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Tran-sborder (south-east Serbia/west Bulgaria) correlations of the Jurassic sediments: Infra-Getic Unit

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Abstract. The Infra-Getic Unit is a palaeogeographic unit, predestined by palaeotectonics. From the point of view of geological heritage, it represents a geosites framework. For the purpose of the correlation, the Serbian sections of Lukanja, Bogorodica Monastery, Rosomač and Senokos, as well as the Bulgarian sections of Komshtitsa, Gintsi, and Stanyantsi were used. The Jurassic sediments of the Infra-Getic Unit crop out on the southern slops of the Stara Planina Mountain in east Serbia and west Bulgaria. The Lower Jurassic started with continental and continental-marine sediments (clays and sandstones) (Lukanja clastics and Lukanja coal beds in Serbia and the Tuden Formation in Bulgaria) and continue with Lukanja quartz sandstones (Serbia) and the Kostina Formation (Bulgaria). These sediments are covered by Lukanja brachiopod beds and Lukanja limestones (Serbia) and the Romanov Dol, Ravna and Dolni Loukovit Members of the Ozirovo Formation (Bulgaria) predominantly consist of bioclastic limestones. The sedimentations follow with Lukanja belemnites-gryphaea beds (marls and clayey limestones), which in Bulgaria correspond to the Bukorovtsi Member (also marls and clayey limestones) of the Ozirovo Formation. The Middle Jurassic sedimentation started with black shales with *Bossitra alpine*. These sediments are individualized in Serbia as Senokos aleurolites and clays and in Bulgaria they are known as the Etropole Formation. In Serbia the section continues with sandstones called Vodenički sandstones of Bajocian age, known in Bulgaria as the Dobrogled Member of the Polaten Formation. However, in Bulgaria, the age is Upper Bajocian–Lower Bathonian, and it cover the marls of the lower member (Gornobelotintsi Member) of the Bov Formation and is covered by the upper member – alternation of marls and clayey limestones – the Verenitsa Member of the Bov Formation. The Vodenički sandstones–Dobrogled Member which ended their distribution in the section of Komshtitsa, to the east (in the Gintsi section), they are not represented – build a body of sandstones, a prodelta coming from the west to the east. The Bov Formation corresponds to the Senokos ammonite beds in east Serbia. The upper boundary of the Senokos ammonite beds and of the Bov Formation is sharp. It is covered by grey limestones of the Yavorec Formation in Bulgaria and by the Kamenica limestones in eastern Serbia. They are covered by grey or red nodular/lithoclastic limestones ("*ammonitico rosso*" type) of the Gintsi Formation in Bulgaria and the Pokrovenik ammonitic (*acanthicum*) limestones in Serbia. The Jurassic section in the Infra-Getic ended with grey micritic and lithoclastic limestones, which belong to the Rosomač and Rsovci limestones in east Serbia and to the Glozhene Formation in Bulgaria.

Key words: Jurassic, Infra-Getic, correlations, lithostratigraphic units, south-eastern Serbia, western Bulgaria.

Апстракт. Инфрагетска јединица је палеотектонски условљена палеоеографска јединица а са становишта геолошког наслеђа представља подручје геолошких објеката. У циљу упоређења анализирани су профили Лукање, Манастира Богородице, Росомача и Сенокоса у Србији и профили Комштице, Гинци и Стањанци у Бугарској. Јурски седименти Инфрагетске јединице су откривени на јужним падинама Старе Планине у источној Србији и западној Бугарској. Доња јура почиње са континенталним и континенталноморинским седиментима (глинци и пешчари) (Лукањски кластити и лукањски слојеви угља у Србији

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и Туден формација у Бугарској) и наставља се Лукањским кварцним пешчарима (Србија) и Костином формацијом (Бугарска). Ови седименти су прекривени Лукањским брахиоподским слојевима и Лукањским кречњацима (Србија) и члановима Романов Дол, Равна и Долни Луковит Озировске формације (Бугарска) изграђени претежно од биокластичних кречњака. Седиментација се наставља Лукањским белемнитско-грифејским слојевима (лапорци и глиновити пешчари) којима у Бугарској одговара Букуровачки члан (такође лапорци и глиновити пешчари) Озировске формације. Средњојурска седиментација почиње црним глинцима са *Bossitra alpina*, седиментима који су у Србији познати као Сенокоски алевролити и глине, а у Бугарској као Етрополска формација. У Србији се профил наставља Воденичким пешчарима бајеске старости, који су у Бугарској познати као Доброгледски члан Полатенске формације где су горњобајеске–доњобатске старости. Ови пешчари прекривају лапорце члана Бов формације (Горњобелотиначки члан), а преко њих лежи горњи члан исте формације (Веренички члан) изграђен од смене лапораца и глиновитих кречњака. Воденички пешчари, односно Доброгледски члан, завршава се у профилу Комштице, даље према истоку (у профилу Гинци) они нису развијени. Бовска формација одговара Сенокосним амонитским слојевима у источној Србији. Горња граница Сенокосних амонитских слојева и Бовске формације је оштра; прекривена је сивим кречњацима Јаворечке формације у Бугарској, односно Каменичким кречњацима у источној Србији. Преко њих леже сиви и црвени кргави или литокластични кречњаци (типа *ammonitico rosso*) Гинци формације у Бугарској и Покровенички акантички кречњаци у источној Србији. Јурски профил у Инфра-генетикуму завршава се сивим микритским и литокластичним кречњацима Росомача и Рсоваца у источној Србији и Гложенској формацији у Бугарској.

Кључне речи: Јура, Инфра-гетик, упоређење, литостратиграфске јединице, југоисточна Србија, западна Бугарска.

Introduction

In this paper we expose our essay to make correlations accross the Serbian/Bulgarian state border of the existing in the published literature Jurassic formal lithostratigraphic units in the framework of the Infra-Getic paleotectonic and paleogeographic unit (Fig. 1). This unit is known in the Serbian literature presumably as the Staroplaninska–Porečka units (ANDJELKOVIĆ *et al*., 1996) and as the Izdremets Jurassic paleograben (SAPUNOV *et al*., 1986, etc.).

