

Suess, E. 1885. *Das Anlitz der Erde*. Band 1. Wien. F. Tempsky, 779 pp.

van Hinsbergen D.J.J., Torsvik, T.H., Schmid, S.M., Maţenco, L.C., Maffione, M., Reinoud L.M., Derya Gürer; W. & Spakman, W. 2020. Orogenic architecture of the Mediterranean region and kinematic reconstruction of its tectonic evolution since the Triassic. *Gondwana Research,* 81: 79-229.

von Raumer, J.F., Stampfli, G.M., Borel, G. & Bussy, F. 2002. Organization of the pre-Variscan basement areas at the north Gondwanan margin. *International Journal of Earth Sciences,* 91: 35–52.

Vozár, J. 2010. *Variscian and Alpine terranes of the Circum-Pannonian Region*. Slovak Academy of Sciences - Geological Institute. Bratislava, 231 pp.

Vozárová, A., Ebner, F., Kovács, S., Kräutner, H.G., Szederkenyi, T., Krstić, B., Sremac, J., Aljinović, D., Novak, M. & Skaberne, D. 2002. Late Variscan (Carboniferous to Permian) environments in the Circum Pannonian Region. *Geologica Carpathica*, 60 (1): 71–104.

Vujisić, T., Navala, M., Lončarević, Č., Kalenić, M. Hadživuković, M. & Milićević, D. 1978. Osnovna geološka karta SFRJ 1:100 000. Tumač za list Lapovo L34–139 [*Basic Geologic Map of Former Yugoslavia 1:100 000. Explanatory booklet for the Sheet Lapovo* – in Serbian]. Savezni geološki zavod, Beograd.

Yanev, S., Lakova, I., Boncheva, I. & Sachanski, V. 2005. The Moesian and Balkan Terranes in Bulgaria: Palaeozoic basin development, palaeogeography and tectonic evolution. *Geologica Belgica*, 8: 185–192.

Will, T.M. & Frimmel, H.E. 2018. Where does a continent prefer to break up? Some lessons from South Atlantic margins. *Gondwana Research*, 53: 9–19.

Winchester, J.A., Pharaoh, T.C. & Verniers, J. 2002. Palaeozoic amalgamation of Central Europe: an introduction and synthesis of new results from recent geological and geophysical investigations. *Geological Society of London Special Pubications*, 201:1–18.

Winchester, J.A., Pharaoh, T.C., Verniers, J., Ioane, D. & Seghedi, A. 2006. Palaeozoic accretion of Gondwana-derived terranes to the East European Craton: recognition of detached terrane fragments dispersed after collision with promontories. *Geological Society Memoirs*, 32: 323–332.

Zagorchev, I. 1976. Tectonic, metamorphic and magmatic markers in the polycyclic ultrametamorphic Ograzdenian complex. *Geologica Balcanica*, 6 (2): 17–33.

Zagorchev, I.S. 1984. Pre-Alpine structure of Southwest Bulgaria. In: Zagorchev, I.S., Mankov, S. & Bozkov, I. (Eds.). *Problems of the Geology of Southwestern Bulgaria*. Tehnika, Sofia, 9–20, (in Bulgarian with English abstract).

Zagorchev, I. 1995. Pre-Paleogene Alpine tectonics in SW Bulgaria. *Geologica Balkanica,* 25 (5–6): 91–112.

Zagorchev, I.S. 1996. Complex shear and flow in the Ograzhdenian Supergroup, Southern Bulgaria. *Zeitschrift für Geologische Wissenschaften*, 24: 255–271.

Zagorchev, I. 1998. Rhodope controversies. *Episodes*, 21 (3): 159–168.

Zagorchev, I. 2000. Rhodope and Vardar: the metamorphic and the olistostromic paired belts related to the Cretaceous subduction under Europe. *Geodinamica Acta*, 13 (1): 55–59.

Zagorchev, I. 2001. Introduction to the geology of SW Bulgaria. *Geologica Balcanica*, 31 (1–2): 3–52.

Zagorchev, I. 2015. Polyphase tectonometamorphism in Bulgaria: Some alternative interpretations and ideas. National Conferemce with International Particpation *"Geosciences 2015" Abstracts*, 99–100.

Zagorchev, I., Krstić, B., Milovanović, D., Sachanski, V. & Goranov, E. 2018. Key stratigraphic and tectonic problems of the pre-Alpine geology of the border area between Bosilegrad and Vlasina (Serbia) and Treklyano and Zemen (Bulgaria). *Proceedings of 17th Serbian Geol. Congr., Vrnjačka Banja, May 17-20, 2018*, 23–29.

Zagorchev, I.S. & Ruseva, M. 1982. Nappe structure of the southern parts of Osogovo Mts. and the Pijanec region (SW Bulgaria). *Geologica Balcanica*, 12: 35–57.

Zagorchev, I. & Milovanović, D. 2006. Deformation and metamorphism in the eastern part of the Serbo-Macedonian Massif. Proceedings of the 18th Carpathian-Balkan Geological Association September 3-6 2006, Belgrade, *Serbian Geological Society,* 670–672.

