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

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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 Baltic 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 gneiss- 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 поли- кристалластих тела која су махом Пан-Афричког порекла. Пан-Афричко порекло указује да су бејсментски терани настали и нешто касније транспорсовани током неопротерозоика и доњег палеозоика на шелфу северне Гондване). Један од најкомплекснијих бејсментских ентитета средњег- до високог степена метаморфизма се налази у оквиру касно- варицијског сутураног асемблажа, суперпозиционо у алпском структурном склопу изнад Супрагетика или некада тзв. “Власинског комплекса”.

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Introduction

For 60 years now, the polycrystalline Neoproterozoic–Lower Paleozoic Serbo-Macedonian Unit (sensu Dimitrijević, 1959, 1963, 1997) or "...Zwischengebirge..." ("...intramontane..."; Kössmaț, 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; Ianu et al., 2005; Decourt et al., 2002; Antić et al., 2017; Plessart 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
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; Gerdijkov et al., 2014; Zagorchev et al., 2015; Spahić & Gaudényi, 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 Sebeș-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 anastaxis (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; Sebeș-Lotru terrane, ca. 460 Ma; Balintoni et al., 2010; Ograzhdan 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 Paleoetethys (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 & Gaudenzi, 2018, 2019; Spahić et al., 2018, 2019 a,b). Study also includes a scarce analytical data repository (Himmelkurs et al., 2009; Meinhold et al., 2010; Kounov et al., 2012; Zagorchev et al., 2012, 2018; Antić et al., 2016a, 2017; Abbö 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 & Gaudenzi, 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 (cf. Spahić et al., 2019b) and Alpine interference.