Substratum

The substratum of the Jurassic sediments in the studied area of the Infra (Sub)-Getic consists of Triassic rocks. In the Serbian Bogorodica, Rosomač and Senokos sections, the substratum consists of redish aleurolites, marls to argillites with concretions of sphaero-siderites, inter-bedded by sandstones, from 5 up to 100 m thick. They are called the Senokos red series (ANDJELKOVIĆ, 1996, p. 78) (Pl. 1, Fig. 2). These sediments cross the state border near the village Komshtitsa and continue to the east up to the Gintsi village. They are the Bulgaria Komshtitsa Formation in the Bulgaria (TRONKOV, 1969). The problem of the age is controversial because of the lack of characteristic fossils: in Serbia two opinions exist: (1) that of ANDJELKOVIĆ *et al*. (1996, p. 78, etc.), after which the Senokos red series is with the Late Triassic age; (2) this of UROŠEVIĆ & RADULOVIĆ (1990), after which they are Rhaeto–Liassic. ANDJELKOVIĆ (1996, p. 78) considered the Senokos Formation as Upper Rhaetian because they were formed under a dry and hot climate, while Jurassic sediments were formed under humid conditions. In Bulgaria, the Komshtitsa Formation, after TRONKOV (1993, p. 170) is connected by a progressive lithologic passage with the Carnian Russinovdol Formation and for that reason it is considered as Carnian–Norian.

In the section of Velika Lukanja, the Jurassic substratum is represented by 2 m of thick red breccia limestones – the Jelovica limestones (Pl. 1, Fig. 1), of Late Raetian age (ANDJELKOVIĆ *et al*., 1996, p. 78).

In the out crops near the villages Stanyantsi, Berende Izvor, Tuden, etc. in Bulgaria, the Jurassic substratum is built up of grey Middle Triassic limestones of the Iskar Carbonate Group.

Lower Jurassic (Figs. 2, 3)

In the vicinities of the villages of Velika Lukanja (Serbia) and Stanyantsi (Bulgaria), the Lower Jurassic sedimentation started by a continental sedimentation (Fig. 2). These sediments are called, in Serbia, the Lukanja clastics and Lukanja coal beds (ANDJELKOVIĆ, 1996, p. 84–86) and, in Bulgaria, the Tuden Formation (SAPUNOV *et al*., 1990). They are covered by marine sandstones.

The Lukanja clastics, (2–120 m thick), (known also as „podinski nivo", ANDJELKOVIĆ, 1958, pp. 13–14) lie with discordance on different Triassic rocks. The Lukanja clastics are built up of conglomerates and sandstones. The conglomerates are with quartz pebbles and cement of silica, rarely of clay. The sandstones predominantly consist of quartz and silica or clayey cement. (Pl. 1, Fig. 4).

The Lukanja coal beds (8–150 m thick) started with fine grained quartz sandstones are gradually intercalated by clay and clayey sandstones with coal beds (Pl. 1, Fig. 3).

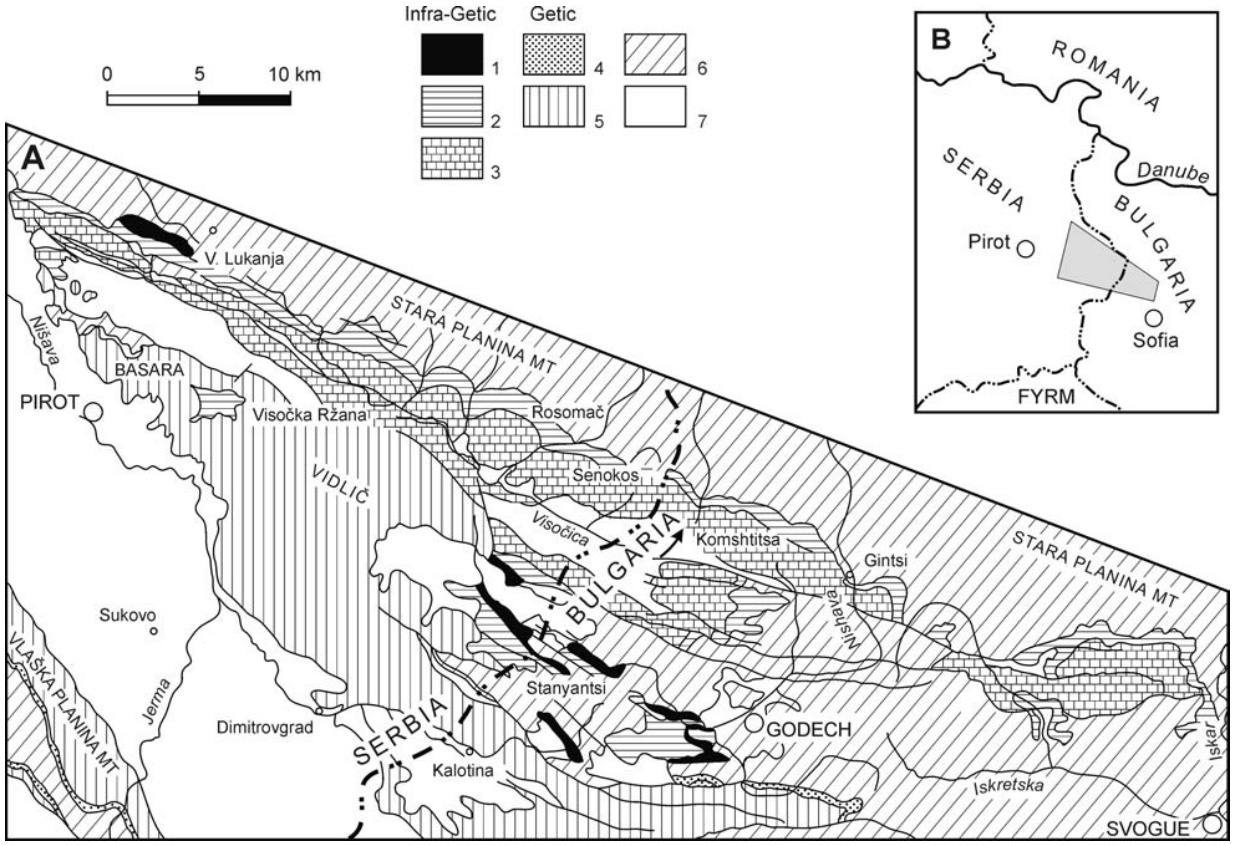
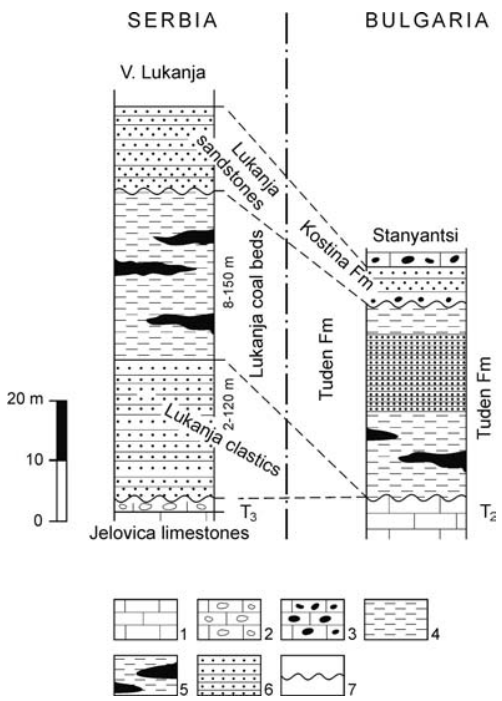


