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Jurassic tectonics of Bulgaria and the adjacent areas

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Резюме. На територията на България 3 композитни терейна (на Мизийската платформа, на Тракийския масив и Балканския терейн), съставни части на Гондвана, са присъединени през късния Карбон към Източноевропейската платформа. Тук се проследява тяхната юрска еволюция. Няколко блока, хорстове и грабени, са изграждали Мизийската платформа. Юрската трансгресия е започнала през късния хетанжки подвек върху повечето от най-понижените части на грабените, където са се отложили континентални и континентални—морски глини и пясъчници, следвани от морски пясъчници и биокластични варовици. През средната юра там са се отложили черни шисти. Върху хорстовете седиментацията започва със средноюрски пясъчници и конгломерати. Юрската дисперсия на тези терейни стартира през ранната юра с образуването на Балканския терейн, разположен между терейна на Мизийската платформа и този на Тракийския масив. Балканският терейн е поделен в надлъжна посока на три единици: най-източна — Маторидния рифтов басейн, в Централна и Западна България — Издремецкия грабен и в Северозападна България — единицата Крайна. В Маторидния басейн е съществувала горнотриаско-долноюрска силицикластична флишки тип седиментация, следваща над карбонатна флишка седиментация. На юг от този басейн е бил разположен шелфът на Екзотичния хребет Златарски, върху който се е осъществявала теригенно-варовита седиментация. През ааленския век, в условията на конвергенция, започва процес на свиване — в басейна е започнало отлагането на „див флиш“ — черни шисти с големи олистолити, произхождащи от разрушаването на хребета Златарски. В края на ранния (?) каловски подвек започва колизия между терейна на Тракийския масив (между неговата единица „Екзотичен хребет Златарски“) и терейна на Мизийската платформа, когато Маторският трог е бил изцяло унищожен. В резултат на това е формиран Заберновският навлак в Странджа и един голям десен отсед, по дължината на който е била разместена зоната Тулча в Северна Добруджа („вмъкната“ като акреационна зона между Скитската и Мизийската платформа). Между хребета Златарски и сушата на Тракийския масив и на Средногорския метаморфен блок през ранната и средната юра е съществувала Тунджанската диагонална зона, запълнена през ранната юра от пясъчници и песъчливи варовици, а през средната юра — от черни шисти, заместващи се на запад от варовити пясъчници и песъчливи варовици. В северозападна посока терейнът на Тракийския масив е бил поделен на единицата на Сръбско-Македонския масив (без юрска седиментация), единицата Супрагетик-Лужница-Коняво (серия от грабени, в един от които — Светлянския грабен, седиментацията е започнала през ранната юра с плитководни варовици и в другите — само със средноюрски варовици и/или черни шисти) и Буковино-Гетско-Драгоманската единица, където седиментацията започва със средноюрски пясъчници и варовици. През средния каловски подвек, през късната юра и най-ранната ранна креда се е образувала една нова рифтова зона със силицикластична флишка седиментация — форландния Ниш-Троянски басейн (трог) между терейна на Мизийската платформа и този на Тракийския масив и върху западната част на Тракийския масив. По това време върху Буковино-Гетско-Драгоманската единица са се отлагали платформени рифови и субрифови варовици, а върху Мизийската платформа, върху хорстовете — също платформени карбонати, а в грабените — предимно нодулярни варовици (тип ammonitico rosso), както и микритни варовици. През юрския период Балканският терейн е играл ролята на заддъгова депресия, а терейнът на Тракийският масив — на невулканска островно-дъгова система.

Ключови думи: Терейнен анализ, юрска тектоника, България, Балкански полуостров.

Abstract. During the Late Carboniferous 3 composite terranes — the Moesian Platform, the Balkan and the Thracian Massif, parts of the Gondwana, were docked into the East European Platform (on the territory of Bulgaria). Their Jurassic evolution was studied here. Several blocks - grabens and horsts structured the Moesian PlatformTerrane. The transgression was effectuated in Late Hettangian on the more subsided parts of the grabens in which clays and sandstones formed, followed by marine sandstones and biodetritic limestones; during the Middle Jurassic were sedimented black shales. On the horsts the sedimentation began with Mid Jurassic sandstones and conglomerates. The Jurassic dispersion of these terranes started during the Early Jurassic with the formation of the Balkan Terrane, situated between the Moesian Platform Terrane and the Thracian Massif Terrane. It is subdivided in longitudinal direction in three units: the Matoride Rifted Basin (to the East), the Izdremets Graben (to the West, in Central and Western Stara planina Mts.) and the Krayna Unit (in North-West Bulgaria). In the Matoride Basin existed a siliciclastic flysch type sedimentation and to south was situated a shelf with terrigenous-calcareous sedimentation — the Zlatarski Exotic Ridge. In conditions of convergence, during the Aalenian, debuted a processes of shortening — in the basin was deposited "wild flysch" — black shales with big olistolithes coming from the destruction of the Zlatarski Ridge. During the Early Callovian (?) started a collision between the Thracian Massif Terrane (its Zlatarski Exotic Ridge Unit) and the Moesian Platform Terrane, when the trough of the Matoride was completely destroied. In result of this were formed the Nappe of Zabernovo (Strandzha Mts.) and a big dextral strike-slip fault, along which was displaced the Zone of Tulcea in the North Dobrogea (“introduced” as an accretion zone between the Scytia and Moesia). Between the Zlatarski Ridge and the dry land of the Rhodope and Sredna Gora metamorphic block during the Early and the Middle Jurassic existed the Tundzha Diagonal Zone fulfilled during the Early Jurassic by sandstones and sandy limestones and during the Middle Jurassic — by black shales, substituted to west by calcareous sandstones and sandy limestones. To northwestern direction the Thracian Massif Terrane was subdivided into Serbo—Macedonian Massif Unit (without Jurassic sedimentation), Supra-Getic-Lužnica-Koniavo Unit (series of grabens in one of which - with Lower Jurassic shallow water limestones and in others — only with Middle Jurassic limestones and/or black shales), and Bucovino-Getic-Dragoman Unit, where the deposition began with Middle Jurassic sandstones and limestones. During the Late Callovian - Late Jurassic - earliest Early Cretaceous was formed a new rift zone with siliciclastic flysch type sediments — the Nish-Troyan Foreland Trough (Basin) between the Moesian Platform Terrane and the Thracian Massif Terrane and on the west part of the Thracian Massif Terrane. In this time on the Bucovino-Getic-Dragoman Unit were deposited reef and subreef limestones, and on the Moesian Platform — on the horsts - platform carbonates and in the grabens — predominantly nodular (“*ammonitico rosso*”) and micritic limestones. During the Jurassic the Balkan Terrane played the role of a back arc depression, and the Thracian Massif Terrane — of an avolcanic island arc system.

Key words: Terrane analysis, Jurassic tectonic, Bulgaria, Balkan Peninsula.

Introduction

The Jurassic tectonic structures of Bulgaria were discussed during the last years in few publications. They concerned different parts of our country: in the SW — Sapunov et al. (1983), Dodekova et al. (1984); the NW — Sapunov et al. (1988); the Central — Sapunov et al. (1991) and the eastern parts — Sapunov and Tchoumatchenco (1987). Tchoumatchenco and Cernjavska (1990), Tchoumatchenco et al. (1992), Georgiev et al. (2001) discussed the Early-Middle Jurassic development of the region of east Stara Planina Mountains. Tchoumatchenco et al. (1989) and Tchoumatchenco and Sapunov (1994) discuss a general view on the Jurassic tectonic of Bulgaria.

The understanding of the Jurassic history of Bulgaria continues to evolve as new data and ideas are applied. Recently the terrane analysis of Howell (1989) is applied to the geologic evolution of the Balkan Peninsula. I agree with the Variscan model (with some differences in the interpretations in its Jurassic evolution) given by Haydutov et al. (1996—97) (Fig. 1) and Yanev (2000) (Fig. 2). After this model three big and composite terranes were broken-up from the Gondwana — Moesian Platform Terrane, Balkan Terrane and Thracian Massif Terrane, and were accreated to the Eastern European Platform. The docking took place in the Late Carboniferous time. Kraűtner (1996—97) and Karamata et al. (1996—97) described their results on the territory of Romania and Serbia. Some new correlations, on the base of the terrane analysis, are made by Tchoumatchenco (2002).

Nikolov and Tzankov (1997) made a summary on the Bulgarian Early Cretaceous basin in the Thethys panorama and Yanev (2000) demonstrated his view of the terranes in the Balkan.

Nachev is the first to write about the neomobilism and the paleogeodynamic of Bulgaria during the Jurassic — Nachev (1980, Figs. 1, 3—9; 1991, Fig. 1, etc.) and Nachev and Nachev (2003, Fig. 9).

The new data confirm the notions of Petković (1930), Jaranoff (1960), etc. about the transition be-

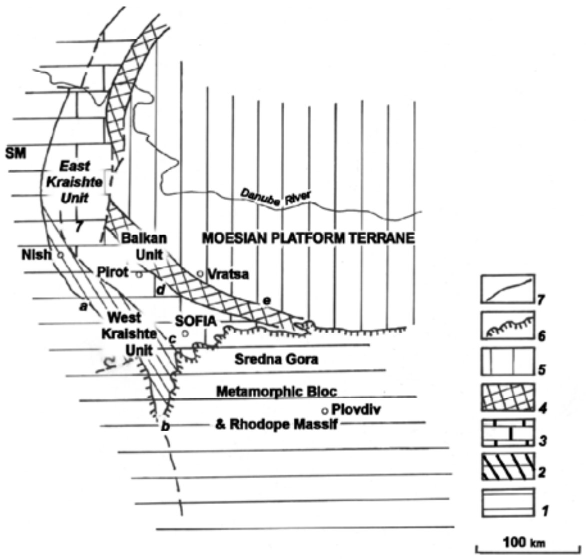

Fig. 1. Sketch map of the Variscan Terranes (after Haydutov et al., 1996-97) (simplified and completed by data from the text of Haydutov et al. 1996-97)
1, *Thracian Massif Terrane* (SM, Serbo-Macedonian massif block, Rh, Rhodope massif and Sredna Gora Metamorphic Blocks); *Balkan Terrane*: *2,* West Kraishte (Elovitza) Unit; *3,* East Kraishte Unit; *4,* Balkan Unit; *5, Moesian Platform Terrane*; *6,* Thracian Suture; *7,* Major Faults (the names of the faults are after Bončev, 1961, 1986): a, Penkiovtsi (Gorochevtsi-Bunovo) Fault, b, Struma Fault, c, Ozren-Trun (Trun-Kosharevo) Fault, d, Sub-Balkan Fault (Vidlič Dislocation), e, Balkanide Front Line (Fore-Balkan Fault, Stara Planina Frontal Strip)

Фиг. 1. Схематична карта на Варисцийските терейни (по Haydutov et al., 1996-97) (опростена и допълнена с данни от техния текст)
1 — терейн на Тракийския масив (SM — блок на Сърбо-Македонския масив, Rh — Родопски масив, Средногорски метаморфен блок); *Балкански терейн*: *2 —* единица на Западното Крайще (Еловица); *3 —* единица на Източното Крайще; *4 —* Балканска единица; *5 — терейн на Мизийската платформа*; *6 —* Тракийска сутура; *7 —* големи разломи (имената са по Bončev, 1961, 1986): a — Пеньковски (Горочевско-Буновски) разлом, b — Струмски разлом, c — Озрен-Трънски (Трънско-Кошаревски) разлом, d — Задбалкански разлом (Видличка дислокация), e — Балканидна челна линия (Предбалкански разлом, Старопланинска челна линия)