The westernmost gneiss-dominated 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 and northern Greece (Chalkidiki peninsula; e.g., Savezni geološki zavod, 1970; Mahel’, 1974; Andelković, 1982; Aleksic et al., 1988; Himarkus 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, Poslonsjke Mts, Jastrebac Mt., Stalač 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 Ograzhdan 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 “Moravska-Šumadijska dislokacija” (Andelković, 1982). This fault system has the character of a strike-slip fault (Kräutner & Krsitić, 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
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; Andelković, 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 (Krautner & 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 Carni-Matti et al., 2004; Schmid et al., 2008; Vozár, 2010 and references therein; Robertson et al., 2013; Spahić & Gaudenzi, 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., Ianču et al., 2005; Plissart et al., 2017). From the east to the
west, predominantly basement nappes are re-configured during the Alpine rearrangement and nappe stacking (KraüTner & KriStič, 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 & KriStič, 1996) is outlined towards the Supragetic basement in Serbia (AnDjeLKOVić, 1982; DiMiTrijeVić, 1997; KraüTner & KriStič, 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 (Cnook-) 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, CViVić (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), Mjosigovich et al. (1880), Suess (1895) and CViVić (1900). The earliest authors assumed that the central parts of the Balkan Peninsula are composed of the oldest (crystalline) mass. CViVić (1901, 1903) designates this geologic entity as the Rhodope Mass (in Serbian: Rodopska masa). The Rhodope Mass is described by CViVić (1924) as "the great old core or the oldest mountain around which were formed the smaller mountains later connect to it". CViVić (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). CViVić, moreover, formulated a generic tectonic chart, describing it as a "cheesboard", composed of crystalline blocks displaced by the faults. MIHAILOVIĆ (1955) pointed out that this crystalline entity has "horst-type" structural fabric. According to MIratov (1949), the Macedonian Massif represents the core of a single large, but destroyed anticline, whereas PETKOVIC (1957, 1960) the SMU landform still interprets as the "anticlinorium" or a large-scale anticline. SirošEK (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 CViVić, 1901) had often been used for a tectonic entity that occupies the Rhodope Mass 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 Kraïštides “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 Kraïštides “escaped” from the Balkanides. The Kraïštides were depicted as an allochthonous system or as a „thrust land“ (”dekenland“). 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 Kraïštides concludes “...only in Paleogene and Neogene times, the Strouma (Kraïštid) 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 Kraïštides and Vardar Zone represents an uniform old massif designating as the “Macedonian-Pannonian Mass” (Makedonsko-panonska masa). Later, similar opinions exhibited Mihailović (1955) and Dimitrjević (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, Dimitrjević (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 consistivity 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 Dimitrjević (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 Dimitrjević, 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 & Ljupčić (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 description of the SMU                                                                 | Notes                                                                                                                                                                                                 |
|----------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Peters, 1863          | "old land"                                                                                           | Descriptive denomination.                                                                                                                                                                           |
| Mojsisovics et al., 1880 | "Eastern Land"                                                                                       | Descriptive denomination.                                                                                                                                                                           |
| Cvičić, 1900, 1903    | Rhodope Mass *(Radopska Masa - RM)*                                                                   | Rhodope Mass (s.l.) it encompass RM+SMU.                                                                                                                                                              |
| Cvičić, 1924          | "big crystalline core", "the oldest mountain"                                                        | Descriptive denomination.                                                                                                                                                                           |
|                      | Thracian Massif                                                                                       | In the first decades of 20th century adopted the term from Boué (1840). Encompass RM+SMU.                                                                                                             |
| Bonchev, 1940         | Macedonian-Pannonian Mass                                                                            |                                                                                                                                                                                                      |
| Muratov, 1949         | Macedonian Mass *(Makedonski masiv)*; Macedonian-Rhodope intrageosynclinally                         |                                                                                                                                                                                                      |
| 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 Complex (LC SMU) and Upper Complex (UC SMU) |
| Andelković, 1965; Vujić 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 *(Dardonska masa)*                                                                       |                                                                                                                                                                                                      |
| Maksimović, 1974      | Serbian crystalline core *(Srpsko kristalasto jezgro)*                                                |                                                                                                                                                                                                      |
| Veselinović et al., 1978 | Morava nappe *(Moravaska navelka)*                                                                      |                                                                                                                                                                                                      |
| Malešević et al., 1980; Kalemić et al., 1975 | Morava structural unit *(Moravaska strukturna jedinica)*                                              |                                                                                                                                                                                                      |
| Andelković, 1982      | Dardanides *(Dardanidi)*                                                                              | Later under names Pirgadikia-, Kerdilion-and Vertikos Units stated that belongs to the SMU (e.g. After Himmeke et al., 2006).                                                                       |
| Jacobshagen, 1968     | SMU is assigned as separate tectonic unit of Greece                                                   |                                                                                                                                                                                                      |
| Haydoutov, 1980, 1991, 1997 | Thracian terrane *(SMU+RM)* + western parts of the Balkan terrane                                 | After Yanov et al. (2005): The Balkan terrane subdivided to West Balkan Mts and Kraishte region.                                                                                                      |
Table 1. Continued.

| Reference(s) | Position and description of the SMU | Notes |
|---------------|------------------------------------|-------|
| Ćiroć, 1996  | Serbian Median Mass (Srpško medugorje) |       |
| Grubić et al., 1999 | Moravicum (Moravikum) and Jastrebićum (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-terranes (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-terranes | The SMU (within Carpatho-Balkanides) contains: EVS, LC SMU and “Vlasina Unit” (syn. “Vlasina Complex”) |
| Antić et al., 2017 | The ‘Eastern Veles Series’ incorporated to the SMU | Accepted that LC SMU and Supragetic basement could two different entities |
| Spahić & Gaudenzi, 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 |
| Abbio 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 poly-cyclic Ograzhdan complex in a SW Bulgarian part of the “Serbian Macedonian Mass”. Later in 1996 (ZAGORCHEV, 1996) gives more details about the Ograzhdan 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 HIMMERKUSETAL., 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 Massif” 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-tectonică 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 Alpis, 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.
**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 Spačić 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 lower-grade metamorphic complex ("Upper Complex") and the medium- to high-grade metamorphic complex (LC SMU);