Fig. 1. Geological map of the studied region (simplified, after KRAÜTNER & KRSTIĆ, 1993) with the location of the studied sections. **A**. Infra-Getic: 1, Lower Jurassic continental and continental/marine: sandstones and clays; 2, Lower and Middle Jurassic marine sandstones, bioclastic limestones, marls, black shales with *Bossitra alpina*, clayey limestones and marls; 3, Middle Callovian–Tithonian micritic, nodular and/or lithoclastic limestones; Getic: 4, Middle Jurassic sandstones, sandy and bioclastic limestones; 5, Middle Callovian–Tithonian reef and subreef limestones; 6, substratum; 7, cover; **B**. Location of the studied region.



The Tuden Formation (about 30 m thick) consists predominantly of clays, intercalated with sandstones. The sections started with grey to black clays and coal shales; the higher sections are intercalated with fine grained sandstones, often laminated (Pl. 3, Fig. 1).

Marine sandstones (Fig. 3) also lie on continental Lukanja coal beds and the Tuden Formation, as well as directly on Triassic sediments. In East Serbia, they are known as Lukanja quartzy sandstones (ANDJELKOVIĆ *et al*., 1996, pp. 86–87) and in Bulgaria as the Kostina Formation (SAPUNOV *in* SAPUNOV *et al*., 1967) (Pl. 3, Fig. 2)

The Lukanja quartzy sandstones (Pl. 1, Fig. 5) (2.8 m thick in Rosomač, 8 m in Senokos and up to 120 m in the Mala Lukanja River) are built of coarse to middle

Fig. 2. Simplified columnar sections of the continental and continental-marine Lower Jurassic sediments of the Infra-Getic domain: Velika Lukanja (Pirot)–Stanyantsi (Godech) area. 1, micritic limestones (Middle Triassic); 2, red brecciated limestones = Senokos red series (Upper Rhaetian); Lower Jurassic: 3, black to grey limestones with quartz pebbles; 4, clays; 5, clays with coal beds and/or coal clays; 6, sandstones; 7, transgressive boundary.