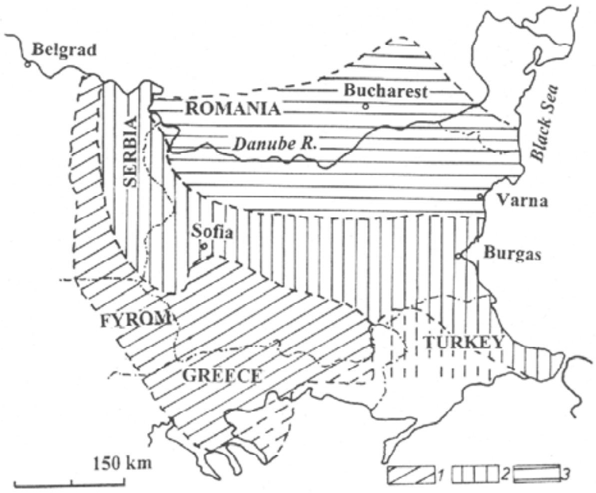

Fig. 2. The terranes in the pre-Alpine basement (after Yanev, 2000 in Nachev, Nachev, 2003)
1, Thracian Terrane; 2, Balkan Terrane; 3, Moesian Terrane

Фиг. 2. Терейните в доалпийския фундамент (по Yanev, 2000 in Nachev, Nachev, 2003)
1 — Тракийски терейн; 2 — Балкански терейн; 3 — Мизийски терейн

tween the South Carpathians and the Belogradchik anticline of the Balkanids.

Dabovski et al. (2002) summarized their opinions on the structure and Alpine evolution of Bulgaria.

A very special tectonic problem in the geology of Bulgaria is the notion of the existence on the territory of Bulgaria of the "South Carpathians". This problem arise since the publications of Bončev (1938, etc.). It was treated also in other Bulgarian publications (Bončev, 1962, 1971, etc.; Tzankov, 1961, etc.; Dabovski et al., 2002; Nachev, Nachev, 2003, etc.). For many Romanian geologists (e.g. Sandulescu, 1980, etc.; Kraűtner, 1996-97; Mutihac, 1990, etc.) as well for the Serbian geologists (Petković, Andjelković, 1960; Grubić, 1980; Dimitrijević, 1992; Andjelković et al., 1996; Kraűtner, Krstić, 2003, etc.), the South Carpathians represent a mountain system. This system crosses the Danube River and continues in east Serbia and western Bulgaria, and all big tectonic units as Supra-Getic, Bucovino-Getic, Sub (Infra) Getic, Danubian continue from Banat in east Serbia. Different is the opinion of the Bulgarian tectonicians. In many publications Bončev (e.g. 1971, p. 201) developed the opinion that the "South-Carpathians" is a special system to which "we include only the Danubicum of the Romanian geologists, i.e. the massifs of Almash, Mehedintsi, Godeianu, etc. and to which belong "this part of Banat, which lies to east of the line Rudaria ("Getic line"). To south of Danube the South Carpathians embrace Leskovać Mts., Poreč, Miroč, Veliki Greben, Deli Iovan, as well as Krayna in our (Bulgarian — P. T.) territory" in the region of the town of Koula. The rest of the Banat belongs to the Kraishtids. This treatment is traditional for the Bulgarian tectonicians — Tzankov (1961, etc.), Dabovski et al. (2002), Nachev and Nachev (2003). For them to the South Carpathians belong only the Upper Tithonian-Berriasian (or only Berriasian) flysch type sediments which crop out to west of the town of Koula. This manner of treatment coincides more or less with the allochtonous sediments of the Sub-Getic or Severin nappes in Romania — Mutihac (1990, etc.) or the Infra-Getic in Serbia — Grubić (1980), Dimitrijević (1992), etc., or Krajinikum — Andjelković et al. (1996).

In a letter (January 13, 2003) from Belgrade the Academician S. Karamata wrote: "The problem of "pre-Variscan terranes" posed by Tchoumatchenco is justified — after the Carboniferous these units can not be considered as terranes any more, only, since by all Post-Variscan tectonics their boundaries were activated, they represented during all later tectonic processes, even before the large overthrusting in Tertiary, blocks or units with boundaries similar as of the former terranes. Therefore they were by Karamata and Krstić (1996—97) treated (erroneously?) as terranes in continuation. Similar terminological problem arises when the Moesian and Thracian blocks/units/masses, and, especially, the Balkan graben/trench are considered as terranes. It is a question if those units, blocks or masses/massif were transported by oceanic crust or moved as blocks with deep roots and rift-zones in between?".

Bulgarian Jurassic tectonic units and their correlations

In the present paper is described the Jurassic stage of evolution of the 3 tectono-stratigraphic terranes of Haydutov et al. (1996—97): Moesian Platform Terrane, Balkan Terrane and Thracian Massif Terrane, their Jurassic subdivisions, and the new created during the Jurassic Nish-Troyan Foreland Basin (Trough).

Moesian Platform Terrane during the Jurassic (Figs. 3-6)

1. Definition. The Moesian Platform Terrane is considered here as heir of the Variscan Moesian Platform Terrane (sensu Yanev and Gochev, in Haydutov et al, 1996—97) and the Jurassic is only a stage of the evolution of this structure. In the description of the units of the Moesian Platform Terrane here are used the name of the unit, which is given for the first time to its older development (in geologic sense): for example here is used the name of the Pleven Horst (as unit) for the zone to east of the present day town of Pleven, which during the Early and the Middle Jurassic represented dry land, and after the Callovian became area of shallow water carbonate platform sedimentation. To the Callovian-Late Jurassic time interval of the evolution of this structure Sapunov and Tchoumatchenco (1987), Sapunov et al. (1988,

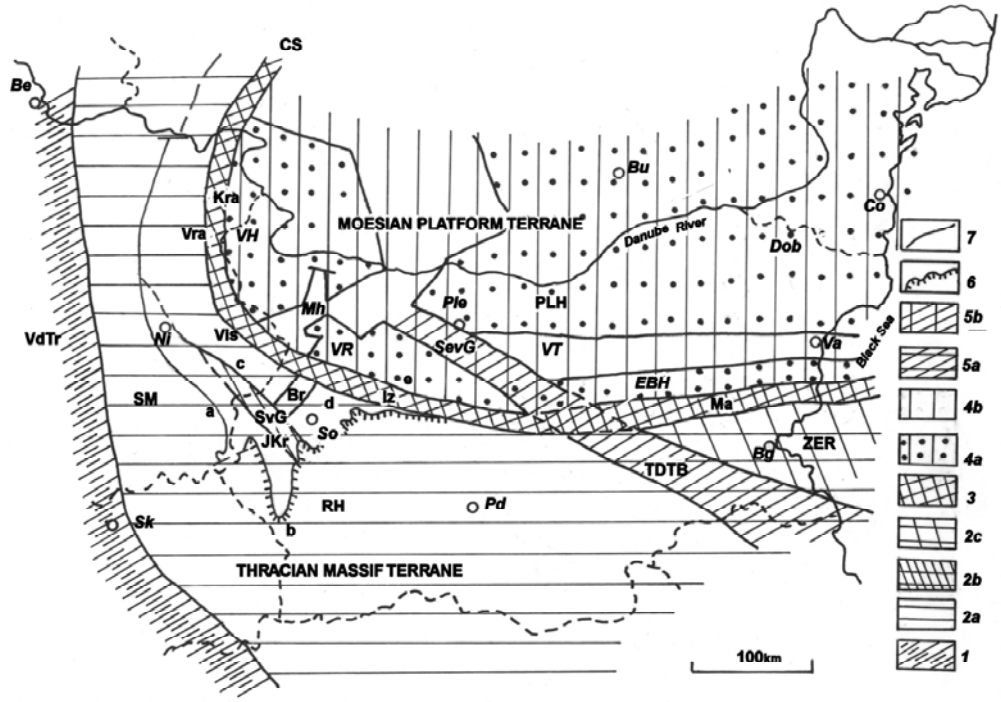

Fig. 3. Tectonics during the Early Jurassic

1, Vardar-Transilvanium Terrane (VdTr); *2a, Thracian Massif Terrane*: SM, Serbo-Macedonian, RH, Rhodope Massif Block, *2b*, Lužnica-Koniavo Unit (JKr): SvG, Svetlya Graben; Br, Breznik Graben, *2c*, Zlatarski Exotic Ridge (ZER); *3*, *Balkan Terrane*: CS, Civcin-Severin "Terrane", Kra, Krajna Zone (Krajnikum), Vra, "Vratarnicka Seria", Iz, Izdremets Graben Unit, Ma, Matoride Rifted Basin Unit; *Moesian Platform Terrane*: *4a,* Horst: VH, Vidin Horst Unit, PLH, Pleven Horst Unit, Dob, Dobrogea Horst Unit, VR, Vratsa Horst Unit, EBH, East Balkan Horst Unit, *4b,* Grabens: Mh, Mihaylovgrad Graben Unit, VT, Veliko Tarnovo Graben Unit; Tundzha-Sevlievo Diagonal Basin: *5a*, Tundzha Diagonal Tilted Basin (TDTB), *5b,* Sevlievo Graben Unit (SevG); *6,* Thracian Suture (sensu Haydutov, 1987); *7,* Major Faults (the names of the faults are after Bončev, 1961, 1986): a, Penkiovtsi (Gorochevtsi-Bunovo) Fault, b, Struma Fault, c, Ozren-Trun (Trun-Kosharevo) Fault, d, satellites of Sub-Balkan Fault (Vidlič Dislocation), e, Balkanide Front Line (Fore-Balkan Fault, Stara Planina frontal strip).
Be — Belgrad; *Bu* — Bucarest; *Bg* — Burgas; *Co* — Costanta; *Pd* — Plovdiv; *Ple* — Pleven; *Sk* — Skopie; *So* — Sofia; *Ni* – Nish; *Va* — Varna

Фиг. 3. Тектониката през ранната юра

1 — Вардарско-Трансилвански терейн (VdTr); *2a — терейн на Тракийския масив*: SM — Сърбо-Македонски масив, RH — блок на Родопския масив, *2b* — Лужничко-Конявски блок (JKr): SvG — Светленски грабен, Br — Брезнишки грабен, *2c* — Екзотичния хребет Златарски (ZER); *3 — Балкански терейн*: CS — Чивчинско-Северински „терейн", Kra — Крайненска зона (Крайникум), Vra — „Вратарничка серия", Iz — единица на Издремецкия грабен, Ma — единица на Маторския рифтов басейн; *терейн на Мизийската платформа: 4a* — Хорстове: VH — единица на Видинския хорст, PLH — единица на Плевенския хорст, Dob — единица на Добруджанския хорст, VR — единица на Врачанския хорст, EBH — единица на Източно-Балкански хорст, *4b* — Грабени: Mh — единица на Михайловградския грабен, VT — единица на Великотърновския грабен; Тунджанско-Севлиевски диагонален басейн: *5a* — Тунджански диагонален басейн (TDTB), *5b* — единица на Севлиевския грабен (SevG); *6* — Тракийска сутура (по Haydutov, 1987); *7* — големи разломи (имената на тези разломи са по Bončev, 1961, 1986): a — Пенкьовски (Горочевско-Буновски) разлом, b — Струмски разлом, c — Озрен-Трънски (Трънско-Кошаревски) разлом, d — сателити на Задбалканския разлом (Видличка дислокация), e — Балканидна челна линия (Предбалкански разлом, Старопланинска челна линия)
Be — Белград; *Bu* — Букурещ; *Bg* — Бургас; *Co* — Кюстенджа; *Pd* — Пловдив; *Ple* — Плевен; *Sk* — Скопие; *So* — София; *Ni* — Ниш; *Va* — Варна

1991), Tchoumatchenco and Sapunov (1994) adopted the name of East-Moesian Carbonate Platform, introduced by Patrulius et al. (1976). The logic here is to conserve the name for one structure with which it "appeared" for the first time in the description of the geologic evolution, and to study it during the whole its development, nevertheless that in earlier publications, describing latter stage of its development Sapunov and Tchoumatchenco (1994) introduced for it another name.