Zagorchev, I., Balica, C., Kozhoukharova, E., Balintoni, I.C., Săbău, G. & Negulescu, E. 2015. Cadomian and post-cadomian tectonics west of the Rhodope Massif – the Frolosh greenstone belt and the Ograzhdenian metamorphic supercomplex. *Geologica Macedonica*, 29: 101–132.

Zakariadze, G., Karamata, S., Korikovsky, S., Ariskin, Adamia, S., Chkhotua, T., Sergeev, S. & Solov'eva, N. 2012. The Early–Middle Palaeozoic Oceanic Events Along the Southern European Margin: The Deli Jovan Ophiolite Massif (NE Serbia) and Palaeo-oceanic Zones of the Great Caucasus. *Turkish Journal of Earth Sciences*, 21(5): 635–668.

Резиме

60 година концепта Српско-македонске јединице: Од кадомске до алпске тектонске конфигурације

Након 60 година од када је Dimitrijević (1959) указао на разлике између „Родопске масе“ и њеног тада „западног дела“ (Petković, 1958), још увек постоје недоумице око самог настанка као и готово целе фанерозојске еволуције, тада новоиздвојене „Српско-македонске масе“ („Доњи комплекс“ и „Горњи комплекс“/Супрагетик/“Власина комплекс“). Овај кристаласти блок (Српско-македонска јединица) неопротерозојско-доњопалеозојске старости (Kalenić et al., 1975; Antić et al., 2016b) на западу се граничи са Вардарском зоном, а према истоку са Супрагетик јединицом (некада „Власински комплекс“) и њеним мезозојским седиментима.

У горњопалеозојском смислу, оно што се за сада може закључити јесте да је овај кристаласти теран некада био део варисцијске европске коре која је накнадно прерађена алпском тектоником (Antić et al., 2017). Међутим, у доњопалеозојском палеогеографском и палеотектонском смислу је документовано присуство пери-Гондванског терана кадомске старости који потиче са удаљене северне континенталне маргине Гондване (e.g., Aleksić et al., 1988; Carminati et al., 2004; Himmerkus et al., 2009; Meinhold et al., 2010; Antić et al., 2016b; Abbo et al., 2020).

Поред обновљеног интереса за ову кристаласту јединицу, бројне недоумице (e.g., Grubić et al., 1999; Gerdjikov et al., 2014; Spahić & Gaudenyi, 2019) отежавају решавање полифазне палеогеографске и тектонске еволуције поменутог кристаластог блока:

(1) Суштински, још увек је нејасно коме припада у Алпском структурном плану Српско- македонска јединица („Доњи комплекс Српско-македонска јединица“)? Да ли је то самостални крсталасти блок некадашње европске маргине (геотектонска јединица првог реда), или припада пакету кредно-палеогених навлака које се карактеришу источном вергенцом Алпског навлачења?

(2) Какав је оригинални доњепалеозојски однос Српско-македонске јединице са Супрагетик јединицом и бејсментом?

(3) Која тектонска јединица представља наставак Српско-македонске јединице („Доњег комплекса“) према северу, тј. у румунском делу Јужних Карпата?

(4) Која је примарна палеодепозициона и тектонска средина која је могла да прихвати тако значајну количину кластичног детритуса (e.g., Avigad et al., 2017)?;

(5) Који литосферни догађај је узроковао настанак недовољно истраженог ордовицијумског термалног оверпринта (472–456 Ma, нумерички подаци старости од Antić et al., 2016a ,b; „Себеш-Лотру теран“, *ca*. 460 Ma; Balintoni et al., 2010; Огражден јединица, 462 Ma; Zagorchev et al., 2012, 2015; Macheva et al., 2016)?

(6) Која је била улога Српско-македонске јединице („Доњег комплекса“) у пермо-тријаском отварању Неотетиса, и који је био однос са тадашњим западним Палеотетисом?

Овај рад представља наставак регионално-геолошких студија (Spahić & Gaudenyi, 2018, 2019; Spahić et al., 2019 a,b; Spahić et al., 2020) и заснива се на подацима везаним за Српско-македонску јединицу („Доњи комплекс“) (Himmerkus et al., 2009; Meinhold et al., 2010; Antić et al., 2016a, 2017, Abbo et al., 2020). Кроз покушај да укажемо на неке од могућих решења на горе-поменуте проблеме, рад се фокусира на Српско-македонску јединицу („Доњи комплекс“). У раду су различити раније публиковани подаци стављени у модеран палеогеографски и тектонски контекст. Као закључак обимног литературног истраживања, као и кроз анализу аналитичких података, указано је на постојање пре-Варисцијског литосферног догађаја највероватније ордовицијумске старости. Искључиво када се буде утврдио директан оригинални однос између Српско-македонске јединице и упрагетика биће омогућено решавање проблема како варисцијске конфигурације тако алпске и корелације ових бејсментских јединица.

Manuscript received October 18, 2019
Revised manuscript accepted April 27, 2020