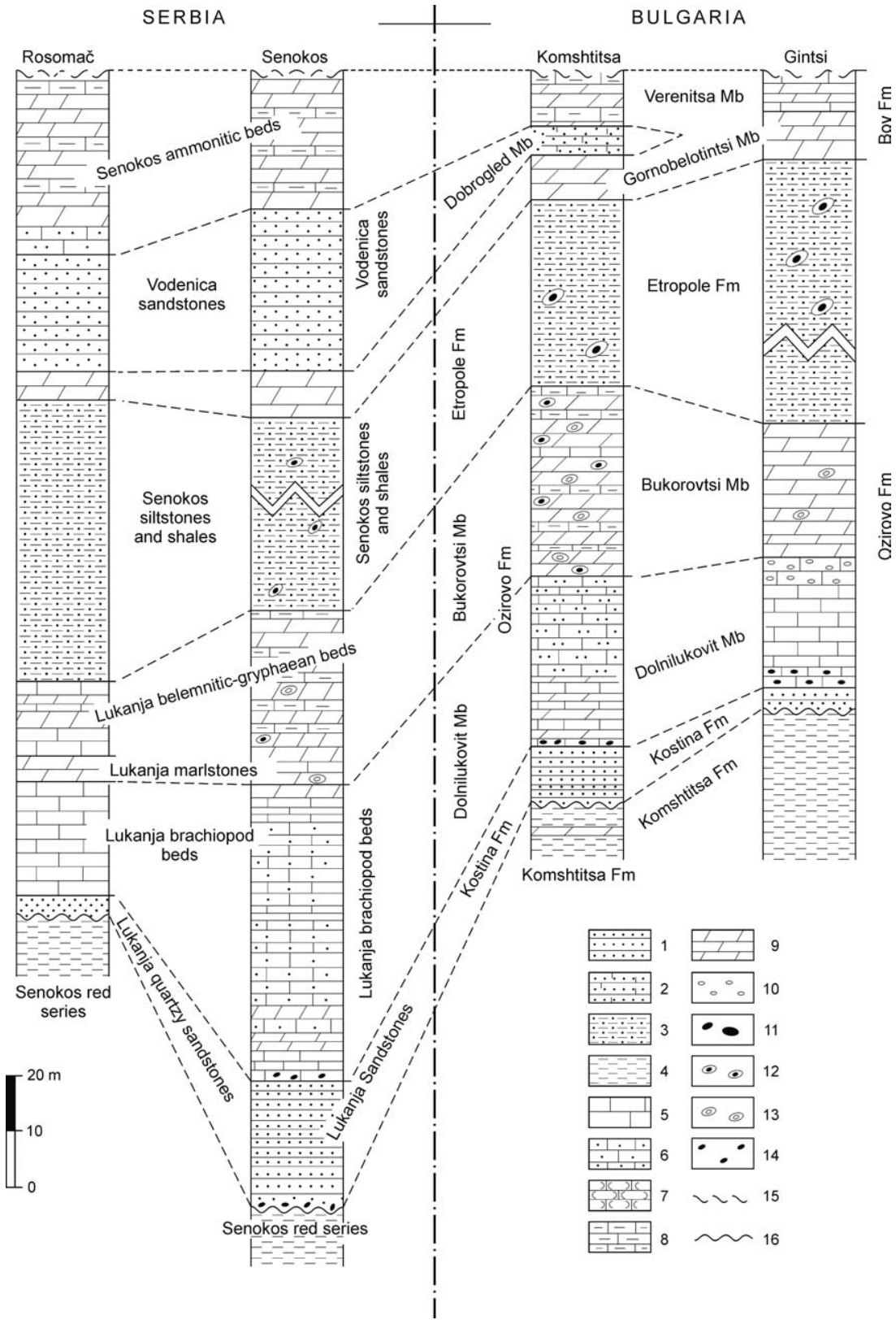


Fig. 3. Simplified columnar sections of the Lower and Middle Jurassic sediments of the Infra-Getic domain in the Pirot-Godech area. **1**, sandstones; **2**, calcareous sandstones; **3**, black shales and aleurolites with *Bossitra alpina*; **4**, clays; **5**, micritic limestones; **6**, sandy and/or bioclastic limestones; **7**, lithoclastic and/or nodular limestones (type "*ammonitico rosso*"); **8**, clayey limestones; **9**, marls; **10**, leptochloritic ooids; **11**, chert nodules; **12**, sideritic concretions; **13**, phosphoritic concretions; **14**, conglomeratic pebbles; **15**, transgressive boundary; **16**, boundary, connectected with submarine gap in the sedimentation.

grained quartz with silica cement and a transition to quartzite of Early Liassic age.

The Kostina Formation (Pl. 3, Fig. 3) lies directly on the Komshtitsa Formation in the vicinities of the villages Komshtitsa and Gintsi and on the Tuden Formation near the village of Stanyantsi. It consists of coarse to middle grained sandstones, from 3.5 m (near Stanyantsi village) up to 12 m thick (near Komshtitsa village). Its age is Middle Hettangian.

The Lower Jurassic sections continue with calcareous sedimentation. In east Serbia, the Lukanja brachiopod beds developed, which, in western Bulgaria, correspond to the Dolniloukovit Member of the Ozirovo Formation (Pl. 3, Figs. 4, 5).

The Lukanja brachiopod beds (ANDJELKOVIĆ, 1958, p. 15) near Senokos village started with dark grey to black crinoidal limestones (1.5 m thick), which contain many well-rounded quartz pebbles (Pl. 1, Fig. 6), as well as many brachiopods and bivalves. The same limestones with quartz pebbles and fossils also crop out in the Bulgarian section of Komshtitsa. In Senokos above them crop out marls (4–5 m) with rare interbeds of clayey limestones (Pl. 1, Fig. 7) (of Hettangian–Sinemurian age). Analogous sediments are individualized in Bulgaria as the Ravna Member of the Ozirovo Formation. The largest part of the Lukanja brachiopod beds is structured by sandy and bioclastic dark grey bituminous limestones, with many brachiopods, bivalves and belemnites (Pl. 1, Fig. 8). Near Senokos village, they were separated by ANDJELKOVĆ & MITROVIĆ-PETROVIĆ (1992) as the Senokos beds. The thickness of the Lukanja brachiopod beds is 40–45 m.

The Bulgarian Dolni Lukovit Member of the Ozirovo Formation (SAPUNOV, 1983) is presented by sandy and/or bioclastic (predominantly crinoidal) dark grey limestones (Pl. 3, Figs. 4, 5), containing many brachiopods, bivalves and belemnites. They are between 20–40 m thick and are of Carixian–Domerian (*p. p.*) age.

The Lower Jurassic sedimentation finished with rocks, individualized in east Serbia as the Lukanja marlstones and Lukanja belemnitic-gryphaean beds and in Bulgaria as the Bukorovtsi Member of the Ozirovo Formation.

The Lukanja marlstones (Upper Pliensbachian) consist of grey, laminated marls, clays, aleurolites and thin bedded clayey sandstones, with many small belemnites. They are covered by the Lukanja belemnitic-gryphaean beds (Upper Pliensbachian–Toarcian) (ANDJELKOVIĆ, 1958), built up of thin bedded sandy marls and clays. Within them, two parts are individualized: lower – belemnitic-brachiopod (with a predominance of small belemnites and brachiopods) and upper – belemnitic-gryphaean parts (with many large belemnites and *Gryphaea*). They contain many sideritic and phosphoritic concretions.

The Bulgarian Bukorovtsi Member is represented by grey silty marls, interbedded by thin (10–15 cm thick) beds of clayey limestones with many sideritic and phosphoritic concretions (Pl. 3, Fig. 6). They contain many belemnites and large bivalves (aequipectens and gryphaeas). They are not subdivided into different parts and encompass the Domerian and the Toarcian.

Middle Jurassic (Fig. 3)

The Middle Jurassic sediments, in south-east Serbia, are subdivided into the following lithostratigraphic units: Senokos siltstones and shales (Aalenian), Vodenica sandstones (Middle Bajocian) and Senokos ammonitic beds (Upper Bajocian, Bathonian and Lower Callovian), and in western Bulgaria into: the Etropole Formation (Aalenian–Bajocian) and the Bov Formation (Upper Bajocian–Upper Bathonian), intercalated by the Dobrogled Member of the Polaten Formation (Bathonian, lower part). The Senokos ammonitic beds and the Etropole Formation are similar to the "black shales with *Bossitra alpine*" from the Alpes.

The Senokos silstones and shales (ANDJELKOVIĆ, 1958) are structured by dark grey to black aleurolitic argillites and marly sandstones with phosphoritic, sideritic and calcareous concretions (Pl. 2, Fig. 1). Near Senokos and Rosomač villages, they are 50–70 m thick. The upper boundary with the Senokos ammonitic beds represents a transition. In Bulgaria, the Etropole Formation is analogous (SAPUNOV *in* SAPUNOV *et al*., 1967). It is built up of dark grey to black shales, generally aleurolitic with sideritic and rare phosphoritic concretions (Pl. 3, Figs. 7, 8). Near Komshtitsa village it is about 30 m thick and encompasses the Aalenian up to the lower part of the Upper Bajocian.