Nikolov and Tzankov (1997) used for the Moesian platform the name of "Moesian Microplate".

After Yanev and Gochev (in Haydutov et al., 1996-97) the Variscan Moesian Platform Terrane was composed "by several structural units comprising the Fore-Dobrogea unit, the Central Moesian unit and the Fore Balkan unit", which composed the Moesian Plate, i.e. during the docking in the Late Carboniferous these terranes were independent and only after the docking they begun a common evolution.

In the latest Late Triassic and the earliest Early Hettangian, after the manifestation of the Early Cimmerian movements, the whole territory of the Moesian Platform Terrane represented a dry land and one tectonic unit, an integral part of the East European Platform. During the latest part of the Early Hettangian different fragments of the Moesian Platform Terrane started their geologic evolution as different tectonic units on the background of the big Moesian Platform Terrane.

2. Terrane boundaries. The Mesozoic geologic history of the Moesian Platform Terrane started with the formation of the Matoride Rifted Basin in Eastern Stara Planina Mountains and the prolongation of this structure to West and Northwest — the Izdremets Graben, considered here as integral parts of the Balkan Terrane (the Severin-Krajina-Izdremets-Mator — Nalbant-South Crimea-Great Caucasus belt). The southern and western boundary represented by the Stara Planina frontal strip (=Balkanide front line of Bončev, 1961; 1986, etc.).

Its easthern boundary is represented by Peceneaga-Camena fault in North Dobrogea — southern prolongation of the Tornquist-Teyesser Line, which separated the Moesian Platform Terrane from the Scythian Platform.

3. Stratigraphy and geologic evolution. Yanev and Gochev (in Haydutov et al., 1996—97, p. 486) subdivided the Moesia in three parts. the boundaries between them, due to scarce data, cannot be strictly shown: the Fore-Dobrodgea Unit (probably more or less coinciding with the Jurassic Dobrogea and Pleven Horst of Sapunov, Tchoumatchenco, 1987), the Central Moesian Unit (probably coinciding more or less with Sevlievo Graben (during the Late Jurassic called by Sapunov et al., 1988 Central Moesian Basin), and the Fore Balkan Unit (which probably partly coincided with the series of horsts along the Western and Southern boundary of Moesia).

During the Early Jurassic (Fig. 3) on the Moesian Platform Terrane existed few big positive (horsts) and negative (grabens) structures (Sapunov et al., 1988, 1991, etc.), which here are considered as units. On the positive structures there was not practically sedimentation. On the western and the southern border area of the Moesian Platform Terrane, from west to east they are: Vidin Horst Unit, Vratsa Horst Unit, East Balkan Horst Unit (they represented probably the so called Danubicum in the Jurassic of the Romanian geologists — Patrulius, 1972; Sandulescu, 1984; Mutihac, 1990; Avram et al., 1995—96; Kraűtner, Krstić, 2003). The Pleven Horst Unit occupied the central part of the Moesian Platform Terrane and was related in that time to east with the Dobrogea Horst Unit. On the periphery of the Vratsa Horst Unit existed only sedimentation of sands (Kostina Formation) and bioclastic and/or sandy limestones (homogenous parts of the Ozirovo Formation), thick from 0,45 m up to 70 m and near the Vola Pick of the Vratsa Mountain — without sedimentation. In the Mihaylovgrad Graben Unit (with NE direction) the Liassic sediments consist of continental and marine sandstones and clays (Bachiishte Formation), marine sandstones (Kostina Formation), and the divided into two members Ozirovo Formation — bioclastic limestones (Dolnolukovit Member) and marls (Bukorovsti Member) separating the Vidin Horst Unit from the Vratsa Horst Units. The Liassic sediments are thick up to 160—200 m. The same sediments, thick up to 775 m fulfilled the Sevlievo Graben Unit with NW direction. It is situated between the Vratsa and the Pleven Horst Units. Probably the Sevlievo Graben Unit was formed along the boundary of Paleozoic fragments of the Moesian Platform. Here it is considered as prolongation of the Tundzha Tilted Basin (developed on the Thracian Massif Terrane in SE Bulgaria) and formed two parts of one big negative structure — the Sevlievo-Tundzha Basin. The East Balkan and the Pleven Horst Units are separated by a negative structure — the Veliko Tarnovo Graben Unit, in which the Liassic rocks are represented by the same sediments as in the Sevlievo Graben Unit, thick up to 223 m.

In the beginning of the Middle Jurassic times the Pleven Horst Unit was cross by a new NW-SE graben — the Razgrad Graben and divided in two new positive structures — the Pleven (s. str.) and the Dobrogea Horst Subunits. In this times the marine ingression occupied the last grabens and progressively begun to cover the horsts. The marine transgression was locally preceded by a continental accumulation of short duration. Shallow water terrigenous, clastic and pelitic sediments, and in more restricted quantity terrigenous-carbonate deposition took place in the basin. In the negative forms, during the Middle Jurassic were deposited pelitic and clastic sediments ("black shales with *Bositra alpina*" type) and in limited quantity — terrigenous-carbonate sediments in relatively deeper conditions. The Middle Jurassic sediments, which were deposited on the horsts, are represented predominantly by clastic and to a lesser degree by pelitic as well as by terrigenous-carbonate sediments.

The thickness of the Middle Jurassic rocks varies in large limits — from few centimeters in the positive regions, where the Jurassic succession began with the Upper Callovian sediments up to few hundred meters in certain parts of the Sevlievo and Mihajlovgrad Graben Units. The zone with maximum thickness is situated in the axial area of the Sevlievo Graben Unit, where it reaches up to 800—1095 m.

During the Callovian a fundamental reconstruction in the tectonic structures of the Moesian Platform Terrane (and in Bulgaria) took place. After the closure of the eastern part of the Balkan Terrane — the Matoride Rifted Basin and the eastern part of the Izdremets Graben, a new fundamental structure appears on the background of the East Balkan Horst Unit — the Nish-Troyan Foreland Basin (Trough). The Pleven, Vidin and Vratsa Horst Units were completely covert by the expansions of the sea and became the place of shallow water carbonate sedimentation. Patrulius et al. (1976), Sapunov and Tchoumatchenco (in Lefeld et al., 1986, Fig. 2) called, for this temporary interval, the Pleven Horst Unit with the name of East Moesian Platform. They considered the Vratsa and the Vidin Horsts as parts of the West Carbonate Platform of Patrulius et al. (1976), united with the Dragoman Horst in one structure. In that time Sapunov and Tchoumatchenco did not knew that between the Vratsa Horst and the Dragoman Horst existed in Serbian territory the prolongation of the Izdremets Graben, which is direct prolongation of the Severin Rift, coming from the East and South Carpathians. Here I consider, that during Callovian and the Late Jurassic, the Vratsa and the Vidin Horsts continued their evolution from the Middle Jurassic times as separated structures. The continuation during Callovian of the two grabens — the Sevlievo and Mihaylovgrad Grabens Units were united by Tchoumatchenco and Sapunov (1994) in one new structure — the Central Moesian Basin (after Patrulius et al., 1976). These two structures are considered here as continuation in the Callovian-Late Jurassic times of the existence of the Sevlievo and Mihaylovgrad Graben Units, only enlarged. Its Tertiary prolongation is known in NW Bulgaria as Lom Depression (Bokov, 1989).

The thicknesses of the Upper Callovian-Upper Jurassic vary in large limits. On the Pleven Horst Unit two zones with maximum thicknesses oriented east-westward existed. The first one is situated south of the town of Pleven, and the maximum thickness reach-

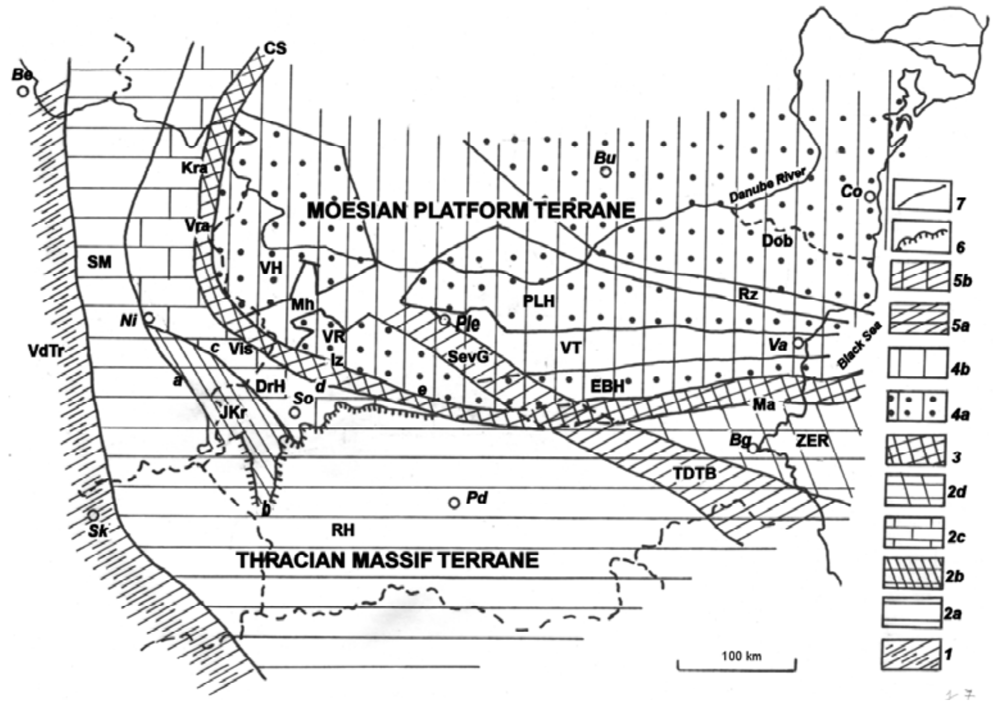

Fig. 4. Tectonics during the Bajocian

1, Vardar-Transilvanium Terrane (VdTr); *2a, Thracian Massif Terrane*: SM, Serbo-Macedonian, RH, Rhodope Massif, *2b,* Lužnica-Koniavo Unit (JKr), *2c,* Bucovino-Getic-Dragoman Unit: DrH, Dragoman Horsts, *2d,* Zlatarski Exotic Ridge (ZER); *3, Balkan Terrane*: CS, Civcin-Severin "Terrane", Kra, Krajna Zone (Krajnikum), Vra, "Vratarnicka Seria", Iz, Izdremets Graben Unit, Ma, Matoride Rifted Basin Unit; *Moesian Platform Terrane*: *4a,* Horsts: VH, Vidin Horst Unit, PLH, Pleven Horst Unit, Dob, Dobrogea Horst Unit ,VR, Vratsa Horst Unit; EBH, East Balkan Horst Unit, *4b,* Grabens: Mh, Mihaylovgrad Graben Unit, VT, Veliko Tarnovo Graben Unit, Rz, Razgrad Graben Unit; Tundzha-Sevlievo Diagonal Basin: *5a,* Tundzha Diagonal Tilted Basin Unit (TDTB), *5b,* Sevlievo Graben Unit (SevG); *6,* Thracian Suture (sensu Haydutov, 1987); *7,* Major Faults (the names of the faults are after Bončev, 1961, 1986): a, Penkiovtsi (Gorochevtsi-Bunovo) Fault, b, Struma Fault, c, Ozren-Trun (Trun-Kosharevo) Fault, d, satellites of Sub-Balkan Fault (Vidlии Dislocation), e, Balkanide Front Line (Fore-Balkan Fault, Stara Planina frontal strip)