2. The 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 Andelković (1982);

3. Milestone of the Alpine concept in the Southern Carpathians portrayed the SMU as a segment of the Getic/Supragetic Unit (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

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

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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 Suprageric), 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 “terrane” –
“Major tectonic units” (Schmid et al., 2008). Ac-
cordingly, to the Alpine basement “terrane” (Su-
pragetic 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 Kistić et al., 2005; position on Fig. 1b): VČM, "Vrška Čuka – Miroč" (Lower Danubian), SPP, “Stara Planina - Poreč” (Upper Danubian), KU, “Kućaj” (Getic), RV, “Ranovac – Vlasina” (Supragetic), LU, “Lužnica Unit” (West Kraštije), 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 Milujojević, 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.](image-url)
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; Krawtner & Krstić, 2002; Balintoni et al., 2010, 2012, 2014; Antić et al., 2016b, 2017; Zagorchev, 2015 and references therein; Kydonakis et al., 2016; Iancu & Segedi, 2017; Spahić & Gaudenzi, 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 (Milojević, 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 Mesoozoic suture referred to as the (East) Vardar Zone (Spahić & Gaudenzi, 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 (Erać et al., 2016; Spahić & Gaudenzi, 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; Erać 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 Miniš 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 (Deleón et al., 1972) of late Cadomian paleocontinental inheritance (Antić et al., 2016b). The western segment of the LCSMU 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; Andelković, 1982; Dimitrijević, 1995, 1997; Spahić, 2006; Marović et al., 2007; Erać et al., 2016).
In the outcrops of Juho–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 granite of magmatic protolith marks the late Cadomian position of the LC SMU, as well as the rocks of Juho–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; MAČEVA et al., 2016) whereas PEYČHEVA 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”; 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 (Zakariaiddze 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 40Ar/39Ar 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 (south-east 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, Sebeș-Lotru terrane and Supragetic basement) another still enigmatic pre-Variscan suture is depicted (Ianču & 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; Murphy 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 Palaeoproterozoic 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 Ograzhdhen 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...
(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; Zagořčev et al., 2012, 2015; Macheva et al., 2016). Such early Paleozoic imprint pattern suggests a more complex “intra-Ordovician” lithospheric-scale episode (see Stepkan 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; cf. 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 (Zagořčev, 2015). The Supragetic basement is an ocean floor assembly of the similar age (Antić et al., 2016b; Spašić 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 Gondwana – 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-for-
profit sectors. The paper benefited from the constructive review of Prof. Dr Ivan Zagorchev from Bulgarian Academy of Sciences.

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Резиме

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

Након 60 година од када је Dimtrijević (1959) укао 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 новоизвојене „Српско-македонске масе“ („ Доњи комплекс“ и „Горњи комплекс“/Супраге тик/„Власински комплекс“). Овај кристални блок (Српско-македонска јединица) неопро теро зој ско 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 кристаласта теран некада био део варијације 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., ALEKić et al., 1988; CARMINAT et al., 2004; HIMMErKUS et al., 2009; MEINHOLD et al., 2010; Antić et al., 2016b; ABBo et al., 2020).

Поред обновљеног интереса за ову кри сталасту јединицу, бројне недоумице (e.g., GruBić et al., 1999; GerDijkov 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 кристаласта блок некадашње европске маргине (геотектонска јединица првог реда), или припада пакету кредно палеогеографских навлака које се карактеришу источном вергенцијом 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 одривојурацког термалног оверпринта (472–456 Ma, нумерички подаци старости од Antić et al., 2016a,b; „Себеш-Лотру теран“, ca. 460 Ma; BA_LIMITONI 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-геолошког 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-Варис-цијског литосферног догађаја највероватније ордовцијумске старости. Искључиво када се буде утврдио директан оригиналан однос између Српско-македонске јединице и упрагетика биће омогућено решавање проблема како ва-рисцијске конфигурације тако алпске и корела-ције ових бејсментских јединица.

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