The Vodenica sandstones (ANDJELKOVIĆ, 1958, p. 20, 21), about 40 m thick, encompasses coarse grained quartz sandstones of red and reddish colour, thick bedded in the base, upwards becoming thin bedded (Pl. 2, Fig. 2); they also contain intercalations of microconglomerates.

The Dobrogled Member of the Polaten Formation (SAPUNOV *et al*., 1993) is about 4 m thick in the section of Komshtitsa (Bulgaria). This lithostratigraphic unit is represented by yellow to brown thick bedded limy sandstones in alternation with thin bedded calcareous limestones (Pl. 4, Fig. 1). Its age is Lower Bathonian.

Between the Senokos siltstones and shales and the Vodenica sandstones, as well as between the Etropole and the Bov Formation, the boundary is connected with a progressive transition. In the section of Komshtitsa (Bulgaria), between them grey-greenish silty marls with rare sideritic concretions, greenish marls developed, which are the horizontal prolongation of the lower member – Gornobelotintsi Member (Pl. 3, Fig. 8) of the Bov Formation. Such a lithostratigraphic unit is not individualized in the sections of south-east Serbia.

Above the Vodenica sandstones, in the vicinities of the villages Senokos and Rosomač, lies the Senokos ammonitic beds (ANDJELKOVIĆ *et al*., 1996, pp. 124–125), represented by grey-greenish sandy marls and clayey marls, rich in ammonites, which in the upper part become an alternation between grey-greenish aleuritic

marls and clayey limestones with *Zoophycos,* about 30–40 m thick (Pl. 2, Figs. 3, 4). The lower boundary represents a passage effectuated by 3–4 m thick aleuritic limestones with many muscovite flakes. From the upper part, in marls and clayey limestones, ANDJELKOVIĆ *et al*. (1996, p. 128) cited *Macrocephalites macrocephalus*, *Oxycerites neumayeri* and *Hecticoceras haugi*. From the Lower Callovian (thickness 0.75 m); higher, also in marls and clayey limestones (thickness 0.50 m) were found the Middle Callovian ammonites *Hecticoceras haugi*, *Oxycerites tilli, Hecticoceras pompecki*, etc.

In Bulgaria, this unit corresponds to the Verenitsa Member of the Bov Formation (TCHOUMATCHENCO, 1978), represented by an alternation between clayey-silty limestones and thin beds of silty marls, about 8 m thick containing *Zoophycos* sp. indet of Late Bathonian age (Pl. 4, Fig. 2). From the uppermost part were collected *Rhopaloteuthis gillieroni* and *Homoeoplanulites homoemorphus*, which prove the middle part of the Upper Bathonian (*Oppelia (Oxycerites) aspidoides* Zone).

To west of Rosomača, in the valley of Jelovica River, Middle–Upper Callovian sandy limestones and sandstones crop out.

Middle Callovian–Tithonian (Fig. 4)

In the base, near the villages of Senokos and Rosomač, crop out the Kamenica limestones (ANDJELKOVIĆ *et al*., 1996, p. 133) represented in the base by brecciated limestones, which are covered by micritic, well bedded limestones, on the beds surfaces of which there are lumachelles of ammonites. These limestones are Lower and Upper (*p. p*.) Oxfordian.

To west of Rosomač village crop out sub reef sediments known as the Ržana limestones. They are represented by grey, well bedded limestones, 10 m thick, which contain many bivalves, gastropods, bryozoans, brachiopods, sponges, etc.

To the Kamenica limestones, in the vicinities of the villages of Komshtitsa, Gintsi, etc. in western Bulgaria, correspond the micritic limestones of the Late Callovian–Oxfordian–Middle Kimmeridgian (*p. p*.) Javorets Formation (Pl. 4, Figs. 3, 4) (NIKOLOV & SAPUNOV, 1970; TCHOUMATCHENCO *et al*., 2001) which consists of grey, predominantly micritic, medium to thin bedded limestones with concretions of black to dark grey chert. The hickness is about 20 m.

The Late Jurassic section continues with the Pokrovenik acanthicum limestones (Pl. 2, Figs. 5–7) in Serbia and the Gintsi Formation (Pl. 4, Figs. 5, 6) in Bulgaria.

The Pokrovenik acanthicum limestones (ANDJELKOVIĆ, 1958; ANDJELKOVIĆ *et al*., 1996, p. 139–142) (of "*ammonitico rosso*" type) consist of red, redish to grey, thin bedded limestones, which contain many lithoclasts and bioclasts (ammonites). On the basis of the ammonites, the Pokrovenik limestones are subdivided in three parts: Lower acanthicum limestones with red to reddish