Be — Belgrad; *Bu* — Bucarest; *Bg* — Burgas; *Co* — Costanta; *Pd* — Plovdiv; *Ple* — Pleven; *Sk* — Skopie; *So* — Sofia; *Ni* — Nish; *Va* — Varna

Фиг. 4. Тектониката през байоския век

1 — Вардарско-Трансилвански терейн (VdTr); *2a — терейн на Тракийския масив*: SM — Сърбо-Македонски масив, RH — блок на Родопския масив, *2b* — Лужничко-Конявска единица (JKr), *2c* — Буковино-Гетско-Драгоманска единица, *2d* — Екзотичния хребет Златарски (ZER); *3 — Балкански терейн*: CS — Чивчинско-Северински „терейн", Kra — Крайненска зона (Крайникум), Vra — „Вратарничка серия", Iz — единица на Издремецкия грабен, Ma — единица на Маторидния рифтов басейн; *терейн на Мизийската платформа: 4a* — Хорстове: VH — Видински хорст, PLH — единица на Плевенския хорст, Dob — единица на Добруджанския хорст, VR — единица на Врачанския хорст, EBH — единица на Източно-Балкански хорст, *4b* — Грабени: Mh — единица на Михайловградския грабен, VT — единица на Великотърновския грабен, Rz — Разградски грабен; Тунджанско-Севлиевски диагонален басейн: *5a* — Тунджански диагонален басейн (TDTB), *5b* — единица на Севлиевския грабен (SevG); *6* — Тракийска сутура (по Haydutov, 1987); *7* — големи разломи (имената на тези разломи са по Bončev, 1961, 1986): a — Пенкьовски (Горочевско-Буновски) разлом, b — Струмски разлом, c — Озрен-Трънски (Трънско-Кошаревски) разлом, d — сателити на Задбалканския разлом (Видлича дислокация), e — Балканидна челна линия (Предбалкански разлом, Старопланинска челна линия)
Be — Белград; *Bu* — Букурещ; *Bg* — Бургас; *Co* — Кюстенджа; *Pd* — Пловдив; *Ple* — Плевен; *Sk* — Скопие; *So* — София; *Ni* — Ниш; *Va* — Варна

es up to 459 m. The next one is situated between the town of Ruse and the southern edge of the Pleven Horst Unit, where the thickness is 320 m. The two thickness maxima are delimitated from the inner areas of the platform, as well as from its southern edge with zones of decreasing thicknesses. The thinner carbonates in the southern edge of the horst were probably formed in conditions of barrier reefs and the zones with maximum thicknesses correspond to narrow, elongated in east-west direction lagoons. In the north and northeast direction another decreasing of the thickness of the carbonates is recorded, being probably connected with the slow but uninterrupted up warding of the Pleven Horst in this direction. The transitional shelf zone between the Pleven Horst Unit and the Nish-Troyan Trough is relatively narrow with a fast increasing of the value of the thicknesses in southern direction. The transitional zone is irregular with few centers of decreasing thicknesses.

In the Vidin and Vratsa Horst Units the zones with maximum thicknesses also correspond to lagoons, which are similarly delimited from the basins by zones of coral buildups. The maximum thicknesses for them are up to 400—500 m.

In the Sevlievo Graben and the zone of its connection with the prolongation of the Mihaylovgrad Graben, the maximum thicknesses of the sediments (pelagic nodular and micritic limestones), are aligned in its axial area, where the average values are from 300 m up to 750 m in the transitional zone with the Nish-Troyan Foreland Basin (Trough). These three big structures continue and to north from the Danube River.

I share the opinion of Mutihac (1990) that the Danubian in horizontal direction passes to the Moesian Platform (*ergo* represents integral part of the Moesian Terrane), separated from the Thracian Massive Terrane by the Balkan Terrane.

4. Possible correlation with neighboring regions. The Bulgarian parts of the Moesian Platform Terrane continue directly to north of Danube River and preserve the same tendencies in their Jurassic evolution, expressed by Patrulius (1972), Patrulius et al. (1976), Avram et al. (1995-96).

Balkan Terrane during the Jurassic (Figs. 3-6)

1. Definition. The Balkan Terrane, during the Jurassic, is situated between the Moesian Platform Terrane and the Thracian Massif Terrane. This definition coincides more or less with the definition of Bončev (1971, p. 53) for the Balkanids: "The Balkanids (s.s.) are put in the space between the two paleoconsolidated regions in the eastern part of the Balkan Peninsula: the Thracian Massif and the Moesian Platform". On Bulgarian territory the Balkan Terrane, during the Jurassic, consisted of three units: Matoride Basin Unit — in eastern Stara planina Mts., Izdremets Graben Unit — in central and western Stara planina Mts., and Krayna Unit — in north-western Bulgaria. To NNW it continued across the zone of Krayna and the zone of Severin in the Carpathians. In NW Bulgaria, between Vrška Čuka Mt. and the village of Shishentsi, Nachev and Nachev (2003) documented a transitional passage between the Callovian-Tithonian limestones of the Moesian platform, and the "Berriasian-Barremian mixed flysch". This fact emerges the problem about the boundary between the Balkan Terrane and Moesia — if the boundary between the Tithonian limestones and the Berriasian flysch represents a transition, not related with transgression or tectonic contact between them. In this case the boundary with Moesian platform must not be a boundary of overthrust fault between the Severin nappes and the Moesian platform, but it is a normal boundary within a basin.

To ENE from Bulgaria the Balkan Terrane continues in North Dobrogea, in the Tulcea Zone with the Nalbant flysch, the sandstones of Denistepe Fm. and the black argillites of Zebil Fm., and can be related with the South Crimea (or Gornyi Krim). The North-Dobrogean-South Crimean part is called by Sandulescu and Dumitrescu (2004, p. 6, etc.) North-Dobrogean-South Crimea Cimmerian Aulacogene.

This terrane heirs and is the continuation in that times of the Variscan Balkan Terrane of Haydutov et al. (1996-97). These authors subdivided the Balkan Terrane into three units — West and East Kraishte Units and Balkan (s.str.) Unit. During the Jurassic only the Variscan Balkan Unit (s.str.) can be assigned to the Balkan Terrane. The two others units — West and East Kraishte during the Jurassic have an evolution more closely related to the evolution of the Thracian Massif Terrane, and as parts of this terrane they will be described here. After the docking to the Moesian Platform Terrane in the Late Carboniferous the whole territory of the eastern Balkan Peninsula represented a part of the East European Platform. In the latest Triassic and the earliest Hettangian times, after the Early Cimmerian phase, the area was a dry land, which began to be submerged in the Late Hettangian when started a dispersion and separation from the East European Platform — in the east Serbia and west Bulgaria represented only by grabens formation. That is why the Jurassic represents only a period of the evolution, a stage of the new disruption resulting in further embryonic (initial) dispersion of the Paleozoic Balkan Terrane of Haydutov et al. (1996-97) from the Moesian Platform Terrane. To east of the Teteven region the situation of the Izdremets Graben Unit is complicated, because the Diagonal Sevlievo-Tundzha Basin crosses it. To east, in the present day east Stara Planina Mountains the riftogenesis is accentuated and was accompanied by the formation of the Mator Basin with flysch type Lower-Middle Jurassic sedimentation (Tchoumatchenco, Cernjavska, 1990; Tchoumatchenco et al., 1989; Peybernès et al., 1989, Tchoumatchenco et al., 1992; Tchoumatchenco, Sapunov, 1994; Georgiev et al., 2001).

My opinion is that the Balkan Unit executed the connection in Bulgarian territory between the Carpathians (the Civcin-Severin rift) and the South Crimea-North Caucasians, with a suspected connection, during the Early-Middle Jurassic, between these two big paleotectonic-paleogeographic areas across the Krayna Unit, Izdremets Graben Unit and the Matoride Basin Unit. These three units are united here as parts of the Balkan Terrane during the Jurassic evolution. In this light the proposed by Tchoumatchenco and Sapunov (1994) area of the Jurassic Moesian Platform must be restricted — only to north and to east of the Balkan Terrane.

2. Terrane boundaries. The boundary between the Moesian Platform Terrane and the Balkan terrane is represented by the Stara Planina frontal strip (=Balkanide front line of Bončev, 1961; 1986, etc.) and its prolongation in eastern direction — the Tchudnite Skali Dislocation. Its boundary with the Thracian Massif Terrane is one of the satellite faults of the Sub-Balkan fault (Vidlič Dislocation of Bončev, 1986, etc.) and its satellites faults, coinciding with the faults, which limited the present day Sofia Graben, to north — from the Stara Planina Mountain.

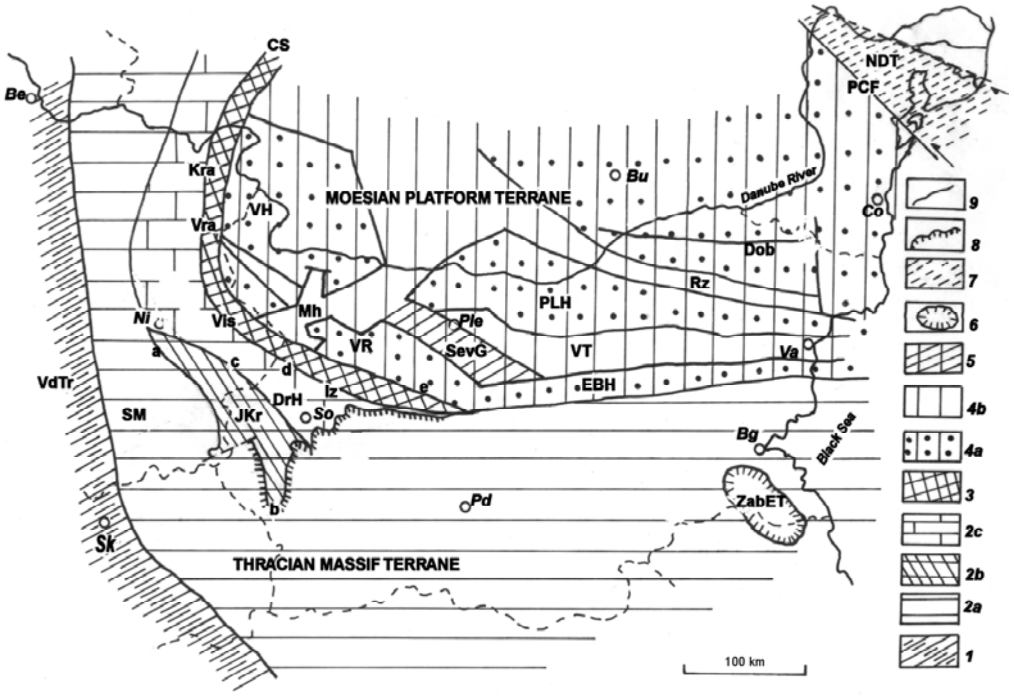

Fig. 5. Tectonics at the end of the Early (?) Callovian

1, Vardar-Transilvanium Terrane (VdTr); *2a*, Thracian Massif Terrane: SM, Serbo-Macedonian, RH, Rhodope Massif, *2b*, Lužnica-Koniavo Unit (JKr), *2c,* Bucovino-Getic-Dragoman Unit: DrH, Dragoman Horst; *3, Balkan Terrane*: CS, Civcin-Severin "Terrane", Kra, Krajna Zone (Krajnikum), Vra, "Vratarnicka Seria", Iz, Izdremets Graben Unit; *Moesian Platform Terrane*: *4a,* Horsts: VH-Vidin Horst Unit, PLH, Pleven Horst Unit, Dob, Dobrogea Horst Unit, VR, Vratsa Horst Unit, EBH, East Balkan Horst Unit, *4b*, Grabens: Mh, Mihaylovgrad Graben Unit, VT, Veliko Tarnovo Graben Unit, Rz, Razgrad Graben Unit; Tundzha-Sevlievo Diagonal Basin: *5,* Sevlievo Graben Unit (SevG); *6,* Zabernovo Exotic Terrane (ZabET); *7, North Dobrogean Terranes*, PCF, Peceneaga-Camena Fault; *8,* Thracian Suture (sensu Haydutov, 1987); *9,* Major Faults (the names of the faults are after Bončev, 1961, 1986): a, Penkiovtsi (Gorochevtsi-Bunovo) Fault; b, Struma Fault, c, Ozren-Trun (Trun-Kosharevo) Fault, d, satellites of Sub-Balkan Fault (Vidlиi Dislocation), e, Balkanide Front Line (Fore-Balkan Fault, Stara Planina frontal strip)

Be — Belgrad; *Bu* — Bucurest; *Bg* — Burgas; *Co* — Costanta; *Pd* — Plovdiv; *Ple* — Pleven; *Sk* — Skopie; *So* — Sofia; *Ni* — Nish; *Va* — Varna

Фиг. 5. Тектониката в края на ранния (?) каловски подвек

1 — Вардарско-Трансилвански терейн (VdTr); *2a* — терейн на Тракийския масив: SM — Сърбо-Македонски масив, RH — блок на Родопския масив, *2b* — Лужничко-Конявска единица (JKr), *2c* — Буковино-Гетско-Драгоманска единица: DrH — Драгомански хорст; *3 — Балкански терейн*: CS — Чивчинско-Северински „терейн", Kra — Крайненска зона (Крайникум), Vra — „Вратарничка серия", Iz — единица на Издремецкия грабен; *терейн на Мизийската платформа: 4a* — Хорстове: VH — Видински хорст, PLH — единица на Плевенския хорст, Dob — единица на Добруджанския хорст, VR — единица на Врачанския хорст, EBH — единица на Източно-Балкански хорст, *4b* — Грабени: Mh — единица на Михайловградския грабен, VT — единица на Великотърновския грабен, Rz — Разградски грабен; Тунджанско-Севлиевски диагонален басейн: *5* — единица на Севлиевския грабен (SevG); *6* — Заберновски екзотичен терейн (ZabET); *7 — Северно-Добруджански терейн*, PCF — разлом Печеняга-Каменна; *8* — Тракийска сутура (по Haydutov, 1987); *9* — големи разломи (имената на тези разломи са по Bončev, 1961, 1986): a — Пенкьовски (Горочевско-Буновски) разлом, b — Струмски разлом, c — Озрен-Трънски (Трънско-Кошаревски) разлом, d — сателити на Задбалканския разлом (Видличка дислокация), e — Балканидна челна линия (Предбалкански разлом, Старопланинска челна линия)

Be — Белград; *Bu* — Букурещ; *Bg* — Бургас; *Co* — Кюстенджа; *Pd* — Пловдив; *Ple* — Плевен; *Sk* — Скопие; *So* — София; *Ni* — Ниш; *Va* — Варна

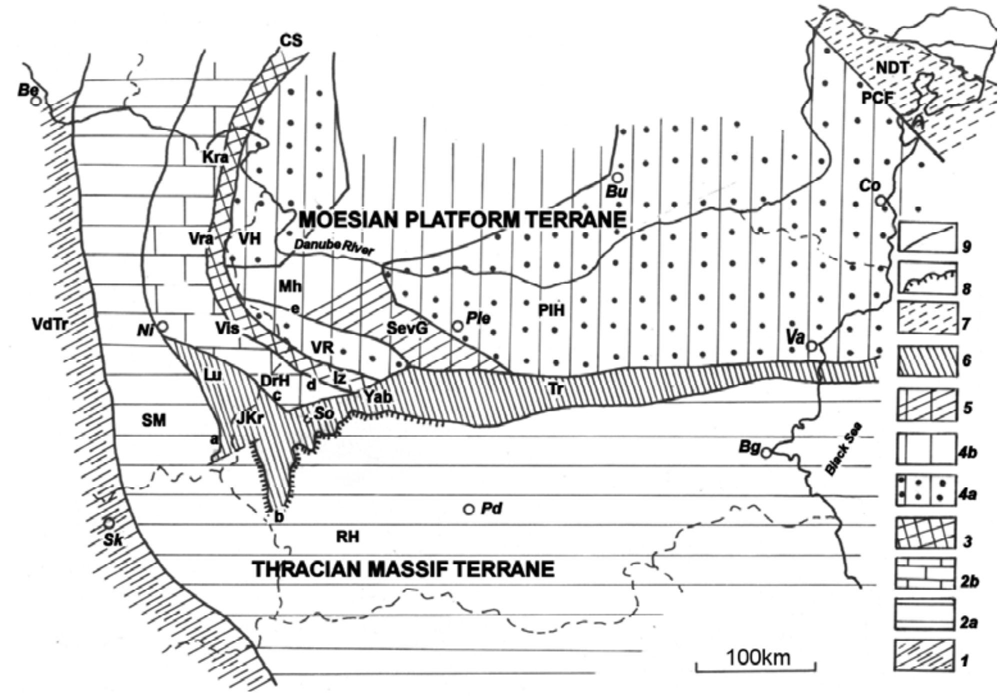

Fig. 6. Tectonics during the Late Tithonian

1, Vardar-Transilvanium Terrane (VdTr); *2a, Thracian Massif Terrane*: SM, Serbo-Macedonian, RH, Rhodope Massif Block, *2b,* Bucovino-Getic-Dragoman Unit: DrH, Dragoman Horst; *3, Balkan Terrane*: CS, Civcin-Severin "Terrane", Kra, Krajna Zone (Krajnikum), Vra, "Vratarnicka Seria", Iz, Izdremets Graben Unit; *Moesian Platform Terrane*: *4a,* Horts: VH, Vidin Horst Unit, PlH, Pleven Horst Unit, VR, Vratsa Horst Unit, *4b,* Grabens: Mh, Mihaylovgrad Graben Unit; Tundzha-Sevlievo Diagonal Basin: *5,* Sevlievo Graben Unit (SevG); *6,* Nish-Troyan Foreland Trough/Basin: Lu, Lužnica Trough (JKr), Yab, Yablanitsa Trough Unit, Tr, Troyan Trough Unit; *7, North Dobrogean Terranes* (NDT), PCF, Peceneaga-Camena Fault; *8,* Thracian Suture (sensu Haydutov, 1987); *9,* Major Faults (the names of the faults are after Bončev, 1961, 1986): a, Penkiovtsi (Gorochevtsi-Bunovo) Fault, b, Struma Fault, c, Ozren-Trun (Trun-Kosharevo) Fault, d, satellites of Sub-Balkan Fault (Vidlič Dislocation), e, Balkanide Front Line (Fore-Balkan Fault, Stara Planina Frontal Strip)

Be — Belgrad; *Bu* — Bucurest; *Bg* — Burgas; *Co* — Costanta; *Pd* — Plovdiv; *Ple* — Pleven; *Sk* — Skopie; *So* — Sofia; *Ni* — Nish; *Va* — Varna

Фиг. 6. Тектониката през късния титонски подвек

1 — Вардарско-Трансилвански терейн (VdTr); *2a — терейн на Тракийския масив*: SM — Сърбо-Македонски масив, RH — блок на Родопския масив, *2b* — Буковино-Гетско-Драгоманска единица: DrH — Драгомански хорст; *3 — Балкански терейн*: CS — Чивчинско-Северински „терейн“, Kra — Крайненска зона (Крайникум), Vra — „Вратарничка серия“, Iz — единица на Издремецкия грабен; *терейн на Мизийската платформа: 4a* — Хорстове: VH — Видински хорст, PLH — единица на Плевенския хорст, Dob — единица на Добруджанския хорст, VR — единица на Врачанския хорст, EBH — единица на Източно-Балкански хорст, *4b* — Грабени: Mh — единица на Михайловградския грабен; Тунджанско-Севлиевски диагонален басейн; *5* — единица на Севлиевския грабен (SevG); *6* — Ниш-Троянски форландов трог/басейн: Lu — Лужнички трог (JKr), Yab — единица на Ябланишкия трог, Tr —Троянски трог; *7 — Северно-Добруджански терейн* (NDT), PCF — разлом Печеняга-Каменна; *8* — Тракийска сутура (по Haydutov, 1987); *9* — големи разломи (имената на тези разломи са по Bončev, 1961, 1986): a — Пенкьовски (Горочевско-Буновски) разлом, b — Струмски разлом, c — Озрен-Трънски (Трънско-Кошаревски) разлом, d — сателити на Задбалканския разлом (Видличка дислокация), e — Балканидна челна линия (Предбалкански разлом, Старопланинска челна линия)

Be — Белград; *Bu* — Букурещ; *Bg* — Бургас; *Co* — Кюстенджа; *Pd* — Пловдив; *Ple* — Плевен; *Sk* — Скопие; *So* — София; *Ni* — Ниш; *Va* — Варна

3. Stratigraphy and tectonic evolution. The Jurassic Balkan Terrane is divided in three units — from east to west — the Matoride Rifted Basin Unit, the Izdremets Graben Unit, and Krayna Unit.