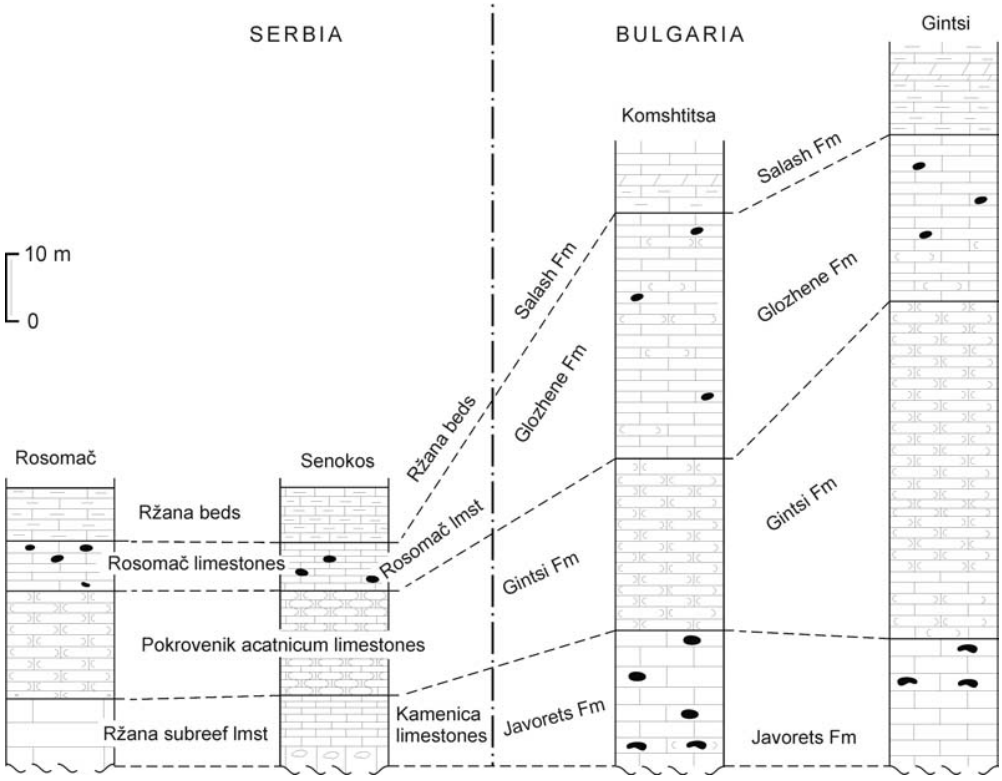


Fig. 4. Simplified columnar sections of the Middle Callovian–Upper Jurassic sediments of the Infra-Getic domain in the Pirot-Godech area. Legend as for Fig. 3.

nodular limestones, 3–5 m thick; Middle acanthicum limestones (7–20 m thick) with reddish limestones, intercalated by grey limestones, with ammonite fossils; Upper acanthicum limestones (3–10 m) with well bedded clayey, nodular and/or lithoclastic limestones, grey-redish to red, rich in ammonites.

The Pokrovenik acanthicum limestones are of Kimmeridgian–Early Tithonian age.

The Gintsi Formation in Bulgaria is analogous to the Pokrovenik limestones in Serbia. They are lithoclastic and/or nodular, red or grey limestones, with marly cement, of Middle Kimmeridgian (upper part)–Middle Tithonian (upper part) age, in the Komshtitsa section 29.15 m thick and in Gintsi section about 40 m.

The Rosomač limestones cover the reddish Lower Tithonian Pokrovenik limestones. The Rosomač limestones are represented by grey well stratificated limestones, containing dark grey to black interbeds of chert. They are Middle Tithonian–Berriasian (*p. p.*) (Pl. 2, Fig. 8). These limestones are known in Bulgaria as the Glozhene Formation (Pl. 4, Fig. 7).

The Jurassic sediments in east Serbia are covered by the Berriasian–Lower Barremian Ržana beds, consisting of slaty, grey biomicritic limestones with intercalations of chert nodules, situated in the Berriasian parts in 5 levels. Their analogous in Bulgaria are the clayey limestones of the Salash Formation (NIKOLOV & TZANKOV, 1971) (Pl. 4, Fig. 8).

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Резиме

Упоређење јурских седимената Инфра-гетске јединице у граничној области југоисточне Србије и западне Бугарске

Инфра-гетска палеогеографска јединица условљена палеотектоником налази се између Данубијске и Гетске палеогеографске јединице. У српској литератури је позната као Инфра-гетикум, а у бугарској као јурски Издремечки палеоров. Циљ овог рада је упоређење односа јурских седимената са обе стране српско–бугарске границе. У том циљу су коришћени профили Лукање, Богородичиног манастира, села Росомач и Сенокос (околина Пирота, југоистоисточна Србија) и профили у атарима села Комштица, Гинци и Стањанци (Годечки срез у западној Бугарској). Јурски седименти у Инфра-гетској јединици су откривени на јужним падинама Старе Планине. Леже трансгресивно преко тријаске подине црвенкастих алевролита, лапораца и аргилита са прослојцима пешчара. Називају се Сенокосна црвена серија у Србији, а у западној Бугарској формација Комштица. Јурске наслаге почињу континенталним и континентално-маринским седиментима (глинци и пешчари) (Лукањски кластити и лукањски угљени слојеви у Србији и Туденска формација у Бугарској), настављају се лукањским кварцним пешчарима (Србија) и кварцним пешчарима Костинске формације (Бугарска). Ове седименте покривају Лукањски брахиоподски слојеви (биокластични кречњаци) и Лукањски кречњаци (Србија) и чланови Озировске формације: Романов Дол (кречњаци са кварцним шљунком), Равна (кречњаци и глинци до лапорци) и Долни Луковит (биокластични кречњаци) у којима преовлађују биокластични кречњаци (Бугарска). Седиментација се наставља Лукањским белемнитско-грифејским слојевима (лапорци и глиновити пешчари) којима у Бугарској одговара Букоровачки члан (такође од лапораца и глиновитих кречњака са кргама фосфорита и сидерита) Озировске формације. Средњојурска седиментација је почела црним алевритским глинцима са ситним шкољкама (*Bossitra alpina*) и крупним белемнитима. Ови седименти су утврђени у Србији као Сенокосни алевролити и глинци, а у Бугарској као Етрополска формација. Ова фација је у Алпима позната као "црни глинац са *Bossitra alpina*". У Србији се профил наставља Воденичким пешчарима бајеске старости, а у Бугарској Доброгледским чланом Полатенске формације. У Бугарској, они су горњобајеске–доњобатске старости, прекривају лапорце доњег члана (Горњобелотиначки члан) Бовске формације, а леже испод горњег Вереничког члана, представљених сменом лапораца и глиновитих кречњака, Бовске формације. Воденички пешчари, односно Доброгледски члан, завршавају у профилу Комштице. Бугарска Бовска формација одговара Сенокосним амонитским слојевима у источној Србији. Горња граница амонитских слојева Сенокоса и Бовске формације је оштра, местимично ерозиона (неправилна), прекривена амонитском бречом са мноштвом *Macrocephalites*–а. У Бугарској, навише следе сиви кречњаци са рожначким кргама Јаворечке формације, а у источној Србији Каменички кречњаци. Изнад њих су сиви или црвени кргави, односно литокластични кречњаци (тип "*ammonitico rosso*") Гинци формације у Бугарској и Покровенички амонитски (акантикум) кречњаци у Србији. Јурски профил Инфра-гетикума се завршава сивим микритским и литокластичним кречњацима који у источној Србији припадају Росомачким и Рсовачким кречњацима, а у Бугарској – Гложен формацији. Закључак је да се литостратиграфске јединице, које су посебно издвојили разни аутори у источној Србији и западној Бугарској, могу поредити и њихов однос доводити у везу са обе стране државне границе.