Matoride Rifted Basin

During the Early Jurassic the Matoride basin Unit represented a unilateral rift structure, which north shoulder was the East Balkan Horst Unit of the Moesian Platform Terrane. A thinner continental crust characterizes it. The Matoride Basin Unit was fulfilled by more than 950 m thick siliciclastic flysch type sediments — the Sinivir and the Balaban Formations, connected by progressive transition with Upper Triassic calciturbidites. During the Middle Jurassic in the Matoride Basin was deposited an up to 600 m "wild flysch" — black shales with many olistolites — the Kotel Formation, containing many Triassic and Lower Jurassic limestones, shales and sandstones fallen blocks, some of them exotic for the Bulgarian Jurassic. During the Early Jurassic times the Matoride Rifted Basin was governed by back-arc extension. At the end of Mid-Jurassic, probably by one of the manifestation of the Yala phase or of the Agasits phase of the Cimmerian Orogenesis the Matoride Basin Unit was closed, overthrusted on the southern part of Jurassic Mesian Platform, and became dry land. Actually the Matorid represent a series of unrooted nappes. Maybe the closure is due to the docking of the Arabian Plate, as an accretion, to the Western Pontide-Thracian Massif Terrane during which event the block to east of the Matoride Basin was moved and introduced between the Moesian Platform Terrane and the Scityan Platform and structured the North Dobrogean "Orogen", described by Gradinaru (1984, 1988, 2000), Sandulescu (1980, 1984, 1994, 2000, 2004), Mutihak (1990), etc. The age of the Matorid Rifted Basin closure is not clear. The youngest sediments of the Kotel Formation in the basin are Middle Bathonian (Dodekova, Tchoumatchenco, 1989). In the Lower Cretaceous sediments of the Nish-Troyan Trough near the village of Kipilovo and to east of village Kostel exist olistolites from the Sinivir Formation, i.e. the closure is after the Middle Bathonian and before the Tithonian, probably during the end of the Early Callovian (?).

In eastern direction the Matoride Rifted Basin Unit is related to the Nalbant and Denis Tepe parts of the Tulcea Zone, Northen Dobrogea and continues to east into the South Crimea and Great Caucasus, where it is on oceanic crust. After Daukeev et al. (2002), during the Triassic and the Early Jurassic the South Crimea was part of the Tauride Basin, and during the Middle Jurassic — part of the Great Caucasian Basin. My opinion is that the Matoride Basin, as well as the Tulcea Zone of the North Dobrogea and the South Crimea represents remnants of the Paleo-Tethys in South-East Europe.

Izdremets Graben Unit

On the Izdremets Graben Unit — western part of the Balkan Terrane, during the early Jurassic were deposited continental and continental-marine sandstones and clays (Tuden Formation), marine sandstones (Kostina Formation) and the bioclastic limestones and marls (Ozirovo Formation), thick up to 120—170 m. On the southern board of the Izdremets Graben Unit the Ozirovo Formation is homogenous and structured predominantly by ferriferous limestones.

During the Middle Jurassic, the Izdremets Graben Unit was fulfilled by black shales with *Bositra alpina* (Etropole Formation) and by clayey limestones and marls (Bov Formation) thick up to 450 m. The more characteristic for this unit are the black shales with *Bositra alpina* — a facies well known in the Alps.

In the westernmost part of the Izdremets Graben Unit, during the Callovian — Tithonian were sedimented micritic, nodular and lithoclastic limestones, similar to the well known in the Alps facies "*ammonitico rosso*" — very characteristic for this unit. It reached up to 100 m. The same sediments are described by Andjelković et al. (1996) in the westernmost part of the Stara Planina Mountain and are included by him in the "Senokos beds" of the "Staroplaninska-Porečka jedinica". These sediments are included by Grubić, Antoniević (1961-62) in the Visočicka Synclinale (Vis). After Karamata et al. (1996-97) this is Stara planina-Porečka Terrane (or Unit).

Krayna (Severin) Basin Unit

After the papers of Bončev (1936, 1938) the notion of "South Carpathians" is very popular in the Bulgarian literature to note the Lower and Upper Cretaceous sediments in the North-Western corner of Bulgaria on the Krayna Heights to west of the town Koula. This is the zone especially of the distribution of the Sinaia flysch, described by Tzankov (in Tzankov et al., 1960). These authors didn't used the term "South Carpathians" but described these sediments only as Sinaia beds. The Lower Cretaceous sediments near Vrška Čuka Mts. and in the Krayna Height are individualized as Krayna zone or Sinaia Trough with Sinaia and Komarnik Formations (Tzankov, 1961, 1972), or Krayna (Severin) Unit (Nachev, Nachev, 2003) and the Upper Cretaceous — as Koula Unit (Tzankov, 1961, 1972; Nachev, Nachev, 2003). The Early Cretaceous age of the sediments of the Krayna Unit is not well established and different authors as Mutihac (1990), Andjelković et al. (1996), etc., attributed to this flysch a Late Tithonian-Early Cretaceous age or Upper Tithonian-Berriasian age (Kraŭtner, Krstić, 2003). That is why these sediments are included in the text of this paper. Nikolov and Tzankov (1997) wrote that "Grubić (1974) believes that traces of paleo-oceanic crust have been preserved in Kraina (East Serbia). Moreover, volcanic-sedimentary rocks ("Vratarnica series") with manifestations of basic volcanic activity are present in this zone. The above-lying Timok (=Sinaia, pars) beds contain also diabases and diabase tuffs". After Nachev and Nachev (2003, p. 154) the sediments between Vrška Čuka Mt. and the town of Koula, which structured the Krayna Unit, are represented by a mixed flysch, which coveres directly the "Tithonian micritic limestones" and are related with them in vertical direction with a transitional passage, formed by "pre-flysch sediments". The flysch rhythms are of two types: (1) intra-clastic limestones-micritic limestones-clayey limestones; (2) grauwackes-aleurolites-argillites. There is also a small quantity of breccia, breccia-conglomerates, and olistostromes with olistolites of micritic limestones (Upper Jurassic). In NE direction exists also lateral (in horizontal direction) transition, executed by sub-flysch into limestones of epicontinental type. The thickness of the flysch of Sinaia Formation is more than 1500 m.

These authors, including and the recently published paper of Dabovski et al. (2002) included the described sediments into the "South Carpathians" on Bulgarian territory. But in the South Carpathians exist also rocks, which are attributed to Getic, Supra-Getic, etc. tectonic units. These rocks also cross the Danube River, cross the eastern Serbia and trough the Serbian/Bulgarian state border penetrate in South-West Bulgaria in the region of the towns of Trun, Slivnitsa-Dragoman. But for them in the Bulgarian geological literature is not used the term "South Carpathians". Why?

From the western side of Vrška Čuka Mts. the development of the Krayna Unit and its "Vratanica Serija" is very complicated. In the "Vratarnica Serija" Andjelković et al. (1996, p. 148—150) described: red radiolarites, thin bedded with argillites and serpentinites, white recristalized limestones, trachibasalte, basalte, dolerite, diabase, spilite. For Karamata et al. (1996—97, p. 434) these trachybasalts, basalts, andesite-basalts, andesites and dacites are with Cenomanian age and are "formed above a subduction zone". In North direction the Krayna unit is represented by siliciclastic flysch, described as Sinaia beds, to which Andjelković et al. (1996, p. 148—150) attributed a Tithonian-Early Cretaceous age.

In the South and East Carpathians Sandulescu (1984) described a sequence with "two main lithostratigraphic units: (1) a lower basaltic, corresponding to the extensional stage — Middle Jurassic and lowermost part of the Upper Jurassic and (2) an upper flysch unit of Upper Jurassic-Cretaceous age. The flysch sequences were fed by material supply from internal rises (Black Flysch) as well as from both sides of the rift basin (Sinaia Flysch)". For Kraŭtner (1996-97) these turbidites fulfilled the "oceanic Civcin-Severin Terrane (p. 334), a rift zone (External Dacidic Rift after Sandulescu, 1984, 1994), which separated during the Jurassic the Bucovino-Getic Terrane from the southern European margin"(p. 339). For Mutihac (1990, p. 276-278) this is a paraautochton structure, which was individualized as a structuro-genetic unit between the autochthon of the Danubian and the "pinza" Getic — Pinza de Severin" and for Sandulescu (2000) — "Severin-Ceahlau rift" (p. 4), or "Outer Dacides" (p. 6). Mutihac (1990) attributed to the basalts an Early Tithonian age and to the flysch — Late Tithonian — Early Cretaceous age.

Thracian Massif Terrane during the Jurassic (Figs. 1-6)

1. Definition. In west Bulgaria the Thracian Massif Terrane is divided into three blocks (Kozhukharov, in Haydutov et al., 1996-97) (Fig. 1): (1) Rhodope massif; (2) Sredna Gora metamorphic block, limited to north by the Thracian Suture and between them by the Maritza fault; (3) Serbo-Macedonian massif — limited to east by the Penkiovtsi (Gorochevtsi-Bunovo) fault. During the Jurassic all the terrains to south and to west from the Balkan (Severin-Izdremets-Matoride Basin) Terrane represented dry land and consequently part of the source province — the Thracian Massif Terrane. That is why the western parts of the Variscan Balkan Terrane (the West and East Kraishte of Haydutov et al., 1996-97) is attributed here to the Serbo-Macedonian Unit of the Thracian Terrane and only the Variscan Balkan Unit (*s.s.*) is considered as Balkan Terrane during the Jurassic. In this time the Rhodope massif block and the Sredna Gora metamorphic blocks cannot be separated one from another and as one integral entity served as source of material for the Jurassic sediments. The limit between the Rhodope Massif and the Serbo-Macedonian Massif is the Struma Fault (Kozhukharov in Haydutov et al., 1996-97). It is prolonged to north probably by the Penkiovtsi (Gorochevtsi-Bunuvo Fault); from west is limited by the Vardar-Transilvanian Terrane. The Serbo-Macedonian Massif is divided during the Jurassic in three units: Bucovino-Getic-Dragoman Unit, Supra-Getic-Lužnica-Koniavo Unit and Serbo-Macedonian Massif (*s.s.*). The Supra-Getic-Lužnica-Koniavo Unit and the Bucovino-Getic-Dragoman Unit are structures, developed on the background of the Serbo-Macedonian Massif and were covered in different times by marine water whilst the Serbo-Macedonian Massif (*s.s.*) represented during the whole Jurassic dry land and source, alimenting the Jurassic sedimentation. To eastern direction, on the background of the Thracian Massif Terrane, are developed, as separate parts, the Tundzha Tilted Basin and the Zlatarski Exotic Ridge.

Bucovino-Getic-Dragoman Unit during the Jurassic (Figs. 2-5)

1. Definition. The most characteristic feature for this unit is that during the Early Jurassic, almost elsewhere, it represented a dry land, covered during the Middle and the Late Jurassic by shallow water sediments.

Bončev (1962, p. 222-223) called this unit Kučaj Zone and included it in the Kraishtide system and latter Bončev (1986, p. 156-157) introduced the term of "Shopsko-Banat quasi platform" for the same unit. In the same sense the term and its variant as Bucovino-Getic had the priority and here is accepted this term. To it is added the term "Dragoman" — its Jurassic Bulgarian equivalent (Sapunov et al., 1985). Part of this unit enters in the "Gethian Unit" of Grubić (1980).