PLATE 1

Serbia

Fig. 1. Jelovica limestones, Triassic, Velika Lukanja.
Fig. 2. Senokos red series, Upper Triassic, Senokos.
Fig. 3. Lukanja coal beds, Lower Jurassic, Velika Lukanja.
Fig. 4. Lukanja clastics, Lower Jurassic, Velika Lukanja.
Fig. 5. Lukanja Quartz sandstones, Lower Jurassic, Senokos.
Fig. 6. Base of the Lukanja brachiopod beds, Lower Jurassic, Senokos.
Fig. 7. Lukanja brachiopod beds, detail, Lower Jurassic, Senokos.
Fig. 8. Lukanja brachiopod beds, general view, Lower Jurassic, Senokos.


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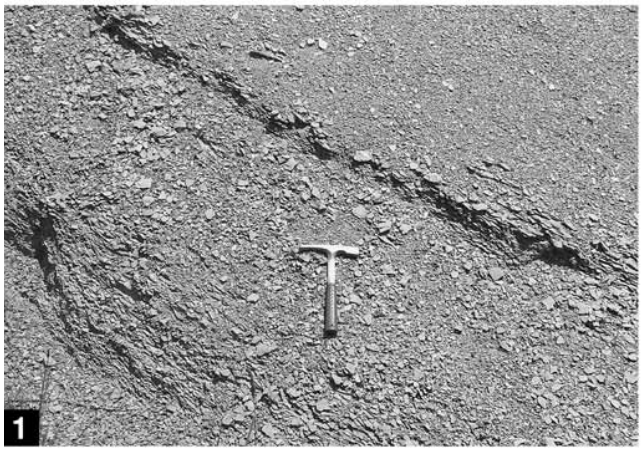
PLATE 2

Serbia

Fig. 1. Senokos siltstones and shales, Middle Jurassic, Senokos.
Fig. 2. Vodenica sandstones, Middle Jurassic, Senokos.
Fig. 3. Senokos ammonitic beds, Middle Jurassic, Senokos.
Fig. 4. Senokos ammonitic beds, Middle Jurassic, Senokos.
Fig. 5. Pokrovenik acanthicum limestones, Upper Jurassic, Rosomač.
Fig. 6. Pokrovenik acanthicum limestones, detail, Upper Jurassic, Rosomač.
Fig. 7. Pokrovenik acanthicum limestones, Upper Jurassic, Rosomač.
Fig. 8. Rosomač limestones, Upper Jurassic, Rosomač.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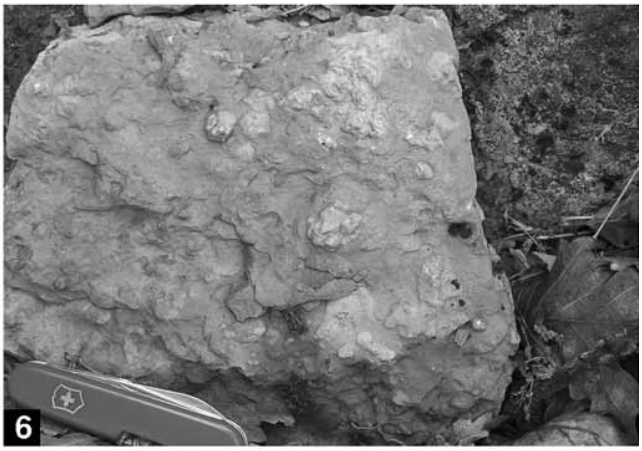
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PLATE 3

Bulgaria

Fig. 1. Touden Formation (Lower Jurassic) and the boundary with the Middle Triassic limestones, Stanyantsi.
Fig. 2. Boundary between the Komshtitsa Formation (Upper Triassic) and the Kostina Formation (Lower Jurassic), Komshtitsa.
Fig. 3. Kostina Formation, Lower Jurassic, Visochica River, Komshtitsa.
Fig. 4. Dolni Loukovit Member, Ozirovo Formation, Lower Jurassic, Komshtitsa.
Fig. 5. Dolni Loukovit Member (detail), Ozirovo Formatin, Lower Jurassic, Komshtitsa.
Fig. 6. Bukorovtsi Member, Ozirovo Formation, Lower Jurassic, Komshtitsa.
Fig. 7. Etropole Formation, Middle Jurassic, Barlya.
Fig. 8. The boundary between the Etropole Formation and the Bov Formation (Gornobelotintsi Member), Middle Jurassic, Barlya.


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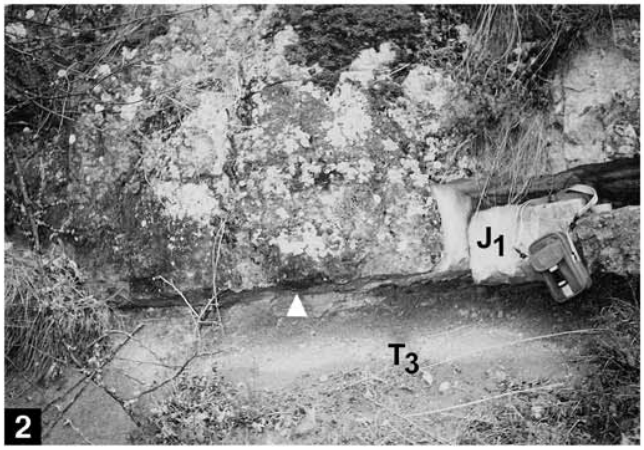