2. Boundaries. The Bucovino-Getic-Dragoman Unit inherits the Variscan East Kraishte of Haydutov et al. (1996-97) and is separated to east from the Balkan Terrane by the satellite faults of the Sub-Balkan fault. From west it is limited by the Ozren-Tran (=Tran-Kosharevo) Fault of Bončev (1961). In the tectonic scheme of Bulgaria (Dabovski et al., 2002, Fig. 1) the Bucovino-Getic-Dragoman Unit enters in the West Srednogorie unit.

3. Stratigraphy and tectonic evolution. During the Early Jurassic this unit is a dry land, covered by marine water only since the Middle Jurassic, when were sedimented sandstones (Gradets Formation) and bioclastic limestones (Polaten Formation thick ca 10-42 m). At the end of the Bathonian existed a submarine sedimentation break and in the Callovian started a cycle of platform (reef or subreef) carbonate sedimentation (Belediekhan and Slivnitsa Formations) ended in the Berriasian. At the southern peripherical parts the Bucovino-Getic-Dragoman Unit ended during the Late Jurassic as a rimmed carbonate platform with the formation of coral reefs: (1) towards the Izdremets Graben Unit — in the region of Beledie Khan Village near Sofia; (2) towards the Yablanitsa Trough — in the vicinities of the village Lyalintsi, Lyubasha Mountain; (3) towards the Supra-Getic-Lužnica-Koniavo Unit — in the region, situated to north of the town Tran, in Serbia (Sučic, 1959). To south this platform carbonate sedimentation progressively passed into pelagic sedimentation of "ammonitico rosso" type, which marked the "normal" end of the Bucovino-Getic-Dragoman Unit to south — into the Yablanitsa Trough — part of the Nish-Troyan Basin (Fig. 6).

In South Carpathians, in the background of this unit, Mutihac (1990) described two zones: (1) Zone Haţeg with Lower Jurassic Gresten facies — sandstones and argillites; Middle Jurassic — ingressive — microconglomerates, sandstones (50 m), sandy limestones (40 m); Upper Jurassic — clayey limestones (Oxfordian and Lower Kimmeridgian), nodular limestones (Upper Kimmeridgian-Lower Tithonian), massive reef limestones — carbonate platform (Upper Tithonian-Lower Cretaceous) and (2) Zone Holbav-Magura Codlei also with Lower Jurassic — Gresten facies with coal and continental clay, Pliensbachian — sandstones and sandy limestones, argillites and calcareous argillites (Toarcian); calcareous sandstones — Middle Jurassic (with *Bositra buchi*); Callovian and Oxfordian — silicites; nodular limestones — Kimmeridgian; massive limestones — Tithonian.

4. Possible correlation with neighboring regions. The Bulgarian part of this unit — the Dragoman Horst, is related in Eastern Serbia directly with the: (a) Gornjačko-Suvoplaninski Belt (which ends before crossing the Serbian/Bulgarian border) and (b) Rtan-Kučaj Zone (Grubić, Antonijević (1961-62) with: (a) Gornjačko-Suvoplaninski nappe and (b) Kučajsko-Svrljiska nappe of Andjelković et al. (1996). The Bucovino-Getic-Dragoman Unit coincides almost completely with the Kučaj Terrane of Karamata et al. (1996-97) and with the Getic of Dimitrijević (1995). In the South and East Carpathian the Bucovino-Getic-Dragoman Unit is correlated with the Median Dacides after Sandulescu, (2000, p. 3, Fig. 1) and the Bucovino-Getic Terrane after Kraűtner (1996-97, p. 332, Fig. 1) who writes: "in Lower-Middle Jurassic a new (Bucovino-Getic) microplate was separated from the southern continental margin of Europe by the Civcin-Severin rifting and spreading system".

Supra-Getic-Lužnica-Koniavo Unit during the Jurassic (Figs. 3-6)

1. Definition. In difference of the Bucovino-Getic-Dragoman unit, during the Early Jurassic the Supra-Getic- Lužnica-Koniavo Unit was covered partly by marine sediments since the Early Jurassic (Ozirovo Formation in the Svetlya Graben). The Jurassic sedimentation took place in many grabens with different lithology. It inherited the West Kraishte of Haydutov et al. (1996-97). Bončev (1962, p. 220-222) introduced the term Rešiţa-Krepolin-Rouy zone for the area between Banat and Kraishte in Bulgaria as part of the Kraishtid. Part of this unit is called Lužnica unit by Grubić (1980). Nikolov and Tzankov (1997) used for this unit the term of "Lužnica flysch trough" which was developed to East of the "Dardanian diagonal" of Bončev (1963). In a preliminary paper Tchoumatchenco (2002) named this unit Jurassic Kraishtides — stressed on longevity of the Kraishtids as tectonic unit. But the term Lužnica-Koniavo Unit introduced by Bončev (1986) earlier than Nikolov and Tzankov (1997), and Tchoumatchenco (2002) have the priority and is used here with enlargement in the time. Kraűtner and Krstić (2003) used for this unit the term Lužnica-Trân-Vlahina Unit, but the nomination of Bončev (1986) has the priority. The Lužnica-Koniavo part of this unit — in Bulgarian territory enters in the Strouma unit of the Morava-Rhodope zone of Dabovski et al. (2002, Fig. 1 and p. 12).

2. Boundaries. The Supra-Getic-Lužnica-Koniavo Unit is bounded to west from the Serbo-Macedonian Massif (s.str.) by the Penkiovtsi (Gorochevtsi-Bunuvo Fault) and to east — by the Ozren-Trun (Trun-Kosharevo) Fault of Bončev (1961). During the Early-Middle Jurassic, from south the Supra-Getic-Lužnica-Koniavo and the Getic-Dragoman Units were limited in the area of Radomir and Sofia by the Thracian Suture (after Haydutov, 1987), which represents also the southern limit of the Yablanitsa Graben of the Nish-Troyan Trough during the Late Jurassic.

3. Stratigraphy and tectonic evolution. The presence of grabens (at least two — Svetlya and Treklyano) predestinated the sedimentation during the whole Jurassic. The sedimentation in the Bulgarian part started in the Early Jurassic only in the easternmost graben — Svetlya Graben (Sapunov et al., 1983). Here it started with continental sandstones and clays (Zhablyano Formation) followed by shallow water bioclastic and sandy limestones (homogenous Ozirovo Formation). During the Early Jurassic existed a supposed connection with the Izdremets Graben trough the Breznik Graben, which crossed the Bucovino-Getic-Dragoman Unit not far from the town of Breznik. In the Middle Jurassic the whole Supra-Getic-Lužnica-Koniavo Unit was covered by seawater. In the Svetlya Graben were sedimented sandstones (Gradets Formation) and bioclastic limestones (Polaten Formation). In this times was formed the western graben — Treklyano Graben, fulfilled by deepwater black shales with radiolarites. During the Callovian-part of the Kimmeridgian were sedimented pelagic limestones — micritic and nodular and/or lithoclastic limestones (Gintsi Formation) and in the Svetlya Graben — lithoclastic limestones (Lobosh Formation), nourished with pebbles from south —

from the Rhodope Massif — result of movements along the Thracian Suture in the Kimmeridgian. Since the Late Kimmeridgian started a siliciclastic flysch type sedimentation (Tcherni Osam and Kostel Formations).

4. Possible correlation with neighboring regions. To North of the Bulgarian/Serbian border the Supra-Getic-Lužnica-Koniavo Unit continues up to the region of Nish, where it is tectonically covered by the Serbo-Macedonian Massif. It is directly connected to north with the Golubacko-Penkjovtsi Unit of Grubić, Antonievć (1961-62), with the Lužnicka nappe of Andjelković et al. (1996), with the Supra-Getic of Dimitrijević (1992), with the "Zona Ruja" (Dimitrievć, 1995) and the Lužnica-Tran-Vlahina Unit of Kraűtner and Krstić (2003). In the South Carpathians, probably the zone Reşiţa-Moldova Noua of the "Pinza Getica" and the "Unitatele supragetice" (Mutihac, 1990, p. 257-276) are the continuation of the Supra-Getic-Lužnica-Koniavo Unit. Muthihac (1990) described that in the "Zone of Reşiţa-Moldova Noua" the Jurassic sediments cover Permian conglomerates and sandstones. The Lower Jurassic is developed in Gresten facies — conglomerates in the base, followed by sandstones (with coal), bituminous schistes and Toarcian marls; the Middle Jurassic is predominantly represented by clayey limestones in the central part (tick 150 m) and limestones rich in ammonites. The Upper Jurassic consists of clayey limestones (Lower Oxfordian), well stratificated limestones with chert (Upper Oxfordian-Lower Kimmeridgian), nodular limestones rich in ammonites ("ammonitico rosso") — Upper Kimmeridgian — Lower Tithonian, micritic limestones with tintinids (Upper Tithonian — 150 m).

Sevlievo-Tundzha Diagonal Basin Unit during the Jurassic (Figs. 3-6)

The Tundzha Tilted Basin (Sapunov, Tchoumatchenco, 1991, 1994a, b) is southeastern prolongation of the Sevlievo Graben (Sapunov et al., 1991), which structures are united here in one unit — Sevlievo-Tundzha Diagonal Basin, imposed in the same time on the Moesian Platform Terrane (by the Sevlievo Graben Unit) and on the Thracian Massif Terrane (by the Tundzha Tilted Basin Unit). On the boundary of the Moesian Platform Terrane it is intercrossed by the East Balkan Horst Unit, which complicated its study.

During the Early Jurassic the Tundzha Tilted Basin Unit covered the east part of the Rhodope Massif Block and Sredna Gora Block, where have been deposited shallow water sandstones (Kostina Fm.) and bioclastic limestones (homogenous Ozirovo Fm.). During the Middle Jurassic were sedimented, in the central parts of the unit, black shales (Zvezdets Fm. closed to the Etropole Fm.), and in western direction, near the source area — sandstones and limestones (similar to the Gradets and the Polaten Formations).

Characteristic for the Tundzha Tilted Basin Unit is that the Jurassic sedimentation started since the Early Jurassic times and continued up to the Late Bathonian (Čatalov, 1990; Sapunov, 1999) when this unit was tectonically closed together with the easternmost part of the Izdremets Graben Unit and the Matoride Basin Unit of the Balkan Terrane as a result of collision between the Thracian Massif Terrane and the Moesian Platform Terrane. During the Late Jurassic it represented a dry land.

Zlatarski Exotic Ridge Unit during the Jurassic (Figs. 3-4)

This tectonic unit was built on the background of the eastern prolongation of the Thracian Massif Terrane, and was completely destroyed during the Middle Jurassic by one of the Cimmerian tectonic phases. It built the southern shelf of the Matoride Rifted Basin. For its existence we judge only from the different olistolites included into the black shales of the Middle Jurassic Kotel Formation. Tchoumatchenco (1988) described the Lower and the Middle Jurassic exotic blocks. They are from different limestones, characteristic for the inner — shallow and the outer — relatively deeper part of the shelf. During the destruction of the Zlatarski Exotic Unit was destroyed also a part of the Matoride Rifted Basin — some of the olistolites in the Kotel Formation represent basinal Upper Triassic and Lower Jurassic flysch type sediments.