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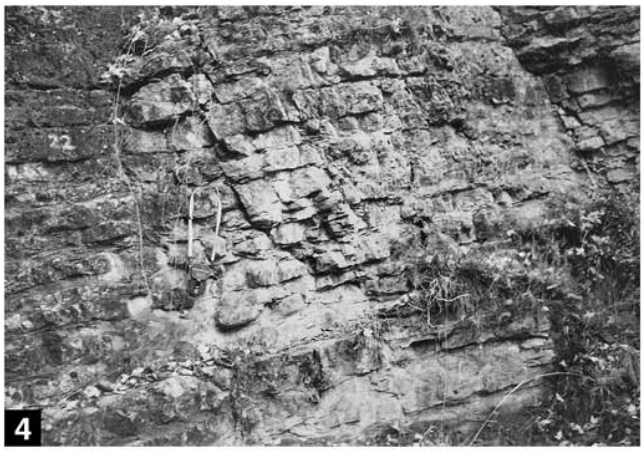
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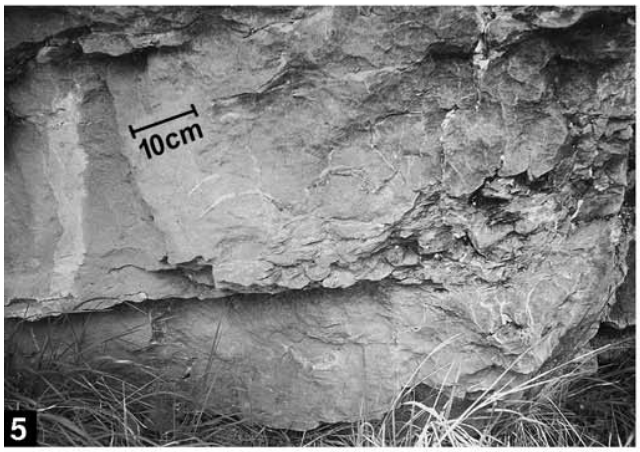

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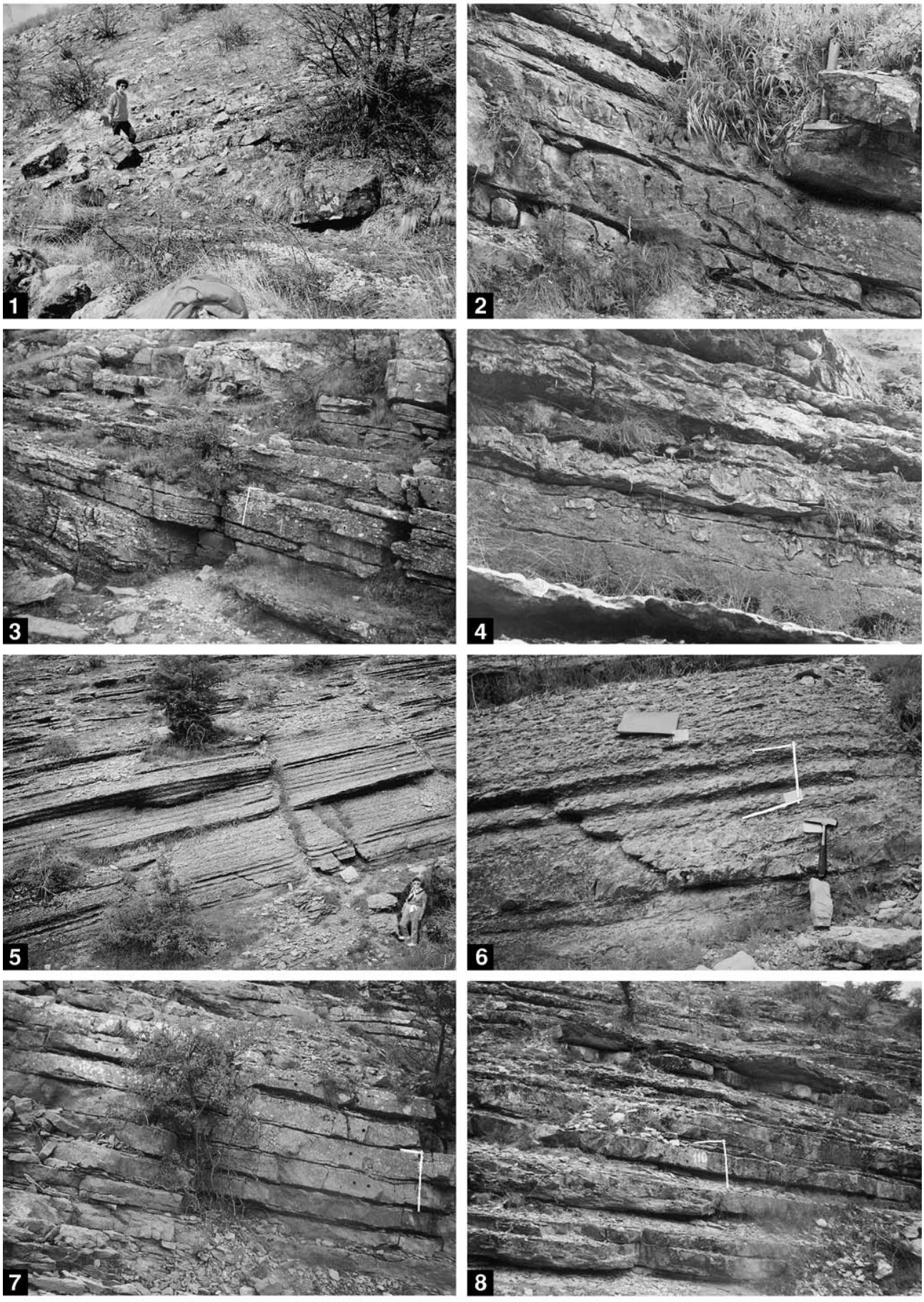
PLATE 4

Bulgaria

Fig. 1. Dobrogled Member, Polaten Formation, Lower Bathonian, Barlya.
Fig. 2. Verenitsa Member, Bov Formation, Middle Jurassic, Barlya.
Fig. 3. Yavorets Formation, Callovian–Oxfordian, Barlya.
Fig. 4. Yavorets Formation, Callovian–Oxfordian, Barlya.
Fig. 5. Gintsi Formation, Upper Jurassic, Barlya.
Fig. 6. Gintsi Formation (detail), Upper Jurassic, Barlya.
Fig. 7. Glozhene Formation, Upper Jurassic, Barlya.
Fig. 8. Salash Formation, Lower Cretaceous, Barlya.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