The Zlatarski Exotic Ridge Unit has its eastern prolongation in the Euxinia Exotic Terraine of Mileev et al. (1989) situated south of the South Crimea. It is also destroyed and the blocks are included into the Jurassic sediments of South Crimea as olistolites. To east it could be prolonged into the Dzirula Massif, between the Great and the Lesser Caucasus.

Zabernovo Exotic Terrane (Fig. 5)

This exotic terrane is built by Paleozoic and Triassic rocks and crops out in Stradzha Mountains (Southeast Bulgaria, Fig. 5). The sediments and their tectonic situation are described by Čatalov (1990) as Nappe of Zabernovo. Here I would like to stress on the fact, that in this big rocky body there are not Jurassic deposits but this terrane is "mise en place" in Strandzha Mountains probably during the Early Callovian (?) when closured the Matore Rifted Basin and are causing by the same tectonic phenomena.

The Middle Callovian-Upper Jurassic-Berriasian Nish-Troyan Basin (Fig. 6)

1. Definition and tectonic evolution. This unit was introduced by Nachev (1976, 1985) in the Bulgarian literature as "Kimmeridgian-Berriasian Nish-Troyan marginal sea (trough)" or represented "back-arc flysch trough" (Nachev, 1980, p. 238). Nachev (1992, p. 73) wrote that the "Nish-Troyan marginal sea (trough)" is "part of the Early Alpine island-arc system on the southern part of the (Balkan) microcontinen". Nikolov and Tzankov (1997, p. 4) named this depression "Peri-Moesian marginal flysch basin" which Early Cretaceous stage "was a back-arc type basin formed over the Moesian microplate. An avolcanic island arc was situated to south of it, within the Balkan Peninsula. This arc was represented by the Thracian island (Rhodope)". Tchoumatchenco et al. (1989) named it Trojanids. Bončev (1986) used the term Middle Bulgarian trough for the same phenomena. The name Nish-Troyan Basin (Trough) has the priority — it is created earlier and will be used here.

At the end of the Early Callovian (?), after the collision between the Zlatarski Unit of the Thracian Massif Terrane and the Moesian Platform Terrane, the whole eastern part of the Rhodope Massif and Sredna Gora metamorphic Blocks became dry land, accreated to the Moesian Platform Terrane. During the Late Callovian — Late Jurassic — earliest Early Cretaceous an important reorganization of the tectonic units took place in Bulgaria. It consisted in the formation of a new rift zone in a distensive context, probably on a thin continental crust — the Nish-Troyan Basin (Trough). This newly formed trough had the features of a foreland basin. The Nish-Troyan Trough structured a basin, comprising three units (parts) — Troyan Trough, Yablanitsa Trough and Lužnica-Koniavo Trough. It started its formation during the Middle Callovian in North-Eastern Bulgaria. In its eastern part it was installed on the territory of the Moesian Platform and was fulfilled by coarse flysch type sediments (Sapunov, Tchoumatchenco, 1987) whilst in the west, in that time, it was fulfilled by micritic and nodular limestones (type "*ammonitico rosso*"). The flysch type sedimentation was enlarged soon after that to west during the Late Kimmeridgian, Tithonian and the earliest Early Cretaceous when were deposited flysch type sediments (Cherni Osam Formation and Kostel Formation) with a thickness ca. 2000-3000 m. In the area of Sofia and Radomir it was prolonged by the imposition of the transversal Yablanitsa Trough Unit (with NE-SW direction), which made the connection with the Lužnica-Koniavo Trough. The Yablanitsa Trough Unit limited the distribution of the Bucovino-Getic-Dragoman Unit to south — on the north limit of the Yablanitsa Trough Unit is documented the progressive transition between the sediments of the carbonate platform of the Bucovino-Getic-Dragoman Unit into the pelagic sediments of type ammonitico rosso, followed by flysch type siliciclastic deposits. Bončev (1936) connected the western part — Lužnica-Koniavo Trough with the eastern part but latter (Bončev, 1986, p. 152) supposed a connection between these two parts and the formation of a general basin in form of arc. Between them had existed series of small basins with Balkanide orientation.

In western Bulgaria, the Nish-Troyan Basin was represented by the Lužnica-Koniavo Trough Unit (with NW-SE direction) fulfilled by Callovian-lowest Upper Kimmeridgian micritic and nodular and/or lithoclastic limestones (Yavorets, Drugan and Gintsi Formations), and Upper Kimmeridgian — Tithonian and earliest Early Cretaceous — siliciclastic flysch type sediments (Kostel Formation), as well as by the vertical transition to the Upper Kimmeridgian Neshkovtsi Formation.

2. Boundaries. The Troyan Trough Unit was asymmetric — with abrupt south boundary and gentle northern, which made the progressive transition to the sediments of the Moesian Platform Terrane (described by Nachev, 1965, north of the town of Teteven). From south, from the Sredna gora metamorphic block and from the Rhodope Block it is limited by the Thracian Suture (Haydutov et al., 1996-97) and its prolongation to east.

The Yablanitsa Trough Unit had also an abrupt southern boundary — the Thracian Suture. The Jurassic Lužnica-Koniavo Trough Unit is bounded from west, from the Serbo-Macedonian Massif (s.str.) by the Penkiovtsi (Gorochevtsi-Bunuvo Fault), and from east — by the Trun-Ozren (Trun-Kosharevo) Fault of Bončev (1961).

3. Possible correlation with neighboring regions. The Nish-Troyan Basin is a newly created structure, connected by the Lužnica-Koniavo Trough Unit with the Supra Getic Unit of east Serbia and the South Carpathians. To east it is probably connected with the flysch type sediments from the South Crimea.

North Dobrogean Terranes during the Jurassic (Figs. 4-5)

The problems connected with the Mesozoic rocks in North Dobrogea, have a long history, not only in the Romanian, but also in the international geologic literature. Sandulescu (1984, 1994, 2000, etc.), Nachev (1980, 1985, 1991, etc.); Nachev and Nachev (2003), Ianovici et al. (1961), etc. indicated Triassic and Jurassic rocks in the Tulcea zone of North Dobrogea as "North Dobrogea Orogen" which is directed to NNW and "enter" below the Carpathians. For Sandulescu and Dumitrescu (2004) it is part of the "North Dobrogea-South Crimea aulacogene". The Triassic and the Jurassic rocks were very well studied by Gradinaru (1984, 1988, 2000) who gave them also a tectonically interpretation — as napes, one above another. I would like to trace their geologic history, as I see it. During the Early and the Middle Jurassic, these rocks formed the liaison between the Bulgarian Matore Rifted Basin and the synchronous rocks in South Crimea and North Caucasus — far to south of their present day situation (in the aquatory of the Black Sea). At the end of the Middle Jurassic, probably in the Early Callovian, when the Matore Basin closed, along the Peceneaga-Camenna Fault (satellite fault and prolongation of the Tornquist-Teyessere Line) the whole North Dobrogea (Tulcea Unit) was displaced (and "mise-en-place" horizontally) as left strike-slip structure. It was docked between the Moesian and the Scythian Terranes. During the Late Jurassic along the Peceneaga-Camena Fault took place the formation of the Upper Jurassic rocks of the Tulcea Unit. It was formed in a very narrow basin with oceanic crust with radiolarites and volcanic activity.

Conclusions

The analysis of the Jurassic sediments of Bulgarian part of Balkan Peninsula shows the presence and the geologic evolution of few terranes, result of the docking in the Late Carboniferous of parts of the Gondwana. The analysis of their Jurassic evolution, subject of this paper, demonstrated that on the level of terranes exist some differences between the interpretations of the Romanian, Serbian and Bulgarian geologists. Their opinions on level terranes (or composite terranes) differ, but on level of elementary terranes or units (subdivisions of the composite terranes) are possible to make a relatively good correlation between the Jurassic units in Bulgaria, Eastern Serbia and the Southern Carpathians.

The Jurassic units from the Bulgarian part of the Moesian Platform Terrane crossed the Danube River and are directly related to the Romanian structures.

The units of the Balkan Terrane have their prolongations outwards of Bulgarian territory. In the Early-Middle Jurassic it was subject to a new break-up. The new dispersion in the East and South Carpathians was executed by a rifting resulting in the formation of sea with oceanic crust followed by a siliciclastic turbidity basin (Civcin-Severin Rift). South of Danube River — in Stara Planina Mountains, the breaking up was only in its initial stage and was expressed by the formation of grabens — Krayna and Izdremets Grabens, with relatively deep water sedimentation. They are related directly trough the Krayna Unit (Krajnikum in Serbia) with the Severin-Coffin Rift Terrane of the Romanian Carpathians. To east, this break up was accentuated and was expressed by the formation of the unilateral Matore rift basin, which followed up from Upper Triassic calciturbidites basement. Which role played these big tectonic units during the Jurassic (?) Georgiev et al. (2001) wrote that “during Sinemurian to the end Early Jurassic time, the evolution of the East Srednogorie-Balkan Zone (in which they incorporated also the Matore Basin — P. T.) was governed by back-arc extension”. In this case where is located the island-arc system? After Nikolov and Tzankov (1997) “to the south of the basin (i.e. the Nish-Troyan Basin, which they called “Peri-Moesian marginal flysch basin”), an avolcanic island arc is located. Its outline and relief changed gradually. Within the Balkan Peninsula, this arc was represented by the Thracian (Rhodope for some authors) island”. I agree with this opinion and give to the Thracian Massif Terrane (=Thracian island after Nikolov, Tzankov, 1997) the role of an avolcanic island arc system during the Jurassic as well. Zlatarski Exotic Ridge Unit played this role during the Late Triassic and Early Middle Jurassic in connection with the Matoride Basin in eastern Bulgaria. The role of a back-arc depression is enlarged here to west and to northwest and is given to the Izdremets Graben Unit and to the Krayna Unit of the Balkan Terrane — i.e. the whole Balkan Terrane — with its three units — Matore Rifted Basin, Izdremets Graben and Krayna Basin was connected to north with the Civcin-Severin Rift, played during the Jurassic the role of back-arc depression.

The Dragoman Horst Unit (developed on the background of the Thracian Massif Terrane) is related directly with the Getic (or the others units with carbonate platform development, to which are given different names by the Serbian authors) from Eastern Serbia and is prolonged into the Bucovinian of the Romanian East Carpathians, and formed the Bucovino-Getic-Dragoman Unit.

The Lužnica-Koniavo Unit and its prolongation to east — the Yablanitsa Unit and the Troyan Unit of the Nish-Troyan Basin, are related directly to the Supra-Getic from east Serbia and the South Carpathians.

The Thracian Massif Terrane, with its Serbo-Macedonian Massif Unit (s.str.), is related to the Serbo-Macedonian Massif Unit from east Serbia. During the Jurassic the Serbo-Macedonian and the Rhodopes Blocks of the Thracian Massif Terrane represented dry land — source area for the Jurassic sediments in the basin to north and east of the Thracian Massif.

The Vardar-Transivanian Terrane, which here is included only as border Terrane, continues in Serbia and in Transilvania.

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